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Something Fishy in Seafood Trade? The Relationship between Tariff and Non-Tariff Barriers

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Abstract

As importing countries honor WTO commitments and lower tariff rates, they may be replacing traditional tariff barriers with non-tariff barriers. Recent literature has found that the implementation of food safety standards, specifically the use of import notifications and rejections, has acted as a significant barrier to trade in both the EU and the US. This article estimates the relation between declining tariff rates and the use of non-tariff barriers, measured by a count of EU seafood import notifications. We divide the motives for the use of import notifications into risk and protectionism. The results show that while non-tariff barriers are driven in part by variables associated with risk, they are also correlated with variables associated with increased demand for protection. We find that when trade agreements force a decrease in tariffs, we observe an increase in the number of import notifications, holding trade constant. This effect is strongest for those products that are rejected at the border for less threatening health reasons. When we calculate the effect on trade, we find that these non-tariff barriers offset nearly one quarter of the gains in trade from tariff reductions.

Keywords: non-tariff barriers, seafood, import notifications, tariffs, European Union

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Introduction

The safety of food imports is in the spotlight. Egyptian fenugreek seeds stand accused as the source of the 2011 deadly E. coli outbreak in Germany and in the United States (US), a 2011 FDA report calls for increased vigilance of the US food import system. While increased scrutiny at the border has the laudable goal of protecting health, food import refusals may be subject to pressure for import protection (Baylis, Martens and Nogueira 2009). If food inspections are directed to protecting domestic industry, presumably they are not always targeting the products with the highest risk. In this article, we ask whether European Union (EU) food import refusals have been driven by demand for protection, particularly in the form of tariff reductions.

As the use of tariff barriers is restricted by trade agreements, domestic pressure for import protection may shift to demand for less transparent non-tariff barriers (NTBs) [1] (Copeland 1990). To limit the protectionist use of NTBs in agriculture and food trade, the World Trade Organization (WTO) established sanitary and phytosanitary (SPS) rules to require that any food import standards must be justified by scientific evidence that proves the barrier is necessary to protect human, animal, or plant health. That said, there is still concern that these measures, if onerous or arbitrarily imposed, can unfairly restrict imports.

Previous work has shown that SPS standards can act as barriers to trade (for example, see Grant and Anders 2010; Baylis, Nogueira and Pace 2010; Otsuki, Wilson and Sewadeh 2001; Disdier and Marette 2010). Flexibility in creating and applying SPS barriers leaves room for protectionist motives to influence the implementation of NTBs. This article explores the motives behind NTBs, asking whether NTBs increase as tariff rates fall, and whether they are more intensively used by countries that have a large domestic demand for protection. We explore these questions by considering seafood trade with the EU.

[1] We define non-tariff barriers as barriers that are not tariffs and have a negative effect on trade (Hillman 1991).

Seafood is a product of particular interest in the case of trade and food safety regulations. While seafood is subject to particular food safety concerns, it is also a product with rapidly increasing demand that holds great potential for developing country exporters. In 2008, world production of seafood was 142 million tonnes, and nearly 40 percent traded internationally with much of this trade being exported by developing countries (FAO Yearbook 2008).

The EU is the largest global seafood importer, and has tripled its imports from just over 5 billion Euros in 1998 to 15.5 billion Euros in 2009. Pacific salmon (10 percent) is the largest import by value followed by frozen shrimp (9 percent), canned tuna and frozen filleted Atlantic pollock (each at around 4 percent). With the exception of pacific salmon, the majority of these products were imported from developing countries. For example, the largest supplier of shrimp by value was Ecuador (19 percent), followed by India (12 percent) and Argentina (10 percent) while the main supplier of Alaskan pollock to the EU was China at 61 percent (European Commission 2009a).

A limited number of articles have empirically explored NTBs, and the majority of these articles ask whether standards act as barriers or as catalysts for trade. Jaffee and Henson (2004) argue that individual country responses to standards vary, and if developing countries can make good investments while adapting to import standards, then they can increase the value of their exports in the long run. Empirical evidence on the effect of standards is mixed. While Swann, Temple and Shurmer (1996), and Moenius (2004) show that standards, measured by count data, can increase trade, other research shows that increase in the severity of standards can impair trade (Otsuki, Wilson and Sewadeh 2001; Disdier and Marette 2010).[2] Two recent articles

[2] Otsuki, Wilson and Sewadeh (2001) showed that a decrease in allowable aflatoxin residue levels on fruits, vegetables, nuts, and cereals decreased exports from various African countries to the EU. The comparative gain in human health resulting from lowering maximum levels seemed to be very small compared to the trade losses associated with the stricter limits. A similar gravity model approach was used by Disdier and Marette (2010) to

consider the effect of establishing new standard systems. Anders and Caswell (2009) find that the introduction of HACCP standards has a negative effect on both volume and value of seafood imported into the US, particularly affecting exports from developing countries and smaller exporters while slightly increasing exports from larger exporters. Similarly, Nguyen and Wilson (2009) examine differing types of standards including maximum residue limits for the EU, HACCP regulations for the US, and the Japan Law for Japan and found that all three separate standards have a mostly negative effect on trade of seafood products, particularly in the case of shrimp and mollusks, which tend to be exported from developing countries.

In this article, we explore the use of import notifications and refusals.[3] Little research has been done specifically on import notifications or rejections, with a few recent exceptions (Buzby, Unnevehr and Roberts, 2008; Baylis, Martens and Nogueira 2009; Grant and Anders 2011; Baylis, Nogueira and Pace 2011). Grant and Anders (2011) use a count of rejections, and Baylis, Nogueira and Pace (2011) use a count of notifications, to examine their effect on seafood trade. Grant and Anders (2011) analyze detailed cross-sectional data on US seafood rejections at a four-digit Harmonized System (HS) level for 1997, 2000, 2004, and 2006 and find that an increase in the number of rejections increases imports to other, non-US markets in each year. Baylis, Nogueira and Pace (2011) find similar results using EU notifications at the six-digit HS level showing import notifications reduced exports to the EU while increasing imports into non-EU countries providing evidence of trade deflection. Two recent articles find similar results of the effect of an extreme form of an import notification: an outright export ban. An EU ban on seafood imports from Bangladesh decreased Bangladeshi seafood exports by 8.7 percent while

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examine the effect of maximum residue limits set by the US, the EU-15, Japan, and Canada, on crustacean trade. They found that that the reduction in maximum levels impeded trade flows, showing that these standards acted as significant NTBs.

[3] Import notifications include outright import refusals, recalls and information notices on import food products. We discuss the specific EU notification system in more detail later in the article.

causing trade to be deflected to the US and Japan (Cato and Lima dos Santos 1998). Similarly, an import ban on fish exports from Lake Victoria resulted in a drop in exports of fish from Kenya, and trade deflection to Asian importers (Henson, Brouder and Mitullah 2000).

In earlier work, we study the potential cause of US import rejections at the two-digit HS level (Baylis, Martens and Nogueira 2009). We identify three main factors affecting inspections and rejections. First, risky foods are positively correlated with import rejections. Second, exporter history has an important role in rejections, as inspections seem to be targeted at countries and products that have not met US standards in the past. Third, domestic concerns are also associated with higher rejections. In particular, domestic lobby expenditures and a pre-existing antidumping complaint increase the probability of a rejection. These results are evidence that protectionism may play a role in rejections and they do not simply act as incidental barriers. A drawback of this article is that we only have information on US rejections at a two-digit HS level, and we do not control for tariffs.

While it is often assumed that as trade agreements lower tariff rates in the interest of creating free trade countries may replace these tariffs with NTBs, few studies consider both NTBs and tariff barriers in the same analysis. Exceptions include Guillotreau and Péridy (2000) who calculate tariff equivalencies of NTBs and estimate the aggregate effect of tariffs and NTBs on trade; and Chemingui and Dessus (2008) who compare the magnitude of tariffs and NTBs in Syria and analyze the impact of removing NTBs on the Syrian economy. To our knowledge, ours is the first article to empirically estimate the effect of a reduction in tariffs on the use of NTBs. We ask whether NTBs are correlated with non-tariff factors that represent an increase in demand for protection. We find evidence that a decrease in tariffs is associated with an increase in NTB as measured by import notifications, and that while food notifications are correlated with product and exporter characteristics that reflect risk, they are also correlated with importer and market characteristics that are related to demand for protection.

Background on Food Standards and Import Regulations

In 1963, the Codex Alimentarius Commission was established by the Food and Agricultural Organization (FAO) and the World Health Organization (WHO) to develop coordinated food standards for all countries to protect consumers from potential food safety breaches. The Codex provided a base for future regulations by domestic governments, the FAO and the WHO in an effort to harmonize international standards for all food products. Specific standards relating to fish products were implemented starting in the late 1970s. The Codex later adapted standards to comply with the Hazard Analysis and Critical Control Points (HACCP) system, which is designed to prevent contamination and spread of disease.

Harmonizing food safety rules has also been a challenge within the EU. Prior to the implementation of an over-arching HACCP standard by the European Commission (EC), EU members implemented their own versions of HACCP regulations, which created trade frictions among member states. To harmonize standards across the EU, the EC implemented Directive 91/493/EEC specifically for HACCP regulations of seafood products along with two other Directives specifically for meat and dairy products. These three directives set requirements for safe food production. In 1993 another directive, 93/43/EEC, was implemented with a specific focus on hygiene of all food products (Ropkins and Beck 2000).

EU Import Inspection System

While the EU has had over-arching standards for all member states since the early 1990s, each country is responsible for its own interpretation and enforcement of the standards. General EU import rules require that all seafood products:

1. Are imported only from previously approved countries.
2. Enter the EU only through approved border inspection posts.
3. Are subjected to thorough document checks and possible physical checks.

A Council Directive implemented in 1991, 91/67/EC, defines the basic regulations that must be followed to place seafood products on the market, and holds third countries to the same standards as EU member countries. The Directive outlines procedures for becoming an approved exporter, as well as creates three divisions (List I, List II, and List III) for common seafood diseases based on severity and concern for spread within the EU. List I applies to infectious salmon anaemia (ISA), currently an exotic disease to the EU. List 1is the most severe and any ISA contaminated seafood is not allowed movement into or within the EU. List II diseases are found in the EU and the goal is to control and eliminate these diseases. List III diseases are the least severe and are frequently found within the EU. Fisheries, as well as specific zones and non-member countries must be preapproved and certified disease-free before movement of seafood within the EU or importation from third countries. Exporting countries who are not preapproved in terms of Lists I-III risk rejection at the EU border (European Commission 2007).

Once a shipment is imported into the EU, it is allowed to move between EU countries uninspected.[4] Because each member state is responsible for its own implementation of EU standards, certain exporters may send shipments to specific EU member states believing these states to be more lax. The EU Food and Veterinary Office inspects ports across member states to

[4] Based on information from Sriram Balasingam, Scientific Officer, Imported Food Team, Enforcement & Local Authority Delivery Division, Food Standards Agency, UK.

ensure that at least the minimum EU standard is met. If a shipment that does not meet EU food standards enters into the EU market, then a notification can be issued and the shipment may be sent out of the country or destroyed (European Commission 2008).

EU Import Rejection System

The EU established the Rapid Alert System for Food and Feed (RASFF) in 1979 which is used by all EU member countries plus the members of the European Free Trade Association. Currently, the RASFF has two main notification divisions based on when products are flagged and the seriousness of required action. Market notifications occur if a product has entered the EU market, and after entering is found to contain a consumer threat. If products on the market are considered a threat in need of immediate action, then an alert notification is triggered and the product is withdrawn from the market to be held, further tested, destroyed, or removed from the country. Products on the market that receive a notification but are not deemed an immediate threat, or for which immediate withdrawal is not required, trigger information notifications, which may include product removal or refusal of entry. The second notification category is a border rejection notification, which signals that a product was rejected at the border and never entered into the EU (European Commission 2008).

Prior to 2008 the two main divisions of the RASFF were alert and information notifications, and there were no separate categories for border rejections or market notifications. Because we use data from 1998 to 2008, all notifications will be included in a single count variable regardless of action taken. These actions include border rejections, re-dispatches to the exporter, destruction, treatment, detainment, sales bans, withdrawal from the market, along with several other less severe actions such as labeling, dating, and no action taken.

In 2008, border rejections comprised the largest share (46 percent) of all initial notifications. Seafood products accounted for 11 percent of these rejections and were the most rejected animal product. Total numbers of notifications have increased between 2006 and 2008. There was a slight decrease in alert notifications due to stricter definitions of alerts, however, both information notifications and border rejection notifications increased during this time (European Commission 2008).

Methods

We take a nonlinear approach, because our dependent variable, $EUnotification_{ijht}$, is a count of events, so the prediction of events will remain positive integers. The mean of $EUnotification_{ijht}$ is equal to 0.013 while the variance is equal to 0.071, implying over-dispersion in the data. We use negative binomial regression to address the dispersion in the data.

In earlier work, we show that these notifications do influence trade flows, and therefore suspect that they may respond to demand for protection (Baylis, Nogueira and Pace 2010). We model protectionism and risk as the two main factors that can increase the probability of earning a notification. The greater the probability of risk associated with a product or exporter, the more likely that a notification will occur. The more interesting portion of this model is protectionism. Tariff rates are used as a form of protectionism. As tariffs decrease, there is concern that domestic demand for protection increases, which could increase the probability that the country may implement other barriers (i.e. notifications) as an alternate form of protection. The base model for this article is as follows:

$$\Pr\left(EUnotification_{ijht}\right) = \beta_0 + \beta_1\left(TradeProtection_{ijht}\right) + \beta_2\left(Risk_{ijht}\right) + \varepsilon_{ijht} \qquad (1)$$

where

$$TradeProtection_{ijht} = f(\hat{T}_{ijht}, X_{ht}, Z_{it}) \tag{2}$$

and

$$Risk_{ijht} = f(X_{ht}, Z_{jt}, D_{ij}) \tag{3}$$

where *i* refers to the importer, *j* to the exporter, *h* to the product (at the six-digit HS level) and *t* to time. The variable $\hat{T}_{ijht}$ represents the tariff rates predicted by bilateral trade agreements and is explained in more detail below. Variables X_{ht} represent specific product characteristics, Z_{it} and Z_{jt} represent specific country characteristics, and D_{ij} is distance from exporting country *j* to importing country *i*. In the following section, we describe specific variables used to capture protectionism and risk.

Protectionist Variables

The primary protectionist variable of interest is the change in tariff rates ($\Delta\hat{T}avg_{ijht}$). Because tariff rates may be determined simultaneously with import standards, we instrument for the change in tariffs using trade agreements and preferences, exporting country income classifications and broad product categories. Trade agreements and preferences are broken down into regional trade agreements (RTA_{ijt}), free trade agreements (FTA_{ijt}), and least developed country (LDC) rates, LDC_j, to represent EU trade preferences toward LDCs. Both RTA_{ijt} and FTA_{ijt} are not seafood-specific agreements, but include all trade agreements involving the EU. Because bilateral trade is largely driven by non-seafood products, we assume that specific seafood standards and import notifications will not influence the signing of a broad trade agreement. The following income classifications are included as exporting country characteristics: $Lower\text{-}MiddleIncome_j$, $Upper\text{-}MiddleIncome_j$, $HighIncome_j$, with $LowIncome_j$ in the constant.[5] The assumption is that the EU has different trading relations with countries at different developmental stages. Second, we assume that while different HS codes face different tariffs, their perishability affects the probability of an import notification. Dummy variables are created for two-digit and four-digit HS product codes to control for differences in tariff rates for different types of products. These include HS-16, and HS-0301 through HS-0307. Last, we include distance, (instrumented) quantity traded between importing and exporting countries, and importing country fish production, and year and importer country fixed effects in both first and second stage regression.

The original tariff data include minimum rates, average rates, and maximum rates (as described in the following section), thus we include analyses for the average rate in base models and use the maximum rates as a robustness check. The first stage regression is as follows:

$$\hat{T}_{ijht} = \alpha_0 + \alpha_1(TradeAgreement_{ijt}) + \alpha_2(IncomeLevel_{jt}) + \alpha_3(Product_h) + \alpha_4 X_{ijht} + \mu_{ijht} \quad (4)$$

where *X* represents those country and product characteristics included in both first and second stage regressions. Overall it is expected that both average and maximum tariff predicted values will have a negative relation with EU notifications. As tariff rates are being limited by the WTO and decrease over time, importing countries may be replacing these "traditional" tariff barriers with NTBs, EU notifications in this article. We difference resulting tariffs between time *t* and time *t-1* and we expect that the probability of receiving a notification will increase.

Domestic producers of lower-priced products may be more vulnerable to cheaper imported products than producers of higher-priced products, and thus demand a higher level of protection. The lagged median price at the six-digit HS level, $MedianPrice_{ht-1}$ is included as a

[5] Income classifications are created according to World Bank classifications: low-income if GDP per capita is less than 996 dollars, lower-middle-income if between 996 and 3,945 dollars, upper-middle-income if between 3,946 and 12,195 dollars, and high-income if greater than or equal to 12,196 dollars.

product characteristic. As the price of an imported product falls relative to prices of the same product from other countries, $RelPrice_{jht}$, domestic producers may be concerned about their ability to compete against this lower priced good. Import market share, $MktShare_{jht}$, is the share of imports by exporter, product, and year, and is expected to increase the demand for protection. If one exporter is the primary supplier of the market for a specific product, it may be perceived to be a larger threat to domestic producers than many small exporters.

One potential driver of increased demand for protection is domestic fish production, $Fishprod_{iht}$. If EU countries produce large amounts of seafood domestically, domestic producers may be more concerned about competition from imports. We include gross domestic product (GDP) per capita as a measure of income. Importer income, $lnGDPpc_i$, is expected to increase the demand for protection resulting in a higher probability of a notification because countries with a higher GDP per capita can afford to protect domestic producers and implicitly tax consumers.

Risk Variables

Risk variables include product characteristics, distance, and exporting country characteristics. It is expected that higher-risk products, such as perishable products will have a higher probability of receiving a notification. Distance also constitutes a risk factor, and it is expected that a greater distance increases risk and, therefore, increases the probability of receiving a notification. It is expected that higher-risk exporters, particularly low-income countries, will have a higher probability of receiving a notification.

While we would like to include the quantity imported, it might be directly affected by an import notification. Thus, in a first stage, we predict the log of the quantity ($ln\hat{Q}_{ijht}$) imported using its first and second lags to control for the potential endogeneity between quantity imported and the probability of receiving a notification. Second, we include product characteristics associated with higher risk. We identify whether the product is $Fresh_h$, $Frozen_h$, and $Processed_h$ assuming that due to perishability, a product will be of highest risk if fresh, and secondary risk if frozen. The variable $Processed_h$ is included in the constant. The distance between the exporter and importer in log, $lnDistance_{ij}$, is a risk factor in seafood trade, particularly when considering perishable, unprocessed, products. The greater the distance a shipment must travel, the higher the probability of spoilage and contamination.

Third, we include various country characteristics to identify those exporters that may be of higher risk of exporting products that do not meet EU standards. We include a dummy variable for countries who do not export that specific product, $NoExp_{ijht}$, and new exporters, $NewExp_{ijht}$. The dummy variable for non-exporters, $NoExp_{ijht}$, equals one for exporters that have never exported an individual product. The dummy variable for new exporters, $NewExp_{ijht}$, equals one for exporters that do not trade in with importer *i* in year *t-1* but do trade in year *t*. It is expected that if this variable is one, the exporter is high risk, and therefore increases the probability of receiving a notification compared to an exporter who traded two years in a row.

We include the count of US import alerts faced by the exporting country by product in the current year: $USalert_{ijht}$. This variable is included with the expectation that having an alert in another developed country (the US) on a specific product indicates to the EU that these exporters and products are high risk. We measure exporter experience, $Experience_{jt}$, as the total value imported into the EU by exporter *j* in year *t*. It is expected that the smaller the value of exports from a country the higher the probability that the country may not meet EU standards because of the lack of familiarity and trust. We include the log of exporter income per capita, $lnGDPpc_j$, with the assumption that as exporter income increases, the risk associated with that country decreases.

The base model in equation 1 is estimated using importer country fixed effects with maximum rates as a robustness check. We include two additional fixed effects regressions to control for effects that may not be observable for specific exporting regions (with and without importer country fixed effects). The exporting regions are: North Africa, Sub-Saharan Africa, Antarctica, Central America and the Caribbean, Europe, the Middle East, North America, South America, South Asia, the South Pacific, and South East Asia.

The fully-specified model is as follows:

$$\begin{aligned}\Pr\left(EUnotification_{ijht}\right) &= \beta_0 \\ &+ \beta_1\left(\Delta\hat{T}avg_{ijht}\right) + \beta_2\left(MedianPrice_{jht-1}\right) + \beta_3\left(RelPrice_{jht}\right) \\ &+ \beta_4(MarketShare_{jht}) + \beta_5(Fishprod_{iht}) + \beta_6\left(ln\hat{Q}_{ijht}\right) \\ &+ \beta_7(Fresh_h) + \beta_8(Frozen_h) + \beta_9\left(lnDistance_{ij}\right) \\ &+ \beta_{10}\left(No\ Exp_{ijht}\right) + \beta_{11}\left(NewExp_{ijht}\right) + \beta_{12}\left(USalert_{ijht}\right) \\ &+ \beta_{13}\left(Experience_{jt}\right) + \beta_{14}\left(lnGDPpc_j\right) + \beta_{15}(lnGDPpc_i) \\ &+ \varepsilon_{ijht}\end{aligned} \tag{5}$$

If standards are meant to limit the risk to human health, then notifications should be correlated with risk factors. If there is a strong relation between high demand for protection and high probabilities of notifications, then there may be something other than science at play.

Data

The data were collected from several sources detailed below. Each data series is merged by importing country, exporting country, year, and product code where applicable. The final panel dataset has 281,940 observations that cover a period of 11 years from 1998-2008, where the unit of observation is annual imports between two countries of a specific seafood product at the six-digit HS level. The three key variables in the data include EU import notifications, trade flows, and tariff rates along with multiple country and product controls. Summary statistics are presented in table 1. The data only include importers in the EU at the time of trade because only EU members can issue import notifications.

Table 1. Summary Statistics

Variables	Mean	Standard Deviation	Min	Max
$EUnotifcation_{iiht}$	0.014	0.272	0	29
$\Delta\hat{T}avg_{iiht}$	-0.247	1.375	-9	1.43
$\Delta\hat{T}max_{iiht}$	-0.314	1.859	-11.846	1.48
$MedianPrice_{jht-1}$-1	6.243	4.623	0.516	36.10
$RelPrice_{jht}$	1.350	6.531	0.004	2622.88
$MktShare_{jht}$	0.264	1.534	0	84.28
$Fishprod_{iht}$	12.806	19.497	0	101.87
$ln\hat{Q}_{iiht-1}$	4.576	3.993	0.773	15.92
$Fresh_h$	0.209	0.407	0	1
$Frozen_h$	0.352	0.478	0	1
$lnDistance_{ij}$	7.784	1.132	4.088	9.897
$NewExp_{ijht}$	0.059	0.235	0	1
$USalert_{ijht}$	3.680	13.703	0	286
$Experience_{jt}$	3.591	4.974	0	32.11
$lnGDPpc_i$	9.799	0.584	7.789	10.936
$lnGDPpc_j$	9.040	1.464	4.394	10.936

EU Notifications

EU notifications come from the RASFF portal (European Commission, 2009b). The data originally included all products with notifications from 1998-2008. Along with the notification, we observe the date of notification, notification type, action taken after notification, and specific hazard along with the reporting (importing) country and exporter. We restrict the data to include only seafood products and used the product descriptions to code the notified products at the six-digit HS level.[6] The total number of notifications by year is illustrated in figure 1.

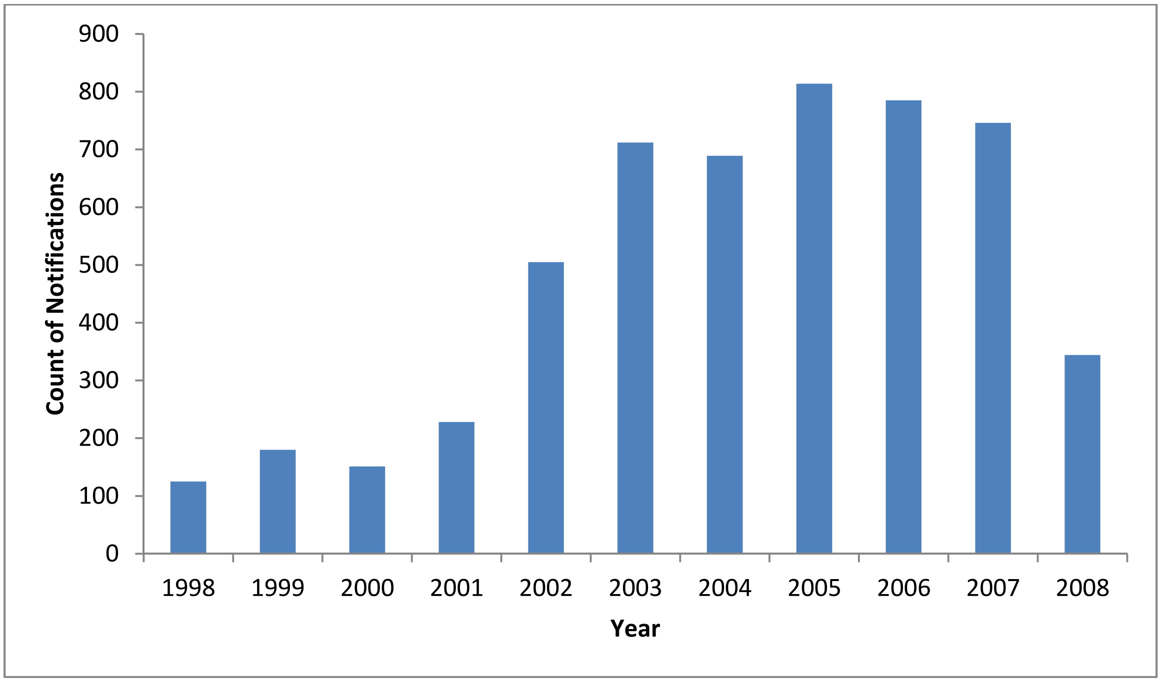

Figure 1. EU Import Notifications by Year

[6] Products were assigned a code at the 6-digit HS level, including all Chapter 03 codes and the seafood divisions from Chapter 16, specifically HS-1604 and HS-1605. The 6-digit HS level enables us to look at specific products rather than more general products, for example, frozen fillets versus all fillets. A full list of included products and descriptions is available upon request. For simplicity all product codes in this dataset as well as any other data downloaded at the six-digit code level were aggregated to the 1996 version of the Harmonized System. This aggregation causes some loss of detail, but allows for consistency over time periods because new HS code divisions were added in 2002 and 2007. If products were not specifically labeled and included only a simple description such as "tuna" or lacked important descriptions such as "whole" or "filleted", then educated guesses were made based on previous seafood exporting trends from that exporter to the EU. For example, if countries traded primarily filleted tuna and very little whole tuna for several years, the assumption was made that the product was filleted tuna. Simply excluding those observations would introduce bias into the sample because those trade flows would appear to be unaffected by import notifications. Further, assuming the notification covered all products at the 4-digit level would have inflated the importance of a notification, again potentially biasing the results. We manually edited 426 of the 4,151 notifications.

We present the five products and countries with the most notifications figures 2 and 3. Notifications were summed over products and exporting countries over all eleven years and then percentages were calculated for the five most flagged products and notifications. We use the same top five products and exporters to calculate their respective percentages of quantity imported into the EU. Looking specifically at the top five products that received notifications, we have, in order from greatest to smallest: frozen shrimp (HS-030613), frozen fillets (HS-030420), fresh fillets (HS-030410), "other" frozen fish (HS-030379), and non-frozen shrimp (HS-030623). While frozen shrimp account for over 20 percent of all notifications, frozen shrimp only account for approximately 7 percent of imports into the EU. Comparing across products, frozen fillets account for a much larger share of quantity imported than frozen shrimp, yet earn fewer notifications. Thus, notifications are not merely a function of import quantity.

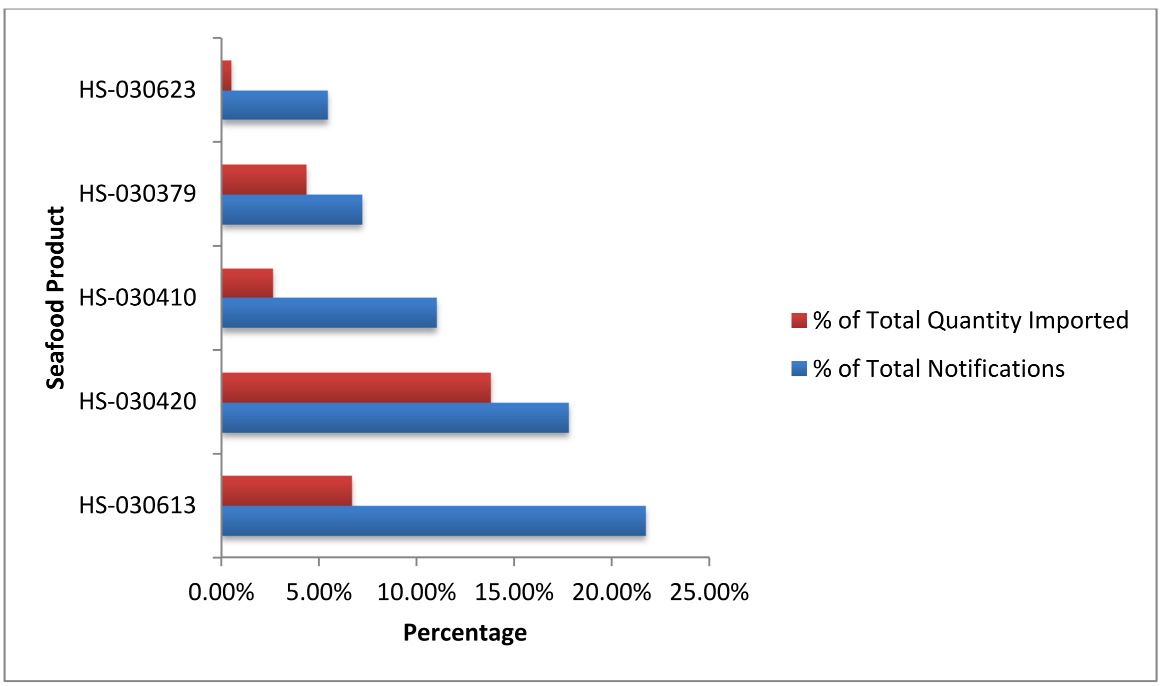

Figure 2. Five Most Notified Products

Moving to the five countries with the most import notifications, in percentage terms, we have, in order from highest to lowest percentage: Vietnam, Indonesia, China, India, and Thailand. Notifications do not seem to be merely a function of quantity imported. Notifications on products exported from Vietnam account for just over 11 percent of total notifications while quantity imported into the EU from Vietnam only accounts for approximately 1 percent of total quantity. Thailand, who accounts for less that 8 percent of notifications, exports more to the EU than Vietnam at over 2 percent.

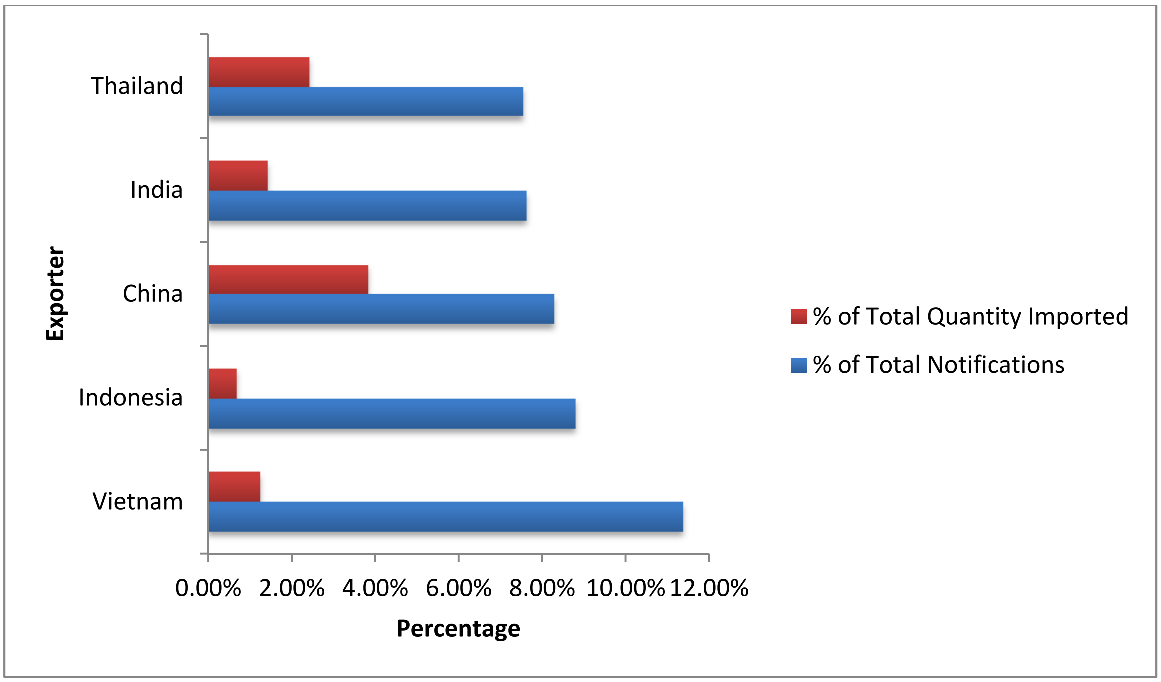

Figure 3. Five Most Notified Exporters

We observe a total of 5,089 notifications, with stated hazards ranging from administrative issues (low hazard) to deadly diseases such as salmonella (high hazard). The disposition of these products also varies greatly, with about 40 percent being denied entry into the EU, and another 18 percent being destroyed. Table 2 divides the notifications by degree of hazard based on the stated subject of the notification and by disposition, based on the action taken. The dependent variable for this analysis is $EUnotification_{ijht}$ which is the count of all notifications, regardless of action taken, summed over country pair from exporter (j) to importer (i), seafood product at the six-digit HS level (h), and year enacted (t). The notifications are counted in this manner to allow for proper merging with other large portions of the data, namely trade flows and tariff rates which are specific to country pairs, individual products, and year.

Table 2. Notification Summary Statistics

EU notification category	Number of notifications	Percent of notifications
Hazard		
low	469	9.2%
low-mid	312	6.1%
mid	362	7.1%
mid-high	1,762	34.6%
high	2,181	42.9%
Disposition		
information	378	7.4%
redispatched	2,020	39.7%
detained	922	18.1%
destroyed or no entry	1,769	34.8%
Total	5,089	

Note: Low hazards are defined as those notifications where the concern is largely an administrative issue, including "substances" of concern listed as unauthorized establishment, labeling, packaging problems, past sell date, fraud, etc. Low-mid hazards include hazard categories that include unauthorized additives, pesticide residues, allergens and undetermined. Mid hazards include those whose appearance suggests product deterioration, such as where substances include histamine. Mid-high hazards include microbial and parasitic contamination and harmful veterinary drug residues. High hazards include those products where salmonella, E. coli and toxins such as shellfish poisoning are suspected.

Trade Data

Trade import data in current US dollars and quantities were downloaded from the United Nations Commodity Trade Statistics Database (UN COMTRADE) (UN COMTRADE 2010). Data were downloaded at the six-digit HS level for all seafood trade during the period 1998-2008 for all country pairs. Because the notification data from RASFF include only the EU, the trade data were later restricted to include only importing countries that are either a part of the EU or become a member state during this time period, starting with the EU-15 in 1998 and expanding to the EU-27 by 2008. Exporting countries are all trading partners in the world.

Tariff Rates

Tariff rates were obtained from the WTO Tariff Analysis Online (TAO) (WTO 2010). The data include minimum, average, and maximum rates for applied tariffs and bound tariffs, as well as products, countries, and groups of countries that are included at specific tariff rates by year. Table 3 includes original and interpolated summary statistics for both the average and maximum rates. The means and standard deviations for both the interpolated average and maximum rates are slightly higher than the original rates.

Table 3. Tariff Rate Summary Statistics

Variable	Observations	Mean	Standard Deviation
Applied Rate	255,738	5.972	6.934
Imputed App. Rate	281,940	6.372	5.852
Maximum Rate	255,738	7.534	8.692
Imputed Max. Rate	281,940	8.033	7.162

Other variables and their data sources are discussed in detail in Appendix A.

Results

The results of the first stage regressions for both average and maximum tariff rates are presented in table 4, where column (1) contains results using average tariff rates by year, country pair and six-digit HS code, and column (2) contains results for maximum rates with overall R-squared values of 0.62 for each. The signs on the instrumental variables are consistent with expectations. Both indicators of trade agreements, RTA_{ijt} and FTA_{ijt}, are negatively correlated with tariff rates and are jointly significant at the 0.001 percent level. Products from high-income countries tend to have a lower tariff rate compared to low-income countries (included in the constant).

Prepared and high-value products face higher tariff rates than unprocessed and low-value products. And as one might expect, a higher instrumented quantity of imports is associated with a lower tariff. We use the predicted values of the dependent variables from the first stage, $\hat{T}avg_{ijht}$ for average rates and in $\hat{T}max_{ijht}$ for maximum rates, in the negative binomial regressions on the count of notifications.

Table 4. First Stage Regression Results

Variables	(1) Average Tariff Rate	(2) Maximum Tariff Rate
Regional Trade Agreement	-5.766***	-6.960***
	(0.0471)	(0.0579)
Free Trade Agreement	-3.156***	-3.918***
	(0.0436)	(0.0536)
Least Developed Country	0.181**	0.616***
	(0.0876)	(0.106)
Lower-Middle Income Exporter	0.328***	0.418***
	(0.0498)	(0.0611)
Upper-Middle Income Exporter	-0.562***	-0.908***
	(0.0540)	(0.0662)
High Income Exporter	-0.784***	-1.174***
	(0.0536)	(0.0655)
Processed	4.369***	3.441***
	(0.0861)	(0.104)
HS 0301	-1.299***	-1.989***
	(0.213)	(0.256)
HS 0304	-1.193***	-0.231*
	(0.100)	(0.121)

HS 0305	0.633***	-0.417***
	(0.0921)	(0.111)
HS 0306	0.311***	-0.665***
	(0.0875)	(0.105)
HS 0307	-1.580***	-2.935***
	(0.0903)	(0.109)
HS 0303	-0.919***	-1.146***
	(0.0856)	(0.103)
ln(Distance)	0.701***	0.938***
	(0.0187)	(0.0226)
Instrumented ln(Import Quantity)	-0.0107**	-0.00917
	(0.00491)	(0.00598)
Domestic Fish Production	1.23e-06	5.66e-06***
	(1.00e-06)	(1.22e-06)
Constant	8.659***	12.10***
	(0.246)	(0.298)
Year fixed effects	Yes	Yes
Importing country fixed effects	Yes	Yes
Observations	378,532	378,532
Number of panel	36,499	36,499

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

Table 5 presents the results of negative binomial regressions on the count of notifications on the change in predicted average tariff rates. Column (1) contains results for the base model plus importer country fixed effects, column (2) contains results for the base model plus exporter region fixed effects and column (3) contains results for the base model plus importer country and exporter region fixed effects. In general, a coefficient β from the negative binomial model can be interpreted as follows: a one unit change in an explanatory variable is associated with a β change in the difference in logs of the dependent variable. Each of the three regressions shows that a drop in the average tariff rate, which may cause an increase in the demand for protection, increases the probability of the occurrence of a notification. Specifically looking at column (1), a one unit decrease in the change of applied tariff rates increases the difference in logs of the probability of receiving a notification by 0.108, while including exporting region fixed effects increases that number to 0.171. This negative relation between change in tariff rates and notifications is expected and provides evidence in support of the argument that as tariff rates decline, they are being replaced with NTBs.[7]

Other variables representing protection are also positively correlated with the probability of a notification. As the relative price of a product from a specific exporter decreases relative to the price of the same product from other exporters, the probability of receiving a notification increases. This negative relation represents the increased competition that occurs when an exporter is selling a relatively low-priced good. The need for domestic protection increases and the probability of a notification increases as a result. Second, as the market share of a single country exporter increases, so does the probability of a notification. As domestic fish production increases, the probability of a notification also increases.

Notifications are also associated with risk. As products and exporters become riskier, the probability of a notification increases. The greater the volume of exports, the greater the probability of a notification, as one would expect. Products that are more perishable carry a higher risk resulting in a higher probability of a notification. Both frozen and fresh products have a positive relation with notifications compared to processed products, with the fresh goods having the highest probability of a notification. As distance increases, risk likely also increases and we do see this relation when we do not control for exporter fixed effects.

[7] We also run the same specifications using the maximum tariff, and the estimated coefficients on the change in tariffs while slightly smaller, show a similar effect as to those on the applied tariffs, with the coefficient in the full fixed effects model being 0.125 and significantly different from zero at the one percent level. The full results of the regression using maximum tariffs are presented in Appendix B table B1.

Variables accounting for previous exporter experience show that as previous experience decreases, or if an exporter has a reputation of poor previous experience, these countries face an increased risk of an import notification. The variable accounting for new exporters is only significant in the regional effects model, but is always positive showing that exporters who have not exported that product to the EU are considered riskier. We also see that if an exporting country has a US alert on record, then the EU is more likely to see that country as high-risk and the probability of a notification increases. Furthermore, if an exporter has little experience exporting to the EU the probability of receiving a notification also increases.

In the above regressions, the fixed effects are themselves of interest, indicating which importers and exporters are particularly likely to file, or to find themselves subject to, notifications, all else equal. We present a ranking of importing countries and exporting regions in table 6. In the case of import fixed effects the smaller importers of Malta, Cyprus, and Romania are included in the constant. We find that Estonia, Lithuania, Greece, and Italy, followed closely by Poland and Spain have some of the highest proclivities to use notifications, holding characteristics such as income and fish production constant. Poland, Lithuania and Estonia are on the Baltic Sea while Greece, Italy and Spain are on the Mediterranean. Because all six of these countries are on the water and have greater access to seafood production, they conceivably demand more domestic protection. Surprisingly, Slovenia has a very high probability of issuing a notification. The results on the importer countries fixed effects signal that there are importer country characteristics not accounted for in the protectionist variables.

In terms of exporting regions, we observe that South Asia and South East Asia are subject to the highest number of notifications, holding export quantity, income and other characteristics constant. Other European countries are less likely to face a notification. South America and Antarctica are included in the constant.

Overall, our results show that not only high-risk exporters and products have a higher probability of receiving a notification, but importing countries that have a high demand for protection also have a higher probability of issuing a notification. Specifically, we find evidence that as the change in tariff rates declines, these traditional barriers to trade are being replaced with NTBs in the form of import notifications. After separating risk from protectionist motives we also find evidence that import notifications can be used as purposeful NTBs without legitimate reasons for use.

Table 5. Negative Binomial Regression Results with Applied Tariff Rates

Variables	(1) Importer FE	(2) Export Region FE	(3) Importer FE & Export Region FE
$\Delta\hat{T}avg_{ijht}$	-0.108***	-0.120***	-0.171***
	(0.0356)	(0.0391)	(0.0393)
$MedianPrice_{t-1}$	-0.00623	-0.0192**	-0.0105
	(0.00999)	(0.00965)	(0.00994)
$Relprice_{jht}$	-0.0822*	-0.0991**	-0.0910**
	(0.0425)	(0.0441)	(0.0430)
$Mktshare_{jht}$	0.0351***	0.0302**	0.0259**
	(0.0123)	(0.0127)	(0.0127)
$Fishprod_{iht}$	0.00500***	0.00372***	0.00459***
	(0.00154)	(0.00132)	(0.00153)
$ln\hat{Q}_{ijht-1}$	0.260***	0.281***	0.266***
	(0.00987)	(0.00987)	(0.00990)
$Fresh_h$	1.288***	1.312***	1.405***
	(0.0968)	(0.0958)	(0.0978)
$Frozen_h$	0.513***	0.604***	0.611***
	(0.0765)	(0.0757)	(0.0762)
$ln(Distance_{ij})$	0.850***	-0.0776	-0.0483
	(0.0431)	(0.108)	(0.0662)

$NoExp_{jht}$	-0.0664	-0.0121	-0.0180
	(0.166)	(0.164)	(0.166)
$NewExp_{jht}$	0.374**	0.446**	0.418**
	(0.185)	(0.184)	(0.185)
$USalerts_{jht}$	0.00534***	0.00344***	0.00375***
	(0.000721)	(0.000728)	(0.000728)
$Experience_j$	-0.0127	-0.0180	0.00438
	(0.0110)	(0.0124)	(0.0120)
$ln(GDPpc_j)$	-0.432***	-0.241***	-0.284***
	(0.0225)	(0.0295)	(0.0240)
$ln(GDPpc_i)$	1.189***	0.0783	1.166***
	(0.323)	(0.0659)	(0.324)
Constant	-20.55***	-3.986***	-14.00***
	(2.787)	(1.191)	(2.818)
Year FE	Yes	Yes	Yes
Importer FE	Yes	No	Yes
Export Region FE	No	Yes	Yes
Observations	281,940	281,940	281,940
Number of panel	36,218	36,218	36,218
	Base Region = Malta, Cyprus and Romania	Base Region = S. America + Antartica	

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

Table 6: Ranking of Importer Country and Export Regions Fixed Effects

	Importer Countries	Export Regions
High	Estonia, Lithuania, Slovenia, Romania, Italy, Bulgaria, Greece, Poland	Southeast Asia, South Asia, North Africa, S. America
Medium	Spain, Slovakia, Portugal, Germany, UK, Latvia, Sweden, Hungary	South Pacific, Central America & the Caribbean, North America,
Low	Denmark, the Netherlands France, Czech Rep., Belgium-Luxembourg, Finland, Austria, Ireland,	Middle East, Sub-Saharan Africa, Europe

Note: countries and regions are listed in order of highest to lowest within each category

To compare the magnitude of key risk and protection variables, we present the estimated changes in count of notifications due to changes in select explanatory variables in table 7, calculated as the coefficient times the mean of the variable: $\hat{\beta}\mu_{ijht}$. Using the results in column 3, with importer and exporter fixed effects, we see that a ten percent reduction in a tariff ($\Delta\,\hat{T}avg$) increases the expected frequency of a notification occurring by 0.42 percent. Similarly, if $Fishprod_{iht}$ increases by 10 percent then the expected frequency of a notification increases by 0.59 percent. While these effects seem small, if they are compared to significant indicators of risk, specifically a US alert, then the effects of protectionist motives are relatively large. Further, given that the overall probability of a notification is only 0.014, these magnitudes are substantial.

Table 7. Estimated Change in Count of Notifications for Select Variables

	(1)	(2)	(3)
Variables	Importer FE	Export Region FE	Importer FE & Export Region FE
$\Delta\hat{T}avg_{ijht}$	-0.027*** (0.009)	-0.030*** (0.010)	-0.042*** (0.010)
$Fishprod_{iht}$	0.064*** (0.020)	0.048*** (0.017)	0.059*** (0.020)
$Mktshare_{jht}$	0.009*** (0.003)	0.008** (0.003)	0.007** (0.003)
$USalert_{jht}$	0.020*** (0.003)	0.013*** (0.003)	0.014*** (0.003)

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

Robustness Tests

Because we cannot explicitly measure demand for protection, one might be concerned that our measures of demand for protection may be capturing other effects. We explore this possibility with several robustness tests. First, we separate out those notifications on pathogens and heavy metals such as salmonella, E. coli, listeria or mercury contamination. We then compare whether a change in tariffs has a differential effect on notifications of these more severe contaminants versus the milder safety concerns. If notifications are not driven by demand for protectionism, we should not observe differences for the more versus less severe safety concerns.

We find that an instrumented change in tariff has a much larger effect on the less severe hazard categories (results are reported in table 8). That said, one might be concerned that less severe hazards are more likely to be allowed entry into the EU. We test this by restricting our sample to those products that were denied entry into the EU, and again comparing severe versus less severe hazards, and find the same pattern. Thus, we find that a decrease in tariffs caused by a trade agreement has a significantly larger effect on notifications of less severe hazards than severe hazards.

Table 8. Logit Regression on Low versus High Hazard Notifications

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Not med-high or high hazards	Not high hazards	Not med-high or high hazards and no entry	Not high hazards and no entry	Not med-high or high hazards and no entry	Not high hazard and no entry
$\Delta\hat{T}avg_{ijht}$	-0.250**	-0.601***	-0.269**	-0.266***	-0.273**	-0.457***
	(0.106)	(0.104)	(0.118)	(0.0925)	(0.131)	(0.127)
$MedianPrice_{t-1}$	0.0233	0.203***	-0.0486*	0.0600***	-0.0733**	0.162***

	(0.0206)	(0.0203)	(0.0263)	(0.0184)	(0.0286)	(0.0258)
$Relprice_{jht}$	0.201**	-0.126	0.375***	0.143	0.469***	0.336**
	(0.0952)	(0.0786)	(0.124)	(0.0902)	(0.143)	(0.138)
$Mktshare_{jht}$	-0.0272	-0.0185	-0.0116	-0.0155	-0.00273	-0.0323
	(0.0191)	(0.0173)	(0.0227)	(0.0158)	(0.0242)	(0.0225)
$Fishprod_{iht}$	-0.000344	-0.00183	0.00198	-0.00137	-0.00175	0.0188***
	(0.00255)	(0.00235)	(0.00296)	(0.00210)	(0.00263)	(0.00279)
$ln\hat{Q}_{ijht-1}$	-0.0822***	-0.0303**	-0.0837***	-0.0219*	-0.0871***	0.00768
	(0.0133)	(0.0122)	(0.0164)	(0.0124)	(0.0180)	(0.0164)
$Fresh_{h}$	-1.295***	-0.896***	-1.113***	-0.530***	-1.095***	-0.705***
	(0.160)	(0.147)	(0.199)	(0.144)	(0.219)	(0.200)
$Frozen_{h}$	-0.652***	-0.156	-0.780***	-0.244**	-0.883***	-0.253*
	(0.121)	(0.113)	(0.150)	(0.114)	(0.168)	(0.153)
$ln(Distance_{ij})$	-0.611***	-0.511***	-0.805***	-0.476***	-0.459***	-0.319***
	(0.0907)	(0.0837)	(0.111)	(0.0833)	(0.0912)	(0.0892)
$USalerts_{jht}$	0.00545***	0.00723***	0.00332**	0.00497***	0.00564***	0.00877***
	(0.00115)	(0.00118)	(0.00147)	(0.00105)	(0.00156)	(0.00173)
$Experience_{j}$	0.0262	0.173***	0.0608*	0.0653***	0.0549	0.186***
	(0.0254)	(0.0231)	(0.0317)	(0.0213)	(0.0336)	(0.0304)
$ln(GDPpc_{j})$	-0.0482	-0.231***	-0.185***	-0.150***	-0.0236	-0.202***
	(0.0411)	(0.0350)	(0.0562)	(0.0364)	(0.0536)	(0.0455)
$ln(GDPpc_{i})$	1.647**	-0.590	2.019	-0.299	0.112	0.640***
	(0.788)	(0.597)	(1.237)	(0.514)	(0.181)	(0.181)
Constant	-10.45	11.47*	-7.906	7.767*	4.346**	-2.542
	(8.222)	(6.278)	(10.87)	(4.719)	(2.022)	(1.975)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	No	No
Export Region FE	Yes	Yes	Yes	Yes	No	No
Observations	3,833	3,833	3,833	3,833	1,952	1,952

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

Second, we consider the subset of importing countries that are large producers of seafood, measured as averaging over 80,000 tonnes per year, to see whether these countries are more sensitive to a reduction in tariff that smaller fish producing EU members. We also interact the tariff variable with whether the country produces that specific 4-digit category of fish. Last, we interact the tariff variable with a change in domestic fish production, on the theory that those countries that face a drop in domestic production will be the most sensitive to increased threat from imports. While the first two interaction terms are not significantly different from zero, we do observe evidence that countries with higher production of fish are more likely to increase their use of NTBs in response to a drop in tariff than countries as a whole. Further, our results are consistent with the theory that countries may be more sensitive to drops in tariffs on those products that directly compete with domestic production. We observe that those producers seeing a decrease in domestic production are significantly more sensitive to drops in tariffs in those specific products. Thus, we feel that these robustness tests provide some evidence to support our supposition that protectionism help drive notifications. We present the coefficient estimates of the change in tariff and the interaction terms in table 9. The complete set of results is presented in Appendix B table B2.

Table 9. Results for Large Fish Producing Importers

Variables	(1) Positive fish production	(2) Large fish producers > 80,000 MT	(3) Change in domestic fish production
Change in tariff	-0.111	-0.082	-0.168***
	(0.130)	(0.117)	(0.041)
*Change in tariff * positive fish production*	-0.048		
	(0.136)		
*Change in tariff * large fish producers*		-0.092	
		(0.123)	
*Change in tariff * change in fish production*			0.022*
			(0.012)
Full Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes
Export Region FE	Yes	Yes	Yes
Observations	281,940	281,940	281,940

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

We also undertake a number of robustness tests to check potential econometric concerns with our regression. One might worry that our results are being driven by new EU members, which may have different importing standards and which further leave us with an unbalanced panel. To address this concern, we run the original regressions with only the original 15 members of the EU, and find very similar results, that the effect of substituting NTBs for tariffs is largely driven by the original EU members. Results are found in Appendix B table B3.

Second, one may be concerned about the count nature of our dependent variable. The move from 0 to 1 notification may have a differential effect from the move from 4 to 5 notifications. Further, one might be concerned that our measure of notifications double-counts notifications if several countries notify against the same concern with the same import product. Inspecting our data, we see that often countries have multiple notifications against the same product from the same country for the same problem. Since each notification is registered on different dates, and for different shipments, we believe that each notification does represent the potential severity of the NTB. To see if our results are driven by the number of notifications or simply the presence of a notification we run the regression on the dichotomous variable that identifies the presence of a notification against a certain product from a certain country in a certain year. We also regress the number of notifications, given that there is one in place. We see that the effect of the first notification is substantial, while additional notifications are also driven by a drop in tariffs, the effect is not significantly different from zero.

Due to concerns about including excess amounts of zeros, we estimate the model where trade flows that are zero in year *t* are not included. The results show that the large amount of zeros does not drive the results. The magnitude of the coefficient for change in tariff rate becomes slightly stronger and the lag of median price becomes positive but not significant.

More details and the estimation results of these robustness tests are reported in Appendix B table B4.

Effect of notifications

As countries negotiate for lower tariffs, it is important to know how much those tariffs decrease trade and how much they result in higher rates of refusals, which in turn decrease trade. Thus, it is important to know the differential effects of these two trade instruments, that is, how much is trade decreased by a refusal versus a tariff? To answer this question, we use a standard gravity model to regress traded value by country, by 6-digit hs code and by year against changes in tariffs, refusals. Since tariffs, refusals and lagged trade value are all potentially endogenous, we instrument for each of them, using the same trade agreement instruments for tariff reductions as above, and for refusals we use the number of refusals for the same product in the same year from other countries in the same region as the exporter (as in Baylis, Nogueira and Pace 2011). We follow Holtz-Eakin et al (1988) and Arellano and Bond (1991) and use second-order lags to instrument for lagged value. Results of this regression are shown in table 10.

We use two estimation strategies to address zero trade flows. We first consider only positive trade flows (columns 1 and 2 of table 10), which we feel may be justified since one needs a positive trade flow for a refusal to occur. One might be concerned that ignoring zero trade flows may bias our results, so we also use a heckman selection model, where the probability of observing positive trade is a function of all exogenous second stage variables and and a dummy variable for non-zero trade flows in the previous period (columns 3 and 4).

Table 10: Gravity Model of Trade Value

Variable	(1) ln(positive trade values)	(2) ln(positive trade values)	(3) Heckman	(4) Heckman
Import notifications	-0.561***	-0.549***	-0.725***	-0.720***
	(0.107)	(0.106)	(0.105)	(0.106)

change in tariff rate	-0.233***	-0.225***	-0.189***	-0.184***
	(0.0268)	(0.0264)	(0.0269)	(0.0267)
Lagged ln Value	0.256***	0.247***	0.765***	0.722***
	(0.00630)	(0.00634)	(0.0149)	(0.0149)
Lagged Total Exports$_j$	9.16e-11***	9.40e-11***	1.95e-10***	2.11e-10***
	(0)	(0)	(0)	(0)
ln (GDP$_i$ x GDP$_j$)	0.00308	0.00443	-0.0132	-0.00613
	(0.0194)	(0.0191)	(0.0196)	(0.0195)
Exchange Rate	0.00291**	0.00265**	0.00149	0.00113
	(0.00116)	(0.00115)	(0.000975)	(0.000977)
Common Language	0.210	0.242*	0.342***	0.448***
	(0.142)	(0.142)	(0.0926)	(0.0937)
ln Distance	-0.260*	-0.310**	-0.791***	-0.937***
	(0.157)	(0.157)	(0.110)	(0.112)
Border	0.0884	0.104	1.139***	1.333***
	(0.299)	(0.299)	(0.202)	(0.205)
Mills ratio			5.825***	5.958***
			(0.143)	(0.155)
Importer and Exporter FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
HS4-digit FE	No	Yes	No	Yes
Observations	18,722	18,722	51,525	51,525

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

As can be seen in table 10, the log of trade value decreases with both an increase in tariffs and an increase in refusals in all four specifications. A quick calculation from the results in column 4 shows that the trade-decreasing effect of a refusal is the same as a trade-decreasing effect of a tariff increase of 3.9 percent. This effect is substantial, given that tariffs on EU seafood imports average only 6 percent over our time period, and decrease an average of 0.25 percent per year. Using results from the regression on refusals, we see that reducing tariffs 10 percent increases the probability of a notification of 0.42 percent. Therefore, the trade value regression would imply that a trade agreement with an exporting country that reduced tariffs from a level of 7 percent to 2 percent would more than double bilateral seafood trade (from $115 thousand to $288 thousand for each HS6 category to each EU member country), while this same reduction in tariffs would increase in notifications by 0.21, reducing the net gain in trade by nearly a quarter ($41 thousand per six-digit HS category per country). Thus, notifications may be substantially reducing the potential trade benefits of tariff reductions.

Discussion and Conclusion

Recent empirical research has found that standards and the resulting food import rejections or notifications act as trade barriers especially in the short run and for small, developing countries (Otsuki, Wilson and Sewadeh 2001; Anders and Caswell 2003; Nguyen and Wilson 2009; Grant and Anders 2011; and Baylis, Nogueira and Pace 2011). What previous research fails to address is the reason behind these rejections and notifications. This article contributes to the literature by empirically examining the relation between tariff rates and NTBs in seafood trade, specifically by separating EU demand for protection from the inherent food safety risk of products and exporters.

The two main objectives for this article are to determine if there is a negative correlation between notifications as NTBs and the reduction in tariff rates, and if there are signs of protectionism in the use of NTBs. We find evidence to support both of these claims. The EU, one of the world's largest seafood importers, tracks import notifications through the RASFF system. Using a count of these notifications by importer, exporter, product code, and year, we find that as trade agreements mandate decreases in tariff rates, the probability of a notification increases. We also find that importing countries in the EU who demand high levels of protection also have a higher probability of issuing a notification.

We include explanatory variables related to risk and protectionist characteristics to separate the effects that risk and demand for protection have on notifications. Importer country and export region fixed effects are included to control for characteristics not explicitly included in the other explanatory variables. We find that high-risk exporters, determined by income and trade experience, have a higher probability of receiving a notification than low-risk exporters. Similar results are found for high-risk products, determined primarily by perishability. Thus, we see evidence that EU import notifications are effective in terms of risk.

However, more than risk appears to be at play. Analysis of protectionist variables shows that high-income importers who produce large amounts of seafood domestically have a higher probability of issuing a notification. We find that Estonia, Italy, Greece and Lithuania are significantly more likely to implement a notification than other EU member states, which makes sense because they are all countries with access to water. Analysis also shows that when importers are threatened by relatively low-priced goods, they are more likely to issue a notification. These results suggest that the demand for protection plays an important role in the probability of implementing a notification.

We further test our hypothesis by comparing those notifications of specific high-risk diseases, such as salmonella, E. coli and shellfish poisoning against lower-risk claims, on the assumption that lower-risk notifications may be more subject to protectionism. We find that lower-risk notifications are associated more closely with mandated decreases in tariffs, even when controlling for differences is disposition of the products. Second, we consider those countries with higher levels of food production, and find that those countries and products that see a drop in domestic production are more likely to let a decrease in tariffs trigger a notification.

Overall, we find that EU importing countries that have a high demand for protection are more likely to interfere with imports through import notifications. While it is true that SPS standards must have valid and testable backing in science, the results of this article show that NTBs may still be used intentionally to keep competition low in the EU. Further, we demonstrate that the effect of these NTBs is not small. Specifically, we find that the increased probability of a notification may decrease trade benefits from tariff reductions by nearly one quarter.

While we would argue our results are evocative, there are a number of limitations to our research. One of the main concerns is our six-digit HS level coding of the notifications based on product descriptions. Many product descriptions in the RASFF data were vague, which resulted in guessing product codes based on previous trade trends to avoid dropping to the two- or four-digit level. Also, because we handwrote code in Stata to assign product codes at the six-digit level to thousands of notifications, there are likely mistakes in HS coding due to human error.

Another limitation is the number of missing tariff rates in the initial data. Rates in the WTO TAO are self reported by implementing countries, and there were many countries missing multiple year or product rates. We used linear interpolation to fill in some of the missing tariff rates which could lead to error.

Finally, it is clear after examination of the fixed effects models that there are likely country characteristics that affect notifications that we do not explicitly capture in the model. This model is simplified and it is likely that risk and protectionism are not the only motives for use of NTBs. Also, this article does not address what or who is directly driving protectionism in the EU. Baylis, Martens and Nogueira (2009) find that specific political motives increase the probability of NTBs in the US. This may be the case in the EU, but political actions were not explicitly measured due to lack of data available.

WTO requirements are set in place to ensure SPS standards are only used for scientifically-backed health and safety protection but do not appear to be working as intended. The results for this article show that the implementation of standards may be used directly for protectionist purposes. Policy makers should take the flexibility in standard implementation into consideration when designing trade rules. As they stand, rules for implementation of SPS standards are not strong enough to prevent intentional use of NTBs.

In the case of the EU, allowing individual member states to interpret and implement standards is a problem. All EU members must meet minimum EC standards, but it appears that countries with higher protectionist motives are using a more strict interpretation and implementation of EC standards to block imports. Given we observe this effect for different countries within the EU even given the standardized import rules, it raises the concern that countries outside the EU with even more latitude in setting standards might be even more likely to use this flexibility to use standards as trade barriers.

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Appendix A: Data

Protectionist Variables

Import market share, $MktShare_{jht}$, is calculated from UN COMTRADE values as the share of importers per exporter per product per year (UN COMTRADE 2010). Importer production, $Fishprod_{iht}$, was downloaded from the FAO (FAO 2010) and is the importer domestic production by six-digit product code and year. Importer income, $GDPpc_i$, is GDP per capita and was obtained from the Penn World Table (UPenn 2010).

All price calculations are performed on UN COMTRADE data. Price is calculated as trade value by country pair, product, and year divided by the quantity of the same observation. $RelPrice_{jht}$ is calculated by obtaining the mean of the price by exporter and dividing it by the median of price. This calculation gives the relative price by exporter in relation to all other exporters of the same product in the same year. The median price, $MedianPrice_{ht-1}$, is calculated as the median of price by product and then lagged.

Risk Variables

US import alert data were obtained from the FDA website and the product descriptions were used to code the data at the HS4 level (FDA 2010). Since these data do not include alerts that have since been withdrawn, we use the numbering of the alerts to impute missing alerts by country and hscode. These US data were matched with the EU notification data by country pair, product code, and year. Alerts are counts of products and exporters which the US government has deemed to be of concern and are further required to undergo increased scrutiny, including mandatory inspections or testing.

Dummy variables for non-exporters, $NoExp_{ijht}$, and new exporters, $NewExp_{ijht}$, are created by summing import values by product over the value by years. If an exporter changes from a value of 0 to a non-zero value in the next year, they are considered new exporters and the dummy is equal to 1. If an exporter always has a trade value of 0 for an individual product, then the dummy for non-exporter is equal to 1. The main variable for exporter experience, $Experience_{jt}$, is the sum of the trade value, in current US dollars, of all imports into the EU by exporting country. Exporter income $GDPpc_j$ is GDP per capita and is sourced from the World Development Indicators (World Bank 2010).

The quantity variable, lnQ_{ijht-1}, is the lagged natural log of the quantity plus 1 in kilograms traded between countries j and i. Using the lagged value allows prediction of future quantities while using the natural log to create a stationary variable. This allows us to control for the possible relation between increased quantities of seafood products traded over time and increased numbers of notifications. We add 1 to the trade quantity prior to taking the log to keep zero trade flows in the dataset.

Products based on the UN COMTRADE HS codes were divided into $Fresh_h$, $Frozen_h$, and $Processed_h$. Each variable is a dummy variable (0 if no, 1 if yes) and created at the two- four- and six-digit HS code levels, depending on types of products included. $Fresh_h$ includes all fresh and live seafood products in all of HS-0301 and HS-0302, HS-030621 through HS-030624, HS-030629, HS-030721, HS-030731, HS-030741, HS-030751, HS-030791, as well as fillets in HS-030410. $Frozen_h$ includes all frozen seafood products in all of HS-0303, HS-030611 through HS-030614, HS-030619, HS-030710, as well as frozen fillets in HS-030420. $Processed_h$ includes all prepared seafood products in the HS-16 chapter as well as all products in the HS-0305 category.

The measure of distance, $Distance_{ij}$, is in kilometers from capital to capital of importing and exporting countries. If countries changed during time period (particularly in Eastern Europe), the distance to the closest current country capital was used. Information to compute distance comes from Haveman and Robertson International Trade Data at Macalester University supplemented by information from the CIA world factbook and timeanddate.com.

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Appendix B: Other Robustness Tests

Table D1 presents the results of the primary specification presented in table 5, but using maximum instead of applied tariff rates. As can be seen, a decrease in the (instrumented) maximum tariffs significantly increases the probability of an additional notification, but the coefficients are slightly smaller than those for the applied tariffs. We feel this result makes sense since protectionism is likely to be best observed in the form of applied tariffs as opposed to maximum tariffs rate.

Table B1. Results of Negative Binomial Regression of EU Import Notifications on Change in Maximum Tariff Rates

Variables	(1) Importer FE	(2) Export Region FE	(3) Importer FE & Export Region FE
$\Delta\hat{T}max_{ijht}$	-0.0875***	-0.0938***	-0.125***
	(0.0286)	(0.0315)	(0.0329)
MedianPrice$_{t-1}$	-0.00619	-0.0192**	-0.0127
	(0.00999)	(0.00965)	(0.0101)
Relprice$_{jht}$	-0.0822*	-0.0991**	-0.105**
	(0.0425)	(0.0441)	(0.0448)
Mktshare$_{jht}$	0.0352***	0.0303**	0.0228*
	(0.0123)	(0.0127)	(0.0133)
Fishprod$_{iht}$	0.00502***	0.00373***	0.00444***
	(0.00154)	(0.00132)	(0.00155)
$ln\hat{Q}_{ijht-1}$	0.260***	0.281***	0.264***
	(0.00987)	(0.00988)	(0.00991)
Fresh$_h$	1.287***	1.312***	1.322***
	(0.0969)	(0.0958)	(0.0985)
Frozen$_h$	0.513***	0.604***	0.533***
	(0.0765)	(0.0757)	(0.0766)
ln(Distance$_{ij}$*)*	0.850***	-0.0777	0.294***
	(0.0431)	(0.107)	(0.0585)
NoExp$_{jht}$	-0.0666	-0.0122	-0.00319
	(0.166)	(0.164)	(0.166)
NewExp$_{jht}$	0.376**	0.449**	0.412**

	(0.185)	(0.184)	(0.185)
$USalerts_{jht}$	0.00535***	0.00344***	0.00502***
	(0.000721)	(0.000728)	(0.000709)
$Experience_j$	-0.0125	-0.0179	0.0153
	(0.0110)	(0.0124)	(0.0119)
$ln(GDPpc_j)$	-0.433***	-0.243***	-0.261***
	(0.0225)	(0.0295)	(0.0239)
$ln(GDPpc_i)$	1.188***	0.0772	1.178***
	(0.323)	(0.0659)	(0.324)
Constant	-20.53***	-3.960***	-16.70***
	(2.787)	(1.191)	(2.811)
Year FE	Yes	Yes	Yes
Importer FE	Yes	No	Yes
Export Region FE	No	Yes	Yes
Observations	281,940	281,940	281,940
Number of panel	36,218	36,218	36,218

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

Full results for the regressions where we interact the predicted change in tariffs with a dummy variable for larger fish producing importers are presented in table D2.

Table B2. Negative Binomial Regression on Change in Tariff interacted with Large Fish Producing Importers

Variables	(1) Positive fish production	(2) Large fish producers > 80,000 MT	(3) Change in domestic fish production
Change in tariff	-0.111	-0.0816	-0.168***
	(0.130)	(0.117)	(0.0405)
*Change in tariff * positive fish production*	-0.0479		
	(0.136)		
*Change in tariff * large fish producers*		-0.0922	
		(0.123)	
*Change in tariff * change in fish production*			0.0216*
			(0.0115)
dummy for $Fishprod_{iht}$	-0.0329		
	(0.154)		

Fishprod$_{iht}$	0.00441***	0.00443***	0.00399**
	(0.00159)	(0.00155)	(0.00159)
change in Fishprod			0.0101
			(0.00721)
MedianPrice$_{t-1}$	-0.0120	-0.0128	-0.0129
	(0.0101)	(0.0101)	(0.0101)
Relprice$_{jht}$	-0.0956**	-0.105**	-0.106**
	(0.0435)	(0.0448)	(0.0450)
Mktshare$_{jht}$	0.0215	0.0225*	0.0231*
	(0.0133)	(0.0133)	(0.0132)
$ln\hat{Q}_{ijht-1}$	0.264***	1.323***	0.264***
	(0.00991)	(0.0985)	(0.00991)
Fresh$_h$	1.315***	0.533***	1.322***
	(0.0997)	(0.0766)	(0.0985)
Frozen$_h$	0.527***	0.295***	0.532***
	(0.0768)	(0.0585)	(0.0766)
ln(Distance$_{ij}$*)*	0.225***	-0.00269	0.294***
	(0.0547)	(0.166)	(0.0585)
NoExp$_{jht}$	-0.000571	0.408**	-0.000787
	(0.166)	(0.185)	(0.166)
NewExp$_{jht}$	0.405**	0.00501***	0.407**
	(0.185)	(0.000709)	(0.185)
USalerts$_{jht}$	0.00529***	0.0151	0.00497***
	(0.000704)	(0.0118)	(0.000710)
Experience$_j$	0.0187	-0.260***	0.0146
	(0.0118)	(0.0238)	(0.0119)
ln(GDPpc$_j$*)*	-0.280***	1.179***	-0.259***
	(0.0235)	(0.324)	(0.0239)
ln(GDPpc$_i$*)*	1.171***	0.162	1.196***
	(0.324)	(0.159)	(0.325)
Constant	-15.93***	-16.62***	-16.86***
	(2.802)	(2.813)	(2.816)
Year FE	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes
Export Region FE	Yes	Yes	Yes
Observations	281,940	261,163	281,940
Number of panel	36,218	36,078	36,218

Standard errors in parentheses

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

Table A3 presents the full results on only the original EU-15 members. Thus, these results do not include those countries that joined the EU after 1997. As can be seen, the results are very similar, while the coefficient on the change in tariffs is, if anything, slightly larger than the original results presented in table 5.

Table B3. Negative Binomial Regression for Original EU Members Only

Variables	(1) Importer FE	(2) Export Region FE	(3) Importer FE & Export Region FE
$\Delta\hat{T}avg_{ijht}$	-0.162***	-0.193***	-0.220***
	(0.0382)	(0.0444)	(0.0434)
$MedianPrice_{t-1}$	-0.0129	-0.0210**	-0.0168
	(0.0105)	(0.0104)	(0.0104)
$Relprice_{jht}$	-0.0814*	-0.0961**	-0.0907**
	(0.0431)	(0.0447)	(0.0437)
$Mktshare_{jht}$	0.0323**	0.0252*	0.0234*
	(0.0128)	(0.0133)	(0.0133)
$Fishprod_{iht}$	0.00407***	0.00218	0.00360**
	(0.00158)	(0.00135)	(0.00156)
$ln\hat{Q}_{ijht-1}$	0.252***	0.267***	0.258***
	(0.0101)	(0.0101)	(0.0101)
$Fresh_h$	1.317***	1.377***	1.430***
	(0.0996)	(0.0987)	(0.100)
$Frozen_h$	0.493***	0.595***	0.585***
	(0.0791)	(0.0782)	(0.0787)
$ln(Distance_{ij})$	0.889***	0.0404	-0.0101
	(0.0455)	(0.115)	(0.0681)
$NoExp_{jht}$	-0.0896	-0.0726	-0.0358
	(0.167)	(0.166)	(0.167)
$NewExp_{jht}$	0.299	0.380**	0.347*
	(0.193)	(0.192)	(0.192)
$USalerts_{jht}$	0.00431***	0.00279***	0.00297***
	(0.000782)	(0.000792)	(0.000790)
$Experience_j$	-0.00432	-0.00751	0.0138
	(0.0114)	(0.0130)	(0.0126)
$ln(GDPpc_j)$	-0.454***	-0.258***	-0.304***
	(0.0233)	(0.0306)	(0.0250)
$ln(GDPpc_i)$	1.029***	-0.658***	1.006***
	(0.320)	(0.110)	(0.321)
Constant	-0.32	-0.11	-0.321

	-21.14***	2.552*	-14.60***
	(3.466)	(1.512)	(3.497)
Year FE	Yes	Yes	Yes
Importer FE	Yes	No	Yes
Export Region FE	No	Yes	Yes
Observations	237,350	237,350	237,350
Number of panel	25,750	25,750	25,750

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

Column 1 of Table B4 presents results from a probit on the probability of any notification of that imported product from a specific country during a specific year. Column 2 presents the results for the linear regression on the number of notifications given there is at least one notification in place. As can be seen, the results show that the effect of the decrease in tariff is stronger for the decision to have a notification, but has the same sign in the number of notifications regression. Importer fish production however does not appear to affect the number of notifications, only that there is one, and the price variables switch signs. Column 3 includes results for a robustness test on positive quantities imported. The magnitude of the coefficient for change in tariff rate becomes slightly larger and quantity has a slightly larger effect on import notifications than in table 5.

Table B4. Robustness Tests on Functional Form

	(1)	(2)	(3)
	EU notification dummy	EU notification, no zeros	EU notification, positive imports in current or past year
Variables	Probit regression	Negative Binomial Regression	Negative Binomial Regression
$\Delta \hat{T}avg_{ijht}$	-0.0760***	-0.0806*	-0.125***
	(0.0208)	(0.0452)	(0.0362)

MedianPrice$_{t-1}$	-0.00200	0.0232**	-0.00256
	(0.00319)	(0.00977)	(0.0108)
Relprice$_{jht}$	-0.0222*	0.0183	-0.0781*
	(0.0133)	(0.0373)	(0.0473)
Mktshare$_{jht}$	0.0120***	0.0187**	0.0352***
	(0.00420)	(0.00888)	(0.0122)
Fishprod$_{iht}$	0.00242***	-0.00115	0.00360**
	(0.000550)	(0.00121)	(0.00164)
$ln\hat{Q}_{ijht-1}$	3.97e-06	6.92e-06	1.03e-05
	(3.31e-06)	(5.90e-06)	(7.46e-06)
Fresh$_h$	0.117***	0.0209***	0.271***
	(0.00374)	(0.00749)	(0.0130)
Frozen$_h$	0.609***	0.196***	1.185***
	(0.0334)	(0.0759)	(0.105)
ln(Distance$_{ij}$*)*	0.312***	0.172***	0.514***
	(0.0257)	(0.0596)	(0.0789)
NoExp$_{jht}$	-0.0326	0.0427	0.824***
	(0.0233)	(0.0507)	(0.0448)
NewExp$_{jht}$	0.0779	-0.0958	0.449**
	(0.0572)	(0.152)	(0.200)
USalerts$_{jht}$	0.218***	-0.0415	0.00516***
	(0.0672)	(0.171)	(0.000747)
Experience$_j$	0.00332***	0.000354	-0.0221*
	(0.000348)	(0.000564)	(0.0117)
ln(GDPpc$_j$*)*	0.00298	0.00184	-0.456***
	(0.00440)	(0.0115)	(0.0238)
ln(GDPpc$_i$*)*	-0.124***	-0.0204	1.071***
	(0.00853)	(0.0192)	(0.346)
Constant	0.463***	-0.0380	0.0720
	(0.134)	(0.265)	(0.168)
Year FE	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes
Export Region FE	Yes	Yes	Yes
Observations	281,940	1,799	176,317
Number of panel	36,218	1,004	33,628

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