# Trade Diversion and the Initiation Effect: A Case Study of U.S. Trade Remedies in Agriculture

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**Abstract**

This paper estimates the impact of U.S. trade remedy (TR) actions on agricultural trade from 1990 to 2014. Most previous studies of the effects of TR actions have left out agricultural products. We use a four-country oligopolistic trade model to study the impact of TR duties on imports from non-named countries, and we improve on methodological issues present in earlier studies. Our empirical results show that TR investigations benefit non-named foreign exporters and U.S. imports from non-named countries increase even before the implementation of a TR duty. The extent of trade diversion is positively related to the size of the duty. Moreover, we find evidence of an initiation effect revealed by a significant increase in imports from non-named countries that did not previously trade the relevant product with the United States. The considerable extent of trade diversion in agriculture provides robust evidence for leakage effects of TR laws which has a detrimental impact on their protective effect.

**Keywords:** trade remedy laws, agricultural trade, trade diversion, initiation effect

**JEL Classification:** F12, F14, Q17

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# 1 Introduction

The Uruguay Round Agreement on Agriculture (URAA) was a milestone for the liberalization of agricultural trade. The agreement helped to reduce trade distortions as it tamed traditional policy instruments such as tariffs, export subsidies, and import quotas. Although the agreement contributed to a significant reduction of market distortions, it also fostered the use of alternative instruments of trade protectionism as many countries still prefer to regulate agricultural markets and subsidize farmers. The issue gained additional importance in recent years, because developing and transition countries started to expand their financial support to the farming sector, partly driven by the fact that developed countries continued to support their farmers (He and Sappideen, 2012). Trade remedy (TR) laws are a prominent example of such an alternative protection mechanism for agriculture. Article VI (GATT, 1994) allows member states to protect their domestic industry from injuries caused by foreign competitors that price discriminate or export at a price below production costs.[1] Even though TR actions are widely used, their impact on agricultural trade is poorly understood as studies mostly leave out agriculture (Blonigen, 2004).

The agricultural sector provides an interesting environment to study the impact of TR laws because this industry has many unique characteristics compared to manufacturing. First, TR duties levied against agricultural exporters are typically larger than for manufacturing (Blonigen, 2004). For instance, China's exporters of fresh garlic to the U.S. face a country-wide duty of 376.67 percent. Second, the garlic trade example indicates an additional issue that relates to the storability of agricultural products. While manufactured products are storable for many months or even years, many agricultural products perish rapidly (Jaffee and Gordon, 1992). Notably, high perishability is associated with larger transaction costs. Third, the timing of agricultural production decisions is different from the timing in the manufacturing industry since farmers have to determine their crop choices months or even years in advance. For instance, environmental regulations and crop rotation requirements make agricultural supply inelastic and diminish the ability of agricultural producers to react to trade shocks caused by TR duties. A final issue relates to the ability to adapt in a changing trade environment which is more difficult for agricultural than manufacturing producers

[1] Although countervailing duties are governed by the Agreement on Subsidies and Countervailing Measures, their application is also regulated by Article VI.

because trade standards for agricultural products are usually higher and often involve sanitary and phytosanitary regulations (Disdier et al., 2008). These characteristics of the agricultural sector motivate us to study the impacts of TR duties on agriculture.

The interest in TR laws has grown substantially in the course of their proliferation as trade restriction instruments (Cheng et al., 2001; Feinberg and Reynolds, 2006; Zanardi, 2006). Kerr (2006) argues that these duties are often fraudulently used to suppress imports and support domestic industries. Not only do TR laws cause trade distortions, but they also hinder further multilateral trade liberalization efforts (Prusa, 2005). The empirical and theoretical literature devoted to the study of antidumping (AD) and countervailing duty (CVD) laws is fairly substantial. Yet, most studies focus solely on manufactures (Staiger and Wolak, 1994; Prusa, 2001, 2005; Bown and Crowley, 2007; Vandenbussche and Zanardi, 2010), whereas only a few studies are concerned with agricultural trade (Keithly and Poudel, 2008; Carter and Gunning-Trant, 2010; Li et al., 2011; Carter and Steinbach, 2013; Carter and Mohapatra, 2013).

The literature has discussed different channels through which TR duties can affect agricultural trade. First, a duty can destroy trade in the particular product (destruction effect). Second, a duty can result in larger imports from other countries (diversion effect). Third, an exporter that faces a duty can increase exports to third countries to compensate for the lost market share (deflection effect). Fourth, a TR duty can affect downstream or upstream products. Fifth, since trade is part of a strategic decision process, a country which is continuously exposed to TR investigations, might avoid trading with the complainant country. This effect is called trade deterrence. Although various studies have looked at these different aspects, the literature is still far from being conclusive, particularly when it comes to agricultural trade.

We identified three major empirical limitations in the literature on trade remedies. A first potential limitation is the level of data aggregation. Most studies use trade data at the 6-digit HS code level. The aggregation level can blur away the effect of antidumping or countervailing duties because a 6-digit HS code can cover hundreds of commodities that are not targeted by a particular ruling and are potential substitutes for the targeted products. Carter and Gunning-Trant (2010) circumvent this problem by collecting trade data at the detailed 10-digit level of the Harmonized Tariff Schedule (HTS). Besedeš and Prusa (2017) also use quarterly 10-digit HTS-level import data.

In fact, we believe that this level of data detail is necessary to provide meaningful estimates, but we encountered a further limitation which related to the time consistency of available trade data. The HTS codes are frequently updated, which can result in inconsistent time series. We solve this problem by constructing consistent time series with HTS codes that are based on revisions of the tariff schedule.

A further limitation of earlier studies is the extent of temporal aggregation. Almost all studies use annual trade data that is either based on a calendar year or constructed based on the date when a petition was filed.[2] Relying on annual data is a limitation because it makes it impossible to identify the extent of trade diversion that is caused by the different stages of a TR investigation. Instead of using annual trade data, we exploit variation in monthly import trade data for the United States. This allows us to measure the extent of trade diversion that is caused by a preliminary duty and disentangle it from that of the final duty. Moreover, our study is the first to measure the degree of trade diversion resulting from the initiation of a TR investigation for countries that did not previously trade with the complainant.

Our paper contributes to the literature on the impact of TR laws by investigating the diversion effect for the intensive and extensive margins of agricultural trade.[3] The analysis relies on a four-country oligopolistic trade model with Cournot competition. The theoretical model provides two testable hypotheses: First, the imposition of a TR duty results in higher imports from non-named countries (trade diversion); and second, foreign producers from countries that did not export to the complainant country before the initiation of a TR investigation are incentivized to contest the market (initiation effect). Our empirical approach is an important improvement over the existing literature as we pay particular attention to product-level heterogeneity by including a full set of time and commodity fixed effects. Moreover, we also pay particular attention to econometric issues that can affect the validity of our estimation results by fitting the regression model with a maximum likelihood estimator that accounts for zero observations in the data. This is of exceptional importance for studies that are concerned with the diversion effects of TR duties. Our results

[2] A benefit of this approach is that it circumvents the problem of zero trade flows. However, doing so wastes much of the information contained in the trade data.

[3] We deviate from the trade literature in our definition of intensive and extensive trade margins. Usually, the intensive trade margin refers to the volume of sales per firm, while the extensive trade margin denotes the number of firms selling in a market. To test our propositions, we define the intensive trade margin as the quantity and value of imports, while the extensive trade margin refers to the number of trading partners.

provide strong evidence for a significant trade diversion effect along the intensive and extensive trade margins and indicate that the applied duties have a significant impact on imports from non-named countries. Moreover, we also find compelling evidence in support of the initiation effect. Our empirical results show a considerable increase in imports from non-named countries that did not previously trade with the United States. This initiation effect is positively associated with the size of the TR duty.

The remainder of this paper is organized as follows. After the introduction, the theoretical model is described and our motivation for the investigation of the trade diversion and initiation effects is provided. The third section explains our methodology and describes the empirical specification, estimation strategy, and robustness checks. We discuss the issue of zero trade flows and introduce an efficient and consistent estimator. The section also discusses data sources and expectations regarding the parameter signs. The fifth section presents and discusses the regression results. We analyze the implications of TR laws for the intensive and extensive trade margins. Our conclusions summarize the study, discuss limitations, and pose questions for further research.

## 2 Theoretical Model

TR laws have become an essential instrument of agricultural protectionism in the United States. The two principal trade remedies are the AD and the CVD law which are both set out in Title VII of the Tariff Act of 1930. TR duties reduce imports from named countries. Consequently, domestic producers and non-named foreign producers enjoy a higher price for the targeted product, giving domestic producers an incentive to expand their production and motivating non-named foreign producers to increase their exports. Moreover, some foreign producers for whom participation in the market was noneconomic before the duty was imposed, are now incentivized to step in and contest the market as they are aware that TR orders tend to remain in place for decades due to weak sunset reviews.

Most studies that investigate the implications of TR laws do not provide a theoretical motivation for their empirical work. The choice of a theoretical framework is mainly driven by the market characteristics. For instance, Bown and Crowley (2007) rely on an oligopolistic competition setting to examine the impacts on third markets. Their model builds on the assumption that the exporting firm exerts market power in the import market. Although agricultural markets are usually perfectly competitive at the producer level due to the large number of price-taking primary producers, the issue of market power is still of relevance because of the characteristics of the food supply chain. Notably, market concentration beyond the farm gate is typically very high (Howard, 2016). In particular, agricultural trade is increasingly dominated by a few large trading companies and food processors. These characteristics of the food supply chain make an oligopolistic competition setting a suitable environment to study the implications of TR laws. Following Bown and Crowley (2007), we use the oligopolistic competition setting to illustrate the diversion effects of trade remedies and demonstrate the initiation effect.[4]

Assume there are four countries indexed $i \in \{A, B, C, D\}$. In each country, one firm, also indexed as $i$, produces one good. Moreover, assume for simplification that firm $A$ only serves its domestic market, while firms $B$, $C$ and $D$ serve their domestic market and export to country $A$. **Table 1** illustrates the markets to which each firm can export. The quantity that is produced for domestic consumption is denoted $q_i$, while exports are denoted $q_{ij}$, where $i$ indicates the country of origin and $j$ the country in which the good is consumed. Consumers in the importing country consider the domestically produced good and the imported good as strategic substitutes, i.e., they derive the same utility from the consumption of either good. We denote total market supply in the home market as $Q_i = \sum_j q_{ji} + q_i$ and the supply in the foreign market as $Q_j = \sum_i q_{ij} + q_j$, while total output in each country is therefore given by $q_i^* = q_{ij} + q_i$. Each firm regards its domestic market and the foreign market as separated, implying that the quantity in each market is allocated independently and firms are subject to Cournot perception.[5]

The same technology is used by each competitor and firms face an inverse demand function denoted as $p(Q_i, Y_i)$, where $Y_i$ is a set of demand shifters such income. Production cost in $i$ is represented by a cost function $c(q_i^*, W_i)$, where $W_i$ is a set of cost factors that occur with $q_i^*$. We assume

[4] Bown and Crowley (2007) investigate trade deflection and trade depression effects of remedy laws while we study "trade diversion". The authors use the notion "trade creation via import source diversification" to denote trade effects for non-named countries, whereas we follow Carter and Gunning-Trant (2010) and use the term "trade diversion". The term trade creation is misleading because trade remedies do not create trade, but rather the investigating country diversifies its trade relations to compensate the reduction of foreign supply.

[5] Cournot perception implies that the other firms will hold output fixed. We assume a Cournot-Nash equilibrium instead of a Bertrand-Nash equilibrium because agents regard the domestic and the foreign good as strategic substitutes. This implies that firms compete in quantities and not in prices.

**Table 1:** Potential market access of competing firms

| | Country A | Country B | Country C | Country D |
|---|---|---|---|---|
| Firm A | X | | | |
| Firm B | X | X | | |
| Firm C | X | | X | |
| Firm D | X | | | X |

that marginal costs are strictly convex in $q_i^*$ with $c'(q_i^*, W_i) > 0$ and $c''(q_i^*, W_i) > 0$ which reflects increasing marginal cost. Now, suppose that there are no other trade costs between $i$ and $j$ than a tariff $\tau$, where $\tau_{ji}$ denotes a duty that $j$ levied against $i$. For simplicity we assume that the burden of the duty falls entirely on the exporter. Thus, the profit function can be expressed in its general form as follows:

$$\Pi_i = \overbrace{\underbrace{p(Q_i, Y_i)q_i}_{\text{in Home}} + \underbrace{p(Q_j, Y_j)q_{ij}}_{\text{in Foreign}}}^{\text{Sales}} - \overbrace{\underbrace{\tau_{ji}q_{ij}}_{\text{Duty}} - \underbrace{c(q_i^*, W_i)}_{\text{Production}}}^{\text{Costs}}, \tag{1}$$

where sales are determined by sales at home and in the foreign country and costs are a function of the duty and the production cost. A firm's objective is to maximize its profits by choosing the quantity of sales in each market such that

$$\max \Pi_i = p(Q_i, Y_i)q_i + p(Q_j, Y_j)q_{ij} - \tau_{ji}q_{ij} - c(q_i^*, W_i). \tag{2}$$

If we now assume that country $A$ imposes a duty against country $B$, the first order conditions for home markets are given by:

$$\frac{\partial \Pi_A}{\partial q_A} = p(Q_A, Y_A) + p'(Q_A, Y_A)q_A - c'(q_A^*, W_A) \equiv 0 \tag{3a}$$

$$\frac{\partial \Pi_B}{\partial q_B} = p(Q_B, Y_B) + p'(Q_B, Y_B)q_B - c'(q_B^*, W_B) \equiv 0 \tag{3b}$$

$$\frac{\partial \Pi_C}{\partial q_C} = p(Q_C, Y_C) + p'(Q_C, Y_C)q_C - c'(q_C^*, W_C) \equiv 0 \tag{3c}$$

$$\frac{\partial \Pi_D}{\partial q_D} = p(Q_D, Y_D) + p'(Q_D, Y_D)q_D - c'(q_D^*, W_D) \equiv 0 \tag{3d}$$

and the first order conditions for the profit maximizing quantity of exports for firms $B$, $C$ and $D$ to country $A$ are:

$$\frac{\partial \Pi_B}{\partial q_{BA}} = p(Q_A, Y_A) + p'(Q_A, Y_A) q_{BA} - \tau_{AB} - c'(q_B^*, W_B) \equiv 0 \tag{4a}$$

$$\frac{\partial \Pi_C}{\partial q_{CA}} = p(Q_A, Y_A) + p'(Q_A, Y_A) q_{CA} - c'(q_C^*, W_C) \equiv 0 \tag{4b}$$

$$\frac{\partial \Pi_D}{\partial q_{DA}} = p(Q_A, Y_A) + p'(Q_A, Y_A) q_{DA} - c'(q_D^*, W_D) \equiv 0 \tag{4c}$$

The solution to the first order conditions yields each firm's best reaction (or response) function with respect to the sales decisions of the other firms, which can be expressed in the general form for the home market as:

$$q_i = R_i[p(Q_i, Y_i), c(q_i^*, W_i)], \tag{5}$$

and $i$'s best reaction function for the foreign market is given by:

$$q_{ij} = R_{ij}[p(Q_j, Y_j), \tau_{ji}, c(q_i^*, W_i)]. \tag{6}$$

Solving the seven best reaction functions simultaneously yields the Cournot-Nash equilibrium quantities which are sold by each firm in each market. Because marginal costs are strictly convex in $q_i^*$, the exporting firms $B$, $C$ and $D$ will choose to allocate total sales between their home market and the foreign market so that the net marginal revenue, which is defined as marginal revenue less the the duty, is the same in the home and the foreign market. This is a crucial assumption because it forces firms to reallocate their sales across markets when a TR duty is imposed.

The theoretical model allows us to make three propositions regarding the potential effects of TR actions:

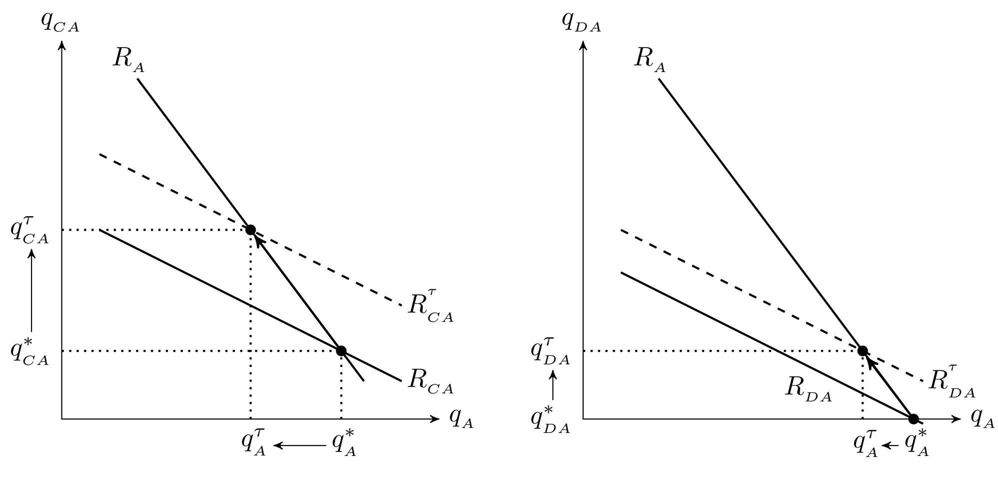
- First, a TR duty levied by country $A$ against exports from firm $B$ causes a decline in $B$'s exports to country $A$ which is know as the *trade destruction* effect.[6]

- Second, a duty imposed by country $A$ against exports from firm $B$ will cause an increase in firm $C$'s exports to country $A$. This effect is called *trade diversion*.

[6] We do not measure the extent of trade destruction caused by trade remedies in agriculture. This question remains open for future research.

– Third, a TR against firm $B$ motivates firm $D$ to contest the other firms in market $A$. Here we rely on the assumption that firm $D$ did not initially export to country $A$ and only served its domestic market before the duty was imposed against firm $B$, implying that the costs of entering market $A$ were larger than the benefits. The duty raised the price of the good in country $A$, which made it profitable for firm $D$ to contest the market in country $A$. We call this the *initiation effect*. The propositions can be proved by totally differentiating the first order conditions and applying Cramer's rule after dividing by $\tau_{AB}$. We find for firm $A$ that $\frac{\partial q_A}{\partial \tau_{AB}} > 0$, whereas we find for firm $B$ that $\frac{\partial q_{BA}}{\partial \tau_{AB}} < 0$ and for firm $C$ that $\frac{\partial q_{CA}}{\partial \tau_{AB}} > 0$. The firm in country $D$ reacts to the duty imposed against firm $B$ by $\frac{\partial q_{DA}}{\partial \tau_{AB}} > 0$.

Trade diversion via import source diversification and the initiation effect are illustrated in **Figure 1**. The reaction functions $R_i$ and $R_{ij}$ represent a firm's best response to the decision of the other firms. The Cournot-Nash equilibrium for firm $C$'s sales in country $A$ is $(q^*_C; q^*_{CA})$ is shown in the left hand panel. Once country $A$ imposes a duty against country $B$, sales of firm $C$ increase to $q^\tau_{CA}$ and home sales of firm $A$ decrease to $q^\tau_A$. This effect is called trade diversion via import source diversification. On the other hand, due to the introduction of a TR duty by country $A$ against country $B$, the Cournot-Nash equilibrium shifts for firm $D$ in market $A$ from $(q^*_A; q^*_{DA})$ to $(q^\tau_A; q^\tau_{DA})$ as shown in the right hand panel.




**(1)** Trade diversion effect (country $C$) **(2)** Initiation effect (country $D$)

**Figure 1:** Effects of a TR duty on exports from firm $C$ and $D$ to country $A$

The model allows us to analyze the trade diversion and initiation effects for the intensive and extensive trade margins. The terms intensive and extensive trade margins are traditionally used to distinguish the patterns of international trade at the firm level. In our case, the intensive trade margin refers to the quantity and value of imports, while the extensive trade margin denotes the number of trading partners. Although we would prefer to investigate the propositions with firm level data, such detailed data are not available. Therefore, our notion of the intensive trade margins derives from the oligopolistic trade model, where we assume that only one firm operates in each home market. The notion of an extensive trade margin also relates to the oligopolistic trade model, but we have to assume that firm $C$ did not export to country $A$ prior to the duty. Hence, a change in the extensive trade margin due to a TR duty would be reflected in a lower or higher number of trading partners.

# 3 Data and Empirical Approach

## 3.1 Data

TR investigations

TR investigations in the U.S. always follows the same predefined procedure. Although the statuary timetable of an AD investigation is similar to the timetable of a CVD investigation, both procedures differ in terms of time required to complete the different stages of the investigation.[7] Typically an industry, or some group representing an industry (e.g., a trade association), simultaneously files a petition with the Commerce Department's International Trade Administration (ITA) and with the International Trade Commission (ITC). In order for duties to be levied against foreign firms, the ITA must determine that goods have been sold at less than fair value (LTFV) and the ITC must determine that the domestic industry has been or is threatened with material injury by reason of dumped or subsidized imports. It is noteworthy that each AD petition is filed against firms in a single country. However, if the domestic industry believes that several countries have sold at LTFV, it will simultaneously file a petition against groups of firms in each country. A multiple petition filing increases the likelihood of an affirmative injury decision because the ITC follows the

[7] Figures A1 and A2 in the Appendix provide a detailed overview of the different stages of a TR investigation.

“cumulation principle” when making the injury decision. The cumulation principle allows the ITC to consider the total volume of allegedly dumped imports from all named countries.

Once the petition has been filed, the ITA and ITC make a series of decisions. Within 45 days the ITC makes a preliminary injury decision. If this decision is negative, the case is terminated. Review of ITC cases suggests that the material injury standard is lower at the preliminary stage than at the final decision, and therefore cases terminated at the preliminary injury stage do not appear to have merit (Moore, 1988). The purpose of the preliminary determination is to filter out “frivolous” petitions. If the ITC’s preliminary decision is affirmative, the ITA makes a preliminary LTFV decision within 160 days and then a final LTFV decision within 75 days of its preliminary decision. A final LTFV determination is made regardless of the preliminary decision (i.e., the ITA’s preliminary decision does not terminate the investigation). The chief purpose of the preliminary LTFV decision is to set a temporary bond rate that is in effect until the case is officially resolved. The bond grants the domestic industry temporary protection for the course of the investigation. If the respondents lose, the bond is forfeit. If the ITA’s final decision is affirmative, the ITC must make its final injury decision no longer than 75 days after the ITA’s final determination of the duty size. If the ITC’s final decision is affirmative, duties are collected for a period of no less than two years. If the ITC’s final decision is negative, the case is terminated and any bond paid during the course of the investigation is refunded to the respondents.

In this paper, we explore the variation in the timing of TR investigations to quantify the trade diversion and investigation effects. We obtained detailed information on the timing of all TR investigations from the ITC. Their database contains information on each agricultural investigation filed between 1990 and 2014. We use their database as a starting point to identify the relevant stages of each TR investigation. For this purpose, we rely on the U.S. Federal Register which publishes detailed information on the timing of each investigation and information on the scope (HTS codes). Overall, we identified 30 TR investigations that led to an affirmative final decision. These investigations are summarized in Table A1 in the Appendix. Most investigations were initiated against developing countries and only few against developed countries. For each investigation, we obtained information on the scope and the timing of the major investigation stages (initiation, preliminary duty, and final duty). These measures allow us to draw inferences for each period of an investigation and to deconstruct the investigation effect.[8] We are able to decompose the investigation effect for the different stages of a TR investigation because we rely on highly disaggregated trade data that are collected for every month of the investigation period.

Trade Data

Our monthly trade data are from the U.S. Imports of Merchandise Trade published by the Census Bureau. The import trade data are recorded at the 10-digit HTS level and cover the period January 1990 to December 2014. The dataset includes information on trade values, shipped quantities, and collected duties at the port level. For our analysis, we consider imports for consumption, which measures the total value of merchandise that physically clears customs and goods withdrawn from customs bonded warehouses or U.S. Foreign Trade Zones. These products enter the consumption channels immediately. Notably, the data do not include goods that are held in bonded warehouses.

A potential issue with detailed import trade data is the frequent revision of HTS codes (Pierce and Schott, 2012). Particular commodities that face a TR investigation are frequently reclassified to better account for product heterogeneity. To account for these changes, we construct consistent synthetic HTS codes that reflect changes of the tariff schedule over time. For this purpose, we rely on the approach outlined by Pierce and Schott (2012). The synthetic HTS codes allow us to disentangle the duty effect and account for breaks in the trade data series. The procedure is applied to all 30 affirmative TR investigations investigated in this paper. We find that each investigation has a minimum of one HTS code that changes over the course of a TR investigation.

Control variables

We follow the TR literature and include additional control variables. We use a measures of the gross domestic product to capture country effects. Moreover, we account for domestic and foreign supply with measures of total agricultural output. To account for price effects, we include the consumer price index in our regression model. Furthermore, the census trade data allow us to calculate the paid tariff and transportation costs. We include these parameters as further covariates. All covariates are derived from databases maintained by the U.S. Census Office, the U.N. Food and

[8] Staiger and Wolak (1994) argue that the initiation of a TR investigation investigation reduces imports from targeted countries which could increase imports from non-targeted countries. This perspective is supported in Prusa (2001) who argues that the initiation of an investigation influences firm's decisions. The claim finds further support in Carter and Gunning-Trant (2010).

Agriculture Organization, and the World Bank. The covariates are included selectively in the regression analysis.

### 3.2 Empirical approach

We use a reduced form regression model to estimate the diversion and initiation effects of U.S. TR investigations in agriculture.[9] The empirical analysis extends from two years prior–to three years after–the initiation of a TR investigation.[10] Our baseline regression specification accounts for unobserved factors with case and time fixed effects. In contrast to earlier studies, we do not rely on a double-log regression model to identify the parameters of interest (Prusa, 2001; Bown and Crowley, 2007; Carter and Gunning-Trant, 2010), but instead, we use a count data model that allows us to account for zero observations in the trade data. Our baseline specification is given in its generalized form as follows:

$$I_{kt} = \exp\left(\alpha_k + \alpha_t + \sum_{p=1}^{3} \gamma_p \ln(\tau_c) P_p + \boldsymbol{X}_{it}\boldsymbol{\gamma}_x\right)\eta_{kt}, \tag{7}$$

where $k$ denotes an 8- or 10-digit HTS product, $t$ time in months, and $p$ the stages of a TR investigation. The dependent variable $I_{kt}$ maps into three different specifications. We capture the intensive trade margin by the value ($v_{kt}$) and the quantity ($q_{kt}$) of consumption imports, while the extensive trade margin is quantified by the number of trading partners ($n_{kt}$). Our preferred regression specification includes fixed effects for the HTS codes and each month of a TR investigation. To ensure the robustness and sensitivity of our empirical approach, we compare different combinations of fixed effects.[11] Depending on the regression specification, we include a

[9] We dropped trade events with countries named in a TR investigation. The aggregated response of the non-named countries is the outcome of interest. Therefore, we aggregate imports from all other countries to reveal the trade diversion and initiation effects.

[10] The beginning of an investigation is defined by the date when a domestic industry files a petition. To give an example, a petition was filed on February 28, 1994 on behalf of the Fresh Garlic Producers Association. The preliminary duty was imposed on July 7, 1994 and the final decision was announced on September 26, 1994.

[11] For the baseline specification, we compare nine different combinations of fixed effects. We include fixed effects for quarters and years in specification (1), for the investigation months in specification (2), for the cases in specification (3), for the HTS codes in specification (4), for the quarters, years, and investigation months in specification (5), for the quarters, years, and cases in specification (6), for the quarters, years, and HTS codes in specification (7), for the investigation months and cases in specification (8), and for the investigations months and HTS codes in specification (9), respectively.

number of additional covariates, which are summarized by the matrix $\boldsymbol{X}_{it}$ and vary at the HTS code level over time. These control variables are the gross domestic products, the domestic and foreign supply (measured by the global and U.S. agricultural output), the U.S. consumer price index, the tariff rate, and transport costs. We denote the multiplicative error term with $\eta_{it}$. The key parameters of interest are denoted by $\gamma_p$. These shift parameters account for the main stages of a TR investigation (initiation, preliminary duty, and final duty). Moreover, to account for the impact of the duty rate, we interact the preliminary and final duties with the dummies for the different stages of the TR investigation. Lastly, we also specify an autoregressive regression model to account for the dependency of imports over time. For this specification, we follow the literature and assume that imports in one month depend on imports in the previous month (Prusa, 2001; Bown and Crowley, 2007; Carter and Gunning-Trant, 2010).

To empirically explore the relationship between our variables of interest and the count outcomes, we use the Poisson pseudo-maximum likelihood (PML) estimator (Gong and Samaniego, 1981; Gourieroux et al., 1984). The Poisson PML estimator is consistent in the presence of heteroskedasticity, and even if the conditional variance is not proportional to the conditional mean, the Poisson PML estimator is consistent (Wooldridge, 1999; Cameron and Trivedi, 2013). Because the estimator does not assume anything about the dispersion of the fitted values, we do not test for this aspect. An advantage of the Poisson PML estimator is that the scale of the dependent variable has no effect on the parameter estimates, which is a challenge for the Negative Binomial PML estimator. Moreover, as long as the conditional mean is correctly specified, the Poisson PML estimator yields estimates that are similar in size to the estimates of both the Gaussian and Negative Binomial PML estimators. Lastly, to address heteroskedasticity in the error term, we use a robust variance estimator and account for clustering at the investigation level (Cameron and Miller, 2015).

# 4 Results

We start by summarizing our findings regarding trade diversion. We compare two model specifications to capture the trade effect of TR investigations. First, we account for differences in the trade diversion effect across the main stages of a TR investigation (initiation, preliminary duty, and final duty) using dummies for the investigation stages. Second, we interact these period dummies with the applied duty rates to account for differences in the TR effect according to the duty size. We then measure the initiation effect by analyzing imports from countries that did not trade with the United States before the initiation of the TR investigation. We focus on the estimation results for our preferred regression specification which interacts the period dummies with the applied remedy duties.

## 4.1 Trade diversion effect

Our estimation results show that trade remedies have a significant effect on imports from non-named countries. The regression results for the empirical specification with period dummies for the different stages of a TR investigation are presented in Table 2. The table shows the coefficient estimates for the regression specification with month and HTS code fixed effects.[12] We present the estimates for the baseline specification in columns 2-4 and add the first temporal lag of the dependent variables as a further regressor in columns 5-7. We study the trade diversion effect for the intensive margin by analyzing the import quantity (1) and value (2), and the extensive margin by focusing on the number of trading partners (3). According to our theoretical model, we can expect an increase of imports from non-named countries after the imposition of a TR duty. Our empirical results are largely in support of this hypothesis as the coefficient estimates are positive and highly significant for the baseline specification. Although we find that the standard errors are larger when including the lagged dependent variable, the coefficient estimates convey the same picture. Moreover, we find that the trade diversion effect is different for the quantity and value specifications (intensive margins). Although we find strong evidence for trade diversion in the value

[12] The detailed regression results for the model specifications with different combinations of fixed effects are presented in the Tables A2, A4, and A6 in the Appendix. Overall, the estimation results for the trade diversion effect are fairly stable across regression specifications.

specification, we only find limited statistical evidence in the quantity specification. This difference implies that firms in non-named countries do not significantly increase their export volumes to the United States after the initiation of a remedy investigation, but rather increase the price of their products. We also find robust statistical evidence for a diversification of import source after the initiation of a remedy investigation which is indicated by the positive and statistically significant coefficient estimates for the extensive margin (number of trading partners). Overall, the estimates provide strong evidence of a significant trade diversion effect along the intensive and extensive trade margins.

**Table 2:** Trade diversion effect for non-named countries (stage of investigation specification)

| | Baseline specification | | | Specification with lag | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| $P_1$ | 0.333** | 0.239*** | 0.049 | 0.171 | 0.277*** | 0.048* |
| | (0.136) | (0.069) | (0.032) | (0.128) | (0.064) | (0.025) |
| $P_2$ | -0.205** | 0.156** | 0.060* | -0.129 | 0.135* | 0.053* |
| | (0.186) | (0.072) | (0.035) | (0.082) | (0.069) | (0.028) |
| $P_3$ | -0.128 | 0.295*** | 0.063 | -0.120 | 0.282*** | 0.088** |
| | (0.122) | (0.088) | (0.043) | (0.122) | (0.084) | (0.035) |

(1) quantity, (2) value, and (3) number of trading partners.

Cluster-robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Our estimation results also indicate that the size of the duty determines the degree of trade diversion. Table 3 summarizes the regression results for the duty specification.[13] Instead of including period dummies in the regression specification, we now include the interaction between period dummies and the preliminary and final duty rates. This table is organized in the same fashion as Table 2. Our regression results show that the initiation of a TR investigation has a significant and lasting effect on imports from non-named countries. The trade diversion effect is present in the intensive and extensive margins. Comparing the baseline specification

[13] The regression results for the alternative model specifications are presented in the Tables A3, A5, and A7 in the Appendix. The estimates are fairly stable across regression specifications.

with the specification that includes the first temporal lag of the dependent variable, we find that both specifications convey a similar picture regarding the significance level and size of the effect.

**Table 3:** Trade diversion effect for non-named countries (duty specification)

| | Baseline specification | | | Specification with lag | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| $P_1$ | 0.442*** | 0.196*** | 0.071*** | 0.258** | 0.169*** | 0.062*** |
| | (0.133) | (0.066) | (0.026) | (0.124) | (0.059) | (0.022) |
| $\ln(\tau_1)\, P_2$ | -0.027 | 0.035** | 0.023*** | -0.010 | 0.006 | 0.019*** |
| | (0.020) | (0.015) | (0.007) | (0.018) | (0.014) | (0.006) |
| $\ln(\tau_2)\, P_3$ | 0.028 | 0.057*** | 0.031*** | 0.017 | 0.048*** | 0.032*** |
| | (0.021) | (0.014) | (0.006) | (0.020) | (0.013) | (0.006) |

(1) quantity, (2) value, and (3) number of trading partners.
Cluster-robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notably, the coefficient estimate for the investigation effect is larger for the intensive margin than for the extensive margin. More specifically, we find that the effect is almost double in size for the quantity, compared to the value specification. Our findings imply that the assumption of our theoretical model regarding market structure (Cournot competition) is appropriate. Moreover, the interaction between the period dummies and the duty rates are largely significant and positive. The significant estimates indicate that the duty rate is a driving factor of trade diversion. Our estimation results also show that the larger the applied duty is, the stronger the trade diversion effect. The trade diversion effect is more pronounced when the final duty comes into force than when the preliminary duty is effective. This is because uncertainty is resolved and transactions costs are reduced. Overall, the estimates provide strong evidence for a significant trade diversion effect along the intensive and extensive trade margins and indicate that the applied duty rate has a substantial effect on import trade with non-named countries.

## 4.2 Initiation effect

Table 4 summarizes the regression results for the initiation effect and the duty specification.[14] We focus on the duty specification because this specification allows us to account for the impact of the duty size. The regression results indicate that a TR investigation has a strong and lasting impact on trade with non-named countries that were not previously trading partners with the U.S. for the relevant product. We find that the initiation of a remedy investigation leads to a significant increase in imports from non-named countries and a substantial diversification of trade relationships.

**Table 4:** Trade diversion effect for non-named countries previously not exporting relevant product to the U.S. (duty specification)

| | Baseline specification | | | Specification with lag | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| $P_1$ | 6.294*** | 4.676*** | 1.801*** | 6.223*** | 4.082*** | 1.905*** |
| | (0.646) | (1.049) | (0.169) | (0.667) | (0.859) | (0.145) |
| $\ln(\tau_1)\, P_2$ | 1.548*** | 1.160*** | 0.580*** | 1.533*** | 1.048*** | 0.639*** |
| | (0.167) | (0.227) | (0.062) | (0.168) | (0.181) | (0.053) |
| $\ln(\tau_2)\, P_3$ | 2.056*** | 1.294*** | 0.651*** | 2.034*** | 1.162*** | 0.623*** |
| | (0.235) | (0.242) | (0.063) | (0.238) | (0.194) | (0.058) |

(1) quantity, (2) value, and (3) number of trading partners.

Cluster-robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Again, we find evidence for a stronger diversion effect in the quantity specification which implies that firms mainly compete in quantities (Cournot competition) and not in prices (Bertrand competition). The estimates are about 1.5 times as large for the quantity versus the value specification. These findings apply to the baseline specification and to the specification which includes the first temporal lag of the dependent variable. Notably, we also find substantial evidence for the initiation effect in the extensive margin. Including the first temporal lag of the dependent variable does not alter the regression results significantly. Moreover, we find that the applied duty has a substantial trade

[14] The estimation results for the alternative regression specification are presented in the Tables A8, A9, and A10 in the Appendix. Overall, the estimation results are fairly stable across regression specifications.

diversion effect. This effect is more significant for the intensive margins than for the extensive margins. Overall, our regression results provide strong empirical evidence for the initiation effect which we argued for in our theoretical model. The degree of trade diversion is influenced by the duty size, which is also consistent with our theoretical assumptions.

## 5 Conclusions

Our paper highlights two essential properties of trade implications caused by TR laws in agriculture using detailed U.S. import trade data. First, our empirical investigation shows that TR duties result in a substantial degree of trade diversion. We find that trade diversion is present in the intensive and extensive trade margins and is influenced by the duty size. Although our findings are qualitatively in line with earlier studies on the diversion effects of TR actions (Carter and Gunning-Trant, 2010; Prusa, 1997), we find evidence of a stronger diversion effect, mainly when interacting the applied TR duties with the different TR investigation stages. Moreover, our estimates of the investigation effect are substantially smaller than the estimates presented in earlier studies. We believe that these differences are mainly due to methodological limitations in previous studies that result in an overestimation of the investigation effect. Second, we find substantial evidence for the existence of an initiation effect which is revealed by the significant increase in imports from non-named countries that did not export the relevant product to the U.S. before the TR investigation. The initiation effect is strongly related to the duty size and higher duties lead to more trade diversion through the initiation effect.

We acknowledge some limitations of our study design. The first issue relates to the scope of our analysis, as we are focusing on TR investigations initiated by the agricultural industry in the United States. This selection is limiting because the U.S. is a developed economy which sources a significant share of its food imports from emerging countries. A second issue relates to heterogeneous effects of trade diversion across countries. One can expect that non-named developed economies are more capable of filling in for named countries because their food industry has a larger export capacity. Hence, we should expect stronger trade diversion potential with developed than with developing countries. The third issue relates to the role of sunset reviews that are usually conducted every five years. Our trade data suggest that a sunset review leads to an increase in trade with named countries as some of the firm-specific duties are lowered due to the review. To our knowledge, there is no literature on this issue which makes it an interesting area for future research. Lastly, we would like to address the issue of firm heterogeneity. The applied duty is time variant for most firms which implies not only different transactions costs but also different cost structures which allows these firms to apply to the ITC for a lower duty rate. Firm-specific trade data would provide more precise estimates of the dynamics of TR investigations. In summary, our paper provides valuable insights into an important agricultural trade policy issue. We show evidence that TR duties cause a substantial amount of trade diversion in agriculture which lowers the level of protection provided by TR laws.

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# 7 Appendix

## Tables



## Figures

**Table A1:** Affirmative TR investigations of the United States between 1990 and 2014

| Investigated country | Product description | Initiation | Preliminary decision | Final decision | Duty rate |
|---|---|---|---|---|---|
| China | Fresh Garlic | 02/28/1994 | 07/11/1994 | 09/26/1994 | 376.67 |
| Thailand | Canned Pineapple | 07/05/1994 | 01/11/1995 | 07/18/1995 | 3.02 |
| Italy | Pasta | 06/08/1995 | 01/19/1996 | 06/14/1996 | 12.09 |
| Turkey | Pasta | 06/08/1995 | 01/19/1996 | 06/14/1996 | 60.87 |
| Italy | Pasta | 06/08/1995 | 10/17/1995 | 06/14/1996 | 11.23 |
| Turkey | Pasta | 06/08/1995 | 10/17/1995 | 06/14/1996 | 15.82 |
| China | Crawfish Tail Meat | 10/15/1996 | 03/26/1997 | 08/01/1997 | 201.63 |
| Chile | Fresh Atlantic Salmon | 07/10/1997 | 01/16/1998 | 06/09/1998 | 4.57 |
| Chile | Certain Preserved Mushrooms | 02/02/1998 | 08/05/1998 | 10/22/1998 | 148.51 |
| China | Certain Preserved Mushrooms | 02/02/1998 | 08/05/1998 | 12/31/1998 | 198.63 |
| India | Certain Preserved Mushrooms | 02/02/1998 | 08/05/1998 | 12/31/1998 | 11.30 |
| Indonesia | Certain Preserved Mushrooms | 02/02/1998 | 08/05/1998 | 12/31/1998 | 11.26 |
| China | Non-Frozen Apple Juice Concentrate | 07/06/1999 | 11/23/1999 | 04/13/2000 | 51.74 |
| Argentina | Honey | 11/02/2000 | 05/11/2001 | 04/10/2001 | 30.24 |
| China | Honey | 11/02/2000 | 05/11/2001 | 10/04/2001 | 183.80 |
| Argentina | Honey | 11/02/2000 | 03/13/2001 | 10/04/2001 | 5.85 |
| Chile | Individually Quick Frozen Red Raspberries | 06/06/2001 | 12/31/2001 | 05/21/2002 | 6.33 |
| Vietnam | Frozen Fish Fillets | 07/24/2002 | 01/31/2003 | 06/23/2003 | 63.88 |
| Canada | Hard Red Spring Wheat | 10/29/2002 | 05/08/2003 | 09/05/2003 | 8.86 |
| Canada | Hard Red Spring Wheat | 10/29/2002 | 03/10/2003 | 09/05/2003 | 5.29 |
| Brazil | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 08/04/2004 | 02/01/2005 | 7.05 |
| China | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 07/16/2004 | 02/01/2005 | 112.81 |
| Ecuador | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 08/04/2004 | 02/01/2005 | 3.58 |
| India | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 08/04/2004 | 02/01/2005 | 10.17 |
| Thailand | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 08/04/2004 | 02/01/2005 | 5.95 |
| Vietnam | Frozen and Canned Warmwater Shrimp and Prawns | 01/27/2004 | 07/16/2004 | 02/01/2005 | 25.76 |
| Brazil | Orange Juice | 01/04/2005 | 08/24/2005 | 01/13/2006 | 16.51 |
| Argentina | Lemon Juice | 09/27/2006 | 04/26/2007 | 09/21/2007 | 85.00 |
| Mexico | Lemon Juice | 09/27/2006 | 04/26/2007 | 09/21/2007 | 205.37 |

**Table A2:** Trade diversion effect on non-named countries (quantity specification with investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.084 | 0.126 | 0.350*** | 0.350*** | 0.126 | 0.258* | 0.258** | 0.333* | 0.333** | 0.180 | 0.197* | -0.166 | 0.171 |
| | (0.301) | (0.464) | (0.124) | (0.090) | (0.464) | (0.145) | (0.111) | (0.201) | (0.136) | (0.145) | (0.106) | (0.176) | (0.128) |
| $P_2$ | -0.231 | -0.513 | 0.014 | 0.014 | -0.513 | -0.133 | -0.133 | -0.205 | -0.205** | -0.066 | -0.114 | -0.055 | -0.129 |
| | (0.327) | (0.488) | (0.091) | (0.071) | (0.488) | (0.140) | (0.096) | (0.145) | (0.086) | (0.157) | (0.097) | (0.159) | (0.082) |
| $P_3$ | 0.146 | 0.173 | 0.224*** | 0.224*** | 0.173 | -0.073 | -0.073 | -0.128 | -0.128 | -0.024 | -0.070 | -0.242 | -0.120 |
| | (0.149) | (0.172) | (0.057) | (0.044) | (0.172) | (0.175) | (0.120) | (0.193) | (0.122) | (0.191) | (0.121) | (0.214) | (0.122) |
| $I_{t-1}$ | | | | | | | | | | 0.023*** | 0.008*** | 0.059*** | 0.017*** |
| | | | | | | | | | | (0.003) | (0.002) | (0.003) | (0.002) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.007 | 0.015 | 0.769 | 0.870 | 0.015 | 0.777 | 0.881 | 0.829 | 0.955 | 0.678 | 0.881 | 0.895 | 0.961 |
| *AIC* | 67,600 | 66,670 | 24,768 | 10,306 | 66,670 | 24,690 | 10,227 | 24,314 | 9,851 | 22,383 | 9,902 | 19,980 | 9,486 |
| *BIC* | 67,768 | 68,175 | 24,985 | 10,814 | 68,175 | 25,047 | 10,865 | 26,006 | 11,719 | 22,746 | 10,544 | 21,668 | 11,349 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A3:** Trade diversion effect on non-named countries (quantity specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.106 | 0.159 | 0.338*** | 0.338*** | 0.159 | 0.307** | 0.307*** | 0.442** | 0.442*** | 0.208 | 0.240** | -0.091 | 0.258** |
| | (0.289) | (0.443) | (0.126) | (0.091) | (0.443) | (0.150) | (0.113) | (0.203) | (0.133) | (0.137) | (0.104) | (0.166) | (0.124) |
| $\ln(\tau_1)\, P_2$ | -0.062 | -0.135 | -0.001 | -0.001 | -0.135 | -0.018 | -0.018 | -0.027 | -0.027 | -0.007 | -0.015 | 0.012 | -0.010 |
| | (0.087) | (0.130) | (0.026) | (0.021) | (0.130) | (0.033) | (0.023) | (0.036) | (0.020) | (0.039) | (0.024) | (0.037) | (0.018) |
| $\ln(\tau_2)\, P_3$ | 0.055* | 0.064* | 0.061*** | 0.061*** | 0.064* | 0.015 | 0.015 | 0.028 | 0.028 | 0.013 | 0.011 | -0.026 | 0.017 |
| | (0.031) | (0.035) | (0.015) | (0.012) | (0.035) | (0.033) | (0.021) | (0.034) | (0.021) | (0.037) | (0.022) | (0.037) | (0.020) |
| $I_{t-1}$ | | | | | | | | | | 0.023*** | 0.008*** | 0.059*** | 0.017*** |
| | | | | | | | | | | (0.003) | (0.002) | (0.003) | (0.002) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.007 | 0.015 | 0.768 | 0.869 | 0.015 | 0.777 | 0.881 | 0.830 | 0.955 | 0.679 | 0.881 | 0.895 | 0.961 |
| $AIC$ | 67,527 | 66,584 | 24,772 | 10,310 | 66,584 | 24,690 | 10,227 | 24,313 | 9,850 | 22,383 | 9,902 | 19,987 | 9,487 |
| $BIC$ | 67,695 | 68,090 | 24,989 | 10,819 | 68,090 | 25,046 | 10,865 | 26,005 | 11,718 | 22,745 | 10,545 | 21,675 | 11,351 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A4:** Trade diversion effect on non-named countries (value specification with investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | -0.388*** | -0.556*** | -0.138 | -0.138*** | -0.556*** | -0.046 | -0.046 | 0.239* | 0.239*** | 0.270** | 0.053 | 0.192* | 0.227*** |
| | (0.130) | (0.140) | (0.125) | (0.050) | (0.140) | (0.157) | (0.058) | (0.127) | (0.069) | (0.110) | (0.054) | (0.106) | (0.064) |
| $P_2$ | -0.036 | 0.123 | 0.171 | 0.171*** | 0.123 | 0.087 | 0.087 | 0.156 | 0.156** | -0.100 | 0.087 | 0.078 | 0.135* |
| | (0.146) | (0.141) | (0.140) | (0.047) | (0.141) | (0.186) | (0.060) | (0.141) | (0.072) | (0.183) | (0.057) | (0.129) | (0.069) |
| $P_3$ | -0.595*** | -0.624*** | 0.081 | 0.081*** | -0.624*** | -0.029 | -0.029 | 0.295** | 0.295*** | 0.597*** | 0.144* | 0.270** | 0.282*** |
| | (0.079) | (0.082) | (0.077) | (0.027) | (0.082) | (0.218) | (0.080) | (0.148) | (0.088) | (0.206) | (0.075) | (0.136) | (0.084) |
| $I_{t-1}$ | | | | | | | | | | 4.532*** | 1.077*** | 5.531*** | 1.167*** |
| | | | | | | | | | | (0.190) | (0.103) | (0.166) | (0.084) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.061 | 0.066 | 0.214 | 0.895 | 0.066 | 0.224 | 0.936 | 0.232 | 0.962 | 0.539 | 0.942 | 0.714 | 0.969 |
| $AIC$ | 2,032 | 2,401 | 1,756 | 1,256 | 2,401 | 1,788 | 1,289 | 2,161 | 1,662 | 1,427 | 1,270 | 1,772 | 1,643 |
| $BIC$ | 2,200 | 3,906 | 1,972 | 1,765 | 3,906 | 2,144 | 1,926 | 3,854 | 3,530 | 1,790 | 1,913 | 3,460 | 3,506 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A5:** Trade diversion effect on non-named countries (value specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | -0.310** | -0.440*** | -0.135 | -0.135*** | -0.440*** | -0.019 | -0.019 | 0.196 | 0.196*** | -0.008 | 0.016 | 0.039 | 0.169*** |
| | (0.127) | (0.133) | (0.124) | (0.049) | (0.133) | (0.150) | (0.054) | (0.140) | (0.066) | (0.122) | (0.051) | (0.101) | (0.059) |
| $\ln(\tau_1)\, P_2$ | 0.015 | 0.069 | 0.052 | 0.052*** | 0.069 | 0.035 | 0.035*** | 0.035 | 0.035** | -0.145** | 0.009 | -0.130*** | 0.006 |
| | (0.045) | (0.049) | (0.042) | (0.013) | (0.049) | (0.051) | (0.013) | (0.060) | (0.015) | (0.058) | (0.013) | (0.044) | (0.014) |
| $\ln(\tau_2)\, P_3$ | -0.163*** | -0.164*** | 0.033 | 0.033*** | -0.164*** | 0.016 | 0.016 | 0.057 | 0.057*** | 0.042 | 0.031** | -0.001 | 0.048*** |
| | (0.022) | (0.022) | (0.023) | (0.008) | (0.022) | (0.044) | (0.016) | (0.046) | (0.014) | (0.031) | (0.014) | (0.029) | (0.013) |
| $I_{t-1}$ | | | | | | | | | | 4.562*** | 1.077*** | 5.561*** | 1.167*** |
| | | | | | | | | | | (0.179) | (0.101) | (0.164) | (0.086) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.062 | 0.067 | 0.214 | 0.895 | 0.067 | 0.224 | 0.936 | 0.232 | 0.963 | 0.556 | 0.942 | 0.718 | 0.969 |
| *AIC* | 2,032 | 2,402 | 1,755 | 1,256 | 2,402 | 1,788 | 1,289 | 2,161 | 1,662 | 1,426 | 1,270 | 1,771 | 1,643 |
| *BIC* | 2,200 | 3,907 | 1,972 | 1,765 | 3,907 | 2,144 | 1,926 | 3,853 | 3,530 | 1,789 | 1,913 | 3,459 | 3,506 |

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A6:** Trade diversion effect on non-named countries (number of trading partner specification with investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.063 | 0.043 | 0.030 | 0.030* | 0.043 | 0.056 | 0.056** | 0.049 | 0.049 | 0.030 | 0.048** | 0.022 | 0.048* |
| | (0.075) | (0.081) | (0.064) | (0.016) | (0.081) | (0.076) | (0.025) | (0.073) | (0.032) | (0.044) | (0.021) | (0.047) | (0.025) |
| $P_2$ | 0.194** | 0.256*** | 0.044 | 0.044*** | 0.256*** | 0.050 | 0.050* | 0.060 | 0.060* | 0.035 | 0.048** | 0.035 | 0.053* |
| | (0.082) | (0.087) | (0.068) | (0.016) | (0.087) | (0.084) | (0.028) | (0.079) | (0.035) | (0.051) | (0.024) | (0.049) | (0.028) |
| $P_3$ | 0.117** | 0.113** | 0.097** | 0.097*** | 0.113** | 0.065 | 0.065* | 0.063 | 0.063 | 0.105 | 0.096*** | 0.081 | 0.088** |
| | (0.050) | (0.050) | (0.038) | (0.010) | (0.050) | (0.098) | (0.034) | (0.088) | (0.043) | (0.065) | (0.030) | (0.062) | (0.035) |
| $I_{t-1}$ | | | | | | | | | | 0.114*** | 0.047*** | 0.116*** | 0.051*** |
| | | | | | | | | | | (0.002) | (0.002) | (0.002) | (0.003) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.035 | 0.038 | 0.212 | 0.925 | 0.038 | 0.215 | 0.936 | 0.216 | 0.938 | 0.790 | 0.944 | 0.808 | 0.948 |
| *AIC* | 97,044 | 97,157 | 77,421 | 17,388 | 97,157 | 77,173 | 17,140 | 77,463 | 17,431 | 32,859 | 16,224 | 32,894 | 16,487 |
| *BIC* | 97,212 | 98,662 | 77,638 | 17,897 | 98,662 | 77,529 | 17,778 | 79,156 | 19,299 | 33,222 | 16,867 | 34,583 | 18,351 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A7:** Trade diversion effect on non-named countries (number of trading partner specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.022 | 0.002 | 0.035 | 0.035** | 0.002 | 0.070 | 0.070*** | 0.071 | 0.071*** | 0.046 | 0.052*** | 0.059 | 0.062*** |
| | (0.073) | (0.078) | (0.063) | (0.015) | (0.078) | (0.072) | (0.021) | (0.070) | (0.026) | (0.039) | (0.018) | (0.043) | (0.022) |
| $\ln(\tau_1)\, P_2$ | 0.035* | 0.053** | 0.012 | 0.012*** | 0.053** | 0.018 | 0.018*** | 0.023 | 0.023*** | 0.014 | 0.014*** | 0.020 | 0.019*** |
| | (0.020) | (0.023) | (0.017) | (0.004) | (0.023) | (0.020) | (0.006) | (0.021) | (0.007) | (0.012) | (0.005) | (0.012) | (0.006) |
| $\ln(\tau_2)\, P_3$ | 0.017* | 0.017 | 0.033*** | 0.033*** | 0.017 | 0.028 | 0.028*** | 0.031 | 0.031*** | 0.041*** | 0.030*** | 0.045*** | 0.032*** |
| | (0.010) | (0.011) | (0.009) | (0.003) | (0.011) | (0.019) | (0.006) | (0.020) | (0.006) | (0.013) | (0.005) | (0.012) | (0.006) |
| $I_{t-1}$ | | | | | | | | | | 0.114*** | 0.047*** | 0.116*** | 0.051*** |
| | | | | | | | | | | (0.002) | (0.002) | (0.002) | (0.003) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 8,113 | 8,113 | 8,052 | 4,636 | 8,113 | 8,052 | 4,636 | 8,052 | 4,636 | 7,920 | 4,560 | 7,920 | 4,560 |
| $R^2$ | 0.035 | 0.037 | 0.213 | 0.926 | 0.037 | 0.215 | 0.936 | 0.217 | 0.939 | 0.791 | 0.945 | 0.810 | 0.949 |
| *AIC* | 97,108 | 97,220 | 77,385 | 17,352 | 97,220 | 77,159 | 17,126 | 77,448 | 17,415 | 32,831 | 16,212 | 32,861 | 16,472 |
| *BIC* | 97,276 | 98,725 | 77,601 | 17,861 | 98,725 | 77,515 | 17,764 | 79,140 | 19,283 | 33,194 | 16,854 | 34,549 | 18,336 |

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A8:** Trade diversion effect on non-named countries that did not trade before of the case initiation with the United States (quantity specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.640 | 0.321 | 4.534*** | 4.534*** | 0.321 | 4.984*** | 4.984*** | 6.294*** | 6.294*** | 5.101*** | 5.131*** | 6.148*** | 6.223*** |
| | (1.142) | (1.264) | (1.416) | (1.416) | (1.264) | (0.831) | (0.833) | (0.641) | (0.646) | (0.888) | (0.847) | (0.661) | (0.667) |
| $\ln(\tau_1)\, P_2$ | -0.128 | -0.068 | 1.022*** | 1.022*** | -0.068 | 1.087*** | 1.087*** | 1.548*** | 1.548*** | 1.068*** | 1.062*** | 1.558*** | 1.533*** |
| | (0.105) | (0.074) | (0.238) | (0.238) | (0.074) | (0.242) | (0.242) | (0.175) | (0.167) | (0.226) | (0.225) | (0.194) | (0.168) |
| $\ln(\tau_2)\, P_3$ | 0.222*** | 0.225*** | 2.014*** | 2.014*** | 0.225*** | 1.720*** | 1.720*** | 2.056*** | 2.056*** | 1.738*** | 1.745*** | 1.987*** | 2.034*** |
| | (0.024) | (0.034) | (0.261) | (0.260) | (0.034) | (0.232) | (0.234) | (0.250) | (0.235) | (0.241) | (0.239) | (0.248) | (0.238) |
| $I_{t-1}$ | | | | | | | | | | -0.026 | -0.033 | 0.200 | 0.016 |
| | | | | | | | | | | (0.046) | (0.043) | (0.317) | (0.063) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 4,335 | 4,265 | 4,514 | 4,514 | 4,265 | 4,335 | 4,335 | 4,265 | 4,265 | 4,272 | 4,272 | 4,202 | 4,202 |
| $R^2$ | 0.016 | 0.029 | 0.501 | 0.514 | 0.029 | 0.695 | 0.702 | 0.929 | 0.926 | 0.760 | 0.776 | 0.925 | 0.925 |
| $AIC$ | 2,584 | 2,656 | 1,247 | 1,133 | 2,656 | 1,121 | 1,007 | 1,310 | 1,196 | 1,120 | 1,003 | 1,305 | 1,197 |
| $BIC$ | 2,724 | 3,851 | 1,446 | 1,627 | 3,851 | 1,434 | 1,612 | 2,677 | 2,855 | 1,438 | 1,614 | 2,676 | 2,859 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A9:** Trade diversion effect on non-named countries that did not trade before of the case initiation with the United States (value specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | -1.056** | -1.256** | 2.215*** | 2.215*** | -1.256** | 1.216 | 1.216 | 4.675*** | 4.676*** | 2.615** | 2.312* | 3.764*** | 4.082*** |
| | (0.483) | (0.537) | (0.570) | (0.566) | (0.537) | (1.704) | (1.701) | (1.063) | (1.049) | (1.109) | (1.303) | (0.860) | (0.859) |
| $\ln(\tau_1)\, P_2$ | 0.065 | 0.080 | 1.133*** | 1.133*** | 0.080 | 0.805* | 0.805* | 1.160*** | 1.160*** | 0.924*** | 0.936*** | 1.101*** | 1.048*** |
| | (0.085) | (0.071) | (0.138) | (0.136) | (0.071) | (0.453) | (0.451) | (0.232) | (0.227) | (0.306) | (0.336) | (0.177) | (0.181) |
| $\ln(\tau_2)\, P_3$ | 0.242*** | 0.241*** | 1.681*** | 1.681*** | 0.241*** | 1.238*** | 1.238*** | 1.294*** | 1.294*** | 1.259*** | 1.217*** | 1.162*** | 1.162*** |
| | (0.024) | (0.031) | (0.110) | (0.107) | (0.031) | (0.456) | (0.453) | (0.249) | (0.242) | (0.301) | (0.335) | (0.198) | (0.194) |
| $I_{t-1}$ | | | | | | | | | | 30.420*** | 17.868*** | 63.085*** | 23.141*** |
| | | | | | | | | | | (5.117) | (3.487) | (10.194) | (3.263) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 4,335 | 4,265 | 4,514 | 4,514 | 4,265 | 4,335 | 4,335 | 4,265 | 4,265 | 4,272 | 4,272 | 4,202 | 4,202 |
| $R^2$ | 0.021 | 0.037 | 0.639 | 0.710 | 0.037 | 0.740 | 0.858 | 0.821 | 0.974 | 0.781 | 0.896 | 0.926 | 0.974 |
| *AIC* | 112 | 441 | 112 | 199 | 441 | 147 | 234 | 477 | 564 | 146 | 235 | 476 | 566 |
| *BIC* | 253 | 1,637 | 311 | 693 | 1,637 | 459 | 839 | 1,844 | 2,224 | 464 | 845 | 1,846 | 2,228 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A10:** Trade diversion effect on non-named countries that did not trade before of the case initiation with the United States (number of trading partner specification with interacted investigation stage dummies)

| | Baseline specification | | | | | | | | | Specification with lag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| $P_1$ | 0.150 | -0.077 | 1.938*** | 1.938*** | -0.077 | 1.626*** | 1.626*** | 1.801*** | 1.801*** | 1.863*** | 1.793*** | 1.980*** | 1.905*** |
| | (0.164) | (0.192) | (0.175) | (0.174) | (0.192) | (0.161) | (0.156) | (0.180) | (0.169) | (0.131) | (0.133) | (0.147) | (0.145) |
| $\ln(\tau_1)\, P_2$ | 0.148*** | 0.177*** | 0.776*** | 0.776*** | 0.177*** | 0.511*** | 0.511*** | 0.580*** | 0.580*** | 0.607*** | 0.590*** | 0.657*** | 0.639*** |
| | (0.038) | (0.039) | (0.065) | (0.064) | (0.039) | (0.061) | (0.059) | (0.067) | (0.062) | (0.051) | (0.049) | (0.058) | (0.053) |
| $\ln(\tau_2)\, P_3$ | 0.348*** | 0.350*** | 1.119*** | 1.119*** | 0.350*** | 0.632*** | 0.632*** | 0.651*** | 0.651*** | 0.617*** | 0.628*** | 0.607*** | 0.623*** |
| | (0.017) | (0.020) | (0.053) | (0.051) | (0.020) | (0.065) | (0.060) | (0.069) | (0.063) | (0.060) | (0.056) | (0.063) | (0.058) |
| $I_{t-1}$ | | | | | | | | | | 0.262*** | 0.119*** | 0.297*** | 0.132*** |
| | | | | | | | | | | (0.040) | (0.029) | (0.042) | (0.031) |
| $\delta_q$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_{yr}$ | Yes | No | No | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| $\delta_t$ | No | Yes | No | No | Yes | No | No | Yes | Yes | No | No | Yes | Yes |
| $\mu_K$ | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes | No |
| $\mu_k$ | No | No | No | Yes | No | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 4,335 | 4,265 | 4,514 | 4,514 | 4,265 | 4,335 | 4,335 | 4,265 | 4,265 | 4,272 | 4,272 | 4,202 | 4,202 |
| $R^2$ | 0.069 | 0.085 | 0.600 | 0.726 | 0.085 | 0.665 | 0.798 | 0.716 | 0.849 | 0.692 | 0.840 | 0.815 | 0.872 |
| *AIC* | 9,347 | 9,278 | 6,724 | 5,443 | 9,278 | 6,384 | 5,103 | 6,504 | 5,223 | 5,598 | 4,916 | 5,677 | 5,057 |
| *BIC* | 9,487 | 10,473 | 6,923 | 5,937 | 10,473 | 6,696 | 5,708 | 7,871 | 6,882 | 5,916 | 5,527 | 7,047 | 6,719 |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

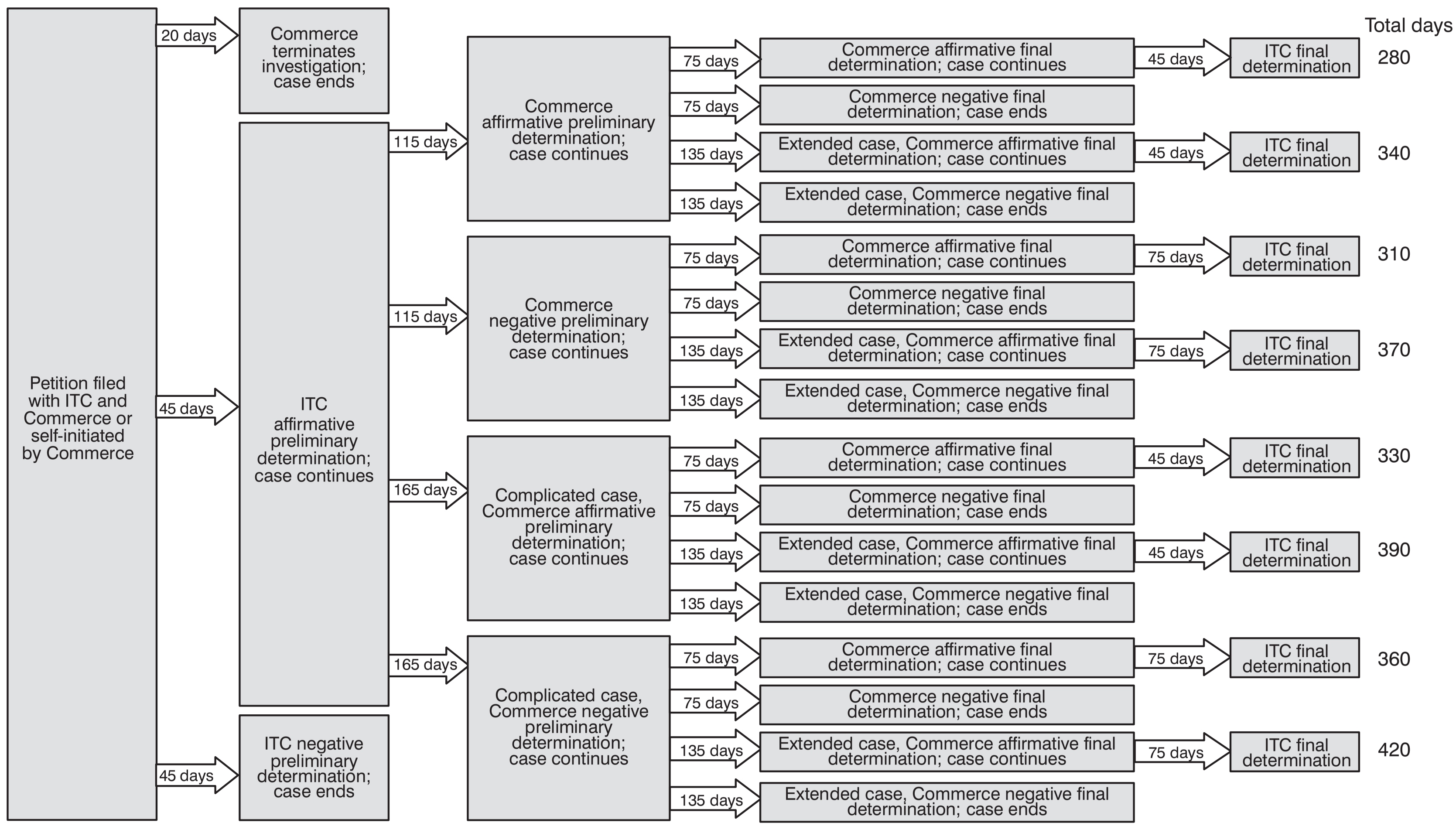


**Figure A1:** Statuary timetable of AD investigations. Source: `https://www.usitc.gov/trade_remedy/documents/timetable.pdf`

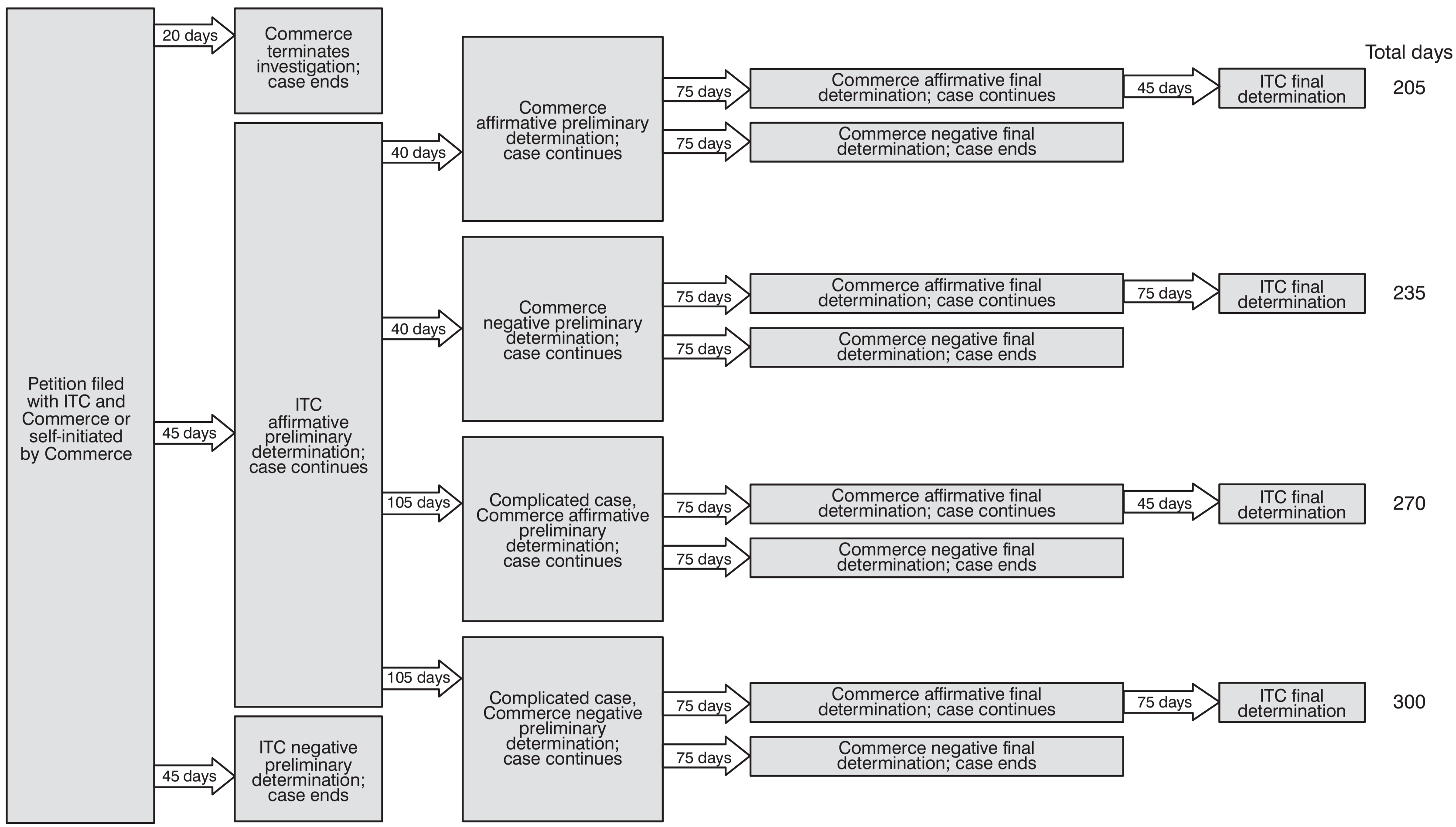


**Figure A2:** Statuary timetable of CVD investigations. Source: `https://www.usitc.gov/trade_remedy/documents/timetable.pdf`