

Jouanjean, Marie-Agnès

Working Paper

Standard, Reputation and Trade: Evidence from US horticultural imports refusals

LICOS Discussion Paper, No. 281

Provided in Cooperation with:

LICOS Centre for Institutions and Economic Performance, KU Leuven

Suggested Citation: Jouanjean, Marie-Agnès (2011) : Standard, Reputation and Trade: Evidence from US horticultural imports refusals, LICOS Discussion Paper, No. 281, Katholieke Universiteit Leuven, LICOS Centre for Institutions and Economic Performance, Leuven

This Version is available at:

<https://hdl.handle.net/10419/75016>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



LICOS Centre for Institutions and Economic Performance

Centre of Excellence

LICOS Discussion Paper Series

Discussion Paper 281/2011

Standard, Reputation and Trade: Evidence from US horticultural imports refusals

Marie-Agnès Jouanjean



Katholieke Universiteit Leuven

LICOS Centre for Institutions and Economic
Performance
Waaistraat 6 – mailbox 3511
3000 Leuven

BELGIUM

TEL: +32-(0)16 32 65 98

FAX: +32-(0)16 32 65 99

<http://www.econ.kuleuven.be/licos>

Standards, Reputation and Trade: Evidence from US Horticultural Import Refusals

Marie-Agnès JOUANJEAN¹

LICOS Centre for Institutions and Economic Performance – K.U.Leuven
&
GEM Groupe d’Economie Mondiale – Sciences Po

First version: March 2011

This version: January 2012

Abstract

By disentangling productivity from quality sorting in horticultural exports, this paper investigates the impact of food safety standards and consumers’ preference for quality on developing countries’ capacity to export high care and differentiated agricultural products (HCAs). Using a new database on US import refusals, the empirical analysis shows that a shock to reputation has a downgrading effect, reducing the capacity to participate and benefit from trade in HCAs. The occurrence of at least one refusal in the current year reduces HS 6-digit average unit export price by over 8% and the long-run propensity suggest a 25% cut.

JEL: F13 – O13 – Q17

Keywords: SPS – Standards – Agricultural Trade – Quality-sorting – Reputation

¹My sincere thanks to Ben Shepherd for his groundbreaking comments. I am grateful to Thierry Mayer and Marc Melitz for their guidance and advice. Comments can be addressed to: marieagnes.jouanjean@sciences-po.org

1. Introduction

In the debate over trade liberalization and development, part of the discussions about the access of developing countries agricultural products to developed countries markets switched from tariff issues to the building of effective export capacity of developing countries.

Since the 1980s, there has been an increasing interest in the promotion for the production of Non-Traditional Agricultural Exports² (NTAEs) in developing countries. On the one hand, governments and international development agencies advocate they would be a profitable alternative in the context of deteriorating international markets for traditional exports. On the other hand, the increasing demand for year-round access to horticultural products in developed countries provided strong grounds for supporting the development of such new market opportunities. Yet in conjunction with the surge of such high-value or differentiated agricultural and food products (hereafter HVAs) imports from developing countries, the last two decades have witnessed an enhanced awareness of food safety issues in developed countries. Non-tariff measures flourished with the aim, conceptually at least, to satisfy a certain level of quality and safety of agricultural products. A growing set of regulations in developed countries exerted increased pressure on producers from developing countries to transform their processes in order to be eligible to export.³

The impact of increased SPS measures and private standards or codes of practices is still unclear. Their effects on the capacity for developing countries to access developed countries' markets for HVAs is a vivid research theme that until now provided mixed results. One of the central concerns is about the capacity for developing countries and in particular for smallholders to develop and sustain their exports in such context of increasingly stringent standards. Yet, while some advocates that food safety standards undeniably hamper exporting abilities (Otsuki, Wilson and Sewadeh 2001), others present evidence that they can also

² In opposition to traditional agricultural export crops like coffee or bananas.

³ We make use of both terms producer and firm and use them as identical terms.

stimulate and enable competitiveness (Jaffee 2005; Maertens and Swinnen 2009). While standards may be an impediment to trade and development for producers in developing countries, they could also serve as a “catalyst for realizing pro-poor export-led growth in developing countries” (Maertens and Swinnen, 2006) and present an opportunity for exporters to “decommodify”.

Empirical evidence is still limited and this paper contributes to this debate. By disentangling the drivers of trade in horticultural products, it presents evidence supporting the two following statements: First, the demand for high-value agricultural products and in particular HCAs in developed countries and more recently in some emerging countries gave an opportunity to exporters to exit crowded and less profitable commodity markets and to enter alternative systems of product valorisation. This argument tends to support the view that standards can act as a catalyst. Second, this paper also provides evidence that low capacity to produce quality as well as shocks to reputation reduce the opportunity and benefice to trade in HCAs.

One crucial aspect of the paper is to provide grounds for the fact that agricultural products are becoming much like industrial products in the way that consumers are looking for quality, safety as well as differentiated products. In other words, agricultural and food markets evolve from productivity-based toward quality-based competition. As such, this paper is a contribution to the recent literature on the relationship between quality and trade. Its novelty lies in emphasizing a reputation effect on the capacity to export HCAs. This notion is discussed in the second section. In the third section I develop a new framework that endogenizes various quality parameters in a Melitz (2003) setting: it integrates heterogeneity in the capacity of exporting countries to produce quality and in consumers' preference for quality. Many studies analyse the effect of new SPS measures on predicted trade flows with an ex-ante approach (Otsuki et al. 2001). Yet, too few studies adopt an ex-post analysis posture. They were at the time rendered impossible because of the lack of comprehensive

data on the implementation of SPS measures in world trade.⁴ The last section of the paper fills this void. Using a new database on US import refusals, it provides evidence about the effect of a shock to reputation on average horticultural f.o.b. export price.

2. The notions of quality and reputation in horticultural trade

This section presents empirical evidence about: first, the importance of considering heterogeneity in quality when analysing trade in horticulture; second, the reputation impact of exporting non-compliant horticultural products. The analysis of US case stories supports the relevance of the use of import refusals data as a proxy for a reputation shock in the empirical analysis developed in the last section of this paper.

2.1 The notion of quality

Various foods scares and related events triggered the strengthening in public regulation in developed countries. But, in addressing consumers concerns on quality and food safety, the private sector also found a way to differentiate their products and to compete in quality-defined markets. Therefore, along with public regulation, the private sector developed codes of practices (US market) and certifications (EU market), usually far more burdensome. As a consequence, new institutional arrangements were necessary; food retailers reduced their reliance on brokers or terminal markets and increasingly sourced directly from producers. This gave producers the opportunity to enter different systems of product valorisation. If trade in fruits and vegetables is usually referred to as trade in HVAs, yet “the implied dichotomy between low- and high-value markets presents an unduly simplistic picture of the market choices” (Jaffee et al. 2011). There is still much heterogeneity in requirement between

⁴ Disdier *et al.* (2007) were able to conduct a study on the effect of Non Tariff Measures (NTBs) relying on WTO members' 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. Also, studies pinpoint the high level of aggregation of such a database and above all the lack of information concerning many important bilateral restrictions.

and within importing countries along various distribution channels and market segments. In this line, Jaffee and Masakure (2005) emphasize this heterogeneity between and within EU countries according to consumers' preferences but also to patterns of fresh product purchases and distribution. For example, high-end supermarket chains in the UK generally require high standards and food safety compliance – in particular when considering the growing importance of pre-packs and other high care products. But other horticultural segments in the country are governed by very different standards. Ethnic, food services and restaurant supply chains' predominant consideration remains price and continuity. As for the US, even though supermarket chains tend to follow the same path as EU retailers, the supply of horticulture products in bulk through brokers is still widely used (Hanson and Blandon, 2009).

On the other side, as stated in Jaffee, Henson and Rios (2011), this evolution provided exporters with a convenient mean to differentiate their product in otherwise crowded commodity markets. The reduction in transport costs due to new transportation technologies (Coyle, Hall and Ballenger 2001) and the subsequent increase in competition even more stimulated the development of new strategies among suppliers. The case of Kenyan horticulture exporters is a very famous example (Jaffee and Masakure 2005). In the late 1980's, only 10% of the Kenyan French bean production was sold directly to supermarket chains in Europe. The rest was sold in bulk through wholesale markets or distributors. With the increase in competition in the European market because of the diversification of supplying origins and the subsequent downward pressure on wholesale prices, sales of loose products became marginally profitable. This prompts the pursuit of product innovation and quality as an adaptation to new market conditions. During the 1990's, even though export quantities did not increase much, export value grew along with the proportion of products directly exported to supermarkets. According to Jaffee and Masakure (2005), this shift of strategy toward value-added processing and packaging allowed for a three-fold increase of Kenya's export value, from 1000 US\$ per ton in the early 1990s to 3000 US\$ per ton. Even

though trade in bulk still represents an important component of Kenyan exports in order to cover their costs, this provides further evidence of the opportunities offered by consumers' increasing demand for HCAs and their willingness to pay a premium. According to Jaffee and Hanson (2004), "rising private sector and public standards have posed challenges to the Kenyan fresh produce industry, yet at the same time they have also thrown a 'life line' to the industry". Peru is another well-known example, often cited as a "Standard Success Story". Even though the country benefits from favourable conditions for the production of winter vegetables for north hemisphere high-income countries, prohibitive transport costs prevented any price competition with other suppliers. Thus they adopted a high-quality strategy and implemented national standards in line with international norms that not only allowed them to become competitive in such markets but also generated increased "client loyalty" (Jaffee and Henson 2004). Indeed, such strategy reduced the risk of trade disruptions due to erratic and irregular quality.

Those arguments, used as baseline justification of the analysis developed in this paper, support the hypotheses that not only preference for quality but also reputation are determinants of the pattern of horticultural exports. To highlight this, I firstly assume that horticultural products can be defined according to two levels of quality; roughly relying on this differentiation between bulk/commodity exports – for which a buyer/consumer's prime concern will be set on price – and HCAs – for which a buyer's prime concern will be set on safety, reliability and value-added attributes. Secondly, I introduce a reputation parameter – defined in the following section – that impacts the importers' valuation of quality of the exporting country's whole sector, whether firms export in bulk or HCAs.

2.2 The notion of reputation

The enhanced awareness of food safety issues changed the relationship between exporters and importers. Studies on food scares and crises clearly highlighted the spillovers of such events on the whole sector. For example, Jaud et al (2009) link food scares and supplier

concentration in the EU market. Using a new database quite similar in structure to the one used in this paper for the US, they show that EU agro-food imports are vulnerable to food alerts and that they are more concentrated on a few suppliers for “risky products”.

Many case studies stress the impact of non-compliance of few products shipments on the overall export sector. In Peru, cooperation between the public and private sector was spurred on by a food safety outbreak that occurred in Spain in 1997 and traced back to Peruvian canned asparagus. According to Jaffee and Hanson (2004), European consumers were left with unfavourable impression causing Peruvian asparagus sales to slump. An even closer example was the E-coli outbreak that occurred in Germany in spring 2011. German government claimed that cucumbers produced in a Spanish organic farm caused the outbreak. Even though this information was rapidly found to be erroneous, consumers’ suspicion spreads to the whole Spanish fresh vegetables sector, which suffered tremendous losses in a few weeks.

It would be expected that trade in HCAs would reduce the risks of trade disruption due to quality, food safety or disease issues. But what happens if the effects of a crisis is not firm specific but rather relates to the whole sector’s food scare history between two trading countries? The definition of reputation used in this paper draws from Tirole (1996) who defines collective reputation as an aggregate of individual reputations. Thereby, the consumer uses the past behaviour of the member’s group to predict the individual firm's future behaviour. As such, reputation is assumed to impact export value in various ways. First, there is path dependency between the potential histories of food safety crises related to one country’s exports. Second, even though one firm produces compliant products, it is the collective reputation of the sector that will influence consumers’ rating of the product.

2.3 FDA inspections, import refusals and reputation.

Usually, the US Food and Drug Administration (FDA) inspects 1% of food import shipments at the port of entry (Buzby et al. 2008). But if a product or an exporter (country or firm)

repeatedly violates US regulations or poses risks 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) system. The surveillance of products is increased by compulsory detention and the burden of proof that the shipment is compliant is transferred to the exporter. This system of AD and DWPE has first been implemented in the late 1980s. This period witnessed simultaneously an increase in imports of horticultural products in the US market and rising food safety concerns on the part of US consumers and authorities. Thus, aside from detentions due to different pest outbreaks, the increasing attentiveness to food safety and in particular to pesticide residues led to the implementation of AD and alerts for various countries and products for which many violations had been observed.

The occurrence of an alert creates delays and new risks for the importer distribution chain. Under DWPE, exporters that are able to send products complying with the US legislation five times in a row (re)gain access without automatic detention. Still, they continue to be submitted to a 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; the limited resources of the FDA lead inspections to be path dependent, by continuously focusing on products and/or producers that encountered problems in the past. Along this line, Buzby et al (2008) confirmed the existence a strong correlation between refusals and FDA alerts. FDA inspections, and as a consequence refusals, are clearly biased against exporters or countries holding a record of risk of their food exports.

In order to test the effect of a shock to reputation, this paper makes use of a new dataset built upon information on FDA import refusals. Our hypothesis is that the existence of an import alert due to a history of non-compliance of products from a given country will have a bad reputation effect on every exporter of this specific product from that country.

Remarkably, customs authorities do not recognize private certifications, thus the probability for one exporter to be detained by customs authorities – all other things equal – is the same whether the firm exports HCAs or not. This higher probability for shipments to be controlled and detained will have an impact on the reliability of exporters and thus on their reputation. The following case studies provide further evidence supporting the relevance of the use of import refusals data as a proxy for reputation shock in the empirical analysis.

2.4 Evidence from Guatemalan exports to the US.

Different case studies in Central America and the Caribbean's have emphasized the effects of such path dependency on trade flows and the risk of market disruption. Guatemalan snow peas exports are a famous example. The introduction of NTAEs in Guatemala brought new production technologies and new demands of aesthetic and grade qualities that necessitated in such tropical climates an intensive use of chemical inputs. At first, these aesthetic requirements, as a "Search" attribute of quality, did not present specific information asymmetry issues. Guatemala rapidly became first provider to the US, but from the end of the 1980s, the massive use of pesticides resulted in frequent shipment detention and refusals. As a result, the FDA issued in 1992 a countrywide alert for pesticide residues on Guatemalan imports. Guatemala didn't endure the same market disruption as the Dominican Republic, confronted to the same issue, and through time managed to stay among top exporters. Nonetheless, recurrent refusals and the inability to properly address this concern have been highly detrimental to the country's relative competitive position. First, exporters suffered immediate losses: as reported by Thrupp (1995), in the early 1990s, 27.3 % of NTAEs shipments sampled from Guatemala were detained. Between 1990 and 1994, 3,081 detentions of Guatemala's exports due to pesticide residues resulted in a loss of a total of US\$17,686,000. But producers also suffered longer-term consequences. Guatemala is still today under countrywide alerts with DWPE. While it managed to recover its leading place as snow peas exporters to the US in quantity, all these issues have decreased Guatemalan

reputation and competitiveness in the US market compared to its two rivals, Mexico and more recently Peru. Between 2000 and 2006, average export unit prices were 0.50 US\$/kg to 0.70 US\$/kg for Guatemala, compared to 1.20\$/kg to 1.90\$/kg for Mexico and Peru.⁵ Producers in both later countries sell their production directly to the food distribution chain whereas 80% of Guatemalan snow peas are sold through brokers for half price (Hanson and Blandon, 2007). Quite surprisingly, a survey (Julian, 2003) among US snow pea's market stakeholders emphasized that Guatemalan smallholder production, compared to large estate production in Mexico or in California, was much better matched with US consumers demand. But the same survey also highlighted that because of the risks associated with automatic detentions, some US importers were no longer directly importing snow peas from Guatemala but rather buying them to brokers, once snow peas had cleared customs.

In Guatemala, major shippers managed to get off automatic detention. Yet recurrent import refusals from small and/or inexperienced exports, in particular during prices spikes, continue to fuel Guatemalan bad reputation. One last surprising consequence was export diversion by some of the most efficient exporters in Guatemala toward the European Union market. They felt the European market was more secure, transparent (one GlobalGAP certification rather than multiple retailer specific codes of practices) and that it better valued their production⁶.

In the following, the identification of the determinants of average horticultural export prices will highlight the mechanisms behind this reputation effect.

3. Quality and reputation matters: theoretical framework

New trade models of firm heterogeneity confirm the importance of differences in producers' productivities. Across-firm productivity levels explain a significant proportion of the variance of trade flows. The Melitz (2003) model and its extension by Helpman, Melitz and

⁵ NBER trade database, Authors' own calculation.

⁶ Author's own exporter survey in Guatemalan; November December 2009.

Rubinstein (2008) and Chaney (2008) is now widely accepted. The model introduces fixed and variable export costs in a framework of asymmetric countries and firm heterogeneity with firm productivity being Pareto-distributed. The cut-off condition on the incentive to export defines a productivity threshold above which producers should be able to export to distant markets. In this framework, f.o.b.⁷ export prices are inversely related to distance and to the difficulty to enter one's market, generally revealed by fixed costs of entry.

However, Schott (2004) highlighted the inconsistency of new trade theory models and their expected inverse relationship between price and producer productivity. His study of US imports presents a strong relationship between GDP per capita and average export unit value within products at the HS10 level. Hummels and Klenow (2005) confirm this prediction and show that richer countries export more units at higher prices to a given market. These results are consistent with the observation that higher income countries produce products of higher quality. Both papers underline the importance of other exporting country characteristics and correlate increase in unit value with the exporter's relative endowment of physical and human capital. Focusing on the demand side, Hallak (2006) finds that richer countries tend to benefit from higher demand for imports from countries producing high-quality goods.

In order to explain these observations, studies following the Melitz (2003) benchmark model offer specific deviations and include a quality factor of trade. Johnson (2009), Baldwin and Harrigan (2009) and Crozet, Head and Mayer (2009) test a quality-sorting hypothesis on various sectors and confirm the inconsistency of price behaviour with the benchmark models. These papers theoretically and empirically demonstrate the importance of taking quality into consideration when explaining bilateral trade flows in specific sectors, although most of them did not provide clear-cut disentangled impacts between quality-sorting on the one hand and productivity-sorting on the other. It is usually assumed that agricultural trade, presented as commodity trade, tends to follow productivity sorting patterns (Johnson, 2009). In other

⁷ Free on Board

words, we should observe an inverse relationship between mill price and distance between trade partners. My hypothesis in this paper is that it is not necessarily the case when it comes to horticultural products. One of the core contentions of this paper is to demonstrate that usual productivity-sorting model is not solely sufficient to explain average unit export prices in horticulture. Thereby, it proposes and tests an in-between model combining productivity and quality-sorting, better suited to capture the duality in the determinants of horticultural exports.

As aforementioned, it is considered in this paper that horticultural products can broadly be grouped into two categories: commodity products and HCAs. Thus, innovation of this paper lies in a first step in the introduction of two key features. First, in a productivity-sorting setting, it allows for a quality differentiation by the most productive firms. Second, consumers from different countries have heterogeneous preferences for quality. This next section proposes an in between solution compared to the usual literature and introduces both features of productivity and quality-sorting in a model based on firm heterogeneity with firms' productivity following a Pareto distribution. This section of the paper follows the Melitz (2003) framework augmented by Eaton, Kortum and Kramarz (forthcoming), Baldwin and Harrigan (2009), Johnson (2009), and Crozet, Head and Mayer (2009). Within a CES framework, I adopt a similar method, adding a quality parameter that allows for consumers to maximize their utility according to a quality-adjusted price.

3.1 Productivity vs. quality sorting models

Most quality-adjusted models switch from a productivity-sorting to a quality-sorting setting by hypothesizing that producing quality is costly. Heterogeneity in productivity is therefore replaced by heterogeneity in quality. Thus, one of the difficulties raised by quality-sorting models is to define a relationship between firm productivity and quality without losing the possibility of comparison with the original Melitz productivity-sorting model. These models relate quality and productivity through a power function of the type

$$q = c^\theta \tag{1}$$

with q the quality parameter, c firms' factor requirement and $\theta \geq 1$. Kugler and Verhoogen (2008) studying unit values of inputs of Colombian manufacturing plants provide direct empirical support for such a relationship between quality and cost showing that higher cost inputs are associated with higher quality outputs. The general setting then usually defines a quality-adjusted price $\tilde{p} = p/q$ and a quality adjusted demand $\tilde{x} = xq$. With this, the difficulty lies in the definition of the power parameter θ . The model developed in this section will not depart from these hypotheses. I innovate by endogenizing the power parameter, making this relationship idiosyncratic to the dyadic relationship between the exporting and importing country.

The consequence of defining quality as in equation (1) is that depending on the value of the power parameter; all exporting firms will export either under productivity-sorting or quality-sorting. Baldwin and Harrigan (2009) define this power parameter as the elasticity connecting quality and factor requirements. Thus, setting $\theta = 0$ reduces the model to the standard Melitz (2003) productivity-sorting model. If $0 < \theta < 1$, the quality-adjusted price increases with cost and thus with unit price, rendering undesirable for producers to resort to a quality strategy. Within this range of θ , productivity-sorting will be more relevant in explaining trade flows export prices. It is only when $\theta > 1$ that the quality-adjusted price will negatively relate to unit price. In other words, the more factor requirement is needed to produce one unit of product, the higher the quality and the lower the quality-adjusted price. The relationship hence integrates the consumer quality-adjusted demand: based on a firm's factor requirement, consumers will regard some varieties as superior to others in terms of quality if and only if $\theta > 1$. Thus, quality-sorting models fully reverse the relationship between variable costs and prices: the more difficult the access to one country's market, the higher both quality and average export prices are. Therefore, firms are sorted according to quality with the higher firm's factor requirement representing the higher quality. As in

Baldwin and Harrigan (2009), in quality-sorting settings, firm heterogeneity is thus distributed Pareto over factor requirements instead of productivity.

Johnson (2009) builds a framework allowing for close identification of the sign of the correlation between quality-adjusted price and unit price among various sectors. He systematically detects if the dynamic of these exporting sectors either matches with a productivity-sorting or a quality-sorting setting. Borrowing from John Sutton's terminology, he proposes to link firms' factor requirements to their "capability" defined by the ratio of quality to costs. This "capability" can be compared to a quality-adjusted factor requirement. Firm heterogeneity does not rely on their factor requirement, but on their capacity to transform variable costs into quality. Thus firm's quality is a constant elasticity function of their capability. His methodology makes it possible to identify empirically if the power parameter governing the relationship between quality and capability is $\theta > 1$ or $\theta < 1$, indicating if exports are following productivity or quality-sorting. His results are of tremendous interest for various reasons: he builds and tests a theoretical framework that clearly supports the rejection of the homogeneous quality formulation of the standard heterogeneous firms' models, but also, he clearly states the existence of both productivity and quality-sorting throughout the various sectors he is studying. Unfortunately, his results are not of any support concerning the agricultural sector since Johnson (2009) discarded non-manufacturing trade of his sample "on the ground that monopolistic competition models ought to be best suited to understand trade in differentiated manufactures".

Even though this complete inversion of the relationship fits much better with average observed export prices in many sectors, I argue that it still does not allow for considering the full reality of sectors such as the horticultural export sector. In the model I suggest an in-between solution that would better fit the horticultural sector and would allow highlighting the effect of a bad reputation on export prices. Instead of a continuous relationship between quality and productivity, I consider the existence of one homogenous level of quality.

Horticultural products can be differentiated according to the type of market chain through which they enter the importing country. Thus, in order to make the model description more straightforward, I will refer from now on to productivity and quality products. Productivity products relate to commodities, sold for example to intermediaries or more specifically to brokers in the US. Quality products relate to HCAs products, directly imported by retailers. To put it differently, the firm has an opportunity to differentiate its products in HCAs and HCAs are homogenous in quality.

The model introduces a quality threshold, idiosyncratic to the dyad, defined over the lower productivity level necessary to profitably export quality products. In other words, it relates to the level of productivity at which it becomes profitable for one exporter to export quality products to one country according to its consumers' preference for quality. I also endogenize the power parameter relating quality to productivity θ_i , defined over $[0, +\infty[$, and make it specific to the exporting country. This parameter characterizes the capacity $1/\theta_i$ of the exporting country to produce quality. As a consequence, the level of productivity necessary to make quality profitable in one export market will depend on the exporter's capacity to produce quality: it will be much easier to produce horticultural product fulfilling basic quality requirements in France than in Guatemala. Also, the endogenization of the quality parameter to the importing country will enable products from the same sector within one exporting country to be exported under various regimes according to the country of destination. Thus, I expect more quality products to be exported to high-income countries when productivity products will better fit exports toward developing countries. As usual in the literature, I assume quality products to be costlier and that the cost of producing quality is a power function of a firm's factor requirement. Thus define c the physical factor requirement necessary to produce one unit of productivity products and c_q the physical factor requirement necessary to produce one unit of quality product so that:

$$c_q = c^{(1+\theta_i)} \quad (2)$$

Firms are heterogeneous in their level of productivity that will then define, according to the targeted market, if it is profitable to export either productivity or quality products. I assume here that each firm with a level of productivity higher than the quality threshold will automatically switch to quality products.

3.2 The setting: disentangling productivity and quality sorting

3.2.1 The consumer's problem

I consider a world of C countries indexed by i , varying in size and location, in which consumers maximize a CES utility across a continuum of varieties over the set V available in country i .

I assume consumers/buyers are able to recognize “quality” from “productivity” products. Heterogeneity among consumers of various countries relies on the intensity of their preference for quality q_i . Like in Eaton, Kortum and Kramarz (2008), I introduce the term α_i representing an endogenous shock to the quality parameter in country i . This shock will have a downgrading effect on the quality parameter, in other words it represents the effect of a bad reputation on consumers' valuation of quality. For productivity products, the quality term becomes $\alpha_i q_i = 1$. The consumer maximizes utility according to a quality-adjusted demand $\tilde{x}_i(v) = \alpha_i q_i x_i(v)$, such that:

$$U_i = \left[\int_{v \in V_i} [\tilde{x}_i(v)]^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (3)$$

The parameter σ is the elasticity of substitution across products and as usual, it is the same across countries.⁸ Given the budget constraint of country i where the income Y_i equals to expenditure $Y_i = w_i L_i$, with L_i , the consumers' supply of labour to firms and w_i their wage, the quality-adjusted demand for the variety v becomes:

⁸ Melitz and Ottaviano (2008) relaxed this hypothesis by developing a model in which each firm faces a linear demand. This model allows for mark-up variations across firms and destination markets. Their conclusions will be discussed further in this paper.

$$\tilde{x}_i(v) = \tilde{p}_i(v)^{-\sigma} \tilde{P}_i^{\sigma-1} Y_i \quad (4)$$

where $\tilde{p}_i(v) = \frac{p_i(v)}{\alpha_i q_i}$ is the quality-adjusted price and $\tilde{P}_i = \left(\int_{v \in V_i} [\tilde{p}_i(v)]^{1-\sigma} dv \right)^{\frac{1}{1-\sigma}}$ the quality-adjusted price index. This allows defining a physical demand⁹ quite similar to Johnson (2009) with:

$$x_i(v) = [\alpha_i q_i]^{\sigma-1} p_i(v)^{-\sigma} \tilde{P}_i^{\sigma-1} Y_i \quad (5)$$

3.2.2 The producer's problem

As usual in the literature, a Dixit-Stiglitz framework of monopolistic competition characterizes the supply-side of the model so that a single firm produces each variety and there is free entry into the industry. Firms are heterogeneous in their productivity in the sense that marginal cost varies across firms. Firms from i will incur fixed costs f_{ij} of selling to market j . Firms' productivity is distributed Pareto, with the distribution function $g(\varphi)$ over $(\varphi_0, +\infty)$ and a continuous cumulative distribution $G(\varphi)$. Operating profits of a country i 's firm producing variety v and selling to j is classically expressed as:

$$\pi_{ij}(v) = \frac{R_{ij}(v)}{\sigma} - f_{ij} \quad (6)$$

Assuming a continuum of firms and a reasonable number of them allows for the disappearance of strategic interactions. Thus, when maximizing their profits, firms will charge a mill price with a constant mark-up over marginal costs: $p_i(v) = [\sigma/(\sigma - 1)]w_i c$. The country specific factor cost is w_i and $c = 1/\varphi$ is the firm's specific factor requirement, or the inverse of its productivity, needed to produce one unit of the variety v . If a firm from i seeks to sell its products to consumers in j , those consumers will bear an additional transport cost τ_{ij} defined in a Samuelson's iceberg costs fashion.

⁹ Usual productivity-sorting demand is expressed as: $x_i(v) = \frac{(p_i(v))^{-\sigma}}{P_i^{1-\sigma}} Y_i$

$$p_i(v) = [\sigma/(\sigma - 1)]\tau_{ij}w_i c$$

According to (2), the quality product mill price is $p_i(v) = [\sigma/(\sigma - 1)]w_i c^{(1+\theta_i)}$. Thus the capacity of a given firm to produce quality will depend on the interaction of three parameters:

- The firm's productivity $\varphi = 1/c$: the higher a firm's productivity, the more likely it will produce quality products.
- The country's capacity to produce quality $1/\theta_i$: the higher this capacity, the lower the additional costs of producing quality will be.
- The intensity of consumers' preference for quality q_i : the more one country's consumers find utility in consuming quality products, the more firms will be prompt to switch to a quality strategy. The higher the shock on the quality parameter, the lower $\alpha_i q_i$.

Thus the quality threshold is reflected by the upper limit level of factor requirement \bar{c} for which it is profitable to switch to a quality strategy. This threshold corresponds to the specific productivity level for which $p_i(v) = \tilde{p}_i(v)$ implying $\alpha_i q_i = \bar{c}^{\theta_i}$. This allows us to define a quality-adjusted price such that:

$$\tilde{p}_i(v) = [\sigma/(\sigma - 1)]w_i \tilde{c} \quad (7)$$

where $\tilde{c} = \frac{c^{(1+\theta_i)}}{\bar{c}^{\theta_i}}$ represents the quality-adjusted factor requirement. It can be highlighted that $\tilde{c} > c$ if $c > \bar{c}$ and $\tilde{c} < c$ if $c < \bar{c}$. Every firm with a factor requirement $c \leq \bar{c}$ will have a quality-adjusted price $\tilde{p}_i(v) \leq p_i(v)$ and thus will find an advantage in switching from productivity to quality products.

I consider that fixed cost is the same whether the firm decides to produce under quality or productivity strategy.¹⁰ I assume that $f_{ii} = 0$. A firm will export to country j if and only if $\pi_{ij} \geq 0$ with firm's revenues from selling to country j such as:¹¹

¹⁰ Making fixed costs different whether producing quality or productivity products complicates unnecessarily the model without yielding more interesting results for the purpose of this paper.

$$R_{ij}(v) = p_{ij}(v)x_j(v) = \left(\tau_{ij}p_i(v)\right)^{1-\sigma} [\alpha_{ij}q_j]^{\sigma-1} P_j^{\sigma-1} Y_j \quad (8)$$

Thus, the condition for one firm of country i to export to country j is $\frac{R_{ij}(v)}{\sigma} \geq f_{ij}$, implying the following cut-off condition:

$$\varphi_{ij} = A \frac{\tau_{ij}w_i}{P_j} \left(\frac{f_{ij}}{Y_j}\right)^{\frac{1}{\sigma-1}} \quad \text{with } A, \text{ a set of parameters} \quad (9)$$

The cut-off condition for a firm to export productivity products is the same as in the benchmark productivity-sorting model. If $c_{ij} > \bar{c}$ then $\tilde{c}_{ij} > c_{ij}$, at the cut-off, firms will not find any advantage in producing under a quality strategy. Under this condition, the existence of the quality strategy will not increase the number of firms able to export to j . Firms from i will only be able to export to j if their productivity is at least $\varphi_{ij} = 1/c_{ij}$. A specificity of this model lies in the extreme case where all firms from i export under quality-sorting; that is where $c_{ij} < \bar{c}_{ij}$ and $\tilde{c}_{ij} < c_{ij}$. Therefore, around the cut-off, some firms that would not have been able to export to j under productivity-sorting will be able to export under quality-sorting. In other words, the possibility to switch to quality production will enable firms with a factor requirement c such that $\tilde{c}_{ij} < \tilde{c} < c_{ij} < c < \bar{c}_{ij}$ to export to j . For convenience, I focus on a benchmark case for which $c_{ij} > \bar{c}_{ij}$ implying that both productivity and quality products will be exported. Other cases are extreme situations. In our benchmark situation – all other things equal – the number of exporting firms to one country will be constant and will only be dependent of the entry threshold. As a result of (8), $R_{ij} \neq 0$ if and only if $c \leq c_{ij}$. If $c_0 > c_{ij}$ only a subset N_{ij} , hence representing N_{ij} varieties, of the N_i producing firms in country i will be able to export to country j . The productivity of those N_{ij} exporting firms is defined over $[\varphi_{ij}, +\infty[$.

¹¹ Productivity sorting firm's revenues are expressed as $R_{ij}(v) = \frac{(\tau_{ij}w_i c)^{1-\sigma}}{\left(\left(1-\frac{1}{\sigma}\right)P_j\right)^{1-\sigma}} Y_j$

3.2.3 Expected average unit export f.o.b. price

Trade data only provide with information on the average unit export f.o.b. price of products at the HS 6-digit level. Therefore we are looking for an expression of the expected unit export f.o.b price of all varieties exported by i to j .

According to the productivity-sorting setting, the expected unit export f.o.b price depends solely on the expected productivity level conditional on firms exporting to i .¹² Thus, under this setting, the expected unit export f.o.b. price of exports from i to j is given by:

$$E(p_{ij}|\pi_{ij} \geq 0) = \bar{p}_{ij} = \left(\frac{\sigma}{\sigma-1}\right) \frac{w_i}{E(\varphi|\pi_{ij} \geq 0)} \quad \text{with } \sigma > 1$$

This becomes:

$$E(p_{ij}|\pi_{ij} \geq 0) = \varepsilon \frac{p_j Y_j^{\frac{1}{\sigma-1}}}{\tau_{ij} f_{ij}^{\frac{1}{\sigma-1}}} \quad \text{with } \varepsilon \text{ a set of parameters} \quad (10)$$

In the Productivity-Quality-Reputation (PRQ) setting, expected unit export f.o.b. price also depends on the proportion of firms exporting productivity or quality products to this market. Thus, the expected price conditional on exporting from i to j is defined as:

$$E(p_{ij}|\pi_{ij} \geq 0) = (\sigma/\sigma - 1)w_i V_{ij} \quad \text{with } V_{ij} = (V_{ijp} + V_{ijq}) \quad (11)$$

As in Helpman et al (2008), V_{ijp} and V_{ijq} are two monotonic functions of the proportion of exporters respectively exporting under a productivity or quality strategy to country j , $G(c)$.

¹² Productivity-sorting expected productivity is expressed as:

$$E(\varphi|\pi_{ij} \geq 0) = \frac{1}{1-G(\varphi_{ij})} \int_{\varphi_{ij}}^{+\infty} \varphi g(\varphi) d\varphi = \left(\frac{\kappa}{\kappa+1}\right) \varphi_{ij} \quad \text{with } \kappa \text{ the Pareto distribution parameter.}$$

$$V_{ijp} = \begin{cases} \frac{1}{1-G(\bar{c}_{ij})} \int_{\bar{c}_{ij}}^{c_{ij}} c dG(c), & \text{for } c_{ij} > c > \bar{c}_{ij} \\ 0, & \text{Otherwise} \end{cases} \quad (12)$$

$$V_{ijq} = \begin{cases} \frac{1}{1-G(\bar{c}_{ij})} \int_0^{\bar{c}_{ij}} c^{(\theta_i+1)} dG(c), & \text{for } c_{ij} > \bar{c}_{ij} > c \\ 0, & \text{Otherwise} \end{cases}$$

As already mentioned, I do not consider extreme cases for which firms from one country only export productivity or quality products to a specific market, implying a different number of exporting firms to market j . Nevertheless, it is possible to identify that the benchmark situation lies between those two extremes, within a framework considering a constant number of exporting firms. The two extreme values of this benchmark situation for V_{ij} are: $V_{ijp,max}$ for which all firms with a factor requirement $c < c_{ij}$ export under productivity sorting; and $V_{ijq,max}$ for which all firms export under quality sorting.

$$V_{ijp,max} = \frac{1}{1-G(c_{ij})} \int_0^{c_{ij}} c dG(c) = \frac{\kappa}{\kappa+1} c_{ij}$$

and

$$V_{ijq,max} = \frac{1}{1-G(c_{ij})} \int_0^{c_{ij}} c^{(\theta_i+1)} dG(c) = \frac{\kappa}{\theta_i + \kappa + 1} c_{ij}^{\theta_i+1}$$

with κ the Pareto distribution parameter.

According to our assumption, we have $V_{ijp,max} < V_{ij} < V_{ijq,max}$.

The assumption in this paper is that the proportion of firms producing quality products will vary positively with the capacity of the exporting country and with the preference for quality of the importing country. On the contrary, it will be negatively impacted by a shock to consumers' preference for quality. Thus, the level of the expected price will be a function of

the quality threshold $\bar{c} = (\alpha_{ij}q_i)^{1/\theta_i}$. According to (12), in the benchmark scenario, the value of V_{ij} is the following:

$$V_{ij} = (V_{ijp} + V_{ijq}) = \frac{1}{1 - G(c_{ij})} \int_{\bar{c}_{ij}}^{c_{ij}} c \, dG(c) + \frac{1}{1 - G(\bar{c}_{ij})} \int_0^{\bar{c}_{ij}} c^{(\theta_i+1)} \, dG(c)$$

Developing this equation gives us the following value of V_{ij} , defined over the productivity cut-off condition and the quality threshold:

$$V_{ij} = \frac{\kappa}{\kappa+1} \frac{(c_{ij}^{\kappa+1} - \bar{c}_{ij}^{\kappa+1})}{c_{ij}^{\kappa}} + \frac{\kappa}{\theta_i + \kappa + 1} \bar{c}_{ij}^{\theta_i+1} \quad (13)$$

Because of the second threshold, it is not possible to obtain an empirical procedure that allows estimating parameters' elasticities. Nevertheless, parameters influencing the average f.o.b price are clearly identified allowing us to derive a reduced form of the average price equation and to identify the signs of these parameters. In order to derive such reduced form, I define V_{ij} , the expected factor requirement of exporting firms as:

$$V_{ij} = h(c_{ij}, \bar{c}_{ij}) = h(c_{ij}, \theta_i, q_j, \alpha_{ij}) \quad (14)$$

4. Empirical procedure

4.1 Average unit export f.o.b prices in the productivity sorting setting

In order to verify the first hypotheses of this paper on heterogeneity in quality, I test the workhorse model based on Melitz (2003) and its application to average f.o.b. export prices of horticultural exports. According to (10), the empirical setting of the productivity-sorting model is set forth in equation (15) where expected f.o.b price of exports \bar{p}_{ij} from i to j depends positively on export market size and negatively on fixed and variable costs.

The expected average price of exports from i to j , can now be expressed in log-linear form as:

$$\ln \bar{p}_{ij} = \ln \varepsilon + p_j + [1/(\sigma - 1)]y_j + [1/(\sigma - 1)]\ln f_{ij} - \ln \tau_{ij} \quad (15)$$

where lowercase variables p_j and y_j represent the natural logarithms of respective uppercase variables. As in Helpman, Melitz and Rubinstein (2008) and Johnson (2009), I parameterize the bilateral fixed and variable costs as follows. I assume that τ_{ij} (variable trade costs) is stochastic due to i.i.d. un-measured trade friction $u_{1,ij}$ which is country-pair specific. As an analogy to their definition, I define $\tau_{ij} = D_{1,ij}^\chi e^{-u_{1,ij}}$ where $D_{1,ij}$ represents bilateral symmetric distance between i and j with $u_{1,ij} \approx N(0, \sigma_u^2)$. Thus I have $\ln \tau_{ij} = \chi d_{1,ij} - u_{1,ij}$. Fixed trade costs, are classically set as $\ln f_{ij} = \phi_i + \phi_j + \rho D_{2,ij} + u_{2,ij}$. This data is defined in dyadic form by interacting indicators for the exporting and importing country. I assume that fixed trade costs rely on ϕ_i and ϕ_j , respectively the exporter and importer fixed effects. $D_{2,ij}$ is a set of overlapping data that I assume will decrease the fixed cost of exporting from i to j (sharing a language; a frontier; a free trade agreement, etc.), and $u_{2,ij}$ stands for the unobserved variations in trade costs. In what follows, I simplify the number of variables through the linear combination $\eta_{ij} = u_{1,ij} + u_{2,ij}$ of unobserved variations in fixed and variable costs of trade that I assume to be normally distributed, with σ_η^2 the variance of the composite error. To be thorough, all variables of the model ought to be divided by the variance of this normal distribution. I do not compute this calculation in this paper; I focus on the signs of the left hand side. Substituting those parameters back into the log-linear expression (15) yields the following expression:

$$\ln \bar{p}_{ij} = \xi_0 + \xi_i + \xi_j - \chi d_{ij} + \rho D_{2,ij} + \eta_{ij} \quad (16)$$

$\xi_i = [1/(\sigma - 1)]\phi_i$ and $\xi_j = p_j + [1/(\sigma - 1)]y_j - [1/(\sigma - 1)]\phi_j$ are respectively exporter and importer fixed effects and $\xi_0 = \ln \varepsilon$ is the constant.

The following panel econometric test introduces a time dimension. Some variables, such as income, will become time-dependent. Hence, some variables can be transformed as $\xi_j = p_j - [1/(\sigma - 1)]\phi_j$. The log-linearized expected average price equation becomes:

$$\ln \bar{p}_{ij} = \xi_0 + \xi_i + \xi_j + [1/(\sigma - 1)]y_{jt} - \chi d_{1,ij} + \rho D_{2,ij} + \eta_{ijt} \quad (17)$$

4.2 Average unit export f.o.b prices in the productivity-quality-reputation (PQR) setting

According to (12) I derive a reduced form of the average price equation. The cut-off condition c_{ij} is defined over the same parameters as in the benchmark model but the expected unit export price will now also depend on the quality threshold. I have assumed that this threshold would increase with the preference for quality of the importing country and with the capacity of the exporting country and decrease with a shock to the preference for quality, idiosyncratic to the dyad. This allows us to define the following estimation equation:

$$\ln \bar{p}_{ij} = \gamma_0 + \gamma_1 p_j + \gamma_2 y_j + \gamma_3 \ln f_{ij} + \gamma_4 \ln \tau_{ij} + f(\theta_i, q_j, \alpha_{ij}) \quad (18)$$

I define $\frac{1}{\theta_i} = Y_{pc,i}^{\beta_1} e^{\delta_{1,i}}$ and $q_j = Y_{pc,j}^{\beta_2} e^{\delta_{2,j}}$ where $Y_{pc,i}$ and $Y_{pc,j}$ represent respectively the exporting and importing country GDP per capita with the unobserved quality parameters represented by $\delta_1 \approx N(0, \sigma_{\delta_1}^2)$ and $\delta_2 \approx N(0, \sigma_{\delta_2}^2)$. Thus I have $\ln \frac{1}{\theta_i} = \beta_1 y_{pc,i} + \delta_{1,i}$ and $\ln q = \beta_2 y_{pc,j} + \delta_{2,j}$

The shock to consumers' preference will be defined as a function of the occurrence of custom refusals. Thus I define $\alpha_{ij} = S_{ij}^{\beta_3} e^{\delta_{3,ij}}$ with $\delta_3 \approx N(0, \sigma_{\delta_3}^2)$. Thus, $\ln \alpha_{ij} = \beta_3 s_{ij} + \delta_{3,ij}$. I expect β_1 and β_2 to be positive and β_3 to be negative. Substituting those parameters back into the log-linear expression of the expected export f.o.b. price yields the following expression:

$$\ln \bar{p}_{ijt} = \psi_0 + \psi_i + \psi_j + \beta_1 y_{pc,i} + \beta_2 y_{pc,j} + \beta_3 s_{ij} + \beta_4 d_{1,ij} + \beta_5 D_{2,ij} + \delta_{1,i} + \delta_{2,j} + \delta_{3,ij} + \eta_{ij} \quad (19)$$

With ψ_0 the constant and ψ_i and ψ_j respectively the exporter and importer fixed effects.

In what follows, I test reputation on panel data, introducing a time dimension. The average price equation with the introduction of time can be presented as the following:

$$\ln \bar{p}_{ijt} = \psi_0 + \psi_i + \psi_j + \beta_1 y_{pc,it} + \beta_2 y_{pc,jt} + \beta_3 s_{ijt} + \beta_4 d_{1,ij} + \beta_5 D_{2,ij} + \beta_6 y_{jt} + \delta_{1,it} + \delta_{2,jt} + \delta_{3,ijt} + \eta_{ij} \quad (20)$$

Our dataset allows us to test for the effect of reputation on horticultural imports only in the US.

In such a context, country fixed-effects are de facto dyadic given that all our exports are directed to the same country. In order to take care of our symmetry problem, I define a ‘‘Competitiveness’’ parameter C_{ij} in analogy with the ‘‘Attractiveness’’ parameter used by Crozet, Head, and Mayer (2009). This parameter collects all non time-dependent determinants of exports.

$$\ln C_{ij} = \psi_0 + \psi_i + \psi_j + \beta_4 d_{1,ij} + \beta_5 D_{2,ij} + \eta_{ij} \quad (21)$$

Replacing (21) in (20) yields the following estimation equation:

$$\ln \bar{p}_{ijt} = \ln C_{ij} + \beta_1 y_{pc,it} + \beta_2 y_{pc,jt} + \beta_3 s_{ijt} + \beta_6 y_{jt} + \delta_{1,it} + \delta_{2,jt} + \delta_{3,ijt} \quad (22)$$

In our econometric test including the reputation variable, $\ln C_{ij}$ corresponds to an exporter fixed effect, since the importing country is invariant.

4.3 Accounting for the export price of horticultural products

I use CEPII BACI¹³ trade data at the HS 6-digit level for the 1998-2007 period. It reconciles bilateral trade flows reported by exporter (f.o.b) and importer (c.i.f) in the UN-COMTRADE

¹³ CEPII Centre d'études prospectives et d'informations internationales - BACI (Base pour l'Analyse du Commerce International) International Trade Database at the Product Level

trade database. This dataset not only includes trade in quantity but also the equivalent trade value. With this, I compute the average unit f.o.b. price. This calculation and the comparison are made easier since I only consider horticultural trade, which is systematically reported in kilograms. The analysis of average unit prices presents many outliers corresponding to very small trade flows. As Baldwin and Harrigan (2009), I eliminate trade flows of less than 500kg to make sure results are not influenced by noisy and economically unimportant observations. BACI is the only database providing consistent unit-values at the world and product level, so it is particularly well suited to analysing international trade prices (Gaulier and Zignago, 2009).¹⁴ The dataset covers 10 years, 221 countries and 102 products including fresh, frozen and dried fruits and vegetables from HS Chapters 07 and 08.

The classic variables of distance and GDP were respectively retrieved from the CEPII database and from WDI's World Bank online website. GDP per capita, also gathered from WDI, are computed as a proxy for the exporting country's capacity to produce quality as well as the intensity of consumers' preference for quality in the importing country.

I use a new dataset compiled from FDA data on import refusals to simulate a shock α_{ij} to the valuation of quality parameter on the US market. The FDA makes refusals information public in their Import Refusal Report (IRR). To gain access to historical refusals data, a Freedom of Information request has been submitted in September 2009, which the FDA satisfied by supplying data in May 2010. The FDA uses its own product codification. Thus, a correspondence mapping FDA codes to the Harmonized System at the 6-digit level was built so as to relate these products to reported trade flows and unit prices. Since this dataset only covers trade with the US, the effect of this shock will be tested on a panel covering 11 years, 102 products and 141 exporting countries to the US.

¹⁴ As in Baldwin and Harrigan (2009), I remove traded quantities inferior to 500 kg. Analysis of the data provides evidence that low trade levels usually present very high unit prices. These values are expected to bias considerably our results. The test gathers observed positive trade values since I am only interested in unit prices.

4.3.1 Productivity sorting

I first test the productivity-sorting model using equation (17). The average unit export f.o.b price doesn't verify the productivity-sorting assumption. While a negative relationship is expected in a productivity-sorting framework, estimation results presented in table 1 display a positive relationship between average unit f.o.b export prices and distance. Since distance is positively related to average unit price, it is not surprising that sharing a frontier has a negative impact. Sharing a common language is also negatively, although not significantly, related to average unit prices, but having a history of colonial ties has a positive impact on prices. This supports the rejection of the hypothesis of homogenous quality among firms within the horticultural sector. Thus a comprehensive heterogeneous firm trade model applied to the horticultural sector should also include space for a heterogeneous quality setting. Those results support the assumption that horticultural products are much like industrial products when it comes to sorting out.

4.3.2 Evidence on the importance of quality

I first test the empirical setting (20) on the same database used in the previous productivity-sorting test. Comprehensive data on reputation are only available for US imports but it is still possible to test for the quality and capacity parameters in a multiple importer setting before turning to the more restricted database. As already mentioned, this setting is a reduced form thus I focus my attention on coefficient variations and signs rather than on their size.

As expected, both GDPs per capita are positively related to average export f.o.b. unit prices as well as distance (table 2). More surprising is the negative coefficient for importer GDP. Melitz and Ottaviano (2008) and Baldwin and Harrigan (2009) have already highlighted such results. The former highlight that the size of the market – for which GDP is used as a proxy – affects the toughness of competition to which firms will respond through a variation in their mark-ups. This implies that aggregate productivity and average mark-ups respond to the size of the market and that mark-ups are decreasing in the number of competitors and with the

export threshold of the market of destination. Baldwin and Harrigan (2009) give one other explanation within their “Quality Heterogeneity Firms and Trade” model. They consider that as export market size increases, more low quality firms will find it profitable to enter. Those low quality firms (here firms producing productivity products) will have a lower mill price. As a consequence, average export f.o.b. price in larger markets will be lower. Both assumptions may well explain those results.

These observations and the results obtained are comforting regarding the ability of the model developed here to disentangle the effect of quality and productivity on the observed average export prices. On the one hand, I observe the effect of the market size that tends to decrease the average export price either through more competition or on the contrary allowing for lower quality products to enter the market. On the other, high-income markets have a high preference for quality, enabling exporting firms to profitably switch to quality products. Also, results confirm the importance of producer’s capacity to produce quality on the mix or proportion of productivity and quality products.

4.3.3 Reputation impact: evidence from the US

In a second step, I test the reputation effect on the US market. One might suspect that import refusals are related to GDP per capita; a simple correlation highlights the very little relation between those two variables. This confirms the relevance of refusals as a good proxy for a shock on the quality valuation parameter.

I first create a dummy variable equal to one if there has been at least one refusal for each exporter/product/year. Refusals counts are endogenous to import levels. If every country has the same probability of having one shipment refused, larger trade flows would result in a higher number of refusals. Thus a direct use of refusals count is not likely to capture the expected reputation effect. It would rather inform us on the impact of the addition of one refusal on average export price rather than the impact of the existence of refusals. Moreover, controlling for imports in the regression is problematic since they are highly correlated with

other variables used in this specification (e.g. GDP and GDP per capita). Still, using dummy variable risks to overweight marginal refusals. Thus, refusals count will be used later on in robustness checks.

As expected, average f.o.b unit prices are positively related with exporters' GDP per capita and negatively related to the existence of at least one refusal (table 3). All other things equal, the occurrence of at least one refusal in the current year reduces average unit export price by 8.26%. This confirms our hypothesis on the effect of a shock to the quality parameter – in other words to reputation – on the capacity to export quality. Moreover, I observe that the introduction of this parameter slightly increases the positive effect of the exporter GDP per capita on unit prices, further highlighting the impact of the exporter's capacity to produce quality on average unit export price.

One could expect refusals to have a lagged influence on prices. I thus test the same equation using one to five years lagged refusal dummies.¹⁵ Lagging refusals also suppresses the co-temporality of the data and possible endogeneity issues. Observed coefficients are increasing with the length of the lag. This suggests a long-term effect of refusals that echoes the importance of the earnestness highlighted in this paper. Our database covers 10 years. Making further lags implies reducing the panel data to four or less years resulting in too few observations for results to be reliable. However, tests show that from 5 years lags, the effect of the occurrence of refusals seems to become less significant. To confirm this, a finite distributed lag model of order five is implemented. The results present a negative sign for all lags with two years and three years lags that are one percent statistically significant. The estimated long-run propensity is equal to -0.3, corresponding to a reduction by over 25% of the average unit export price given the occurrence of at least one refusal each and every year for the past five years. This long-run propensity is found to be one percent statistically

¹⁵ Agricultural products are characterized by their seasonality, thus by a discontinuous time: one year represents one period during which a reputation shock can occur.

significant using the simple rearrangement of the specification suggested in Woolridge (2003) that allows obtaining its standard error for which the t statistic is about -3.96.

We go further into this intuition with a new set of variables based on history of occurrence of refusals. The first variable is built as the count of years with a refusal dummy equal to one, over the five years prior to the observation. In a second stage I build another set of dummies each representing the five possible values of the later variable. For example, an observation in 2006, if the country had a refusals dummy equal to one both in 2005 and 2003, the dummy “two year with refusals>0 the past five years” will be set equal to one. Other variables such as “four year with refusals>0 the past five years” will be equal to zero. Table 4 presents the results of the econometric specification using those variables as proxies for the reputation effect. Results clearly highlight the impact of recurrent refusals: the longer the history of refusals, the more downgrading impact on average export prices.

In order to verify the reliability of the use of a refusal dummy, I test the empirical setting using the log of the refusal count, replacing zeros in refusals by 0.001. Second, as aforementioned, one could question the causality between the number of refusals and export quantities. The same empirical setting is tested using an import-weighted number of refusals. This last setting has to be taken with caution because of previously mentioned caveats. Both results, presented in table 5, confirm the results obtained with the refusal dummy. Finally, the same setting was also tested using a probit. The indicator variable T_{ijt} is defined equal to one if the observed average price of a specific product exported from i to j , \bar{p}_{ijt} , is lower than the average export price of all exporters of this product to j , $Pr(T_{ijt} = 1 | \bar{p}_{ijt} < \bar{p}_{jt})$. Results are consistent with the OLS.

These results confirm the intuition of the importance of quality but also of the effect of a shock to reputation in the analysis of horticultural trade flows.

5. Conclusion

Following previous work on the role of productivity in explaining how producers of industrial goods react to exposure to international trade, this paper provides evidence that heterogeneous quality is also a determinant of the capacity to export horticultural products. The paper goes a step further by showing that preference for quality provides a way to create the conditions for increased and more profitable market access. Accordingly, a negative reputation shock conveys a downgrading effect, reducing the ability for countries to export quality products. Exporting a mix of compliant and non-compliant products can reduce the opportunity and benefice to trade in HCAs. Analysing the effect over time, this paper highlights the importance of the exporters' earnestness.

On a policy-oriented level, those results give further credential and support to the current aid for trade agenda in agriculture. Particularly, the agenda calls for innovative initiatives to better inform and support producers in complying with standards so as to more easily differentiate production toward HCAs. In some areas of Madagascar as well as in countries of Central America, the strong involvement of the private sector in securing safe and stable supply of horticultural products has been decisive in the development of the sector and allowed for a sensible improvement of producers' conditions.¹⁶

This paper also highlights the importance of the implementation of public/private partnerships in particular in the setting and harmonization of domestic and international standards. Such initiatives already proved to be successful in various countries. In Guatemala, the Guatemalan Exporters Association in cooperation with various domestic and international public institutions greatly facilitated both the development and the sustainability of Guatemalan's high-quality exports through capacity building, knowledge transfer and international visibility of the sector. In Peru, the food safety outbreak on asparagus underlined

¹⁶ Bart, M., L. Randrianarison and J.F.M. Swinnen, (2006)

that one careless exporter could disrupt markets. As a consequence, the public and private sector in Peru understood that all stakeholders in the export chain needed to be involved to prevent future problems. Accordingly, they implemented an important program of standards harmonization that is now the mainstay of the country's success in HCAs exports.

7. References

- Baldwin, R.E. and T. Ito (2008), "Quality competition versus price competition goods: an empirical classification." working paper, NBER.
- Baldwin, R. and J. Harrigan (2009), "Zeros, Quality and Space: Trade theory and trade evidence." NBER Working Paper.
- Baylis, K., A. Martens and L. Nogueira (2009), "What drives food import refusals?" 2009 AAEA annual meeting , Milwaukee.
- Buzby, J. C., L. J. Unnevehr and D. Roberts (2008), "Food Safety and Imports : An Analysis of FDA Food-Related Import Refusal." Economic Research Service, Economic Information Bulletin Number 39.
- Chaney, T. (2008), "Distorted Gravity: The Intensive and Extensive Margins of International Trade." American Economic Review, American Economic Association, vol. 98(4), 1707-21.
- Coyle, W., W. Hall and N. Ballenger (2001), "Transportation Technology and The Rising Share of U.S. Perishable Food Trade." In: Changing Structure of Global Food Consumption and Trade, Economic Research Service/USDA.
- Crozet, M., K. Head, and T. Mayer (2009), "Quality sorting and trade: Firm-level evidence for french wine." Working Papers 53883, American Association of Wine Economists.
- Diop, N., and S.M. Jaffee (2005), "Fruits and Vegetables: Global Trade and Competition in Fresh and Processed Product Markets." In: Aksoy, M.A and Beghin, J.C. (ed.) Global Agricultural Trade and Developing Countries. World Bank, pp. 237-257.
- Disdier, A.-C., L. Fontagné and M. Mimouni (2007), "The impact of regulations on agricultural trade: Evidence from SPS and TBT agreements." Working Papers 2007- 04, CEPII research center.
- Eaton, J., S. Kortum and S., F. Kramarz, forthcoming, "An Anatomy of International Trade: Evidence from French Firms.' *Econometrica*.
- Gaulier, G. and S. Zignago (2010), "BACI: International Trade Database at the Product-Level. The 1994-2007 Version." Working Papers 2010-23, CEPII research center.
- Hallak, J. C. (2006) "Product Quality and the Direction of Trade." *Journal of International Economics* 68, 1, 238-265.
- Helpman, E. , M. Melitz and Y. Rubinstein (2008), "Estimating Trade Flows: Trading Partners and Trading Volumes." *Quarterly Journal of Economics*, 123(2), 441-487.
- Henson, S. and 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 and S. Jaffee (2008), "Understanding Developing Country Strategic Responses to the Enhancement of Food Safety Standards." *The World Economy*, 31-4, 548-568.

- Jaffee S. (2003), "From Challenge to Opportunity: Transforming Kenya's Fresh Vegetable Trade in the Context of Emerging Food Safety and Other Standards in Europe." Agriculture and Rural Development Discussion Paper 1, World Bank.
- Jaffee S. (2005), "Food Safety and Agricultural Health Standards: Challenges and Opportunities for Developing Country Exports." Report No.31207, Poverty Reduction & Economic Management Trade Unit and Agriculture and Rural Development Department, World Bank.
- Jaffee S. and S. Henson (2004), "Standards and Agro-Food Exports from Developing Countries: Rebalancing the Debate." World Bank Policy Research Paper No. 3348. World Bank.
- Jaffee, S., S. Henson and L.D. Rios (2011), "Making the Grade : Smallholder Farmers, Emerging Standards, and Development Assistance Programs in Africa." Report No. 62324-AFR, A Research Program Synthesis, The World Bank.
- Johnson, R. (2009), "Trade and prices with heterogeneous firms." Technical report, Working paper - Princeton University and UC Berkeley.
- Julian, J. (2003), "Assessment of the impact of Import detentions on the Competitiveness of Guatemalan Snow Peas in US markets." PhD Thesis, Purdue University.
- Grant, J.H. and D.M. Lambert (2008), "Do Regional Trade Agreements Increase Members' Agricultural Trade?" American Journal of Agricultural Economics, American Agricultural Economics Association, vol. 90(3), pages 765-782.
- Maertens, M., J.F.M. Swinnen (2007), "Standards as Barriers and Catalysts for Trade and Poverty Reduction." Journal of International Agricultural Trade and Development vol:4 issue:1 pages:47-61
- Maertens, M., J.F.M. Swinnen (2009), "Trade, Standards, and Poverty: Evidence from Senegal." World Development 37(1): 161-178.
- Melitz, M. (2003), "The impact of trade on intra industry reallocations and aggregate industry productivity." Econometrica 71, 6, 1695-1725.
- Melitz, M. and G.I. Ottaviano (2007), "Market size, Trade and Productivity." Review of Economic Studies, 75, 295-316.
- Minten, B., L. Randrianarison and J.F.M. Swinnen, (2006), "Global Retail Chains and Poor Farmers: Evidence from Madagascar." LICOS Discussion Papers 16406, LICOS - Centre for Institutions and Economic Performance, K.U.Leuven.
- Otsuki, T., J. S. Wilson and 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, P.K. (2004), "Across-product versus within-product specialization in international trade." Quarterly Journal of Economics 119, 2, 647-678.

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

Tirole, J.A. (1996), "Theory of Collective Reputations with Applications to the Persistence of Corruption and to Firm Quality." *Review of Economic Studies*, Vol 63, Num 1.

Wooldridge, J. (2003), "Introductory Econometrics: A Modern Approach." South-Western Division of Thomson Learning, 2e ed.

7. Tables

Table 1: Productivity-sorting setting - Test on average export unit price (f.o.b)

Dep var: Average Unit Price	OLS (1)	OLS (2)
GDP Importer	0.187*** [0.0491]	
Distance	0.101*** [0.0134]	0.102*** [0.0126]
Contiguity	-0.114*** [0.0327]	-0.113*** [0.0314]
Common Language	-0.0253 [0.0269]	-0.0381 [0.0259]
Colony	0.162*** [0.0317]	0.168*** [0.0310]
Constant	-4.847*** [0.959]	3.204
Observations	648,423	658,978
R-squared	0.298	0.339
Fixed effects	Year, product, exporter and importer	Product-year, Exporter-year and Importer-year

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Robust standard errors are clustered at the exporter-importer level.

Table 2: PRQ setting without reputation - Test on average export unit price (f.o.b)

Dep var: Average Unit Price	OLS
	(1)
GDP Importer	-0.801*** [0.171]
GDP per capita Importer	0.983*** [0.164]
GDP per capita Exporter	0.273*** [0.0461]
Distance	0.1000*** [0.0135]
Contiguity	-0.113*** [0.0329]
Common Language	-0.0269 [0.0270]
Colony	0.162*** [0.0318]
Constant	8.823*** [2.873]
Observations	645,001
R-squared	0,3

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Regression is inclusive of year, product, exporter and importer fixed-effects. Robust standard error is clustered at the exporter-importer level.

Table 3: PRQ setting - Test on average export unit price (f.o.b)

Dep var: Average Unit Price	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP per cap Exporter	0.317** [0.129]	0.321** [0.129]	0.323** [0.129]	0.323** [0.129]	0.323** [0.129]	0.323** [0.129]	0.323** [0.129]	0.331** [0.129]
Refusal Dummy		-0.0862** [0.0343]						-0.0219 [0.0292]
Refusal Dummy 1 year lag			-0.0887*** [0.0340]					-0.0188 [0.0275]
Refusal Dummy 2 years lag				-0.134*** [0.0319]				-0.0826*** [0.0259]
Refusal Dummy 3 years lag					-0.130*** [0.0320]			-0.0678*** [0.0244]
Refusal Dummy 4 years lag						-0.114*** [0.0363]		-0.0319 [0.0281]
Refusal Dummy 5 years lag							-0.161*** [0.0517]	-0.0843* [0.0478]
Constant	0.702 [0.902]	-3.312** [1.375]	-3.329** [1.374]	-3.336** [1.374]	-3.345** [1.373]	-3.331** [1.375]	-3.337** [1.374]	-3.436** [1.375]
Observations	9,354	9,354	9,354	9,354	9,354	9,354	9,354	9,354
R-squared	0.448	0.449	0.449	0.449	0.449	0.449	0.449	0.450
Number of years (2003-2007)	5	5	5	5	5	5	5	

Notes : ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Each regression is inclusive of year, product and exporter fixed-effects. Robust standard errors are cluster at the product-exporter level.

Table 4: PRQ setting with reputation effect in time - Test on average export unit price (f.o.b)

Dep var: Average Unit Price	OLS (1)	OLS (2)
GDP per capita Exporter	0.331** [0.129]	0.329** [0.129]
Number of years with refusals the past 5 years	-0.0577*** [0.0142]	
Dummy=1 if 1 year with refusals>0 the 5 years previous to the observation		-0.109*** [0.0388]
Dummy=1 if 2 year with refusals>0 the 5 years previous to the observation		-0.0925* [0.0513]
Dummy=1 if 3 year with refusals>0 the 5 years previous to the observation		-0.179*** [0.0505]
Dummy=1 if 4 year with refusals>0 the 5 years previous to the observation		-0.216*** [0.0643]
Dummy=1 if 5 year with refusals>0 the 5 years previous to the observation		-0.264*** [0.0953]
Constant	-3.436** [1.374]	-3.422** [1.375]
Observations	9,354	9,354
R-squared	0.450	0.450
Number of years (2003-2007)	5	5

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Each regression is inclusive of year, product and exporter fixed-effects. Robust standard errors are cluster at the product-exporter level.

Table 5: PRQ setting - Test on average export unit price (f.o.b)

Dep var: Average Unit Price	OLS (1)	OLS (2)
GDP per capita Exporter	0.241*** [0.0536]	0.241*** [0.0536]
Number of refusals	-0.00138*** [0.000532]	
Weighted number of refusals		-0.00118* [0.000609]
Constant	-3.819*** [0.589]	-3.806*** [0.589]
Observations	17,813	17,813
R-squared	0.415	0.415

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Each regression is inclusive of year, product and exporter fixed-effects. Robust standard errors are cluster at the product-exporter level.

Table 6: PRQ setting- Probit on average export unit price (f.o.b). < all exporters average export unit price (f.o.b)

Dep var: T=1 if the exporter's average unit price is lower than all exporters average unit price.	Probit
GDP per capita Exporter	-0.258*** [0.0865]
Refusal dummy	0.245*** [0.0526]
Constant	1.889** [0.743]
Observations	17,870

Notes: ***, ** and * respectively indicates significance at the 1%, 5% and 10% levels. Each regression is inclusive of year, product and exporter fixed-effects. Robust standard errors are clustered at the product-exporter level.