Assessing the Potential Impact of Strengthening Food Safety Regulations on Developing Countries: The US Food Safety and Modernization Act

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Abstract

This paper's goal is to assess the extent to which producers in developing countries have coped stricter US food safety regulations. We approach the question by calculating refusals/imports ratios and their trends for a sample of developing countries. We conclude there is a learning process in low value added products.

Introduction

Food safety standards have emerged primarily from developed nations due to a number of different factors (Maertens & Swinnen, 2009). Highly publicized food scares have resulted in a generalized sense of vulnerability with respect to food contamination, triggering increased demand for safer food (Cuite & Hallman, 2009; Faysal, Mittelheimer & McCluskey, 2009). Rising incomes and healthier diets have increased demand for fresh products (Maertens & Swinnen, 2009). It has opened a window of opportunity for exporters in developing countries to focus on fresh and processed foods, which are an alternative to traditional commodities.

However, inherent contamination risks associated with the production, transformation and sale of these foods pose serious challenges for international trade (Henson & Jaffee, 2008). Consequently, authorities in developed countries have responded to consumer concerns by improving regulations, surveillance, and oversight. This is the case for the United States and the Food Safety and Modernization Act (FSMA). The FSMA focuses on improving food safety by preventing hazards from farm-to-table. In so doing, it takes the view that all stakeholder efforts in the global food supply chain should be oriented toward making the food supply safe for U.S. consumers (Knutson & Ribera, 2011).

As authorities in developed countries put pressure on retailers, they, in turn, shift the onus to producers by developing various standards. Efficient technologies for controlling production processes (temperature sensors,

humidity sensors, computers technology, etc.) have spurred food producing facilities to reduce risk in their operations by adopting risk reducing standards (Gereffi & Lee, 2009). To gain access to markets, food industries have had to adopt best management practices and risk reducing standards such as HACCP (Hazard Analysis of Critical Control Points), SQF (Safe Quality Food), and ISO norms (International Standards Organization).

Given the aforementioned factors, it is unsurprising that developing countries are being subjected to increased scrutiny on food safety issues. Their safety surveillance systems, quality controls, and protocols are generally less developed (Okello & Narrod, 2007) and are sometimes quite different due to varying tolerance to risk, lack of technology and institutional capacity, weaknesses in physical infrastructure, and higher incidences of certain infectious diseases (Jaffee & Henson, 2004). As it relates to their products, standards for product and raw materials traceability and border inspections are routinely applied (Henson & Jaffee, 2008).

The goal of this paper is to assess the extent to which producers in developing countries have coped with stricter US food safety regulations. Several studies have tackled the issue at hand. For instance, Buzby and Regmi (2009) found that low- and middle-income countries have had the largest increases in import violations in recent years, accounting for 605 refusals and 498 refusals per billion dollars, respectively. Additionally, they found that most refusals were concentrated in products such as fresh vegetables, fresh fruit, fish and seafood (Buzby & Regmi, 2009). We also cite the work by Jolly et al. (2008) where it is stated that exporters in developing countries have responded to increasing food safety requirements, prior to FSMA, by undertaking the necessary investments in order to comply with US food safety requirements. They determined that time was negatively related to food refusals (Jolly, Namugabo, & Abebe, 2008).

We approach the question by calculating refusals/imports ratios for a sample of Latin American and Caribbean countries. Afterwards, by using linear regression analysis we obtained time trends at food product level, and at country level. Additionally, we validated results from previous studies for the period under consideration (2002-2010). We used Food and Drugs Administration (FDA) refusals data in order to calculate refusals' proportions for developing and developed countries. We also validated whether or not, fruits, vegetables, fish and seafood are still

concentrating most refusals.

The paper is organized as follows. The second section provides background information on the main factors driving increased food safety concerns, and a brief description of the FSMA. The key elements of Value Chain Analysis in the context of the US food safety system are also presented in this section. The third section presents the methodology we used to answer our main question and validate results (for 2002 – 2010) from previous studies on the topic. In sections fourth and fifth, we present and discuss our results, their implications, and our concluding remarks.

Background

US Food Import Trends

We used data from USDA - GATS[1] in order to study US food imports (for consumption) from 1970 to 2010. Table 1 indicates that US food imports value has increased, more than sixteen times over the period. Between 1970 and 2010, the value of US food imports increased from USD $5.7 billion to USD $96.4 billion, representing a yearly increase of 6.1%. Although the share of imports coming from developing countries decreased over the period (from 72% in in 1970 to 59% in 2010) in nominal terms, the value increased substantially from USD 4.1 billion in 1970 to USD 57.2 billion in 2010. The latter represented an annual growth rate of about 5.4%.

There has been a change in the pattern of US food imports[2] originating in developing countries. In the 1970s, bulk products[3] accounted for almost two-thirds, while fish[4] and consumer oriented[5] products together represented a little less than a third. By 2010, the pattern was reversed: bulk products share was 19% while consumer oriented

[1] This acronym refers to the United States Department of Agriculture, Global Agricultural Trade System.
[2] We use USDA-GATS categories, which are based on the BICO Report. This is the Foreign Agricultural Service's report of U.S. agricultural export and import data on Bulk, Intermediate, and Consumer-Oriented (BICO). This data base includes forest products and edible fish and seafood products. We did not consider forestry products since our focus is food safety. Categories for developing and developed economies are considered in this data source. We considered imports oriented towards US consumption.
[3] Bulk products: wheat, coarse grains, rice, soybeans, cotton, tobacco, pulses, peanuts, other bulk commodities.
[4] Fish products: salmon whole or eviscerated, canned salmon, crab and crab meat, fish paste, fish eggs and other edible fish and seafood.
[5] Consumer oriented products: Snack foods, breakfast cereals, red meats (frozen, chilled or fresh), red meat preparations, poultry meat, dairy products, eggs and egg products, fresh fruit, fresh vegetables, fruit and vegetable juices and preparations, tree nuts, wine and beer, nursery products, pet foods and other consumer oriented.

and fish products share was 68%. Annual growth rates for US consumer oriented food imports between 1970 - 2010 was 7.6%; for US fish and seafood food imports was 8.1%; for US bulk food imports was 1.6%; and for intermediate products[6] was 5.4%. Intermediate products' share in total US food imports has been around 11% during the four decades under study (Table 2).

Another important feature of US food imports originating in developing countries during the past 40 years is related to the proportion of high risk products clearing US customs. We use the fact that produce (fruit and vegetables), fish and seafood are considered high risk for contaminants and substances such as microbial pathogens, naturally occurring toxins, toxic pesticides traces and environmental contaminants (Buzby & Regmi, 2009). The data indicate that in 1970 the proportion of high risk products coming to the United States from the Third World was 11%; by 2010 it was 40% (Table 3).

Consumer Food Safety Concerns and US Government Response

Widely known cases of food contamination in the United States (Table 4) triggered a generalized sense of vulnerability with respect to food contamination (Cuite & Hallman, 2009; Faysal, Mittelheimer, & McCluskey, 2009). Note most cases that these have occurred within the last two decades, reflecting the increased testing with more sophisticated techniques over the period. Scientific advances such as genetic fingerprinting of foodborne pathogens have made it much easier to identify foodborne pathogens that normally would go undetected (Doyle, 2000).

In developed countries, owing to publicized outbreaks and increasing foodborne disease detection capacity, food safety is no longer taken for granted. Nowadays, consumers are aware of the link between food products and health, not only in the sense of healthy habits, but also in terms of food safety. Consequently, authorities in developed countries have responded to consumer concerns by improving regulations, surveillance, and oversight.

In this paper we focus on the FSMA signed into law in January 2011. The FSMA passed as law was motivated by the recognition of: a) expectations of US food import value to keep increasing exponentially; b) fragmentation of

[6] Intermediate products: wheat flour, soybean meal, soybean oil, vegetable oils excluding soybean, feeds and fodders, live animals, hides and skins, animal fats, planting seeds, sugar/sweeteners/beverage bases, other intermediate products.

the US food safety system and c) budgetary constraints. It was understood that the US food safety system was fragmented and inefficient with more than fifteen agencies collectively administering three laws related to food safety (Suppan, 2008). Concerns were not only raised because of lack of institutional coordination but also because a strategy based on inspection and testing at ports needed to be revised since resources needed to control for food safety were to increase proportionally to the increasing food imports flow.

By the time the US Congress was discussing the FSMA however, some lessons were already learnt. For instance, after 1999, US food industries using Hazard Analysis and Critical Control Points (HACCP) and being certified, by accredited third parties, allowed for reducing Federal inspection and testing requirements. Then, the decision to extend HACCP principles and third party certification to all entities involved in the import life cycle[7] came as no surprise (Suppan, 2008). Another issue already known and practiced in some US food sectors was the need to keep track of food products from value chain primary links to consumers. In this case, it was possible to identify sources of a foodborne disease outbreak or a contamination episode, for instance, in the US beef industry (Smith, Tatum J.D., Belk, & Grandin, 2003).

The Food Safety and Modernization Act (FSMA) is considered the most significant overhaul to the U.S. food safety system in over 70 years (US Congress, 2010). Broadly, the main issues addressed by the law are related to standardization, instruction, testing, inspection, traceability, and strict accomplishment of U.S. standards by imported food. For imports specifically, importers will be required to provide risk-based verification of suppliers to ensure that they are not adulterated or misbranded and that they are in compliance with HACCP procedures. Records must be kept for a two-year period and provided on demand to the FDA. In cases where safety risks are known to exist, the law requires certification that the product and facilities comply with the stated U.S. safety requirements. To facilitate importer certification, the FDA is authorized to arrange with foreign governments and other third-party certifiers (certifying agency) to inspect overseas facilities, suppliers, and food types (Knutson & Ribera, 2011).

[7] Foreign growers and manufacturers, foreign governments, foreign exporters, U.S. importers, manufacturers and retailers, testing and certification bodies, and regulatory authorities at the federal, state and local levels

A major implication of the FSMA is that U.S. sanitary standards now apply to all food products and ingredients entering the United States. Foreign producers who are interested in selling their products in the United States will be subjected to the same regulations and norms as U.S. producers. For businesses related in any way to food products (growing, packing, manufacturing, transportation), they must have a system in place to be able to identify the main sources of risk within their operations, to take actions in order to ameliorate risk, and to be able to prove that they are doing so by keeping records and third-party certification. Hence both certification and traceability will be of paramount importance in implementing and overseeing the new law.

US Food Value Chains

A value chain is defined as a system of interlinked activities that various actors perform to transform inputs into outputs through value addition at each stage and with the assistance of other parties who provide supporting services. The FSMA takes into consideration that many US food value chains have their primary links abroad. So it is instructive to use Value Chain Analysis (VCA) methods in order to assess whether or not producers in developing countries have coped with US stricter food safety requirements.

Value chain analysis (VCA) is a systematic examination of the main actors and supporting activities involved in taking a product from the initial to the final stage of production (i.e., conception/design to delivery/marketing) (Kaplinsky 2004). By using value chain analysis methods, researchers can map public and private policy domains, study rent dynamics, and governance along a product's chain. It also gives insight on income distribution determinants and value added at each link of the chain.

According to VCA theorists, there are key agents who coordinate the activities of every single link along a value chain. This coordination involves logistics, quality standards to be met, and compliance with regulation in final markets. In the value chain literature this role is known as governance[8]. In the case of food products entering the United States, large retailers are able to dictate standards to producers and exporters worldwide via intermediaries

[8] Governance takes three forms: *legislative*, which defines the basic requirements of the chain; *judicial*, which ensures that agents from every link comply with the requirements; and *executive*, which assists value chain participants in meeting requirements (Gereffi & Lee, 2009) **Invalid source specified.**. An agent may perform more than one of these different types of governance.

down the value chain (Maertens & Swinnen, 2009; Gereffi & Lee, 2009).

Food safety standards, such as third party certification and traceability, may be viewed in the context of innovations that allow firms to develop and maintain competitive advantage. Third party certification[9], for instance HACCP, used to be voluntary and aimed at differentiating products to capture a greater portion of the market and to appropriate associated rents (such as price premium). With the FSMA it becomes mandatory so product differentiation by HACCP is lost as a source of rent. It affects every producer, since the source of price premium is gone, but the effect is worse for late adopters who may incur extra costs for meeting these new standards.

For those agricultural activities that have been successful in implementing their traceability[10] systems, it does still represent a source of competitive advantage. The latter is because even though during the past decade it has been set mandatory in most high-income countries, the degree of attainment has been far from satisfactory thus far, as there are many obstacles that still need to be addressed for systems to be deemed effective. The critical challenges for U.S. traceability systems are to define: a) the information to be shared; b) lot (batch) definition; c) the format of the information so it establishes a common code for every producer involved in a specific food chain; d) the events in which data must be collected; and e) traceability system costs, such as hardware, software, skills needed, and buildings (Institute of Food Technologists, 2010). It must be mentioned that currently producers are required to keep records of any transaction, such as purchases (ingredients, raw materials, inputs required for production) and sales (terminated or intermediate products). However, one must be mindful about the fact that after the FSMA, traceability becomes a must for any producer interested in joining a US food value chain.

Strategic Options

We focus on buyer-driven value chains since they characterize situations where retail sectors are highly

[9] This exists in a written guarantee by an independent agency that production processes or products meet the requirements contained, in a certain standard. Naturally, it only makes sense if additional revenue expected from certification exceeds additional costs.

[10] Traceability is defined by the Codex Alimentarius as *"the ability to follow the movement of food through specific stages of production, processing and distribution"*

concentrated and food production is fragmented[11]. Given the fragmented nature of developing countries fruit, vegetable and seafood production and the relatively concenrated U.S. retail sector, one may reasonably conclude that most of the corresponding value chains are buyer driven (Gereffi & Lee, 2009).

Facing stricter food safety standards, producers in developing countries are faced with three choices: upgrade, downgrade, or exit the export market (Lee, Gereffi, & Beauvais, 2010; Gereffi & Lee, 2009). Downgrading implies searching for external markets that are less strict in terms of meeting food safety standards. Exiting the export market implies selling their product in local markets. These options imply exit from high income markets. Upgrading involves improving farming techniques and product quality to meet the standards. A caveat is in order, however, since upgrading does not necessarily guarantee market access, particularly since standards are continually evolving in the competitive global agrifood system. In a buyer-driven chain, for example, public institutional support and active upgrading by large exporters are crucial to the success of upgrading as a strategic option; otherwise, export growth will be stymied (Lee, Gereffi, & Beauvais, 2010). Producers in this particular structure, especially those in niche markets, must also be prepared to mount quick and decisive responses to quality and safety problems when they arise (Lee, Gereffi, & Beauvais, 2010).

For this paper ,, we focused on the upgrading option because our interest is learning how developing country producers have coped with US food standards. As it is too soon to evaluate the FSMA impact on producers from developing countries, we evaluated data from previous years (2002-2010), which are characterized by a permanent increase in food safety standards and greater control in ports (Jolly, Namugabo, & Abebe, 2008; Buzby & Regmi, 2009).

Methodology

In focusing on producers in developing countries, we posed the following questions: 1) Are most US imports refusals concentrated in developing countries?; 2) What products concentrate most food import refusals?; 3) have

[11] For completeness we state that value chains may be characterized into four types: buyer-driven, producer-driven, bilateral oligopolies, and traditional market (Lee, Gereffi, & Beauvais, 2010); (Gereffi & Lee, 2009).

developing countries complied with or response to stricter US food safety requirements?

An import refusal does not necessarily mean that a product intended for entry to the United States that did not clear US Customs represented a threat to human health. Lack of required information on the label, or even inadequate translation of required information, may cause a shipment to be considered as a violation. In this study, we do not evaluate the cause of refusals; wesimply consider a refusal as representing a situation in which a product "appears" to violate laws enforced by the FDA (food safety standards).

1) **Refusals by development stage**: we used the monthly FDA import refusal reports by country since October 2001 to November 2011. In assigning a country to developed[12] or developing categories, we borrowed from USDA-GATS. Then, we matched refusals data with country categories. Finally, we sorted import refusals according to the originating country's state of development and prooceed to sum. Refusals data encompasses all items controlled by the FDA; this includes food products[13], drugs, medical devices, vaccines, veterinary items, cosmetics, tobacco and radiation emitting products.

2) **Refusals by product category**: we used the monthly FDA import refusal reports by product category. We included in our share calculations data for the period between 2002 and 2010. We considered FDA categories from 01 to 50 which represent food products. We grouped fruit and vegetables categories (include fresh, juices and preparations). Seafood and fishery products are a specific FDA category. We then ranked group categories according to their share in total US food imports refusals. Those groups with less than 1% share are encompassed in the category designated as *others*.

3) **Developing countries' responses to stricter US food safety requirements**: We used two tools: the *refusals/import* ratio and a representative sample of countries. The numerator in a *refusals/import* ratio consists ofthe number of refusals during a unit of time. The demominator corresponds to import value (in billions); this is the value of the product clearing US customs per unit of time (Buzby & Regmi, 2009).. The refusals/imports ratio

[12] Developed countries exporting food to the United States: Andorra, Australia, Austria, Belgium, Canada, Cook Islands, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Liechtenstein, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.
[13] Food items account for 54% of total refusals.

allows us to compare countries with a uniform measure from the standpoint of complying withUS food safety requirements[14]. Taking the latter into account we estimated three refusals/imports indicators: a) fruits and vegetables (encompassing fresh, juices and other preparations); b) fish and seafood; and c) snack foods.

We focused on Latin America and Caribbean (LAC)countries because they account for 54% of US food imports coming from developing countries. Table 5 and Table 6 show the trends in this respect. We focused on those LACcountries with exports to the United States that have a share greater than 1% in any of the food related BICO categories (consumer oriented, bulk, fishery and seafood and intermediate). The countries in our sample represent 29% of total US food imports (on average for the period 2002-2010) [15].

First, we calculated the refusals/imports ratios by US import product category for the aggregate of all countries in our sample. Secondly, we calculated the refusals/imports ratios for all food product categories for each country in our sample[16]. Third, we gathered information with respect to US food imports originating in each country in our sample. We calculated the trends over the period 2002-2010 by using simple linear regression analysis. As we were interested in time trends, we regressed the natural logarithm of the refusal/import ratios on time, and the natural logarithm of US food imports from each country on time. Negative coefficients for refusal/imports ratios indicate that there has been a learning process in meeting US food safety standards meaning exporters from developing countries have effectively joined US food value chains.

Results

These are organized as follows:

Developing countries account for most FDA import refusals: Table 7 provides information on refusals by the

[14] USDA-GATS and FDA data were used to construct the ratios. We used USDA-GATS data in order to obtain denominators. Numerators were obtained from FDA import refusal reports. Given that categories used by FDA import refusals reports do not match any categorization of the USDA-GATS information system; it was required to group the data such that the same items were studied from both standpoints (i.e. refusals and imports value)

[15] The sample comprises Mexico, Brazil, Chile, Colombia, Argentina, Peru, Ecuador, Costa Rica, Honduras, Guatemala, Nicaragua and Dominican Republic. US data on food imports have records for 180 developing countries in total and 205 countries when including developed and developing countries.

[16] Food items range from categories 01 to 50 in FDA refusals categories.

countries' development stage. Considering nominal values, figures for developed countries display a negative trend, which indicates these countries have been capable of meeting US food safety standards. When it comes to developing countries, it is apparent that the amount of refusals has increased. In relative terms, developing countries increased their share in US imports refusals from 69% in 2002 to 81% in 2010.

Food refusals according to product category: our results about products that are more prone to refusals are illustrated in Table 8. During the period 2002 to 2010, fruits, vegetables, fish and seafood products accounted for 51% of total US food import refusals. When considering total FDA refusals for 2002 to 2010, these groups accounted for 28% (i.e. including all categories controlled by FDA).

There is a learning process: table 9 summarizes our results for refusals/imports ratios for the aggregate LAC sample. By observing refusals/imports ratios, one concludes that categories *fishery and seafood* and *fruits and vegetables* have improved their capabilities in exporting succesfully to the US market. However, the refusal/imports ratio of the snack food category implies LAC countries in our sample are struggling in their efforts to clear US Customs.

The previous observation is supported by results from our linear regressions. For *fishery and seafood* and *fruits and vegetables*, we obtained negative coefficients of -13.7% (statistically significant at 5%) and -17.4% (statistically significant at 1%) respectively. These negative trends support our statement that producers in developing countries are coping with increasingly stricter US food safety requirements. However, for snack foods this is not the case since results yield a positive (statistically significant at 1%) coefficient of 22.4% (Table 10).

Developing countries are not homogeneous: we obtained averages for each country's refusals/imports ratio over the period 2002-2010 (Table 11). Results indicate a very wide range from 18 refusals/imports (Chile) to 1084 refusals/imports (Dominican Republic) with mean 165 and standard deviation of 281.

Results from the linear regressions of refusals/imports on time yield negative coefficients for every country. However, coefficients are not statistically significant (at 10%) for Nicaragua, Honduras, Guatemala, Argentina, Colombia, Ecuador and Peru. If one considers only statistically significant coefficients, we obtain a range from -

14.2% to -27.0%, with mean 18% and standard deviation of 6.2% (Table 12).

Regression results of *US food imports from each country* on *time* yield positive and statistically significant coefficients for all countries in the sample. We observe a great deal of heterogeneity coming from the fact that coefficients range from 5% (Ecuador) to 18% (Peru), with mean 9%and standard deviation 4% (Table 12).

Discussion and Conclusions

The United States' dependence on other countries to meet its food demand has increased exponentially and it is expected to keep increasing (Suppan, 2008). US food imports originating in developing economies represent more than half of US total food imports (54%). Almost half of these (i.e. food imports from developing countries) correspond to products characterized as high risk. This explains why, from a US food supply standpoint, it is quite worrisome that surveillance systems, quality controls, and protocols are generally less strict in developing countries (Okello & Narrod, 2007). The latter, together with improved detection techniques and highly publicized foodborne diseases and food contamination episodes, have caused a generalized feeling of vulnerability with respect to food safety.

The FSMA synthesized a series of factors that are required to improve US food supply safety system. It centralizes authority responding to previous fragmentation claims, anticipates the likely increase in food imports and also switches from in-port detection into a farm-to-table approach. The current US food safety system is based in three main pillars HACCP, third party certification and traceability. Producers in developing countries face a set of strategic alternatives consisting in upgrading, downgrading or exit export markets. We concentrated our attention on producers that have made the decision of upgrading (i.e. investing resources for covering the extra costs associated with risk control and certification) and have maintained their participation in US food value chains.

Since it is too soon to evaluate the FSMA impacts on developing countries, we focused on assessingtthe extent to which producers in developing countries have met stricter food safety regulations along the period 2002-2010.

There is a consensus among scholars about the fact that the aforementioned period represents environment of increasing food safety regulations reasonably well (Buzby & Regmi, 2009; Jolly, Namugabo, & Abebe, 2008; Suppan, 2008). Our data sources are USDA-GATS and FDA import refusal reports. We used refusals data (FDA), imports data (USDA-GATS) and calculated refusals/imports ratios. Our approach consisted in studying trend for the data at hand so we could tell if there had been a learning process in coping US food safety regulations.

For the period 2002-2010, it was found that FDA import refusals are highly concentrated in exports coming from developing countries. The share of US import refusals from developing countries increased from 69% to 81%. This result is consistent with those obtained by Jolly et al. (2008) and Buzby & Regmy (2008). Given that those studies evaluated periods encompassing 1992 to 2006, we conclude that US import refusals are inversely proportional to the countries' development stage. However, we must highlight that refusals/imports ratios from developed countries for 2002-2010 displayed a sustained decrease.

We analyzed refusals data related to product. We found that vegetables, fruits, fish and seafood are responsible for 51% of total FDA food refusals. This result is consistent with previous studies on the topic (Buzby & Regmi, 2009; Jolly, Namugabo & Abebe, 2008). However, these products are more controlled than others because of inherent contamination risks.

Due to data tractability (FDA imports refusal reports), we focused on a sample of LAC countries that altogether represent almost a third of total US food imports. Results for aggregated figures from all countries in our sample yielded a negative trend in the refusals/imports for the aggregated data. This result was also obtained by Jolly et al. (2008). However, our analysis allows us to go further. We state that this negative trend is true only for low value-added products. In fact, we found a positive trend for refusals/imports ratio for snack food (value-addedproduct). With respect to value-added products, the latter indicates that either LAC countries are in early stages of learning how to meet US food safety requirements, or there is not a learning process at all. We are inclined to think that LAC countries have experienced problems in meeting US food safety standards for added value products since previous studies show that for the period 1992-2006 snack food represented 34% of total

food refusals at US customs (Jolly, Namugabo, & Abebe, 2008).

From the standpoint of LAC countries, these observations are worrisome since the proportion ofvalue-added products originating in LAC countries that reach US markets is low (Table 13). LAC countries exporting a proportion of less than 10% of added value products are Ecuador, Guatemala and Nicaragua; those exporting between 10-20%, areChile, Brazil, Colombia, Costa Rica and Dominican Republic. Above the aforementioned levels arePeru, Nicaragua, Mexico and Argentina. US data confirms observations that many developing countries have become "new agricultural economies" with export-oriented supply chains and production systems (Friedmann, 1993; Henson, Brouder & Mitullah, 2000; Franko, 2007; Murray & Silva, 2004).

There is a significant level of heterogeneity among countries in our LAC countries sample, indicating different levels of capacity to comply with US food safety standards. With respect to such conclusions however, a caveat is in order since refusals/ imports ratios are strongly associated to number and experience of exporters in meeting food safety requirements, and to to the variety of products exported (specialization) as well. These explain why Mexico averages 168 refusals per thousand dollars of imports (due to the diversity of products and large number of exporters) and Costa Rica averages 28 refusals per thousand dollars of imports.[17]

We calculated refusal/imports ratio for each country in our sample for 2002-2010, and obtained negative trends by running linear regressions of the log (refusals/imports) on time. We found that exporters from LAC countries in our sample may have been successful in meeting US food safety standards (that is, there is a learning process involved). Additionally, linear regresssion results obtained for food exports to the United States by country over time yielded positive trends and statistically significant coefficients for all countries. The mean for the "learning" coefficients was 11.9% while the mean for US food imports coefficients for all countries was 9%, implying that LAC countries in our sample learn faster how to meet US food safety regulations than they increase their food exports to the United States. Overall, our results –albeit preliminary – provide useful insights into how developing countries are affected by increased stringency of food safety standards.

[17] In the case of Costa Rica, the main product exported is banana and it is highly concentrated in this respect.

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Tables

Table 1 Value of US food imports and Developing Economies share

	US total food imports	US food imports from Developing Economies	Developing Economies Share
Units	US millions	US millions	percentage
1970	5,751	4,120	72%
1980	19,993	13,201	66%
1990	28,091	15,687	56%
2000	48,879	26,049	53%
2010	96,413	57,243	59%

Data source: USDA-GATS 2012. Own calculations

Table 2 Composition of US food imports originating in Developing Economies

Year	US million				Share on total		
	Consumer oriented	Seafood	Bulk	Intermediate	Consumer oriented and seafood	Bulk	Intermediate
1970	1134	0	2524	462	28%	61%	11%
1980	3065	1341	7411	1384	33%	56%	10%
1990	6463	3128	4330	1766	61%	28%	11%
2000	11182	7113	5038	2716	70%	19%	10%
2010	27850	10896	11116	7381	68%	19%	13%

Data source: USDA-GATS 2012. Own calculations

Table 3 High risk US food imports originating in developing countries

Year	US millions			Percentage
	Fresh products*	Seafood	Total Food imports	Share of high risk products
1970	470	0	4,120	11%
1980	1096	1341	13,201	18 %
1990	2801	3128	15,687	38 %
2000	5022	7113	26,049	47%
2010	12202	10896	57,243	40 %

*Fresh vegetables, fresh fruits, bananas and plantains, tree nuts. Data source: USDA-GATS 2012. Own calculations

Table 4 Most publicized cases of food contaminated in the United States

Source	**Year**	**Product**	**Contaminant**
United States	1996	Apple juice	*E.coli* 0157
Mexico	1999	Orange juice	*Salmonella*
United States	2000	Bean Sprouts	*E.coli* 0157
United States	2002	Beef	*E.coli* 0157
United States	2003	Green onions	Hepatitis A
China	2007	Pet food	Melamine
United States	2007	Beef	*E.coli* 0157
United States	2007	Peanut butter	*Salmonella*
China	2008	Infant formula	Melamine
Canada	2008	Ready to eat meat	Listeriosis
United States	2008	Jalapeno	*Salmonella enterica*
United States	2009	Peanut butter	*Salmonella*
United States	2010	Eggs	*Salmonella*
United States	2010	Beef products	*Salmonella*
United States	2011	Turkey burgers	*Salmonella*

Source: Center for Disease Control, 2011

Table 5 US food imports ratios* according to country categories

US food imports	**Year**	**Developing/World**	**LAC/Developing**	**LAC/World**
Total	2000	53%	57%	30%
	2010	59%	54%	32%
Consumer oriented	2000	43%	76%	33%
	2010	54%	74%	40%
Fish and seafood	2000	72%	36%	26%
	2010	75%	24%	18%
Intermediate	2000	39%	41%	16%
	2010	44%	37%	16%
Bulk	2000	84%	54%	45%
	2010	84%	45%	37%

* Ratio calculations are based on import value.
Data source: USDA-GATS 2012. Own calculations

Table 6 US food imports from Developing Countries and from LAC countries (US Millions)

Year	Consumer oriented	Seafood	Bulk	Intermediate	Consumer oriented	Seafood	Bulk	Intermediate
	LAC				Developing Economies*			
1970	694		1350	210	1134		2524	462
1980	2105	858	4529	637	3065	1341	7411	1384
1990	4933	1313	2362	920	6463	3128	4330	1766
2000	8499	2587	2696	1124	11182	7113	5038	2716
2010	20708	2668	4955	2713	27850	10896	11116	7381

*Includes LAC. Data source: USDA-GATS 2012. Own calculations

Table 7 Number of US import refusals according to country type 2002-2010

Row Labels	2002	2003	2004	2005	2006	2007	2008	2009	2010
Developed	5280	5118	4732	4590	3592	3395	3649	3390	3540
Developing	11681	12495	15550	15339	13336	12834	13020	12961	14690
Developing share	69%	71%	77%	77%	79%	79%	78%	79%	81%

Data source: FDA. Own calculations

Table 8 Refusals 2002-2010 according to FDA food groups

Products category	Refusals	Share
Fruit and vegetables products	26363	31%
Fishery and Seafood Prod	17409	20%
Candy	6131	7%
Spices, Flavors And Salts	5297	6%
Bakery Products	4953	6%
Multiple Food Dinner	3461	4%
Soft Drink/Water	3082	4%
Cheese/Cheese Prod	2777	3%
Chocolate/Cocoa Prod	2400	3%
Snack Food	1986	2%
Macaroni/Noodle Prod	1540	2%
Dressing/Condiment	1481	2%
Milk/Butter/Dried Milk Prod	1349	2%
Others	7592	9%

Source: Monthly FDA imports refusal reports Jan 2002-Dec 2010. Own calculations

Table 9 Refusals / US billion value and trend 2002-2010 for selected LAC countries*

Product	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Refusals / US Imports value (US billion)								
Fishery and seafood	204	166	121	107	98	43	49	92	80
Fruits and vegetables	312	267	386	347	281	214	101	96	109
Snack food	57	66	40	105	122	88	146	193	404

Data sources: FDA imports refusal reports and USDA-GATS
* Mexico, Brazil, Chile, Colombia, Argentina, Perú, Ecuador, Costa Rica, Honduras, Guatemala, Nicaragua, Dominican Republic.

Table 10 Linear regressions results according to product group

	Coefficient	*Standard Error*	*t Stat*	*p-value*	R Square
Fishery and seafood	-0.13724	0.04721	-2.90729	*0.02275*	0.54699
Fruits and vegetables	-0.17400	0.04032	-4.31529	0.00350	0.72679
Snack foods	0.22442	0.04476	5.01389	0.00154	0.78220

Data source: USDA-GATS; FDA imports refusals report. Own calculatios.

Table 11 Average refusals / imports 2002-2010 *

	Refusals /imports**
Country	Average
Chile	18
Costa Rica	28
Argentina	32
Ecuador	46
Brazil	53
Colombia	55
Guatemala	99
Peru	105
Nicaragua	138
Honduras	154
Mexico	168
Dominican Republic	1084

* All values refer to period 2002-2010

** Average for the period. Number of refusals per imports (in US billion) clearing US costumes

Data sources: USDA-GATS; FDA import refusal reports. Own calculations

Table 12 Results of linear regressions for each country

	LN (refusals/imports) on time		**LN of total US food imports on time**	
Country	**Coefficients**	**p-value**	**Coefficients**	**p-value**
Mexico	-0.142	0.000	0.103	0.000
Costa Rica	-0.270	0.001	0.052	0.001
Nicaragua	-0.087	0.293	0.133	0.000
Guatemala	-0.042	0.217	0.092	0.000
Honduras	-0.017	0.831	0.058	0.001
Dominican Republic	-0.250	0.062	0.055	0.005
Argentina	-0.088	0.158	0.098	0.001
Brazil	-0.175	0.000	0.085	0.001
Chile	-0.107	0.056	0.083	0.000
Colombia	-0.070	0.206	0.087	0.000
Ecuador	-0.115	0.134	0.050	0.000
Peru	-0.070	0.179	0.177	0.000

Data source: USDA-GATS; FDA imports refusals report. Own calculatios.

Table 13 Share of US food imports originating in LAC with a certain degree of value added*

	Mexico	Argentina	Chile	Brazil	Colombia	Peru	Costa Rica	Nicaragua	Ecuador	Guatemala	Dominican Republic	Honduras
2002	33%	38%	15%	23%	6%	12%	12%	20%	5%	6%	19%	5%
2010	32%	48%	18%	17%	12%	21%	12%	24%	7%	5%	13%	6%

* Processed Fruit & Vegetables; Wine and Beer, Snack Foods, Fruit & Vegetable Juices, Cheese, Roasted & Instant Coffee, Other Dairy Products, Red Meats (FR/CH/FR), Red Meats (Prep/Pres). Source: USDA-GATS Own calculatios.