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Still a Barrier to Trade? A Review of
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Abstract

Since the FDA's adoption of HACCP standards in 1997, there has been concern that these standards have continuously acted as a barrier to trade for seafood exports from developing countries. This study compares trade data of seafood exports to the U.S with the refusal data from the FDA, in order to determine if there is a continuous negative effect of the FDA's stringent standards on trade across the top seafood exporting countries to the U.S. Overall, it is found that the bulk of seafood refusals are from developing countries, notably a small group of lower-middle income Asian countries who are also some of the largest exporters of seafood to the U.S. Relative to how much they trade, developing countries actually have had better or roughly equivalent compliance rates at the U.S border, and there were no differential effects found on the impact of refusals on trade for any of the top seafood exporting countries. Learning was not observed with this data for any of the top exporting countries to the U.S, implying more research may be required at the firm level in these countries to continue studying 'standards as barriers'.

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The opportunity to participate in the U.S market is critical for international seafood exporters because Americans are the third largest consumers of seafood in the world, and their consumption is increasingly supplied through imports[1]. At the same time, seafood is one of the leading causes of foodborne illness in the U.S, accounting for 18-20% of the 76 million cases estimated to occur every year (Food and Water Watch, 2007). Given the risks associated with seafood and the significant portion of seafood imported from abroad, it is therefore important for the health of the American people that strong food safety standards are enforced for seafood imports.

The *Federal Food, Drug and Cosmetic Act* requires that all seafood, both domestic and imported, is "pure, wholesome, safe to eat, produced under sanitary conditions, and contains informative, truthful labelling in English" (Buzby, 2008). As of 1997, in accordance with the terms set forth by the Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures of the World Trade Organization (WTO), the Food and Drug Administration (FDA), the agency that monitors seafood imports, also mandated that all seafood entering the U.S market has to be produced using a Hazard Analysis and Critical Control Points (HACCP) or equivalent system. Employing a HACCP system improves food safety because the producer is required to identify and eliminate any risks to food safety in their production process. It is also more efficient for the FDA to uphold these standards because the bulk of the responsibility in monitoring the safety of seafood products is then transferred to the producer.

While important for consumer safety, the drawback of any heightened safety standards is the potential that it serves as a non-tariff barrier to trade. This may especially affect exporters from developing countries who may not have the appropriate infrastructure in place or resources required to learn how to comply.

[1] In 1999, 66% of seafood consumed in the U.S was imported, while only a decade later the share of imports was 84%. (United States Department of Agriculture, Foreign Agriculture Statistics, 2009)

The analysis in this paper investigates if there is any evidence that the FDA's rules for seafood imports have indeed acted as a barrier to trade for seafood exporters, and particularly those from developing countries. The analysis also extends to ask if these barriers persist over time or if developing country seafood producers learn to adapt to FDA standards. These questions will be addressed using new data from the FDA's Import Refusal Reports that has not been previously analyzed, and using analytical methods that go beyond existing literature on FDA import refusals.

First, trends in FDA Import Refusal Reports are presented to identify patterns in refusals across countries and over the period 2000 to 2010. Second, seafood product refusals are compared against trade data of seafood exports to the U.S. Third, the relationships between refusals and seafood trade data will be further evaluated by calculating correlations between the number of refused shipments and the annual value of trade, as well as between the number of refused shipments and the annual growth rate of seafood exports to the U.S. In order to address the standards as barriers hypothesis seafood exporters will grouped by income level to analyze whether developed and developing countries differ in refusals relative to their U.S. trade status over time.

The final section in this paper explores the hypothesis of "Country Learning". It will be tested to see whether there is any evidence in the data that countries can learn to adapt to new (more stringent) standards over time. Country learning will be analyzed for the top 25 seafood exporters to the U.S. by comparing refusal rates, as the annual number of refused shipments relative the amount traded for an exporting country.

Literature Review

The existing literature suggests that safety standards in developed countries can have a harmful effect on trade (Swann, 2010), particularly for agricultural products from developing countries (Henson and Loader, 2001; World Bank, 2005; Henson and Jaffee, 2008) and even more specifically, for seafood imports from these countries (Anders and Caswell, 2008; Nguyen and Wilson, 2009). Although all these studies concluded that standards could act as a barrier, different theories were presented concerning the impact of these standards.

For example, Henson and Jaffee (2008) agree that standards can hinder trade in agricultural products from some producers in developing countries. The authors proposed that standards may actually benefit firms within these same developing countries who prepare for the implementation of standards and then earn a premium on their products when their compliance serves as a competitive advantage.

Looking specifically at seafood exports to the U.S, Anders and Caswell (2009) stated that after the implementation of HACCP, developing countries as a whole suffered losses in trade to the U.S. While larger seafood exporting countries gained trade, smaller seafood exporters lost, regardless of their development status. Meanwhile in a similar study, Nguyen and Wilson found that HACCP standards had a continuous negative effect on seafood trade on all developing countries, and trade losses differed across seafood product type. Both previous studies estimated the total lost value of trade attributed to the implementation of a standard. Their estimated total impacts are meant to include the direct loss from shipments that were refused at the U.S. border, as well as the indirect loss in forgone exports from producers who were unable to comply with higher U.S. safety standards.

In this paper, the focus will be on examining the direct (and quantified) trade loss based on the information available from FDA Import Refusal Reports.

Several studies have analyzed import refusal reports encompassing all food categories and commented on the relatively large share of total refusals made up by seafood products[2](Buzby et al. 2008; Buzby and Regmi, 2010; Gale and Buzby, 2009). Other studies have concentrated exclusively on import refusal records for seafood (Allhouse, Buzby et.al 2003, FAO, 2005; Food and Water Watch, 2007), finding that developing countries were the origin for most of the refused shipments. Past studies have mostly relied on import refusal records for the period 1996 to 2006. The new import refusal data available in this study (2006-2010) will be used to make comparisons with previous analysis to explore the ongoing effect of standards as barriers for the case of U.S. FDA import regulations. The longer time period used in this study also enables empirical tests of whether or not countries learned to adapt to U.S. food standards over time. One past study by Baylis and Nogueira (2009) first tested the hypothesis that country learning was dependent on the length of time a country had been trading with the U.S. The authors found no relationship between decreasing import refusals and the length of time a country had been trading with the U.S.

Dataset

Two main data sets are used in this study. First, a set of annual trade data for seafood exports to the U.S. for all major trade partners over the period 2000 to 2010 (USDA FAS 2011).

Second, data on Import Refusal Reports were obtained from the FDA after a FOIA data request. Records for detainments and refusals were supplied from October 1995 to September 2010[3]. To assure a level of consistency in the data only records for the years 2000 to 2010 were used in the analysis.

Individual records in the import refusal data provide information on the country of origin of a seafood shipment, a product description, the FDA product code, the charge or reason why the shipment was detained, and the value of the shipment. The records also include the final activity[4], that is, whether or not the shipment was ultimately released or refused. Also, in some years FDA records also indicate if a shipment was detained with or without physical examination[5]. Individual product descriptions were coded using the FDA's code builder. Each product shipment was categorized into one of seven main seafood classes[6] and the most common species: Shrimp, Tuna, Salmon, Lobster, Crab, Mahi Mahi, Catfish and Tilapia.

Reasons for violation (or charges) are mostly classified by the FDA under two main categories: Adulteration and Misbranding. Adulteration usually describes something physically

[2] Between 1998 and 2004, seafood products accounted for 20.1% of all food products refused by the FDA, which is the second largest number of refusals after vegetables with 20.6% (Buzby, 2008).
Import refusal records for the year 2002 were not available.

[3] Import refusal records for the year 2002 were not available.

[4] On average 1% to 5% of all records lacked final activity information and were excluded from the analysis. The exemption is the year 2001 were almost 50% of all records were missing.

[5] Records obtained for the years 2003-2006 did not include information about the detentions without physical examination.

[6] For this report, class codes for the same types of products were grouped together. For example, Fish, Hot Smoked and Cold Smoked Fish, Fish Balls and Cakes etc. were all grouped together as "Fish". Similar groupings were performed for Crustaceans, Shellfish and Other Aquatic Species.

wrong with a product (ex. Filth, Salmonella, Listeria, Unapproved Vet Drugs, Unsafe Additives), and Misbranding charges are usually problems with labelling and documentation. Every record in the dataset represents one detention, however there are shipments that are detained for more than one reason and therefore have multiple detention records. For most of the data analysis in this study, records with the same entry line data (indicating the same shipment) were only counted as one record. There is no way to tell if one reason for violation is more influential in causing a shipment to be refused than another so when the trends were analyzed across violation reasons, all records were included.

FDA Inspection Methods

Before looking at the FDA data itself, it should be noted that not all detained shipments are necessarily in violation of U.S FDA rules. According to Section 801(a) of the Food, Drug and Cosmetic Act, shipments are detained because they "appear to be in violation of one of the laws enforced by the FDA" and "the appearance of a violation may arise by the examination of physical samples, a field examination, review of entry documents, or based upon the history of prior violative shipments made from the same shipper". Only 2% of all imported seafood shipments are subject to sensory or laboratory testing. These shipments are not chosen randomly, but according to the FDA's risk based criterion (Buzby, Unnevehr and Roberts). Entry of most shipments to the U.S market depends on the examination of self-reported documentation from seafood processors or the importers in the U.S. to show that the shipments were produced in compliance with HACCP protocols or equivalent safety standards (Food and Water Watch). Often, products are detained because of problems with the documentation and many of these shipments are released after further examination or appropriate modifications.

Since the FDA does not have the resources to test all imported shipments, they apply 'Import Alerts' which are notices targeting products, manufacturers, and shippers who have a history of violating FDA standards. These notices require that the shipment is detained without physical examination (DWPE) and puts the responsibility on the importer or shipper to present evidence (usually in the form of a test result) that the product complies with FDA standards (Buzby and Regmi).

While the FDA is trying to ensure the highest level of consumer safety, the problem with targeting shipments for testing with Import Alerts is that the producers who are put on notice are more likely to have their shipments refused than those who are simply sending in self-reported documents. This may be show bias from a trade point of view, especially since most of the import refusals are heavily targeted towards producers from lower-middle income countries.

Table 1: Number of Seafood Detainments Without Physical Examination

	2000	2001	2007	2008	2009	2010
Total Detainments	**2569**	**2764**	**6442**	**7368**	**8007**	**5948**
High-income	559	650	720	581	791	622
Upper-middle Income	483	357	755	427	411	303
Lower -middle Income	**1495 (58%)**	**1700 (61%)**	**4821 (75%)**	**6151 (83%)**	**6660 (83%)**	**4863 (81%)**
Low-Income	32	57	146	209	145	160

Source: FDA 2011.

By examining the records for which DWPE information was available, table 1 shows that the vast majority of shipments detained without physical examination are from lower-middle income countries[7]. While lower middle-income countries accounted for 50% to 56% of seafood exports (by value) to the U.S. their share of DWPE since 2008 was above 80%. The country driving most of these import alerts is China, which made up less that 2.5% of all DWPEs in 2000, but accounted for almost 55% of DWPE shipments by 2010. Much attention has been paid to Chinese seafood products, especially after it was discovered that Chinese fishmeal fed to farmed fish was contaminated with melamine, and when U.S. inspectors found traces of illegal antibiotics in Chinese farm-raised catfish (Food and Water Watch, 2007).

Table 2: China's Number of Shipments DWPE and Share of Total Shipments DWPE

	2000	2001	2007	2008	2009	2010
#	60	37	2567	4035	3261	2167
% of total	2.34	1.34	39.85	54.76	40.73	36.43

Overall, the implications of this testing system are that the import refusal reports are not an accurate representation of seafood compliance among all countries because the refusals are the result of where the FDA concentrates their inspections. The reports do however accurately represent which countries lose in trade when their products are refused.

Data Analysis

Trends in Import Refusal Reports

After analyzing refusal patterns across country income groups, reasons for refusal and product category several trends emerged from the data. First, the share of refused shipments for countries that were already experiencing the highest numbers of refusals in early years, has increased over time. Table 3 shows that the share of the top three and top five FDA offenders has increased by about 17% since 2000. While the total number of refused shipments has

[7] Countries were classified in income groups in accordance with the World Bank's Classification System by Income Group at http://econ.worldbank.org/

increased for many seafood exporting countries and multiple reasons, the overall growth in refusals is heavily concentrated among just a few countries.

Table 3: Share of Total Refusals Made up by the Countries with the Most Refusals

	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010
Top 3	26.58	28.95	28.22	34.81	33.79	42.97	50.68	45.72	41.41	43.11
Top 5	39.49	43.68	40.88	45.53	46.76	54.17	60.72	57.33	53.34	56.97

China, Vietnam, Indonesia, Thailand and the Philippines are the five countries that had the most refused shipments annually during the years 2005 to 2010. These are all classified as being lower-middle income countries, which explains why it was observed that the share of all refused shipments from lower-middle income countries is the largest share among all income groups and is the only share that has been increasing over the last decade. Overall, the share of refused shipments originating from developing countries increased from 65% to 85% in the past 10 years, agreeing with earlier studies that problematic seafood products most often come from developing countries.

In the next two data analysis sections, comparisons will be made between the trends in the refusal data and those in the market in order to put the compliance behaviour of developing countries into perspective. Because this comparison is mostly focused on the number of refused shipments, it is important here to comment on the differences in refusal reasons for shipments from developed and developing countries.

For shipments from all income-groups, filth was the main reason for refusal every year however the degree to which it was a problem differed between developing and developed countries. In 2010 for example, only 34.43% of refused shipments from high-income countries were charged with filth, but for developing countries, this statistic ranged from 46% to 68% across income groups. Salmonella is also a violation that was found in a higher proportion of refused shipments from developing countries (especially shipments from low-income countries) than the proportion of shipments from developed countries.

Table 4: Most Popular Violations as a Share of Refusals From Each Income Group

		2000	2001	2003	2004	2005	2006	2007	2008	2009	2010
High Income Countries	Total Refusals	138	70	608	547	380	306	264	405	290	183
	FILTHY / INSANITARY	46.38%	32.86%	30.59%	21.21%	34.21%	22.22%	27.65%	26.67%	37.93%	34.43%
	NEEDS FCE	17.39%	12.86%	18.75%	19.20%	11.05%	12.42%	17.05%	18.77%	17.59%	22.40%
	NO PROCESS	27.54%	18.57%	21.88%	25.23%	20.26%	15.03%	19.32%	21.73%	21.38%	28.96%
	NUTRIT LBL	15.22%	20.00%	7.40%	4.39%	12.89%	6.21%	10.23%	17.53%	12.76%	13.66%
	SALMONELLA	3.62%	12.86%	6.91%	6.95%	8.95%	12.09%	16.67%	12.84%	13.79%	7.10%
Upper-Middle Income Countries	Total Refusals	80	28	349	306	243	155	210	174	244	180
	FILTHY/ INSANITARY	32.50%	60.71%	44.70%	44.77%	46.50%	34.84%	45.24%	56.90%	56.15%	68.33%
	NO PROCESS	3.75%	10.71%	11.46%	7.52%	10.29%	8.39%	3.33%	5.75%	8.20%	3.33%
	SALMONELLA	35.00%	7.14%	17.48%	33.66%	27.57%	23.87%	13.81%	28.16%	20.90%	15.00%
Lower-Middle Income Countries	Total Refusals	170	89	1104	1129	1077	747	1165	1036	1075	830
	FILTHY/ INSANITARY	69.41%	66.29%	47.55%	58.72%	45.96%	38.69%	47.30%	49.23%	55.07%	46.39%
	NEEDS FCE	4.12%	2.25%	6.70%	3.63%	2.23%	5.35%	3.26%	3.96%	2.79%	5.42%
	NO PROCESS	4.12%	2.25%	7.61%	4.69%	4.18%	6.29%	4.98%	6.18%	4.37%	7.59%
	SALMONELLA	36.47%	43.82%	37.05%	38.18%	39.65%	27.71%	21.72%	22.78%	24.47%	32.17%
	VETDRUGRES	0.00%	0.00%	7.34%	5.40%	6.13%	13.92%	15.97%	12.74%	10.23%	7.59%
Low Income Countries	Total Refusals	7	3	72	210	120	51	54	91	67	69
	FILTHY / INSANITARY	57.14%	66.67%	73.61%	77.14%	72.50%	45.10%	74.07%	63.74%	64.18%	59.42%
	SALMONELLA	0.00%	33.33%	19.44%	76.19%	41.67%	41.18%	12.96%	69.23%	50.75%	56.52%

Refused shipments from developed countries were more often charged with reasons such as 'No Process[8]', 'Needs FCE[9]' and ' Nutrient Labeling [10]', all reasons defined as being more paperwork-related problems rather than hazardous safety issues (such as filth and salmonella). The fact that refused shipments from developing countries were more likely refused because of physical deficiencies rather than improper paperwork, highlights the ongoing problems that firms in developing countries have in meeting basic hygiene standards. This issue was discussed by Ababouch (2005), who explained that a shipment charged with being 'filthy' often indicated that the shipment's products were contaminated with insects or insect parts. Ababouch further explained that the contamination itself usually occurs when pre-processing operations such as shrimp grading, heading and peeling or shellfish shucking, take place under unsanitary conditions in areas outside of the processing plant (fish farms, fish landing places, beaches, family homes etc.) Although his report stated that improvements had been made in educating workers on the basic principles of hygiene, Ababouch also stressed the difficulty of educating a labour force with such a high turn-over rate, which is probably why filth continues to be a driving force in generating refusals for developing countries.

[8] No Process: It appears that the manufacturer has not filed information on its scheduled process as required by 21 CFR 108.25(c)(2) or 108.35(c)(2).

[9] Needs FCE: It appears the manufacturer is not registered as a low acid canned food or acidified food manufacturer pursuant to 21 CFR 108.25(c)(1) or 108.35(c)(1).

[10] Nutrient Labelling: The article appears to be misbranded in that the label or labeling fails to bear the required nutrition information.

Comparison of Import Refusal Reports and Trade Data

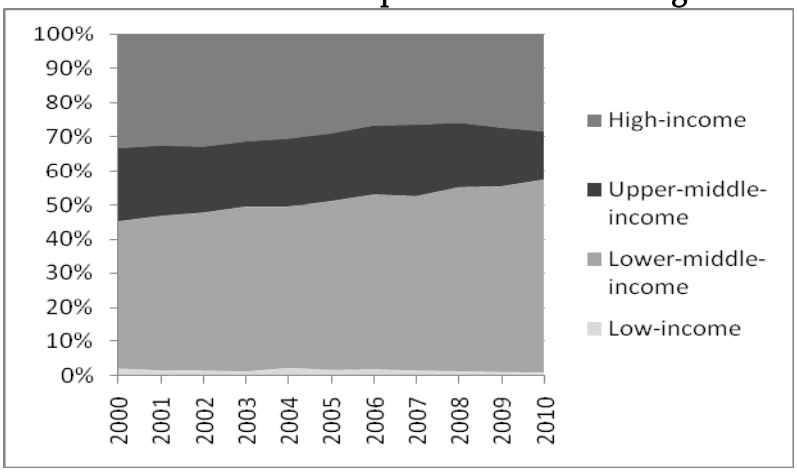
In the previous section, five lower-middle income countries from South-East Asia were identified as the main offenders of FDA Seafood Safety Standards. Four of these five countries, are now the largest seafood-exporting countries to the U.S (by value of exports in U.S $), having experienced tremendous growth in the past ten years.

In 2009, China overtook Canada as the largest exporter of seafood (by value) to the United States, and by 2010, their annual value of these exports was 308% larger than in the year 2000. Thailand's annual value of seafood exports has grown 25%, although they are now the third largest exporter of seafood to the U.S. whereas in the year 2000, they were the second largest. The value of seafood exports to the U.S from Indonesia and Vietnam increased by 174% and 188% respectively during this time period, and these countries rose above Chile and Mexico (both Upper-Middle Income Countries) ranking as the 4th and 5th largest seafood exporters.

As of 2010, the top 25 countries with the highest annual value of seafood exports to the U.S included 9 high-income countries, 7 upper-middle-income countries, 8 lower-middle income countries and one low-income country. Bangladesh is the only low-income country in this group, and they are the only low-income country in the group of 50 highest seafood exporting countries.

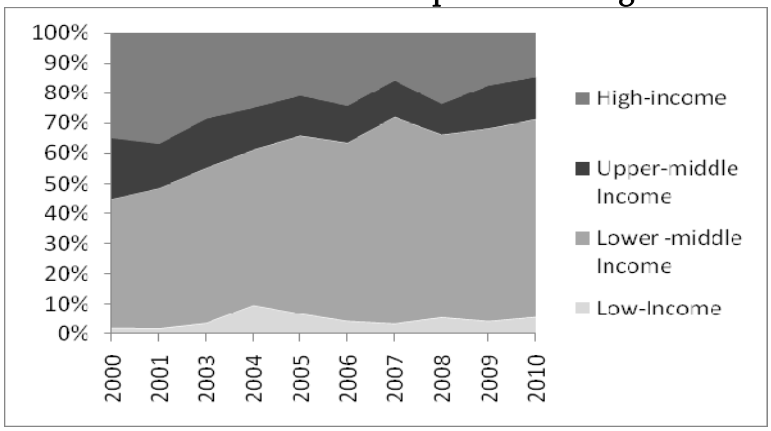
Overall, in the past decade the total annual value of seafood exports to the U.S from all income groups has increased, but as Figure 1 displays, these exports are increasingly made up from lower-middle income countries.

Figure 1: Market Share of Seafood Exports to the U.S Among Income Groups



Trends displayed in Figure 1 and Figure 2 indicate similar patterns in terms of the share of the market and the share of refusals made up by the different income groups. Lower-middle-income countries account for both the most refusals, and are the income group with the most exports to the U.S. This income group is also the one whose shares in refusals and exports are growing.

Figure 2: Share all Refused Seafood Shipments Among Income Groups



Also in the previous section, it was stated that over the examined time period, a smaller number of countries have produced an increasing share of all refused shipments. Similarly, in the global seafood market, a smaller number of countries have been exporting a larger share of all seafood imports into the U.S.

Table 5: Share of Total Exports From The Top Three and Top Five Largest Seafood Exporting Countries to the U.S

Countries	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Top 3	43.51	43.45	42.75	43.17	42.31	43.04	45.01	44.52	45.81	46.45	47.89
Top 5	53.92	53.46	54.01	55.99	54.00	55.54	58.18	58.63	60.68	59.12	60.55

From table five, it is clear that in the year 2000, the largest 5 seafood exporting countries accounted for 53% of all seafood imports (by value), and by 2010, this statistic grew to just over 60%. Referring back to Table 3 in the previous data analysis section, it was shown that the share of refusals from the countries who were responsible for the most refusals overall also increased (by approximately 17%). Given the similarities in the trends between refused shipments and the growth of exports, it appears as though a small group of lower-middle income countries has been dominating the seafood import market in the U.S, meanwhile also heavily contributing to the total number of refused seafood shipments. These trends seem somewhat contradicting as one would expect that a high number of refusals would result in lower exports or at least a decreasing growth in exports over time. What is the impact of refusals: do they hinder growth or are they simply proportional to how much a country trades? Do these impacts change between developing and developed countries? These questions will be explored in the following section.

Relationship Between Refusals and Trade Data

The previous two sections described which countries have the highest number of refusals. Generally it was found that standards act as a barrier to trade because they often reject a high number of shipments from these countries. However, how much of an impact do refused

shipments have on the total seafood exports of the country-of-origin? The main goal for this section is to see if any relationship exists between refusals and the value of exports or the growth in the annual value of seafood exports among the top exporting countries.

In order to evaluate this relationship, the correlation of the number of refused shipments each year and the annual value of seafood exports to the U.S in the following year was calculated for the top exporting countries. Next, the correlation of the number of refused shipments and the growth in exports from that year was calculated for these same countries[11]. Only the top 25 seafood-exporting countries as of 2010 were included in this calculation (and this group has remained mostly the same since 2000) since they have constituted on average about 90% of all exports to the U.S over the past decade (USDA, 2011).

A positive correlation between the annual export values or their growth and the annual number of refused shipments, would indicate that the number of refusals were simply proportional to the value of exports. A negative relationship would indicate that a high number of refusals may have contributed to decreasing total exports (by value), and a low number of refusals may be associated with a larger number of exports, thus supporting the hypothesis that lower refusal rates from a country help increase exports from that country.

Table 6: Average Correlation Between Refusals and Export Values Among Income Groups

Income Group	Growth	Value of Exports
High	-0.002	0.195
Upper-Middle	0.128	0.049
Lower-Middle	0.431	0.159

After completing both sets of calculations, the correlation values were too low for almost all of the countries to identify either a positive or negative strong relationship (see Table 7 in the Appendix). Only two countries, China and India, had correlation values that were above 0.8. Also there were no strong differences in correlation values across income groups.

These simple calculations indicate that the refusal of shipments directly at the border does not appear to be a strong factor in affecting a country's annual value of seafood exports or its growth of exports to the U.S. Intuitively, this makes sense when considering the values of the refused shipments relative to a country's total exports. The total lost value of these shipments every year for each of the top 25 seafood-exporting countries was usually less than 1% of each country's total seafood exports to the U.S. For an entire country, this value is small therefore it is expected that these refused shipments were not extremely persuasive at the national level for pushing better safety standards (see Table 9 in Appendix). At the firm level, however, several thousand dollars' worth of lost product can be expensive, especially for small exporters from developing countries.

The following table reveals the average value of a refused shipment among the different income groups (which includes only countries from the top 25 seafood exporting countries). One trend that appears is that the average value of a refused shipment from the high-income

11 The correlation calculation using the growth of annual export values was only calculated between 2003 and 2009 as the data from 2002 was missing from the Import Refusal Reports. Also the correlation was

group is always lower than the average value from other groups. For example in 2010, the average value of a refused shipment from a high income country was $21,465.80, while it was $26,023.10 for a lower-middle income country.

Table 5: Average Value of Refused Shipments

Income Group	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010
High	11247.8	25349	9301.54	16463.9	19657.7	16522.9	18171.6	22132.8	17595.5	21465.8
Upper-middle	19818.2	32861.6	13851.1	19659.5	28002.6	59800.2	27139.7	28006.1	18334.3	23381.5
Lower - middle	27756.1	21648.8	20407.5	21585.6	26520.9	24487.3	29986.2	33865.2	27751	26023.1

This information suggests that producers in developing countries may be affected more by refused shipments simply because on average, they are losing more money in lost product than producers from high-income countries.

Considering that the data presented in Table 5 generalizes information from thousands of different producers, research employing data on refusals and trade at the firm level would present a more accurate portrayal of the losses producers experience in each country.

Country-Learning

While the previous section looked for relationships in the direction of the growth of refused shipments and seafood exports, this section focuses on the relative magnitude of refused shipments and seafood exports in order to evaluate whether or not any 'learning' occurs at a national level. Here, 'Country Learning' was defined as an observable decrease in the annual refusal rate for a country, over time. The refusal rate was defined as the number of refused shipments from a country relative to that country's annual value of seafood exports to the U.S and was calculated for the top 25 seafood exporting countries over the period from 2000 to 2010.

After calculating the refusal rates of each country and examining them during the given time period, there were no countries found to exhibit an overall decreasing trend in their refusal rates. Nevertheless, this does not necessarily indicate that countries are not learning to adapt to standards, since there are a few reasons which could explain why decreasing trends in the refusal rate were not observed.

First, compliance with the HACCP system was implemented in 1997, but this paper only uses data from 2000 to 2010 as earlier available data from the Import Refusal Reports was incomplete and difficult to merge with the newer data set. It is possible that most of the learning specific to HACCP standards, took place between 1997 and 2000, and any further adaptation has since been minimal.

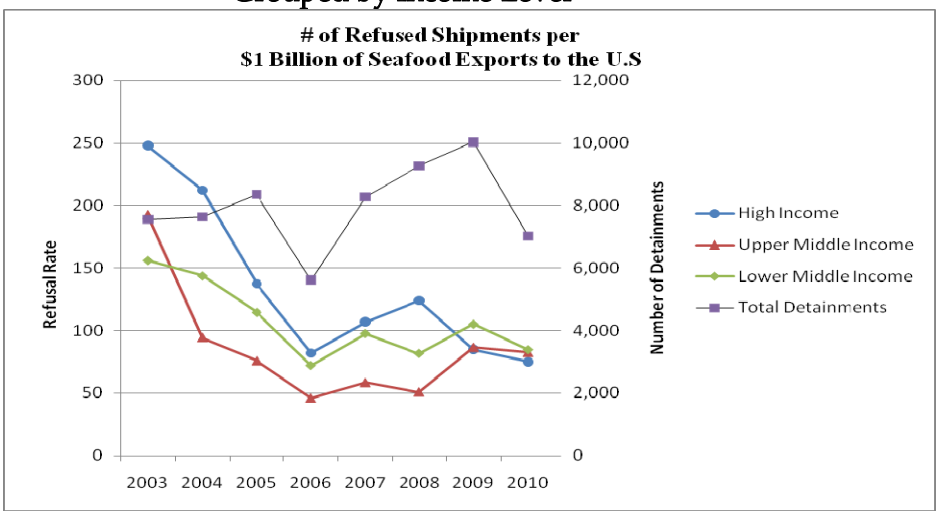
Also, as mentioned previously, the information collected by the FDA is not the result of an objective testing process and instead, the number of refused shipments is dependent on how many shipments the FDA chooses to test, and which shipments they decide are the most risky at a given time. For this reason, more information about individual firms and about the total number of shipments tested from the FDA would be needed to help identify any 'learning'

occurring in a country.

Furthermore, another reason why these refusal rates may not be a strong indicator of learning, is that the number of refusals is small for some countries (ex. Norway, Russia, Denmark etc.) who often have no more than 3 or 4 refused shipments per year. Even a small variation in this number from year to year then becomes a large 'relative' change for that country.

From a trade point of view however, these results give a clear indication of how each group is performing, relative to one another.

Figure 6: Comparison of the Average Refusal Rates for the Top 25 Exporting Countries Grouped by Income Level



As seen on the graph above, one interesting find is that the average refusal rate for the top exporting high-income countries was actually higher than that of the top lower and middle income countries from 2000 to 2008, and similar in the following years. This implies that for much of the decade, higher income countries (as a group) contributed more refusals relative to how much seafood they exported, than developing countries. Earlier in this paper, it was indicated that lower-middle income countries are generally targeted more by the FDA, thus they have a higher chance of being refused, therefore it is especially interesting, but also worrisome that higher-income countries have been those with more 'relative refusals'.

While no country learning was observed in this section, again more research would be useful at the firm-level in order to see if firms do learn to adapt to standards over time. Furthermore, if learning is experienced, it would be interesting to identify characteristics of firms that contribute to learning, in order to better help those other firms who struggle.

Summary

In general, the descriptive analysis of the import refusal reports has indicated that developing countries, are indeed accountable for a significant share of all refused shipments, and the reasons for their refusals tend to be more severe than for refused shipments from developed countries. On the other hand, calculations from the 'country learning' test indicate

that developing countries, notably lower-middle income countries, have performed better or were comparable to high-income countries, relative to the value of the total exports they traded (when looking at the top seafood exporting countries). Overall, there was no direct correlation between the number of refusals, and the growth in seafood exports, or the annual value of seafood exports for the top seafood exporting countries. The refusals did not seem to have a significant effect on trade, let alone a differential effect on developing or developed countries.

Without finding any observable links between increased refusals at the border and decreasing exports for the top seafood exporting countries, the results from this study are in line with those found from Anders and Caswell (2009), whose models showed that the large seafood exporting countries did not suffer in trade after the implementation of HACCP standards in the U.S., regardless of development status. More research is needed though to identify the effect of refusals at the border on smaller exporting countries.

Furthermore, the results from this study also correspond with Henson and Jaffee (2008) who predicted that the opportunity for growth existed within developing countries for firms who have learned to adapt to standards earlier than their competitors.

Information from manufacturers would be helpful to track the learning and progress of these specific manufacturers over time to confirm that there truly is a differential effect of learning across individual firms and not at a country levels. It would also help answer the question of "Standards as Barriers" at the firm level within large exporting-countries, and for smaller seafood exporting countries as a whole.

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Appendix

Table 7: Annual Number of Refusals from the top 25 Seafood Exporting Countries

Countries	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010 (Jan.-Sept.)
China	24	9	130	115	142	204	371	204	199	152
Canada	27	8	104	68	57	32	14	32	28	14
Thailand	35	17	108	115	125	40	80	75	76	107
Indonesia	22	18	223	257	167	181	265	263	215	225
Vietnam	31	19	225	338	306	156	222	313	280	167
Ecuador	7	6	14	31	52	38	40	9	33	15
Chile	7	3	28	31	13	20	17	5	19	7
Norway	3	2	2	11	11	6	2		5	
India	15	11	140	92	88	34	53	16	45	20
Mexico	39	9	101	55	71	45	34	27	54	14
Russia		3	6	6	1	6	4	5	9	9
Japan	7	2	89	72	23	93	28	71	12	12
Philippines	16	6	154	120	111	47	90	91	124	68
Honduras	8	1	20	1	29	11		3	30	1
Malaysia	1	1	18	14	34	12	42	44	37	29
United Kingdc	7		51	53	8	3	9	41	29	16
Taiwan	9	5	68	68	59	48	57	62	38	37
Peru	1	2	42	10	9	2	12	7	11	14
New Zealand			1	1	1	3	4			1
Brazil	10		59	44	28	11	18	21	34	29
Korea, Republ	19	9	96	75	66	28	61	107	56	25
Iceland		2	4	7	23			2	2	1
Bangladesh	2	2	17	168	76	38	44	75	43	43
Denmark	2		4	4	3					1
Panama		2	10	40	7	11	4	7	12	15

Table 8: Growth of Annual Exports for top 25 Exporting Countries and Correlation Values Determined in the subsection of the Data Analysis "Relationships between Refusals and Trade Data"

	Growth of Annual Exports (by Value) 2000-2010	Correlation with Total Value of Exports	Correlation with Growth
China	248.24%	0.81	-0.39
Canada	4.90%	0.08	0.22
Thailand	10.14%	-0.16	0.33
Indonesia	152.21%	0.39	-0.25
Vietnam	125.58%	0.55	0.00
Ecuador	57.57%	-0.01	0.55
Chile	46.47%	-0.17	0.46
Norway(*)	102.86%	-0.37	-0.44
India	-18.03%	0.89	-0.21
Mexico	-11.80%	-0.34	0.61
Russia	14.56%	0.17	-0.37
Japan	63.68%	0.17	-0.19
Philippines	46.51%	0.08	0.37
Honduras	3.70%	-0.26	0.00
Malaysia	405.70%	0.76	-0.18
United Kingdc	181.59%	0.28	-0.47
Taiwan	-31.50%	-0.48	-0.23
Peru	289.62%	0.01	0.10
New Zealand(	-23.47%	0.40	0.60
Brazil	-48.95%	0.25	-0.04
Korea, South	26.42%	0.60	-0.38
Iceland	-55.09%	0.17	0.53
Bangladesh	-34.54%	0.48	-0.45
Denmark(*)	56.59%	0.58	-0.74
Panama	-19.71%	0.42	0.57

Table 9: Annual Share of Refused Shipments from Total Seafood Exports to the U.S.

Country	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010 (Jan - Sept)
China	0.15%	0.06%	0.24%	0.30%	0.37%	0.32%	0.79%	0.54%	0.48%	0.36%
Indonesia	0.03%	0.15%	1.05%	1.12%	0.71%	0.55%	0.77%	0.78%	0.59%	0.95%
Vietnam	0.42%	0.05%	0.64%	1.18%	1.08%	0.50%	0.68%	0.99%	0.91%	0.72%
Bangladesh	0.00%	0.06%	1.10%	3.74%	2.22%	0.44%	0.50%	2.30%	2.40%	2.35%
India	0.40%	0.10%	1.07%	0.70%	1.04%	0.32%	0.82%	0.32%	0.87%	0.25%
Taiwan	0.89%	0.07%	1.55%	1.71%	1.67%	1.60%	1.27%	2.30%	1.23%	1.63%
Thailand	0.02%	0.01%	0.11%	0.11%	0.23%	0.04%	0.15%	0.11%	0.07%	0.06%
Philippines	0.08%	0.01%	0.86%	0.65%	0.48%	0.28%	0.37%	0.87%	1.11%	0.50%
Brazil	0.17%	0.00%	0.78%	1.09%	0.79%	1.79%	0.64%	1.51%	1.37%	1.34%
Mexico	0.13%	0.01%	0.14%	0.30%	0.58%	0.47%	0.15%	0.07%	0.08%	0.10%
Malaysia	0.00%	0.06%	1.21%	0.15%	0.52%	0.22%	0.70%	0.56%	0.44%	0.70%
Chile	0.02%	0.03%	0.04%	0.09%	0.02%	0.10%	0.11%	0.03%	0.16%	0.09%
Ecuador	0.03%	0.06%	0.08%	0.05%	0.10%	0.08%	0.14%	0.05%	0.11%	0.05%
Canada	0.01%	0.01%	0.01%	0.04%	0.02%	0.01%	0.01%	0.04%	0.01%	0.01%
Venezuela	0.80%	0.22%	0.54%	0.31%	0.56%	0.02%	0.27%	0.10%	0.70%	0.84%
Korea, South	0.11%	0.02%	0.77%	1.08%	0.64%	0.14%	0.29%	0.50%	0.30%	0.33%
Honduras	0.22%	0.02%	0.62%	0.00%	0.34%	0.52%	0.00%	0.07%	0.39%	0.01%
Japan	0.02%	0.01%	0.61%	0.26%	0.07%	0.04%	0.14%	0.03%	0.25%	0.24%
United Arab Emirates	0.29%	0.02%	1.28%	3.76%	0.13%	3.27%	0.76%	3.78%	0.19%	0.43%
Peru	0.00%	0.13%	0.53%	0.41%	0.58%	0.30%	0.43%	0.00%	0.20%	0.42%
Panama	0.00%	0.00%	0.26%	0.11%	0.10%	0.00%	0.15%	0.43%	0.42%	0.67%
Russia	0.02%	0.00%	0.03%	0.08%	0.02%	0.05%	0.15%	0.02%	0.02%	0.02%
Norway(*)	0.00%	0.01%	0.05%	0.28%	0.22%	0.11%	0.02%	0.03%	0.01%	0.11%
Nicaragua	0.00%	0.26%	0.01%	0.02%	0.01%	0.67%	0.10%	0.01%	0.04%	0.13%
Netherlands	0.08%	0.30%	0.18%	0.68%	2.11%	0.15%	0.03%	0.00%	0.43%	0.00%

Table 10: Refusals Rates: Number of Refused Shipments per $1 Billion in Seafood Exports to the U.S for Top 25 Seafood Exporting Countries

	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010 (Jan - Sept)
China	41.40	13.72	113.60	92.95	98.54	106.13	185.59	94.80	98.56	93.14
Canada	14.11	4.11	48.85	32.11	26.50	14.65	6.34	14.17	13.94	7.83
Thailand	19.28	10.57	75.71	84.70	82.33	22.09	44.64	37.87	38.02	68.52
Indonesia	60.84	47.19	521.05	405.65	229.40	232.82	301.51	240.68	235.76	295.73
Vietnam	103.13	39.86	307.93	597.32	486.72	239.30	321.41	411.01	412.96	300.69
Ecuador	19.28	15.34	28.76	68.20	99.26	66.61	70.16	14.98	57.70	29.93
Chile	14.02	6.20	42.12	46.35	17.21	20.99	16.63	5.09	25.99	16.09
Norway	20.56	17.39	16.17	103.72	109.79	45.69	13.37	0.00	16.89	0.00
India	52.88	37.15	309.31	226.27	234.01	105.66	203.56	71.84	193.55	89.39
Mexico	73.32	18.50	255.56	125.95	160.00	99.19	67.98	55.72	115.10	63.09
Russia	0.00	13.97	23.73	26.89	3.16	15.93	9.50	16.63	30.58	46.47
Japan	45.90	16.65	572.21	516.15	127.61	489.65	132.70	289.87	48.08	71.60
Philippines	107.61	40.50	794.63	606.66	471.53	195.13	363.19	341.82	569.23	411.57
Honduras	61.95	8.13	160.57	7.55	187.60	75.28	0.00	19.95	224.03	8.77
Malaysia	37.58	33.63	775.16	96.72	242.44	72.62	239.44	204.87	274.99	238.87
United Kin	148.36	0.00	875.81	1041.48	210.25	51.03	112.86	493.76	218.28	156.73
Taiwan	48.96	27.73	559.32	487.59	453.59	415.17	453.99	413.89	301.78	401.15
Peru	37.34	83.57	1027.47	184.39	159.36	37.35	151.67	78.85	105.43	163.52
New Zealai	0.00	0.00	8.09	7.41	7.45	23.23	33.41	0.00	0.00	10.96
Brazil	73.14	0.00	283.12	262.60	199.30	84.74	148.26	216.24	487.14	429.88
Korea, Rep	250.41	121.03	1367.42	1112.89	948.33	395.14	820.94	1226.64	583.79	325.55
Iceland	0.00	13.17	27.39	45.26	169.65	0.00	0.00	21.79	23.53	13.13
Bangladesh	13.54	21.25	200.02	948.68	546.01	197.05	279.12	561.96	444.73	595.56
Denmark	41.77	0.00	117.96	211.19	158.85	0.00	0.00	0.00	0.00	15.52
Panama	0.00	19.25	91.41	377.89	62.23	106.20	39.30	70.79	159.77	225.20