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US SPS Enforcement: Do Refusals Harm Reputation?

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Abstract: This paper uses a novel dataset on US import refusals to show that reputation is an important factor in the enforcement of SPS measures. The strongest reputation effect comes from a country's own history of compliance in relation to a particular product. However, the data are also suggestive of the existence of two sets of spillovers. First, import refusals are less likely if there is an established history of compliance in relation to other goods in the same sector. Second, an established history of compliance in relation to the same product by neighboring countries also helps reduce the number of import refusals. We also find some evidence that these effects tend to be stronger for lower income countries. These findings have important policy implications for developing country exporters of agricultural products. In particular, they highlight the importance of a comprehensive approach to upgrading standards systems, focusing on sectors rather than individual products, as well as the possible benefits that can come from regional cooperation in building SPS compliance capacity.

JEL Codes: F13; F15; O24.

Keywords: Product standards; SPS measures; Import refusals; Developing countries.

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1 Introduction

Non-tariff measures have become progressively more important as trade policy instruments as applied tariff rates have fallen across the world in recent years. From a development perspective, technical regulations and product standards are a particularly important type of non-tariff measure because they highlight the fact that the favorable market access accorded under duty and quota-free preferential schemes remains conditional on compliance with regulations in areas such as consumer safety. Previous research shows that product standards and technical regulations in the large, developed markets can have two contradictory sets of effects for developing country exporters. On the one hand, the costs of compliance—retooling, product re-design, testing, and certification—can be substantial enough to keep many small and medium enterprises out of international markets, thereby affecting the pattern of international specialization (e.g., Essaji, 2008). But at the same time, foreign standards can also provide the impetus for firms and sectors to upgrade production technologies and realize beneficial productivity gains (e.g., Maertens and Swinnen, 2009). The question of which types of standards tend to promote which set of effects is clearly of vital policy importance to developing country exporters. The issue of how best to direct technical assistance resources so as to support the upgrading of standards systems and development of compliance mechanisms in developing countries is also an important part of broader Aid for Trade discussions.

Most previous work on standards and technical regulations has focused on the rules themselves, rather than their application or enforcement through specific at-the-border mechanisms. There are a number of recent exceptions, however. Karov et al. (2009) focus on identifying the trade impacts of US SPS regulations at the product-country level by analyzing the effects of treatment requirements and grants of new market access. Similarly, Alberini et al. (2005) examine implementation of the FDA's seafood HACCP program using a dataset of plant inspections. Neither paper, however, deals with the import refusals mechanism that is the focus of the present paper. Buzby et al. (2008) and Buzby and Roberts

(2010) analyze similar data on US import refusals to that used in the present paper, but only provide descriptive statistics. Baylis et al. (2010) use data on EU import refusals in a gravity model to show that they tend to decrease trade. However, they do not examine the determinants of import refusals, and in particular the potential for reputation effects, which is the focus of our paper. Finally, the first stage of the empirical approach taken by Cadot et al. (2009) uses EU import alerts—closely related to refusals—as the dependent variable, but the cross-sectional setting of their regressions means that they are unable to account for reputation effects of the type we are interested in here.

In this paper, we use newly collected data to focus on one important example of the de facto implementation of product standards: refusal of entry into the US market for imported foods. The advantage of looking at measures such as import refusals is that they are implemented on a country- and product-specific basis, rather than being the same de jure for all exporters. Most standards and regulations are effectively most-favored nation (MFN) measures, which makes it difficult to identify their effects on exporters by exploiting cross-country variation in outcome measures, such as trade flows. Focusing on a country- and product-specific measure, such as import refusals, provides a potentially much richer source of data in which identification can be based on cross-country as well as cross-product and through-time variation.

In addition to exploiting new data on US import refusals, this paper makes a number of contributions to the existing literature. First, we provide some of the first explicit evidence of reputation effects in the enforcement of SPS measures. Specifically, we show that even after controlling for the size of import flows, a history of SPS compliance is associated with fewer current import refusals. Second, we show that it is not just reputation for a particular product that matters, but sector-wide reputation (i.e., there are cross-product spillovers in SPS enforcement): a product tends to suffer from more import refusals if closely related products are also subject to refusals. Third, we investigate, and find evidence to support, the hypothesis that the reputation of neighboring countries also matters for SPS enforcement. Our results suggest that imports are more likely to be refused if the same product from neighboring countries has also been subject to refusals. We interpret this finding as evidence in favor of geographical spillovers in SPS enforcement.

To our knowledge, the three reputation effects we are investigating have not been explicitly considered before in the literature. Baylis et al. (2010) use similar data to ours to analyze the determinants of US import refusals over the period 1998-2004. Their core hypotheses are that: countries with greater experience exporting food to the US experience fewer refusals (the "learning curve" effect); and import refusals are subject to political pressure (the "standards for sale" effect; cf. Grossman and Helpman, 1984 for the case of tariffs). The data indeed support the second hypothesis: standard political economy measures such as the level of lobbying activity, decreases in US employment, and anti-dumping actions are significantly associated with a higher number of refusals. However, the authors find that the data do not support their first hypothesis: more recent exporters actually face fewer refusals than established ones, even after controlling for export volumes. They speculate that this result may be due to a direct reputation effect, namely that enforcement resources tend to be concentrated on past violators. They do not pursue the point, but it is one that we take up here, using a different empirical specification that can better identify the effect, which we find to be highly significant. This paper therefore develops the intuition in Baylis et al. (2010) in relation to individual reputation effects, but also extends it to include the possibility of reputational spillovers from related products and sectors.

The paper proceeds as follows. In the next section, we provide an outline of the US import refusals regime. Based on that description, Section 3 presents our dataset, focusing on the new import refusals data. We present some preliminary analysis that supports our hypotheses using descriptive statistical techniques, then proceed to develop a fully-specified econometric model of import refusals. Section 4 presents and discusses the results from our model, and conducts robustness checks. Section 5 concludes with a discussion of policy implications, and avenues for further research.

2 The US Import Refusals Regime

Imports of food into the US have significantly increased in volume, variety, and also diversity of origin. Food and agricultural imports doubled from $41 billion in 1998 to $78 billion in 2007 (Buzby and Roberts, 2010). Fruit and vegetable and fish product imports have followed the same trend: fruits and vegetables imports increased more than five-fold from $811.5 million in 1989 to $4.28 billion in 2007, a 10.5% rate of annual growth (Karov et al., 2009). The value of imports of edible fish products (including canned fish) increased 2.5 times from $5.4 billion in 1988 to $13.7 billion in 2007. Between 2007 and 2010, imports augmented further to reach $14.9 billion.[2]

Imports as a share of US consumption have been rising rapidly too. Imported fruits and nuts represented 33.9% of total US consumption in 2004, up from 13.4% during the 1981-85 period. For vegetables, imports increased from 4.5% to 10.9% of U.S. consumption over the same period (Buzby et al., 2008). Similarly, while less than 50% of US fish consumption was imported products in 1980, the market share of imported products was over 75% in 2003 (Allshouse, Buzby, Harvey and Zorn, 2003).

According to Buzby and Roberts (2010), since 1990, there have been 77 new entrants in the market for fresh and minimally processed fruits, and 40 new entrants for fresh and minimally processed vegetables. This means for American consumers a higher variety of products (e.g., exotic fruits), and availability all year round.

[2] Source: Fisheries Statistics Division of the National Marine Fisheries Service (NMFS).

This rapid increase, which outstrips the overall growth of consumption in the US, and mostly likely efficiency improvements from foreign suppliers, demonstrates that improvements in market access have certainly played a crucial role.

Market access conditions for fruit and vegetables and fish, however, noticeably differ.[3] Seafood trade imports into the U.S. are generally less restricted than other food products; there are no quotas and heavy duties on imports. 90% of imports of fish enter duty-free compared to 24% for fruits and vegetables; the average tariff on fish products is 1.0% against 4.9% for fruits and vegetables (WTO, 2010). Moreover, imports of fruits and vegetables have been historically highly restricted, with strict regulation of entry eligibility for foreign products, and for 22 categories of fruits and vegetables the presence of 31 marketing order regulations specifying how products should be marketed.[4]

2.1 Eligibility to Export to the US: Plant Health Controls and Memorandum of Understanding for Molluscan Shellfish

The US Department of Agriculture's Animal Plant Health and Inspection Service (APHIS) is the agency charged with regulating entry eligibility into the US under the authority of the Plant Protection Act. The purpose is to "safeguard U.S. agriculture and natural resources from the risks associated with the entry, establishment, or spread of animal and plant pests and noxious weeds" (source: APHIS website).

At the outset, only a share of the world's production is eligible for export to the US. For instance, Mexican avocados were banned until 1997. The importation of fresh apples is permitted from only 17 countries, representing 44% of global exports of apples, and 15% of global production (ERS, 2010). For products like fresh olives, dates, and figs, none or almost no imports are allowed.[5]

[3] Which is one of the motivations for focusing on both sectors in our analysis.
[4] See http://www.ams.usda.gov/AMSv1.0/FVMarketingOrderLandingPage.
[5] http://www.ers.usda.gov/Data/FruitVegPhyto/data.htm

When access to the US market is permitted, this is often under the condition of complying with a number of pest-mitigating measures, such as treatments (e.g. fumigation), the implementation of risk management systems, geographic origin or destination restrictions, and pre-clearance requirements (Karov et al., 2009). Standards vary for each country and are recorded in the APHIS *Fresh Fruit and Vegetables Import Requirements (FAVIR)*,[6] a positive list of fruits and vegetables that have been approved for entry into the US and the requirements that must be met for admission into the U.S. By definition, all other products are banned, although not being on the list does not necessarily mean an outright import ban: it may just reflect the fact that no exporter applied for an importation permit.[7] A summary of FAVIR can be accessed through an online database.[8]

The control of fish product imports generally focuses on product testing and inspection. However, raw molluscan shellfish may only be imported into the United States from countries whose seafood regulatory authority has an appropriate Memorandum of Understanding with the FDA (Australia, Canada, Iceland, Japan, Mexico, New Zealand, and the United Kingdom).[9]

2.2 Food Safety

Food products are the source of numerous food-borne illnesses (due to pathogens, toxins, and chemicals). All food products must be unadulterated (not bear or contain any poisonous or deleterious substances), be fit for consumption, and not contaminated or decaying, in order to be allowed for consumption in the U.S. At the federal level, there are three agencies involved in the oversight of food and food ingredients safety: the US Department of Agriculture's Food Safety and Inspection Service (FSIS), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA). FSIS ensures the safety of imported meats, poultry, and processed egg products. FDA covers all other

[6] Per 7 CFR 319.56 as well as the quarantine 56 streamline revision APHIS published July, 2007.
[7] Applying for a permit is a complex process.
[8] http://www.aphis.usda.gov/favir/info.shtml
[9] http://www.fda.gov/InternationalPrograms/Agreements/MemorandaofUnderstanding/default.htm

products.[10] EPA licenses pesticide products and monitors pesticide residues in products. The FDA enforces compliance with the limits set by FDA by testing US-produced and imported food. To sum up, FDA supervises pesticides residues, food hygiene, additives and contamination.

The FDA enforces the Federal Food, Drug and Cosmetics Act (FD&C) as well as other laws designed to protect consumer health, welfare, and safety. Under Sec. 801 of FD&C, products are subject to inspection when imported. Imported food products are expected to meet the same standards as domestic products, i.e. they must be pure, wholesome, safe to eat, and produced under sanitary conditions. Food imports must also contain informative and truthful labeling in English.[11]

Standards mean for fruits and vegetables that FAVIR requirements have to be met. Another important requirement is that since 1997, producers must follow FDA's good agricultural practices (GAP) for the control and management of microbial food safety.

Likewise, since 1995 fish products imports must meet hazard analysis and critical control point (HACCP) standards, as must domestic producers. HACCP standards are also included in the Codex Alimentarius international standard. Implementation of the standard varies internationally: in the case of the U.S. HACCP applies to processors only, in contrast with the EU where it applies to the entire supply chain. Other measures applying to seafood include traceability requirements such as the identity preservation system for molluscans, and labeling of origin and method of production (wild harvest or farm raised).

Other programs concerning food products in general are also in place such as the acidified and low acid canned foods regulations. Acidified and Low Acid Canned Foods must be manufactured in accordance with FDA regulations. Food canning establishments must also register with FDA.

[10] This includes beyond food products, drugs, biologics, cosmetics, medical devices, and electronic products that emit radiation.

[11] http://www.fda.gov/ForIndustry/ImportProgram/ImportProgramOverview/default.htm

All the measures described above are defined on the principle of national treatment: importers and domestic producers are subject to the exact same requirements. There is however a significant difference of treatment between domestic goods and imported products, in implementation of food safety measures. The Act allows for refusal of imported FDA-regulated products for "appearing" to be adulterated or misbranded. The law is interpreted in a broad sense as allowing the FDA to make admissibility decisions based not only on physical evidence such as examination, facility inspection, or laboratory results, but also based on historical data, information from other sources (e.g. about a disease outbreak), labeling, and any other evidence.[12] Factors such as reputation can clearly come into play in this decision. In other words, if there is the faintest suspicion that a product from a given origin will not meet FDA standards, it can be detained. Therefore the standard of proof for determination of refusal for food import products is much less strict than for domestic products, which must be based on an actual violation. Therefore we can form the hypothesis that refusals may be partly path-dependent (as noted by Baylis et al., 2010) since past histories of violation from similar products and origins are criteria that may be used to decide whether there is a suspicion of adulteration of misbranding, which can in turn justify a refusal.

Baylis et al. (2010) explain that this looser requirement may be motivated by the fact that the FDA has less easy access to means of verification for imported products: for instance FDA does not have extra-territorial jurisdiction and may not be able to inspect foreign plants. This is also ultimately motivated, according to the FDA, by limited resources for physical inspection of products.[13]

[12] Presentation by Domenic Veneziano, Director, FDA Division of Import Operations at the Food & Agriculture Border Gateway Summit January 16, 2008.
[13] ibid footnote 10.

2.3 FDA Process for Importing Products

Under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, the FDA issued regulations in December 2003 requiring two things: 1) that food facilities (including foreign) are registered with the FDA;[14] and 2) FDA be given advanced notice of shipments of imported food. Depending on the mode of transport, notices must be submitted between 2-8 hours and five days prior to arrival. The information required for prior notice varies, based on the type of entry, mode of transportation for entry, and whether the food is in its natural state.[15]

The prior notice is filed with customs and FDA. Upon reviewing the notice, the FDA can decide to release the product, request additional information or documents, request physical examination of the product, or recommend detention of the product. Detention means that in the absence of petition or reconditioning of the goods from the exporter, the product will not be released into US territory and will either be re-exported or destroyed within approximately 90 days.

Physical examination entails verification of labeling, of the container integrity, sampling, and verification, and leads to either a recommendation of release or detention. According to the literature, about 1-2% of all food shipments are subject to physical examination by FDA, and a fraction of these are subject to sampling (Buzby et al., 2009; Baylis et al., 2010).

2.4 Alerts

The FDA relies on a system of alerts for particularly sensitive categories of products in order to help it save and allocate inspection resources. Alerts are issued when the FDA determines that there is a particular risk associated with a product, producer/exporter, country or region of origin.

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[14] Registration is for the purpose of collecting information and is not an approval process.

[15] (21 CFR 1.281) for details on the required information. The PN requires additional information to what is normally required under import process: the country from which the article is shipped and the crossing location within the port of arrival; revised information is also required regarding the actual manufacturer, the registration number of the manufacturer and shipper and information about the grower if known. http://www.fda.gov/Food/FoodDefense/Bioterrorism/ucm083245.htm

As mentioned earlier, the FD&C treats imported and domestic products differently. Imported products that appear to be in violation of import requirements can be refused admission without examination, so-called detentions without physical examination (DWPE). In most circumstances, alerts determine that firms and products identified will be subject to DWPE. In this case, FDA will automatically detain the concerned products until it is demonstrated to the FDA that the violation has been remedied. Therefore the burden of proof falls on the shoulders of the importer or shipper, or the manufacturer/grower of the product. As noted by Baylis *et al.* (2010) alerts are strikingly rarely changed: three quarters of alerts in place in 2009 had been in place for more than 10 years, and a significant portion of them (one quarter of all alerts) for more than 20 years.

Alerts appear to be decided on similar legal basis to refusals, e.g. the standard of “appearance”. According to the FDA, alerts are triggered by historical violations at the following levels: commodities; manufacturers/shippers; growers; sometimes importers; geographic area; and countries of origin (Venezziano, 2008). Sources of information come from FDA’s own field offices, but also foreign inspections and evidence from other countries.[16] It is not entirely clear how criteria leading to an alert differ from those to determine detention without physical examination, but it is likely that they are closely related. For instance, previous import refusals are a factor used to justify the creation of an alert.

Since alerts are used to allocate inspection resources and also decide automatic detention, and that alerts are themselves decided on the basis of past history of violation, we can assume that this acts as reinforcing the potential for path-dependence in the refusal of foods entering the US.

[16] For instance, beyond publicly available evidence such as refusal data, the EU and US authorities communicate on certain matters.

3 Methodology and Data

As the above discussion demonstrates, US border authorities exercise broad discretions when implementing the import refusals regime. As previously noted by Baylis (2010), there is a strong possibility of path dependence: the authorities might look at past patterns of compliance in allocating scarce enforcement resources, leading to a correlation between past and present import refusals, even after controlling for other factors. We refer to this as the "own reputation" effect. In addition, the structure of the US import refusals system is suggestive of two other effects that might be in operation. One is a "sector reputation" effect, by which we mean the possibility that import refusals for a particular product are associated with past import refusals affecting closely related products. The second is a "neighbor reputation" effect, namely the possibility that import refusals affecting a given product from one country might be more likely if neighboring exporters of the same product have a history of non-compliance. In the remainder of this section, we outline the data and model we will use to test for the existence of all three effects.

3.1 US Import Refusals Data

This paper uses a new dataset of US import refusals for the period 1998-2008. It extends the data used in Jouanjean (2011), and covers HS chapters 3 (fish and crustaceans), 7 (vegetables), 8 (fruits), and 20 (preparations of vegetables, fruits, and nuts). Refusals in these sectors accounted for over 50% of all FDA import violations over the 1998-2004 period (Buzby et al., 2008). We are therefore confident that by focusing on these three sectors, we are capturing an important part of overall import refusal activity in the US. This subsection describes the US import refusals regime in more detail, focusing on the way in which the data used here were collected.

Since 1998, the FDA has implemented an automatic system governing the admission process for FDA-regulated shipments of foreign-origin products presented for entry into the US. The system, known as the “Operational and Administrative System for Import Support” or OASIS, is designed to simplify operations and reduce the time taken for clearance of shipments. It classifies imported items into different risk categories by tracking historical data on shipments that were previously refused admission into the US. Again, this process is suggestive of path dependence and reputation effects of the type that are the focus of this paper.

The FDA makes refusals information public in their Import Refusal Report (IRR), which is generated from OASIS data. Reports provide information on the manufacturer’s name and country of origin, as well as the dates and motives for the refusal. To gain access to historical refusals data, we submitted a Freedom of Information Act request in September 2009, which the FDA satisfied by supplying data in May 2010.

Products in the OASIS system are identified by a specific FDA code. In order to relate these products to reported trade flows, we constructed a correspondence mapping FDA codes to the Harmonized System at the 4-digit level. FDA product codes comprise five elements: Industry Code, Class, Subclass, Process Indicator Code (PIC), and Product Code. The Industry Code describes the broadest area in which a given product falls. In this paper, we focus on refusals related to Industry Codes 16 (fishery and seafood products), 20-22 (fruit and fruit products), and 24-25 (vegetables and vegetable products).

The Class Code defines a narrower category of products that are specific to each industry. In other words, one Class Code can have a different definition under various Industry Codes. Class Codes provide two pieces of information. First, they give more information on the “sub-group” to which a product belongs. In addition, they help clarify the kind of transformation the product has been subject to.

For convenience, we refer to the class sub-group as “Industry Type” and to the type of transformation as “Class Name”. In the event that a Class is only assigned to a sub-group of the Industry Code but that no specific transformation is mentioned (such as Class A in the following examples), we apply a specific mention “Not Further Specified” (N.F.S).

The last two codes, Subclass and Process Indicator Codes (PIC), are specific to each food industry code. The former gives an indication as to the material type of the container holding the product (metal, glass, etc.), and the latter describes the process used in preparing the product (Raw, Commercially Sterile, Pasteurized, etc.). The association of both the Industry and Class Codes to the Product Code is usually enough to define the product in the HS classification.

3.1.1 Assumptions Made in Constructing the Database

Exporters provide the product code relating to their shipment when they file the prior notification required by the FDA for any food exports to the US. Exporters build this code themselves according to FDA recommendations. However, it can sometimes happen that exporters or importers have a different understanding of how they should build product codes, and might sometimes lack the relevant information. This kind of issue is highly unlikely for most of our products of interest, since they are generally fresh or minimally processed. However, one specific code definition from the FDA retained our attention and necessitated more careful handling as we describe in the following.

For all Classes except N.F.S., the association of the Industry Code, Class, PIC, and Product is precise enough to avoid any misunderstanding by exporters. It therefore enables an obvious correspondence with the Harmonized System code at the HS4 level. However, the association of the specific PIC defining "Packaged Food" with N.F.S Class can be more problematic. Indeed, exporters tend to use this code for many types of products for which another appropriate PIC or Class should probably be preferred. Thus, the correspondence with the HS4 classification requires the use of the Subclass code to differentiate products comprised under this association of PIC defining "Packaged Food" and a N.F.S designations.

For "Metal" and "Glass" containers, we make the straightforward assumption that those products were transformed, and thus fall into HS Chapter 16 for fish and fishery products, and HS Chapter 20 for fruit and fruit products, and vegetables and vegetable products. For containers of different materials, we use two sources of information. First, data from 1998 to 2001 contain product description data in which the FDA agent could fill in a precise definition of the product. Second, we extend the research using the name of the manufacturer from the database in order to gather information from company websites on the type of products they are exporting. According to this sample of manufacturers, we were able to make assumptions about the type of transformation associated with those product codes.

3.2 Other Data

In addition to the novel dataset on FDA import refusals discussed in the previous subsection, we use standard data sources for the remaining variables used in our analysis (Table 1). We source trade data from UN-Comtrade, accessed via the World Bank's WITS platform. We use US import data for 1998-2008 at the HS four-digit level, including all exporting countries. In light of the high quality of US import data, we replace all missing values with zero to indicate that no trade took place for the given exporter-product-year combination. We only include trade data for which we have corresponding refusals data, namely HS chapters 3, 7, 8, and 20. In addition to trade data to control for imports in levels and first differences, we source per capita GDP data in PPP terms from the World Development Indicators. Finally, as an additional robustness check (see below), we estimate the model including US effectively applied import tariffs as an additional explanatory variable. These data are sourced from UNCTAD's TRAINS database via the World Bank's WITS platform.

3.3 Preliminary Analysis

Before moving to a fully-specified econometric model, it is useful to examine some simple correlations in the data to see whether they support our three hypotheses, namely the own reputation effect, the sector reputation effect, and the neighbor reputation effect. As outlined above, we expect to see positive associations between, on the one hand, the number of refusals for a given country-product-year combination, and, on the other, the number of refusals affecting that country-product combination in the previous year (own reputation), the number of refusals affecting related products—those in the same HS2 chapter—from the same country in the previous year (sector reputation), and the number of refusals affecting the same product from related countries—the five geographically closest to the exporter—in the previous year (neighbor reputation). For ease of presentation we consider data for a single year only, 2008 (the most recent year in our database), and convert the variables to logarithms to reduce dispersion.

In all three cases (Figures 1-3), the data provide support for our propositions. The positive association is strongest, as would be expected, in the case of own reputation (Figure 1). Although the correlations in Figures 2 and 3, which capture reputational spillover effects, are weaker, they are nonetheless positive and 1% statistically significant. In terms of slope coefficients, the stronger gradient of the line of best fit in Figure 3 than in Figure 2 provides some preliminary evidence that neighbor reputation may be quantitatively more important than sector reputation.

Of course, the graphical analysis we have presented is based on simple correlations only. It does not take account of intervening influences. To address this issue more fully, the next subsection develops an econometric model, for which we report estimation results in the next section.

3.4 Empirical Model

As discussed above, we are primarily interested in assessing the impact of reputation effects in the enforcement of US SPS regulations through import refusals. Our dependent variable is therefore a count of the number of import refusals affecting a particular exporter-product-year combination. Because it takes strictly non-negative integer values, we use the Negative Binomial model as our workhorse estimator.[17] However, in additional results available on request, we show that the choice of estimator is

[17] Because of numerical problems with Stata's built-in Negative Binomial estimator, we estimate the model using the more general GLM framework and iterative re-weighted least squares. See Santos Silva and Tenreyro (forthcoming) for full details of this issue as it affects the closely related Poisson estimator.

not critical to our main conclusions. In particular, our results stand if a Poisson estimator is used instead. However, we prefer the Negative Binomial model due to obvious over-dispersion in the dependent variable, i.e. its variance (27) is substantially greater than its mean (0.5).

As independent variables, we include three measures of reputation. The first, "own reputation", is simply the lagged dependent variable, i.e. the number of refusals affecting a given exporter-product combination in the previous year. The second, "sector reputation", is a lagged count of the number of refusals affecting products in the same HS 2-digit chapter from a given exporter, but excluding the number of refusals affecting the product in question. It is therefore a measure of the extent to which related products are subject to import refusals. The third variable, "neighbor reputation", is a lagged count of the number of refusals affecting the same product exported from geographically close countries. We define "closeness", using geodesic distance as the benchmark, i.e. the five closest countries to the exporter. If reputation effects are present in the data, we expect all three of these variables to have positive and statistically significant coefficients.

It is also important to ensure that we control for other possible influences on the number of import refusals. The level of imports, and the speed of import growth, are two obvious controls to include. We expect both to be positively associated with the number of refusals. For a given probability of refusal, a higher volume of imports leads mechanically to a greater number of refusals. We expect import growth to be positively associated with refusals because an import "surge" is likely to lead to a concentration of enforcement resources on the new exporter, for which there is little history of compliance. In both cases, we use import volumes (quantities) rather than values, to ensure that we are capturing pure quantity effects, and not mixing quantity and unit value effects, which would be the case if we used import values. Moreover, we keep both variables in levels, rather than taking logarithms, to ensure that observations with zero trade are retained in the estimation sample.

In addition to import quantities in levels and first differences, we also control for the exporting country's per capita GDP. We use this measure as a proxy for the exporter's level of financial and technical capacity, which is an important determinant of its ability to comply with foreign standards. To take account of additional country-, product-, and time-specific factors, we also include a full set of fixed effects in those three dimensions. Product fixed effects are of particular importance, because they allow us to control for the inherent riskiness of particular products, which is likely to lead to a greater rate of inspections and refusals.

Bringing these points together, and specifying the mean of the count of refusals conditional on a matrix of explanatory variables $\mathbf{X}$, gives an empirical model of the following form:

$$(1)\ E[Refusals_{ikt}|\mathbf{X_{ikt}}]$$

$$= b_0 + \underbrace{b_1 Refusals_{ikt-1}}_{Own\ Reputation} + \underbrace{b_2 \sum_{j=1;j\neq k}^{K_{HS2}} Refusals_{ijt-1}}_{Sector\ Reputation} + \underbrace{b_3 \sum_{j=1;j\neq i}^{N\_Neighbors} Refusals_{jkt-1}}_{Neighbor\ Reputation}$$

$$+ b_4 \Delta Imports_{ikt-1} + b_5 Imports_{ikt-1} + b_6 \log(GDPPC_{it}) + f_i + f_k + f_t$$

where f indicates fixed effects in the exporter (i), product (k), and time (t) dimensions.

4 Estimation Results and Interpretation

Table 2 column 1 presents results for the baseline model, i.e. equation (1) above. In line with expectations, the lag of import quantity has a positive and 1% statistically significant coefficient; however, lagged import growth has an unexpected negative and statistically significant coefficient.[18] This finding suggests that import volumes are obviously an important determinant of the total number of refusals, but that it is the overall quantity of imports—not recent growth—that matters most. Indeed,

[18] In additional results, available on request, we show that our findings are not sensitive to the specification of the past import growth term. For instance, using growth over the five preceding years does not make any qualitative difference to our results.

recent growth may be capturing improvements in country competitiveness, including upgrading of the standards system, which would tend to make refusals less likely. Finally, per capita GDP has a negative coefficient, which is in line with expectations, but it is statistically insignificant. Rather than interpret this result as indicating that the level of development of national standards infrastructure is not relevant to the determination of import refusals, we instead conclude that per capita GDP is simply a poor proxy for the variable we are really interested in measuring. In any case, we return to the issue of income effects below, when we split the sample into different World Bank income group categories.

Interestingly, even after controlling for lagged import volume, the coefficient on the lagged number of refusals is positive and 1% statistically significant. The refusals data are clearly quite persistent through time, which is consistent with the existence of an own reputation effect: a history of compliance is associated with fewer current refusals, but a history of non-compliance is associated with a greater number of current refusals. This result lines up well with the findings of Jouanjean (2011), and confirms the intuition of Baylis et al. (2010). It is more in line with expectations than the counterintuitive finding of Alberini et al. (2005) that seafood HACCP inspections are not based on compliance history at the plant level.

The model in Table 2 column 1 also suggests that sector reputation has a positive and statistically significant impact on the current number of refusals. Although the coefficient is considerably smaller in magnitude than for the own reputation variable, it is nonetheless 1% statistically significant. In addition to a history of compliance in relation to a given product, therefore, a history of compliance in related products is also important in determining the current number of import refusals. It is important to stress that the count of refusals affecting related products does not include those directly affecting a given exporter-HS 4 digit product combination, so the effect identified by this coefficient is quite independent of the own reputation effect.

The remaining variable in Table 2 column 1 is the neighbor reputation effect, based on a "neighborhood" defined as a country's five geographically closest neighbors. Again, the coefficient on this variable is positive and 1% statistically significant, which is in line with expectations. In terms of magnitude, the neighbor reputation coefficient lies between the own reputation and sector reputation coefficients: its effect is nearly three times as strong as the sector reputation effect, but it is still only one-sixth as strong as the own reputation effect.

Bringing these results together, we find strong support for all three of our core hypotheses: own reputation, sector reputation, and neighbor reputation all have a significant impact on the current number of import refusals. In the remaining columns of Table 2, we present some simple robustness checks. First (column 2) we include tariffs as an additional explanatory variable. We then (columns 3-4) estimate the model separately for sub-samples of countries identified by the World Bank's country income classification. In additional results, available on request, we also estimate the model using alternative estimators (Poisson and, with a dummy dependent variable for at least one refusal, Logit), as well as separately for each World Bank geographical region.

Column 2 of Table 2 presents results including data on the US effectively applied tariff rate—i.e., including preferences—to assess the degree to which SPS enforcement and protectionist measures are correlated, and to address a potential source of omitted variables bias.[19] Results are very close to the baseline model: all three reputation variables retain positive and 1% statistically significant coefficients, although their magnitudes fall slightly in each case. Interestingly, the tariff variable has a positive coefficient, which is suggestive of stronger SPS enforcement in sectors that are relatively protected, perhaps due to the influence of industry lobbies, as suggested by Baylis et al. (2010). More broadly, this result could be interpreted as indicating a degree of complementarity between tariffs and non-tariff

[19] The sample size in column 2 is greatly reduced due to the lack of availability of tariff data in UNCTAD's TRAINS database.

measures, in this case import refusals. Clearly, more work is required before strong conclusions can be drawn, but the data at this stage are highly suggestive of such a link.

From a policy point of view, it is important to know whether the types of reputation effects highlighted in column 1 of Table 2 are common to a wide range of countries, and in particular low- and middle-income countries. Our prior is that these effects should be stronger than average for low- and middle-income countries, because compliance with standards represents more of a burden—in terms of technical capacity and relative cost—than in high income countries.

With this outlook in mind, Table 2 columns 3-4 present estimation results for the baseline model using restricted country samples, focusing on different per capita income groups, as defined by the World Bank. Column 3 excludes all high-income countries (OECD and non-OECD) from the estimation sample. Contrary to expectations, there is no general evidence of stronger reputation effects: coefficient estimates are close to the baseline, although the magnitude of the sector and neighbor reputation effects are somewhat stronger. Similar findings follow from column 4, where we exclude from the sample upper middle-income countries in addition to high income countries: the coefficients on sector and neighbor reputation are somewhat stronger than under the baseline. Bringing these results together, we conclude that there is no evidence that the own reputation effect is more important for low- and lower-middle-income countries. On the other hand, the sector and neighbor reputation effects do appear to be somewhat more important for those countries.[20]

5 Conclusion, Policy Implications, and Avenues for Further Research

This paper has produced some of the first direct evidence that reputation effects matter in the enforcement of US SPS measures through the import refusals system. Specifically, countries with a

[20] We also estimated a model for low income countries only, but the estimates failed to converge.

history of compliance tend to experience fewer refusals, even after controlling for other factors. In addition, countries with a history of compliance in related products also tend to experience fewer current refusals, as do countries whose neighbors have an established history of compliance. We interpret these last two effects as evidence of reputational spillovers in the enforcement of SPS rules.

From a development point of view, we find some evidence that sector and neighbor reputational effects are more important for lower income countries. This result sits well with findings in the broader literature on standards and trade, which suggest that it is primarily poorer countries that encounter negative trade effects from foreign product standards (e.g., Disdier et al., 2008).

Although more research is clearly needed in a number of areas—more on this below—some important policy implications would seem to follow from our findings. First, exporters of agricultural products seeking to break into the US market need to focus on building SPS capacity so as to become reliable sources. It is not sufficient to export a mix of compliant and non-compliant goods: reputation matters, and the presence of the latter will make it harder to get the former into the market as well. Consistency and reliability of production are therefore key issues in the development of SPS capacity in poor agricultural exporters.

Second, our results strongly suggest that a comprehensive approach to SPS compliance is likely to be more effective than a piecemeal one. Although it might seem sensible to concentrate limited SPS capacity building resources on a small number of products that are individually important, such an approach neglects the importance of the sectoral spillover effects evident in our data. Building capacity across the sector as a whole can have important benefits for individual products.

Similarly, the likelihood that regional reputation matters for SPS enforcement also has important policy implications. Regional approaches to the development of standards systems are becoming more common for many reasons, such as the ability for small, poor countries to pool technical and financial resources (Maur and Shepherd, forthcoming). Our findings suggest an additional reason for encouraging regional standards cooperation: geographical spillovers mean that compliance by a country's neighbors can help it achieve more effective market access.

Currently, there is only a very small literature examining SPS measures at the level of enforcement mechanisms, such as alerts or import refusals. Further work in this area has the potential to bring significant insights into the workings of product standards more generally, and in particular their effects on developing country exporters. Baylis et al. (2010) make a first attempt to assess the trade impacts of import refusals. Extending their work to take account of the types of reputation spillover effects we have identified here could be a fruitful avenue for future research. Our own work highlights the need to treat import refusals as endogenous in gravity model settings, which is an important dimension in which the robustness of previous assessments needs to be established. Similarly, Baylis et al. (2009) provide some initial evidence suggesting that political economy forces may be relevant in determining the application of SPS measures. Since almost nothing is known about the political economy determinants of product standards (c.f. Kono, 2006), this too would be an interesting research question to pursue using data similar to those we have used here.

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Tables

Table 1: Data and sources.

Variable	Description	Year	Source
$GDPPC_{it}$	Per capita GDP of country i in year t (in PPP terms).	1998-2008.	World Development Indicators.
$Imports_{ikt}$	Imports of product k from country i in year t, in quantity terms (not value).	1998-2008.	UN Comtrade via WITS.
$Refusals_{ikt}$	Number of import refusals affecting product k exported from country i in year t.	1998-2008.	Authors.
$Tariff_{ikt}$	Effectively applied US tariff on product k from country i in year t.	1998-2008.	UNCTAD Trains via WITS.

Table 2: Regression results.

	(1) Baseline	(2) Tariffs	(3) UMI+LMI+LI	(4) LMI+LI
$\underbrace{Refusals_{ikt-1}}_{Own\ Reputation}$	0.062***	0.047***	0.053***	0.057***
	(0.000)	(0.000)	(0.000)	(0.000)
$\underbrace{\sum_{j=1;j\neq k}^{K_{HS2}} Refusals_{ijt-1}}_{Sector\ Reputation}$	0.004***	0.003***	0.006***	0.005***
	(0.000)	(0.000)	(0.000)	(0.002)
$\underbrace{\sum_{j=1;j\neq i}^{5} Refusals_{jkt-1}}_{5\ Neighbor\ Reputation}$	0.011***	0.007***	0.013***	0.013***
	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta Imports_{ikt-1}$	-0.000**	-0.000	-0.000***	-0.000
	(0.044)	(0.622)	(0.000)	(0.100)
$Imports_{ikt-1}$	0.000***	0.000***	0.000***	0.000*
	(0.000)	(0.002)	(0.000)	(0.073)
$\log(GDPPC_{it})$	-0.062	0.273	-0.264	-0.455
	(0.903)	(0.598)	(0.684)	(0.560)
$\log(1 + tariff_{ikt})$		3.417***		
		(0.001)		
Constant	-44.411***	-37.045***	-40.947***	4.980
	(0.000)	(0.000)	(0.000)	(0.479)
R2	0.027	0.030	0.036	0.004
Observations	68684	15240	50952	35112
Fixed Effects	Exporter	Exporter	Exporter	Exporter
	HS 4 Product	HS 4 Product	HS 4 Product	HS 4 Product
	Year	Year	Year	Year

*Note: Estimation is by Negative Binomial in all cases. Prob. values based on robust standard errors corrected for clustering by exporter are in parentheses below the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).*

Figures

Figure 1: Current vs. lagged refusals, 2008.

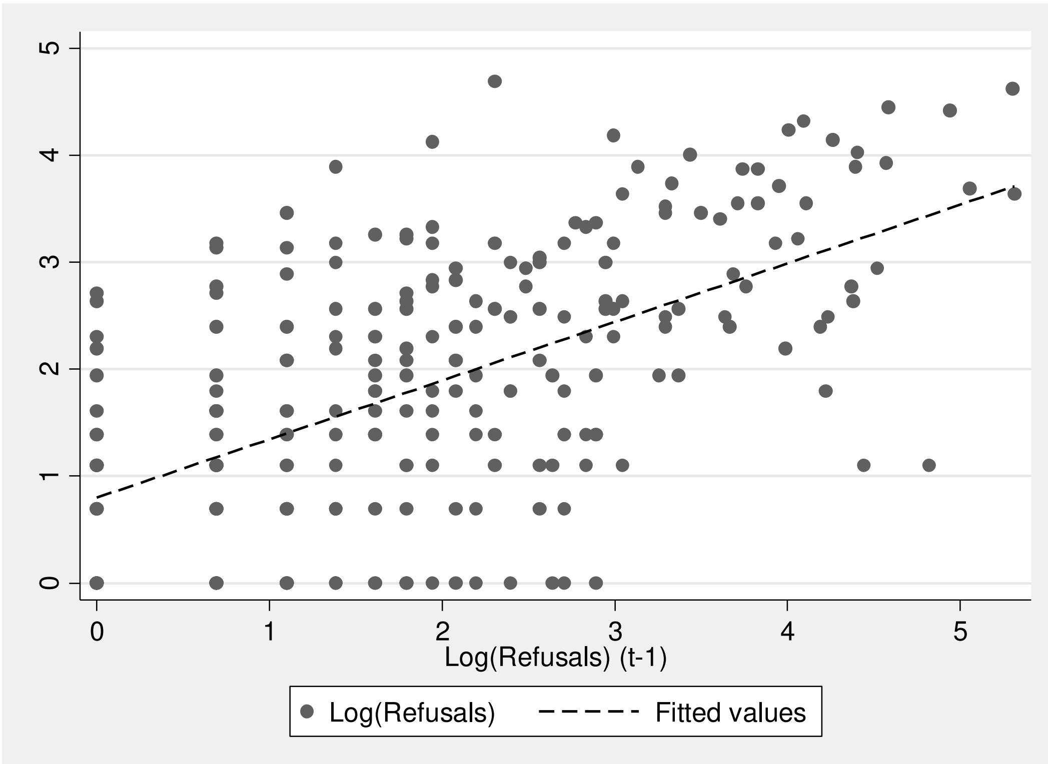


Figure 2: Refusals versus lagged refusals affecting similar products (same HS2 chapter), 2008.

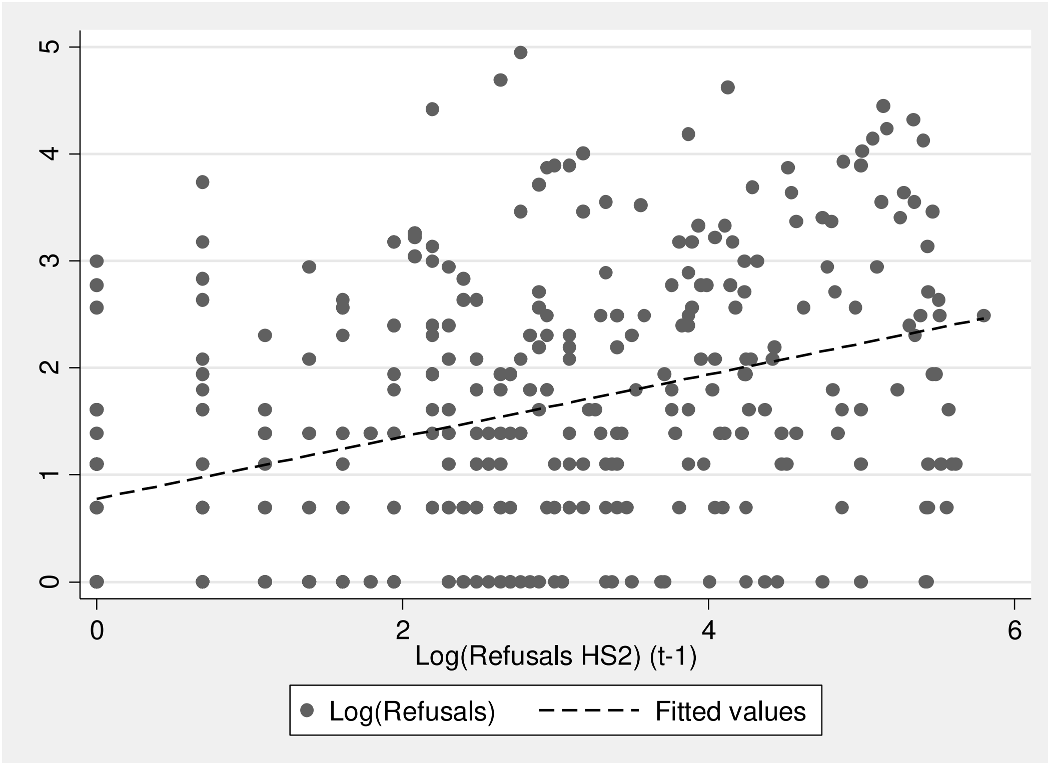
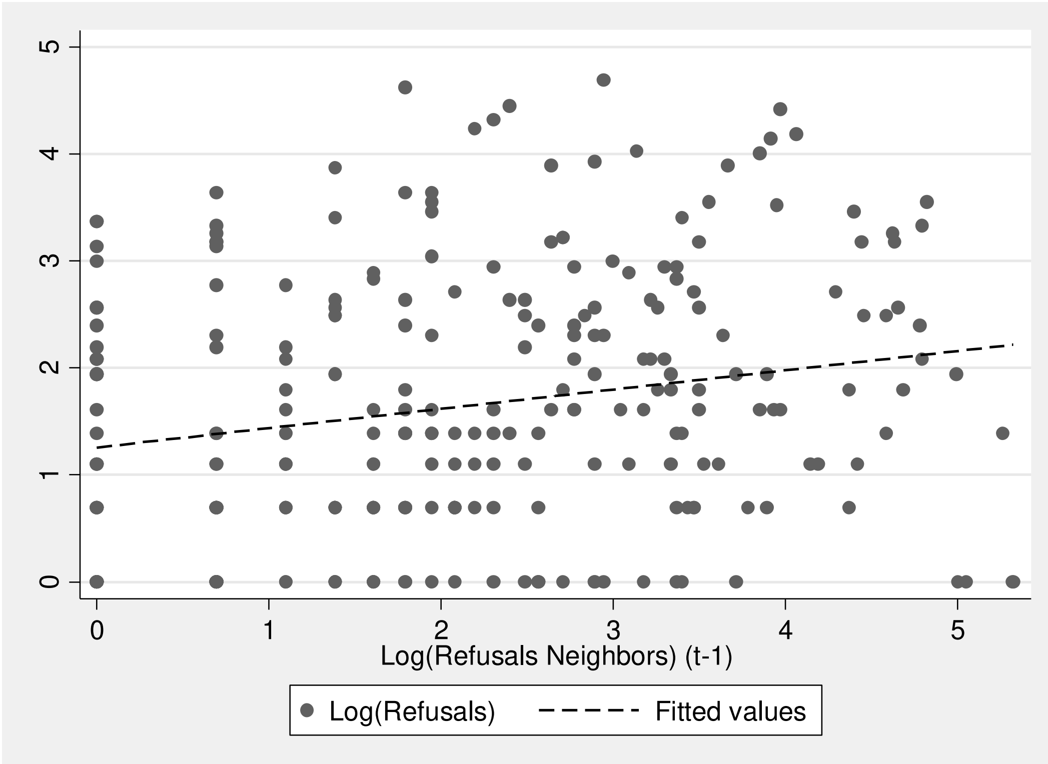


Figure 3: Refusals vs. lagged refusals affecting the five closest countries, 2008.



Appendix

Table 3: Industry Class Codes for fruit and fruit products.

Industry	Industry type	Class	Class name
20	Berries	A	Simple
		B	Dried or Paste
		C	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		D	Juices or Concentrates
		F	Purees
		E	Toppings and Syrups
	Citrus	G	Simple
		H	Dried or Paste
		J	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		K	Juices or Concentrates
		M	Purees
		L	Toppings and Syrups
	Core Fruit	N	Simple
		Q	Dried or Paste
		R	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		S	Juices or Concentrates
		U	Purees
		T	Toppings and Syrups
21	Pit Fruit	G	Simple
		H	Dried or Paste
		J	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		K	Juices or Concentrates
		I	Purees
		L	Toppings and Syrups
	Subtropical and Tropical Fruit	S	Simple
		T	Dried or Paste
		U	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		X	Subtropical/Tropical Fruit Pulp
		R	Purees
		W	Toppings and Syrups
		V	Juice, Milk, Creme, Drink or Nectar, Sub/Tropical Fruit
	Mixed	A	Simple
		B	Dried or Paste
		C	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		F	Purees

		E	Toppings and Syrups
		D	Juices or Concentrates
22	Vine fruit	A	Simple
		B	Dried or Paste
		C	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		F	Purees
		E	Toppings and Syrups
		D	Juices or Concentrates
	Other fruit	G	Simple
		H	Dried or Paste
		J	Jams, Jellies, Preserves, Marmalades, Butters and Candied
		I	Purees
		L	Toppings and Syrups
		K	Juices or Concentrates

Table 4: Industry Class Codes for vegetables and vegetable products.

Industry	Industry type	Class	Class name
24	Bean, Pea, Corn	A	Simple
		B	Dried or Paste
		C	with Sauce
		D	Juice or Drink
	Fruit used as Vegetable	F	Simple
		G	Breaded
		H	Dried or Paste
		J	Juice or Drink
		K	with Sauce
	Leaf & Stem Vegetable	T	Simple
		W	Juice or Drink
		U	Dried or Paste
		V	with Sauce
	Sprouts from Seeds Peas or Beans	E	Simple
25	Fungi Products	S	N.E.C
		R	Broken or Kibbled
		Q	Pieces and Stems, Sliced
		P	Whole (Button)
	Mixed Vegetables	E	Simple
		H	with Sauce
		F	Dried or Paste
		G	Juice or Drink
	Root & Tuber Vegetable	J	Simple
		L	Dried or Paste
		N	with Sauce
		K	Breaded
		M	Juice or Drink

Table 5: Industry Class Codes for fishery and seafood products.

Industry	Industry type	Class	Class name
16	Crustaceans	J	Simple
		K	Breaded
		L	Cake, Balls, etc
	Fish	A	Simple
		S	Cold Smoked
		I	Hot Smoked
		B	Breaded
		C	Cake, Balls, etc
	Fishery Prod, n.e.c	Y	Simple
	Shellfish	E	Simple
		T	Cold Smoked
		O	Hot Smoked
		F	Breaded
		G	Cake, Balls, etc
	Other Aquatic Species	M	Simple
		V	Cold Smoked
		U	Hot Smoked
		N	Breaded
		P	Cake, Balls, etc
	Aquaculture Harvested Fishery/Seafood Product	X	Simple
	Engineered Seafood	R	Simple
	Mixed Fishery/Seafood Products	W	Simple