UNEXPECTED PRICING-TO-MARKET IN GOODS CLASSIFIED AS HOMOGENEOUS

Valentina Rollo*

The Graduate Institute of International and Development Studies

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Abstract. This paper uses cross-country, firm-level, panel data to verify the widely used assumption that small open economies are price takers. By studying how exporters from Low Income Countries (LICs) adjust their prices according to their trade partners' characteristics, I show that even firms from LICs conduct pricing-to-market: they differentiate the free on board (fob) price of exports across markets. This finding shows that the small open economy assumption has not empirical evidence. Most importantly, in contrast to existing evidence, pricing-to-market is not confined to differentiated goods, and rather also applies to homogeneous goods. The disparate tastes across importing countries seem to be leading pricing-to-market in homogeneous goods exported by LICs, thus highlighting the importance of considering the demand side when studying pricing-to-market.

Keywords: *unit values, pricing-to-market, firm level data, variable demand elasticity of substitution.*

JEL Classification: F1, C33

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* Graduate Institute of International and Development Studies, Maison de la Paix, Chemin Eugène-Rigot 2, CH-1211 Genève. E-mail: valentina.rollo@graduateinstitute.ch

1. Introduction

The variation of export prices across destinations was first defined by Krugman (1986) as pricing-to-market. This paper relates Krugman's pricing-to-market to the heterogeneous firms' literature, and more specifically to the strand of research that analyses price adjustments to identify firm level quality or productivity competition - rather than adjustments to exchange rate shocks. The empirical literature suggests that adjustments actually do happen and that more investigation is needed to better explain the patterns observed across different countries.[2] Most studies in this literature (with the exception of a recent background paper by Asprilla *et al*, 2014) try to identify evidence of price differentiation in middle- to high-income countries, with a focus on the manufacturing sector. My paper expands on this literature by focusing on a group of Low Income Countries (LICs), and includes all products, rather than only manufacturing products.

The question of if and how exporting firms in LICs conduct pricing-to-market has so far received limited attention. Rather research has centered on trying to understand the factors that determine export flows and export diversification by looking at trade value or the number of destinations and products exported. This paper contributes to this literature by introducing the possibility that LICs can price discriminate by setting different prices in different destinations. It does so by focusing on free on board export prices, proxied by unit values. This implies testing the widely used small open economy assumption that exporters from LICs, as price-takers, cannot conduct pricing-to-market. I test this assumption on both differentiated and homogenous goods.

To accomplish this research objective, I use a firm-level dataset of exporters from several countries: Albania, Burkina Faso, Bulgaria, Jordan, Malawi, Peru, Senegal, Tanzania and Yemen. Access to these data overcomes data availability constraints that have limited, until

[2] The lack of consensus is due to some models (constant markup models such as Melitz 2003) predicting no relationship between export prices and the characteristics of trade partners, and other models predicting a relationship which is either competition driven (Melitz and Ottaviano, 2008) or quality driven (Baldwin and Harrigan, 2011).

recently, empirical work on the pricing behavior of LIC's exporters. By accessing this disaggregated information, this study explores the pricing behavior of firms across destinations and further examines whether the observed patterns are led by heterogeneity of "tastes" across destinations. This analysis relies on the methodology adopted by Manova and Zhang (2012), and builds on Rollo (2012) by providing evidence for a group of countries, thus overcoming the single-country study approach that constrained the latter paper.

Specifically, my results show that the dispersion of prices across markets for a firm-product pair is positively correlated with the number of destinations served, which indicates that firms charge different prices if they serve multiple destinations. This result is valid in both Upper Middle Income Countries (UMICs) (Bulgaria, Jordan and Peru) and Lower Middle Income (LMICs) and Low Income Countries (LICs) (Albania, Burkina Faso, Malawi, Senegal, Tanzania and Yemen). These findings confirm that the law of one price does not necessarily apply to exporters from small economies and provide evidence of a pricing behavior not usually associated with LICs.

The primary difference from Manova and Zhang (2012) – and the related literature – hinges on the result that prices are differentiated across destinations in both homogenous and differentiated goods. These results stand in contrast to the findings of previous studies in the trade literature and present an unexpected result that could open areas for future research. For example, allowing for the possibility that food products can be differentiable amplifies the spectrum of existing opportunities for developing countries. Even LICs could exploit product differentiation and market niches in countries where consumers are willing to pay more for products that satisfy specific quality characteristics.

The importance of the diversity of tastes across destinations is then tested in an extension of the analysis. By using the demand elasticity of substitution estimated by Kee, Nicita and Olarreaga (2008), it is possible to show that pricing-to-market in homogeneous goods exported by LICs applies only to goods that are characterized by highly heterogeneous tastes across destinations. Whereas differentiated goods are always priced to markets, regardless of the taste heterogeneity, by all exporting countries (UMICs, LMICs and LICs).

Even though these findings are unexpected, they are not inexplicable. Agricultural economists have long been interested in markets for agriculture products (normally classified as homogeneous goods) that are differentiated by quality. As Unnevehr *et al* (2010) explain in their review of the relationship between food and consumer economics, as consumers demand for premium quality, healthier, safer, and more environmentally friendly food products has increased, firms have responded by marketing quality-differentiated foods with explicit claims. In fact, agricultural economics commonly divides the global market of several "homogeneous" goods between the commodity market and the highly diversified specialty market. The latter can offer higher profit margins and enable farmers to differentiate their products through origin and flavor. Opportunities for farmers to access these specialized markets are increasing as consumer demand continues to grow for higher-quality, sustainably produced products. These findings highlight the importance of studying pricing-to-market from both the supply and the demand side.

The remainder of the paper is organized as follows: Section 2 derives the hypothesis to be tested from the theoretical framework and reviews the findings from previous theoretical and empirical works. Section 3 introduces the data used in the empirical analysis and highlights some of its features and characteristics. Section 4 describes the empirical framework used to test the testable hypothesis. Section 5 reports the results of the empirical analysis, while Section 6 performs some robustness checks, and Section 7 concludes.

2. Theoretical underpinnings and previous findings

2.1. Testable hypothesis

The main challenge in studies of price discrimination is the difficulty to discern mark-ups from market specific costs. To this end, I use the free on board (fob) unit value of each shipment in the dataset.[3] This unit value should be seen as the "farm gate" price of the exported transaction, not including the costs for shipping, handling, storage, marketing, or the tariff paid in the final destination. Hence, the analysis is conducted under the assumption that this price should only include the mark-up applied by the firm and its marginal cost. In addition, the nature of the data (in terms of disaggregation) allows me to assume that each product exported by a firm is of a specific variety or quality. Consequently the marginal cost of a product sold by a firm remains unchanged across destinations and I can relate price discrimination to the different demand elasticities across destinations, in the absence of product-quality or production-cost differences.[4]

Profit-maximization[5] for a representative firm implies the identity between marginal revenue (r) and marginal cost (c):

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[3] The data used in this paper contains transaction data of exporters only, for this reason I will not be able to analyses the factors that affect the entry into exporting decision of firms.

[4] This means ruling out the possibility that a firm can sell different versions or qualities of the same product to different destinations. I assume that a product at the 6-digit level of the Harmonized System is already a product of a specific quality-variety. However, in Section 6.1, I repeat the analysis using 8-digits products of the Harmonized System, to ensure that each product is really of a different version or quality from the others.

[5] The pricing equation is derived from the classical profit maximization problem of a representative firm, where profit is defined as the difference between total revenue and total cost: $\Pi(q) = p(q) * q - C(q)$. To maximize profit, we can derive it with respect to q:

$$\partial\Pi/\partial q = \partial R/\partial q - \partial C/\partial q = 0$$

Which yields the first order condition: $r = m$

and consequently: $p(q) + q\left(\partial p/\partial q\right) = m$, which can be rewritten as: $p(q)\left(1 - p(q)/q * \partial p/\partial q\right) = m$

and since $p(q)/q * \partial p/\partial q \equiv 1/\varepsilon$, we can simplify it to: $p\left(1 - 1/\varepsilon\right) = m$ which yields the pricing equation.

$$(1) \qquad r \equiv m$$

which yields the pricing equation:

$$(2) \qquad p_{fpdt} = \frac{m_{fpt}}{1 - {}^{1}/_{\varepsilon_{fpdt}}}$$

where p_{fpdt} is the fob price of firm f exporting product variety p to destination d in year t, m_{fpt} is the marginal cost of producing good p, which is firm specific and does not vary across destinations, and ε_{fpdt} is the perceived demand elasticity of substitution: price in each firm-product pair is the result of a mark-up over marginal cost. The main **testable hypothesis**, related to equation (2), can be expressed as follows:

- Firms from small economies (which I associate with **Lower-Middle Income and Low Income (LMICs & LICs) countries) should be price takers, and thus charge the same fob price to all markets.**

This reflects the assumption that they perceive the demand elasticity as close to infinite and thus charge the same fob price for all destinations.

2.2. Previous findings

This paper relates to the extensive trade literature on exporters' price heterogeneity across export markets. The possibility that exporting firms can adjust their mark-up by destination as a reaction to changes in exchange rate has been documented in Dunn (1970) and Mann (1986) before being defined by Krugman (1986) as pricing-to-market. Such concept has subsequently been vastly explored to explain empirical patterns in international economics, such as incomplete exchange rate pass-through to exporter prices. The strand of literature on exchange rate pass-through is so extensive that it would be impossible to include an exhaustive list. A high number of empirical studies have searched for evidence of pricing-to-market in both industrial and agricultural products, at product level and at more disaggregated firm-level (for instance Knetter, 1989, 1993; Marston, 1990; Gagnon and Knetter, 1995; Falk and Falk, 2000; Glauben and Loy, 2003; Alessandria and Kaboski, 2011; Berman et. al. 2012; and Pall *et al*, 2013, *et cetera*), and the results are very heterogeneous and do not allow drawing general conclusions.

As a consequence the only conclusion to be drawn is that pricing-to-market behavior differs across countries and export industries (Pall *et al* 2013).

The analysis undertaken in my work also relates to the more general literature that focuses on destination specific characteristics that should determine the variation in export prices (at product or firm level) across destinations. These destination characteristics range from distance (Hummels and Skiba, 2004; Baldwin and Harrigan, 2011; Martin, 2012), to income (Hummels and Klenow, 2005; Hallak, 2006; Bastos and Silva, 2010; Khandelwal, 2010; Hallak and Schott, 2011), trade costs (Feenstra, 1989; Kreinin, 1961; Mallick and Marques, 2007; Atkeson and Burstein, 2008; and Yu, 2010) and even income inequality (Fajgelbaum *et al*, 2011; Bekkers *et al*, 2012; Flash and Janeba 2013).

Moreover, the use of firm level data relates this paper to the heterogeneous firms' literature, where different models predict constant or variable prices across destinations. Depending on the type of competition that characterizes the market, it is possible to classify the main models explaining firm heterogeneous performance as:

1. price competition models: Melitz (2003) and Melitz and Ottaviano (2008), where better performing firms are characterized by higher productivity and lower marginal costs; and
2. quality competition models: Baldwin and Harrigan (2011), Antoniades (2008), and Fajgelbaum, Grossman, and Helpman (2011), where the quality dimension enters the model to explain why bigger and more productive exporters pay higher wages, use better inputs and have marginal costs increasing in quality.

In terms of price heterogeneity across destinations, in both price (Melitz, 2008) and quality (Baldwin and Harrigan, 2011) competition models that assume constant elasticity of substitution (CES) demand, all firms charge a constant mark-up over variable cost in every market. As a consequence, the fob price charged by a firm is determined only by marginal costs and not by the characteristics of the destination market. Melitz and Ottaviano (2008) modify the assumption of CES demand by including a linear demand and variable mark-ups. Therefore the fob price depends on the degree of competition and other characteristics of a destination market: a firm might set different prices across destinations (pricing-to-market). The same linear demand is also included in Antoniades (2008), and Fajgelbaum *et al* (2011).[6]

Manova and Zhang (2012) is the main empirical reference for this paper. The authors analyze a custom database on Chinese firms and establish six stylized facts on the variation in export prices and imported-input prices across firms, products and trade-partner countries. The finding of relevance to this paper is the fifth stylized fact: across firms within a product, firms that serve more destinations set a wider range of export prices. Predominantly, this pattern is more pronounced for products with greater scope for quality differentiation. In my paper I confirm that the fifth stylized fact from Manova and Zhang (2012) holds in a larger group of countries. However, differently from these authors, I find that pricing-to-market is not different in homogeneous and differentiated goods. Pricing-to-market in homogeneous goods was already found in Rollo (2012) in a single-country study on Tanzania.

The distinction between differentiated and homogeneous goods is commonly used as a way to infer that pricing-to-market is led by quality attributes of exported goods. For this reason my paper also relates to the group of papers that look for evidence of quality differentiation, both across firms and across destinations. Looking at quality differentiation across firms, Hallak and Sivadasan (2008), and Iacovone and Javorcik (2008) find that exporting status and output prices are positively related. Crozet, Head, and Mayer (2009) find evidence that high-quality producers export to more markets, charge higher prices, and sell more in each market. Recent work from Flach (2014) shows evidence of quality differentiation within firms in a Brazilian dataset. As for quality differentiation across destinations, Brambilla, Lederman, and Porto (2012) and Bastos and Silva (2010), Hallak (2006), Hummels and Klenow (2005) and Fieler (2011) find that firms set higher prices in bigger, richer, and more distant countries. Also Görg, Halpern and Muraközy (2010) find a positive relationship between export unit values and distance and wealth of destinations, but a negative relationship between unit values and market size – as previously found in Baldwin and Harrigan (2011).

[6] I refer to Manova and Zhang (2012) for a detailed review of heterogeneous firms models in the trade literature.

In sum, the empirical literature confirms that different firms charge different prices and that exporters do adjust their prices according to the characteristics of their trade partners. However, evidence of such behavior in LICs and in non-manufactured goods has been scarce, due to (until recently) limited availability of firm level data. Consequently, more investigation is needed to verify whether the patterns observed in the literature can be confirmed for small economies, more specifically LICs, normally considered price takers. This paper contributes to the literature by filling this gap.

One possible explanation for the failure of the law of one price is that firms engage in price-discrimination to take into account the relevant demand elasticities (Dornbusch, 1987, Knetter, 1989 and 1993). Auer, Chaney and Sauré (2014) argue that differences in pass through is not driven by the quality of the good itself, but rather by the interaction of quality with demand for quality. A similar conclusion is drawn in Dvir and Strasser's (2013) finding that in the European car industry, car attributes such as air conditioning are priced-to-market depending on the country-specific demand for the respective attribute. At the same time Simonovska (2014) argues that exporters extract high mark-ups for identical goods from rich importers with low demand elasticities. A recent paper by Di Comite *et al* (2014) proposes a model where consumer preferences are asymmetric across varieties and heterogeneous across countries. This literature relates to my paper, which tries to establish whether the ability to price discriminate depends on the importer's demand elasticity.

3. Data and descriptive statistics

The data employed in this paper are transaction-level customs data for the period 2000-2011. The countries included in this study are Albania, Burkina Faso, Bulgaria, Jordan, Malawi, Peru, Senegal, Tanzania and Yemen. More detail is reported in Table 1. The data was collected by the Trade and Integration Unit of the World Bank Research Department, as part of their efforts to build the Exporter Dynamics Database (EDD). The sources for the data for each country and the cleaning procedure used to obtain the data are detailed in the Annex of Cebeci, Fernandes, Freund and Pierola (2012).

The dataset received contains annual information on shipments of exporters for nine countries. Each annual observation contains information on arbitrary[7] firm ID, product information (at HS-6 digits)[8], date, destination (ISO3), shipment value in US dollars[9] and net weight. Previous to merging this dataset with other data, I ensure that the product codes belong to a single classification.[10] After converting the product data to the 6-digit HS2002 classification, my analysis can count on a sample of approximately 1 million and 7 hundreds unique observations at the country-firm-product-destination-year level.

For the analysis, the firm's price is proxied by the fob unit value of every annual shipment, which is the value of shipment divided by quantity of shipment, at the country-firm-product-

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[7] The firm ID is not the official identification number, for confidentiality issues. Also for confidentiality issues, the database did not contain any description or characteristic of the firm and its activities. For this reason it was not possible to identify and/or exclude wholesalers from the results and it is not possible to merge this dataset with other datasets that include more firms' characteristics.

[8] In the case of Tanzania I have access to daily information at the 8 digit level, which I will use in the Robustness Section.

[9] The shipment values are converted from local currency to US dollars using average annual exchange rates from IFS-IMF.

[10] The details of the cleaning procedure and conversion to HS2002 are reported in the Appendix.

destination level. This proxy for price has been largely used in previous literature, as actual prices are typically not observed.[11]

With regard to the firm, value, quantity and prices are the only information available. The dataset is then merged with destination and product specific characteristics such as the Rauch classification[12] (to classify products as homogeneous and differentiated goods), and the import demand elasticity estimated by Kee, Nicita and Olarreaga (2008) - for 149 countries at the HS88 6-digit level averaged across the years 1988–2002.[13] Finally, I also merge the data with the World Bank classification of countries into Upper Middle Income Countries (UMICs), Lower Middle Income Countries (LMICs) and Low Income Countries (LICs).[14]

3.1. Features of the data

Before starting the econometric analysis, it is useful to look at the descriptive statistics, which can already show some important features that motivate the rest of the analysis. Table 2 shows that for the whole sample the number of destinations per firm-product pair is very low (below two) on average. However, since this paper focuses on pricing-to-market, it is relevant to highlight that the average number of destinations for multiple-destinations firms (firms that export to at least two destinations) is higher. This last observation indicates that in this sample of nine countries only a small share of firms export the same product to multiple destinations, a common finding in the empirical literature.[15] However these firms make the bulk of exports, as

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[11] Lavoie and Liu (2007) examine the potential bias in pricing-to-market results when using unit values aggregating differentiated products. They argue that more confidence can be placed on results obtained using disaggregated data for which there are good reasons to believe exporters have market power in the international market (for instance, they produce a differentiated product relative to other countries' products, the exporter has a large world market share, *et cetera*).

[12] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Rauch

[13] http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22574446~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

[14] http://data.worldbank.org/news/new-country-classifications

[15] A number of studies (Bernard *et al.*, 2007, Eaton et al., 2004, Muuls and Pisu, 2007, Andersson *et al.*, 2007, to cite a few) find not only that a minority of firms accounts for a disproportionate fraction of

indicated by the fact that approximately one third of all firms export more than seventy per cent of exports.

Secondly, it is important to look at the variation in export prices across different dimensions. The first column of Table 3 reports the standard deviation (sd) of the logarithm of prices of each firm-product-destination-year by country. The sd of the logarithm of prices is very high, indicating that - not surprisingly - variation in export prices is considerable in each country. Since a clear source of variation in export prices is the fact that the dataset includes exports of a wide range of products[16], I first control for the variation in prices within products, across firm-destination pairs. This reduces the variation in prices considerably. Next, the high variation in the log of prices by firm-product pairs across destinations, as shown in Column 3, is a preliminary sign of price differentiation across destinations. This variation is highest for Malawi and Tanzania, two LICs. This observation justifies asking whether the small open economy assumption is confirmed by empirical evidence. In fact Table 3 predicts that pricing-to-market is to be expected in both UMICs and LICs, and that this is not necessarily a prerogative of differentiated goods.

Lastly, the products exported are classified according to the Rauch Classification[17] (1999): (1) homogeneous goods are defined as products whose price is set on organized exchanges; (2) differentiated goods are products whose price is not set on organized exchanges and which lack a reference price because of their intrinsic features; (3) while goods not traded on organized exchanges that possess a benchmark price are defined as reference goods.[18] Based on this

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aggregate exports but also that these firms are characterized by a high degree of both product and geographical diversification. Moreover, Andersson *et al.* (2007) and Castellani *et al.* (2008) provide evidence of a positive relationship between productivity and geographical and product diversification.

[16] In a robustness check, gold and precious ores (product 28, 27, and 68, at the SITC two digits) are excluded from the analysis. Results do not change, so that leaving these goods in the dataset does not modify the results. Results are available upon request.

[17] The Rauch Classification is a measure of horizontal differentiation, not vertical. An example of horizontal differentiation is the ice-cream, which is produced in different tastes, but one is not necessarily better than the other.

[18] Javorcik, B. and Narciso, G. (2008).

classification, a dummy variable for product differentiation is built: it is one if the product falls into category (2) and zero otherwise. As per Table 4, in terms of share of total observations (first two columns), except for Yemen, the majority of shipments from all countries correspond to trade in differentiated goods. Nevertheless, a look at the number of exported products indicates that all countries (excluding Albania) export more homogeneous than differentiated goods. This confirms that homogeneous goods are an important component of exports in this group of countries. Moreover we have seen from Table 3 that price varies across destinations also in homogeneous goods, even though to a lower extent compared to differentiated goods. This justifies the fact that I do not drop homogeneous goods from the sample, as done in most of the literature dealing with pricing-to-market.

4. Empirical framework and testable hypothesis

4.1. Pricing-to-market

The testable hypothesis derived in Section 2.1 is that firms from LICs exporting a product p to multiple destinations d are expected to be price takers: not to charge different prices in different destinations, in respect of the law of one price. Since my variable of interest is the variation of prices across destinations, I focus on the standard deviation of price, rather than directly on price. More specifically, I use the specification already adopted by Manova and Zhang (2012), who analyze the relationship between the number of destinations served and the variation in export prices. Accordingly, equation (3) examines the correlation between the price dispersion (standard deviation) across destinations served by a firm f selling product p in time t and the number of destinations served by that multiple-destinations firm:

$$(3)\quad sd_{fpt}(\log price_{fpdt}) = \alpha + \beta * \log(nr\ destinations_{fpt}) + \delta_p + \gamma_t + \eta_{fp}$$

This is an interesting way of posing the question, because it shows whether exporters that serve multiple destinations charge different prices or the same price in all destinations. Importantly, the correlation captured by β in equation (3) does not arise mechanically. In fact, firms can decide to set the same price or a narrow set of prices in all destinations served, rather than setting different prices in different destinations. This is reflected in Figure 1, where the distribution of $sd_{fpt}(\log price_{fpdt})$ shows that most multi-destinations firms charge a narrow set of prices across destinations. It is also essential to stress that β identifies a correlation and not causality. In fact it is not possible to claim that equation (3) infers a causal relationship, because a representative firm makes its market entry decisions and pricing strategies jointly.

Product and year fixed effects are included in the specification to control for (country) product specific and year specific un-observables. The errors are clustered at the conservative firm-product level. The use of product fixed effects allows me to exploit the variation in prices across firms and ask whether exporters that serve more destinations offer a wider range of export prices. Alternatively, firm-product fixed effects are used to control for firm-product un-observables and to have a stricter definition of within firm-product variation in prices. The use of this alternative fixed-effect identifies the variation of prices across time and modifies the question to whether firms charge a wider set of export prices if the number of destinations served increases overtime.

Subsequently, to test whether pricing-to-market is a characteristic of all products or only of differentiated products, I interact the number of destinations with a dummy variable (Diff) indicating if the good is differentiated:

$$(4)\ sd_{fpt}(\log price_{fpdt}) = \alpha + \beta * \log(nr\ destinations_{fpt}) +$$

$$+ \lambda * \log(nr\ destinations_{fpt}) * Diff + \delta_p + \gamma_t + \eta_{fp}$$

As an additional check I also split the sample between homogeneous and differentiated goods, as defined by Diff. All the variables used in the analysis are described in the Appendix Table 1.

4.2. Heterogeneity of demand

In order to capture the possibility that pricing-to-market is led by differences across destinations, I need a demand elasticity of substitution that varies across products and importing countries. To this end I can use the demand elasticity of substitution by Kee, Nicita and Olarreaga (2008), estimated for a broad range of countries at the six digits level for the period 1988–2001 (and assumed to be time-invariant). It is defined as the percentage change in the quantity of an imported good when the price of this good increases by one percent, holding prices of all other goods, productivity, and endowments of the economy constant.

Since my main dependent variable is the dispersion of prices across destinations, it is useful to first calculate the dispersion (sd) of the elasticity of substitution across destinations by product: $sd_p(\varepsilon_{pd})$. Secondly I divide products in quantiles, according to their $sd_p(\varepsilon_{pd})$, and then produce:

- *HSDE$_p$*: a dummy variable, which is one if the $sd_p(\varepsilon_{pd}) > median\ (sd_p(\varepsilon_{pd}))$. HSDE stands for High Standard Deviation of Elasticity of Substitution.

- $Q(sd_p(\varepsilon_{pd}))$: a continuous variable indicating the decile of $sd_p(\varepsilon_{pd})$: $Q(sd_p(\varepsilon_{pd})) \in [1,10]$

These variables are included in equation (3) as follows:

$$(5)\quad sd_{fpt}(\log price_{fpdt}) = \alpha + \beta * \log(nr\ destinations_{fpt}) + \pi * \log(nr\ destinations_{fpt}) * HSDE_p + \delta_{fp} + \gamma_t + \eta_{fp}$$

$$(6)\quad sd_{fpt}(\log price_{fpdt}) = \alpha + \beta * \log(nr\ destinations_{fpt}) + \pi * \log(nr\ destinations_{fpt}) * Q(sd_p(\varepsilon_{pd})) + \delta_{fp} + \gamma_t + \eta_{fp}$$

The interaction with the $\log(nr\ destinations_{fpt})$ helps verifying whether pricing-to-market is led by the difference in tastes across destinations, in either differentiated or homogeneous goods. This implies assuming that $HSDE_p$ and $Q(sd_p(\varepsilon_{pd}))$ are proxies for the dispersion in tastes across destinations for each product.

5. Results

5.1. Pricing-to-market

When I estimate the baseline equation on the whole sample, exporters that supply more destinations seem to have a higher price's dispersion across destinations, as confirmed by a significant and positive correlation between $sd_{fpt}(\log price_{fpdt})$ and $\log(nr\ destinations_{fpt})$ in Column (1) of panel (A) in Table 5. In other words, firms charge different prices if they serve multiple destinations. This result is confirmed if I restrict the sample to the sub-sample of UMICs (Panel B), and is unexpectedly further confirmed if the reduced sub-sample includes LICs and LMICs (Panel C). This finding does not support empirical evidence to the small open economy assumption, according to which small economies are price takers, and are not expected to conduct pricing-to-market.

Interestingly, when I include the interaction with the "Rauch" dummy, in Column (2) of all Panels, I find it to be not significant, showing that pricing-to-market is not a specific characteristic of differentiated goods and that the pricing-to-market coefficient is not significantly different in homogeneous and differentiated goods. This result is confirmed once I divide the sample between homogeneous and differentiated goods, in Columns (3) and (4), in all Panels (A) to (C). This result is in contrast to the findings of previous literature, including Manova and Zhang (2012), who find pricing-to-market to be a characteristic of differentiated goods only. Intuitively, it is common to think that pricing-to-market is associated more with differentiated than with homogeneous goods, as it is linked to quality differentiation. This is a puzzling result that requires more attention.

Since there might be an omitted variable concern that the results are actually led by firm specific characteristics, in columns (5)-(8) of Table 5, in all Panels, the specification described by equations (3) and (4) are slightly modified so as to include firm-product fixed effects instead of country-product fixed-effects. This change allows associating more precisely the variation in prices within a specific country-firm-product triplet to changes on mark-ups. The results found in columns (1)-(4) hold when the specification changes.

To give an idea of the economic significance of the correlations shown in Table 5, it is useful to consider the effect of a one standard deviation increase in the number of destinations served by a firm-product. In UMICs, a one standard deviation increase in the log (number of destinations), or 2.6 destinations, would be associated to an increase in price dispersion (the standard deviation of the log (price)) of 7%. In other words, this means that the price dispersion would increase from the 50th percentile to the 57st percentile. The economic significance of the correlation for LICs and LMICs is even higher. A one standard deviation increase in the log (number of destinations), or 2.2 destinations, would be associated to an increase in price dispersion (the standard deviation of the log (price)) of 10%. In terms of percentiles, the price dispersion would increase from the 50th percentile to the 58st percentile. Clearly these calculations reveal the correlation for the average product and the average firm. As a consequence it means that these magnitudes would be much lower for sectors in the smallest quantiles, but they would be economically more relevant for sectors at the top of the distribution. The quantification of the correlations for each single country are reported in Table 6, and confirm that the results are homogeneous across exporting countries, and are not led by a few exceptions.

The results that pricing-to-market is not a prerogative of UMICs, and that it is conducted even in homogeneous goods is unsettling because it is common to think that small economies are price takers and that price dispersion is associated with differentiated rather than with homogeneous goods. However the standard results in the pricing-to-market literature are mainly related to developed or middle income countries. LICs and LMICs are important exporters of agriculture products, and have a comparative advantage in these products.[19] Consequently, they might be able to price discriminate: to charge different mark-ups in different markets as a reaction to differences in the demand elasticity of consumers. This argument is developed in the next section.

[19] Unreported statistics (available upon request) show that the majority of products where LICs and LMICs countries have a Revealed Comparative Advantage (RCA) are Homogeneous goods.

5.2. Heterogeneity of demand

Pricing-to-market can be led by the way products are perceived by consumers. The quality of a product could be perceived differently in different countries, and this would make quality a subjective rather than an objective concept, which could be exploited by exporters by charging different mark-ups or branding specialized goods as products of different qualities in different markets. In other words, different countries could have different perceptions of niche products even within homogeneous goods. In fact we have seen from the agriculture economics literature that homogeneous goods are commonly divided between commodities and specialty goods. As an example, coffee is classified as a homogeneous good in the Rauch classification, while it is a product that can be differentiated by its intrinsic quality and different specialties (Arabica versus Robusta, organic versus non organic, *et cetera*). Most importantly, each country might have its own taste and sensitivity to the varieties of coffee. This could be exploited by exporters, by charging different mark-ups or branding the product differently in different destinations. I take this into account in equations (5) and (6).

The importance of taste in pricing-to-market is reported in Table 7, which shows different results for UMICs and LICs & LMICs. In Panel (A) and (B) I test equations (5) and (6) first only on differentiated goods and then on homogeneous goods (Columns (1) - (4)). In UMICs (Panel (A)), pricing-to-market is not affected by the diversity of tastes within product across destinations. This is confirmed in Columns (5) to (8), where the sample is further divided in homogeneous and differentiated goods with a high or a low taste's diversity. However, when I repeat the analysis in the sub-sample of LICs & LMICs, in Panel (B), taste reveals an important factor, but only for homogeneous goods. More specifically, taste does not affect pricing-to-market in differentiated goods, as per Columns (1) and (3). However, homogeneous goods are priced to market only if they face very different tastes in different destinations, as per Columns (2) and (4). These results are further confirmed when the sample is split in four sub-samples in Columns (5)-(8). This indicates that pricing-to-market in differentiated goods exported by LICs is explained by other factors that I am considering. However homogeneous goods require a highly diversified distribution of taste (demand elasticity of substitution) across destinations to be sold at different prices. This can be due to the fact that exporters exploit the difference in tastes across countries, at least in the products where the country has a comparative advantage and in products where exporters can brand their products by (perceived) quality or market niches. Several other reasons might lead to this behavior (from market power arguments to destination specific characteristics), but the result of relevance is the further confirmation that the small open economy assumption has no empirical evidence.

6. Robustness

6.1. Controlling for compositional effects

A potential concern to my analysis arises from the use of data at HS 6-digit level, which precludes the possibility to control for measurement errors. More specifically, each HS 6-digit product may consist of many HS 8 digit products. Consequently, a change (for instance increase) in the unit value of a HS 6-digit code could be due to (i) a change in the composition of one underlying HS 8-digit product, or (ii) it could genuinely be a change (increase) in prices across all underlying products. To establish pricing-to-market, it is essential to focus on the second channel. Consequently, I reproduce the results from Table 5 and Table 7 for the Tanzanian dataset at the HS 8-digit level.[20] This explains the concerns expressed in Lavoie and Liu (2007), who examine the potential bias in pricing-to-market results when using unit values aggregating differentiated products. The authors argue that more confidence can be placed on results obtained using disaggregated data.

These concerns should be alleviated in Table 8, which shows (Panel (A)) that pricing-to-market is confirmed even using HS 8-digit data, for both differentiated and homogeneous goods. Moreover, Columns (5) and (6) in Panel (B) confirm the findings from Section 5.2, that homogeneous goods exported by LICs are priced to market only when they face very heterogeneous tastes across destinations. The results for differentiated goods (Columns (3) and (4)) are counter-intuitive, and indicate that probably factors other than taste heterogeneity lead pricing-to-market in these goods. However, what matter is that the use of data for Tanzania at the HS 8-digit level confirms the main findings of the paper: (i) that LICs can conduct pricing-to-market, even in homogeneous goods; and (ii) that there is evidence that pricing-to-market in homogeneous goods is done only when products face a highly diversified range of elasticities of substitutions (tastes) across destinations.

[20] Access to HS 8 digit level data was available only for Tanzania.

6.2. Alternative "Rauch" dummy

A further concern relates to the possibility that my results on homogeneous goods depend on the way I construct the "Rauch" dummy, which is one if goods are classified by Rauch (1999) as differentiated, and zero otherwise. Accordingly, homogeneous goods include, by construction, both differentiated and reference goods. This is consistent with Manova and Zhang (2012). In order to be more specific about homogeneous goods, I could re-build the dummy by simply ignoring reference goods, so as to assign zero to strictly defined homogeneous goods. In other words, based on the Rauch classification (as per Section 3.1), a dummy variable for product differentiation is one if the product falls into category (2) and zero if it falls into category (1) - Category (3) is left out. Once again, as per Table 9, the main results hold. Within each country-firm-product triplet, if firms increase the number of destinations to which they export, their price dispersion across destinations increases. LMICs and LICs conduct pricing-to-market in homogeneous goods only when the taste dispersion across destinations is high.

7. Concluding remarks

The analysis presented in this paper contributes to the literature on pricing-to-market by testing the small open economy assumption: exporters from LICs are price takers and cannot conduct pricing-to-market. The empirical analysis draws from Manova and Zhang (2012) and rejects the small open economy assumption. Specifically, even for exporters from LICs, I find that the higher the number of destinations served, the higher the dispersion of export prices. Interestingly, when the sample is reduced to homogeneous goods, the correlation between the number of destinations served and price dispersion holds positive significant, as with differentiated goods. This result applies to all countries (UMICS, LMICs and LICs) and is in contrast to the findings in previous literature - including Manova and Zhang (2012) - where pricing-to-market was a characteristic of differentiated goods only, as economic intuition would suggest.

I develop the analysis further by focusing on the Kee-Nicita-Olarreaga (2008) import demand elasticity of substitution. I find that dispersion in "tastes" across destinations determines pricing-to-market in homogeneous goods exported by LICs and LMICs. This finding can be attributed to exporters recognizing and exploiting the "taste premium" by charging different prices (either due to different mark-ups or different branding of qualities) in different destinations. This interesting result calls into question the objective versus subjective nature of quality for some types of products. It also suggests that what matters for pricing-to-market is not quality but rather the interaction of quality with the demand for quality in the destination market, (Auer et al 2014). In this regard it is important to note that, even though it is a standard practice to treat agricultural commodities as homogeneous goods, these commodities are increasingly perceived by consumers as differentiable by quality, according to production practices, seeds, geographical locations of production, sanitary and phyto-sanitary measures and food safety requirements.[21] Allowing for the possibility that food products can be price differentiated amplifies the spectrum of existing opportunities for developing countries to

[21] Saker and Surry (2006)

exploit market niches in countries where consumers are willing to pay more for products that satisfy specific quality characteristics.

Even though the results in this paper cannot provide a conclusive answer to the question of what is leading price dispersion for multiple-destinations exporters, they do provide evidence that even exporters in small LICs, which are normally viewed as price-takers, charge different prices for the same product across destinations. Several factors may contribute to this behavior, ranging from market power arguments to destination specific characteristics, but what is confirmed is that there is no empirical evidence backing up the small open economy assumption.

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Figures and Tables

Figure 1: Distribution of price dispersion, by firm-product

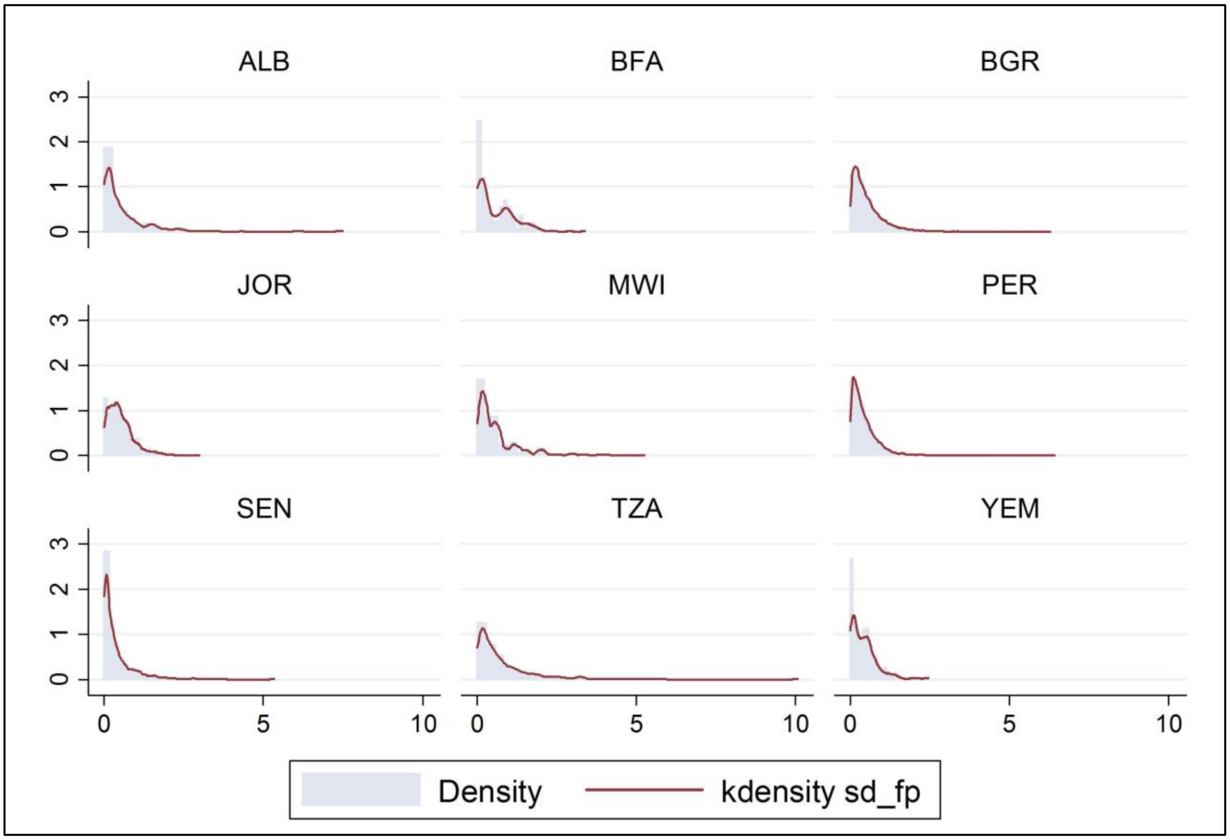

Table 1: Observations by Country

Country	Observations	Years	Income Group
Albania*	46,693	2004-2009	LMIC
Burkina Faso	11,882	2005-2010	LIC
Bulgaria	819,927	2001-2006	UMIC
Jordan	72,624	2003-2011	UMIC
Malawi	15,011	2004-2009	LIC
Peru	638,031	2000-2009	UMIC
Senegal	72,623	2000-2010	LMIC
Tanzania	76,331	2003-2009	LIC
Yemen	17,445	2006-2010	LMIC
Total	*1,770,567*	*2000-2011*	

*Note: Albania has been promoted to UMIC in 2013, but I leave it in the previous income group since the data I analyse is in a period where it was a LMIC.

Table 2: Sample Characteristics

Country	Destinations by firm-product (Mean)	Destinations by firm-product (Mean) *MD firms*	Share of MD Firms	Share of exports by MD Firms
Albania	1.1	2.5	16	26
Burkina Faso	1.4	3.0	33	81
Bulgaria	1.6	3.9	30	82
Jordan	1.7	3.9	39	79
Malawi	1.1	3.6	13	85
Peru	1.5	3.6	34	92
Senegal	1.6	3.5	40	77
Tanzania	1.4	3.2	32	72
Yemen	1.4	3.2	30	67

Table 3: Variation in Export Prices

Across:	***Firms, products, destinations, and years***	***Firms and destinations***	***Destinations***			***Firms***		
Country	*sd (log(price))*	*sd (log(price)) by product year*	*sd (log(price)) by firm product year*			*sd (log(price)) by destination product year*		
	All	*All*	*All*	*Diff*	*Hom*	*All*	*Diff*	*Hom*
Albania	2.45	1.13	0.60	0.68	0.35	0.96	1.03	0.57
Burkina Faso	2.34	0.93	0.48	0.60	0.33	0.74	0.83	0.59
Bulgaria	1.93	1.18	0.56	0.61	0.41	0.92	1.01	0.63
Jordan	1.92	0.79	0.48	0.52	0.40	0.67	0.75	0.54
Malawi	1.96	1.29	0.72	0.84	0.57	1.07	1.16	0.82
Peru	1.71	1.09	0.44	0.45	0.36	0.87	0.93	0.64
Senegal	1.84	0.91	0.43	0.53	0.28	0.70	0.80	0.50
Tanzania	2.37	1.44	0.83	0.88	0.59	1.06	1.17	0.76
Yemen	3.38	0.87	0.47	0.63	0.39	0.67	0.76	0.60

Table 4: Proportion of differentiated and homogeneous products exported

Country	*Share of Hom and Diff products over total number of export flows*		*Share of Hom and Diff products over total number of exported products*	
	Hom	*Diff*	*Hom*	*Diff*
Albania	17.39	82.61	29.69	70.31
Burkina Faso	41.36	58.64	54.07	45.93
Bulgaria	24.09	75.91	55.38	44.63
Jordan	37.46	62.54	86.11	13.89
Malawi	27.60	72.40	60.00	40.00
Peru	22.58	77.42	75.28	24.72
Senegal	37.51	62.49	75.00	25.00
Tanzania	36.99	63.01	85.29	14.71
Yemen	59.15	40.85	83.33	16.67

Table 5: Pricing-to-market in homogeneous and differentiated goods

Panel A: All Countries

Dependent variable: sd(log(price)) across destinations within a country firm product triplet								
Variation Across:	firms (or time)				time			
Within:	country-product				country-firm-product			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	ALL	Hom	Diff	ALL	ALL	Hom	Diff
log(nr dest by cfp)	0.046***	0.047***	0.047***	0.041***	0.081***	0.081***	0.080***	0.078***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.005)	(0.007)	(0.007)	(0.007)
log(nr dest by cfp)*Diff		-0.006				-0.004		
		(0.005)				(0.010)		
FE	c-p	c-p	c-p	c-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	213605	204530	58076	146454	213605	204530	58076	146454
R-squared	0.266	0.253	0.283	0.227	0.747	0.743	0.716	0.746
f-p cluster	102628	97846	25072	72774	102628	97846	25072	72774

Panel B: Upper Middle Income Countries

Dependent variable: sd(log(price)) across destinations within a country firm product triplet								
Variation Across:	firms (or time)				time			
Within:	country-product				country-firm-product			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	ALL	Hom	Diff	ALL	ALL	Hom	Diff
log(nr dest by cfp)	0.043***	0.045***	0.045***	0.041***	0.076***	0.074***	0.072***	0.075***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.005)	(0.008)	(0.007)	(0.007)
log(nr dest by cfp)*Diff		-0.004				0.000		
		(0.005)				(0.010)		
FE	c-p	c-p	c-p	c-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	186,738	179,394	47,327	132,067	186,738	179,394	47,327	132,067
R-squared	0.221	0.220	0.268	0.190	0.737	0.736	0.708	0.739
f-p cluster	64707	64707	64707	64707	64707	64707	64707	64707

Panel C: Lower Middle Income & Low Income Countries

Dependent variable: sd(log(price)) across destinations within a country firm product triplet								
Variation Across:	firms (or time)				time			
Within:	country-product				country-firm-product			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	Hom	Diff	All	All	Hom	Diff
log(nr dest by fp)	0.077***	0.059***	0.059***	0.042***	0.126***	0.125***	0.125***	0.105***
	(0.010)	(0.013)	(0.013)	(0.014)	(0.020)	(0.025)	(0.024)	(0.029)
log(nr dest by fp)*Diff		-0.016				-0.019		
		(0.019)				(0.038)		
FE	c-p	c-p	c-p	c-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	26,867	25,136	10,749	14,387	26,867	25,136	10,749	14,387
R-squared	0.404	0.374	0.322	0.365	0.776	0.768	0.738	0.769
f-p cluster	8067	8067	8067	8067	8067	8067	8067	8067

Robust se in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Economic significance of correlations by country

Country	Correlation between price dispersion and number of destinations	sd (log(nr dest by cfp))	Increase in number of destinations	Percentage increase in price dispersion accompanying an increase in the number of destinations served
Bulgaria	0.076***	1.0	2.7	7.4
	(0.008)			
Jordania	0.044**	1.0	2.7	4.4
	(0.020)			
Peru	0.080***	0.9	2.5	7.3
	(0.007)			
*UMICs**	0.076***	*1.0*	2.6	7.3
	(0.005)			
Albania	0.244**	0.5	1.6	11.5
	(0.113)			
Burkina Faso	0.196*	0.7	2.0	13.5
	(0.103)			
Malawi	0.116	0.8	2.3	9.8
	(0.137)			
Senegal	0.069***	0.9	2.3	5.9
	(0.019)			
Tanzania	0.169***	0.9	2.4	14.6
	(0.041)			
Yemen	0.202**	0.8	2.3	17.0
	(0.101)			
*LICs & LMICs***	*0.126****	*0.8*	*2.2*	*10.2*
	(0.020)			

Table 7: Pricing-to-market explained by heterogeneity in taste across destinations

Panel A: Upper Middle Income Countries

Dependent variable: sd(log(price)) across destinations within a country firm product triplet
Variation Across: time
Within: country-firm-product

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Hom		Diff	
	Hom	Diff	Hom	Diff	Low sd	High sd	Low sd	High sd
log(nr dest by cfp)	0.072***	0.063***	0.076***	0.068***	0.076***	0.065***	0.069***	0.083***
	(0.019)	(0.017)	(0.013)	(0.012)	(0.013)	(0.010)	(0.012)	(0.013)
log(nr dest by cfp)*Q $sd_p(\varepsilon_{pd})$	-0.000	0.002						
	(0.003)	(0.003)						
log(nr dest by cfp)*High $sd_p(\varepsilon_{pd})$			-0.010	0.016				
			(0.016)	(0.014)				
FE	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	42,631	121,499	42,631	121,499	15,751	26,880	68,551	52,948
R-squared	0.704	0.740	0.704	0.740	0.681	0.718	0.730	0.753
f cluster	6258	6258	6258	6258	6258	6258	6258	6258

Panel B: Lower Middle Income & Low Income Countries

Dependent variable: sd(log(price)) across destinations within a country firm product triplet
Variation Across: time
Within: country-firm-product

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Hom		Diff	
	Hom	Diff	Hom	Diff	Low sd	High sd	Low sd	High sd
log(nr dest by cfp)	0.001	0.151**	0.038	0.113**	0.037	0.171***	0.115**	0.090*
	(0.051)	(0.071)	(0.034)	(0.045)	(0.035)	(0.039)	(0.045)	(0.048)
log(nr dest by cfp)*Q $sd_p(\varepsilon_{pd})$	0.019**	-0.009						
	(0.008)	(0.011)						
log(nr dest by cfp)*High $sd_p(\varepsilon_{pd})$			0.131**	-0.022				
			(0.051)	(0.059)				
FE	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	9,875	13,082	9,875	13,082	2,820	7,055	6,647	6,435
R-squared	0.729	0.764	0.729	0.764	0.724	0.731	0.770	0.756
f cluster	2074	2074	2074	2074	2074	2074	2074	2074

Robust se in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Tanzania data at 8 digits

Panel A: Pricing-to-market

Dependent variable: sd(log(price)) across destinations within a country firm product triplet								
Variation Across:	firms (or time)				time			
Within:	country-product				country-firm-product			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	ALL	Hom	Diff	ALL	ALL	Hom	Diff
log(nr dest by cfp)	0.145***	0.066**	0.068***	0.088***	0.199***	0.153***	0.158***	0.139**
	(0.020)	(0.026)	(0.026)	(0.027)	(0.042)	(0.049)	(0.047)	(0.063)
log(nr dest by cfp)*Diff		0.023				-0.007		
		(0.037)				(0.076)		
FE	p	p	p	p	f-p	f-p	f-p	f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,148	8,963	3,790	5,173	10,148	8,963	3,790	5,173
R-squared	0.359	0.324	0.304	0.306	0.744	0.737	0.723	0.734
f-p cluster	3067	3067	3067	3067	3067	3067	3067	3067

Panel B: Heterogeneity in taste across destinations

Dependent variable: sd(log(price)) across destinations within a country firm product triplet								
Variation Across:	time							
Within:	country-firm-product							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Hom		Diff	
	Hom	Diff	Hom	Diff	Low sd	High sd	Low sd	High sd
log(nr dest by cfp)	0.048	0.274**	0.101	0.179**	0.119	0.172***	0.188**	0.078
	(0.102)	(0.108)	(0.065)	(0.073)	(0.074)	(0.061)	(0.074)	(0.094)
log(nr dest by cfp)*Q $sd_p(\varepsilon_{pd})$	0.016	-0.027						
	(0.017)	(0.020)						
log(nr dest by cfp)*High $sd_p(\varepsilon_{pd})$			0.080	-0.099				
			(0.085)	(0.113)				
FE	f-p	f-p	f-p	f-p	f-p	f-p	f-p	f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,518	4,757	3,518	4,757	1,215	2,303	2,781	1,976
R-squared	0.709	0.728	0.709	0.728	0.694	0.719	0.744	0.697
f cluster	666	666	666	666	666	666	666	666

Robust se in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Alternative "Rauch dummy"

Panel A: Pricing-to-market

Dependent variable: sd(log(price)) across destinations within a country firm product triplet

	UMICs				LICs & LMICs			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	ALL	Hom	Diff	ALL	ALL	Hom	Diff
log(nr dest by cfp)	0.076***	0.047***	0.047***	0.075***	0.126***	0.164***	0.164***	0.105***
	(0.005)	(0.012)	(0.011)	(0.007)	(0.020)	(0.038)	(0.037)	(0.029)
log(nr dest by cfp)*Diff		0.028**				-0.059		
		(0.014)				(0.048)		
FE	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	186,738	145,223	13,156	132,067	26,867	18,605	4,218	14,387
R-squared	0.737	0.741	0.686	0.739	0.776	0.767	0.717	0.769
f-p cluster	64707	64707	64707	64707	8067	8067	8067	8067

Panel B: Heterogeneity in taste across destinations

Dependent variable: sd(log(price)) across destinations within a country firm product triplet

	UMICs				LICs & LMICs			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hom		Diff		Hom		Diff	
	Low sd	High sd	Low sd	High sd	Low sd	High sd	Low sd	High sd
log(nr dest by cfp)	0.074**	0.037***	0.069***	0.083***	0.056	0.189***	0.115**	0.090*
	(0.031)	(0.013)	(0.012)	(0.013)	(0.083)	(0.043)	(0.045)	(0.048)
FE	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p	c-f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,277	8,789	68,551	52,948	771	3,040	6,647	6,435
R-squared	0.618	0.719	0.730	0.753	0.783	0.685	0.770	0.756
f cluster	1612	1612	1612	1612	999	999	999	999

Robust se in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix: Cleaning procedure

The data used in this paper includes six digits data for Albania, Bulgaria, Burkina Faso, Peru, Senegal, Jordan, Malawi, and Yemen and 8 digits data for Tanzania.

The first step in the cleaning procedure is to drop, from the raw data, observations for which firm, product and destination cannot be identified.

Secondly, before merging the data with product and country characteristics, I have to solve a well-known problem: conversion of products to the same classification[22]. In this data it is not possible to know what HS-classification has been used to register the data. In fact, the HS 6-digit product codes included in each of the datasets are those provided by the countries and may be at different revision levels depending on the year. As a consequence, for the same country, different classifications could have been used in different years. In order to assess which specific HS revision is used for each country in each year I compare the list of product codes in the country's dataset in a year to the lists of product codes included in HS 1996, HS 2002 and HS 2007 classifications as provided in WITS/COMTRADE. Consequently, I should convert all observations to the same HS2002 classification.

It would be useful to simply use the standard conversion tables freely available, however the relationship from one classification (say 1996) to the other (say 2002) is not always unique, as sometimes one HS1996 code is converted to many HS2002 codes, or many HS1996 codes are converted to the same HS2002 code. This creates many *duplicates*. Moreover it is very common that the multiple codes generated are not even in the same group of differentiated goods or homogeneous goods. This means that simply dropping duplicates could change the data in a way that could eventually change the results of my analysis, which focuses on the Rauch Classification.

[22] Moreover, I only keep years from 2000 to 2011. This choice is motivated by the need to convert all products across the years to a single HS classification. By choosing 2000 to 2011 I remove the need to convert products from the 1992 concordances, and to focus on converting products from the HS1996 to HS2002 and HS2007 to HS2002 concordances.

To reduce the problems with duplicates, I have decided to "clean" the conversion tables so as to leave only unique relationships. This means that if a HS1996 code is converted in many HS2002 codes, I check if these HS2002 codes are all differentiated or not. If this is the case, I can just keep anyone of them. If this is not the case then I check the percentage of differentiated versus not differentiated goods, and then select any code in the category (homogeneous or differentiated) that represent the majority. If a HS1996 product is converted to the same number of differentiated and not differentiated products, then I do not convert, I drop these conversions from the table not to have to pick a case. At this point, I am left with the possibility that many HS1996 codes are converted to the same HS2002 code. This is a problem only if the same firm is exporting two HS1996 codes, because after converting to HS2002 it would wrongly appear that the same firm is exporting two different quantities of the same product. So after the conversion, if I encounter these issues I re-convert HS2002 to the original classification, not to create fault duplicates.

This cleaning procedure is useful because it allows converting products to the same HS2002 classification, and then merging the data with the Rauch Classification (also converted to HS2002) and to the Knee, Nicita, Olarreaga elasticity of substitution, also converted to HS2002.

Appendix Table 1: Description of Variables Used

Name	Description		Mean	Std. Dev.
Dependent Variable				
$sd_{fpt}\log(price_{fpdt})$	Standard deviation of logarithm of fob price across destinations within a country firm product triplet		0.51	0.53
Correlated variable				
$\log(\text{nr of destinations}_{fpt})$	Logarithm of number of destinations served by a country-firm-product-year quartet	ALL	0.72	0.94
		UMICs	0.74	0.95
		LMICs & LICs	0.57	0.82
Interaction Variables				
Diff	Dummy variable indicating whether the good is differentiated or homogeneous (according to the Rauch classification)			
$Q\ sd_p(\varepsilon_{pd})$	Variable taking values between 1 and 10, indicating the decile of the $sd_p(\varepsilon_{pd})$ across product			
$HSDE_p$	Dummy variable indicating if a product' standard deviation of demand elasticity of substitution - across destinations - is above/below the median standard deviation			