

**Do Firms Hedge Against Political Tensions?  
Evidence from Chinese Food Importers of Norwegian Salmon**

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# Do Firms Hedge Against Political Tensions? Evidence from Chinese Food Importers of Norwegian Salmon

**Abstract:** Political and economic tensions, which often jeopardize trade, are rising among the world's major powers, and countries like China are more frequently using food-related trade actions to deal with deteriorating political relations. Using an event study approach, this paper investigates how importers respond to lasting political tensions by examining China's seafood importers' responses to the six-year Norway-China political tensions after Norway awarded Liu Xiaobo, a Chinese political dissident, a Nobel Peace Prize in 2010. Our results reveal firm-level responses at both the intensive and extensive margins. At the intensive margin, firms that imported Norwegian fresh salmon before the sanction saw a 20% persistent decline in their fresh salmon import value and an 80% decrease in the import share of Norwegian fresh salmon products over our study period. At the extensive margin, we find a trade diversion effect that firms imported fresh salmon from Norway to other countries and regions, but also a consistent "political hedging" effect three years after sanction with a 20% decline in the maximum import share from any particular country or region, even if not Norway.

**Key Words:** International trade, International political economy, Norway, Nobel Peace Prize, Political sanctions, Event study approach, Agricultural trade

**JEL Codes:** F51, F14, P33, Q17, Q18

## 1 INTRODUCTION

Rising nationalist sentiments are raising political tensions across the world—former U.S. President Donald Trump sought to “make America great again,” China’s President Xi Jinping calls for “the great rejuvenation of the Chinese nation,” and France’s Emmanuel Macron is trying to restore France’s glory through his “Jupiterian” presidency, all while a majority of Britain’s citizens voted to leave the European Union to take back control. In a more globalized world, political tensions do not necessarily evolve into wars, but rather manifest as a trade dispute. In fact, the widespread use of economic sanctions nowadays constitutes one paradox of major global powers’ foreign policies. As such, nationalist and strong-state narratives create risks for political tensions internationally, which creates significant uncertainty for global trade. The International Money Fund’s World Trade Uncertainty Index shows that these political tensions contributed to a recent sharp rise in trade uncertainty over the past few years after two decades of stability, threatening global trade and economic growth (Ahir et al., 2019).

Many previous studies analyze the relationship between trade and political tensions (Berger et al., 2013; Che et al., 2015; Davis and Meunier, 2011; Head et al., 2010; Long, 2008; Michaels and Zhi, 2010). However, there are two critical gaps in the current literature. First, most previous studies focus on short-term political tensions that last for days or months, such as consumer boycotts (Heilmann, 2016; Pandya and Venkatesan, 2016). Except for the four-year ongoing sanction on Iran examined in Haidar (2017), the periods of political tensions examined in recent studies are mostly limited to two years at most (Crozet and Hinz, 2020). As a result, firms barely changed their trading strategies, and trade responses to these political tensions are often short-lived, sometimes driven solely by firms with stronger governmental ties. Second, most previous research relies on aggregate trade data to analyze the impact of political tensions, which masks firm-level trading behavior under political tensions. Recent papers (Ahn and Ludema, 2020; Crozet and Hinz, 2020; Haidar, 2017) utilize firm-level data to shed light on the effect of political tensions on individual firm’s behavior in sanctioned countries, such as Iran and Russia; however, how political tensions affect firms’ trade practices and importing portfolios involving products from

sanctioned countries remains unclear.

To understand the firms' importing behavior in response to political tensions at both the extensive and intensive margins, we focus on a unique six-year Norway-China tension event and collect rich trade data from the China Customs Bureau that includes firm-level transactions from 2007 to 2015. In particular, we leverage detailed data on all Chinese seafood importers and importing trips against China's six-year sanction of Norwegian salmon products due to bilateral political tensions that started in 2010. The sanction lasted until 2016 when China issued a new health certificate for Norway's exports of fish products. Firms' responses to this sanction provide a unique opportunity to observe how political sanctions change firms' trading strategies over a long period. We explore three main research hypotheses. First, we hypothesize the sanctions had significant negative impacts on imports of Norwegian fresh salmon for firms that imported these products before the sanction, which provides an estimate of the magnitude of the intensive-margin impacts of political sanctions on fresh salmon importers. Second, we hypothesize that long-lasting political sanctions reshape firms' trading strategies permanently, resulting in persistent post-effects of lasting political tensions. In our case, impacted firms possibly looked for fresh salmon from other countries/regions or shifted to other seafood products, depending on whether the benefits of transition outweighed the costs of not doing so. Furthermore, once firms began outsourcing from multiple countries/regions, they permanently diversified their import portfolio for profits. Lastly, we hypothesize these intensive- and extensive-margin responses could vary by firm characteristics, with greater responses for firms with better resources and existing alternative trade routes.

Our main identification strategy is the widely used event study approach (Allcott and Rogers, 2014; Gallagher, 2014; Markevich and Zhuravskaya, 2018; Sun and Abraham, 2020) in which we leverage China's prompt sanctions following the 2010 Nobel Peace Prize announcement. We combine this with firm-level data from the China Customs Bureau, which provides price, value, and source country/region information for all 74,221 import observations for China's seafood importers from 2007 to 2015. Using firms importing aquatic seafood as the control group, we first quantify the salmon sanction's intensive-

margin impacts and their persistence over time on the import outcomes of fresh salmon for most affected firms that imported these products before 2010. Second, we examine three extensive-margin outcomes due to the political sanction—the maximum import share of fresh salmon from any country, the import share of fresh salmon from any particular source country, and the number of countries a firm imports fresh salmon from. We expect to see trade diversion effects as firms actively seek other importing source countries and non-sanctioned substitute products. In addition, the maximum fresh salmon import share also captures a strategic diversification effect where political sanctions make firms less likely to depend on any particular country solely. Finally, we employ a generalized triple difference design to examine the heterogeneous responses across firm characteristics such as firm type, firm size, and existing trading routes.

Our results reveal that China's importing firms responded to the salmon sanction at intensive and extensive margins. Previous literature (Du et al., 2017; Fuchs and Klann, 2013) mainly focuses on the intensive margin at the national level. In our paper, by utilizing firm-level data, we are able to perform a deeper analysis on the optimal importing behavior of agents under political tensions. At the intensive margin, firms that only imported Norwegian fresh salmon before the sanction saw a 20% persistent decline in their total fresh salmon import value and an 80% decrease in the import share of Norwegian fresh salmon products. Furthermore, the declines were not short-lived, but instead remained persistent throughout the six-year political sanction and even after China-Norway relations unfroze. At the extensive margin, we find not only a trade diversion effect where firms import from other countries and fewer firms import fresh salmon from Norway, but also a permanent "political hedging" effect with a decline in the maximum import share from any particular country, even if not Norway. In particular, we find that the maximum share of seafood a firm imports from any country decreased by 20% on average, especially for firms with a pre-existing trade route with Norway. Furthermore, we find a shift from Norway dominating import market shares to other countries and regions, especially the Faroe Islands and the United Kingdom, accounting for more import market share. In addition to that, we find little evidence that the decline in maximum import share is associated with

the changes in China's fresh salmon demand. The firm-level analysis reveals that lasting political tensions between China and Norway made China's importers adopt the strategy of import diversification in order to compromise the negative impacts of a poor long-term bilateral relationship.

Our paper makes three contributions to the literature on the interplay between trade and political tensions. First, while notably scarcer, there is increasing evidence of the impact of political and economic sanctions on firms' decisions and trade practices (Ahn and Ludema, 2020; Baker and Davis, 2016; Bloom, 2009; Crozet and Hinz, 2020; Gullstrand, 2020; Haidar, 2017; Handley and Limao, 2017; Massol et al., 2023; Weber and Stepień, 2020). These studies use firm-level data to quantify the effect of sanctions on sanctioned firms using various economic outcomes and find evidence that sanctioned firms would divert exports to non-sanctioning countries and that the sanctions have a spillover effect on non-sanctioned products. For example, Gullstrand (2020) utilized detailed information about firms' exports and imports on the product level to understand the impacts of Russia's counter-sanctions on Swedish firms. Crozet and Hinz (2020) assess the consequences of the sanctions regime against the Russian Federation, as well as their counter-sanctions, on the exports of goods of involved countries. Using firm-product-destination-month information, they find that the drop in Western exports was not driven by a change in Russian consumers' preferences, but mainly by an increase in country risk affecting international transactions with Russia. However, little research explores the behavior of importing firms in sanctioning countries. In contrast to these studies, we identify political hedging strategies of importing firms—firms persistently reduce the maximum import share from any country even if their main importing source country is not affected by the sanction three years after the salmon sanctions. This is consistent with the findings of our partial-equilibrium model of firms' importing diversification behavior where some firms continue to import from new trading partners even after China-Norway relations unfroze in 2016. In other words, compared to the short-term consumer boycotts, a lasting political tension could fundamentally change importers' diversification strategies and permanently change trade patterns—Norway now plays a diminished role.

Second, our work contributes to the extensive literature that examines the impact of non-tariff measures (NTMs) on trade and economic growth outcomes (Besedeš et al., 2017; Che et al., 2015; Du et al., 2017; Frankel, 1982; Fuchs and Klann, 2013; Gawarkiewicz and Tang, 2017; Graziano et al., 2018; Heilmann, 2016; Hufbauer et al., 2003; Irwin, 2005; Luo et al., 2021; Mahlstein et al., 2022; Massol et al., 2023; Miromanova, 2023; O’rourke, 2007; Pandya and Venkatesan, 2016). One of the most relevant studies, Luo et al. (2021), investigates the impact of China’s sanctions on fruit exports of the Philippines and finds a short-term impact on bananas and pineapple exports to China in the first three months. Massol et al. (2023) investigate the effects of the 2012–2016 sanctions against Iran’s petrochemical exports on the main importing markets in Asia and use it to measure the degrees of spatial integration attained outside and during the sanction period. At the firm level, one recent paper by Beestermöller et al. (2018) examines the impact of food safety regulations on the agri-food trade. It suggests that border rejections amplify the turnover among exporting firms at the extensive margin of trade. As a complement to this strand of literature, our work leverages the uncertainty created by the settled six-year China-Norway political dispute and examines the effect of the lasting political tension on bilateral trade outcomes at the firm level. Our results show that the more stringent sanitation and veterinary testing on fresh salmon imports had a substantial and lasting impact on both the intensive and extensive margin of trade.

Third, this paper relates to a strand of literature that investigates the heterogeneous responses of firms under political tensions (Du et al., 2017; Heilmann, 2016; Lin et al., 2019). These studies examine the impact of political tensions on politically influenced firms and find those firms’ imports display higher sensitivity to political relations relative to other types of firms. In our context, our heterogeneity analysis reveals that not only politically influenced firms, such as China’s state-owned enterprises, adjusted their trading behavior, but, rather, privately owned firms also became more precautionary and intentionally diversified their trading portfolios.

The rest of this paper proceeds as follows. In section 2, we provide some background on China’s 2010 decision to impose sanctions on the imports of Norwegian fresh salmon, as

well as China's fresh salmon trade in general from 2007 to 2015. Section 3 provides details on China's firm-level customs data we use in this study. Section 4 presents the event study approach that we employ to causally identify firm-level responses to the 2010 fresh salmon sanction at both the intensive and extensive margins. Section 5 provides results on firm-level responses at the extensive and intensive margin. Finally, we discuss how our results differ from and improve previous findings and explore the possible mechanisms using a partial-equilibrium model of firm importing decisions in section 6. Section 7 concludes.

## **2 BACKGROUND ON CHINA'S 2010 SANCTION ON NORWEGIAN FRESH SALMON**

China's economic sanctions have traditionally aimed to convey the government's dissatisfaction with a particular event, rather than inflicting lasting, substantial economic harm on the concerned foreign nation. Such acts signal China's frustration and serve as a warning of more substantial retaliation if a country or region does not reverse a certain action or does not make an official gesture to improve relations. China's sanctions tend to be subtle: they are unilateral, not officially declared, implemented without being formally passed into law, and limited in terms of sectoral application, economic scope, and duration. The advantage of a subtle sanction is that it is harder to prove the existence of any underpinning domestic regulation. China is more inclined to use non-transparent political measures that are not legislated, and apply non-tariff barriers that have not been notified to or declared with multilateral bodies such as the WTO and the United Nations. The disadvantage of subtle sanctions is that, without formal legislation, China can only effectively command official bureaus and state-owned firms, but not private firms. Nevertheless, China still prefers informal sanctions because such sanctions are easily reversible and their very existence can be denied, for instance, the China-Norway fresh salmon sanction.

A six-year political dispute between China and Norway began with the nomination and awarding of the 2010 Nobel Peace Prize (Figure 1). In January, it was leaked that Mr. Liu Xiaobo, a famous imprisoned Chinese political dissident, was nominated for the Nobel Peace Prize. China's Ministry of Foreign Affairs (MFA) spokesman Ma Xiaoxu quickly responded in February 2010 that awarding Liu would be a "grave mistake." Similarly, in a visit to Norway in June 2010, China's Vice Foreign Minister Fu Ying warned Norway's



government that awarding the prize to Liu would be viewed as "an unfriendly move towards Beijing" and could deteriorate relations between Oslo and Beijing (Moskwa, 2010). On September 28, 2010, MFA spokesman Jiang Yu explicitly warned that awarding Liu would "send a wrong message" because Liu was imprisoned for breaking China's laws. However, Norway's Nobel Committee still awarded the prize to Mr. Liu in October 2010, which immediately angered China's government. Within days, China summoned Norway's ambassador and declared the decision a "blasphemy" and insult to China's people (Reuters, 2010), and then canceled the meeting with Norway's minister of fisheries (Guardian, 2010).

The political tensions quickly spread to the arena of commerce and trade. As Chen and Garcia (2016) documents, on December 8, 2010, the Beijing Capital Airport Entry-Exit Inspection and Quarantine Bureau (IQB) issued a regional order that required stricter and more thorough inspection of Norwegian fresh aquaculture products. The Central Office of Quality Supervision, Inspection and Quarantine of China issued document No. 9, on January 28, 2011, which called for more stringent sanitation and veterinary testing of imports of chilled farmed salmon<sup>1</sup>. The majority of stakeholders interviewed by Chen and Garcia (2016) claim that there have been changes in customs practices and border procedures, and they have been disproportionately imposed on imports from Norway<sup>2</sup>. Norway's salmon exports to China quickly reflected the effects of these measures, shrinking 60% in a year in which China's salmon market quickly grew (Godfrey, 2012).

The China-Norway bilateral relationship was not normalized again until 2016, though it did go through some ups and downs from 2012 to 2016. In February 2012, Norway supported China having an observer role as a non-Arctic state in the Arctic Council (BBC,

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<sup>1</sup>To import salmon into China, importers need to apply for a permit for sanitation testing and veterinary inspection, which is called the "Animal and Plant Inspection and Quarantine Permit". The application for the permit requires specific information, including the quantity to be imported, species, exporting country/region, and port of entry into China. The approved permit is quantity-specific, import-firm-specific, export-country-specific, and import-port-specific.

<sup>2</sup>For example, the shipments of Norwegian salmon were always checked and that testing and inspection took longer—at the time, it could take up to 20 days for Norwegian salmon to clear customs. Salmon from other producing countries were only randomly checked; and when checked, complete sanitation tests and veterinary inspections only took three to four days. From 2011 onwards, the General Administration of Quality Supervision, Inspection and Quarantine has approved licenses for low volumes of Norwegian salmon (10 to 30 tons); this restriction did not apply to salmon from other countries (volumes up to 300 tons).

2012), to which China responded positively by calling for further "concrete measures" from Norway to improve bilateral relations. Despite these thawing signs, in December 2012, China offered visa-free visits to Beijing for visitors from many European countries other than Norway (Anderlini and MacCarthy, 2012). Starting in 2013, Norway made other friendly gestures toward China when a new government was elected and Børge Brende, who reportedly had direct contact with China's prime minister, was made Norway's foreign minister. In May 2014, Norway's government declined to meet the Dalai Lama (Gladstone, 2014), which received praise from China. However, in 2015, Norway's national security and intelligence departments accused China of massive cyberattacks and illegal intelligence collection, rated China as a "threat" alongside Russia, and also expelled a Chinese graduate student due to national security concerns (Reuters, 2015). All these actions led to slowly improving, yet stagnant, bilateral political relations.

In September 2014 and March 2015, China banned the imports of whole salmon from certain regions of Norway over concerns of infectious salmon anemia (Wright, 2015). In April 2015, almost one year after Norway's decision to not meet with the Dalai Lama, China agreed to accept new proof that Norwegian salmon met international health and safety standards, and thus, exports from Norway's three affected countries could resume using a new health certificate for fish products (Berglund, 2015). It was not until December 2016 when Norway and China finally resumed and normalized diplomatic and political ties following a surprise visit by Norway's foreign minister Brende (Jacobsen and Blanchard, 2016). In April 2017, Norway's Prime Minister visited China for the first time since 2010 and resumed bilateral trade talks on a free trade agreement. One month later, China formally agreed to reopen Norwegian salmon exports, more than six years after bilateral relations froze (Jing, 2017; Sina, 2017).

### 2.1 *China-Norway fresh salmon trade*

Since Norwegian fresh salmon was introduced to the sushi plate in the late 80s, Norwegian salmon became the world's most popular fish and sushi topping. Today, according to the annual Seafood Consumer Insight study, Norway stands for more than half of the global market for Atlantic salmon and is the most preferred origin among fresh salmon

consumers (Neumann and Gangsø (2021)). Norway exports salmon to more than 100 countries across the world, more than 1 million tonnes in 2019, which represents 14 million meals of Norwegian salmon eaten every single day.

Norwegian salmon has been sold in the Chinese markets for over 20 years. Because of China's expanding middle class, fresh salmon exports from Norway to mainland China grew gradually from 200 Million Yuan in 2007 to 350 Million Yuan in 2010, according to the UN Comtrade. With the awarding of the Nobel Peace Prize to a Chinese dissident in 2010, China's government responded to it by issuing a series of orders that imposed stricter inspection on Norwegian fresh salmon, as Norwegian salmon holds a unique position in the minds of Chinese consumers. The new inspection regime has led to a sharp decrease in the export volume of Norwegian fresh salmon to mainland China. The export volume of Norwegian salmon to mainland China dropped dramatically from 12,555 tonnes in the first 11 months of 2010 to 6,618 tonnes in the same period of 2011 (Luan, 2011). The damage to the image of Norwegian salmon was believed to forfeit a significant part of Norway's investment in the Chinese market.

In the meanwhile, the Norwegian Seafood Council (NSC) has diligently nurtured the demand for salmon in China, particularly emphasizing the image of high-quality salmon originating from Norway, through extensive marketing and awareness campaigns after the 2010 event. These efforts included a significant financial commitment, with the NSC allocating NOK 15 million (approximately USD 2.4 million) towards their campaigns in 2012. The subsequent year, in 2013, the NSC further intensified its focus on the Chinese market by nearly doubling its budget, investing around NOK 30 million to bolster the presence and reputation of Norwegian salmon in China (Chen et al. (2015)). In spite of these endeavors, the import share of Norwegian fresh salmon failed to return to its previous levels in the next five years. China's importers diversified their sources by exploring alternative options in countries such as the Faroe Islands, the United Kingdom, and beyond.

### 3 DATA

We use data from the China Customs Bureau that includes individual firms' trade records and information on imports and exports for each firm, recorded according to the eight-digit classification (a refined version of the Harmonized Commodity Description and Coding System (HS) six-digit classification). Data also contain information about import arrival port, shipment, mode of transport, routing countries, as well as firm characteristics such as firm type and location. Our analysis includes approximately 99% of all observations. We define the value for every product that China imports from other countries as the value of imports China reports arriving from other countries. We present all price and value data in nominal Chinese yuan (CNY), and we present quantity data in metric tons, megawatt-hours, or discrete units (e.g., widgets, vehicles, etc.), as noted. Unless otherwise noted, we source data in the text and figures from the China Customs Bureau.

The treatment sample is a balanced panel with 3,564 observations from 66 firms at the firm-year-country level of fresh salmon imports from 2007 to 2015. Between 2007 and 2015, these firms mainly imported fresh salmon products from six countries—Norway, the United Kingdom, Chile, the Faroe Islands, Australia, and Canada. From this set, we have two mutually exclusive subsets—31 firms that only imported Norwegian fresh salmon before 2010, and 35 firms that imported Norwegian fresh salmon and/or imported fresh salmon from other countries during the pre-sanction period.

We focus on the impact of the salmon sanctions on the 66 firms that imported fresh salmon before 2010 (see Table 1 panel A for summary statistics). During the 2007–2010 period, 39 firms only imported fresh salmon in one year, 14 firms imported fresh salmon in two of the years, and 13 firms imported fresh salmon in at least three of the years. Before 2010, each firm had, on average, 5.36 seafood trading routes, 1.31 import source countries, and a 98% maximum import share for any source country. However, after the salmon sanction, firms' average number of importing source countries rose to 2.43 and the maximum import share of any one country dropped to 83%. These 66 firms differ from one another in ways that are potentially relevant to other seafood import outcomes. The average seafood share of all imports among these firms is about 37%, while there are about 19 firms in our study with

a seafood share below 50% of all imports. Moreover, 47% of firms import higher than the average market level, and 55% of the firms import fresh salmon from Norway and/or other countries.

To accurately identify the causal effects of the salmon sanction, we examine a counterfactual situation in which firms in the seafood industry were unaffected by China's sanction of Norwegian fresh salmon. We start with non-fresh seafood firms that did not import any seafood products from Norway before 2010. Figure A1 presents the 2007–2010 import trends of countries that were and were not affected by the salmon sanction across different seafood products. We restrict our sample to the top seven frozen- or aquatic-product importing source countries and look for those that have import trends similar to fresh salmon in the years preceding the 2010 salmon sanctions.

As shown in Figure A1b, most of the frozen-product importing source countries have a relatively higher importing trend from 2007 to 2010, especially for frozen product imports from Russia. As opposed to frozen product imports, aquatic product imports have the same pattern across the top seven aquatic-product importing source countries (Figure A1c). Considering Japanese, American, and Indonesian aquatic imports share a similar trend with average fresh salmon imports, we restrict our sample to these countries and break the aquatic imports down to shrimp, crab, squid, and other aquatic seafood for further comparisons. Figure A1d shows that, among these aquatic groups, American shrimp, Indonesian squid, and Japanese other aquatics help reduce the magnitude of the pre-trend import differences.

We then compare how treated firms and the sub-sample control groups differ across the firm characteristics between 2007 and 2010. Appendix Table A1 columns (1), (3), and (5) show the mean of firm characteristics in 2007 among treated firms and control firms, and columns (2), (4), and (6) show the mean of firm characteristics in the pre-sanction period among treated firms and control firms. We find all three sub-sample control groups have insignificant differences in each firm characteristic; thus, we keep all 199 firms as our control group. In section 5, we use other types of firms within our sub-sample to check the

robustness of the estimated coefficients.

All 199 firms in our control group were in the aquatic seafood market before China's sanction. By 2015, the number of firms decreased to 67. Similar to firms importing fresh salmon, these firms had similar average seafood shares (73%) and seafood trading routes (5.02). After the salmon sanction, the number of import source countries changed from 2.50 to 2.16, and the maximum import share changed from 83% to 85%. More detailed information about these categories is available in Table 1.

Finally, to understand the heterogeneous response to the sanction between trade intermediaries and other firms, we gathered firm information for the 66 companies in our sample using Tianyancha<sup>3</sup>. Details about trade intermediaries were only available for 60 of these companies. Based on the scope of business, we define a firm as a trade intermediary if it acts as an intermediary or middleman in the process of facilitating trade between a buyer and a seller in any business. Among these firms, we find 23 trade intermediaries. Consequently, we limit our analysis to these 60 companies and employ event study methodology to gain enhanced insights into the varied reactions between trade intermediaries and manufacturing firms.

## 4 EMPIRICAL STRATEGY

### 4.1 *Intensive-margin impacts on fresh salmon imports*

In our main empirical analysis, we first study the direct impact of China's 2010 salmon sanction on the intensive margin of fresh salmon imports for the treated firms, which we define as firms importing fresh salmon before the sanction. To use all firms in our dataset, we construct a balanced panel by assigning a negligible amount of import value for the years when a firm did not import.<sup>4</sup> Between 2007 and 2015, China's fresh salmon importers made 3,564 import observations of fresh salmon products, and the control firms made 1,935 import observations of certain aquatic products. For the treated firms, we explore two

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<sup>3</sup>Tianyancha (<https://tianyancha.com/>) is a Chinese online platform and database that provides business and company information. Tianyancha allows users to search for information about companies, such as their registration details, financial records, ownership structure, and more.

<sup>4</sup>Mechanically, this means we add 0.01 to the import value of fresh salmon and certain aquatic products to avoid the log of zero. As a result, each firm has the same number of observations each year.

measures of fresh-salmon import decisions for China’s firms: (a) the value of firm-level imports of fresh salmon; and, (b) the quantity of firm-level imports of fresh salmon. We use firms that imported certain aquatic products from three countries as the main control group and estimate the following event study specification:

$$y_{ijct} = \sum_{\tau \in [-3,5], \tau \neq 0} \alpha_{\tau} [D_{ijt,\tau} \times FS_i] + \gamma_i + \sigma_{pt} + \eta_c + \epsilon_{ijt} \quad (1)$$

where  $i$  indexes China’s import firm;  $t$  indexes the year;  $y_{ijct}$  is a log of import value or import quantity for import good  $j$  from country/region  $c$  to port  $p$  by firm  $i$  in year  $t$ ; and,  $FS_i$  is an indicator equal to 1 if firm  $i$  imported fresh salmon before 2010. For  $\tau > 0$ ,  $D_{ijt,\tau}$  equals 1 if it is the  $\tau$ th year after China’s salmon sanction. For  $\tau < 0$ ,  $D_{ijt,\tau}$  equals 1 if it is the  $-\tau$ th year before the salmon sanction. Imports in 2010 (Year 0) are excluded from our event-study analysis. We include the firm fixed effect  $\gamma_i$  to absorb time-invariant differences and allow consistent estimation even in the presence of differences between treated and untreated firms. We further include the country/region fixed effect  $\eta_c$  and port-by-year fixed effects  $\sigma_{pt}$  to control for unobserved common shocks. In our setting,  $D_{it,\tau}$  is highly serially correlated and the default standard errors are likely to be downwards-biased (Arellano et al., 1987; Bertrand et al., 2004; Cameron and Miller, 2015). To address this issue, we use cluster-robust standard errors, which allows us to assume errors in different years for a given firm are correlated but errors for different individuals are uncorrelated.

Our main coefficient of interest,  $\alpha_{\tau}$ , represents the average annual percentage changes in fresh salmon imports versus aquatic product imports  $\tau$  years following China’s decision to impose sanctions relative to the event year 0, conditional on all the covariates and fixed effects included in the regression. These coefficients provide two critical pieces of information. First, they provide a check of Granger causality between the salmon sanction and fresh salmon imports. If the pre-period coefficients are statistically indistinguishable from zero and have no clear trend, this would provide some reassurance for the identification assumption. Second, the specification allows us to investigate the dynamic impact of the salmon sanction over the study period.

The main concern for identification is whether the parallel trends assumption is valid in our

event study design. In the absence of treatment, treated units should experience the same trends in average outcomes as control units. In our context, we want the three-subsample group to form a credible counterfactual for the treated firms (Blundell and Dias, 2009) after accounting for time-invariant (observed and unobserved) differences between firms and common port-by-year shocks. To check the validity of the identification assumption, we provide suggestive evidence of no differential pre-trends in the import value of fresh salmon relative to the import value of certain aquatic seafood from these three countries before 2010.

Lastly, we also explore how firms only importing Norwegian fresh salmon before 2010 responded to the salmon sanction differently than firms that imported fresh salmon from Norway and/or other countries before 2010. Our hypothesis is that firms that only imported Norwegian fresh salmon before 2010 were more likely affected by the sanction because those firms needed to afford an additional cost before importing fresh salmon from other source countries. Thus, we expect firms that only imported fresh salmon from Norway before 2010 would have a more significant decline in fresh salmon import value than other treated firms.

#### 4.2 *Extensive-margin impacts*

We also investigate the extensive-margin impacts of the salmon sanction. We ask whether firms would reshape their trading strategies in terms of three measures: (a) the maximum import share for any source country; (b) the fresh salmon import share of main source countries (Norway, the Faroe Islands, the United Kingdom, and Chile); and, (c) the number of countries importing fresh salmon.<sup>5</sup> Similar to intensive-margin impacts, we also investigate the heterogeneity effect of the salmon sanction on extensive-margin outcomes according to whether firms only imported Norwegian fresh salmon before 2010.

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<sup>5</sup>Another potential extensive-margin impact is that Chinese importers might smuggle the Norwegian fresh salmon via neighboring countries or regions. Motivated by the increased difficulty of importing Norwegian salmon legitimately, several interviewed stakeholders admitted to having smuggled Norwegian salmon via Hong Kong and/or Vietnam (Chen and Garcia (2016)). However, understanding this effect is beyond the scope of our study, given it is hard to estimate precisely the amount of salmon smuggled from each neighboring country and region.



To understand how importers change trading strategies in the short and long run, we first explore the changes in the maximum import share for any source country due to the salmon sanction. We define  $Share_{it}^{c,max}$  as the maximum import share for any source country for firm  $i$  in year  $t$  and calculate the maximum share by using the ratio of the largest fresh-salmon imports from a specific source country in terms of the total fresh salmon import by firm and year. We then use the following specifications to estimate the sanction impacts:

$$Share_{it}^{c,max} = \sum_{\tau \in [-3,5], \tau \neq 0} \alpha_{\tau} [D_{it,\tau} \times FS_i] + \gamma_i + \sigma_t + \epsilon_{it} \quad (2)$$

where  $i$  indexes China's import firm and  $t$  indexes year. We include the firm fixed effect  $\gamma_i$  and year fixed effects  $\sigma_t$ . We cluster the estimated standard errors at the firm level and all other variables are defined the same as in equation (1).

A closer examination of the import share of fresh salmon for each source country details how firms change their importing sources over the study period. We focus on the main fresh-salmon importing source countries (Norway, the Faroe Islands, the United Kingdom, and Chile) and calculate the import shares by firm and year. We then examine the change of import share for each country by estimating the event study specification as follows:

$$Share_{it}^c = \sum_{\tau \in [-3,5], \tau \neq 0} \alpha_{\tau} [D_{it,\tau} \times FS_i] + \gamma_i + \sigma_t + \epsilon_{it} \quad (3)$$

where  $i$  indexes China's import firm;  $t$  indexes the year;  $c$  indexes the main importing source countries (Norway, the Faroe Islands, the United Kingdom, and Chile); and,  $Share_{it}^c$  is the import share for firm  $i$  in year  $t$  from country/region  $c$ . For instance,  $Share_{it}^{Norway}$  represents Norway's import share for firm  $i$  in year  $t$ . We cluster the estimated robust standard errors at the firm level and all other variables are defined the same as for equation (2).

Lastly, we investigate the impact of China's salmon sanction on the number of countries importing fresh salmon after 2010. We calculate the number of importing source countries by summing the number of countries that a firm imported fresh salmon from by firm and year. We then use treated firms as the treatment group and aquatic seafood firms as the

control group and estimate the event study specification as follows:

$$Countries_{it} = \sum_{\tau \in [-3,5], \tau \neq 0} \alpha_{\tau} [D_{it,\tau} \times FS_i] + \gamma_i + \sigma_t + \epsilon_{it} \quad (4)$$

where  $i$  indexes China's importing firm;  $t$  indexes the year; and,  $Countries_{it}$  is the number of importing source countries for firm  $i$  in year  $t$ . The estimated robust standard errors are clustered at the firm level and all other variables are defined the same as in equation (2).

## 5 RESULTS

We first present the intensive-margin results by examining the changes in fresh salmon import value relative to the import value of our control groups. We then estimate the extensive-margin impact by testing how the maximum import share, import shares of individual main source countries, and the number of importing source countries differ among treated firms relative to our control groups. Lastly, we explore how the heterogeneous impact of the salmon sanction differed according to firm size, firm ownership structure, and previous trading history.

### 5.1 Intensive-margin impacts on fresh salmon imports

Figure 2 shows some suggestive evidence of how treated firms responded to the sanction. As shown in Figure 2a, between 2007 and 2010, Norwegian fresh salmon imports grew at an average annual rate of 32%, from 28 million CNY in 2007 to 86 million CNY in 2010. Over the same period, the little-to-no fresh salmon imports from other countries suggest that Norway dominated the fresh salmon market before 2010. After Norway awarded Liu Xiaobo a Nobel Peace Prize in 2010, China's IQB called for more stringent sanitation and veterinary testing of imports of chilled farmed salmon, leading to a dramatic drop in Norwegian salmon imports in 2011. However, the Norwegian fresh salmon imports readjusted to 2010 levels in 2012. One explanation for this is the price of Norwegian fresh salmon decreased in 2012, leading to an increase in Norwegian fresh salmon imports even with stricter inspections. Inconsistent with this hypothesis, Figure A2 in the appendix shows that the Norwegian fresh salmon price in 2012 was comparable to 2011 levels and the main fresh-salmon importing source countries also experienced a drop in fresh salmon price. This suggests that a drop in price might not explain the import increase in 2012.

Another possible reason could be the early 2012 gesture made by Norway's government to support China's application to become a permanent observer of the Arctic Council provided a positive signal for China's fresh salmon importers. Anticipating trade relations would unfreeze, China's firms increased their salmon import share from Norway in 2012. However, when China offered visa-free visits to Beijing for Europeans from every country except Norway in December 2012, China's firms decreased fresh salmon imports from Norway and increased fresh salmon imports from other countries or regions, such as the Faroe Islands, the United Kingdom, and Chile.

China's firms may also have shifted from importing fresh salmon to importing frozen salmon, as the sanction only affected fresh salmon products from Norway. If that is the case, we then expect that the frozen salmon imports would quickly rise up right after the fresh salmon sanction. Figure 2b shows the change in China's frozen salmon import value by country from 2007 and 2015. We find no evidence of a spillover effect on Norwegian frozen salmon imports after 2010. Frozen salmon imports from other countries did not respond to the sanction, except for Chile, whose import value increased from 10 million CNY in 2012 to 70 million CNY in 2014. In addition to that, Chile's increase in frozen salmon imports after 2013 turns out to be highly associated with their efforts to control salmon diseases from 2007 to 2010, as suggested in Alvial et al. (2012).

We then implement the event study specification shown in equation (1) to estimate the intensive-margin impact of the 2010 sanction on fresh salmon import value and quantity for treated firms (see Columns 1 and 2 of Table 2). In the years before the salmon sanction, the coefficients were all statistically indistinguishable from zero, had modest magnitude, and had no clear trend. Following the salmon sanction, the import value fell sharply and the average import decreased by 22.7% ( $=e^{-0.258}-1$ ) in value in the first year, relative to the import value of control groups. In contrast with previous studies that find political tensions only have temporary effects on trade (Crozet and Hinz, 2020; Fuchs and Klann, 2013; Heilmann, 2016; Michaels and Zhi, 2010; Pandya and Venkatesan, 2016), the magnitude and long-run nature of the sanction's effects are noteworthy. These effects fluctuated and persisted over the next few years to a 23.2% reduction in fresh salmon import value by the

end of 2015, suggesting that the friendly gestures by Norway's governments in 2012 and 2014 might have a negligible impact on Norwegian fresh salmon imports after sanction.

The results are similar in the case of import quantity. Column 2 of Table 2 shows evidence of the sanction's impact on import quantity over the study period. In the first year after the sanction, the import quantity decreased by 9%, but is statistically insignificant; and, starting in the second year, the quantity decreased by 19%, which persists over the rest of the period. As a robustness check, we also run the regression from equation (1) but using the price of the trade as a dependent variable. We report the results in Appendix Figure B1. We find little evidence that the salmon sanction significantly affects the fresh salmon trading price over our study period. This suggests that fresh salmon import prices played a minor role in affecting China's fresh salmon importing decisions.

Columns 3 and 4 of Table 2 also present results using subsets of treated firms. When we restrict the sample to firms that only imported fresh salmon from Norway before 2010, Changes in the value of fresh salmon imports are significantly larger (23%) in the first year and show a persistent sanction impact over our study period relative to the value of control groups. The estimated coefficient in the last year of our study period, roughly -23.7%, is slightly larger in magnitude than for the difference-in-differences estimates of the whole sample. However, when we restrict the sample to firms that imported fresh salmon from Norway and/or other countries before 2010, we find little-to-no evidence of sanction impact on the log of fresh salmon import value. The fresh salmon import value decreases relative to control groups in the second year, but is statistically insignificant over most of our study period.

## 5.2 *Extensive-margin impacts*

We then examine how firms changed their import strategies after the 2010 salmon sanction by testing the maximum import share changes due to the sanction across treated firms and present the results in Table 3. The sanction uncertainty might have an impact on firms' decisions and lead to more diversified trading portfolios. Consistent with this hypothesis, we observe a dramatic fluctuation in the first two years after the sanction and a gradual

decrease in the long run. Despite the friendly gesture by the Norway government in early 2012, China's attitude towards Norway in December 2012 provided an obvious signal for the fresh salmon importers that the bilateral relations were not going to freeze in the next few years, leading to more diversified trading portfolios among these importers.

A closer examination of firms that only import fresh salmon from Norway suggests that firms that only imported Norwegian fresh salmon before 2010 significantly switched their importing source country away from Norway until the third year (see Column 1 of Table 3), which can be explained by the fact that these firms needed time to find new potential import sources. The steady decrease in the maximum import share in the last two years might suggest these firms completely transitioned away from Norway as a source country. In contrast, in Column 2 of Table 3, we observe that firms that import fresh salmon from Norway and/or other countries responded to the sanction in both the short and long run. In the first year after the sanction, the maximum import share of fresh salmon products decreased by 17.9% relative to the control groups. The maximum share recovered to pre-sanction levels in the second year, while in the fifth year, these firms readjusted their import strategies and decreased their maximum import share by 24.8% from any source country to reduce the potential risks.

To further understand how firms switched their source countries, we examine how the import share of main source countries changed due to the salmon sanction (see Columns 3 and 4 of Table 3). We find some evidence of both negative short-run and long-run relationships between the sanction and China's imports of fresh salmon. Column 3 of Table 3 suggests that Norway experienced a 30% drop in China's import share in the first year after the sanction. The import share readjusted to pre-sanction levels in the second year due to a positive signal from Norway's government; however, the import share then continued decreasing over the rest of the period, such that Norway's import share fell to 80% in the fifth year. The decreasing Norway import share suggests that China's importers decided to change their trading strategies and shift their main import source to other countries or regions. Conversely, the imports from the Faroe Islands filled the widening gap that the sanction created. We find that the Faroe Islands are the biggest winner of the salmon

sanction (see Column 4 of Table 3 ). In the first year after the sanction, the Faroe Islands' share of China's fresh salmon imports increased 60%, and the impact persisted over the rest of the period.

Finally, we examine the effect of the salmon sanction on the number of fresh-salmon importing source countries and present the results in Columns 5 and 6 of Table 3). We also find a heterogeneous response to the sanction regarding the number of fresh-salmon importing source countries across firms with different trading histories. When we restrict the sample to firms that imported only Norwegian fresh salmon before 2010 (Columns 5), the sanction shows a notable effect on the number of fresh-salmon importing source countries. The number of importing countries is 1.37 in the fourth year, which is larger relative to the years before the sanction and consistent with the evidence that these firms needed time to search for potential import sources. For firms that imported fresh salmon from Norway and/or other countries before 2010 (Column 6), the sanction shows both short- and long-run impacts on the number of importing source countries over the study period. In the first year after the sanction, the number increases by almost 1 relative to control groups. The number quickly fell back to pre-sanction levels in the second year but increased 0.7–0.9 in the following years, suggesting that these firms switched their importing sources as China-Norway relations stayed frozen.

### 5.3 *Heterogeneous impact of China's 2010 salmon sanction*

We present evidence on the methods by which treated firms adjusted in response to the sanction. We find the sanction impact might be heterogeneous across firms for three reasons. First, firms with small importing volumes or large seafood import shares, which are more vulnerable to stringent sanitation and veterinary testing, are more likely to be affected by the sanction and potential exit from the market. Second, as we mentioned in the background, without formal legislation, China can only effectively command official bureaus and state-owned firms, but not private firms. The state-owned firms are more likely to adjust their trading behavior relative to privately owned firms. Third, firms exporting through intermediaries may significantly reduce the costs of exporting and have heterogeneous responses to trade shocks (Ahn et al. (2011); Bernard et al. (2012); Lin et al.

(2019); Lu et al. (2017)). Therefore, this section tests how sanction impacts differ depending on firm size, seafood share of total imports, whether it is state-owned, and whether it is a trade intermediary.

We use a generalized triple-difference design to examine heterogeneous responses to the salmon sanction across different firm characteristics. For ease of interpretation, we implement these tests by interacting the first term in equation (1) with indicators for firm characteristics. Our main specification is:

$$y_{ijt} = \sum_{\tau \in [-3,5], \tau \neq 0} \alpha_{\tau} [D_{ijt,\tau} \times FS_i] + \sum_{\tau \in [-3,5], \tau \neq 0} \eta_{\tau} [D_{ijt,\tau} \times FS_i \times Z_j] \quad (5)$$

$$+ \gamma_i + \sigma_{pt} + \eta_c + \epsilon_{ijt}$$

Where  $Z_j$  is an indicator function that equals one if firm  $j$  belongs to a specific group where the import value of firm  $j$  is above the average industry value, the seafood share of all imports is above 50%, whether it is a state-owned enterprise, or whether it is a trade intermediary. All other variables are defined the same as in equation (1).

One hypothesis is that the sanction would have larger impacts on firms with larger seafood import share. Firms with higher seafood import share are more likely to be affected by the salmon sanction; hence they would import fewer fresh salmon than firms with smaller seafood import share. We split firms depending on whether their seafood import share is above 50%. Table 4 column (2) presents our results. We find that, in the first two years, firms with higher seafood share decreased fresh salmon imports by 23% more relative to firms with low seafood share. The effect continued expanding—five years later, firms with a higher seafood share imported 26% fewer fresh salmon.

We then test whether the salmon sanction had a more significant impact on relatively larger fresh salmon firms or relatively smaller firms. One might think that firms with larger import values could bear the switching costs and import fresh salmon from other countries, and therefore, the sanction would be associated with a larger decrease in import value for large firms relative to small firms. Given that Chinese customs data do not provide details on firms' characteristics (e.g., productivity, employment, total sales), we center

firm size around the average importing value of all firms in that year. Consistent with this hypothesis, Table 4 column (1) confirms that these firms are more likely to decrease their imports of fresh salmon after 2010.  $Z_j$  is defined in equation (5) as an indicator that equals 1 if the import value of firm  $j$  is above the average industry value. We find evidence that firms importing higher-than-average volumes decreased their fresh salmon imports by 28% more than firms with lower import volumes in the second year and by 31% more five years after the sanction.

Finally, we test whether state-owned firms or trade intermediaries are more likely to adjust their trading behavior than privately owned firms. In contrast with previous literature (Du et al., 2017; Lin et al., 2019), we find evidence of little-to-no differential response to China's salmon sanction across state-owned and private-owned firms (see Table 4 column (3)). This result suggests that not only politically influenced firms, such as China's state-owned enterprises, adjusted their trading behavior, but, rather, privately owned firms also became more precautionary and intentionally diversified their trading portfolios. In addition, in column (4) of Table 4, we find little evidence of significant differences in import responses between trade intermediaries and other firms, suggesting that trade intermediaries adjust their trading patterns similarly to other firms. Taken together, we conclude that the sanction had dramatic impacts on firms with large import values, higher seafood import share, and more fresh salmon trading routes, but no differential impact across different firm types and whether they are trade intermediaries, at least for the firms that comprise our sample.

## 6 DISCUSSIONS AND A PARTIAL-EQUILIBRIUM EXPLANATION

### 6.1 *Threats to identification and robustness checks*

We test the robustness of our event study results presented in section 5. We first discuss whether the treatment effect varies across different timing, and we then run placebo tests to examine any potential unobserved shocks in 2010. Lastly, we test whether the estimated coefficients would be biased if we used alternative control groups.

First, recent papers by Roth (2022) and Goodman-Bacon (2021) discuss the potential biases of estimating the average treatment effects when the effects change over time. In our case,



there are two orders issued by China's IQB (December 2010 and January 2011) calling for more stringent sanitation and veterinary testing of Norwegian fresh salmon imports. However, given that importing firms knew about the nomination in January 2010, and both IQB actions happened around the end of 2010, the chances that the treatment effect would vary much are pretty small; therefore, we treat these two events as one policy treatment to examine its impact on fresh salmon imports.

Second, given the long time span of our study period, multiple factors pose threats to our ability to identify a causal impact. First of all, despite Norway's endorsement of China's application for permanent observer status in the Arctic Council in early 2012, China implemented visa-free visits for visitors from all European countries except Norway in December, just ten months later. This action conveyed a signal to Chinese importers that the strained relationship between the two countries would persist in the near future. If this is the case, then we would expect another persistent shock in the imports after December 2012. In Appendix Figure A3, we find that the imports from Norway experienced a slight decline after December 2012 in terms of import value and its share, while it recovered within a few months. To test whether this is a significant shock to Norwegian exports, we run a t-test on the coefficient of  $\alpha_2$  and  $\alpha_3$  from equation (1). The t score shows that these two coefficients are insignificantly different from each other, suggesting that the December events had little impact on Norwegian fresh salmon imports. Second, there might be other shocks that both affect the fresh salmon imports and occur concurrently with, or just after, China's salmon sanction began. We looked into the timeline of China's free trade agreement with major six countries and found no FTA was signed over our study period<sup>6</sup> Finally, the Chilean salmon farming industry was facing unprecedented economic losses related to the infectious salmon anemia (ISA) disease back in 2007 and slowly recovered in the next few years. The good news from Chile's fresh salmon industry might attract China's importers to import fresh salmon from Chile. Nevertheless, during the years 2012 and 2013, we observed only a marginal rise in Chile's imports in both value and its country/region

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<sup>6</sup>For example, In November 2005, Chinese President Hu Jintao and former Chilean President Ricardo Lagos witnessed the signing of the China-Chile Free Trade Agreement. The Agreement entered into force in October 2006. The China-Australia FTA was officially signed on June 17, 2015, and took effect in December 2015.

share in Appendix Figure A3. The monthly fresh salmon exports to China from Norway and other major source countries provide visual confirmation for our estimated causal impacts of Chinese sanctions from December 2010. That implies that the influence on the trading strategies of China's importers might be limited.

Third, another potential threat to the internal validity of the study is that there might be other shocks that both affect the seafood imports and occur concurrently with, or just after, China's salmon sanction began. To investigate this, we estimate regressions similar to equation (1) but replace the dependent variable with other seafood product import values from unaffected firms that never imported any type of salmon before 2010. If there are any shocks that affect the seafood imports, then we would expect some evidence of import changes after 2010. Figures B2a and B2b present the event study results for other seafood imports from unaffected firms. Overall, we find little-to-no evidence that the salmon sanction had any impact on other seafood imports from unaffected firms. These results suggest there were no other factors influencing the seafood import values at the time of the salmon sanction. In addition, we also construct several alternative control groups by exploiting different firm configurations among seafood importers, including firms that import American shrimp, Indonesian squid, Japanese other aquatic products. The estimated coefficients are similar to those in our baseline results.

Lastly, Norway might be busting the sanction by exporting fresh salmon through other countries to avoid additional inspection and quarantine (Chen and Garcia (2016); Garcia and Nguyen (2023)). Because of the close proximity to China and low trade barriers with Norway, Hong Kong and Vietnam become the most likely transfer destinations<sup>7</sup>. To understand the potential role of Hong Kong and Vietnam in Norwegian fresh salmon imports to China's market during the sanction period, we collect the annual fresh salmon exports from Norway to China, Hong Kong, and Vietnam from the UN Comtrade trade data. We show how the export quantity and value changed over our study period in Appendix Figures A4a and A4b. Before 2010, Norwegian fresh salmon exports to Vietnam

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<sup>7</sup>We report the Norwegian fresh salmon export value to the world by continents and neighboring countries or regions in Appendix Figures A5a and A5b.

showed pretty consistent trends, but in 2011, fresh salmon exports to Vietnam increased abruptly and continued increasing for the next four years. The abnormally high increases in exports to Vietnam suggest that salmon might be smuggled from Vietnam to mainland China. However, due to the limited data availability, we know little about this fact except for some anecdotal evidence from fresh salmon importers' interviews (Chen et al. (2015))<sup>8</sup>. In the meantime, we find little evidence that Norway exported more fresh salmon to Hong Kong after 2010, which suggests that re-exported Norwegian salmon through Hong Kong might not enjoy more lenient sanitation tests and veterinary inspections. Similarly, we do not observe a significant increase in fresh salmon import from Hong Kong or Vietnam to mainland China, suggesting that Hong Kong and Vietnam might have only played a small role, if any, in diverting Norwegian salmon back into China.

## 6.2 *Import diversification and emerging explanation*

We develop a partial-equilibrium model of firms' importing behavior to rationalize our empirical findings. As suggested in Haveman and Hummels (2004), countries tend to import from few exporters—58% of importers purchase from around 10% of available exporters. We do find that China's salmon importers decreased their purchases from Norway and expanded their sourcing countries under the lasting bilateral political tension. China's importers chose to take an import diversification strategy when facing political risks. As Wolak and Kolstad (1991) and Muhammad (2012) argue, one reason that firms do diversify imports is to control the price uncertainty of the sourcing countries. In the spirit of Antras et al. (2017)—firms pay a fixed cost to improve their efficiency—we build a simplified model to understand firms' behavior under political tensions. Firms can add a new import country by paying a one-time fixed cost, which can potentially improve their efficiency of production by importing from multiple sources. Thus, firms face trading higher efficiency for a higher fixed cost of importing.

In our simplified model, firms face a declining demand curve for salmon, and salmon from Norway and other countries are perfect substitutes. Because of the growing season

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<sup>8</sup>According to UN Comtrade and the China Custom data, there were no reported fresh salmon exports from Vietnam to China nor reported fresh salmon imports from Vietnam to mainland China over our study period.

of salmon, it is reasonable to assume the production process is not evenly distributed throughout the year, and we assume the cost function  $C$  is convex (Ahn and McQuoid, 2017). Similar to Antras et al. (2017), the demand curve takes the form of  $Q^d = BP^{-\sigma}$  or  $P = B(Q^d)^{-1/\sigma}$  with  $\sigma$  being greater than 1. The assumption is reasonable because we focus on country-specific salmon, making the good easier to be substituted by other close international suppliers. Kinnucan and Myrland (2005) also estimate the import demand elasticity of EU, US, and Japan to be 1.28, 1.29, and 2.03 respectively.<sup>9</sup> Prior to the political tension, China imported virtually all of its salmon from Norway. The present value of profit of a represented firm importing only from Norway before the political tension is:

$$\pi_1 = \max_{\{S_{n,t}\}_{t=1}^{\infty}} \sum_{t=1}^{\infty} \frac{1}{(1+r)^t} [p(S_{n,t})(S_{n,t}) - \tau_{n,t}C(S_{n,t})] \quad (11)$$

Where  $S_{n,t}$  represents salmon imported from Norway;  $P$  is the price function; and,  $\tau_{n,t}$  represents the normal tariff equivalent of trade barriers on imports from Norway before the political tension.

Firms can still choose to expand their sourcing countries by paying a fixed cost of  $F_o$ :

$$\pi_2 = \max_{\{S_{n,t}, S_{o,t}\}_{t=1}^{\infty}} \sum_{t=1}^{\infty} \frac{1}{(1+r)^t} [p(S_{n,t} + S_{o,t})(S_{n,t} + S_{o,t}) - \tau_{n,t}C(S_{n,t}) - \tau_o C(S_{o,t})] - F_o \quad (12)$$

Where  $S_{o,t}$  represents salmon from other countries;  $P$  is the price function; and,  $\tau_o$  represents the tariff equivalent of trade barriers on imports from other countries.

However, because of the political tensions, firms realize there will be a higher trade barrier importing from Norway that lasts for  $T$  periods; thus, the profit of importing only from Norway and multiple outsourcing is:

$$\pi_1^* = \max_{\{S_{n,t}\}_{t=1}^{\infty}} \sum_{t=1}^T \frac{1}{(1+r)^t} [p(S_{n,t})(S_{n,t}) - \tau_{n,h}C(S_{n,t})] + \sum_{t=T+1}^{\infty} \frac{1}{(1+r)^t} [p(S_{n,t})(S_{n,t}) - \tau_{n,l}C(S_{n,t})] \quad (13)$$

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<sup>9</sup> $B$  here is a constant that governs the scale of demand.

$$\pi_2^* = \max_{\{S_{n,t}, S_{o,t}\}_{t=1}^{t=\infty}} \left\{ \begin{array}{l} \sum_{t=1}^T \frac{1}{(1+r)^t} [p(S_{n,t} + S_{o,t})(S_{n,t} + S_o) - \tau_{n,h}C(S_{n,t}) - \tau_o C(S_{o,t})] + \\ \sum_{t=T+1}^{\infty} \frac{1}{(1+r)^t} [p(S_{n,t} + S_{o,t})(S_{n,t} + S_o) - \tau_{n,t}C(S_{n,t}) - \tau_o C(S_{o,t})] - F_o \end{array} \right\} \quad (14)$$

Where  $\tau_{n,h}$  represents the higher trade barriers for Norway that last for  $T$  periods because of the political tensions.

For simplicity, assuming firms are facing the same demand function each period, we can get the optimal Norwegian salmon importing quantity under these two trade strategies:

$$S_{n,t}^1 = \begin{cases} S_{n,h}^1 & \text{if } t \leq T \\ S_{n,l}^1 & \text{if } t > T \end{cases} \quad (15)$$

$$S_{n,t}^2 = \begin{cases} S_{n,h}^2 & \text{if } t \leq T \\ S_{n,l}^2 & \text{if } t > T \end{cases} \quad (16)$$

Using the envelop theorem, we can get the following first-order conditions that explain the additional profit gain from sourcing from multiple exporters under political tension:

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial F_o} = -1 \quad (17)$$

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial \tau_{n,h}} = \frac{1 - (1+r)^{-T}}{r} [C(S_{n,h}^1) - C(S_{n,h}^2)] \quad (18)$$

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial T} = \frac{\ln(1+r)(1+r)^{-T}}{r} [C(S_{n,h}^1) - C(S_{n,h}^2)] \quad (19)$$

Obviously, the first condition with respect to  $F_o$  is negative, meaning that a higher fixed cost to find another supplier would erode the profit gained from sourcing from another exporter. The signs of the remaining two conditions depend on the sign of the cost differential  $C(S_{n,h}^1) - C(S_{n,h}^2)$ . We could show that this cost differential is positive and prove that  $S_{n,h}^1 > S_{n,h}^2$  using proof by contradiction, since firms will choose to expand sourcing

countries if  $\pi_2^* > \pi_1^*$ . Because firms maximize profit, we know that, in equilibrium, the marginal cost of importing an additional unit of salmon must always equal the marginal revenue of doing so. Assume that  $S_{n,h}^1 \leq S_{n,h}^2$ , which suggests that under the multiple sourcing scenarios the firm imports more quantity from Norway *and* buys from another country/region. Because of the convexity of the cost function, the marginal cost of the multiple sourcing scenarios with higher import quantity would be higher than that of importing only from Norway. This implies the marginal revenue of multiple sourcing is also higher than that of importing only from Norway. However, we know the cost function is convex with  $C'(0) < C'(S_{n,h}^2)$ —firms will import positive amounts of salmon from other countries as long as  $\frac{\tau_{n,h}}{\tau_o} > \frac{C'(0)}{C'(S_{n,h}^2)}$ . This implies a higher importing quantity of salmon in the multiple outsourcing scenario, for which, according to the elastic demand, the marginal revenue should be lower. Thus, our assumption of  $S_{n,h}^1 \leq S_{n,h}^2$  must be wrong, and  $S_{n,h}^1 > S_{n,h}^2$  is proven.

As a result, we could sign all three first-order conditions as follows:

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial F_o} < 0 \quad (20)$$

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial \tau_{n,h}} > 0 \quad (21)$$

$$\frac{\partial \pi_2^* - \pi_1^*}{\partial T} > 0 \quad (22)$$

The last two conditions suggest that a prolonged political tension, a higher  $T$ , or a rise in tariff-equivalent trade barrier  $\tau_{n,h} - \tau_{n,l}$ , would increase the profit gain resulting from sourcing from another country/region, which provides an incentive for firms to expand their sourcing countries and engage in import diversification. In this model, the tensions between Norway and China will raise the tariff equivalent of trade barriers  $\tau_{n,h}$ , which last for  $T$  periods. Both factors in this lasting political tension can generate enough space to allow firms to change trading strategies. In other words, whether a firm implements import diversification depends on how severely the political tension raises the cost and

how long the tension lasts. Our finding of much larger trade responses for this lasting political tension is consistent with this theoretical result.

Intuitively, the only cost of using an import diversification strategy is the additional fixed cost of establishing a new trading route. Once firms pay the fixed cost, they can reduce their average cost of production by using multiple inputs. This means that even after the political tensions, firms that have paid the fixed cost to establish another trading route do not have to incur that cost again, and some of them will continue to import from these new partners. This might explain our finding of the political hedging effect via the reduction in the maximum share of fresh salmon imports from any country or region.

Finally, note that if we do not include the fixed cost in the profit function,  $\pi_2 \geq \pi_1$  will always hold, as long as  $\tau_o$  does not exceed  $\tau_{n,h}$  too much. As a result, the Norway exporters that once dominated the market could not retain that market share once China's importers accessed salmon from other countries. Once implemented, the import diversification strategy permanently changed the trade pattern. In the aggregate data, we see that Norwegian salmon had not restored its share in China's fresh salmon market even two years after the bilateral relationship normalized.

## 7 CONCLUSION

The political tensions between Norway and China following the award of the Nobel Peace Prize to Chinese dissident Liu Xiaobo resulted in a frozen bilateral relationship and an effective Norwegian fresh salmon sanction that lasted for over six years. Taking advantage of this lasting political sanction and leveraging firm-level data from all of China's seafood importers from 2007 to 2015, we provide evidence that fresh salmon firms adapted their imports to this political sanction at both the intensive and extensive margin. Firms that imported fresh salmon before 2010 saw a dramatic 20% decline in fresh salmon imports. We also find that as firms expanded trading routes and imports from countries other than Norway, they became more precautionary and lowered the maximum share of fresh salmon imports from any country, even if not Norway. Furthermore, unlike the findings in most consumer boycott studies, we find that both politically influenced firms, such as

China's state-owned enterprises, and privately-owned enterprises adjusted their trading behavior and diversified their trade portfolios. Our heterogeneity analysis also suggests that China's dramatic decrease in Norwegian fresh salmon imports was driven by large import reductions in firms with larger import values and those with higher seafood import share.

There are several limitations to our analysis. First, we cannot pinpoint the month of the importing trips; thus our annual data cannot uncover the dynamic and immediate responses following major events that may have further deteriorated or improved Norway-China relations. Second, our customs database contains a wealth of information on firms' import prices and quantities; however, it does not contain many firm characteristics, such as the number of employees. We augment customs data with an auxiliary firm-level database that identifies firm ownership structure through database name searches using Tianyancha, a commercial Chinese firm database. We were able to match most, but not all, firms. We also use the value of firms' total imports as proxies for firm size. Finally, our data ends in 2015, which is before the normalization of China-Norway political relations, as a result, we are unable to examine the persistence of these extensive- and intensive-margin effects after the six-year-long political tensions. We provide suggestive evidence using aggregate monthly trade data that firms do not return to the pre-sanction import portfolio dominated by Norway.

Our paper has important implications in understanding the consequences of politically motivated trade policies. Our results show that the political sanctions on Norwegian fresh salmon imports led to a persistent shift in the fresh salmon market where competitors, such as the Faroe Islands, Chile, and the United Kingdom captured Norway's market share. This transition is costly for fresh salmon importers—they experienced an average loss of 2.19 million CNY following the sanction compared to unaffected control firms.<sup>10</sup>

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<sup>10</sup>For this calculation, we re-estimate equation (1) but assume all the time indicators equal to 1 if firms import goods after 2010. We use the log of the import value of Norwegian fresh salmon or fresh salmon from any other source country as the dependent variable for the treatment group. We multiply the relevant coefficient by the average fresh salmon import value before 2010 to get the average value reduction in Norwegian fresh salmon imports and the average value gain in fresh salmon imports from any other source country. We calculate the average loss by subtracting the average gain in fresh salmon import from any other



The persistent loss of Norway exports and the political hedging effect revealed through the lower maximum share of imports suggest that a significant degree of the loss due to this disruption is permanent. Finally, our heterogeneity analysis shows that this sanction hurts smaller firms more due to their lack of resources to develop other trading routes.

Our paper suggests several fruitful avenues for future research. This is especially meaningful for the current world as political risks are rising globally. First, our findings of persistent trade responses to political sanctions contrast much of the previous literature, which calls for more analysis of consequential political disruptions of trade relationships, such as the ongoing U.S.-China trade war, as opposed to short-lived events like consumer boycotts. Second, due to data limitations, we cannot assess how firms' profits were impacted due to China's political sanction. With more detailed firm-level data, we could understand more of the mechanisms behind the behavior of fresh salmon firms during China's salmon sanction. Finally, it will also be worthwhile to examine how exporters from Norway to other countries coped with this significant trade disruption.

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source country from the average value reduction in Norwegian fresh salmon imports.

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## TABLES

**Table 1. Summary Statistics of China's Seafood Importers**

	Obs	Mean	S.D.	Median
<b>Firms Importing Fresh Salmon before 2010 (Treated Firms)</b>				
Fresh Salmon Import Value	3,564	191,638	1,435,363	0
Fresh Salmon Import Quantity	3,564	24,503	182,331	0
Total Seafood Import Value	540	7,783,898	17,262,276	1,240,380
Seafood Share of All Imports before 2010	240	.69	.40	.98
No. of Seafood Trading Routes before 2010	240	5.36	5.39	3
No. of Import Source Countries				
Before 2010	110	1.31	.66	1
After 2010	83	2.43	1.56	2
Maximum Import Share for Any Source country				
Before 2010	110	.98	.07	1
After 2010	83	.83	.20	.95
<b>Firms Importing Certain Aquatic Seafood before 2010 (Control Firms)</b>				
Aquatic Seafood Import Value	1,935	134,362	1,498,789	0
Aquatic Seafood Import Quantity	1,935	55,366	587,120	0
Total Seafood Import Value	1,953	6,882,770	19,062,430	1,063,824
Seafood Share of All Imports before 2010	868	.73	.37	.96
No. of Seafood Trading Routes before 2010	868	5.02	5.28	3
No. of Import Source Countries				
Before 2010	424	2.50	2.26	1
After 2010	295	2.16	1.78	1
Maximum Import Share for Any Source Country				
Before 2010	424	.83	.22	1
After 2010	295	.85	.20	1

**Notes:** Table 1 presents the observation, means, standard deviations and medians. The upper panel presents raw summary statistics for the sample of 66 firms importing fresh salmon before 2010. The lower panel presents raw summary statistics for the sample of 199 firms importing American shrimp, Indonesian squid, and Japanese other aquatic products before 2010. Our study period is from 2007 to 2015.



**Table 2. Intensive-margin Impacts**

	(1)	(2)	(3)	(4)
<i>3 years before event</i>	-1.009** (0.443)	-1.156** (0.488)	-0.675 (0.487)	-1.869** (0.766)
<i>2 years before event</i>	-0.600* (0.349)	-0.725* (0.401)	-0.399 (0.409)	-1.224** (0.562)
<i>1 year before event</i>	-0.494 (0.391)	-0.613 (0.431)	-0.329 (0.468)	-0.515 (0.616)
<i>year of event</i>				
<i>1 year after event</i>	-1.034*** (0.305)	-1.220*** (0.321)	-0.964** (0.377)	-1.289*** (0.447)
<i>2 years after event</i>	-1.262*** (0.309)	-1.499*** (0.320)	-0.930** (0.360)	-1.987*** (0.500)
<i>3 years after event</i>	-1.314*** (0.349)	-1.480*** (0.362)	-1.074** (0.440)	-1.931*** (0.492)
<i>4 years after event</i>	-1.195*** (0.311)	-1.374*** (0.330)	-0.859** (0.357)	-1.965*** (0.513)
<i>5 years after event</i>	-1.467*** (0.340)	-1.910*** (0.382)	-1.145*** (0.381)	-2.344*** (0.586)
Observations	3399	3399	3234	3120
N (Firms)	366	366	347	335
Firm FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
PortXYear FE	Yes	Yes	Yes	Yes
Adjusted $R^2$	.97	.91	.97	.97

Notes: Table presents our event study estimators from equations (4) three years before to five years after China's Norwegian salmon sanction. Standard errors are clustered by firms. Regressions (1)–(3) include firm fixed effects and year fixed effects, except where otherwise noted. Data cover the years 2007–2015. Asterisks denote p-value < 0.10 (\*), < 0.05 (\*\*), or < 0.01 (\*\*\*).

**Table 3. Extensive-margin Impacts**

	No. of Countries		Import Share		Maximum Share	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>3 years before event</i>	-0.949*** (0.288)	-1.292** (0.502)	0.082 (0.078)	0.000 (.)	0.050 (0.034)	0.079 (0.049)
<i>2 years before event</i>	-0.044 (0.273)	-0.447 (0.389)	-0.038 (0.073)	0.000 (.)	-0.015 (0.033)	0.037 (0.049)
<i>1 year before event</i>	-0.488** (0.196)	-0.441 (0.363)	-0.046 (0.049)	0.000 (.)	0.015 (0.024)	0.005 (0.047)
<i>year of event</i>						
<i>1 year after event</i>	0.479* (0.253)	0.943** (0.399)	-0.266*** (0.083)	0.670*** (0.080)	-0.092* (0.054)	-0.177*** (0.062)
<i>2 years after event</i>	0.563 (0.715)	0.330 (0.430)	-0.123 (0.080)	0.514*** (0.100)	0.013 (0.028)	-0.015 (0.054)
<i>3 years after event</i>	1.020 (0.658)	0.963*** (0.355)	-0.335*** (0.107)	0.600*** (0.070)	-0.210* (0.108)	-0.084* (0.050)
<i>4 years after event</i>	1.557** (0.669)	0.954** (0.429)	-0.408*** (0.121)	0.658*** (0.081)	-0.173** (0.069)	-0.180* (0.091)
<i>5 years after event</i>	1.125** (0.566)	1.685** (0.780)	-0.744*** (0.152)	0.586*** (0.087)	-0.209*** (0.080)	-0.272*** (0.073)
Observations	913	928	628	501	913	928
N (Firms)	200	198	173	144	200	198
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	.48	.48	.62	.64	.39	.39

Notes: Table presents our event study estimators from equations (4) three years before to five years after China's Norwegian salmon sanction. Standard errors are clustered by firms. Regressions (1)–(3) include firm fixed effects and year fixed effects, except where otherwise noted. Since the Faroe Islands did not engage in any fresh salmon exports to China prior to 2010, we anticipate the absence of any estimates for the years preceding 2010. Data cover the years 2007–2015. Asterisks denote p-value < 0.10 (\*), < 0.05 (\*\*), or < 0.01 (\*\*\*).

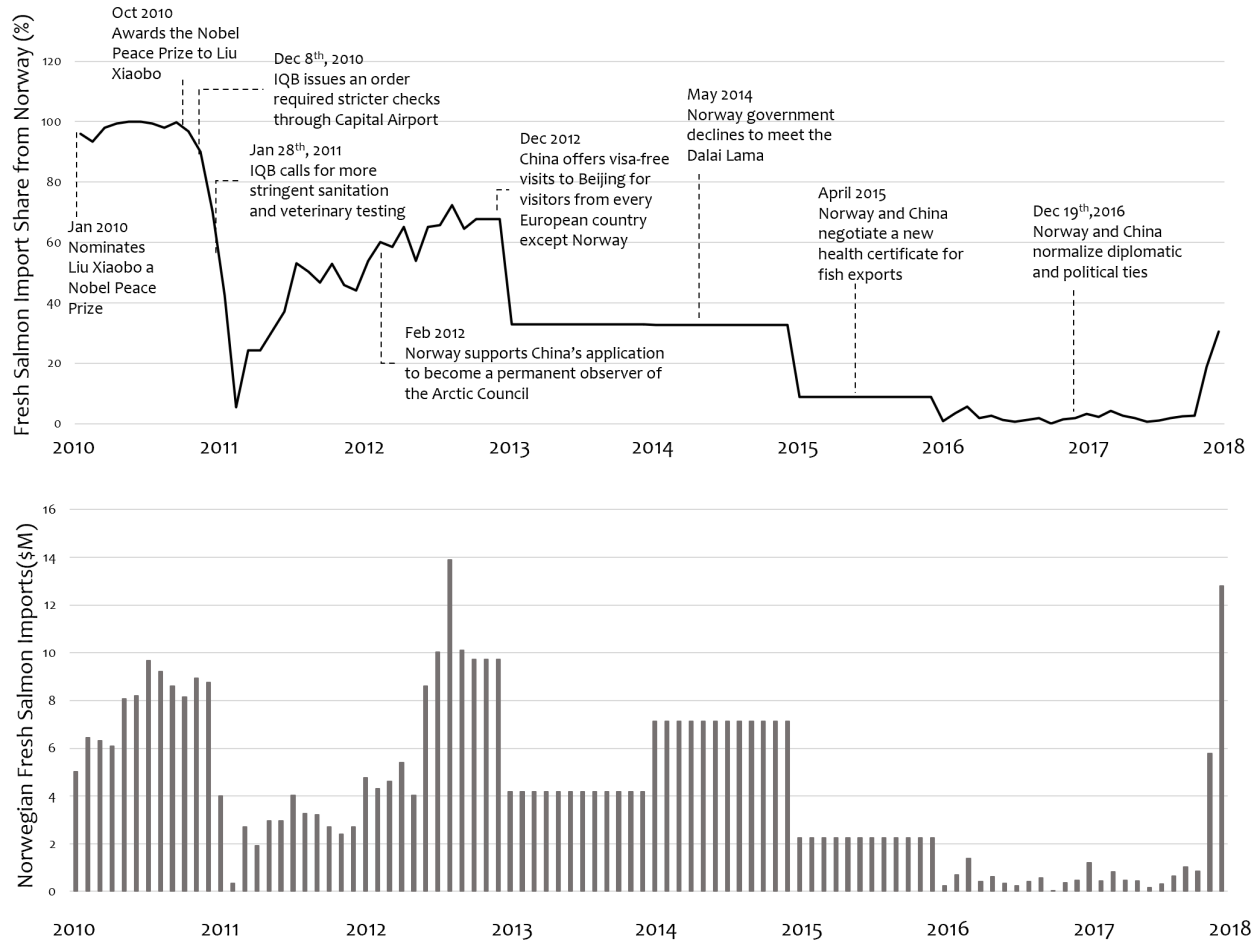
**Table 4. Heterogeneous Impacts of China's 2010 Salmon Sanction**

	(1) Seafood Imports > 50% of Total Imports	(2) Firms Imports Above Average	(3) State-owned Firms	(4) Trade Intermediaries
<i>3 years before event</i>	-0.360*** (0.104)	-0.331*** (0.122)	0.136 (0.168)	0.121 (0.106)
<i>2 years before event</i>	-0.267*** (0.089)	-0.148 (0.113)	0.080 (0.137)	0.102 (0.096)
<i>1 year before event</i>	-0.166 (0.108)	-0.173 (0.127)	0.099 (0.089)	0.006 (0.117)
<i>year of event</i>				
<i>1 year after event</i>	-0.069 (0.085)	-0.072 (0.115)	-0.009 (0.116)	0.058 (0.105)
<i>2 years after event</i>	-0.278*** (0.080)	-0.356*** (0.087)	-0.017 (0.110)	0.099 (0.078)
<i>3 years after event</i>	-0.249*** (0.090)	-0.354*** (0.102)	0.039 (0.112)	0.181** (0.088)
<i>4 years after event</i>	-0.254*** (0.092)	-0.341*** (0.109)	0.031 (0.113)	0.109 (0.110)
<i>5 years after event</i>	-0.315*** (0.086)	-0.386*** (0.097)	0.045 (0.112)	0.084 (0.093)
Observations	6521	6521	6521	6197
N (Firms)	382	382	382	376
Firm FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
PortXYear FE	Yes	Yes	Yes	Yes
Adjusted $R^2$	.97	.97	.97	.97

Notes: Table 4 presents our event study estimators from equation (5) three years before to five years after the Norwegian salmon sanction. Standard errors are clustered by firms. Regressions include firm fixed effects and port-by-year fixed effects, except where otherwise noted. See text for details. Data cover the years 2007–2015. Asterisks denote p-value < 0.10 (\*), < 0.05 (\*\*), or < 0.01 (\*\*\*).

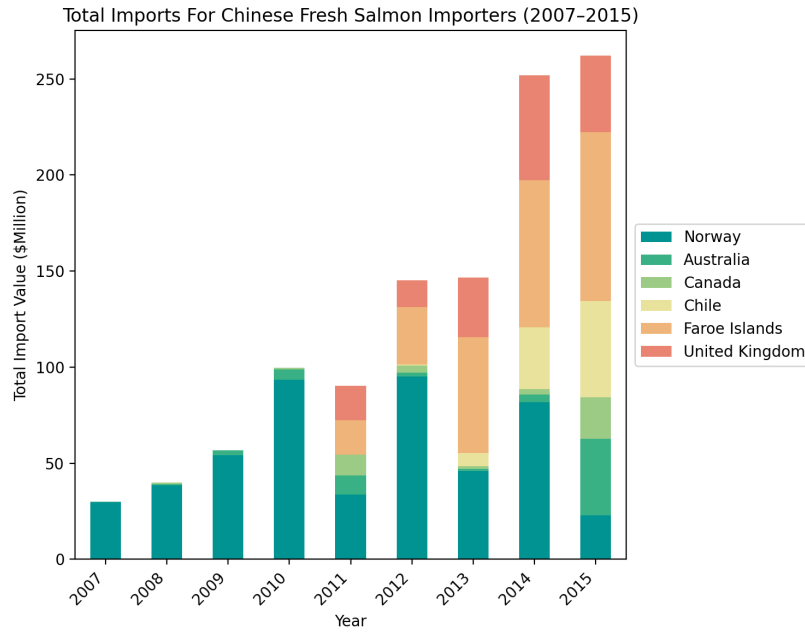
# FIGURES

**Figure 1. Timeline of China-Norway Fresh Salmon Trade Disruptions (2010–2017)**

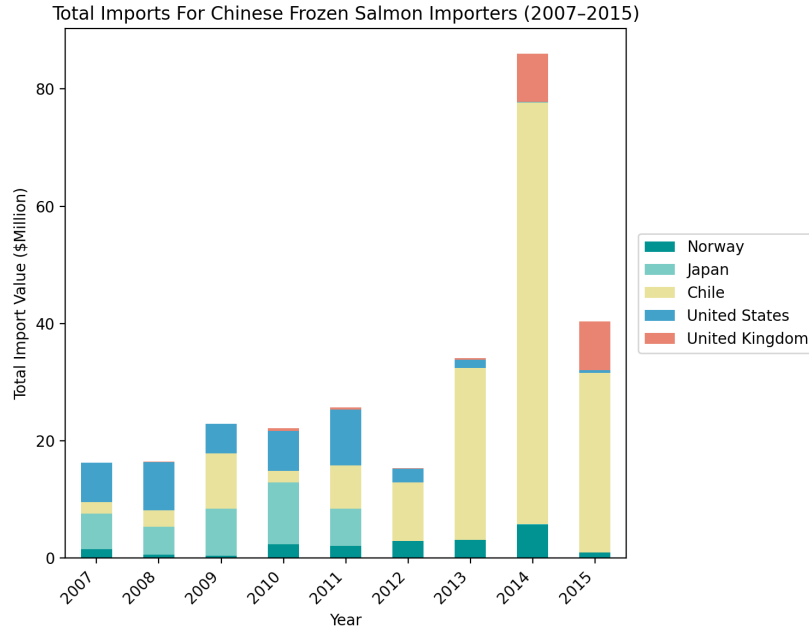


**Notes:** Figure 1 plots the 2010–2017 monthly Norwegian fresh salmon import value and share obtained from UN Comtrade. Given UN Comtrade only provides annual data from 2013 to 2015, we evenly distribute the annual imports to each month for the 2013–2015 period.

**Figure 2. Import Trends For Chinese Fresh and Frozen Salmon Importers (2007–2015)**

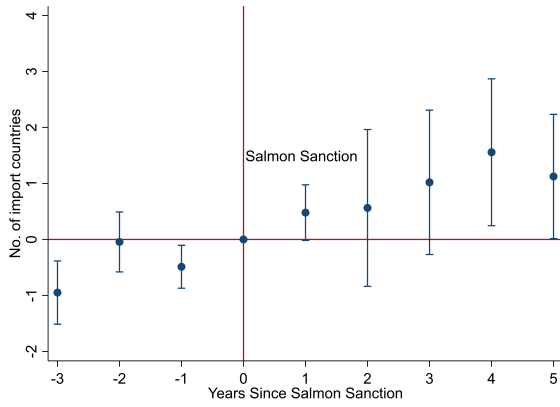


**(a) Value of Fresh Salmon Imports**

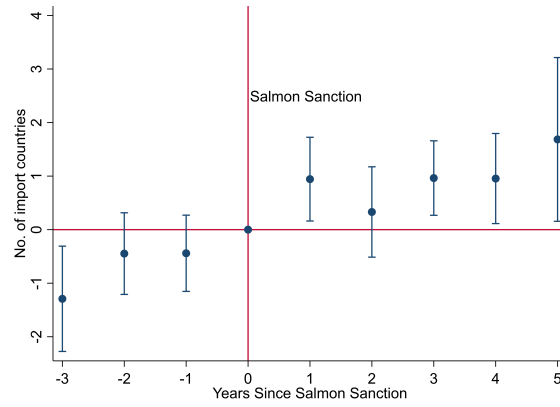


**(b) Value of Frozen Salmon Imports**

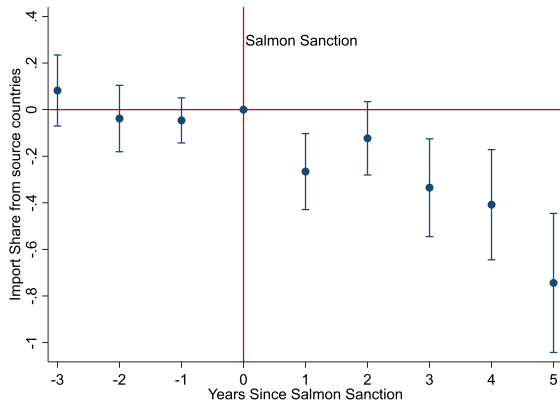
**Figure 3. Extensive-margin Impacts**



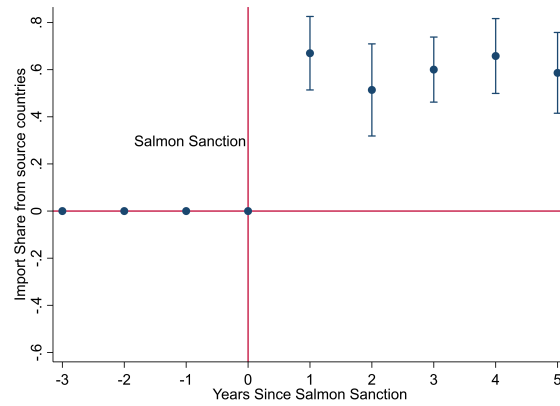
**(a) Number of Countries (Firms Only Import from Norway)**



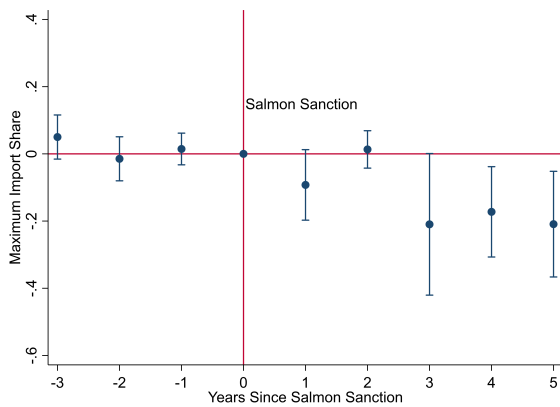
**(b) Number of Countries (Firms Import from Norway and/or Other Countries)**



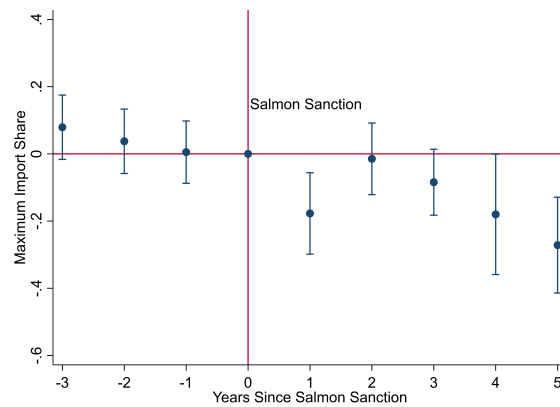
**(c) Norway's Import Share**



**(d) Faroe Islands' Import Share**



**(e) Maximum Import Share (Firms Only Import from Norway)**



**(f) Maximum Import Share (Firms Import from Norway and/or Other Countries)**

**Do Firms Hedge Against Political Tensions?  
Evidence from Chinese Food Importers of Norwegian Salmon**

**Appendices for Online Publication**

## Online Appendix A ADDITIONAL EVIDENCE

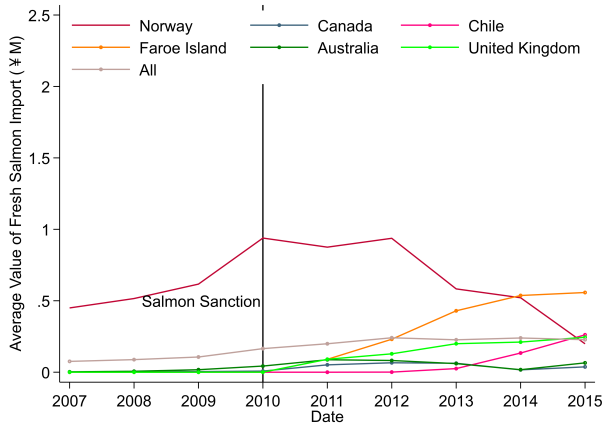
**Table A1. Summary Statistics, Fresh Salmon and Controls**

	Seafood Share of All Imports		No. of Seafood Trading Routes		Transport by Sea	
	2007	2007-2010	2007	2007-2010	2007	2007-2010
Fresh Salmon	.64	.63	2.17	3.11	.64	.58
<i>All Control Groups</i>	.75	.76	3.04	3.36	.66	.62
American Shrimp	.7	.7	2.95	3.12	.54	.6
Indonesia's Squid	.83	.82	3.03	3.46	.7	.63
Japan's Other Aquatics	.61	.66	3.11	3.27	.64	.61

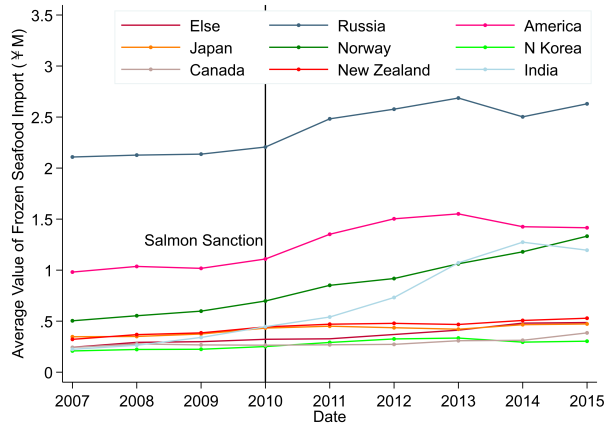
**Notes:** Table A1 presents the firm characteristics value of treatment and alternative control groups in 2007 and value between 2007 and 2010.



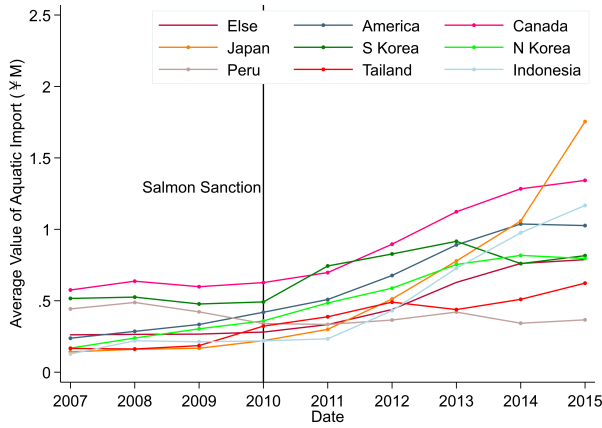
# Figure A1. Import Value Trend of Seafood Products



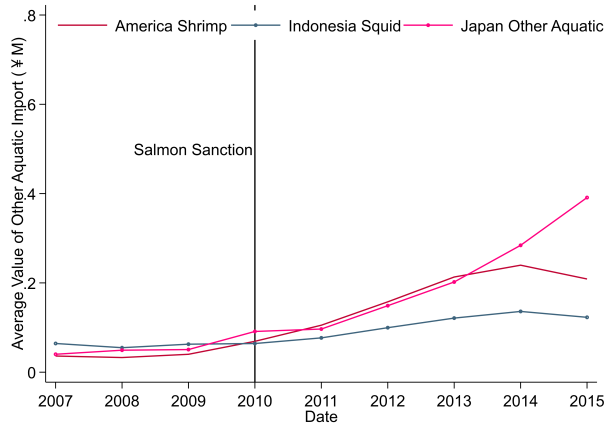
(a) Fresh Salmon (Treated Firms)



(b) Frozen Fishes (Control Groups)

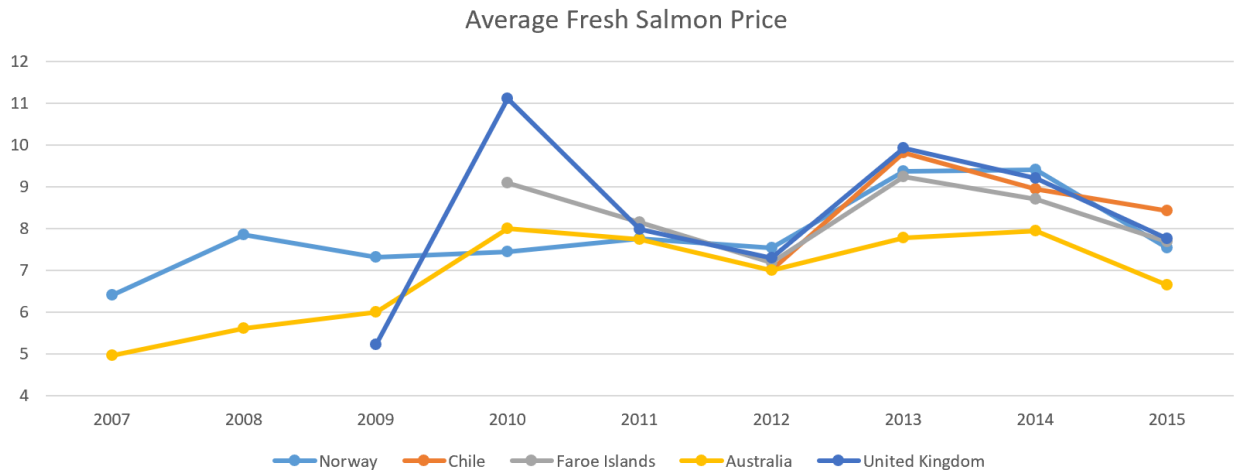


(c) Aquatics (Control Groups)

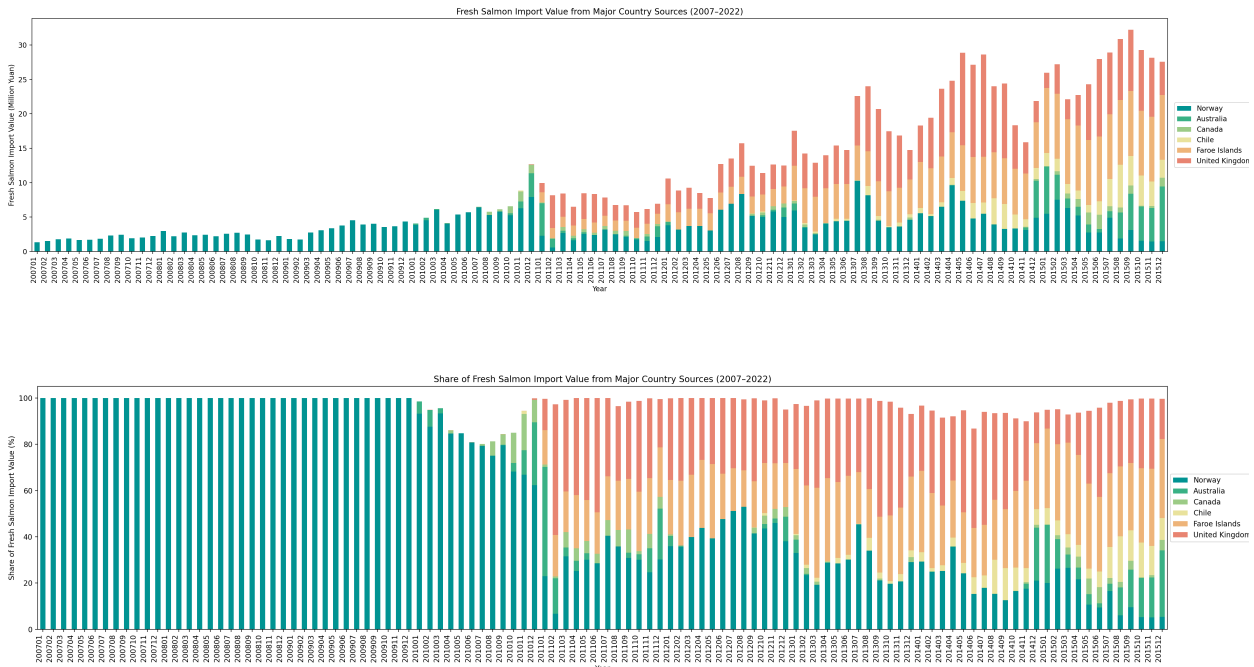


(d) Other Alternative Aquatics (Control Groups)

**Figure A2. Average Price Trends in Fresh Salmon Imports in Main Source Countries/Regions**

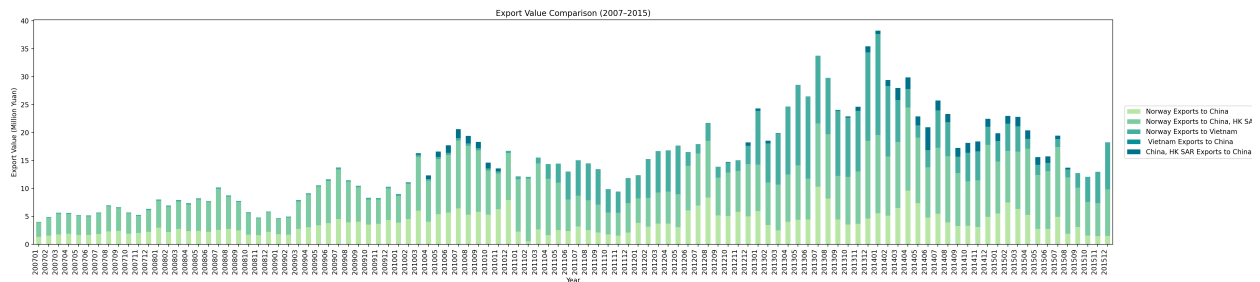


**Figure A3. Monthly Fresh Salmon Exports from Six Major Countries/Regions**

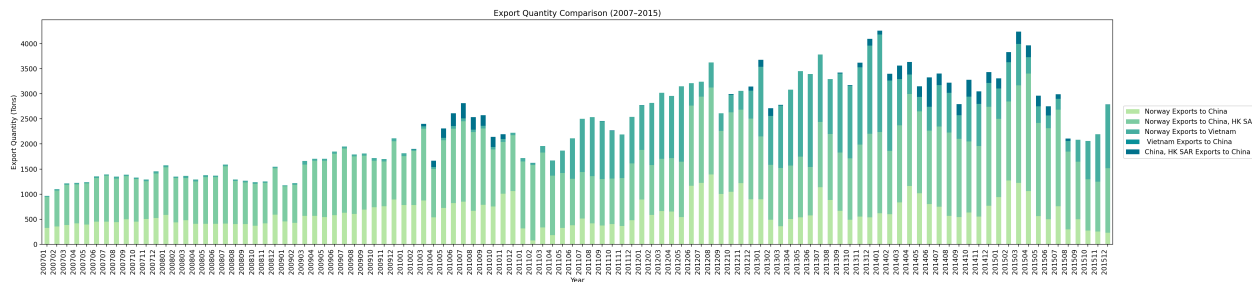


**Notes:** Figure A3 plots the 2007–2015 monthly fresh salmon export value and share from major six country/region sources from UN Comtrade. Given UN Comtrade only provides annual data for Faroe Island, we evenly distribute the annual imports to each month for the 2007–2015 period.

**Figure A4. Monthly Fresh Salmon Export**



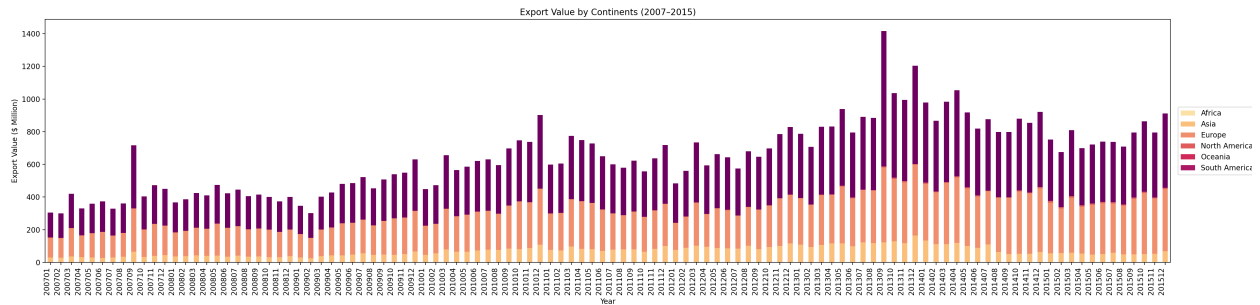
**(a) Quantity**



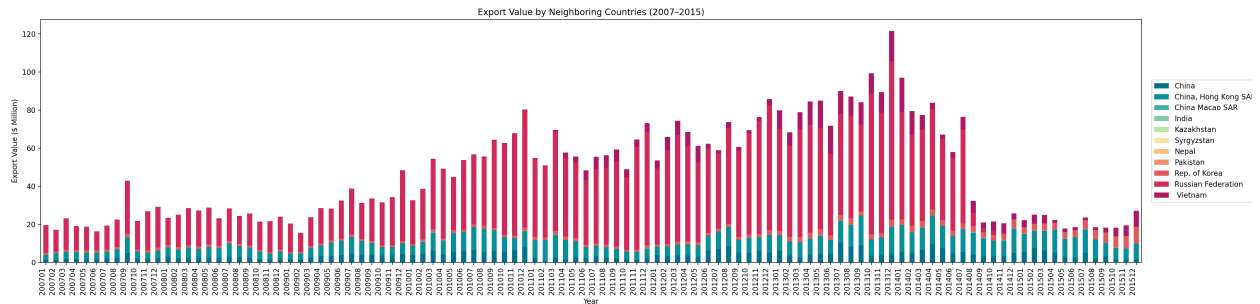
**(b) Value**

**Notes:** Figure A4 plots the 2007–2015 monthly fresh salmon export value and share from Norway to China, Hong Kong, and Vietnam, and Hong Kong to mainland China from UN Comtrade. According to UN Comtrade and the China Custom data, there were no reported fresh salmon exports from Vietnam to China nor reported fresh salmon imports from Vietnam to mainland China.

**Figure A5. Monthly Norwegian Fresh Salmon Export Value**



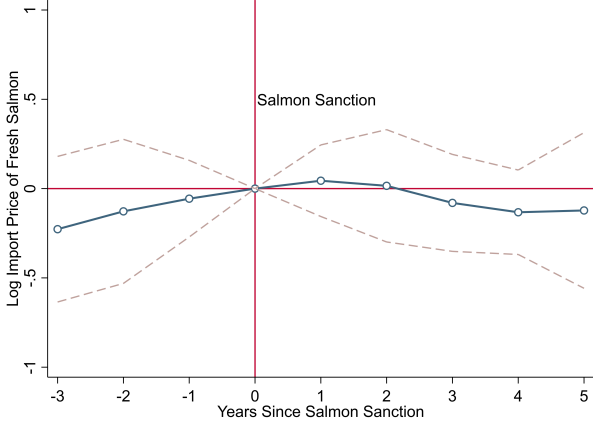
**(a) Export Value by Continents**



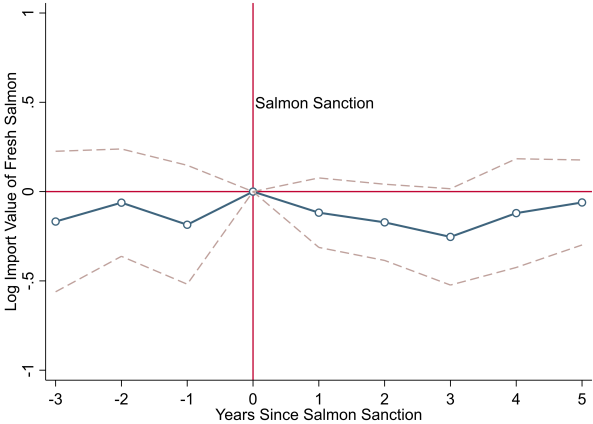
**(b) Export Value to China and Neighboring Countries/Regions**

**Notes:** Figure A5 plots the 2007–2015 monthly Norwegian fresh salmon export value by continents or neighboring countries/regions near China from UN Comtrade.

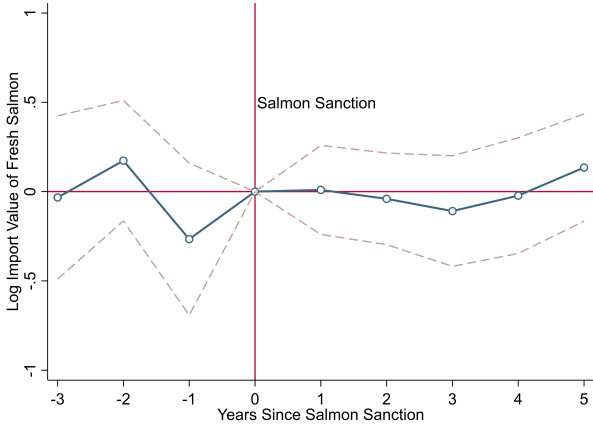
**Figure B1. Impacts on Trade Prices**



**Figure B2. Placebo Tests of the Sanction's Impacts**



**(a) Treatment: American Frozen Cod**



**(b) Treatment: Norwegian Frozen Cod**