

Direction, Extension and Price of Exports' Quality

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ABSTRACT

We examine the extension, direction and the premium-price of bilateral export of quality by Brazil. Goods are grouped as differentiated and non-differentiated. With a demand-structured model, we first assess that spatial trading of quality with non-parametric statistics analyses of the extensive market and good's margins. It spots *inter allia* the role of importer's GDP per capita and the quality-adjusted trade cost, $\tilde{D}$, and also in the interpretation of the parametric unit-value (UV) model, especially around the positive and negative impacts of both $\tilde{D}$ and importer's size. The supply-structured model, hinging on the relative unit value (RUV), exams the between-product price premium, which rests on comparative advantages as confirmed by the sectoral RCA (revealed comparative advantages) variable.

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1. Introduction

When taking international trade in terms of product quality, the implicit trade in factors service is reshaped by the country's development level, and demand linkages to trade – through non-homothetic preferences – gain a greater role (Remier & Hertel, 2010; Fieler, 2011a, 2011b, Caron et al., 2014). Yet, this evolving relationship becomes far more intricate in a multi-country world economy with several bilateral trades. The determinants of international trade unfold into several new directions: the demand side not only adjusts the supplied price premium, but also the market extension, whereas the cost and quality competition among exporters that make price and quality-(or export-basket) discrimination across markets. Concluding, price premium (unit value) is far from sufficient to characterize trade in quality.

The *map of economic complexity* (Hidalgo et al., 2007) comes immediately to mind as a reference, but rather than a theoretically agnostic approach, we can structure this complex supply and demand space of international trade in quality across industries upon several concepts and modeling of the literature of trade in quality (Schott, 2004; Hallak, 2006, Hallak & Schott, 2011; Hummels & Klenow, 2005; Baldwin & Harrigan, 2011), together with others from the quality-competition literature (Boccard, 2010; Tirole, 1991). The central implications are that, firstly, the extension of covered markets is a crucial twin side of quality competition, similarly to multi-product firm analyses (Bastos & Silva, 2010a; Arkolakis & Muendler, 2012; Manova & Shang, 2012; Mayer et al., 2014; Eckel & al., 2015). Secondly, the traditional gravity of trade is reshaped when goods are a “quantity-quality” composite. Thirdly, when dealing with market extension, we must consider that quality not only makes goods asymmetric, but also poses an asymmetric information problem, making both marketing and social network to matter. An additional conclusion is that parametric statistical analysis is far from sufficient to characterize these elements.

We start the analysis of these twin sides of quality competition – i.e., the extensive and the quality margin of trade – with a demand-structured model. Theoretically, this demand analysis of asymmetric goods is grounded on oligopoly (Tirole, 1991; Sutton, 2007; Coibon, Einav & Hallak, 2007; Eckel et al., 2015). The former theoretical tradition warrants us reaching, from well-defined preferences for goods, a demand whose elasticity

changes across qualities and consumers (that are heterogeneous).² This proves to be fundamental to derive changes in price elasticity for consumers and market types. Moreover, from consumer's willingness to pay (WTP) we derive whether a good covers a market or not, regardless of any supply-side barriers, which is rather a firm-entry condition. Last but not the least, within this approach we can more naturally introduce the heterogeneously information problem of quality faced by each consumer.

In the empirical analysis, a first step is taking pre-defined differentiated and non-differentiated goods, based on Rauch (1999). With goods thus grouped, we exam variation in the product's extensive margin of the differentiated goods as compared to non-differentiated goods, from one side, and then variation in the (importing) markets' extensive margin with respect to importer's characteristics. This mapping entails using some (computer-based) *data mining* tools from Wolfram (2015),³ which encompasses some *data visualization* tools. In methodological terms, that reminds the quoted *network analysis* of *economic complexity*. Similarly to above quoted studies, we take a single exporter, which is however a developing country's exporter, Brazil, rather than a developed one.

Besides shedding important lights about trade in quality, the analysis of market and product's extensive margins proves to be very helpful for assessing the estimates of the quality-margin model: the last stage of this demand-structured analysis of trade in quality. We are better entitle to pin point why UV (unit value) increases with distance, which is clearly connected to product and market extensions, as well as with the geographic and network characteristics of those markets. It equally entitles us to better assess the vexing positive and negative impact of consumer's income and market size, respectively.

We then advance to the supply linkages of trade in quality, which means moving towards the between products price premium. Theoretically, this is solved by a comparative advantage in quality provision, which is built largely on quality competition from exports – i.e., on learning from exporting – and quality competence in a core activity, borrowed from Eckel & Neary (2011) and Eckel et al. (2015). Rather than UV (unit value), the price

² Cinquetti (2015) shows that the attempt to apply the workhorse model of monopolistic competition to quality competition implied some *ad hoc* formulation so as to warrant non-homothetic demand for quality across importing markets, or overcoming it with non-homothetic preferences for consumers that are homogenous internationally. That is why the IO literature on quality competition is not based on monopolistic competition – see also Belleflamme & Peitz (2015).

³ Wolfram (2015) calls it by the big data science.

premium is given by RUV (relative unit value), which captures variation in the relative world price of each exported product. That aims to show how the country fared in the price premium across the whole set of differentiated-good exports. Data mining tools were also crucial for obtaining the RUVs both at 4-digits level classification, and at 3-digits level. The latter, together with the revealed-comparative-advantage (RCA) index, works as a sectoral explanatory variable of the supply-side linkages to trade in quality is the sectoral. True, intermediate-good is a great loophole in such a supply-side linkages (see Sutton, 2007; Goldberg et al., 2010; Kluger & Verhoogen, 2011; Manova & Zhang, 2012), but, within the proposed framework, it would take either a relevant policy change, absent in the present case, or a multi-exporter economy model.

All previous results of the demand-structured (UV) model of trade are maintained. Most important, both the sectoral-level RCA and RUV variable show to positively affect the between-product variation in the RUV variable, which is referred to the quality advantage of products belonging to the exporter's core. The 3-digit RUV, which works as a control for the 3-digit RCA, reinforce this interpretation, but more advanced analysis (e.g., 6-digit Rauch's list) should be considered.

The paper is thus structured. Section 2 sets up the theoretical model, focusing on the demand structure of trade in quality. Section 3 then takes up a non-parametric analysis of the markets and goods extensive margins of trade in quality. Section 4 takes up a parametric analysis of the model of exporter's quality margin, whose interpretation is greatly helped by the previous non-parametric analysis. Section 5 theoretically expands the quality model with supply-side structures, and Section 6 estimates this RUV model. Section 7 concludes.

2. The Demand Structure of Trade in Quality.

Bilateral trade between i to j is

$$T_{ij} = \sum_k p_{ij}(k) X_{ij}(k), \quad (1)$$

where $\sum_k$ stands for the extensive margin, $X_{ij}(k)$ for the intensive margin, and p_{ij} the quality margin. More to the point, for a specific k and j , $p_{ij}(k) = T(k)_{ij} / X_{ij}(k)$, is the unit value, which proxies the quality margin, as explained below.

Consumer preferences for asymmetric (in quality) goods drive their international price, p_{ij} . However, if quality is exclusive to some suppliers, we can anticipate another role for profit-maximizing price strategies (Sutton, 2007; Coibon, Einav & Hallak, 2007; CEH, henceforth; EIJN), and on the gravity of quality (Cinqueti, 2015) as well.

2.1 Consumer Preferences and price

Each K product has a set of differentiated goods, and preferences for the latter are defined by an upper utility in quantity, whose form we can skip (see Eckel et al., 2015). Preferences for K 's horizontal and vertically differentiated goods follow the spatial (Hotelinian) approach by CEH, in which goods' (vertical) quality is in the $q \in \{\underline{q}, \bar{q}\}$ interval and so their perceived quality $\delta_{\bar{q}} > \delta_{\underline{q}}$. Within the $\{\underline{q}, \bar{q}\}$ limits, we have distinct “quality segment”, composed of a set of competing varieties defined by spatial circumferences $\omega_{\underline{q}}$ and $\omega_{\bar{q}}$, in which the segmented heterogeneous consumers s are uniformly distributed. This segmented clientele, $\{S_{\underline{q}}, S_{\bar{q}}\}$, follows from the unit demand.

The subutility function for the vertically differentiated goods is given by

$$u_q = \delta_q - \nu_y p_q - \frac{\omega_q}{n_q} \quad (2)$$

Given that $x_s = 1$, quantity is not an argument of (2). Monotonic transforming S_q into an income position, y , yields ν_y , which stands for the income elasticity with respect to quality, and $\nu_y(y) < 0$, given that the utility of money is concave (Tirole, 1991). The $\frac{\omega_q}{n_q} = |r_q - r_{s,q}^*|$ is then given by the mean consumer radial distance of demanded q from his ideal variety $r_{s,q}^*$.

In each quality-segmented market, the symmetric equilibrium price is given by (CEH):

$$p_q = c + \frac{\omega_q}{n_q \nu_y}, \quad (3)$$

where $c = c_{\bar{q}} = c_{\underline{q}}$ is the marginal cost, and n_q is the number of competing varieties in that segment. For supply-side reasons, explained below, $\frac{\omega_{\bar{q}}}{n_{\bar{q}}} \geq \frac{\omega_{\underline{q}}}{n_{\underline{q}}}$, so $\bar{q}$ is not less exclusive than $\underline{q}$. Therefore, $\varepsilon_{\bar{q}}(p_{\bar{q}}) < \varepsilon_{\underline{q}}(p_{\underline{q}})$, where $\varepsilon_q(p_q) = 1 + c \frac{\nu_q n_q}{\omega_q}$ (CEH) is the own-price elasticity of demand, from which follows that $p_{\bar{q}} > p_{\underline{q}}$. The symmetric subgame perfect Nash equilibrium (SPNE), together with c warrant us defining (3) as the demand side of non-price taking firms enjoying symmetric market power within each ω_q .

2.2 International Demand without Barriers

If consumers are further segmented into different countries, then a product produced in country i is sold in country j at price

$$p_{ij}(q) = c + \frac{\omega_q}{n_{qj}(X_j) \nu_{y_j}}, \quad (4)$$

Hence, $p_{ij}(q)$ increases with per capita income in importing country j , given ν_{y_j} , and falls with the j market size, X_{qj} , which determines the competing goods, n_{qj} -- pushing down $\varepsilon_q(p_q)$. The first effect is grounded on consumer willingness to pay (WTP), and the second one on market competition intensity.

Therefore, assuming that consumers cannot resell goods, producer and consumer price vary internationally. The underlying price discrimination is expressive of a FOB price competition, which, unlike (Brander & Krugman, 1983), is irrespective to trade cost.

2.2 International Demand with Geographic and Information Barriers

Let us now consider that, in this world economy, goods faces an iceberg trade cost, t_{ij} , and consumers an information problem. Let us first examine these two barriers before amending them on demand and so on (4).

Taking (2) as $u(q, x) = qx$, and substituting it into the iceberg trade cost $t_{ij}(q) = d_{ij}x_{ij}(q)$, we obtain a quality-adjusted unit trade cost

$$t_{ij}(q) = \frac{d_{ij}u}{q}, \quad (5)$$

Therefore, $t_{ij}(q)$ decreases with q and is thus non-linear on distance, whereas trade cost increases linearly with distance, $t_{ij}(k) = d_{ij}x_{ij}$, for non-differentiated goods K_- .

Geographic distance is, accordingly, less of a problem for trade in quality, given that q is a valuable and weightless attribute of goods. From another standpoint, the gravity force is stronger, since barriers are lower. Rauch (1999) addresses that when comparing the evolution of trade volume for differentiated goods across time, but it scantily perceived, or highlighted in outstanding studies (Hummels & Klenow, 2005; Baldwin & Harrigan, 2011; Hallak & Schott, 2011).

On the other hand, the q 's asymmetric information problem is reinforced internationally. Consumer position changes to $s_{ij} \in \{\underline{q}', \bar{q}'\}$, with $\underline{q}' < \underline{q}$ and $\bar{q}' < \bar{q}$, meaning that foreign-market consumers are less completely informed. This introduces a search cost not faced by local consumers, $s_{ij}(q) > s_j(q) = 1$, which is increasing in q , $s'(q) > 0$, which explains why advertising expenditure grows with q , as detailed below.⁴ The implications are twofold. Firstly, this less valuable q' with distance shifts $t_{ij}(q)$ to

$t\left(\frac{q}{s_{ij}}\right) = t(q)$, which is thus given by

$$t_{ij}(\tilde{q}) = \frac{d_{ij}u}{\tilde{q}}. \quad (6)$$

⁴ Advertising is either an informative or an persuasive expenditure. The hypothesis of consumer's rationality allows us to reduce the likely weight of a "cheating effect" within the persuasive element.

Social network between population in i and j reduces s_{ij} , making $t(q)$ lower.

Secondly, the international repositioning of consumers to $s_{ij} \in \{\underline{q}', \bar{q}'\}$ does not affect their degree of exclusivity, as given by $\frac{\omega_{\bar{q}}}{n_{\bar{q}}} \geq \frac{\omega_q}{n_q}$. That is so because the advertising expenditure on q is equally felt on q' , so the relative information covering does not change, $\frac{\bar{q}'}{\bar{q}} \geq \frac{q'}{q}$. In other words, the international search cost, $s_{ij}(q')$, does not affect q 's degree of exclusivity.

Therefore, considering these trade and information barriers, (4) shifts to

$$p_{ij}(q) = (1 + t_{ij}(\tilde{q})) + \frac{\omega_q}{n_{qj}(X_j)\nu_{y_j}}. \quad (7)$$

Following Anderson & Wincoop (2003), when borrowing the Dixit & Stiglitz (1977) preferences to their demand-structured gravity model, we reduce marginal cost to $t_{ij}(k_q)$, which here involves normalizing c to one. Therefore, the price elasticity of demand increases with geographic distance of markets, but social network between i and j attenuates it. Higher q acts inversely, for offering larger scope for product differentiation. Finally, $n_j(k)$ is a j -market characteristic. These are then the elements driving the FOB-price competition in (7), together with $t_{ij}(\tilde{q})$.

The WTP from (2) not only affects $\mathbf{p}_{ij}(\mathbf{k}_q)$, the average price premium from i to j , from (6), but also the extension of goods with $x(q)=1$, and so their extensive margin, the $\sum \mathbf{k}_{ij}$. Substituting (7) into (2), we attain the condition for $x_{ij}(k)=1$, given the

$$\delta_q - \left(\nu_{y_j} t_{ij}(\tilde{q}) + \frac{\omega_q}{n_{y_j}(X_j)} \right) \geq 0. \quad (8)$$

That is, a quality-adjusted price, the term within parenthesis, should not exceed the reservation price, δ_q . Given the asymmetric information problem in q , (8) can be named a participation constraint, while (7), which implicitly defines the charged FOB (the offered contract) by the exporters stands for the incentive compatibility constraint.

Let us write down the market's and the goods' extensive margins, K_j and J_k respectively, for each importer j and good k from exporter i :

$$K_j = \sum_k x_{ij}(k) \quad J_k = \sum_j x_{ij}(k), \quad M_i = \sum_k \sum_j x_{ij}(k), \quad \text{with } x_{ij}(k) = 1 \quad (9)$$

Where K_j gives the number of k imported goods by each j , J_k the number of j in which good k was sold, and M_i sums up both, giving the total number of exported transactions (counted as $x_{ij}(k) = 1$) across all importing markets. Notice that (9) basically decomposes $\sum_k$ in (1).

Given (8), the K_j 's margin (i) increases with y via v_{y_j} , and (ii) falls with geographic distance and lower social-network via $t_{ij}(\tilde{q})$. On the other hand, $J_k(\bar{q}) > J_k(\underline{q})$, given both $\delta_{\bar{q}} > \delta_{\underline{q}}$ and $t_{ij}(k_{\bar{q}}) < t_{ij}(k_{\underline{q}})$, which is corroborated by v_{y_j} . Putting together these predictions for K_j and J_k , there would also be a large spectrum of low-quality product with the closer markets.

For non-differentiated products, the K_j is dictated by the “the winner takes it all” rule (Baldwin & Harrigan, 2011; Eaton & Kortum (2002). More simply

$$p_{ij}(k) = \min\{p_{ij}(k); i = 1, \dots, I\}, \quad (10)$$

which means CIF price competition. As compared to (8), (10) would lead to narrower (foreign) market extension, namely $J_k(k_q) > J_k(k)$, where k_q and k are the differentiated and non-differentiated goods, respectively. Firstly because trade cost is less of a problem for quality, $t_{ij}(k_q, d_{ij}) < t_{ij}(k, d_{ij})$, given (5)-(6). Secondly, in the case of k_q goods the t_{ij} increase can be met by a FOB price competition.

Summarizing, in a multicountry world economy both the quality margin and the extensive margins map trade in quality. The $\sum k_{ij}(q)$ is to change with both q and j , which can be both highlighted with changes in j 's characteristics and its comparative impact on $K_j(k_q)$ and $K_j(k)$. The J_k margin can equally be outlined by comparing differentiated and non-differentiated goods. Finally, price premium (7) can be tested by an UV_{ij} (unit value) parametric model for differentiated products.

3. Direction and Extension of Product and Quality's Exports

From (8) we predict that the markets' extensive margin will be greater in wealthier and larger countries, as well as in closer and more connected (networks) markets. From another token, due to their higher degree of exclusivity and lower unit trade cost, high-quality goods is expected to reach larger extension of markets, with a varying degree with the development level and proximity of the importing countries. This predicted behavior of market and good's extensive margins has to do with the peculiar demand and pricing behavior of differentiated goods as compared to non-differentiated ones. The latter, given homothetic preferences and (8) and the resulting $t_{ij}(\tilde{q})$, would be more sensitive to distance, and less sensitive to GDP per capita and network LINKAGES.

Before examining these export direction and extension, let us briefly consider Brazil's exports over the 1995, 2005, and 2014 years.⁵ Their respective export values (i.e., the sum of intensive margins of trade with all partners) were US\$ 46.5 bi, US\$ 118,5 bi, and US\$ 225,1 bi, which represented an increase from 0.46% to 0.65% in the world export, and eventually reached 1.2% in 2014.⁶ In 1995, the country was in the wake of a large trade-policy reform, from 1988 to 1990, opening its domestic market, and of a macroeconomic stabilization, in 1994, with a hiper-inflation dropping to a one-digit yearly inflation (Cinquetti, 2000). In this decade, the manufacturing industries shrank in size, but experienced an impressive productivity improvement (Bonelli & Fonseca, 1998). The entailed allocative and productive efficiency gains were, certainly, a supporting basis of the 2005's export expansion from. Equally or even more important, was the new institutional environment, starting in 2002. The new Federal government had a more pro-active and visible presence in international affairs, which certainly contributed to opening new international markets. At the same time, we cannot ignore parallel reforms hitting property rights, and the stronger interventionism, from 2008 onward, that yielded meager TFP change from then on (See Penn World Table, 2016).

To move now to the corresponding K_j and J_k 's extensive margins, it must be told that goods are grouped according Rauch's (1999) list of 1189 goods, based on the 4-digit

⁵ Our data was re-collected by early 2016, when just a very tiny share of trade data of 2014 was not informed to UN Comtrade.

⁶ From UN Comtrade data.

SITC Rev. 2 codes, classified as differentiated (or named) goods, reference priced (namely intermediate) goods, and organized exchange (commodities) goods.⁷

Table 1 shows a 50% increase in M_i from 1995 to 2005, with a slighter greater increase coming from n-(named) goods, , and then a decrease from 2005 to 2014. In sum, there was an expansion in the M_i 's world transactions in the first 10-year interval, and then a retraction in the second interval. Noticing that M_i would be greater than that reported in Table 1 had we used a 6 or 8-digits SITC codes. The same evolution was observed for the n-goods M_i index, which both a greater expansion and contraction in the two intervals.

Table 1. Extensive Margins of Markets Across Time

	1995		2005		2014	
	Named	All	Named	All	Named	All
All Partners	12,849	19,757	21,798	31,571	20,731	30,527
In % values						
Latin America & Caribbean	0.48	0.30	0.31	0.32	0.30	0.30
Mercosur	0.09	0.13	0.05	0.06	0.05	0.06
North America	0.04	0.05	0.03	0.01	0.03	0.03
Europe & Central Asia	0.20	0.28	0.27	0.27	0.25	0.26
Arab Countries ^y and South Asia	0.09	0.11	0.13	0.13	0.12	0.11
East Asia & Pacific	0.11	0.16	0.11	0.12	0.13	0.14
Sub-Saharan Africa	0.08	0.10	0.14	0.14	0.17	0.16

Source: U.N.Comtrade

^yMiddle East & North Africa.

Table 2 gives a first *look through the window*, by grouping the total K and J for all goods and the differentiated ones. As shown, the expansion in the number of partners – the extensive margin of markets – played a greater role for the 1995-2005 expansion, whereas the contraction in the number of exported goods – the extensive margin of goods – played a greater role for the 2005-2014 contraction. Table 1 also shows a deep change in the relative importance of each partner. That of Mercosur fell, in 2005, to about 50% of its value of 1995, and that of Latin America fell more deeply, from 48% to 31% for n-good exports. Opposite change happened with respect to Sub-Saharan African countries in n-good

⁷ We thank Rauch's kind assistance, since August 2014, for interpreting and using his list which is now more clearly organized in his webpage.

exports: they moved from the last position to the third one. We must be careful about the numbers of North-America in Table 1, which excludes Mexico (in Latin America), for the extensive margin per region is proportional to the number of countries. The relative direction of exports in 2014 remained very close to that of 2005.

Table 2. Good's and Market Extensive Margins

Goods' Extensive Margin (J_k)				Markets' Extensive Margin (K_j)			
	1995	2005	2014		1995	2005	2014
All	667	681	667	All	187	213	214
Differentiated	378	381	373	Differentiated	183	211	214

Source: Idem

On the whole, the first period of export expansion was associated with an expressive expansion in both in the J_k and the K_j 's margins, especially the latter, whereas, in the second (2005-14) interval, the J_k fell to its initial values and the K_j 's margins remained about the same. The first-period change can be assigned to fruits of greater presence in the international arena, with entry in new markets, especially in the Sub-Saharan Africa, in the Arabs and South Asian countries, and in "Europe and Central Asian" countries. One may reckon that South Asian and Central Asia had a greater role in the observed increase. ON the other hand, Brazil's regional comparative advantage (in Latin America) for its n-goods almost went way, which cannot be divorced from the humble inter-regional trade, greatly due to the poor transportation infra-structure, which also made a large room to the booming export expansion of Asia led by China.

A quick glance at the intensive and extensive margins with the main partners in 2014 (Table 3) is very telling about their determinants. By 2014 China had become the main importer, followed by the USA. Were we to rely on Anderson and Wincoop's (2003) gravity model, which rules out zero-export markets, we would infer that China was the main direction of Brazilian exporters in 2014. However, the 3rd and 4rd columns of Table 3 show that China ranked 15th as far the number of imported products is concerned. India figures similarly with respect to the intensive margins, meaning that these countries intensively imported some goods from Brazil, but they rank far behind in the extension of

trade goods. That importance is even smaller for n-good export, as shown in the two last columns of Table 3.

Table 3. Brazil's Trade Partners: Intensive and Extensive Margins in 2014

Intensive Margin		Extensive Market Margins			
Importer	US\$ millions	Importer	All Goods	Importer	Differentiated Goods
China	40427.36	USA	586	USA	351
USA	23859.85	Paraguay	563	Uruguay	334
Argentina	13682.02	Uruguay	559	Paraguay	332
Netherlands	11430.50	Bolivia	548	Bolivia	328
Japan	6646.17	Argentina	531	Chile	325
Germany	6385.51	Chile	521	Argentina	324
India	4653.40	Angola	510	Angola	315
Chile	4633.65	Colombia	486	Mexico	309
Venezuela	4475.26	Mexico	484	Colombia	305
Bunkers	4037.68	Peru	477	Peru	305
Italy	3975.61	Germany	468	Germany	294
Russian Federation	3826.62	France	446	France	291
Rep. of Korea	3823.16	United Kingdom	436	Ecuador	280
United Kingdom	3672.25	Italy	431	Venezuela	277
Mexico	3300.95	China	430	Italy	274
China, Hong Kong	3272.07	Venezuela	424	United Kingdom	273
Spain	3200.19	Ecuador	418	Dominican Rep.	262
Belgium	3178.22	Belgium-Lux.	415	Panama	261
Uruguay	2773.28	Netherlands	411	China	260
France	2765.87	Japan	408	Spain	258
Paraguay	2752.59	Spain	408	Portugal	255
Un. Arab Emirates	2702.97	Portugal	403	Japan	252
Saudi Arabia	2525.04	Equatorial Guinea	389	Costa Rica	251
Singapore	2471.63	Dominican Rep.	388	Canada	249
Switzerland	2296.98	Panama	386	Netherlands	248
Canada	2271.70	Canada	383	South Africa	247

Fonte: U.N. COMTRADE

These evidences also suggest that the 1995-2005 change in the extensive margin of markets had a very different profile in each of these new markets. As far as Asia is

concerned, the greater internationalization came with a reduction in the range of exported goods. Besides the profile of the new markets, the extensive margins of differentiated goods had also a tremendous shrinkage in Latin America. In so far productivity level figure as the main country's basis of the extensive margin in Eaton & Kortum's (2002) extensive gravity model literature, we cannot help thinking on the slow progress of TFP in Brazil during the period, as reported above. The parallel sluggish progress in the service sector, which imparts on input price faced by local producers, brings about a similar reduction in the extensive margin of exports.

Yet, the unusual position of China, whose dim position in the extensive margin was even lower for n-goods, is a blatant evidence of the non-homothetic preferences, a centerpiece in models of trade in quality, given China's low GDP per capita. The parallel position of the USA helps to reinforce the case. Without forgetting the greater search cost faced by Asian consumers, given both distance and social network.

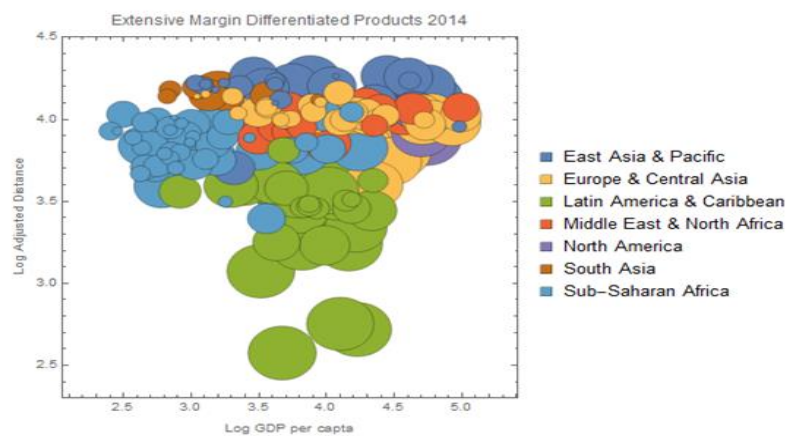
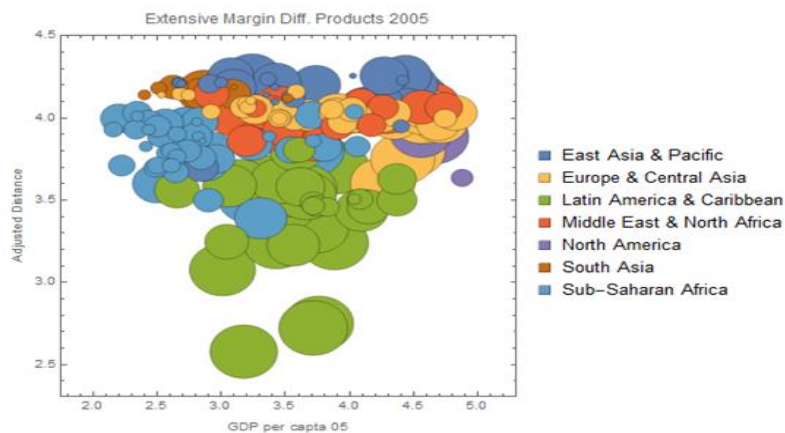
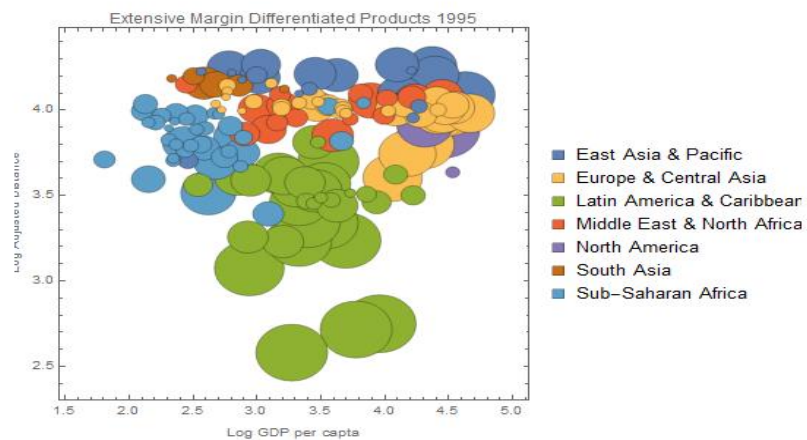
The three graphics below plot the extensive margin of n-goods in the “income $\times$ distance” space of the importing markets. Income (log of GDP per capita) proxies the willingness to pay (WTP) for quality. Following (5), we attempt a network-adjusted distance, given by

$$\tilde{D}_{ij} = \frac{D_{ij}}{1 + \text{contignet} + \text{comlang} - \text{ethno} + \text{FTA}}, \quad (11)$$

where D_{ij} is the distance from i to j 's main economic centers, *contignet* are neighbor countries expanded for those with heavy immigration network in i , “*comlang-ethno*” are, basically, Portugal and its other former colonies, and *FTA* is free trade agreement (Mercosur). Each denominator item varies between 0 and 1, but *contignet* expands only to 0.5, in the case of non-neighbor Latin-America countries and the six countries with heavy immigrant presence in Brazil (Italy and Spain; Lebanon and Syria; Japan and Taiwan). In order to highlight a third variable determining the bubbles, we distinguished the continental area in colors, standing for the linkage (network) term.⁸

⁸ All data for $\tilde{D}_{ij}$ are based on cepii (2011).

Extensive Margins in Exported Markets --- Differentiated Goods



Sub-saharan and Europe are the only continents where the two coordinates, $\tilde{D}_{ij}$ and GDP per capita, are concentrated within a limited interval of values, and the three large LA (Latin American) bubbles with short bubble with short $\tilde{D}_{ij}$ are the Mercosur countries. One central information of the 1995's chart is that Latin American, Europe and North America gather together the largest extensive margins, with these bubbles shrinking with distance, for the LA countries, and expanding with GDP per capita for Europe. In the case of the LA countries, the greater bubbles are definitely explained by our network-adjust distance variable. The small African's bubbles suggest a threshold in GDP per capita for n-goods to enter into a market, whereas the small bubbles of both the East Asian & Pacific and Arab Countries reinforce the role of the $\tilde{D}_{ij}$ barrier. It can be argued that GDP per capita does not play such a definite role upon the bubble's size in the East Asian & Pacific countries, which refers to a parallel role played by market size (total GDP), yet the positive impact of GDP per capita is quite definite for all other regions.

That GDP per capita does play a role in amplifying the importer's extensive margins is reinforced in the 2005 and 2014's bubbles. Indeed, GDP per capita gains a more prominent role in these last years, as the bubbles increase more regularly in size with this variable. But the main change in the 2005 and 2014's bubbles is their spatial concentration. This does not but confirm the new direction of Brazil export in these years, in which the huge shrinkage in LA countries – especially the South-American ones – in parallel with greater presence in many developing countries in Africa, East Asia, and in the Arab Countries. Once more, this less regionally concentrated export destination might means some missing exported markets, which seems to be a problem in African countries as well. At the same time, as far as n- goods are concerned, the role of GDP per capita adds a dismal evidence to the South-South trade strategies.

The participation constraint (8) can be alternatively evaluated by the distribution of the J_k 's good margins of differentiated and non-differentiated goods, which helps understanding the previous analysis of the n-goods K_j margins. Many studies have shown that high quality goods reach more markets, which equally means more distant markets (Arkolakis & Muendler, 2012; Bastos & Silva, 2010a, 2010b; Martin, 2012). The first graph in Figure 2 shows that, in 1995, 27% of the n-goods reached only 6 markets, and about 46% reached only 24 markets. The graph also shows that each new step (a new range

of exported markets) was diminishing in the share of exported goods, which becomes steeper for goods reaching 36 or more markets. This profile changed radically in 2005, whose forms repeat in 2014, with a large share of goods was exported to a larger number of markets. More precisely, in 2005 n-goods exported to only 12 markets amounted to 12% of the total and 45% of were exported to 48 markets. Similarly, the maximum of markets sold by a good was 85 in 1995, 156 in 2005, and 158 in 2014, which agrees with the changes in the Bubble graphics. Hence, the exporting condition was amplified and more evenly distributed in the latter period for both differentiated and non-differentiated goods.

That quality is positively associated with the extension of external markets is indirectly shown by the J_k margins of the non-differentiated goods in the lower Figure 3. In 1995, about 46% were exported to only 12 markets, half of that reached by differentiated goods, while the maximum number of markets was 85. The evolution towards larger extension after 1995 is similar to that of the n-goods, and so the changes in the J_k distribution in 2005 and 2014. These evidences corroborate our theoretical model as to why trade in quality faces smaller barriers and enjoys larger extension: $t_{ij}(k_q) < t_{ij}(k)$, greater exclusivity (of product's characteristics) and the associated lower price-elasticity of demand from higher y . Moreover, the FOB price of quality competition means more room for complying the participation constraint.

Figure 2 Extensive Margins of Exported Goods - Differentiated Goods

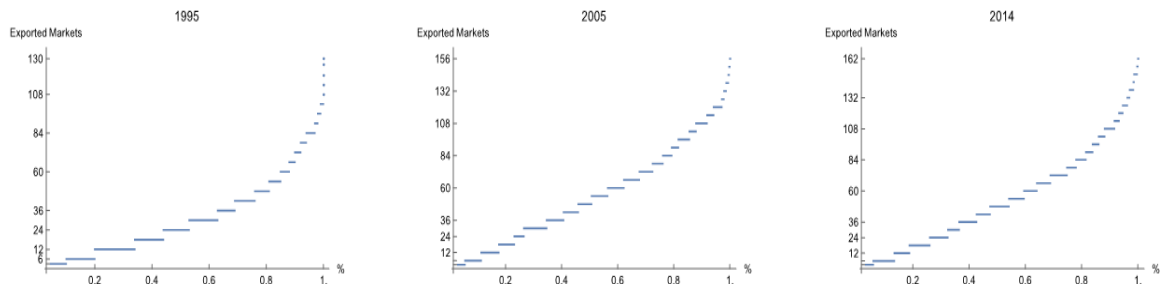
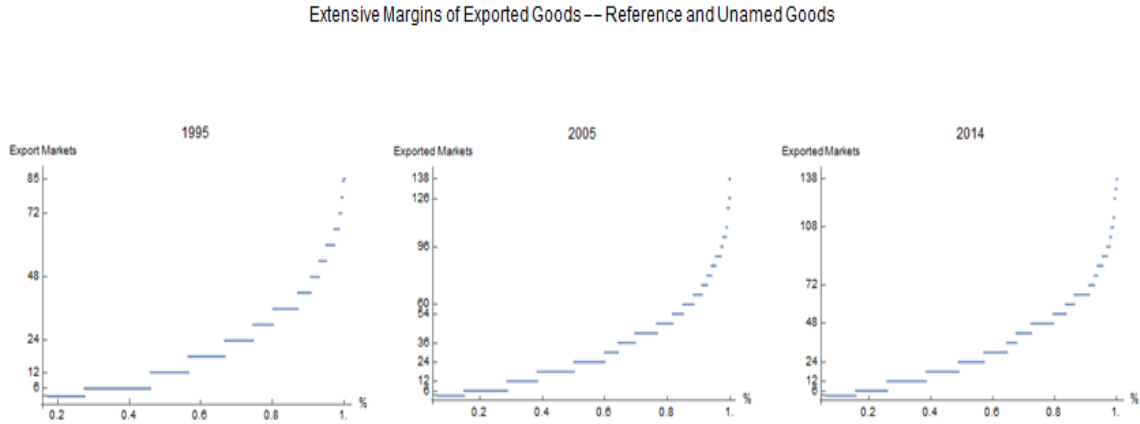


Figure 3 Extensive Margins of Exported Goods – Reference and Unamed Goods



4. The Demand Structure of the Export's price premium

While market extension can be counted for either each j or k , the price-premium is specific to each j and k . Moreover, since each quantity is measured by a specific unit (volume, number of items, weight, etc.), any between-product aggregation (*e.g.*, $\sum_k p_{ij}(k_q) = \mathbf{p}_{ij}(\mathbf{k}_q)$) is meaningless. A remaining is analyzing analysis the quality margin ($UV_{ij}(k_q)$) across distinct j markets through a parametric model based on (7).

To some extent, the literature muddles up the consumer and the market attributes driving the FOB price competition. Our price equation (7), however, clearly separates consumer's WTP and market characteristics. Bearing in mind that, from the market entry (or participation constraint) equation (8), some $p_{ij}(k)$ may also expresses change in the basket of imported goods, that is, $\mathbf{p}_{ij}(\mathbf{k}_q)$. The baseline empirical specification of (7) is then the following linear stochastic equation

$$\ln UV_{ijt}(k) = \alpha + \beta_0 \ln(GDP_{jt}) + \beta_1 \ln(PCGDP_{jt}) + \beta_1 \ln(\tilde{D}_{ij}) + \varepsilon_{ijt} \quad (12)$$

where $UV_{ijt}(k)$ is the FOB price of k shipped from country i (Brazil) to j in year t (1995, 2005 and 2014), GDP_{jt} and $PCGDP_{jt}$ are the total and per capita GDP of j , respectively,

and $\tilde{D}_{ij}$ composes both distance and network, as given by (11). Actually, to fully identify the gravity and network variables affecting the quality margin, we make several experiments with these variables, which means going beyond $\tilde{D}_{ij}$ alone. A total of 682 n-goods are considered, and, as mentioned before, the Rauch's (1999) list is based on 4-digit level of the SITIC, Rev. 2.

Fixed-effect panel-models were used to estimate (12), which is a standard practice in the literature (Baldwin & Harrigan, 2011; Fieler, 2011b). Given the sample dimension – more than 300 goods groups (at 3-digit level) and a short time span – the random-effect model would be more suitable. However, the $UV_{ijt}(k)$ are greatly affected by the specific quantity of each good, which makes the groups a fixed effect.. Noticing that the Hausman test could not be performed, and the values and signs of the coefficients obtained from both estimations are quite similar.⁹

Estimates of the baseline model (12) are shown in Table 4 and one main result, besides the goodness of fit, is that most of the theoretically relevant variables are statistically significant, with the expected signs. The positive GDP per capita fits the predicted consumer's WTP, $\nu_{y_j}(k_q)$, and agrees with the previous non-parametric analysis. The negative coefficient of GDP fits the theoretical prediction that markets size intensifies the competition, by amplifying $n_{jq}(X_j)$, but it is not statistically significant.

⁹ It can be ordered to the authors.

Table 4. Demand determined model for the UV of exports – Fixed Effect Models

Variables	Baseline Model	Region controls	Adjusted distance	Region controls	Distance step function	Region controls
$\ln(GDP)$	-0.0120 (0.0082)	-0.0102 (0.0085)	-0.0106 (0.0083)	-0.0058 (0.0083)	-0.0050 (0.0079)	-0.0078 (0.0084)
$\ln(PCGDP)$	0.0367*** (0.0091)	0.0473*** (0.0102)	0.04025*** (0.0091)	0.0464*** (0.0101)	0.0285*** (0.0095)	0.0466*** (0.0101)
<i>Contig</i>	-0.0967*** (0.0282)	-0.0461* (0.0272)			-0.1076*** (0.0249)	-0.0720*** (0.0253)
<i>comlang_off</i>	-0.1444*** (0.0360)	-0.2281*** (0.0385)			-0.1069*** (0.0361)	-0.2152*** (0.0400)
<i>FTA95</i>	- 0.0117 (0.0393)	-0.0350 (0.0408)			-0.1624*** (0.0297)	-0.1829*** (0.0292)
$\ln(dist_{ij})$	0.2705*** (0.0301)	0.2499*** (0.0360)				
$\ln(\tilde{D}_{ij})$			1.7638*** (0.1215)	1.6711*** (0.1322)		
$Km \leq 4,315$					reference	
$4,315 < Km \leq 8,540$					0.2240*** (0.0262)	0.1882*** (0.0253)
$8,540 < Km \leq 12,765$					0.4128*** (0.0404)	0.2804*** (0.0419)
$Km \geq 12,765$					0.4209*** (0.0431)	0.3705*** (0.0735)
<i>South Asia (1)</i>		0.2123*** (0.0736)		reference		0.1836* (0.1060)
<i>Europe & Central Asia(2)</i>		0.1990*** (0.0390)		-0.0345 (0.0603)		0.1781*** (0.0463)
<i>Middle East & North Africa (3)</i>		0.1099** (0.0484)		-0.1119** (0.0650)		0.1090** (0.0541)
<i>Sub-Saharan Africa (4)</i>		0.2454*** (0.0513)		-0.0271 (0.0654)		0.2002*** (0.0522)
<i>Latin America & Caribbean (5)</i>		0.0735 (0.0511)		-0.1024 (0.0642)		0.0203 (0.0501)
<i>East Asia & Pacific (6)</i>		0.0675 (0.0492)		-0.1309** (0.0557)		0.0710 (0.0802)
<i>North America (7)</i>		reference		-0.2622*** (0.0704)		reference
F test	118.20***	70.66***	177.58***	87.20***	96.29***	62.49***
R ² within	0.115	0.116	0.116	0.116	0.116	0.117

Notes: *, ** and *** denote 10, 5 and 1 per cent significance level, respectively; Heteroscedastic robust standard errors in parentheses. Total number of observation was 46,373. We have used year dummies for all models.

The most impressive result is the great positive impact on $UV_{it}(k)$ of the network-adjusted distance, $\tilde{D}_{ij}$, which is about six times as great as the standard distance, $dist_{ij}$. It corroborates how network-related variables make the cultural and historically adjusted distance stronger upon the quality margin, an impact that might go through the extensive margin as noticed above. That is, the associated fall in the price-premium with shorter $\tilde{D}_{ij}$ would also be explained by the lower search cost in the j_s closely connected with i , as corroborated by large extensive margins of these markets seen in the previous Section. At the same time, it shows that $UV_{it}(k)$ may further fall with the other arguments of $\tilde{D}_{ij}$, as corroborated by the singular negative coefficients of the regressors *Contig*, *comlang_off*, and *FTA*. These arguments fit into the traditional distance terms, and so with the theoretical model. Lastly, both $\tilde{D}_{ij}$ and $dist_{ij}$ coefficients confirm the falling trade cost, $t_{ij}(\tilde{q})$, for high-quality goods, as well as, indirectly, the greater WTP for quality stemming from the higher exclusivity of higher k_q , as given by $\frac{\omega_q}{n_{qj}(X_j)}$, and from the lower income elasticity of substitution, ν_{y_j} . This relationship is corroborated by the segmented-distance variables of countries into four distant groups, showing that the greater the distant the greater their positive partial correlation.

Finally, drawing on evidence in Figure 1, we expanded the baseline model with controls for regions. By doing this, the impact of distance on $UV_{it}(k)$ is reduced because part of its effect goes through the regions dummies. Not all of the six-tested regions dummies are statistically significant, and models (2) and (6) are the most representative of the region-impact. In both specifications, the highest coefficients are those of the Sub-Saharan Africa dummy followed by South Asia. However, once we recognize that each of these regions are featured by some typical market size and GDP per capita, it is hard to give an unique and definite interpretation.

5. The Supply Structure of Trade in Quality.

The development level also matters in the international supply of quality, given that supply of quality is costly in human capital. Krugman's (1990) model of new and old goods, and Markusen's (1986) model of North-South trade are two earlier formulations, while Schott (2004) is a landmark empirical analysis of vertical specialization with respect to development level. Multi-exporter-importer evidence is provided in Fieler's (2011a, 2011b) Ricardian models, while Hallak (2004) and Hallak & Schott (2011) advance over the true content of unit-value variation and its correlation with development level. Firm-level studies of exporters have tracked not only the price premium, but also the spatial distribution of the supplied structure quality (Eckel et al., 2015, Manova & Shang, 2012; Bernard et al., 2011; Martin, 2012, Bastos & Silva, 2010a, 2010b, Arkolakis & Muendler, 2012). Alcalá (2014) takes up a sector-level analysis, and examines the UV's performance of Spain in two closely connected sectors and its correlation with the RCA of each sub-group.

To our knowledge, there has been no countrywide analysis of within and between quality specializations. Not surprisingly, we lack any inter-sectoral measure of price performance.¹⁰ The $UV_{ij}(q)$ neatly captures change in unit value of each k -product across importing markets, but it does not tell us whether they were above or below the world-market mean price, nor it informs the between-product price premium.

5.1. The Relative Unit Value

Theoretically speaking, the challenge is obtaining the relative unit value, $RUV_{ij}(k)$, for which we need an international price numeraire, $UV_w(k)$. More to the point

$$RUV_{ij}(k) = \frac{UV_{ij}(k)}{UV_w(k)}, \quad (13)$$

where $UV_w(k)$, the price numeraire for all k -exports by i , is the unit value in the world market, *i.e.*, its average value across all international transactions in goods k . Theoretically

¹⁰ In some sense, the puzzle here reminds that of measuring comparative advantages for bilateral trade in a multi-product and multi-country economy, which were differently solved by Eaton & Kortum (2003) and Costinot et al. (2011).

trivial, the $RUV_{ij}(k)$ is a typical big data problem, which can only be solved (in a cost-efficient way) with some data-mining methods. As an illustration, one of the examined years of Brazil's exports of n -goods amounted to more than 30,000 transaction in more than 380 k -products and 150 j -markets. Therefore, to obtain all $RUV_{ij}(k)$ we had to (i) single out each (of the 30,000) $UV_{ij}(k)$, (ii) do the same for the world-to-world transaction leading to the $UV_w(k)$, and finally (iii) match each of them (i.e., each $X_{ij}(k)$ and $p_{ij}(k)$), and simply dividing them out.

The comparative price-premium performance, $RUV_{ij}(k)$, clears out specific quantity measures (weight, quantity, volume, etc.) that bear no relationship with the between-product price variation. It then perfectly fits to an analysis about the supply structure of inter-industry price-premium performance that can, arguably, be grounded on any claimed comparative-advantage relationship.

5.2 The supply structure of quality: theoretical model.

In an international economy, the inter-industry performance is referred to comparative advantages. However, the latter is grounded on exogenous country's characteristics, whereas performance is grounded on endogenous industry's characteristics. Nonetheless, and several recent studies attempted to integrate the competitive and non-competitive mechanisms, and a general conclusion is that trade gains based on comparative advantages feed into gains based on industry's endogenous distortions and vice-versa (Anderson, 2008). A common treat of these analyses is relinquishing comparative advantages from the autarky state, while the pure-trade equilibrium is one with endogenous geographic barriers to trade (Melitz, 2003; Costinot et al., 2011; Eaton & Kortum, 2002).

Let us start with specialization problem; the product allocation equilibrium of a trading economy. Let $\mathbf{p}$ is the price vector of the k products, $\mathbf{x}$ their quantity supply, for a given endowment $\mathbf{v}$. As the GDP $Y(\mathbf{v}) = r(\mathbf{p}, \mathbf{v})$ is the solution to revenue maximization for each x_k industries (Harrigan, 1997), the same applies for the revenue function of imperfectly competitive industries, one we let market structure constant. That is,

$$x_k = \partial r(\mathbf{p}, \mathbf{v}; \theta_k(n_k); n_k) / \partial p_k \quad k = 1, \dots, K. \quad (14)$$

where the *ceteris paribus* arguments are demand $\theta_k(u_k, n_k)$, and n_k that indirectly conveys barriers to entry.

Can the cost based inter-product specialization (14) conditions the quality based within-product specialization? From the other way around, can we extrapolate the interplay of cost and quality competition in multi-product firm models (Baldwin & Gu, 2009; Eckel et al., 2015.; Bernard et al., 2011; Mayer et al., 2014) to industries? Empirically would mean tracing the 4-digit products to each of the 3-digits industry they belong to, which is compatible with tracing the 5-digit (or 6 digit) products supplied by each 4-digit firms. As proposed, this intra-industry technology relationship is germane to the *flexible manufacturing* hypothesis of Eckel & Neary (2011) and EIJN. However, the inter-industry opportunity cost involves some relationships that are taken as given by firms.

Most importantly, when moving from (14) to imperfect competition is considering that it is about q_k , a weightless attribute of goods carrying an information problem that transforms them into experience goods. From one side, it means that a key barrier to entry is advertising, so that economies of scale are not grounded on large production plants. Secondly, from the production side the notion of experience goods means learning. As a result, the interplay between cost and quality competition refers us to interplay between geography and trade (Krugman, 1991; Brackman et al., 2009), as shown next.

Let us resume the revenue $r(\mathbf{p}, \mathbf{v}; \theta_k(n_k); n_k)$ with respect to its imperfectly competitive, $p_{ij}(k)$ in (7), but now with focus on the controlled supply-side variables. Disregarding bilateral trade, and considering the noted attributes of q_k , it leads to

$$p_i(k_q) = [c_i(k_q, \mathbf{v}_k) + t(k_q)] + \frac{\omega_{kq}}{n_{k_q} v_{y_j}}. \quad (15)$$

where $p_i(k_q)$ stands for an exporter price of industry k supplying quality q , in which $t(k_q)$ is an average trade cost faced over all importing markets. Since we are dealing with a range of q in k , then $c_i(k_q) = E[c_i(k_q)]$: the mean cost-efficiency of i in industry k .¹¹ The last right-hand side term of (14) composes the average competition intensity and WTP over

¹¹ That does not excludes the possibility of heterogeneous firms within k , but our industry-level analysis of inter and intra-industry trade in quality refers us to a homogenous-firm approach.

all these importing markets, in which the new $\omega_{kq} = \frac{\omega_{kq}}{s'_q}$ is the producer perceived quality.

In brief terms, the costs terms $[c_i(k_q, \mathbf{v}_k) + t(k_q)]$ and ω_{kq} are controlled by suppliers.

The firm optimization problem over the above mentioned variables can be outlined from the return function in each sector. But to proceed from (13), we let $\bar{X}_i(k_q)$ and $\underline{X}_i(k_q)$ identify sectors with and without comparative advantages, respectively, so

$$\pi_{ij}(k_q) = \{[p_{ii}(k_q) - c_i(k_q)]x_{ii}(\bar{X}(k_q)) + [p_{ij}(k_q) - (c_i(k_q) + t_{ij}(k_q))]x_{ij}(\bar{X}(k_q)) - \gamma_{k_q}\}, \quad (16)$$

where γ_{k_q} is the fixed advertising cost on q . For the $\underline{X}_i(k_q)$ sectors, one has

$$\pi_{ij}(k_q) = \{[p_{ii}(k_q) - c_i(k_q)]x_{ii}(\underline{X}(k_q)) + [p_{ij}(k_q) - (c_i(k_q) + t_{ij}(k_q))]x_{ij}(\underline{X}(k_q)) - (\gamma_{k_q})\} \quad (17)$$

The $x(\bar{X}(k_q))$ $x(\underline{X}(k_q))$ aims to show that the homogenous firms carry their sector's characteristics. For instance, despite product differentiation, the comparative advantage cost, from (13), constrains the supply of the $\underline{X}_i(k_q)$ sectors to domestic markets, or to a narrow extension of foreign market. Roughly speaking to exports to neighbor's countries.

Yet, the above relationships can boil down to a mere quantity side of specialization, $\bar{X}_i(k_q) > \underline{X}_i(k_q)$. However, quality competition is not simply a by-product of cost competition (EIJN), as suggested in some multi-product firm models. To begin with, one implication of our spatial approach to preferences is that the goods' characteristic appreciated by domestic consumers can differ from the preferred characteristics by foreign consumers, especially when consumer's heterogeneity hinges on income level, and the producer is based on a low-income economy. More concretely, the supply-side of q 's asymmetric information, which was coined in (15) as $\omega_{kq} = \frac{\omega_{kq}}{s'_q}$, means that exposition to

foreign sale leads to an increasing learning about the desired q 's characteristics. Accordingly, sectors with comparative advantages already faces a lower search cost s'_q ,

$\frac{s'_q(\bar{X})}{s'_q(\underline{X})} < 1$, thanks to the learning by exporting experience. Therefore, the above cost

difference imparts on $\bar{X}_i(k_q) > \underline{X}_i(k_q)$ and on through how the

The *learning by exporting* hypothesis also goes through the supplied quality to an ampler and distant clientele. The case is nicely exposed by Artopoulos et al. (2013) for the case of the wine and film industry in Argentina, where the access to foreign market entailed learning about the desired characteristic each k_q should have. It is clearly a dynamic relationship, as emphasized by Anderson & Kneller (2007).

Moreover, if one accepts that (16) and (17) depict the mean (homogeneous) firm in each group of sectors, then not only $\bar{X}_i(k_q) > \underline{X}_i(k_q)$, but also the a difference in the surplus $[p_i(k_q) - (c_i(k_q)\bar{X})] > [p_{ij}(k_q) - (c_i(k_q)\underline{X})]$, for a given market extension $J_k(\bar{X}) = J_k(\underline{X})$. That is so since $\max\{J_k(\bar{X})\} > \max\{J_k(\underline{X})\}$, the former sectors face higher total foreign trade as respect to sector's revenue. This would mean that the firms in the former sectors have larger surplus to invest on quality improvement, that is, on γ_{k_q} . This will indeed be the case from the above quality revelation principle when firms go to export. We can certainly argue that this means seeking for a greater exclusivity into their product, which thus leads to greater γ_{k_q} investment, which we can associated with greater expenditure on product improvement. The outcome of this endogenous fixed-cost expenditure is that increase in the share of foreign sales in differentiated products leads to higher barrier – a classical result in the IO literature.

Applying the above arguments into (16)-(17), it follows this within-product specialization:

$$\mathbf{p}_k(\bar{X}) = \partial\pi(p_k, x_k) / \partial\bar{X}(k_q) > \partial\pi(p_k, x_k) / \partial\underline{X}(k_q) = \mathbf{p}_k(\underline{X}) \quad (18)$$

Hence, both industry size and (the mean) quality level $\mathbf{q}_k$ make up a country's comparative advantage in differentiated products. Comparative advantages is still basically defined as a problem of resource allocation within a country, as expressed by $\bar{X}_i$. However, as far as the n-goods are concerned, quality comes in the wake of it, so us writing $\bar{X}_i(k_q)$. Not

forgetting that $\mathbf{q}_k$ is a mean value, of the produced k_q , in the same way as comparative advantages is a mean relationship.

Some anecdotal cases are worth commenting. The Brazilian tiles industry managed to enter into more sophisticated tiles products and exporting them after some radical cost innovation (Vasconcellos, 2013). And the land (and historical experience) gives a cost advantages to this sector in Brazil. Belleflamme & Peitz (2015), for instance, report an international award on coffee quality conferred to a Brazilian firm in a 2006 international context. Both examples are compatible with Brazil occupying a lower-quality segment in this industry, as compared to some developed-countries competitors. As known, Italian and French tiles dominate the higher-quality k_q . The same applies to the car industry, as well as for the furniture and software industries.

Last but not the least, inasmuch as each industry produces several products, it can be said that the incremental learning with exporting, as well as the effectiveness of their advertising is greater for products belong to their core. In other words, their marginal costs increasing, and their advertising effectiveness decreases as the firms in a sector move away from their core. That is, $\partial c_i(k_q)/\partial x_k > \partial c_i(k'_q)/\partial x_{k'}$ (i.e., $\partial \pi_i(k_q)/\partial x_k < \partial \pi_i(k'_q)/\partial x_{k'}$), which compels to a within industry specialization. The same applies to the transportation cost inasmuch as it involves transportation facilities and technologies that are industry's specific.

Hence, both *learning by exporting* and *flexible manufacturing* yield that exporter's price premium will be comparatively greater in those sectors in which the country has comparative advantages, insofar as one recognizes that each k stands for a market (or industry). However, we cannot empirically ground these comparative advantages on exogenous country's characteristics, for lacking detailed information on industry technology, as well as the expected detailed information on country's endowments.¹²

¹² In the 2-developing and 2-developed economy analyzed by Arkolakis & Muendler (2012) one has an indirect evidence of country's characteristics.

6. The supply and demand structure of quality: the empirical RUV model.

As known, trade theory has addressed the international specialization from a cost based perspective, encompassing a large set of comparative-advantages models, as well the most recent heterogeneous-firm trade models (Melitz, 2003). We then follow a more recent strand and focus on a set of price and quality competition model, which shares a somewhat common theoretical ground.

As compared to (7), the supply structured model of trade in quality (18) examines $RUV_{ijt}(k)$ from an additional supply-side vector S_{it} , so it takes the following form

$$\ln RUV_{ijt}(k) = \alpha + \beta_0 \ln GDP_{jt} + \beta_1 \ln PCGDP_{jt} + \beta_2 \ln \tilde{D}_{ij} + \beta_3 S_{it} + \varepsilon_{ijt} \quad (19)$$

where S_{it} is given by $RCA_{ijt}(k)$ and $RUV_{ijt}(k)$, both taken with respect to the world, since they are meant to express the country's i international position. The central hypothesis is around $RUV_{ijt}(k)$ for those k_q belonging or not to k -sectors with supply-side advantages. Accordingly, both $RCA_{it}(k)$ and $RUV_{ijt}(k)$ should be based on k 3-digit (SITC) level. However, the 4-digit classification conceals a lot of information as to the precise source of variation in unit value: whether from changes in the 6 or 8-digit basket of products, or from singular price changes.

Table 5 reports the results of our baseline and the augmented models, whose specifications are very similar to the $UV_{ij}(k_q)$ model. Insofar as the $RUV_{ij}(k_q)$ clears away the specific fixed effects of the quantity in $UV_{ij}(k_q)$, our sample dimension – high cross-section k_q and lower time – re-establishes the condition for the random-effect estimators. That is, bearing in mind the observed difficulty in testing both estimators, in the RE models a larger number of coefficients are statistically significant, which means a large correlation of errors with coefficients in the FE model.

One main and general result is that, by using RUV as proxy for quality, all coefficients become statistically significant and consistent with most studies on trade in quality, as far as the demand structure is concerned. Again, the a substantial role in determining the Brazilian exports' $RUV_{ij}(k_q)$. We observe that the size of the importer matters and bigger importers pay lower prices, which agrees with the predicted higher

price-elasticity of demand in market with more intense competition (i.e, with more competitors). The coefficient of per capita income of the importing country remains as before: with a positive impact on relative unity value.

Interestingly enough, both positive coefficients of the supply-side structure are statistically significant. Hence, we cannot reject the hypothesis that Revealed Comparative Advantage (RCA) in a sector positively conditions the quality competition in those products belonging to the corresponding sectors. It can be argued that price term from high quality can push up the RCA variable, nonetheless RUV is built in a form rather independent from the RCA, and the latter is measured at 3-digit level for the whole export from i to the world. The most tenable relationship that comes to mind is that offered in the multi-product firm models: that any producer does better in its core competence. Any externality argument, on the other hand, should be seen with suspect, from previous discussion in the literature on this respect.

To some extent, the positive coefficient and statistically significant coefficients of the explanatory RUV at 3-digits levels reproduces what was already present in the RUV as dependent variable. Yet, it confirms that the cross-country and cross-product variations in the former is grounded in a exporter's characteristic in the world market with respect to quality competition of a product belonging to a sector in which the exports exhibits better performance.

Table 5. Supply and Demand model for the RUV of exports – Random Effects Models

Variables	Baseline Model	Region controls	Adjusted Distance	Region controls	Distance step	Region controls
$\ln(GDP)$	-0.0257*** (0.0079)	-0.0244*** (0.0083)	-0.0243*** (0.0081)	-0.0194** (0.0081)	-0.0166** (0.0076)	-0.0212** (0.0083)
$\ln(PCGDP)$	0.0346*** (0.0093)	0.0457*** (0.0105)	0.0386*** (0.0092)	0.0447*** (0.0104)	0.0231** (0.0097)	0.0440*** (0.0104)
<i>Contig</i>	-0.1135*** (0.0294)	-0.0495* (0.0278)			-0.1262*** (0.0259)	- (0.0263)
<i>comlang_off</i>	-0.1583*** (0.0372)	-0.2521*** (0.0405)			-0.1135*** (0.0371)	-0.2332*** (0.0413)
<i>FTA95</i>	-0.0072 (0.0406)	-0.0323 (0.0415)			-0.1805*** (0.0298)	-0.2049*** (0.0293)
$\ln(dist_{ij})$	0.3095*** (0.0308)	0.2872*** (0.0365)				
$\ln(\tilde{D}_{ij})$			2.0186*** (0.1222)	1.8773*** (0.1304)		
$\ln(RCA_{it}^k)$	0.0829** (0.0412)	0.0822** (0.0411)	0.0819** (0.0411)	0.0813** (0.0409)	0.0818** (0.0410)	0.0810** (0.0407)
$\ln(RUV_{it}^k)$	0.2806*** (0.0512)	0.2845*** (0.0508)	0.2809*** (0.0512)	0.2845*** (0.0508)	0.2814*** (0.0510)	0.2848*** (0.0507)
$Km \leq 4,315$					-0.4640*** (0.0454)	-0.3765*** (0.0764)
$4,315 < Km \leq 8,540$					-0.2110*** (0.0337)	-0.1671** (0.0699)
$8,540 < Km \leq 12,765$					0.0146 (0.0313)	-0.0530 (0.0662)
$Km \geq 12,765$					reference	reference
<i>South Asia</i>		0.2215*** (0.0771)		0.2823*** (0.0737)		0.2293** (0.1103)
<i>Europe & Central Asia</i>		0.2008*** (0.0398)		0.2355*** (0.0396)		0.1709*** (0.0467)
<i>Middle East & North Africa</i>		0.1256** (0.0503)		0.1737*** (0.0504)		0.1182** (0.0550)
<i>Sub-Saharan Africa</i>		0.2493*** (0.0550)		0.2387*** (0.0542)		0.1945*** (0.0556)
<i>Latin America & Caribbean</i>		0.0515 (0.0535)		0.1465*** (0.0530)		-0.0107 (0.0526)
<i>East Asia & Pacific</i>		0.0374 (0.0508)		0.1142** (0.0451)		0.0790 (0.0822)
<i>North America</i>		reference		reference		reference
Wald chi2 test	441.54***	489.91***	397.78***	471.15***	452.89***	498.17***
R ² overall	0.094	0.095	0.095	0.096	0.095	0.095

Notes: *, ** and *** denote 10, 5 and 1 per cent significance level, respectively; Heteroscedastic robust standard errors in parentheses. Total number of observation was 45,925. We have used year dummies for all models.

7. Conclusions.

That trade in quality goes further away could be seen by distribution of differentiated good's extensive margin as compared to the margins of non-differentiated products. This gives a good evidence in favor of an specific gravity of quality, as reinforce by the ordering of (importing) market's extensive margin with respect to both GDP per capita and a network-adjusted distance variable. These signs about the extension and directions of trade in quality received a last and more conclusive evidence from estimates of the attempted demand-structured trade in quality.

The whole theoretical analysis is built on FOB price competition, as stated by several other empirical studies on trade in quality. However, besides taking the market extension as the twin side of quality, by the previous comparison among differentiated and non-differentiated goods, we take more seriously the implications of quality as an attribute carrying an information problem, so that while the market extension conveys operation of a participation constraint, the variation in the unit value (UV) of exports of the differentiated-goods conveys the corresponding incentive compatibility. That is so once we approach asymmetric goods (vertically differentiated) from heterogeneous preferences by consumers having a reservation prices, setting goods entry into each market. The network approach to the geography of these markets helped to corroborate the attempted information problem of quality.

How does these characteristics of goods condition the cost and quality competition between industries of the exporting country? To address we first had to shift performance from UV to RUV (relative unit value), taking for price numeraire the mean world price of each goods, in the world market. The central proposition is that the search cost by suppliers, with respect to the most preferred product characteristics, leads to a dynamic learning by exporting, while the advertisement investment in quality pushes firm to a core quality competition. In fact, the parametric RUV model, which reinforced the demand structure of trade in quality, showed that the comparative price-premium performance is greater in sectors in which the country has comparative advantages. In sum, the latter is a quantity and quality story.

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