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Standards, Reputation and Trade:

Evidence from US horticultural import refusals

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Abstract

This paper investigates the impact of food safety standards promulgated by governments or imposed by buyers from the private sector on the capacity of developing countries to access developed countries' markets for high value agricultural and food products. I offer an analysis that disentangles productivity-sorting from quality-sorting in fresh fruits and vegetables exports. My theoretical model and empirical analysis confirms the importance of taking into consideration importers' preference for quality as well as exporters' capacity to produce quality products when analyzing average export unit prices of fresh fruits and vegetables. Thanks to a new database on U.S import refusals, my empirical analysis shows that a shock to reputation seems to have a downgrading effect, reducing the capacity of countries to export quality products.

JEL: F13 – O13 – Q17

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

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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 effective capacity of developing countries to export their products. Living aside the debate over such export strategy for food scarce countries, Non Tariff Barriers (NTBs) and in particular Sanitary and Phytosanitary (SPS) measures are today recognized as an important impediment to such trade. However, there is a pending question regarding 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 undeniably hamper exporting abilities, others present evidence that they can also stimulate and enable competitiveness (Jaffee and Hanson, 2005).

There has been since the 80s an increasing interest in the promotion in developing countries for the production of Non-Traditional Agricultural Exports[2]. On the one hand, governments and international development agencies thought they would be a good alternative in the context of the deterioration of conditions in international markets for traditional exports. On the other hand, the increasing demand for year round access to horticultural products in developed countries provided good grounds for supporting the development of such new market opportunities. But in conjunction with the increase of fresh fruits and vegetables (hereafter FF&V) imports from developing countries, the last two decades have witnessed and enhanced awareness of food safety issues in developed countries. While the latter have in reaction implemented a growing set of new regulations, the former had to align their production processes in order to secure their exports. Traditional trade

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

barriers such as tariffs are less instigated to deal with this specific issue and so non-tariff measures flourished with the aim, conceptually at least, to satisfy a certain level of quality and safety of agricultural products.

The increased use of Sanitary and Phyto-sanitary (SPS) measures toward agricultural products has been largely documented by the literature, and their impacts can be split in two different types of outcomes that are after all two sides of the same coin. First, so as to survive international competition, firms from developing countries must evolve and take full account of new regulations on food safety implemented in developed countries.[3] In particular, the demand for quality from consumers in developed countries is exerting increased pressure on producers from developing countries to transform their processes in order to be eligible to export. Eligibility is generally acquired through a certification procedure sanctioning the implementation of defined quality standards. Secondly, if a given producer qualifies for these standards, we can expect that there is a reputation effect that robustly ties the trade relationship over time. One of the central concerns in the literature is about the capacity of developing countries and in particular of smallholders to develop and sustain their exports to developed countries in such context of increasingly stringent food safety standards and the ever more frequent requirement for certification. However, standards should not necessarily be viewed as an impediment to trade and development for producers in developing countries. Some even argue that food safety standards can serve as a "catalyst for realizing pro-poor export-led growth in developing countries" (Maertens and Swinnen, 2006).

Many studies analyse the effect of new SPS measures on predicted trade flows with an ex-ante approach (Otsuki et al 2001). Even though the conclusions of such ex-ante approaches could be nuanced in many ways, they nonetheless highlight the potential trade exclusion effect of those measures. Yet, too few studies adopt an ex-post analysis posture.

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

Such an approach was at the time rendered impossible because of the lack of data on the implementation of SPS measures in world trade.[4]

In Europe, following various food scares and related events, public as well as private standards have been strengthened through new regulations along with the development of private certifications and codes of practice that are usually far more burdensome than public regulations. Private standards are still very much heterogeneous around the world and particularly in the two biggest destinations of developing countries' FF&V exports, namely the US and the EU. In this line, Jaffee and Masakure (2005) emphasize this heterogeneity between and within EU countries, along various distribution channels and market segments, according to consumer preferences but also to patterns of fresh product purchases and distribution. 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 FF&V segments are governed by very different standards. Jaffee and Masakure (2005) take the examples of ethnic but also food services and restaurant supply chains for which the 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 FF&V in bulk through brokers is still widely used (Hanson and Blandon, 2009). Moreover, there is no sign of a convergence process among supermarket chains as there has been in the EU with the EurepGAP followed by the GLOBALGAP certification process. Both heterogeneity and volatility of US supermarkets' codes of practice is one other intricacy for developing country suppliers to develop and access what is referred to as "High Care" markets to the US.

[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. Studies pinpoint the high level of aggregation of such a database and above all the lack of information concerning many important bilateral restrictions.

The increasing role of private standards in the EU, and to another extent in the US, along with the evolution of consumer demand, the reduction in transport costs and the subsequent increase in competition have triggered the development of new strategies among suppliers in developing countries. The case of Kenyan FF&V exporters is a very famous example of this adaptation to new market conditions (Jaffee and Masakure 2005). In the late 80'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 has created an incentive for the pursuit of product innovation and quality. During the 90's, even though export quantities did not increase much, export value grew along with the proportion of pre-packed products directly exported to supermarkets. This export strategy intensified during the following decade with the development and diversification of such pre-packs including semi-processed "high-care" products such as mixed salads, and assortments of cut vegetables produced under highly severe hygienic conditions. 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 shift provides further evidence of the need to satisfy consumers' need for increased value-added agricultural products and their willingness to pay a premium. Peru is another well known example. Even though the country benefits form favourable conditions for the production of winter vegetables for export to high income countries, high transport costs prevented any price competition with other suppliers. Thus they adopted a high quality strategy that not only allowed them to become competitive in such markets but also generated increased “client loyalty”. Such strategy reduced the risk of trade disruptions due to erratic and irregular quality. In other words, this trend created good reputation.

These observations support the hypotheses of this paper that not only quality but also reputation is a determinant of the pattern of FF&V exports. Quality, captured in this paper by prices, has two dimensions. Firstly, I assume two levels of quality, roughly relying on this differentiation between bulk exports – for which a buyer/consumer’s prime concern will be set on prices – and high care products – for which a buyer’s prime concern will be set on safety, reliability and value-added attributes. Secondly, I introduce a reputation parameter that will impact the whole country’s export sector, whether firms export in bulk or high care products. This echoes the notion of reputation highlighted by the case of Peru.

One crucial aspect of the paper is thus to provide grounds for the fact that agricultural products are much like industrial products in the way that consumers are looking for quality and safety and that producers must adapt to these needs. It also inquires whether preferences for quality on the one side and reputation effects on the other are upholding the capacity of producers of agricultural products in developing countries to export to developed countries. As such, this paper is a contribution to the recent literature on the relationship between quality and trade. Therefore, this paper will address the question of the sensitivity of FF&V exports to both quality and reputation shocks. Its novelty lies in emphasizing the need to consider the reputation effect of producing quality. This notion is discussed in the next section. In the third section I empirically investigate a simple productivity sorting model of FF&V exports. The fourth section develops a new framework that endogenizes quality and allows for both quality sorting and productivity sorting of exports in the same export market. The corollary is that it allows for firms to produce according to either productivity sorting or quality sorting. This framework integrates heterogeneity in the capacity exporting countries to produce quality and in consumers’ preference for quality and moreover introduces the existence of a reputation effect. Section five looks at the empirical analysis of that model by making use of a new dataset on import refusals. Section six sets out conclusions and potential policy implications.

2 Alerts and the notion of reputation

Experience of Guatemala and the Dominican Republic

Usually, as little as 1% of food import shipments are inspected by the Food and Drug Administration (FDA) at the port of entry (Buzby et al. ,2008). But if a product or an exporter (country or firms) 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. As a consequence, products for which an alert is implemented are subject to scrutiny at the border. This system of AD and DWPE has first been implemented in the late 80s. 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.

In the case of an alert, 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 has created delays in the US market 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. However, exporters 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 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 refusals are clearly biased against exporters or countries holding a record of risk of their food exports

Different case-studies in Central America have emphasized the immediate effects of such regulations on trade flows and the risk of market disruption of which Guatemala and the Dominican Republic are two famous examples. The introduction of NTAXs – non-traditional agricultural export crop[5] – in the Dominican Republic and Guatemala brought new production technologies and new demands of aesthetic and grade qualities that resulted in an intensive use of chemical inputs. At first, these aesthetic requirements, as a “Search” attribute of quality, did not present specific information asymmetry issues. A survey among participants in the US snow pea market indeed emphasized that Guatemalan smallholder production, compared to large estate production in Mexico or in California, was much better matched with the demand from US consumers (Julian, 2003). Along with the increased awareness of food safety issues in the US from the end of the 80s, the massive use of pesticides resulted in frequent shipment detention and refusals by US customs authorities (FDA). The intensification of production and the overuse of pesticides also led to phytosanitary crises causing temporary export bans6. During the same decade, the Dominican Republic was among the first providers to the US market for some FF&V like snow peas, eggplant or cantaloupe. But in 1987/1988, the FDA issued a countrywide alert for pesticide residues. As the Dominican Republic was struggling with these new issues, Guatemala was entering the NTAXs sector and rapidly replaced the Dominican Republic as the leading provider for some of those FF&V. However, Guatemala rapidly met the same fate

[5] In opposition to traditional agricultural export crops like coffee or bananas.
[6] This was the case for Guatemalan snow peas in 1995

as the Dominican Republic, and was submitted to a countrywide alert in 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 pesticide residues resulted in a loss of a total of $17,686,000. This situation and the inability to address SPS concerns have been highly detrimental to Guatemala's relative competitive position in the field of NTAXs.[7] The sector was only in its infancy and some productions could not recover from such a shock. Yet, although the Guatemalan raspberry export market had been completely disrupted following a cyclospora outbreak crisis, the snow peas chain survived the pesticides and pest outbreak crises, and in 2002 it regained its 1991 pre-crisis export volume. Both Guatemala and the Dominican Republic are still today under countrywide alerts with DWPE for some of their most successful non-traditional agricultural export crops. While Guatemala is the main provider of snow peas to the US market, all these issues have decreased Guatemalan competitiveness in the US market compared to its two biggest rivals, Mexico and more recently Peru. Producers in both countries sell their production directly to the food distribution chain whereas 80% of Guatemalan snow peas are sold through brokers for half price (Hanson and Blandon, 2007). Between 2000 and 2006, average export unit prices were 0.50 US$/kg to 0.70 US$/kg for Guatemala, compared to 1.20$/kg to 1.90$/kg for Mexico and Peru.[8]

The notion of reputation and its measurement

The evolution from bulk FF&V trade to trade in high care products sold directly to supermarkets changed the relationship between exporters and importers. Studies on food scares and crises clearly highlighted an impact of such events on the whole sector. For example, Jaud et al (2009) link food scares and supplier concentration in the EU market.

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[7] Guatemalan imports of fresh berries were also banned for the 1998 season and restored entry in 1999 because of suspicion of cyclospora outbreak (bacteria).

[8] NBER trade database, Authors' own calculation

Using a new database quite similar in structure to the one used here for the US, they show that EU agro-food imports are vulnerable to food alerts in the EU market and that those imports are more concentrated on a few suppliers for what they define as risky products. However, it would be expected that high care products would reduce the risks of trade disruption due to quality, food safety or disease issues. But what would happen if the reputation parameter is not firm-specific but relates to the history of food scares between two trading countries? The definition of reputation that is used in this paper draws from Tirole (1996) who defines a 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 history of food safety crises related to one country’s exports and import refusals. Second, even though over time one firm could have built a relationship of trust with a buyer, it is the collective reputation of the exporting country’s firms in one sector that will influence consumers’ rating of the product.

Alerts are known to be highly correlated with the probability of a shipment being detained and to import refusals in the US. Remarkably, customs authorities do not recognize private certifications, thus the probability for one exporter to be detained by customs authorities – all things being equal – is the same whether the firm exports high-care products or not. This higher probability that shipments will be controlled and detained will have an impact on the reliability of exporters and thus on their reputation.

In order to test the effect of reputation, this paper makes use of a new FF&V refusal dataset built upon information provided by the FDA. Our hypothesis is that the existence of an import alert due to a history of food crises affecting a product from a given country will have a reputation effect on every exporter from that country for that specific product.

3 Disentangling the drivers of trade in horticultural products

New trade models of firm heterogeneity confirm the importance of differences of productivities among producers. Across-firm productivity levels explain a significant proportion of the variance of trade flows (Melitz, 2003). However, Schott (2004), in a study of US import data, highlighted the inconsistency of new trade theory models considering an inverse relationship between price and producer productivity. His study 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 source country characteristics and correlate such an increase in unit value with the exporter's relative endowment of physical and human capital. Focusing on the demand side, Hallack (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 & Harrigan (2009) and Crozet, Head & Mayer (2009) test a quality-sorting hypothesis on various sectors and confirm the inconsistency of price behaviour with the benchmark models in particular sectors. These papers theoretically and empirically demonstrate the importance of taking quality into consideration when explaining bilateral trade flows, 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 words, we should observe an inverse relationship between 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. In order to demonstrate this, I first test in this section the usual productivity sorting model.

Following heterogeneous firms trade models based on Melitz (2003), cut-off conditions on the incentive to export set a productivity threshold above which only the most productive producers should be able to export to distant markets. In this framework, f.o.b export prices are inversely related to distance and to the difficulty to enter one's market. This impediment is generally revealed by fixed costs. The Melitz model and its extension by Helpman et al (2007) is now widely accepted. A technical appendix describes the main features of this model. In what follows, I will test the workhorse model based on Melitz (2003) and its application to average f.o.b. export prices in FF&V exports. The model introduces fixed and variable export costs in a framework of asymmetric countries and firm heterogeneity with firm productivity following a Pareto distribution.

Average fob price in the productivity sorting setting

As usual, 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 the budget constraint of country i with the income Yi equals its expenditure and define Pi as the CES price index in country i.

As usual in the literature, the supply-side is characterized by a Dixit-Stiglitz framework of monopolistic competition. 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 using the same technology. Firms' productivity is distributed Pareto, with the distribution function $g(\varphi)$ over $(\varphi_0, +\infty)$ and a continuous cumulative distribution $G(\varphi)$. Firms from country i will incur fixed costs f_{ij} of selling to a market j.

The country specific factor cost is denoted by 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 country i seeks to sell its products to consumers in country j, those consumers will bear an additional transport cost τ_{ij} defined in a Samuelson's iceberg costs fashion.

The empirical setting of the model is set forth in equation (1) where expected f.o.b price of exports $\overline{p}_{ij}$ from country *i* to country 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:

$$\ln \overline{p}_{ij} = \ln[\sigma/(\sigma-1)] + \ln w_i + p_j + [1/(\sigma-1)]y_j - [1/(\sigma-1)]\ln f_{ij} - \ln \tau_{ij} \qquad (1)$$

where lowercase variables represent the natural logarithms of their respective uppercase variables. As in Helpman et al. (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_{1ij} which is country-pair specific. As an analogy to their definition, I define $\tau_{ij} = D_{1ij}^{\chi} e^{-u_{ij}}$ where D_{1ij} represents bilateral symmetric distance between i and j with $u_{ij} \approx N(0, \sigma_u^2)$. Thus I have that $\ln \tau_{ij} = \chi d_{1ij} - u_{1ij}$. Fixed trade costs, are classically set as $\ln f_{ij} = \phi_i + \phi_j + \rho D_{2ij} + u_{2ij}$. 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_{2ij} is a set of overlapping data that I assume will decrease the fixed cost of exporting from country i to country j (common language, sharing a frontier; a free trade agreement, etc.), and u_{2ij} stands for the unobserved variations in trade costs. In what follows I simplify the number of variables through the linear combination $\eta_{ij} = u_{1ij} + u_{2ij}$ 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. However, I do not compute this calculation in this paper;

I focus on the signs of the right and left hand side. Substituting those parameters back into the log-linear expression (1) of the expected f.o.b. price on the export market yields the following expression:

$$\ln \overline{p}_{ij} = \xi_0 + \xi_i + \xi_j - \chi d_{1ij} + \rho D_{2ij} + \eta_{ij} \qquad (2)$$

Where $\xi_0 = \ln[\sigma/(\sigma-1)]$ is the constant, $\xi_i = \ln w_i + [1/(\sigma-1)]\phi_i$ and $\xi_j = p_j + [1/(\sigma-1)]y_j - [1/(\sigma-1)]\phi_j$ are respectively exporter and importer fixed effects. Our panel econometric test introduces a time dimension. Some variables, such as income, will become time-dependant. Hence, some variables can be transformed as $\xi_j = p_j - [1/(\sigma-1)]\theta_j$. The log-linearized expected average price equation becomes:

$$\ln \overline{p}_{ijt} = \xi_0 + \xi_i + \xi_j + [1/(\sigma-1)]y_{jt} - \chi d_{1ij} + \rho D_{2ijt} + \eta_{ijt} \qquad (3)$$

Data and Empirical results

In order to test the productivity-sorting hypothesis, I make use of CEPII BACI trade data on FF&V 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 trade database. This dataset not only includes trade in quantity but also its equivalent trade value. With this, I compute the average unit f.o.b. trade value. This calculation and the comparison are made easier since I only consider FF&V trade, which are systematically reported in kilograms. BACI is the only database providing consistent unit-values at the world and product level, so it is particularly well suited to analyzing international trade prices (Gaulier and Zignago, 2009)[9] .I have a balanced dataset covering 10 years, 221 countries and 102 FF&V products. The classic variables of distance and GDP were respectively retrieved from the CEPII database and from WDI's World Bank online website.

9 As in Baldwin & Harrigan (2009), I remove traded quantities inferior to 500 kg because analysis of the data provide 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 are only interested in unit prices.

I first implement a “Gravity as usual” specification in order to check for the relevance of applying a gravity model to the FF&V sector. Table 1 provides results from this empirical investigation. It provides results that follow what is expected from a classic gravity specification on export values of agricultural products. Particularly, both importer and exporter GDPs are positively related to export values. Their respective point estimates are close to what the literature usually provides (Disdier et al. 2007 and Grant & Lambert 2008). However, it should be highlighted that the elasticity associated with the importer’s GDP is more than four times higher than the elasticity on the exporter’s GDP. As is common in the literature, I also test the model by replacing GDP with GDP per capita of both the exporting and the importing countries. Results are of the same order of magnitude as those obtained when computing GDPs.[10]

In a second stage, I test whether the productivity setting provides an explanation for the observed average unit export f.o.b price. Results of this test on prices are presented in Table 3. They display a positive relationship between average unit f.o.b export prices and distance when a negative relationship is expected in a productivity-sorting framework. This result supports the rejection of the hypothesis of homogenous quality among firms within the FF&V sector. Thus a comprehensive heterogeneous firm trade model should also include space for a heterogeneous quality sorting setting. Such expectations have already been highlighted by various papers using quality-sorting models. However, earlier studies did not focus specifically on the FF&V sector. Indeed, non-manufactured sectors are usually left out of such tests on the assumption that they are commodity products. One of the novelties of this paper is to provide proof that agricultural products are much like industrial products when it comes to sorting out quality and productivity influences in both consumption and production patterns. As with the “Gravity as usual” setting, I test the same specification replacing importer GDP by GDP per capita. I observe the same kind of results as in the first

10 Table 3 is presenting the correlation between GDP and GDP per capita for exporting and importing countries.

tests on export values. Replacing GDP with GDP per capita slightly increases the elasticities but does not change the results. 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 related to average unit prices, but having a history of colonial ties has a positive impact on prices.

4 Quality and reputation matters

In this section of the paper, I adopt the Melitz (2003) framework, augmented by Eaton, Kortun and Kramarz (2008), Baldwin and Harrigan (2009), Johnson (2009), and Crozet, Head and Mayer (2009), in order to build a quality sorting model based on firm heterogeneity with firm productivity following a Pareto distribution.

This paper is considered as innovative with respect to the existing literature for introducing two key features. First, it allows for the possibility that firms produce according to either productivity sorting or quality sorting. Second, consumers from different countries have heterogeneous preferences for quality. Within a CES framework, I adopt a similar method to Johnson (2009), Baldwin and Harrigan (2009) and Crozet et al (2009), adding a quality parameter that allows for consumers to maximize their utility according to a quality-adjusted price.

Productivity vs. Quality sorting models

Many papers have developed quality adjusted models in order to explain the empirical evidence of increasing prices with distance between any two trading partners. Therefore, most of these models switch from a productivity-sorting to a quality-sorting setting, by hypothesizing that producing quality is costly. In such models, heterogeneity in productivity is therefore replaced by heterogeneity in quality. Indeed, the objective of these models is to introduce quality heterogeneity between firms without multiplying sources of heterogeneity in order to keep the model tractable. Thus, one of the difficulties raised by quality-sorting models is to define a relationship between firm productivity and quality without loosing the possibility of comparison with the original Melitz productivity sorting-model. Hence, those models generally relate quality and productivity through a power function of the type $q = c^{\theta}$ 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 systematically 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 and proper setting of the power parameter θ. The model developed in this section will not depart from these hypotheses. However, I innovate by endogenizing this power parameter, making this relationship idiosyncratic to the dyadic relationship between the exporting and importing country.

According to the usual definition of the quality parameter, quality depends directly on the level of productivity of the firm and of the power parameter. The consequence will be first that depending on the value of the power parameter, all exporting firms from one country i will either export under productivity-sorting or quality-sorting. Baldwin & 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 (described in the technical appendix). And, if $0 < \theta < 1$, the quality-adjusted price increases with cost and thus unit price. It is only when $\theta > 1$ that the quality-adjusted price will be negatively related to unit price, meaning that 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 is integrated in 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 $\theta > 1$. In such a setting, 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 distributed Pareto over factor requirements instead of productivity. Even though this complete inversion of the relationship fits much better with the average observed export prices, I argue that it still does not allow for considering the full reality of some sectors such as the FF&V export sector.

For this reason, 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 is therefore able to identify if these exporting sectors follow a productivity-sorting or a quality-sorting setting. Borrowing from John Sutton's terminology, Johnson (2009) 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 $\theta < 1$. As I have already defined, those two solutions respectively relate to the solutions where export prices are increasing or decreasing in the threshold, indicating if exports are following productivity or quality sorting. His results are of tremendous interest for various reasons: he builds and test a theoretical framework that clearly supports the rejection of the homogeneous quality formulation of the 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 sector of FF&V 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".

In the model I suggest an in-between solution that would better fit the FF&V sector and would allow highlighting the effect of reputation on exports of FF&V. Instead of a continuous relationship between quality and productivity, I consider the existence of one level of quality. The model will introduce 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 from which it becomes profitable for one exporter of country i to export quality products to country j according to consumers of country j's preference for quality. I also endogenize the power parameter relating quality to productivity θ_i, making it idiosyncratic 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. Indeed, it will be much easier to produce quality FF&V fulfilling the 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 "sorting" 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.

For example, in the FF&V sector, I could differentiate what I call productivity and quality products according to the type of market chain through which those products enter the importing country. Productivity products relate to commodities, sold to intermediaries. The objective is to sell a high quantity of products and more productive firms are more profitable. Quality products relate to products for which the information on quality is made available through signals like certification.

Thus I consider in this model that 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.

The setting: disentangling productivity and quality sorting

The consumer's problem

As in the benchmark productivity model (see technical appendix), I consider a world of C countries indexed by i, varying in size and location, in which consumers maximize a CES utility function across a continuum of varieties over the set of Vi varieties available in country i. I assume consumers will be able to recognize "quality" from "productivity" products. Heterogeneity among consumers of various countries will rely on the intensity of consumers' preference for quality. I define q_i the quality parameter specific to consumers in country i. Like in Eaton, Kortum and Kramarz (2008), I introduce the term $\alpha_i(v)$ representing an endogenous shock to the quality parameter specific to variety v in country i. This parameter will represent the reputation parameter. For "productivity" products, the quality term becomes $\alpha_i(v)q_i(v) = 1$.

The consumer maximizes utility according to a quality-adjusted demand $\tilde{x}_i(v) = \alpha_i(v)q_i(v)x_i(v)$.

$$U_i = \left[\int_{v \in Vi} [\tilde{x}_i(v)]^{\frac{\sigma-1}{\sigma}} dv \right]^{\frac{\sigma}{\sigma-1}} \quad (4)$$

The parameter σ is the elasticity of substitution across products and as usual, it is the same across countries.[11] Given the budget constraint in country i and assuming country i's income

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[11] Melitz and Ottavianio (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.

being equal to its expenditure $Y_i = w_i L_i$, with L_i the consumers' supply of labour to firms and w_i their wage, the consumption is given by:

$$\tilde{x}_i(v) = \tilde{p}_i(v)^{-\sigma} \tilde{P}_i^{\sigma-1} Y_i \qquad (5)$$

where $\tilde{p}_i(v) = \dfrac{p_i(v)}{\alpha_i(v) q_i}$ 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 price index. This allows us to define a physical demand quite similar to Johnson (2009) with:

$$x_i(v) = [\alpha_i(v) q_i]^{\sigma-1} p_i(v)^{-\sigma} \tilde{P}_i^{\sigma-1} Y_i \qquad (6)$$

The producer's problem

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. As in the benchmark model, I thus define c the 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 with $c_q = c^{(1+\theta_i)}$. The parameter θ_i defined over $[0,+\infty[$ is idiosyncratic to country i and relates to the capacity $1/\theta_i$ to produce quality. Firms maximize their profits at mill prices. Whether they produce productivity or quality products, the mill price is respectively $p_i(v) = [\sigma/(\sigma-1)] w_i c$ and $p_i(v) = [\sigma/(\sigma-1)] w_i c^{(1+\theta_i)}$. Following the benchmark setting, firm productivity $\varphi = 1/c$ is distributed Pareto over $[\varphi_0, +\infty[$. The cumulative distribution function $G(\varphi)$ describes the distribution of productivity. Thus the capacity of a given firm to produce quality will depend of the interaction of three parameters:

- The firm's productivity: the higher a firm's productivity, the more likely it will produce a quality product.
- The country's capacity to produce quality: the higher this capacity denoted by $(1/\theta_i)$, the lower the additional costs of producing quality will be.

- The intensity of consumers' preference for quality. The more one country's consumers find utility in consuming quality products, the more firms will be prompt to switch to a quality strategy.

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 $\alpha_i(v)q_i = \bar{c}^{\theta_i}$. This allows us to define a quality-adjusted price such that:

$$\tilde{p}_i(v) = [\sigma/(\sigma-1)]w_i\tilde{c} \qquad (6)$$

where $\tilde{c} = \frac{c^{(1+\theta_i)}}{\bar{c}^{\theta_i}}$ represents the quality-adjusted factor requirement. I observe that $\tilde{c} > c$ if $c > \bar{c}$ and $\tilde{c} < c$ if $c < \bar{c}$. Every firm with a factor requirement $c \le \bar{c}$ will have a quality-adjusted price $\tilde{p}_i(v) \le p_i(v)$ and thus will find an advantage in switching from productivity to quality products. Firms from country i will incur fixed costs f_{ij} of selling to a market j. I consider that this fixed cost is the same whether the firm decides to produce under quality or productivity strategy. I assume that. $f_{ii} = 0$.[12] A firm will export to country j if and only if $\pi_{ij} \ge 0$ with $\pi_{ij} = \frac{R_{ij}}{\sigma} - f_{ij}$. Where a firm's revenues from selling to country j are:

$$R_{ij} = p_{ij}(v)x_j(v) = (\tau_{ij}p_i(v))^{1-\sigma}[\alpha_j(v)q_j(v)]^{\sigma-1}P_j^{\sigma-1}Y_j \quad (7)$$

The cut-off condition for a firm to export productivity products is the same as in the benchmark 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 quality strategy will not increase the number of firms able to export to j. However, a specificity of our model lies in the extreme case where all firms export under quality-sorting. In this situation, $c_{ij} < \bar{c}$ and

12 A further version of this paper will introduce fixed costs of producing quality because consumers requirement for certification.

$\tilde{c}_{ij} < c_{ij}$. Therefore, around the cut-off, some firms that would not have been able to export to j under productivity-sorting will however 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 $c_{ij} > \bar{c}$ implying that both productivity and quality products will be exported. Other cases are extreme situations. In our benchmark situation – all other things being equal – the number of exporting firms to one country will be constant and will only be dependant of the entry threshold. The average f.o.b. price of one country i exporting to one importing market depends on the proportion of the number of productivity vs. quality firms exporting to this market. The expected price conditional on exporting from country i to country j is defined as:

$$E\left(p_{ij} \middle| \pi_{ij} > 0\right) = [\sigma/\sigma - 1]\omega_i V_{ij} \text{ with } V_{ij} = \left(V_{ijp} + V_{ijq}\right) \qquad (8)$$

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

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

(9)

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

As already mentioned, I do not consider extreme cases for which there is only productivity or quality sorting on the importing market, implying a change in the number of exporting firms to market j. Nevertheless, we can verify that our benchmark situation lies between those two extremes, within a framework of 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

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

We verify that $V_{ijp,\max} < V_{ij} < V_{ijq,\max}$.

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 and negatively with a shock to consumers' demand for quality. Thus, the level of the expected price will be a function of the quality threshold $\bar{c} = (\alpha_{ij} q_i)^{\frac{1}{\theta_i}}$. According to (9), 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:

$$V_{ij} = \frac{\kappa}{\kappa+1}\frac{\left(c_{ij}^{\ \kappa+1} - \bar{c}^{\ \kappa+1}\right)}{c_{ij}^{\ \kappa}} + \frac{\kappa}{\theta_i+\kappa+1}\bar{c}^{\ \theta_i+1} \qquad (10)$$

with κ the Pareto distribution parameter

Empirical procedure

According to the definition of the expected average price, it is not possible to directly log-linearize the equation because of the introduction of the quality threshold. Thus it is not possible to obtain an estimation procedure that will allow estimating the elasticities of the parameters. However, I clearly identified the parameters influencing the average f.o.b price and the interest here is to identify the sign of these parameters. In order to derive a reduced form of the average price equation, I define V_{ij}, the expected factor requirement of exporting firms as:

$$V_{ij} = h(c_{ij}, \bar{c}_{ij}) = h(c_{ij}, \theta_i, q_j, \alpha_{ij}) \text{ (11)}$$

The cut-off condition c_{ij} is defined over the same parameters as in the benchmark model. The results 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:

$$\ln \bar{p}_{ij} = \gamma_o + \gamma_1 p_j + \gamma_2 y_j - \gamma_3 \ln f_{ij} + \gamma_4 \ln \tau_{ij} + f(\theta_i, q_j, \alpha_{ij}) \qquad (12)$$

Moreover, 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 $\delta_1 \approx N(0, \sigma_{\delta_i}^2)$ and $\delta_2 \approx N(0, \sigma_{\delta_j}^2)$. Thus I have

$$\ln \frac{1}{\theta_i} = \beta_1 y_{pc,i} - \delta_{1,i} \quad \text{and} \quad \ln q = \beta_2 y_{pc,j} + \delta_{2,j}$$

The shock to consumers' preference will be defined as a function of the relative number of custom refusals, highly correlated with import alerts. 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. The unobserved fixed and variable costs of trade and shock to the quality parameter are represented by $\eta_{ij} = u_{1ij} + u_{2ij} + \delta_{3,ij}$, distributed $N\left(0, \sigma_\eta^2\right)$, where σ_η^2 is the variance of the composite error. Substituting those parameters back into the log-linear expression of the expected f.o.b. price of exports yields the following expression:

$$\ln \overline{p}_{ij} = \xi_0 + \xi_i + \xi_j - \chi d_{1ij} + \rho D_{2ij} - \beta_1 y_{pc,i} + \beta_2 y_{pc,j} - \beta_3 s_{ij} + \delta_{1,i} + \delta_{2,j} + \eta_{ij} \quad (13)$$

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:

$$\ln \overline{p}_{ijt} = \xi_0 + \xi_i + \xi_j - \chi d_{1ij} + \rho D_{2ij} + \gamma y_{jt} + \beta_1 y_{pc,it} + \beta_2 y_{pc,jt} + \beta_3 s_{ijt} + \delta_{1,it} + \delta_{2,jt} + \eta_{ij} \quad (14)$$

Our dataset allows us to test for the effect of quality and reputation on FF&V imports in the US. In such a context, this equation will not work because our country fixed effects are de facto dyadic fixed effects given that all our exports are directed to only one region. 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 et al (2009). This parameter collects all non time-dependant determinants of exports.

$$\ln C_{ij} = \xi_0 + \xi_i + \xi_j - \chi d_{1ij} + \rho D_{2ij} + \eta_{ij} \quad (15)$$

Replacing in (14) yields the following estimation equation:

$$\ln \tilde{p}_{ijt} = \ln C_{ij} + \gamma y_{jt} + \beta_1 y_{pc,it} + \beta_2 y_{pc,jt} + \beta_3 s_{ijt} + \delta_{1,it} + \delta_{2,jt} \quad (16)$$

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

Accounting for the export price of horticultural products

I use the same data as in our first productivity-sorting test to which I add various data in order to take into consideration the exporting country's capacity to produce quality, the intensity of consumers' preference for quality in the importing country and the reputation parameter. In this specification, GDP per capita is a proxy for the first two parameters. I gathered GDP per capita data from the WDI.

For the reputation parameter I use data compiled from FDA data on customs import refusals. As already discussed, refusals stand as a reasonable proxy for product reputation on the US market. The FDA uses its own product codification, thus refusals data had to be recoded in HS 6-digits. In order to test the reputation effect, I have a balanced data set covering 11 years, 102 products and 141 FF&V exporting countries to the US. Also, one might suspect that refusals are related to GDP per capita. I tested and verified this with a simple correlation. Table 4 shows the very small relation between refusals and GDP per capita. This confirms the relevance of refusals as a good proxy for reputation.

Evidence on the importance of quality

I first test the empirical setting (14) on the same database that I used in the productivity-sorting test. I am not able to test the reputation effect on this database, but this benchmark will allow us to compare the quality and capacity parameters of this multiple importer database to the specific test on the US market. As already mentioned, this setting is a reduced forms thus I focus my attention on coefficient variations and signs rather than the size of the coefficient itself

As expected, both GDPs per capita are positively related to average export f.o.b. unit prices as well as distance. As in the gravity as usual and productivity-sorting test, there is a large difference between the importer and exporter GDP per capita coefficients. But more surprising is the negative coefficient for importer GDP. Such results have already been highlighted by Melitz and Ottaviano (2008) and Baldwin and Harrigan (2009). The former highlight that the size of the market – for which GDP is usually used as a proxy – affects the toughness of competition to which firms will respond through a variation in their mark-ups and thus will affect the selection of producers and exporters into that market. 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. One other explanation is given by Baldwin and Harrigan (2009) with 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 f.o.b. price in larger markets will be lower. Both assumptions can well explain those results.

These observations and our results 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.

Reputation impact: Evidence from the US horticultural imports.

In a second stage, I test the reputation effect on the US market. As a proxy for reputation, I first created a dummy variable equal to one if there has been at least one refusal for each exporter/product/year. 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. This confirms our hypothesis on the effect of reputation on the capacity to export quality. Moreover, between specification (1) and (2), I observe that the introduction of the reputation parameter slightly increases the positive effect of the exporter GDP per capita on unit prices, thus further highlighting the impact of the capacity of the exporter to produce quality on this average unit export price. We could expect refusals to have a lagged influence on prices. Thus I tested the same equation introducing one to three years lagged refusal dummies. It also suppresses the impact of the co-temporality of the data and thus possible endogeneity issues. I observe that, apart from the one year lag, the refusal dummy coefficient is each time increasing.

As an illustration of the importance of the earnestness highlighted in this paper, I build a set of new variables based on past refusals. The first represents the sum of years presenting at least one refusal in the three years prior to the observation. In a second stage I built another set of dummies representing the three possible values of the last variable For example: for an observation in 2006, there has been at least one refusal in 2005 and in 2003, meaning that the dummies "one year" and "three years" will be equal to zero and the dummy "two year" will be equal to one. Table 6 presents the results of the same econometric specification using those variables for the reputation effect. The results clearly highlight the impact of the recurrence of refusals: the more history of refusals, the higher the negative impact on average export prices.

In order to verify the reliability of the test on a refusal dummy, I first tested the empirical setting using the log of the number of refusals, replacing zeros in refusals by 0,001. Second, we could also have questioned the causality between refusals and export quantities. Indeed, we could consider a relationship between the probability of being inspected and the volumes exported. Thus I also test the empirical setting using a weighted number of refusals, considering an average shipment to be equal to one tone of products. This last setting has to be taken with caution because or risks of endogeneity due to the calculation used to obtain the average export price. Both results are presented in table 6. They confirm the results of the specifications using refusal dummies. These results confirm our intuition of the importance of quality but also of reputation in the analysis of FF&V 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 productivity-levels is also a determinant of the capacity to export horticultural products. The paper goes a step further by showing that quality also provides a way for developing countries to create the conditions for increased and more profitable market access. Accordingly, a negative shock on the reputation of a producer conveys a downgrading effect, reducing the ability for countries to export quality products.

On a policy-oriented level, the significance of producing quality gives further credential and support to the current agenda of aid for trade in agriculture. Particularly, the agenda calls for innovative initiatives in order to support producer in complying with such standards (for example through the implementation of public/private partnerships). In some areas of Madagascar or countries of Central America, the strong involvement of the private sector in securing a safe and stable supply of FF&V has been decisive in the development of the sector and allowed for a sensible improvement of producers conditions. 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. However, generalization and one-size-fits all is in this matter a risky temptation as each country and producers’ specificities should always be taken into consideration.

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7 Tables

Table 1: Gravity as usual

Dep var: log(Export Value)	OLS (1)	OLS (2)
GDP Importer	0.379***	
	[0.0207]	
GDP Exporter	0.0964***	
	[0.0267]	
GDP per capita - Importer		0.445***
		[0.0213]
GDP per Capita - Exporter		0.0994***
		[0.0267]
Distance	-0.510***	-0.510***
	[0.0158]	[0.0158]
Contiguity	0.426***	0.427***
	[0.0293]	[0.0293]
Common Language	0.165***	0.165***
	[0.0261]	[0.0261]
Colony	0.0747**	0.0747**
	[0.0314]	[0.0314]
Constant	-6.148	0.0578
		[544.5]
Observations	651,274	651,274
R-squared	0.248	0.249

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

Table 2

Correlation Importer		
log(GDP)	1	
log(GDP per Capita)	0.5739	1

Correlation Exporter		
log(GDP)	1	
log(GDP per Capita)	0.6056	1

Table 3: Productivity sorting setting: Test on Unit Price

Dep var: Average Unit Price	OLS	OLS
	(1)	(2)
GDP Importer	0.187***	
	[0.0151]	
GDP per capita Importer		0.238***
		[0.0153]
Distance	0.101***	0.101***
	[0.00597]	[0.00597]
Contiguity	-0.114***	-0.113***
	[0.0122]	[0.0122]
Common Language	-0.0253**	-0.0254**
	[0.0110]	[0.0110]
Colony	0.162***	0.162***
	[0.0134]	[0.0134]
Constant	-5.428	-2.379
	[450.2]	[788.9]
Observations	648,423	648,423
R-squared	0.298	0.298

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

Table 4: Productivity-Quality setting: Test on Unit Price (no reputation effect)

Dep var: Average Unit Price	OLS (1)
GDP Importer	-0.801***
	[0.0607]
GDP per capita Importer	0.983***
	[0.0617]
GDP per capita Exporter	0.273***
	[0.0340]
Distance	0.1000***
	[0.00600]
Contiguity	-0.113***
	[0.0123]
Common Language	-0.0269**
	[0.0110]
Colony	0.162***
	[0.0135]
Constant	3.476***
	[0.906]
Observations	645,001
R-squared	0,3

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

Table 5: Productivity-Quality setting with reputation effect: Test on Unit Price

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	0.311***	0.312***	0.313***	0.314***	0.311***	0.313***	0.315***	0.314***
	[0.0729]	[0.0729]	[0.0730]	[0.0730]	[0.0729]	[0.0730]	[0.0730]	[0.0730]
Refusal Dummy		-0.0828***				-0.0688***	-0.0532**	-0.0460*
		[0.0303]				[0.0255]	[0.0246]	[0.0242]
Refusal Dummy 1 year lag			-0.0638**			-0.0380	-0.0164	-0.00869
			[0.0309]			[0.0261]	[0.0251]	[0.0248]
Refusal Dummy 2 years lag				-0.0975***			-0.0735***	-0.0612**
				[0.0307]			[0.0272]	[0.0262]
Refusal Dummy 3 years lag					-0.104***			-0.0633***
					[0.0302]			[0.0231]
Constant	-0.257	-0.282	-0.280	-0.295	-0.276	-0.292	-0.308	-0.310
	[1.161]	[1.155]	[1.157]	[1.154]	[1.156]	[1.154]	[1.151]	[1.150]
Observations	12,909	12,909	12,909	12,909	12,909	12,909	12,909	12,909
R-squared	0.429	0.429	0.429	0.430	0.430	0.430	0.430	0.430
Number of years (2001-2007)	7	7	7	7	7	7	7	7

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

Table 6: Productivity-Quality setting with reputation effect in time: Test on Unit Price

Dep var: Average Unit Price	OLS (1)	OLS (2)
GDP per capita Exporter	0.314***	0.313***
	[0.0729]	[0.0730]
Number of years with refusals the past 3 years	-0.0524***	
	[0.0166]	
Dummy: One year with refusals the past 3 years of the observation		-0.0711**
		[0.0334]
Dummy: Two year with refusals the past 3 years of the observation		-0.0960**
		[0.0395]
Dummy: Three year with refusals the past 3 years of the observation		-0.151***
		[0.0529]
Constant	-0.306	-0.305
	[1.151]	[1.151]
Observations	12,909	12,909
R-squared	0.430	0.430
Number of years (2001-2007)	7	7

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

Table 7

Correlation		
log(GDP per Capita)	1	
Refusal Dummy	-0.0473	1

Table 8: Productivity-Quality setting with reputation effect: Test on Unit Price

Dep var: Average Unit Price	OLS	OLS
	(1)	(2)
GDP per capita Exporter	0.241***	0.241***
	[0.0536]	[0.0536]
Number of refusals	-0.00138***	
	[0.000532]	
Weighted number of refusals		-0.00118*
		[0.000609]
Constant	-3.819***	-3.806***
	[0.589]	[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 and product and exporter fixed-effects. Robust standard errors are cluster at the product-exporter level.

8 Technical appendix

The benchmark model (Melitz 2003))

The consumer 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.

$$U_i = \left[\int_{v \in Vi} \left[x_i(v) \right]^{1-\frac{1}{\sigma}} dv \right]^{\frac{1}{1-\frac{1}{\sigma}}} \qquad (1)$$

I assume the budget constraint of country i with the income Y_i equals its expenditure and define P_i as the CES price index in country i.

$$Y_i = \int_{v \in V_i} p_i(v) x_i(v) dv \qquad \text{and} \qquad P_i = \left[\int_{v \in V_i} \left(p_i(v) \right)^{1-\sigma} dv \right]^{\frac{1}{1-\sigma}}$$

After maximization of the consumers' utility, the demand function for the variety v takes the following form:

$$x_i(v) = \frac{\left(p_i(v) \right)^{-\sigma}}{P_i^{1-\sigma}} Y_i \qquad (2)$$

The producer problem

As usual in the literature, the supply-side is characterized by a Dixit-Stiglitz framework of monopolistic competition. 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 using the same technology. 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 a country j is classically expressed as:

φ_{ij}

$$\pi_{ij}(v) = \frac{R_{ij}(v)}{\sigma} - f_{ij} \qquad (3)$$

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:

$$p_i(v) = \frac{\sigma}{\sigma - 1} w_i c \qquad (4)$$

The country specific factor cost is denoted by 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 country *i* seeks to sell its products to consumers in country *j*, those consumers will bear an additional transport cost τ_{ij} defined in a Samuelson's iceberg costs fashion:

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

It is thus straightforward that the exporting firm's revenues are:

$$R_{ij}(v) = \frac{(\tau_{ij} w_i c)}{\left(\left(1 - \frac{1}{\sigma}\right) P_j\right)^{1-\sigma}}^{1-\sigma} Y_j \qquad (5)$$

A firms from country *i* will decide to export to country *j* only if $\pi_{ij}(a) \geq 0$. Thus condition for one firms of country *i* to export to one country *j* is $\frac{R_{ij}(v)}{\sigma} \geq f_{ij}$, implying the following cut-off condition:

$$\varphi_{ij} = \left(\frac{\sigma^{\frac{1}{\sigma-1}}}{1 - \left(\frac{1}{\sigma}\right)} \right) \frac{\tau_{ij} w_i}{P_j} \left(\frac{f_{ij}}{Y_j} \right)^{\frac{1}{\sigma-1}} \qquad (6)$$

Firms from country *i* will only be able to export to country *j* if their productivity is at least $\varphi_{ij} = 1/c_{ij}$

Aggregation

As a result of (6) $R_{ij} \neq 0$ 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 $\lfloor \varphi_{ij}, +\infty \lfloor$. Thus I can define the conditional distribution of $g(\varphi)$ on $\lfloor \varphi_{ij}, +\infty \lfloor$ as:

$$h(\varphi) = \begin{cases} \dfrac{g(\varphi)}{1 - G(\varphi_{ij})} & \text{if } \varphi \geq \varphi_{ij} \\ 0 & \text{otherwise} \end{cases}$$

Expected average export unit 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 f.o.b prices for all varieties exported by country *i* to country *j*. According to the f.o.b pricing rule $p_i(v) = \frac{\sigma}{\sigma - 1} \frac{w_i}{\varphi}$, thus the expected average f.o.b price depends on the expected productivity level $E[\varphi]$ conditional on firms being able to export to country *i*.

$$\begin{aligned} E\left[\varphi \middle| \pi_{ij} \geq 0\right] &= \frac{1}{1 - G\left(\varphi_{ij}^{*}\right)} \int_{\varphi_{ij}}^{+\infty} \varphi g(\varphi) d\varphi \\ E\left[\varphi \middle| \pi_{ij} \geq 0\right] &= \left(\frac{\kappa}{\kappa + 1}\right) \varphi_{ij} \end{aligned} \qquad (7)$$

With κ the Pareto distribution parameter and φ_{ij} the cut-off condition defined in (6). Accordingly the expected average f.o.b. price $\tilde{p}_{ij}$ of products exported from country *i* to country *j* is given by:

$$E\left[p_{ij} \middle| \pi_{ij} \geq 0\right] = \overline{p}_{ij} = \left(\frac{\sigma}{\sigma - 1}\right) \frac{w_i}{\left[\varphi \middle| \pi_{ij} \geq 0\right]} \qquad \text{with } \sigma > 1$$

Using (7) this becomes

$$E\left[p_{ij} \middle| \pi_{ij} \geq 0\right] = \left(\frac{\sigma}{\sigma - 1}\right) w_i \frac{P_j Y_j^{\frac{1}{\sigma - 1}}}{\left(f_{ij}\right)^{\frac{1}{\sigma - 1}} \tau_{ij}} \qquad (8)$$