UNEXPECTED PRICING-TO-MARKET IN GOODS CLASSIFIED AS HOMOGENEOUS

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Abstract. This paper uses cross-country, firm-level, panel data to study how exporters from Low Income Countries (LICs) adjust their prices according to their trade partners' characteristics. The results show that also LICs differentiate the free on board (fob) price of exports across markets. This differentiated pricing is not commonly associated with small economies, which are normally considered price takers. This finding confirms that the law of one price does not necessarily apply to exporters in small economies. 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 - under the assumption of variable demand elasticity of substitution (for each product across destinations).

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

JEL Classification: F1, C33

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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 diversify their exports not only by exporting different products, but also by exporting different qualities/varieties of the same product to different destinations. It does so by focusing on export prices, rather than on export flows or the number of products/destinations. This implies that the baseline assumption that LICs exporters, as price-takers, cannot diversify their exports over the quality spectrum may need to be abandoned.

Agricultural economists have long been interested in markets for products that are differentiated by quality. As Unnevehr *et al* (2010) explain in their review of the relationship

[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).

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 provide justification for this paper's focus on price-maker behavior across LICs, and its search for pricing-to-market in both differentiated and, most importantly, homogeneous products.

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 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 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 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 vertically 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, in all countries (UMICs, LMICs and LICs). These findings highlight the importance of considering 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 analytical framework used to test the hypotheses identified in Section 2. Section 5 reports the results of the empirical analysis, while Section 6 performs some robustness checks. Finally, Section 7 concludes.

2. Theoretical underpinnings and previous findings

2.1. Testable hypothesis

The main aim of this paper is to examine the pricing behavior of firms in countries of different development status and to check whether they charge different prices when they serve multiple destinations with the same product. 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.[4]

Profit-maximization[5] for a representative firm implies the equality 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: $p(q)\left(1 - p(q)/q * \partial p/\partial q\right) = m$

(1) $r = m$

which yields the pricing equation:

(2) $p_{cfpdt} = \frac{m_{cfpt}}{1-{}^{1}/_{\varepsilon}}$

where p_{cfpdt} is the fob price of firm *f* from country *c* exporting product variety *p* to destination *d* in year *t*, m_{cfpt} is the marginal cost of producing good *p*, which is firm specific and does not vary across destinations, and ε is the perceived demand elasticity of substitution. I depart from the constant elasticity of substitution (CES) assumption and allow for the possibility that any differentiated product *p* might face a different elasticity of substitution across destinations. Accordingly, the pricing equation slightly modifies to:

(3) $p_{cfpdt} = \frac{m_{cfpt}}{1-{}^{1}/_{\varepsilon_{pd}}}$

where price in each product-destination pair is a constant mark-up over marginal cost.

The **testable hypotheses** are related to equation (3) by the assumed ε_{pd}:

1. **Firms from Upper-Middle Income Countries (UMICs) exporting a differentiated product *p* to multiple destinations *d* should be price-makers.**

   This reflects the common perception that such firms perceive their elasticity of substitution as being finite and potentially varying across destinations.

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

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

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

3. **A corollary of the first two predictions is that pricing-to-market by small economies firms**, if found, **should apply only to differentiated goods, where perceived elasticities are finite.**

These hypotheses are summarized in Table 1. The testing methodology is discussed in Section 4.

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 destinations 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 highlights the importance of 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

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

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 offer 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 a 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).

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.

Finally, this paper also relates to the strand of literature that builds upon the above mentioned trade models of monopolistic competition by focusing on the demand side, instead of the supply side. The importance of demand factors in explaining the variability in firm-level prices and sales across a range of export destinations has been highlighted in Eaton *et al* (2011), who find that firm efficiency is not the main determinant of sales variation across markets. Also, Kee and Krishna (2008) find that the correlation between firm-level sales of Bangladeshi firms in different destination markets is very low. 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 - after finding evidence that exporting firms are able to conduct pricing-to-market in all exporting goods - 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 2. 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.[7] Each annual observation contains information on arbitrary[8] firm ID, product information (at HS-6 digits), 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-

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

[8] 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.

[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), 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 3 shows that, overall, the number of exporting firms, products and destinations served has increased overtime, in nearly all countries, and that the increase in the number of destinations has been very modest. Also the average number of firms exporting a specific product to a destination is quite stable and low. We can see that this number does not surpass two in LICs and LMICs, while it is above two in UMICs. This indicates that the competition across firms in the same product exported to a country is not very high, on average. At the same time, the number of

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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

destinations per firm-product pair is even lower (below two) on average. This last observation indicates that in this sample of nine countries only a few firms export the same product to multiple destinations, a common finding in the empirical literature.[15]

Secondly, it is important to look at the variation in export prices across different dimensions. The first column of Table 4 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 pricing-to-market is really linked to the development status of a country. This first description of the data also confirms that we should move beyond the CES assumption. In other words, the variation of prices across destinations indicates that firms charge different prices (and maybe sell different product varieties) across destinations. In fact Table 4 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.

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[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 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.

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 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 5, 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 4 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.

[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).

4. Analytical framework and testable hypothesis

4.1. Pricing-to-market

The first testable hypothesis derived in Section 2.1 is that firms from UMICs exporting a product *p* to multiple destinations *d* are expected to conduct pricing-to-market: to charge different prices in different destinations, in violation 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 (4) examines the correlation between the price dispersion (standard deviation) across destinations served by a firm *f* from country *c* selling product *p* in time *t* and the number of destinations served by that multiple-destinations firm:

$$(4)\quad sd_{cfpt}(\log price_{cfpdt}) = \alpha + \beta * \log(nr\ destinations_{cfpt}) + \delta_{cp} + \gamma_t + \varepsilon_{cfp}$$

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. Country-product and year fixed effects are included in the specification to control for good specific and year specific un-observables. The errors are clustered at the conservative country-firm-product level. The use of country-product fixed effects allows us to ask whether exporters that serve more destinations offer a wider range of export prices. Alternatively, country-firm-product fixed effects are used to control for country-firm-product un-observables and to have a stricter definition of within country-firm-product variation in prices. The use of this alternative fixed-effect modifies the question to whether firms charge a wider set of export prices if the number of destinations served increases overtime. The same analytical framework is used to test the second hypothesis, that multiple-destinations firms from LMICs & LICs are not expected to conduct pricing-to-market.

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

$$(5)\ sd_{cfpt}(\log price_{cfpdt}) = \alpha + \beta * \log(nr\ destinations_{cfpt}) +$$

$$+ \lambda * \log(nr\ destinations_{cfpt}) * Diff + \delta_{cp} + \gamma_t + \varepsilon_{cfp}$$

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, the assumption of constant demand elasticity of substitution needs to be abandoned. To this end, we need to assume variable demand elasticity of substitution (VES), where the variation is both across products and countries. This is possible using the demand elasticity of substitution estimated by Kee, Nicita and Olarreaga (2008). This elasticity is estimated for a broad range of countries at the six digits level for the period 1988–2001, and 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. The Kee, Nicita, Olarreaga elasticity, σ_{pd}, is defined at the product-destination level and is assumed to be time-invariant.

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

- $HSDE_p$: a dummy variable, which is one if the $sd_p(\sigma_{pd}) > median\ (sd_p(\sigma_{pd}))$
- $Q(sd_p(\sigma_{pd}))$: a continuous variable indicating the decile of $sd_p(\sigma_{pd})$: $Q(sd_p(\sigma_{pd})) \in [1,10]$

These variables are included in equation (4) as follows:

$$(6)\quad sd_{cfpt}(\log price_{cfpdt}) = \alpha + \beta * \log(nr\ destinations_{cfpt}) + \pi * \log(nr\ destinations_{cfpt}) * HSDE_p + \delta_{cfp} + \gamma_t + \varepsilon_{cfp}$$

$$(7)\quad sd_{cfpt}(\log price_{cfpdt}) = \alpha + \beta * \log(nr\ destinations_{cfpt}) + \pi * \log(nr\ destinations_{cfpt}) * Q(sd_p(\sigma_{pd})) + \delta_{cfp} + \gamma_t + \varepsilon_{cfp}$$

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 $Q(sd_p(\sigma_{pd}))$ are proxies for the dispersion in tastes across destinations for each product.

5. Results

5.1. Pricing-to-market

Interestingly, as shown in Table 6, exporters that supply multiple destinations seem to have a higher price's dispersion across destinations, as confirmed by a significant and positive correlation between $sd_{cfpt}(\log price_{cfpdt})$ and $\log(nr\ destinations_{cfpt})$ in Column (1) of panel (A). In other words, firms charge different prices if they serve multiple destinations. This result is in fact confirmed for both the sub-sample of UMICs (Panel A) and LICs and LMICs (Panel B) and corroborates my expectations for UMICs; however I also expected small economies to be price takers, so firms from LMICs & LICs were not expected to conduct pricing-to-market. This means that I have an unexpected result.

Most importantly, when I include the interaction with the "Rauch" dummy, in Column (2), 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 both Panel (A) and (B). 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 6, in both Panels, the specification described by equations (4) and (5) are slightly modified so as to include country-firm-product fixed effects instead of country-product fixed-effects. This change allows explaining more precisely the variation in prices within a specific country-firm-product triplet. 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 6, it is useful to consider the effect of a one standard deviation increase in the number of destinations served by a country-firm-product triplet. In UMICs, a one standard deviation increase in the log (number of destinations), or 2.6 destinations, overtime 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 sd of the log(price) 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, overtime 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 destination country. 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 7, and confirm that the results hold for all 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. This is shown in Table 8, where it is clear that the majority of products where LICs and LMICs countries have a Revealed Comparative Advantage (RCA) are Homogeneous goods. In fact, even though the average for LICs and LMICs indicates that these countries have an equal share of homogeneous and differentiated goods within their basket of RCA goods, at the country level the majority of countries have a RCA more in homogeneous than in differentiated goods.

Besides the RCA explanations given above, two main arguments might explain these results. One is the quality argument, according to which firms sell products of different qualities (and so of different prices due to different marginal costs) to different destinations – also called product differentiation. The other is the mark-up argument, which explains that firms charge different mark-ups in different markets – also known as price discrimination. A way to differentiate between "quality led" and "mark-up led" pricing-to-market would be to use an index of vertical differentiation, like the one built by Khandelwal (2010). The problem with this and other indices of vertical differentiation is that they do not include the products defined as homogeneous by Rauch (as they are assumed to be not differentiable). For this reason, since it is not possible to differentiate between quality and mark-up, I analyze the issue from a different point of view: the demand side.

5.2. Heterogeneity of demand

An alternative explanation to pricing-to-market can be given by focusing on 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 selling goods 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. For instance, 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 tastes and sensitivities to the qualities of coffee. This could be exploited by exporters, by charging different mark-ups or exporting different varieties (or qualities) to different destinations. I take this into account in equations (6) and (7).

The importance of taste in pricing-to-market is reported in Table 9, which shows different results for UMICs and LICs & LMICs. In Panel (A) I test equations (6) and (7) first only on

differentiated goods and then on homogeneous goods (Columns (1) - (4)): in UMICs, 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 different tastes in different destinations as per Columns (2) and (4). These results are further confirmed when the sample is split in four subsamples in Columns (5)-(8). This indicates that pricing-to-market in differentiated goods exported by LICs is explained by other factors that we are 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 differentiate their products by quality (or perceived quality) or market niches. Several reasons might lead to this behavior (from market power arguments to destination specific characteristics), but this result further confirms that the law of one price does not necessarily apply to exports from LICs.

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 6 and Table 9 for the Tanzanian dataset at the HS 8-digit level.[19] 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 10, 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.

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[19] 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 11, 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 analyzing how exporters in LMICs & LICs behave with respect to pricing decisions and whether firms adjust their prices according to their trade partner's characteristics. The empirical analysis draws from Manova and Zhang (2012) and partially confirms their results. Specifically, exporters that serve multiple destinations show higher price dispersion across importers, indicating that firms charge different prices if they serve multiple destinations. Interestingly, when the sample is reduced to homogeneous goods, the relationship between the number of destinations served and price dispersion holds positive, 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 is a characteristic of differentiated goods only, as economic intuition would suggest. Moreover, pricing-to-market was unexpected in small economies, as per the predictions in section 2.1.

While the homogenous goods result is unexpected, it is also justifiable. In most LICs, the agriculture sector remains the main source of employment. Moreover, most LICs have a comparative advantage in agricultural goods and, over the years, donor-driven projects have actively developed technologies to add value in agricultural production.[20] For these reasons, the finding that price differentiation also relates to homogeneous goods could be a first indication that the country's comparative advantage in homogeneous goods might signal the possibility to differentiate products by quality attributes or differences in variety. However, price differentiation is not only explained by quality. Pricing-to-market can also be led by firms charging different mark-ups. Unfortunately, it is not possible to discern between price discrimination and product differentiation with these data.

I overcome this constraint by analyzing the issue from the demand side. Using the Lee-Nicita-Olarreaga (2008) import demand elasticity of substitution, I find that dispersion in "tastes"

[20] Koshuma, K.P. R. and Mmasi, S.M., (2008).

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 marginal-costs/qualities/varieties) in different destinations. This interesting result calls into question the objective versus subjective nature of quality for some types of products. It might suggest that countries with a RCA in homogeneous goods can still undertake price differentiation across destinations.

Moreover, these results may challenge the common way of classifying products. The agriculture economics literature has long seen agricultural goods as either commodities or specialty goods. Accordingly, it has adapted its way of classifying goods to changing and increasingly demanding consumers. As a consequence, these findings might encourage new areas of work in the construction of indices of product classification that could better reflect the reality shown in the data.

In fact, 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. For this reason, differences in brand, quality and other product aspects differentiate them for international trade.[21] Allowing for the possibility that food products can be vertically differentiable amplifies the spectrum of existing opportunities for developing countries to exploit product differentiation and 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 preliminary evidence that even exporting firms in small LICs, which are normally viewed as

[21] Saker and Surry (2006)

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 matter most is that the law of one price does not necessarily apply to small LICs.

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Tables

Table 1: Testable Hypothesis

	HOMOGENEOUS GOODS	DIFFERENTIATED GOODS
UMICs	No pricing-to-market	Pricing-to-market
LMICs & LICs	No pricing-to-market	No pricing-to-market

Table 2: 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	*1770567*	*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 3: Sample Characteristics

Year	Firms	Products	Destinations	Firms by product (Mean)	Firms by product-destination (Mean)	Destinations by product (Mean)	Destinations by firm-product (Mean)
Albania							
2004	1516	1557	80	3.6	2.0	1.8	1.1
2005	1612	1475	75	4.0	2.0	1.9	1.1
2006	1741	1511	83	4.4	2.0	2.0	1.1
2007	3828	1547	91	8.2	4.1	2.1	1.1
2008	2095	1736	85	4.6	2.0	2.2	1.2
2009	2115	1867	89	4.8	1.9	2.4	1.1
Burkina Faso							
2005	305	641	78	2.4	1.5	2.1	1.4
2006	318	635	82	2.4	1.5	2.1	1.4
2007	470	730	84	2.6	1.5	2.2	1.3
2008	502	637	83	2.5	1.5	2.1	1.3
2009	392	599	91	2.2	1.3	2.0	1.3
2010	484	670	91	2.2	1.4	2.1	1.3
Bulgaria							
2001	19373	4112	181	20.8	2.7	10.9	1.4
2002	18747	4267	188	22.6	2.7	11.8	1.5
2003	16834	4289	184	23.4	2.7	12.6	1.5
2004	14768	4256	176	22.2	2.6	12.3	1.6
2005	14186	4232	185	22.6	2.6	12.7	1.6
2006	13844	4238	194	22.5	2.6	13.2	1.6
Jordan							
2003	1351	1070	134	3.7	1.6	3.2	1.7
2004	1304	1078	128	3.7	1.6	3.2	1.7
2005	1477	1206	143	4.4	1.6	3.6	1.7
2006	1762	1280	142	5.2	1.8	3.7	1.7
2007	1852	1346	145	5.4	1.8	3.9	1.8
2008	2002	1347	156	6.0	2.0	4.0	1.8
2009	2208	1382	150	6.6	2.1	3.9	1.7
2010	2345	1374	148	5.6	2.1	4.1	1.7
2011	1322	764	106	3.4	1.7	3.0	1.5
Malawi							
2004	164	234	49	1.9	1.3	1.6	1.1
2005	667	926	110	3.9	1.6	2.6	1.2
2006	839	932	102	4.1	1.6	2.7	1.1
2007	536	834	107	2.9	1.4	2.4	1.3
2008	530	969	108	2.6	1.4	2.2	1.3
2009	231	396	71	1.7	1.2	1.8	1.3

Year	Firms	Products	Destinations	Firms by product (Mean)	Firms by product-destination (Mean)	Destinations by product (Mean)	Destinations by firm-product (Mean)
Peru							
1999	3885	2864	147	8.5	2.4	5.2	1.5
2000	4003	2961	149	9.1	2.5	5.4	1.5
2001	4336	2942	151	10.2	2.5	5.5	1.5
2002	4659	3121	145	10.6	2.6	5.4	1.5
2003	5045	3175	162	12.7	2.7	5.9	1.5
2004	5442	3248	175	14.4	2.8	6.3	1.5
2005	6015	3368	172	16.3	2.9	6.7	1.5
2006	6472	3382	177	17.9	3.1	6.9	1.5
2007	6666	3425	170	17.3	3.1	7.0	1.5
2008	7126	3315	170	18.6	3.2	7.5	1.5
2009	7321	3323	172	18.2	3.2	7.3	1.5
Senegal							
2000	422	1182	77	2.3	1.4	2.8	1.7
2001	486	1163	77	2.5	1.4	2.9	1.7
2002	536	1284	84	2.5	1.4	2.9	1.6
2003	594	1416	82	2.9	1.4	3.1	1.6
2004	638	1447	93	3.1	1.5	3.2	1.7
2005	672	1516	93	3.3	1.5	3.1	1.6
2006	708	1524	94	3.5	1.5	3.1	1.6
2007	719	1571	105	3.5	1.5	3.3	1.6
2008	776	1631	107	3.8	1.5	3.3	1.6
2009	802	1551	110	3.8	1.5	3.4	1.6
2010	776	1529	96	3.2	1.5	3.4	1.6
Tanzania							
2003	1201	2176	143	2.9	1.5	3.3	1.7
2004	1347	2146	138	3.3	1.6	3.3	1.6
2005	1596	2150	141	3.4	1.6	3.1	1.5
2006	1719	2151	144	3.5	1.5	3.1	1.4
2007	1952	2346	139	3.7	1.6	3.2	1.4
2008	2065	2255	150	4.1	1.7	3.2	1.4
2009	1817	1947	138	3.8	1.7	2.8	1.3
Yemen							
2006	487	573	73	4.5	2.0	2.4	1.4
2007	466	586	78	4.7	2.1	2.4	1.3
2008	552	665	89	4.9	2.0	2.6	1.4
2009	583	668	88	5.9	2.4	2.6	1.3
2010	572	643	96	4.8	2.3	2.7	1.4

Table 4: Variation in Export Prices

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

Table 5: 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 6: Pricing-to-market in homogeneous and differentiated goods

Panel A: 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***	0.046***	0.045***	0.041***	0.076***	0.074***	0.072***	0.075***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(nr dest by cfp)*Diff		-0.005				0.001		
		(0.331)				(0.960)		
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	187004	179653	47414	132239	187004	179653	47414	132239
R-squared	0.220	0.219	0.268	0.190	0.737	0.737	0.708	0.739
f-p cluster	88311	84436	19641	64795	88311	84436	19641	64795

Panel B: 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)	0.078***	0.059***	0.059***	0.045***	0.128***	0.124***	0.125***	0.108***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
log(nr dest by fp)*Diff		-0.013				-0.015		
		(0.479)				(0.685)		
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	27191	25441	10887	14554	27191	25441	10887	14554
R-squared	0.402	0.372	0.322	0.362	0.776	0.768	0.739	0.769
f-p cluster	14627	13706	5551	8155	14627	13706	5551	8155

Robust p-values in parentheses

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

Table 7: Economic significance of correlations by country

Panel A: Upper Middle Income Countries

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	0.08	0.98	2.65	7.42
Jordania	0.04	1.01	2.74	4.53
Peru	0.08	0.92	2.50	7.34
*UMICs**	*0.08*	*0.95*	*2.60*	*7.25*

Panel B: Lower Middle Income & Low Income Countries

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
Albania	0.24	0.48	1.61	11.55
Burkina Faso	0.19	0.69	1.99	13.24
Malawi	NS	0.85	2.34	NA
Senegal	0.07	0.85	2.35	6.01
Tanzania	0.17	0.87	2.38	14.76
Yemen	0.21	0.84	2.32	17.57
*LICs & LMICs***	*0.13*	*0.81*	*2.25*	*10.37*

** From Table 5, Panel (A)*

*** From Table 5, Panel (B)*

Table 8: RCA by country in 2006

Country	*Number of products with RCA>1*			*Share of products with RCA>1*		
	Tot	*Diff*	*Hom*	*Tot*	*Diff*	*Hom*
			UMICs			
Bulgaria	928	616	312	26.68	**66.38**	33.62
Jordan	270	168	102	28.54	**62.22**	37.78
Peru	410	186	224	14.84	45.37	54.63
Average	*536*	*323*	*213*	*23.36*	*57.99*	*42.01*
			LICs & LMICs			
Albania	279	228	51	35.72	81.72	18.28
Burkina Faso	72	32	40	29.63	44.44	**55.56**
Malawi	105	64	41	27.93	60.95	39.05
Senegal	160	74	86	18.16	46.25	**53.75**
Tanzania	220	103	117	21.44	46.82	**53.18**
Yemen	56	14	42	19.44	25.00	**75.00**
Average	*149*	*86*	*63*	*25.39*	*50.86*	*49.14*

Note: These statistics are calculated based on the total number of products where RCA info is available. The RCA information was extracted from the World Bank's WITs.

Table 9: 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)
	Diff	Hom	Diff	Hom	Diff		Hom	
					HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1
log(nr dest by cfp)	0.063***	0.074***	0.068***	0.076***	0.069***	0.082***	0.076***	0.066***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(nr dest by cfp)* $Q(sd_p(\sigma_{pd}))$	0.002	-0.001						
	(0.392)	(0.805)						
log(nr dest by cfp)*HSDEp			0.015	-0.011				
			(0.291)	(0.512)				
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	121654	42714	121654	42714	66956	54698	15567	27147
R-squared	0.740	0.704	0.740	0.704	0.730	0.752	0.679	0.719
f-p cluster	12455	6267	12455	6267	8976	8317	3122	4759

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)
	Diff	Hom	Diff	Hom	Diff		Hom	
					HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1
log(nr dest by cfp)	0.149**	0.023	0.115***	0.055	0.116***	0.092*	0.054	0.172***
	(0.021)	(0.629)	(0.005)	(0.114)	(0.005)	(0.084)	(0.133)	(0.000)
log(nr dest by cfp)* $Q(sd_p(\sigma_{pd}))$	-0.009	0.016**						
	(0.408)	(0.041)						
log(nr dest by cfp)*HSDEp			-0.023	0.115**				
			(0.704)	(0.015)				
FE	c-f-p	c-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	13237	10003	13237	10003	7802	5435	3570	6433
R-squared	0.763	0.729	0.763	0.729	0.774	0.746	0.727	0.731
f-p cluster	2451	2095	2451	2095	1761	1460	952	1677

Robust p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: 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**
	(0.000)	(0.011)	(0.008)	(0.001)	(0.000)	(0.002)	(0.001)	(0.026)
log(nr dest by cfp)*Diff		0.023				-0.007		
		(0.533)				(0.932)		
FE	p	p	p	p	f-p	f-p	f-p	f-p
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10148	8963	3790	5173	10148	8963	3790	5173
R-squared	0.359	0.324	0.304	0.306	0.744	0.737	0.723	0.734
f-p cluster	5692	5046	1979	3067	5692	5046	1979	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)
	Diff	Hom	Diff		Hom	
			HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1
log(nr dest by cfp)	0.179**	0.101	0.188**	0.078	0.119	0.172***
	(0.014)	(0.124)	(0.011)	(0.405)	(0.112)	(0.005)
log(nr dest by cfp)*HSDEp	-0.099	0.080				
	(0.384)	(0.348)				
FE	f-p	f-p	f-p	f-p	f-p	f-p
Year FE	Y	Y	Y	Y	Y	Y
Observations	4757	3518	2781	1976	1215	2303
R-squared	0.728	0.709	0.744	0.697	0.694	0.719
f-p cluster	739	666	523	482	278	544

Robust p-values in parentheses

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

Table 11: 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***	0.048***	0.048***	0.075***	0.128***	0.165***	0.166***	0.108***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(nr dest by cfp)*Diff		0.028**				-0.057		
		(0.045)				(0.233)		
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	187004	145416	13177	132239	27191	18837	4283	14554
R-squared	0.737	0.741	0.686	0.739	0.776	0.766	0.719	0.769
f-p cluster	88311	69851	5056	64795	14627	10412	2257	8155

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)
	Diff		Hom		Diff		Hom	
	HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1	HSDEp=0	HSDEp=1
log(nr dest by cfp)	0.069***	0.082***	0.075**	0.038***	0.116***	0.092*	0.106	0.178***
	(0.000)	(0.000)	(0.022)	(0.003)	(0.005)	(0.084)	(0.221)	(0.000)
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	66956	54698	3166	8920	7802	5435	903	2969
R-squared	0.730	0.752	0.621	0.718	0.774	0.746	0.759	0.690
f-p cluster	8976	8317	702	1620	1761	1460	327	990

Robust p-values 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

[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.

way that could eventually change the results of my analysis, which focuses on the Rauch Classification.

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_{cfpt} $\log(price_{cfpdt})$	Standard deviation of logarithm of fob price across destinations within a country firm product triplet		0.51	0.53
Correlated variable				
$\log(\text{nr of destinations}_{cfpt})$	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)			
$Q(sd_p(\sigma_{pd}))$	Variable taking values between 1 and 10, indicating the decile of the $sd_p(\sigma_{pd})$ 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			