**The 84th Annual Conference of the Agricultural Economics Society**

**Edinburgh**

**29th to 31st March 2010**

# Preliminary assessment

# Trade and SPS regulations:
*The importance of being Earnest?*

## *DRAFT VERSION: PLEASE DO NOT QUOTE*

Marie-Agnès JOUANJEAN[1]
&
Alexandre LE VERNOY[2]

*Groupe d'Economie Mondiale – Sciences Po*



***Abstract***

There is a pending question regarding the impact of food safety standards promulgated by governments or imposed by buyers from the private sector. Their effects on the capacity for developing countries to access developed countries' markets for high value agricultural and food products is a vivid research theme that up-till-now provided mixed results. While some advocates that food safety standards may hamper exporting abilities, others present evidence that they enable competitiveness and act as a pro-poor growth. This paper contributes to this debate. We offer an analysis on how the intensity of trade flows in fruits and vegetables in Central American countries, Dominican Republic and the U.S. respond to both the level of Sanitary and Phytosanitary regulations and to products reputation on the U.S. market subsequent to import detention/refusal. We emphasize the specific case of non-traditional horticultural products introduced in Central American countries in the 70s and 80s under structural adjustment frameworks. To this end, we implement a gravity model of bilateral trade flows to (1) identify the effect through time of food safety standards on exports from Central America to the US, and (2) measure the degree of adaptation to detention/refusal what we define as resilience of the supply chains. First (and highly preliminary) results show that there is indeed a negative relationship between unit prices and reputation on export markets.

JEL: F13 – O13 – Q17
Keywords: SPS – Agricultural Trade – Reputation – Alerts

[1] MarieAgnes.Jouanjean@sciences-po.org
[2] Alexandre.LeVernoy@sciences-po.org

# 1. Reputation and trade

The late 80s have witnessed rising food safety concerns from US authorities. As a consequence, horticultural products from Central American countries entering US market where potentially subjected to scrutiny at the border. Aside from detentions due to different pest outbreaks, the increasing attentiveness in the US on food safety and on pesticide residues issues led to the implementation of automatic detentions and alerts for various countries and products.

Usually, only around 1% of food import shipments are inspected by the Food and Drug Administration (FDA) at port of entry[3]. If a product or an exporter too repeatedly violates US regulations or poses risk in terms of SPS issues, the FDA will raise the level of surveillance, creating an "Alert" and implementing an "Automatic Detention" (AD) or a "Detention Without Physical Evidence" (DWPE). Different case-studies in Central America have emphasized the immediate effects of such a regulation on trade flows and the risk of an eventual market disruption.

In case of an alert, the burden of the proof of the shipment compliance is transferred to the exporter. Therefore, alerts increase the surveillance of products with compulsory detention. The consequence on the US market is the creation of delays and new risks for the importer distribution chain. Under such DWPE, exporters that are able to send products 5 times in a row complying with the US legislation (re)gain access without automatic detention. However, they stay submitted to higher level of potential controls. This sequence of controls illustrates the importance of *earnestness* in order to ensure a continuous capacity to export over time.

As Baylis *et al.* (2009) point out that the limited resources of the FDA can lead inspections to be path dependant, by continuously focusing on products and/or producers that encountered problems in the past. Thus, it seems fair to say that a newcomer in the exporter community faces lower probability of refusals. Along this line, Buzby *et al* 2008, confirmed the existence a strong correlation between refusals and FDA alerts. FDA inspections and as a consequence

[3] Buzby *et al* (2008), FDA

refusals are clearly biased against exporters or countries holding a record of risk of their food exports

This paper will address the question of the sensitivity of fresh fruits and vegetable (FF&V) market chains to food safety measures. Many studies have analysed the effect of new SPS measures on predicted trade flows with an ex-ante approach (Otsuki *et al* 2001). Even if the scope of the results in terms of loss for exporting developing countries has been largely debated, they nonetheless highlighted the potential trade exclusion effect of such measures. Yet, too few studies adopted an ex-post analysis posture. This was mainly because of lack of data on the implementation of SPS measures in world trade[4].

Thanks to more comprehensive datasets, two recent studies managed to better address the issue of NTBs from an ex-post point of view. The fist study by Karov *et al* (2009) focuses on the impact of SPS treatments and new market entry on US FF&V import whereas Jaud *et al* (2009) link alerts on food related imports and supplier concentration on the EU market. Although employing two different methodologies, both papers conclude that it is difficult for new countries on the EU as well as on the US markets to compete with established suppliers.

Few case studies have already analysed FF&V and SPS, though not analytically. Guatemala and Dominican Republic are two famous case studies. The introduction of NTAXs – non-traditional agricultural export crop[5] – in Dominican Republic and Guatemala brought new production technologies and new demands of aesthetic and grade qualities that resulted in an intensive use of chemical input. These aesthetic requirements, as a "Search" attribute of quality, didn't present specific information asymmetry issues. A survey among participants in the U.S. snow pea market indeed emphasized that Guatemalan smallholder production, compared to

[4] Disdier *et al.* (2007) were able to conduct a study on the effect of Non Tariff Measures (NTBs) relying on WTO member's notifications of SPS and Technical Barriers to Trade (TBTs). However, it has frequently been underlined that WTO members only have the obligation to notify changes to SPS measures since 1995. Thus WTO notifications are a good tool in order to consider changes in exporting countries SPS environment, but they can not be used as a strict proxy for an actual barrier level. Studies pinpoint the high level of aggregation of such database and above all the lack of information concerning many important bilateral restrictions.

[5] In opposition to traditional agricultural export crops like coffee or bananas.

large estate production in Mexico or in California, was much more in adequacy with U.S consumers demand.

Along with the increased awareness on food safety issues in the U.S. from the end of the 80s, this massive use of pesticides resulted in frequent shipment detention and refusals by US custom authorities (FDA). The intensification of the production and this overuse of pesticides also led to phytosanitary crises causing temporary exports bans[6].

In the 80s, Dominican Republic was among the first providers to the U.S. market for some FFVs like snow peas, eggplant or cantaloupe. But in 1987/1988, the FDA issued a countrywide alert for pesticides residues. With accrued commercial and agronomic problems related to this overuse of pesticides and the consequent decrease in yields, many investors envisage to relocate to other more welcoming environments. As Dominican Republic was struggling with those new issues, Guatemala was entering the NTAXs sector and rapidly replaced the Dominican Republic as first provider for some of those FFV, like snow peas. However, they followed Dominican Republic's fate with the overuse of pesticides residues and were submitted to a countrywide alert from 1992. According to Thrupp (1995), in the early 90s, 27.3 % of NTAXs shipments sampled from Guatemala were detained. Between 1990 and 1994, 3,081 detentions of Guatemala's exports due to pesticides residues resulted in a loss of a total of $17,686,000. This situation and the inability to address SPS concerns have been highly detrimental to Guatemala's relative competitive position in the field of NTAXs.

Guatemalan imports of fresh berries were also banned for the 1998 season and restored entry in 1999 because of suspicion of cyclospora outbreak (bacteria). The sector was only in its early age and couldn't recover from such a shock. Yet, if Guatemalan raspberries export market had been completely disrupted, the snow peas chain survived the pesticides and pests outbreak crises, and in 2002 it reached back its 1991 pre-crisis export volume.

Both Guatemala and Dominican Republic are still today under countrywide alerts with DWPE for some of their most successful non-traditional agricultural export crops. While Guatemala is the main provider of snow peas to the U.S. market (figure 1), all these issues have

[6] This was the case for Guatemalan snow peas in 1995

decreased Guatemalan competitiveness on US market compared to its two biggest rivals, Mexico and more recently Peru. Producers in both countries sell their production directly to the food distribution chain whereas 80% of Guatemalan snow peas are sold through brokers for half price[7]. Between 2000 and 2006, average export unit prices were 0,5 US$/kg to 0,7 US$/kg for Guatemala, compared to 1,2$/kg to 1,9$/kg for Mexico and Peru (figure 2) [8].

## 2. Resilience of the supply chain

The last 20 years witnessed undeniably the conjunction of an increase of FF&V imports from developing countries and awareness on food safety issues in developed countries with new regulations regularly implemented. While traditional trade barriers were decreasing, SPS and TBTs, or more generally non-tariff measures (NTMs) increased. This phenomenon could have high impacts on developing countries' capacity to export. However some studies show how food safety standards can serve as a "catalyst for realizing pro-poor export-led growth in developing countries" (Maertens & Swinnen – 2006).

We will illustrate in this paper the importance of shocks (crisis or alerts) on trade and quality perception over time as well as the importance of technology dissemination through development programmes. In particular, we will emphasize what we characterize as the resilience of the exporting country's sector to alerts. In what follows, resilience is understood as the rate of survival and adaptation of a given sector.

Papers usually consider the hypothesis of a learning process with experience of exporting to one country. In this paper, we will confront two learning processes: the exporter but also the importer learning process. On the one hand, exporters are expected over time to be better prepared and able to comply with its trade partner's regulation and quality attributes. With this in mind, we complete the usual learning hypothesis by considering the possibility that one learning process might only be set off by shocks or crisis due to the recognition by the importer of one problem or risk on specific products. This shock can be caused by (i) a new SPS

[7] Hanson et Blandon (2007)
[8] NBER trade database, Authors' own calculation

regulation, (ii) by the issuance of an alert following an outbreak or the recognition of one food safety risk, and to DWPE with the consequent raise in supervision. This learning process will be at the expense of export volumes and prices. Not only it will take time for a country's sector to modify its production technology in order to comply with the regulation, but it will also take time to recover from the shock in term of reputation and reliability. This is what we call the resilience process. On the other hand, importing countries also learn over time about the degree of reliability of their FF&V imports, either from a whole exporting country or from various firms. The implementations of alerts specifying DWPE is the consequence of such an experience from the U.S. authorities.

Considering this assumption of a two ways learning process and from the various experiences provided by the literature, we assume a differentiation in the effect of a food safety crisis on both new and historical trading partners. On the one hand, we believe that historical partners' trade flows will be affected in quantity and value but with is a small probability of complete market disruption. On the other hand, a food safety crisis or a change in SPS measures might be the cause of market disruption for a new trade partner.

## 3. A look at how imports react to reputation

Our theoretical framework stems from the conventional and tractable gravity model of international trade. Gravity models allow studying flows of bilateral trade based on an analogy with the law of gravity in physics. Bilateral exports increase with the size of economies (usually measured by GDP) and decrease with respect to the distance between the two countries. Theoretically, the equilibrium is derived from a classical producer and consumer optimization problem.

### 3.1. Literature wrap-up: Quality or Price competition in the Gravity model

In what follows, we rely on a range of recent articles that provided models and derived econometrical estimations that fit relevantly the purpose of this study. We will make reference

to three benchmark models: Melitz (2003), Helpman-Melitz-Rubinstein (2007) hereafter denoted by HMR and Baldwin & Harrigan (2009) hereafter referred to as QHFT.

The seminal work of Melitz (2003) emphasizes the role of firm heterogeneity by relating trade flow to firm level productivity. It provides a useful framework for our analysis on highly disaggregated trade flows between the US and several of its Latin-American partners. Refinements provided by HMR help us take account of zero-trade flows in our study. It has been established that the usual ordinary-least-squared specification of the gravity equation is unable to deal with the information contained in inexistent trade flows between a pair of country. Finally, QHFT embarks on Melitz's model and places quality differences among products at center-stage.

This paper provides both a theoretical structure and an empirical assessment of the inclusion of reputation in a quality-firm heterogeneity and trade model. We expect this reputation feature to have a significant impact on the direction of trade flows over time by modifying the perception of consumers in the importing market of quality. This section will describe the theoretical model used as a foundation for our empirical analysis in the next sections. This will be undergone as is usual in the economic literature.

The relationship between quality and trade has been treated by various recent papers like Schott (2004), Hallack (2006), Hummels and Klenow (2005), Baldwin and Ito (2008), Johnson (2008), Baldwin and Harrigan (2009) and Crozet, Head and Mayer (2009). All those papers confirm a specific relationship between quality and trade.

Schott (2004), studying U.S. import data, highlights the inconsistency of new trade theory models considering an inverse relationship between price and producer productivity. This paper is also one of the first using prices as a proxy for quality. Schott's study presents a strong relationship between GDP per capita and average unit value *within* products at the HS10 level. They not only show an increase in unit value with exporters' GDP per capita but also with relative endowment of physical and human capital. Johnson (2008) and Baldwin and Ito (2008) confirms the inconsistency of prices behaviors with benchmark models. Focusing on the demand side, Hallack (2006) finds that richer countries will have a higher demand for imports

from countries producing high quality goods. Variations of the benchmark model capable of including the quality factor of trade are proposed by Johnson (2008), Baldwin and Harrigan (2009) and Crozet, Head and Mayer (2009). Following the QHFT theoretical model, Baldwin and Ito (2008) classified export goods by quality and price competition and suggest that price or quality competition depends on the importing country. All those papers demonstrate the importance of taking quality into consideration in explaining bilateral trade flows.

### 3.2. The basic setup

**The consumer problem:** We adopt the common Dixit-Stiglitz approach of *love for variety* reflected by a CES function of preferences. We consider a number of C countries individually indexed by *i*. In country *i*, any consumer's utility is assessed through the following relationship:

$$U_i = \sum_{k=1}^{K} \left\{ \int_{v \in V_i^k} \left[ x_i^k(v) q_i^k(v) \right]^{(1-\frac{1}{\sigma_k})} dv \right\}^{\frac{1}{1-\frac{1}{\sigma_k}}} \quad (1)$$

$V_i$ defines the range of varieties that is consumed in country *i*. In (1), $x_i^k$ refers to the quantity of variety *v* produced by industry k and consumed in country *i*. As it is the case in the QHFT model, $q_i^k$ refers to the consumer's love for quality. Thus in the QHFT model, the consumer will take his consumption decisions according to a quality-adjusted price $p(v)/q(v)$.

As usual, the consumer maximizes its utility given country *i*'s total income $Y_i$ which equals its expenditure level:

$$\sum_{k=1}^{K} \left[ \int_{v \in V_i} p_i^k(v) x_i^k(v) di \right] = Y_i \quad (2)$$

$p_i^k$ is the unit price of variety *v*.

Maximizing utility under a budget constraint yields the usual functional form of demand for variety *v* in country *i*:

$$x_i^k(v) q_i^k(v) = \frac{\left[ p_i^k(v) / q_i^k(v) \right]^{-\sigma_k}}{\left( P_i^k \right)^{1-\sigma_k}} Y_i^k \text{ , Where, } P_i^k = \left\{ \int_{v \in V_i^k} \left[ \frac{p_i^k}{q_i^k} \right]^{1-\sigma_k} dv \right\}^{\frac{1}{1-\sigma_k}} \quad (3)$$

And the expenditure on any typical variety *v* by typical nation *i* is:

$$p_i(v) x_i(v) = \left( \frac{p_i(v)}{q_i(v)} \right)^{1-\sigma} \frac{Y_i}{P_i^{1-\sigma}}$$

In (3), $Y_i^k$ stands for country *i*'s sectoral spending while $P_i^k$ reflects the ideal price index for industry *k* faced by country *i*'s consumer[9].

**The producer problem and prices:** Though quite standard, this last derivation of the consumer demand did not provide for any specification on the formation of prices. We will use the QHFT formulation on how industries react to prices. We assume that there is only one production factor (Labor) and that labor price and productivity are the main drivers of a good's price produced in country *i* and sold in country *j*[10]. The country specific factor cost is denoted by $c_i^k$ and $a_i^k$ is the firm specific factor requirement (inverse of productivity) to produce good *k*. The micro-foundation of profit maximization under monopolistic competition yields a constant mark up over costs of: $\rho_k = \sigma_k / \sigma_k - 1$.

$$p_i^k = \rho_k c_i^k a_i^k \tag{4}$$

With add-valorem cost $\tau_{ij}^k$ [11] of transporting good *k* from *i* to *j*, consumers in country *j* should face the price of the good *k*:

$$p_{ij}^k = \rho_k c_i^k a_i^k \tau_{ij}^k \tag{5}$$

**Introducing quality…:** Like QHFT model, we assume that producing higher quality drives higher marginal cost. Consequently, we impose the following relationship: $q_i^k = \left(a_i^k\right)^{1+\theta}$ with $\theta > -1$. $(1+\theta)$ is computed as the "quality elasticity" thereby reflecting how marginal cost react to higher quality[12]. Under this assumption, firms' competitiveness will depend on a *quality-adjusted price*. The HFT model predicts that export prices should decrease in distance between trade partners. In the QHFT model, even though higher quality goods are more costly, they are better able to penetrate distant markets. Thus, the QHFT model inverses the Melitz

---

[9] Baldwin and Harrigan present the quality-adjusted price as $p_j^k c_j^k = \left(\frac{P_j^k}{q_j^k}\right)^{1-\sigma} \frac{E_i}{\left(P_j^k\right)^{1-\sigma}}$, where $P_j^k = \left\{\int_k \left(\frac{P_j^k}{q_j^k}\right)^{1-\sigma} dj\right\}^{1/1-\sigma}$.

[10] We will not repeat what Marc Melitz provided in its 2003's article.

[11] Samuelson iceberg cost…

[12] If we set θ = -1 we fall back to the standard Dixit-Stiglitz model without quality incidence.

(2003) relationship of price and distance. "As in the HFT model, distance acts as selection device on varieties, but the highest priced variety are the most competitive, the basket of varieties sold in distance markets will have a higher average price than the basket for a near-by market" (Baldwin *et al*. – 2009).

A typical firm then chooses prices taking quality and marginal cost as given. The standard Dixit-Stiglitz results are still valid. Consequently, operating profits for a country *i* firm selling in county *j*:

$$\pi_{ij}(a) = \frac{1}{\sigma}\left[\frac{\tau_{ij}^{k} c_i^{k} (a)^{-\theta}}{1-\frac{1}{\sigma}}\right]^{1-\sigma} \frac{Y_i}{\left(P_j^{k}\right)^{1-\sigma}} - c_i f_{ij} \qquad (6)$$

With $f_{ij}$ a fixed cost of serving country *i.*

**…and reputation:** Our study will introduce the effect of reputation on the quality-adjusted price. We expect reputation to have an influence on prices over time or in choosing a specific destination partner *j*. Reputation, denoted by $\gamma_{ij}^{k}$ will affect the vision of consumers of country *j* of the product in sector *k* exported by country *i*. A bad reputation, with a high $\gamma_{ij}^{k}$ the exported product could change from a quality competition to a price competition. This will decrease the price of export products of variety *k* from country *i* to country *j*. Then, a bad reputation can make one sector/country change from quality to price competition on one of its specific export market, according to the quality elasticity in country *j* and to its the level of reputation.

As a result we have:

$$q_{ij}^{k} = \left(a_i^{k}\right)^{1+\theta i-\gamma_{ij}^{k}} \qquad (7)$$

$$\pi_{ij}(a) = \frac{1}{\sigma}\left[\frac{\tau_{ij}^{k} c_i^{k} (a)^{-\theta i+\gamma_{ij}^{k}}}{\left(1-\frac{1}{\sigma}\right)}\right]^{1-\sigma} \frac{Y_i}{\left(P_j^{k}\right)^{1-\sigma}} - c_i f_{ij} \qquad (8)$$

As in Melitz and QHFT, we impose a cut-off condition that determines a threshold marginal cost for every origin nation. This threshold drives the ability to reach a maximum marginal cost yielding operating profit sufficient to cover costs. Result (3) displays the income of a firm in

country $i$ selling in country $j$. The cut-off conditions that define the bilateral maximum-marginal-cost thresholds $a_{ij}$ are:

$$\frac{1}{\sigma}\left[\frac{\tau_{ij}^{k} c_i^{k} \left(a_{ij}\right)^{-\theta+\gamma_{ij}^{k}}}{\left(1-\frac{1}{\sigma}\right)}\right]^{1-\sigma} \frac{Y_i}{\left(P_j^{k}\right)^{1-\sigma}} = c_i f_{ij} \qquad (9)$$

### 3.3. Gravity and the Eötvös experiment

The famous physics experiment of *Eötvös* led to a theory that had long been suspected but never demonstrated. In a word, it essentially states that there is no "gravitational mass" at all, and that inertial mass is all that really exists. We feel that reputation is a way of explaining many of the volume of trade flows. Reputation creates an inertia between any too pair of countries. This relates mainly to habits and usual practices between industries established in different countries. Particularly, reputation arises from what we could call in more generic terms institutional aspects for instance standards that are, as we will show, crucial in explaining rise and fall in bilateral trade flows.

## 4. Empirical analysis

### 4.1. Data issues

We use U.S. import data available from the NBER and compiled by Feenstra from data of the U.S. Census Bureau. This dataset not only includes trade in quantity but also the equivalent trade value. This allows us to calculate the average unit value for products. This calculation and the comparison are made easier since we only consider FF&V trade, which are systematically reported in kg. Even though HS10 data are available, we will use HS6 because of easier comparison with FDA data on refusals. We eliminated small quantities exchanged. Our analysis showed that low trade levels usually present very high unit prices that could biased our results.

We compiled this dataset with data from the FDA on U.S. import refusals. Unfortunately, the FDA only made available a first set of data covering 1998 to 2001. A longer time frame should be made available soon, as well as new and more specific data on Alerts.

Those data will be included in a further version of this paper. Unfortunately, this 4-year wide dataset won't allow us to study the resilience effect as expected in this first version of the paper, neither to test the intensive and extensive margin through time and in relation to reputation as was intended to. However these features will be tested in a further more complete version of this paper. The FDA is using its own product codification, thus refusals data had to be recoded in HS6. At first, our intention was to study only data from Latin American countries, but for this first version of the paper, we had to keep all FF&V countries exporting to the U.S. market in order to keep as much information as possible. Distance data are taken from the CEPII dataset and GDP are taken from the WDI. These usual gravity data are available on the internet.

### 4.2. Estimated equation, scenarios and results (highly preliminary)

#### 4.2.1 Quality and price

In order to verify that the FF&V sector respond in quality, we first use a methodology developed by Schott (2004). For this, we write the following econometric specification where *GDPperCap* denotes exporters' per capita GDP and $u_{kijt}$ denotes the unit price of products *k* exported by country *I* to country *j* in year *t*:

$$Log(u_{kijt}) = \alpha_{kt} + \beta_{kt} \log(GDPperCap_i) + \varepsilon_{kit} \quad (10)$$

We then make a first OLS test of unit prices response to refusals by generating a refusal dummy: $$Log(u_{kit}) = \alpha_{kt} + \beta_{kt} \log(GDPperCap_i) + \sigma_{kt} REFUS_j + \varepsilon_{kit} \quad (11)$$

Table 2 presents the results of this OLS, with a significant inverse relation between unit price and refusals. We will try to identify in a further version of this paper if unit prices are also related to SPS measures, like various treatment required by authorities in order to enter the U.S. Market.

#### 4.2.2 The gravity equation

To measure both the reputation effect and the degree of resilience, we will make use of a gravity model of bilateral trade with firm heterogeneity, introducing quality differentiation

(HMR 2008, Baldwin *et al* 2009). With the latest empirical techniques devoted to this type of model (integrating zeros and asymmetric trade) we will be able to account for the creation and deterioration of trade in relation to productivity and regulation in the importing country. We will measure the extensive and intensive margins over time (number of exporter vs. quantity exported) as an indicator of the sensibility of the sector to regulation in the importing country (in a further version).

This study will specifically emphasize the probability to export to the US and the sensitivity of unit price of exported FF&V to the same variable as in the gravity model. This will allow us to test our hypothesis on unit value increasing with the perceived product quality on the export market. As a preview analysis, we are only able to test the reputation of products based on the amount of refusals by US customs authorities. Our assumption is that this level of product refusals will negatively relate to export volumes in time and to unit prices. Buzy *et al* (2008) were able to test food related import refusals in relation to FDA alerts for importation into the United States from 1998 to 2004. Their analysis shows a strong correlation between refusals and alerts. Thus, at first, we will use the refusals as a proxy for Alerts in our tests.

Results of the preliminary study based on the gravity equation including refusals as a proxy for reputation are presented in table 3.

***Export value/quantity***

(12) $$Log(X_{ijkt}) = \alpha_t + \beta_{1t}\log(GDP_{it}) + \beta_{2t}\log(dist_{ij}) + \beta_{3t}REFUS_{jkt} + \mu_{1t} + \mu_{2k} + \varepsilon_{ijkt}$$

Results follow the expected patterns of a gravity specification: under an OLS regression as well as under a Poisson, export values are positively related to GDP and negatively related to distance. Export values are positively related to refusals. This result asks the question of the causality between those to variables. Indeed, are import quantities driven by refusals, or refusals driven by import quantities? Even though the results of our test present a significant relationship, two phenomenons with opposite consequences are to be considered in this result. The probability of being inspected increases naturally with the number of products and volumes exported from one country. But the experience of Guatemala and Dominican

Republic tells us that it is when an alert is implemented that we can observe a negative relationship in time between refusals and volumes. The four year dataset we currently exploit is not enough to verify these last hypotheses that we hope to be able to test in a further version of this paper.

A Probit specification also verifies the usual gravity results: the higher the GDP and the smaller distance, the higher the probability of exporting FFV to the U.S. Unfortunately, refusals perfectly specify exports to the U.S. A further version of this specification should include various SPS measures and will give a better view of the impact of such treatment on the probability to export FF&V to the U.S.

***Unit prices***

$$(13)\quad Log(u_{ijkt}) = \alpha_t + \beta_{1t}\log(GDP_{it}) + \beta_{2t}\log(dist_{ij}) + \beta_{3t}REFUS_{jkt} + \mu_{1t} + \mu_{2k} + \varepsilon_{ijkt}$$

As expected, unit prices are negatively related to the existence of at least one refusal. This confirms our hypotheses on product reputation. While refusal dummies are significantly related to unit prices, in our four year sample; the number of refusals by exporter-product is also negatively related to unit prices (though not significantly).

Since unit price are also related to GDP per capita, one could suspect that refusals are related to GDP. We test and verify this with a simple correlation presented in table 4. This shows that there is a very small relation between refusals and GDP per Capita. This confirms our results on refusals being related to products' reputations.

## 5. Concluding remarks

This study proposes two effects on products prices on export markets. It first confirms the relation ship between GDP per capita and products unit prices at the HS6 level for fresh fruits and vegetables. Second, it proposes a further interpretation of the difference in unit prices on export markets based on reputation.

## 6. References


Baldwin, R.E., T. Ito, (2008), Quality competition versus price competition goods: an empirical classification, working paper, NBER

Baldwin, R., J. Harrigan, 2009, Zeros, Quality and Space: Trade theory and trade evidence, NBER Working Paper.

Baylis, K., A. Martens, L. Nogueira, 2009, What drives food import refusals?, 2009 AAEA annual meeting , Milwaukee

Buzby J. C., L. J. Unnevehr, D. Roberts, 2008, Food Safety and Imports : An Analysis of FDA Food-Related Import Refusal, Economic Research Service, Economic Information Bulletin Number 39.

Crozet, M, K. Head, T. Mayer, (2009), Quality sorting and trade: firm level evidence for French wine, Center for Economic Policy Research, Discussion paper n°7295.

Hallak, J. C., 2006, "Product Quality and the Direction of Trade", *Journal of International Economic*s 68, 1, 238-265

Helpman, E. , M. Melitz, Y. Rubinstein, 2008, "Estimating Trade Flows: Trading Partners and Trading Volumes", Quarterly Journal of Economics, 123(2), 441-487. ("HMR")

Henson S., J. Blandon, 2007, "The Impact of Food Safety Standards on an Export-Oriented Supply Chain: Case of the Horticultural Sector in Guatemala", International Food Economy Research Group (InFERG) University of Guelph.

Henson, S, S. Jaffee, 2008, Understanding Developing Country Strategic Responses to the Enhancement of Food Safety Standards, The World Economy, 31-4, 548-568.

Julian, J., 2003, Assessment of the impact of Import detentions on the Competitiveness of Guatemalan Snow Peas in US markets, PhD Thesis, Purdue University.

Maertens M., J. F.M. Swinnen, 2006, Standards as Barriers and Catalysts for Trade and Poverty Reduction.

Melitz, M. , 2003, "The impact of trade on intra industry reallocations and aggregate industry productivity", *Econometrica* 71, 6, 1695-1725 (November).

Otsuki, T., J. S. Wilson, M. Sewadeh, 2001, Saving two in a billion: quantifying the trade effect of European food safety standards on African exports, Food Policy
26, 5, 495-514.

Schott, Peter K., 2004, "Across-product versus within-product specialization in international trade", *Quarterly Journal of Economics* 119, 2, 647-678 (May).

Thrupp, L. A., 1995, Bittersweet harvests for Global Supermarkets: Challenges in latin America's Agricultural Export Boom, World Resources Institute.

Figure 1: US Peas import volumes by origin 1989 - 2006

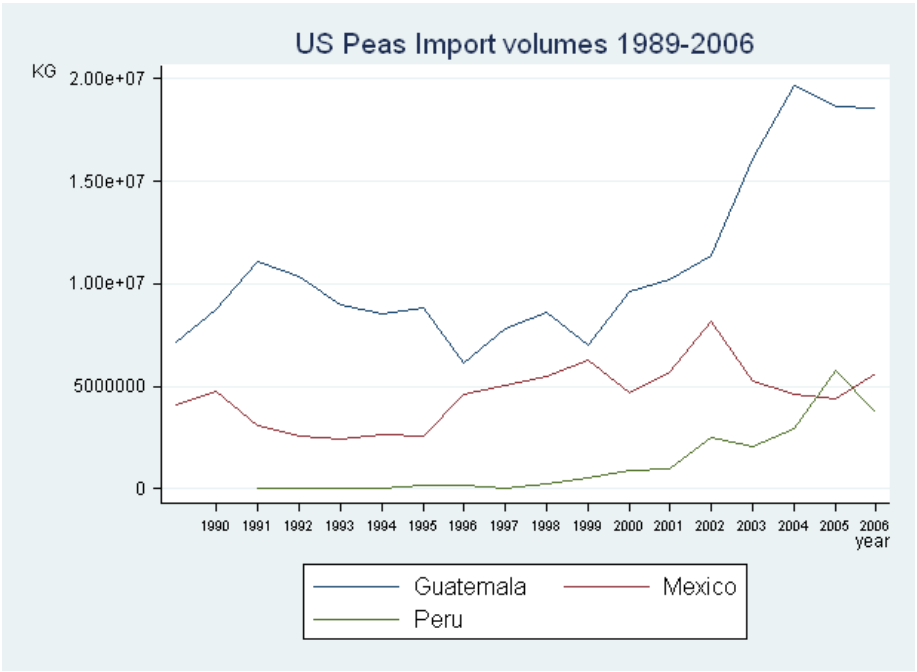


Figure 2: Unite price dor fresh pea, fob US

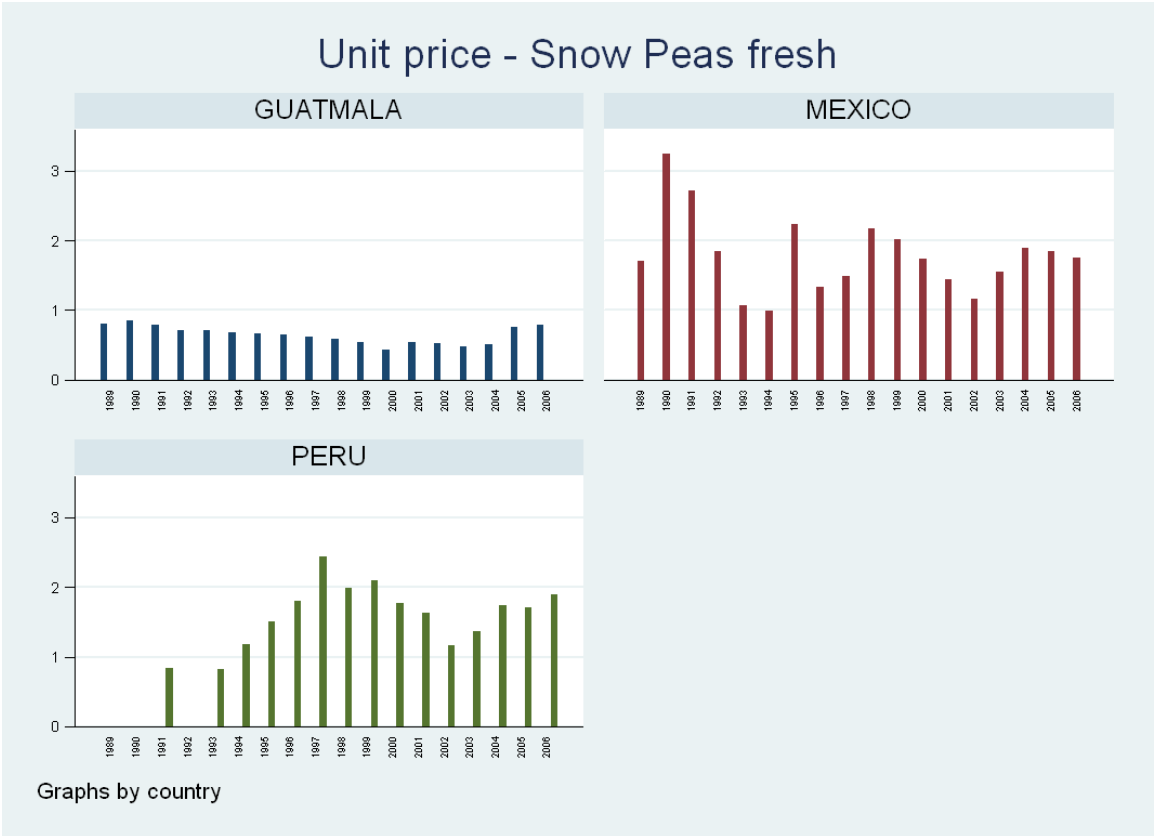

Table 1

FF&V Average Unit Values per Product-Exporter-Year and Exporter GDP per Capita

| Regressor | log (Unit Value) |
|---|---|
| Log (GDP per Capita) | 0.147*** |
| | [0.0441] |
| Product-Year Dummies | Yes |
| Number of Products | 55 |
| Number of Countries | 114 |
| Number if Year | 4 |
| Observations | 2726 |
| $R^2$ | 0.342 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Results for fixed effects are suppressed

Table 2

FF&V Average Unit Values per Product-Exporter-Year, Exporter GDP per Capita and Product Refusals

| Regressor | log (Unit Value) |
|---|---|
| Log (GDP per Capita) | 0.145*** |
| | [0.0437] |
| Refusal Dummy | -0.305*** |
| | [0.0730] |
| Product-Year Dummies | Yes |
| Number of Products | 55 |
| Number of Countries | 114 |
| Number if Year | 4 |
| Observations | 2774 |
| $R^2$ | 0.348 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Results for fixed effects are suppressed

Table 3

| | (1) OLS | (2) POISSON | (3) OLS | (4) Probit |
|---|---|---|---|---|
| Regressor | log(Value) | Value | Log(Unit Value) | Value |
| log(GDP) | 0.248*** | 0.520*** | 0.0566*** | 0.263*** |
| | [0.0607] | [4.42e-06] | [0.0150] | [0.0132] |
| log(Distance) | -0.657*** | -0.619*** | 0.209*** | -0.499*** |
| | [0.138] | [7.57e-06] | [0.0345] | [0.0408] |
| Free Trade Agreements and Non-Reciprocal Preferential Trade Agreement | 0.975*** | 2.166*** | -0.269*** | 0.428*** |
| | [0.224] | [2.48e-05] | [0.0585] | [0.0576] |
| Refusal dummy | 2.746*** | 3.018*** | -0.217*** | _ |
| | [0.317] | [1.80e-05] | [0.0581] | _ |
| Year dummies | Yes | | Yes | Yes |
| Product dummies | Yes | | Yes | Yes |
| Number of years | | 4 | | |
| Observations | 2822 | 25318 | 2822 | 25143 |
| $R^2$ | 0.251 | | 0.557 | |

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Each regression is inclusive of year and product fixed-effects. Robust standard errors are reported between brackets. Every regression yielded a significant fit of the model.

For specification (1), (3) and (4), standard errors where clustered by exporter-product pairs.

Table 4

| Correlation | | |
|---|---|---|
| log(GDP per Capita) | 1 | |
| Refusal Dummy | 0.0277 | 1 |