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2016

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Documentos de Trabajo
N.º 1607

BANCO DE ESPAÑA
Eurosistema

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(*) We would like to thank the seminar participants at the Banco de España and at the 2013 SAEe meeting (CEMFI-UIMP, Santander) for their useful comments. This paper has been written while Vincenzo Merella was a Research Fellow at the Banco de España, whose financial support is kindly acknowledged.

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Documentos de Trabajo. N.º 1607

2016

ISSN: 1579-8666 (on line)

Abstract

Using average import prices (unit values) as proxies for quality, a large body of the international trade literature finds both theoretical and empirical support for the positive relationship between importer income and quality of imports. Several authors, however, argue that the empirical evidence of the link between income and product quality might be spurious, since import prices could be affected by other factors than product quality. This paper takes into account this issue with a new theoretical and empirical approach. Building on Khandelwal's (2010) discrete choice model approach, where quality is inferred by quantitative market shares as well as unit values, we develop a model that allows for willingness to pay for quality to vary with income. We empirically validate the theoretical relationship between importer income and product quality by using the Eurostat's COMEXT database, which collects customs data reported by EU countries at 8-digit disaggregation. Our estimations support the positive link between consumer income and product quality, which is also robust across sectors.

Keywords: quality, consumer income, import shares, unit values, nested logit demand.

JEL classification: F12, F14, L15.

Resumen

Al utilizar el precio (valor unitario) de los bienes importados como estadístico suficiente de su calidad, gran parte de la literatura del comercio internacional encuentra evidencia de una relación positiva entre la renta del importador y la calidad de los productos importados. Sin embargo, esta evidencia podría ser espuria ya que el precio de las importaciones puede estar afectado por factores distintos a la calidad. Este trabajo tiene en cuenta esta limitación con un nuevo desarrollo teórico y empírico. Por un lado, extiende el enfoque de Khandelwal (2010), en el que la calidad de los productos importados se infiere tanto por su cuota de mercado como por su valor unitario, al introducir un modelo teórico en el que la disposición a pagar por la calidad es creciente con la renta del consumidor. Por otro, utiliza para contrastar esta relación la base de datos COMEXT de Eurostat, que recoge el comercio bilateral de aduanas de cada país de la UE a un nivel de desagregación de ocho dígitos. Así, se valida la relación positiva y significativa entre la renta de los consumidores y la calidad de los productos demandados que, a su vez, es robusta entre sectores.

Palabras clave: calidad, renta del consumidor, cuotas de mercado, valor unitario, comercio internacional, modelo *logit* anidado.

Códigos JEL: F12, F14, L15.

1 Introduction

Understanding the determinants of import structure is a fundamental concern of the international trade literature. A growing number of contributions posit a prominent role of product quality in shaping importer behavior. In this paper, we develop a model in which richer consumers demand goods of higher quality and, departing from the assumption that information on quality is embedded only in prices, we empirically test the model predictions using disaggregated trade data.

The influence of the relationship between product quality and consumer income on consumer demand, if supported by empirical evidence, would have major consequences on the international markets. In fact, exporters' strategies on product differentiation may differ when dealing with richer importers seeking high quality goods from the ones adopted when dealing with poorer importers. Likewise, the effectiveness of a given trade policy might dramatically change depending on the type of competition that domestic producers face internationally. The aim of this paper is to contribute to shed light on the structure of international demand by providing novel evidence on the link between quality of exports and importer income.

In a number of recent theoretical contributions, the relationship between product quality and consumer income is regarded as an important determinant of import and export flows [*e.g.*, Flam and Helpman (1987); Murphy and Shleifer (1997); and, more recently, Fajgelbaum, Grossman and Helpman (2011); Jaimovich and Merella (2012, 2015)]. In all these articles, the main prediction is invariably the following: richer importers tend to trade more with exporters producing higher quality goods. The link between quality of exports and importer income appears to find support in a large empirical literature: product quality correlates positively with consumer income [*e.g.*, Hummels and Klenow (2005); Hallak (2006); Bastos and Silva (2010); Flach (2014)]. The extent to which such empirical findings relate to the theoretical prediction is, however, controversial. The crux of the matter is that observed import prices are typically used as proxies for the quality levels of the consumption goods.[1]

The rationale for using a import prices as proxies for quality hinges on a number of arguments: *e.g.*, higher quality goods would require more costly inputs, hence be more expensive; a

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[1] Average import prices (or unit values) are calculated at the product level as the ratio between the total value and the total volume traded from a source country (exporter) to a destination country (importer).

market price differential between two similar goods may hold only if their quality levels differ. Several authors, however, argue that the correlation between prices and income may actually be determined by factors other than quality [*e.g.*, Hallak and Schott (2011); Simonovska (2010)]. The most immediate argument is that goods sourced from different countries may command heterogeneous tariffs and trade costs. Furthermore, exporters may charge varied markups in different markets (pricing-to-market), which could lead to systematically higher prices charged in more developed economies. Finally, even products that are regarded as close substitute may exhibit some distinctive characteristics, which could result in a certain residual degree of horizontal differentiation.

Building on this criticism, part of the literature attempts to construct alternative measures of quality that do not rely solely on prices. For example, Khandelwal (2010) and Pula and Santabárbara (2012) use quantitative market shares to obtain measure of quality for the goods exported by a given country; Hallak and Schott (2011) bring in trade balances. The idea behind these two approaches is to extract information on quality from trade volumes holding prices constant, building on the intuition that consumers care about price relative to quality in choosing among products. Hence, two goods with the same price but different trade volumes should have different levels of quality.

This paper follows (by gathering information on quality from volumes of trade and import prices) and extends (by letting willingness to pay for quality rise with income) Khandelwal's (2010) approach. We use a nested logit demand system to infer information on quality from quantitative market shares as well as import prices. Consumers face a set of vertically and horizontally differentiated goods, produced by monopolistically competitive firms. They have objective taste for quality, whose different levels are identified on the vertical dimension, and idiosyncratic tastes for the specific characteristics that horizontally differentiate products with the same level of quality. To this standard features, we add a preference representation where willingness to pay for quality rises with income. Therefore, our framework allows for the valuation of quality to be income-dependent.

From a theoretical standpoint, our predictions are in line with those found in the literature: richer importers purchase their goods from exporters producing higher quality products. The novel feature in our approach is how this theoretical prediction is validated empirically. Instead of studying the link between importer income and average import price, we investigate the relationship between importer income and the quality derived from comparing products' quantitative market shares and prices.

To test whether a positive correlation importer income and our measure of product quality exists, this paper exploits the unique features of the Eurostat's COMEXT database, which provides information on each EU member state's imports from 240 partner economies at the CN-8 digit product level (approximately 8500 product headings). This information is used to obtain a highly disaggregate measure of the quality levels of the products (for each 8-digit product and every exporter) imported by each EU country. The underlying strategy is to consider different members of the EU as consumers operating in a single market. We can then test the relationship between quality and income using countries GDP per capita. Our estimates suggest a robust positive correlation between income and product quality. Specifically, as we illustrate in Section 3, our results are robust to different specifications, do not rely on any particular industry, and are also robust to a number of controls and alternative instrumentation strategies.

Related literature

A large strand of the literature provides evidence of a positive correlation between quality of imports and importer GDP. Using cross-sectional data for bilateral trade among 60 countries in 1995, Hallak (2006) shows that rich economies tend to import relatively more from exporters that produce high-quality goods. Fieler (2011) uses an even richer dataset (about 160 countries in the period 1995-2007) to illustrate the positive link between income per capita growth and the rise in quality levels. Choi, Hummels and Xiang (2009) exploit household income data (26 countries in 2000) and document that different quality distributions map into different income distributions, in a way that is consistent with rising willingness to pay for quality.[2]

The common feature of all these contributions is that unit values are used as proxies for quality levels. Several studies point out that unit values may capture other links to the importer's income per capita than product quality. Khandelwal (2010) argues that import prices may reflect variations in manufacturing costs, and expensive goods may be traded only because they exhibit

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[2] Further evidence that richer consumers typically purhcase product of higher quality can be found, for example, in Bils and Klenow (2001) and Broda and Romalis (2009).

particular features that match idiosyncratic preferences of a small fraction of consumers in the destination country. Simonovska (2010) investigates the role of pricing-to-market in determining import prices and, using data on prices of more than two hundreds identical goods sold in about thirty countries, shows that variable mark-ups account for up to a third of the observed cross-country price differentials.[3] In addition, heterogeneity in tariffs and transportation costs are a well documented source of differences in the prices of tradables. For these reasons, we choose to depart from the existing literature investigating the link between quality and per capita GDP by adopting an alternative measure of quality, and study the relationship between consumer income and product quality inferring the latter from the relative volumes traded in the international markets.

There are two main approaches in the literature that attempt to construct alternative quality measures. On the one hand, Hallak and Schott (2011) infer relative product quality by positing that countries with trade surpluses offer higher quality than countries running trade deficits, holding observed import prices constant. On the other hand, Khandelwal (2010) deduces quality levels by exploiting trade volumes, postulating that higher-quality products attract higher market shares, conditional on price. We choose to follow more closely the second approach, because the richness of observations in our dataset allows for a finer detailed analysis than that based on world-level exports.[4] Hence, our paper differs from Hallak and Schott (2011) as we infer quality by exporter at the product level rather than looking at each country as a whole. Furthermore, we depart from both approaches in that we explicitly let willingness to pay for quality rise as consumer income increases. This feature represents the main novelty of our paper relative to the existing studies in this literature.

Finally, our paper relates to those contributions building on the tradition of discrete choice models, first proposed by McFadden (1973), and later developed by Berry (1994) and Berry, Levinsohn, and Pakes (1995). These modeling has been applied to international trade by Goldberg (1995) and Verboven (1996) and, more recently, by Verhoogen (2008), Khandelwal (2010)

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[3] Alessandria and Kaboski (2011) provide further evidence of this phenomenon, showing that US exporters ship the same good to low-income countries at lower prices.

[4] We are aware that a “disadvantage is that [. . .] one-way flows to a single country are likely to be substantially more sensitive to mismeasurement of trade costs than countries trade balances with the world.” (Hallak and Schott, 2011; footnote 21, p.434.) For this reason, we implement a number of controls in our empirical work, which we discuss in section 3.

and Pula and Santabárbara (2012). Here, we extend these works by introducing a mechanism that leads to a link between product quality and consumer income. It is worth noting that Fajgelbaum, Grossman and Helpman (2011) also introduce willingness to pay for quality in a model with a nested logit demand system. Their focus, however, is very different from ours. Their study is exclusively theoretical, and aims to explain why richer countries export higher-quality goods, whereas our quantitative model is designed to provide measures of product quality to test the link between the latter and consumer income.[5]

The remaining of the paper is organized as follows. Section 2 illustrates the model from which we derive our predictions. Section 3 discusses our empirical strategy, and shows that our estimations support the theoretical predictions of the model. Finally, section 4 concludes.

2 Theoretical framework

This section builds on the tradition of the nested logit discrete choice models.[6] Most features of our model are standard: (i) we consider a partial equilibrium world economy where a large number of independent markets exist; (ii) throughout the whole theoretical analysis, we restrict our attention to a single, representative, market;[7] (iii) products are potentially sourced from, and destined to, several countries: to simplify matters, we only consider two source countries, denoted N and S, and two destination countries, denoted H and L. The only novel feature of our approach is to allow for willingness to pay for quality to rise with income.

Within every source country there is a unit mass of firms, indexed by j, each producing a differentiated good. Labour inputs are immobile (which allows for different wages in N and S) and technologies differ across countries. We assume that country N enjoys higher wages ($w_N > w_S$) and technological capabilities ($A_N > A_S$) than country S. Every destination country is populated by a unit mass of consumers. The two countries differ in their income levels and (possibly) size, and we assume that country H is richer ($y_H > y_L$) than country L. Size is

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[5] In fact, the divergence in the goal of the two papers entails a fundamental difference in the modelling strategy. Fajgelbaum *et al.* (2011) develop a general equilibrium model where idiosyncratic tastes have a generalized extreme value (GEV) distribution. We opt for a partial equilibrium model with idiosyncratic tastes having a type I extreme value distribution.

[6] For a textbook description of this model, see Tirole (1988).

[7] The arguments discussed here naturally extend to all sectors considered in our empirical investigation, which we then present in section 3.

denoted by ψ and expressed in relative terms, hence the destination region has size one, and $\psi_L \equiv 1 - \psi_H$. Two additional features complete the model. First, outside sectors determine wages and incomes. Second, domestically produced outside varieties are available to consumers in each destination country.

By differentiating their products, firms in the source region engage in monopolistic competition. They exercise their degree of market power by setting the prices of their products taking consumer demand into account. For this reason, we begin our analysis by studying consumer choice. Each individual i in country $M = \{H, L\}$ may consume one unit of a differentiated good (j, X), produced by firm j in country $X = \{M, N, S\}$. Good (j, X) in M is characterized by the quality level $q_{j,X}^{M}$ (which is agreed upon by all consumers) and by the horizontal differentiation term $\varepsilon_{j,X}^{i,M}$ (whose valuation is instead consumer-specific).

Valuation of good (j, X) by consumer i in country M is represented by the indirect utility function:

$$V_{j,X}^{i,M} = \theta^M q_{j,X}^{M} - \alpha p_{j,X}^{M} + \varepsilon_{j,X}^{i,M} \tag{1}$$

where θ^M reflects the country-M consumers' (common) valuation for quality, $p_{j,X}^{M}$ is the price of good (j, X) when traded in country M, and α represents consumers' (worldwide common) price sensitivity. We introduce the concept of rising willingness to pay for quality as income increases by assuming that valuation for quality is an increasing function of income.

Assumption Valuation for quality $\theta^M \equiv \theta(y_M)$ is such that $\theta(0) > 0$ and $\partial\theta(y_M)/\partial y_M > 0$.

As a result, the larger y_M, the higher θ^M, and the greater the willingness to pay for quality, all other conditions holding constant.

Under the assumption that the horizontal term $\varepsilon_{j,x}^{i}$ follows a Gumbel distribution, the expected aggregate demand for good (j, X) by country M is:

$$c_{j,X}^{M} = \frac{\psi_M \exp\left(\delta_{j,X}^{M}\right)}{\sum_{Y=\{M,N,S\}} \int_0^1 \exp\left(\delta_{k,Y}^{M}\right) dk} \tag{2}$$

where $\delta_{j,X}^{M} \equiv \theta^M q_{j,X}^{M} - \alpha p_{j,X}^{M}$ represents the average valuation of good (j, X) in country M, which is independent of $\left\{\varepsilon_{j,X}^{i,M}\right\}$ since idiosyncratic elements vanish when aggregating across consumers.[8]

In each country of the source region, firms compete by producing vertically and horizontally differentiated goods. Vertical differentiation consists of choosing a particular quality version of the supplied good. To produce one unit of quality q, a firm in country X faces the cost $w_X + q^2/\left(2A_X\right)$. (Recall that A_X is a technological parameter; wages w_X are determined by an outside sector and therefore exogenous.) Horizontal differentiation consists of choosing whether to embed specific characteristics to further personalize the supplied good. All firms horizontally differentiate goods at no additional cost.

Each firm j in country X take country-M consumer demand (2) into account when choosing price $p_{j,X}^M$ and quality $q_{j,X}^M$ to maximize profits:

$$\pi_{j,X}^M = \max_{p,q} \left(p - w_X - \frac{q^2}{2A_X} \right) \frac{\psi_M \exp\left(\theta^M q - \alpha p\right)}{\sum_{Y=\{M,N,S\}} \int_0^1 \exp\left(\delta_{k,Y}^M\right) dk} \tag{3}$$

(Atomless) firms cannot influence the equilibrium allocations, hence the optimal price charged is:

$$p_{j,X}^M = \frac{1}{\alpha} + w_X + \frac{\left(q_{j,X}^M\right)^2}{2A_X} \tag{4}$$

the optimal quality is:

$$q_{j,X}^M = \frac{\theta^M A_X}{\alpha} \tag{5}$$

and the (average) valuation of good (j,X) in country M:

$$\delta_{j,X}^M = \frac{\left(\theta^M\right)^2 A_X}{2\alpha} - 1 - \alpha w_X \tag{6}$$

From (4)-(6), we may note that: (i) all firms in each source country optimally supply to country M goods of the same quality level ($q_{j,X}^M = q_X^M$, $\forall j$), which are hence equally priced ($p_{j,X}^M = p_X^M$, $\forall j$) and, on average, equally valued ($\delta_{j,X}^M = \delta_X^M$, $\forall j$); (ii) since $A_N > A_S$, goods produced in N are always of higher quality, and given larger valuation, than those produced in S; (iii) by replacing (5) into (4) in turns out that $p_X^M = w_X + \left(\theta^M\right)^2 A_X/\left(2\alpha^2\right) + 1/\alpha$ and, since

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[8] We illustrate the formal derivation of aggregate demand (2) in Appendix A.1.

$w_N > w_S$, goods produced in N are also more expensive than those produced in S.[9]

Recall that valuation for quality is an increasing function of consumer income. Considered in conjunction with (5), this feature of the model delivers the central prediction of our model, which we may summarize as follows.

Proposition. Goods sourced from country X to the destination country H are always of higher quality than those sourced to L:

$$q_X^H > q_X^L, \ \forall X$$

Proof. The result immediately follows from noticing that, since $y_H > y_L$, then $\theta^H > \theta^L$ and $q_X^H = \theta^H A_X/\alpha > \theta^L A_X/\alpha = q_X^L$. ■

This result implies that richer consumers (higher y), displaying higher willingness to pay for quality (larger θ), have a different spending structure than poorer consumers and, in particular, tend to import higher quality goods. The central prediction of our model is therefore in line with those found in the literature: product quality and consumer income should be positively related.

The novel feature in our approach is how this theoretical result translates into an empirical test. As we discussed in the previous section, empirical contributions investigating the correlation between importer's income and consumption goods quality typically use unit values (average import prices) as proxies for quality. We depart from the literature and infer product quality from (quantitative) market shares in a direct fashion, once unit values are controlled for.

In order to offer a more accurate description of the link between theoretical prediction and empirical test, it proves convenient to derive how import volumes translate into quantitative market shares, relative to the domestic market share. To do so, first notice that we may obtain total consumption c^M in the destination country M by summing up aggregate demand (2) across source countries:

$$c^M \equiv \sum_{X=\{M,N,S\}} \psi_M \frac{\exp\left(\delta_X^M\right)}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} = \psi_M$$

We then derive the market share of the source country X in the destination country M by

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[9] We illustrate the formal derivation of optimality conditions (4)-(6) in Appendix A.2.

computing the ratio between the relevant aggregate demand and total consumption:

$$s_X^M \equiv \frac{c_X^M}{c^M} = \frac{\psi_M \exp\left(\delta_X^M\right)}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} \frac{1}{\psi_M} = \frac{\exp\left(\delta_X^M\right)}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} \tag{7}$$

Following the literature, we can further simplify this expression by normalizing to zero the average valuation of the domestically produced goods (j, M), which amounts to imposing $\delta_M^M = \theta^M q_M^M - \alpha p_M^M = 0$. Using (7), the domestically produced goods market share is:

$$s_M^M = \frac{\exp\left(\delta_M^M\right)}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} = \frac{1}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} \tag{8}$$

As a result, the relative quantitative market share of the source country X in the destination country M is given by the ratio of (7) to (8):

$$\frac{s_X^M}{s_M^M} = \frac{\exp\left(\delta_X^M\right)}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)} \left(\frac{1}{\sum_{Y=\{M,N,S\}} \exp\left(\delta_Y^M\right)}\right)^{-1} = \exp\left(\delta_X^M\right) \tag{9}$$

Taking logarithms, and using the definition of average valuation for good (j, X) in the destination country M to substitute for δ_X^M, we obtain the equation that we bring to the data in order to infer our measure of product quality:

$$\ln s_X^M - \ln s_M^M = \delta_X^M = \chi_X^M - \alpha p_X^M \tag{10}$$

where $\chi_X^M \equiv \theta^M q_X^M = \ln s_X^M - \ln s_M^M + \alpha p_X^M$ is the observationally relevant variable.[10]

This result, implied by the logistic nature of the model, represents the cornerstone of this type of models. From an empirical point of view, since quantitative market shares and prices are observable whereas qualities are not, the latter may be inferred by market shares once the effect of price is accounted for. In this respect, the novelty of our analysis lies in investigating

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[10] This definition is due to the impossibility to identify θ^M and q_X^M separately. This caveat does not represent a major issue, since: (i) θ^M is the same for all goods imported by a given country, hence it works as a mere scale factor applied to a measure that is ordinal by nature; (ii) when comparing goods imported by different regions, this scale factor only magnifies the difference between (ordinal) quality levels; the mapping between $\{q_X^M\}$ and $\{\theta^M q_X^M\}$ is monotonic since q_X^M is an increasing function of θ^M.

the relationship between consumer income and product quality within this framework, where the newly developed measures of quality replace average import prices as proxies for quality.

3 Empirical approach

As we have shown in the previous section, our model predicts that the quality embodied in each traded good is an increasing function of consumer income. This prediction can be empirically tested using (10). Since market shares and prices are observable, quality may be inferred by (quantitative) market shares once the price effect is accounted for. In what follows, we first illustrate the data that we use to test our prediction. We then discuss how we develop our estimations. Finally, we present our empirical results.

3.1 Dataset and estimation strategy

We estimate the demand function (10) for each good using data from the Eurostat's COMEXT database. The COMEXT database collects EU harmonized customs data and contains information on all trade flows reported by each EU country. It is a disaggregated data source, which provides trade data at the CN8-digit product level.[11] In particular, this database contains values and quantities of all imports for each EU country. For a more homogeneous data availability and to obtain a properly balanced panel, in our empirical exercise we consider five developed countries among the EU members, namely: Germany, France, Italy, Spain and the UK.[12] Accordingly, our database is four dimensional: it contains import data for 5 destination EU countries (M) under 8500 product labels (g) from 240 trade partners (X) for the 1995-2007 period (t). In what follows, we denote the good imported under product label g from country X as a variety $z = (g, X)$. As such, in our analysis a variety can be seen as the basic unit of consumer choice.[13]

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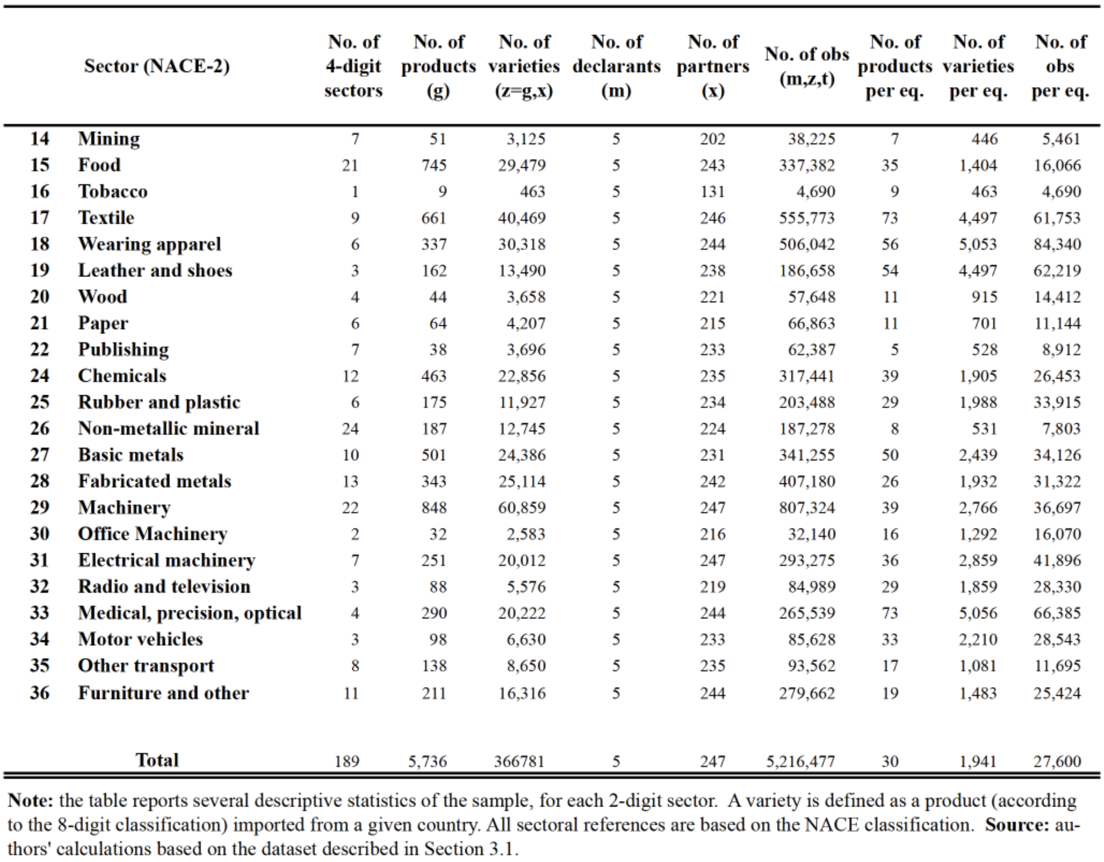
[11] For example, we are able to distinguish within the men's knitted shirt category (CN 4 digit code 6105) by material: cotton (61051000), synthetic fibre (61052010), artificial fibre (61052090), wool (61059010), or other material (61059090).

[12] These five countries are the largest markets within EU, which guaratees that they import a comparable set of products from their trade partners. Besides, the selected countries are among the richest in the world (the relevant per capita GDP figures are well above 30,000 international dollars; source: World Bank, 2013), and display fairly similar income distributions (*e.g.*, the relevant Gini coefficients range from 0.28 to 0.35; source: Eurostat, 2012).

[13] Note that horizontal differentiation, as discussed in the previous section, occurs at the product level. As a result, every variety z includes each differentiated goods j, belonging to label g, produced in the source country X.

Table 1. Summary statistics.



	Sector (NACE-2)	No. of 4-digit sectors	No. of products (g)	No. of varieties (z=g,x)	No. of declarants (m)	No. of partners (x)	No. of obs (m,z,t)	No. of products per eq.	No. of varieties per eq.	No. of obs per eq.
14	**Mining**	7	51	3,125	5	202	38,225	7	446	5,461
15	**Food**	21	745	29,479	5	243	337,382	35	1,404	16,066
16	**Tobacco**	1	9	463	5	131	4,690	9	463	4,690
17	**Textile**	9	661	40,469	5	246	555,773	73	4,497	61,753
18	**Wearing apparel**	6	337	30,318	5	244	506,042	56	5,053	84,340
19	**Leather and shoes**	3	162	13,490	5	238	186,658	54	4,497	62,219
20	**Wood**	4	44	3,658	5	221	57,648	11	915	14,412
21	**Paper**	6	64	4,207	5	215	66,863	11	701	11,144
22	**Publishing**	7	38	3,696	5	233	62,387	5	528	8,912
24	**Chemicals**	12	463	22,856	5	235	317,441	39	1,905	26,453
25	**Rubber and plastic**	6	175	11,927	5	234	203,488	29	1,988	33,915
26	**Non-metallic mineral**	24	187	12,745	5	224	187,278	8	531	7,803
27	**Basic metals**	10	501	24,386	5	231	341,255	50	2,439	34,126
28	**Fabricated metals**	13	343	25,114	5	242	407,180	26	1,932	31,322
29	**Machinery**	22	848	60,859	5	247	807,324	39	2,766	36,697
30	**Office Machinery**	2	32	2,583	5	216	32,140	16	1,292	16,070
31	**Electrical machinery**	7	251	20,012	5	247	293,275	36	2,859	41,896
32	**Radio and television**	3	88	5,576	5	219	84,989	29	1,859	28,330
33	**Medical, precision, optical**	4	290	20,222	5	244	265,539	73	5,056	66,385
34	**Motor vehicles**	3	98	6,630	5	233	85,628	33	2,210	28,543
35	**Other transport**	8	138	8,650	5	235	93,562	17	1,081	11,695
36	**Furniture and other**	11	211	16,316	5	244	279,662	19	1,483	25,424
	Total	189	5,736	366781	5	247	5,216,477	30	1,941	27,600

Note: the table reports several descriptive statistics of the sample, for each 2-digit sector. A variety is defined as a product (according to the 8-digit classification) imported from a given country. All sectoral references are based on the NACE classification. **Source:** authors' calculations based on the dataset described in Section 3.1.

In order to guarantee a certain homogeneity in the demand function for the differentiated products, we estimate a separate demand function for each NACE 4-digit industry.[14] In our analysis, all industries with undifferentiated products are dropped, as bulding a quality ladder in such industries would hardly make sense: those industries are selected using Rauch's (1999) differentiated products classification. Table 1 gives an overview of the database at a 2-digit level. Overall, the database contains 189 four-digit industries, but data availability reduces the number of separate equations we can actually estimate to around 160. On average, per equation, we have 30 products g, around 2000 varieties z and nearly 28000 observations (z, t). The coverage of the database varies significantly across the 2-digit industries. For example, wearing apparel has on

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[14] Each 4-digit NACE industry is linked to the relevant CN 8-digit classification through appropriate correspondence tables provided by EUROSTAT.

average 56 products per equation, while the office machinery industry has only 16.[15]

Taking all the specifics of our database into consideration, we can rewrite (10) in the following form:

$$\ln s_{z,t} - \ln s_{0,t} = \chi_z + \chi_t + \chi_M + \chi_y - \alpha p_{z,t} + \sigma \ln ns_{z,t} + \chi_{z,t} \tag{11}$$

This is the equation that we ultimately estimate separately for each NACE 4-digit industry. In each destination country, $s_{z,t}$ measures the market share of variety z relative to total consumption of goods in the relevant 4-digit industry, in turn computed as the sum of domestic production and imports, minus exports.[16] The market share is calculated in quantitative terms. We also consider an outside variety, required in the demand system, as the domestic substitute for imports in each country, whose market share, $s_{0,t}$, is calculated as one minus the industry's overall import penetration at 4-digit.

In equation (11), we estimate market quality χ_X^M as a sum of five elements: the time invariant component of quality (χ_z) is measured by a variety fixed effect; the common shock (χ_t) is calculated as a year fixed effect; a destination country dummy (χ_M) controlling for idyosincratic features; the income effect, $\chi_y \equiv \beta \ln y_M$, obtained by introducing destination per-capita GDP as a regressor in (11); finally, the term $(\chi_{z,t})$ that is unobserved and is obtained from the estimation error. Intuitively, equation (11) shows that a larger market share is related to higher quality after controlling for the variety's relative price. Most importantly for our analysis, our model predicts that product quality increases with consumer income and, therefore, we expect $\beta > 0$.

The demand function (11) allows for different degree of substitutability across products. The nested logit specification of the demand curve assumes different substitability patterns among groups of varieties or 'nests', which however have to be determined ex-ante. We let product labels g serve as nests. In particular, it is assumed that varieties within the same product exhibit a higher degree of substitutability than varieties of different products. For example, a Chinese cotton shirt is more substitutable with a Vietnamese cotton shirt than with a Chinese nylon shirt.[17] The nest term $ns_{z,t}$ is calculated as the import share of variety z in the total imports

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[15] While it is apparent that our estimates are based on a large but not particularly balanced panel of data, this fact does not represent an issue since each industry is, by construction, independently considered.

[16] The sectoral level is chosen at NACE 4-digits since this is the most disaggregate level at which data is available for calculating market shares in consumption.

[17] In this example, cotton shirts and nylon shirts are two distinct nests.

of product g (the nest).[18] It is introduced to limit the extent of the issues arising from the independence of irrelevant alternatives in traditional logit models.

The substitution parameter σ can be interpreted as follows. As σ approaches one, there will be the highest degree of substitution among varieties within the nest (e.g. between Chinese and Vietnamese cotton shirts), and the lowest across nests (e.g. between cotton and nylon shirts). As a result, if the price of a given variety increases, consumers will substitute it with varieties from the same nest but not from other nests. This implies that the varieties' relative market share will change within the nest, but not outside of the nest, and thus changes in the overall market share $s_{z,t}$ will be exclusively determined by the market share $ns_{z,t}$ within the nest.[19] In fact, in the case of an increase in its relative price, a variety that is easier to substitute will have a stronger decline in its market share, even if no change occurs in its relative quality.

Given that the price $p_{z,t}$ and the nest term $ns_{z,t}$ are endogenous, i.e., contemporaneously correlated with the residual $\chi_{z,t}$, in order to obtain consistent estimates of (11), we consider a number of instruments. For the unit values, $p_{z,t}$, we use two sets of instruments. Given that the COMEXT database contains neither variety-level transportation costs nor non-rival variety characteristics (which are widely used instruments in the literature since Hausman, 1997), our first set of instruments relies on *non-variety specific instruments*, and in particular on country level data, namely the bilateral exchange rate and a proxy for transportation costs calculated as the interaction of bilateral country distances and the oil price.[20] This set of instruments has the advantage of being available for the whole sample. The second set of instruments is *variety-specific*, and consist of the varieties' average unit values on alternative EU markets. The idea behind using these so called Hausman instruments is that changes in unit values in third markets (*e.g.*, Belgium when Germany is considered) can be assumed to reflect cost shocks and thus be used as instruments for prices with regard to the EU member state market under consideration.

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[18] Theoretically, $ns_{z,t}$ should be calculated as a market share in consumption. However, given that we have no information on the size of the domestic market at the product level, we calculate it as an import share, i.e., as the share of variety z import in the total imports of product g. This is equivalent to the assumption that each product market has the same import penetration ratio.

[19] As an example, if the price of the Chinese cotton shirt goes up, consumers will substitute it with Vietnamese cotton shirts and not by Chinese nylon shirts. The overall market share of both cotton and nylon shirts will remain unchanged while the market share of Chinese cotton shirt within the apparel *sector* will fall together with its market share within the cotton shirt *nest*.

[20] Bilateral exchange rates are taken from IFS database, distances are from the CEPII database (http://www.cepii.fr/anglaisgraph/bdd/distances.htm)

In addition, the sustitution parameter, σ, is instrumented with the number of varieties within the nest and the number of varieties exported by a country.

In what follows, we compare the results obtained using three methods: the ordinary least square estimation (labelled 'OLS'), which does not deal with endogeneity issues; an instrumental variable estimation making use of the subset of non-variety-specific instruments only (labelled 'IV1'); and an instrumental variable estimation using the full set of variety and non-variety specific instruments (labelled 'IV2').

3.2 Estimation results

To give an overview of the goodness of the regressions, Table 2 shows a summary of the estimation results, focusing on the coefficient of our variable of interest, *i.e.*, the log of per capita GDP (hereafter, GDP coefficient).[21] Given the large number of separate equations, one per 4-digit industry, the table shows the distribution of the coefficients and the associated p-values across our estimations.[22] From top to bottom, the three boxes in Table 2 illustrate the results of the OLS estimation and of the two sets of IV estimations. Hereafter, unless otherwise stated, we refer to the IV2 approach as the benchmark estimation, since it deals with endogeneity with a broader set of instruments.

As expected, the mean of the GDP coefficient is positive in all different estimation strategies, suggesting that richer countries' consumers tend to purchase higher quality goods from their trade partners. The average magnitude of the coefficient is sizeable (about 1.6). The result of our estimations is not driven by just a few industries: across the 156 estimated equations, the share of positive and significant coefficient is 54%. To put this figure into perspective, a useful comparison is provided by the share of negative and significant *price* coefficients (reported in the Appendix, Table 6). Being based on the well-established negative relationship between demand volumes and prices, one may expect to find that a very large number of sectors exhibit a price coefficient complying with this theoretical prediction. However, the share of negative and significant coefficients is 59%, a mere 5 points higher than the share of positive and significant GDP coefficients.

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[21] Table 6 in the Appendix reports the results relative to the coefficients of prices and nest terms.

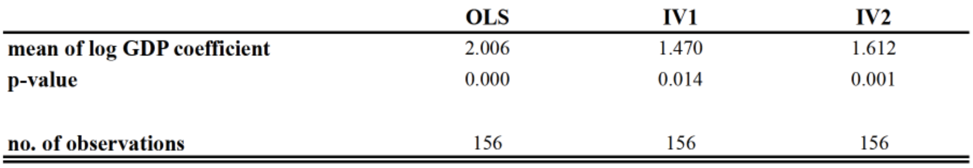
[22] Table 7 in the Appendix reports the value of the GDP coefficients for each estimated equation.

Table 2. Summary of benchmark estimation results: coefficients of log GDP.

	mean	1st quartile	median	3rd quartile
OLS				
log GDP coefficient	2.006	-0.912	1.357	4.901
log GDP coefficient, p-value	0.040	0.000	0.000	0.000
observations per equation	27,570	4,981	15,887	35,586
R2	0.81	0.76	0.81	0.86
Share of equations with positive and significant GDP coefficient			64%	
No. of equations			156	
IV1 (non-variety specific instruments)				
log GDP coefficient	1.470	-2.023	0.980	4.438
log GDP coefficient, p-value	0.209	0.000	0.018	0.413
overidentifying restrictions, p-value	0.309	0.000	0.142	0.616
observations per equation	26,922	5,203	15,600	34,281
R2	0.35	0.08	0.29	0.58
Share of equations with positive and significant GDP coefficient			42%	
No. of equations			156	
IV2 (full set of instruments: non-variety and variety specific instruments)				
log GDP coefficient	1.612	-1.794	1.132	4.651
log GDP coefficient, p-value	0.081	0.000	0.000	0.029
overidentifying restrictions, p-value	0.111	0.000	0.000	0.023
observations per equation	22,294	4,182	13,254	28,558
R2	0.57	0.46	0.63	0.73
Share of equations with positive and significant GDP coefficient			55%	
No. of equations			156	
Hausman Test , p-value	0.731	0.443	0.999	1.000

Note: the table reports several moments of the distribution of the estimates of the log of importer's per capita GDP coefficients, based on 189 separate demand functions, one for each NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The variety unit value and a nest term (computed as the variety import share for a given product) are included as regressors, along with other determinants of quality, namely: variety, year and importer effects. The component of quality measure unrelated to income is estimated as the sum of these three effects plus the error term. Each panel of the table refers to a different set of regressions: the top panel summarizes the results obtained using the ordinary least square (OLS) estimator; the mid panel those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the bottom panel those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). The Hansen-Sargan test is used to assess the over-identifying restrictions. The Hausman test assesses the validity of the full set of instruments. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 3. Mean test for log GDP coefficients.



	OLS	IV1	IV2
mean of log GDP coefficient	2.006	1.470	1.612
p-value	0.000	0.014	0.001
no. of observations	156	156	156

Note: mean test conducted by regressing the log GDP coefficients (originating from the set of estimates summarized in Tables 2 and 6) on a constant, assuming a heteroscedastic distribution of the coefficients. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 2 also reports the average p-value associated to the GDP coefficients estimates. This figure represents the measure for individual and single equation significance (GDP coefficients and their significance for each equation estimated are reported in Table 7 in the Appendix). To assess the joint significance of our GDP coefficients, however, we need to run a formal test, whose p-values are shown in Table 3, separately for each approach. It is straightforward to notice that all our estimates are indeed significant, with only the IV1 estimation just failing to reach the 1% confidence level. All statistical exercises thus lend support to our hypothesis that taste for quality rises with income.

We also conducted several exercises to assess the robustness of our results. The first one determines to what extent the Linder hypothesis bias the quality estimates and, hence, distorts the relationship between quality and income. The Linder hypothesis establishes that countries with similar per capita GDP, displaying similar demand structures, would trade more with each other. In this perspective, any destination country would exhibit an inverse relationship between the market shares captured by exporters from a particular source country and the per capita GDP gap between the two countries. To check whether our results might be mainly driven by this occurrence, we perform again our estimation exercise including as an additional regressor a 'Linder term', computed as the absolute value of the difference between the log of per capita GDPs of the relevant importer and exporter. Table 4 reports the results relative to the log GDP coefficients and the Linder terms.[23] As expected, the Linder term is negative and significant, but its introduction seems to have little influence on the log GDP coefficients, which remain positive and of similar magnitude relative to those delivered by our benchmark exercises.

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[23] Table 8 in the Appendix reports the results relative to the coefficients of prices and nest terms.

Table 4. Summary of estimation results with Linder term: coefficients of log GDP and Linder term.

	mean	1st quartile	median	3rd quartile
OLS				
log GDP coefficient	2.325	-1.009	1.869	5.192
log GDP coefficient, p-value	0.043	0.000	0.000	0.000
Linder term coefficient	-0.224	-0.339	-0.108	0.000
Linder term coefficient, p-value	0.250	0.000	0.089	0.498
observations per equation	26,177	4,397	15,146	33,836
R2	0.81	0.76	0.81	0.86
Share of equations with positive and significant GDP coefficient			62%	
No. of equations			156	
IV1 (non-variety specific instruments)				
log GDP coefficient	1.815	-1.767	1.399	4.546
log GDP coefficient, p-value	0.225	0.000	0.025	0.440
Linder term coefficient	-1.077	-1.689	-0.431	0.142
Linder term coefficient, p-value	0.343	0.016	0.290	0.598
overidentifying restrictions, p-value	0.341	0.000	0.176	0.704
observations per equation	26,436	5,077	15,348	33,798
R2	0.32	0.06	0.23	0.54
Share of equations with positive and significant GDP coefficient			39%	
No. of equations			156	
IV2 (full set of instruments: non-variety and variety specific instruments)				
log GDP coefficient	1.681	-1.590	1.439	4.707
log GDP coefficient, p-value	0.080	0.000	0.000	0.018
Linder term coefficient	-0.907	-1.555	-0.347	0.060
Linder term coefficient, p-value	0.248	0.000	0.088	0.441
overidentifying restrictions, p-value	0.126	0.000	0.000	0.070
observations per equation	21,888	4,037	13,060	28,173
R2	0.50	0.22	0.55	0.72
Share of equations with positive and significant GDP coefficient			55%	
No. of equations			156	
Hausman Test , p-value	0.733	0.392	0.998	1.000

Note: the table reports several moments of the distribution of the estimates of the coefficients of the log of importer's per capita GDP and of a Linder term (computed as the absolute value of the difference in per capita GDP between importer and exporter), based on 189 separate demand functions, one for each NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The variety unit value and a nest term (computed as the variety import share for a given product) are included as regressors, along with other determinants of quality, namely: variety, year and importer effects. The component of quality measure unrelated to income is estimated as the sum of these three effects plus the error term. Each panel of the table refers to a different set of regressions: the top panel summarizes the results obtained using the ordinary least square (OLS) estimator; the mid panel those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the bottom panel those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). The Hansen-Sargan test is used to assess the overidentifying restrictions. The Hausman test assesses the validity of the full set of instruments. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 5. Regressions of quality measures on importer's log GDP.

	OLS	IV1	IV2
mean of log GDP coefficient	0.642	0.112	0.360
p-value	0.003	0.003	0.003
constant	-6.530	-1.141	-3.659
p-value	0.033	0.033	0.033
no. of observations	4,383,714	4,383,714	4,383,714

Note: the table reports the OLS estimates of the coefficients of the log of importer's per capita GDP and of a constant. The dependent variable is a measure of product quality that abstracts from the income component, and is computed as the sum of variety, year and importer effects plus the error term; the results of the set of regressions from which these effects originate are summarized in Table 9. Each column of the table refers to a different regression: the left column summarizes the results obtained using the ordinary least square (OLS) estimator; the mid column those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the right column those obtained with an instrumental variable estimator using the set of variety and non-variety specific instruments (IV2).
Source: authors' calculations based on the dataset described in Section 3.1.

As a further robustness exercise, we test the relationship between quality and income following a two stage approach. First, we estimate quality without considering the income term χ_y in (11), in line with the original Khandelwal (2010) specification. Then, we assess the relationship between importer income and quality estimates by OLS regression. Table 5 summarizes the results that we obtain on aggregate.[24] Once again, these results show that the relationship between product quality and importer's income per capita is positive and highly significant.

4 Conclusion

This paper provides theoretical support and empirical evidence on one of the major issues in the international trade literature: whether willingness to pay for quality rises systematically with importer income. Our framework builds on the discrete choice models approach. The novelty of this paper lies in the joint consideration of two features. First, valuation for quality is income dependent and, in particular, their relationship is positive. Second, we depart from the traditional assumption that import prices are proxies for quality, and we estimate quality using not only information from prices but also from market shares.

We show that a theoretical relationship between these quality measures and consumer income is validated empirically, and discuss under which conditions in terms of income levels and dis-

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[24] Tables 9 and 10 in the Appendix respectively report the price and nest coefficients of the first-stage estimation and the results relative to the coefficients of log GDP at the sectoral level of the second-stage estimation.

tribution. We bring our predictions to the data, testing our hypothesis on a dataset consisting of import data of five EU countries (namely, France, Germany, Italy, Spain and the UK), and over a 13-year time span, i.e., 1995-2007. We find a positive and significant relationship between the quality measure and the GDP per capita of the selected countries. Our estimates are robust to a number of controls and to three different methodological approaches, based on different instrumental variable strategies.

Appendices

A Proof of theoretical results

A.1 Derivation of aggregate demand (2)

Consider the choice of a generic good (j, X) over all possible alternatives in the market, namely $\{(k, Y)\}$, with $k \neq j$ when $Y = X$. Given (1), the decision rule for consumer i in country M is as follows: consume good (j, X) only if $V_{j,X}^{i,M} > V_{k,Y}^{i,M}$, $\forall (k, Y) \neq (j, X)$. Our task is thus to compute the probability:

$$\Pr\left(j, X \left| i, M\right.\right) = \Pr\left(\varepsilon_{j,X}^{i,M} > \max_{Y=\{N,S,M\}}\left\{\max_{j}\left\{\delta_{k,Y}^{M} + \varepsilon_{k,Y}^{i,M} - \delta_{j,X}^{M}\right\}\right\}\Big|_{(k,Y)\neq(j,X)}\right)$$

The term on the right-hand side represents the joint probability that horizontal differentiation of good (j, X) is valued by consumer i in country M more than that of any other good. We can therefore write:

$$\begin{aligned}\Pr\left(j, X|i, M\right) \quad = \quad & \int_{-\infty}^{+\infty} f\left(\varepsilon_{j,X}^{i,M}\right)\exp\left(\int_{k\neq j}\ln\left(\int_{-\infty}^{\varepsilon_{j,X}^{i,M}+\delta_{j,X}^{M}-\delta_{k,X}^{M}} f\left(\varepsilon_{k,X}^{i,M}\right)d\varepsilon_{k,X}^{i,M}\right)dk\right. \\ & \left. + \sum_{Y\neq X}\int_{0}^{1}\ln\left(\int_{-\infty}^{\varepsilon_{j,X}^{i,M}+\delta_{j,X}^{M}-\delta_{k,Y}^{M}} f\left(\varepsilon_{k,Y}^{i,M}\right)d\varepsilon_{k,Y}^{i,M}\right)dk\right)d\varepsilon_{j,X}^{i,M} \qquad (12)\end{aligned}$$

where, exploiting the properties of the exponential function, we have expressed the product of a generic sequence z_h as:

$$\prod_h z_h = \prod_h \exp\left(\ln\left(z_h\right)\right) = \exp \sum_h \left(\ln\left(z_h\right)\right)$$

The term $\int_{-\infty}^{\varepsilon_{j,X}^{i,M}+\delta_{j,X}^{M}-\delta_{k,Y}^{M}} f\left(\varepsilon_{k,Y}^{i,M}\right) d\varepsilon_{k,Y}^{i,M}$ is the cumulative distribution function (CDF) of $\varepsilon_{k,Y}^{i,M}$ up to the value $\varepsilon_{j,X}^{i,M} + \delta_{j,X}^{M} - \delta_{k,Y}^{M}$. Since $\varepsilon_{k,Y}^{i,M}$ is a Gumbel random variable, we have:

$$\begin{aligned}\int_{-\infty}^{\varepsilon_{j,X}^{i,M}+\delta_{j,X}^{M}-\delta_{k,Y}^{M}} f\left(\varepsilon_{k,Y}^{i,M}\right) d\varepsilon_{k,Y}^{i,M} &= \Pr\left(\varepsilon_{k,Y}^{i,M} < \varepsilon_{j,X}^{i,M} + \delta_{j,X}^{M} - \delta_{k,Y}^{M}\right) \\ &= \exp\left(-\exp\left(-\left[\varepsilon_{j,X}^{i,M} + \delta_{j,X}^{M} - \delta_{k,Y}^{M}\right]\right)\right)\end{aligned}$$

Replacing this value into (12) yields:

$$\begin{aligned}\Pr\left(j, X|i, M\right) &= \int_{-\infty}^{+\infty} f\left(\varepsilon_{j,X}^{i,M}\right) \exp\left(-\int_{k\neq j} \exp\left(-\left[\varepsilon_{j,X}^{i,M} + \delta_{j,X}^{M} - \delta_{k,X}^{M}\right]\right) dk\right. \\ &\quad \left. - \sum_{Y\neq X} \int_0^1 \exp\left(-\left[\varepsilon_{j,X}^{i,M} + \delta_{j,X}^{M} - \delta_{k,Y}^{M}\right]\right) dk\right) d\varepsilon_{j,X}^{i,M} \qquad (13)\end{aligned}$$

Also, the probability density function (PDF) of a Gumbel random variable is:

$$f\left(\varepsilon_{j,X}^{i,M}\right) = \exp\left(-\varepsilon_{j,X}^{i,M} - \exp\left(-\varepsilon_{j,X}^{i,M}\right)\right)$$

Plugging this expression into (13), and rearranging, we obtain:

$$\begin{aligned}\Pr\left(j, X|i, M\right) &= \int_{-\infty}^{+\infty} \exp\left(-\varepsilon_{j,X}^{i,M} - \exp\left(-\varepsilon_{j,X}^{i,M}\right)\left[1 + \int_{k\neq j} \exp\left(\delta_{k,X}^{M} - \delta_{j,X}^{M}\right) dk\right.\right. \\ &\quad \left.\left. + \sum\nolimits_{Y\neq X} \int_0^1 \exp\left(\delta_{k,Y}^{M} - \delta_{j,X}^{M}\right) dk\right]\right) d\varepsilon_{j,X}^{i,M} \\ &= \int_{-\infty}^{+\infty} \exp\Big(- \varepsilon_{j,X}^{i,M} - \exp\left(-\varepsilon_{j,X}^{i,M}\right) \\ &\quad \cdot \sum\nolimits_{Y=\{N,S,M\}} \int_0^1 \exp\left(\delta_{k,Y}^{M} - \delta_{j,X}^{M}\right) dk\Big) d\varepsilon_{j,X}^{i,M} \qquad (14)\end{aligned}$$

where in the last equation we have exploited the fact that $1 = \exp\left(0\right) = \exp\left(\delta_{j,X}^{M} - \delta_{j,X}^{M}\right)$.

Denote:

$$\varpi \equiv \sum_{Y=\{N,S,M\}} \int_0^1 \exp\left(\delta^M_{k,Y} - \delta^M_{j,X}\right) dk$$

and:

$$g\left(\varepsilon^{i,M}_{j,X}\right) \equiv \exp\left(-\varepsilon^{i,M}_{j,X} - \varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right)$$

Note that $g\left(\varepsilon^{i,M}_{j,X}\right)$ is the PDF of a Gumbel random variable with CDF:

$$\exp\left(-\varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right)/\varpi$$

since:

$$\begin{aligned} \frac{d \exp\left(-\varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right)/\varpi}{d\varepsilon} &= -\frac{\exp\left(-\varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right)}{\varpi}\left(-\varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right) \\ &= \exp\left(-\varepsilon^{i,M}_{j,X} - \varpi \exp\left(-\varepsilon^{i,M}_{j,X}\right)\right) = g\left(\varepsilon^{i,M}_{j,X}\right) \end{aligned}$$

Thus, we can use the last equation to rewrite (14) as:

$$\begin{aligned} \Pr\left(j, X | i, M\right) &= \frac{1}{\sum_{Y=\{N,S,M\}} \int_0^1 \exp\left(\delta^M_{k,Y} - \delta^M_{j,X}\right) dk} \\ &\quad \cdot \left[\exp\left(-\exp\left(-\varepsilon^{i,M}_{j,X}\right) \sum_{Y=\{N,S,M\}} \int_0^1 \exp\left(\delta^M_{k,Y} - \delta^M_{j,X}\right) dk\right)\right]^{+\infty}_{-\infty} \end{aligned}$$

where the term in square brackets vanishes since its limit value for $\varepsilon^{i,M}_{j,X} \to +\infty$ equals one, and for $\varepsilon^{i,M}_{j,X} \to -\infty$ equals zero. Finally, we multiply and divide by $\exp\left(\delta^M_{j,X}\right)$ to get:

$$\Pr\left(j, X | i, M\right) = \frac{\exp\left(\delta^M_{j,X}\right)}{\sum_{Y=\{N,S,M\}} \int_0^1 \exp\left(\delta^M_{k,Y}\right) dj}$$

Noting that country M has measure ψ_M, integrating over consumers (2) obtains.

A.2 Derivation of optimality conditions (4)-(6)

Differentiating (3) with respect to p, and setting the resulting expression equal to zero, yields:

$$\left[1-\alpha\left(p_{j,X}^{M}-w_X-\frac{q^2}{2A_X}\right)\right]\frac{\psi_M\exp\left(\theta^M q-\alpha p_{j,X}^{M}\right)}{\sum_{Y=\{M,N,S\}}\int_0^1\exp\left(\delta_{k,Y}^{M}\right)dk}=0$$

simplifying and rearranging, (4) straightforwardly obtains. Differentiating (3) with respect to q, and setting the resulting expression equal to zero, we get:

$$\left[-\frac{q_{j,X}^{M}}{A_X}+\theta^M\left(p-w_X-\frac{\left(q_{j,X}^{M}\right)^2}{2A_X}\right)\right]\frac{\psi_M\exp\left(\theta^M q_{j,X}^{M}-\alpha p\right)}{\sum_{Y=\{M,N,S\}}\int_0^1\exp\left(\delta_{k,Y}^{M}\right)dk}=0$$

Simplifying this expression returns:

$$\frac{q_{j,X}^{M}}{A_X}=\theta^M\left(p-w_X-\frac{\left(q_{j,X}^{M}\right)^2}{2A_X}\right)$$

Using (4) to substitute for $p=p_{j,X}^{M}$, simplifying and rearranging leads immediately to (5). Finally, plugging (4) into the definition of $\delta_{j,X}^{M}$, we have:

$$\delta_{j,X}^{M}=q_{j,X}^{M}\left(\theta^M-\frac{\alpha}{2A_X}q_{j,X}^{M}\right)-1-\alpha w_X$$

Then, using (5) to substitute for $q_{j,X}^{M}$, and rearranging, we get (6).

B Additional tables

Table 6. Summary of benchmark estimation results: price and nest coefficients.

	mean	1st quartile	median	3rd quartile
OLS				
price coefficient	-0.003	-0.003	0.000	0.000
price coefficient, p-value	0.064	0.000	0.000	0.003
nest coefficient	0.878	0.861	0.901	0.932
nest coefficient, p-value	0.000	0.000	0.000	0.000
observations per equation	27,570	4,981	15,887	35,586
R2	0.81	0.76	0.81	0.86
Share of equations with negative and significant price coefficient			83%	
No. of equations			156	
IV1 (non-variety specific instruments)				
price coefficient	-0.074	-0.079	-0.010	-0.001
price coefficient, p-value	0.183	0.000	0.042	0.283
nest coefficient	0.469	-0.008	0.671	0.979
nest coefficient, p-value	0.165	0.000	0.006	0.236
overidentifying restrictions, p-value	0.309	0.000	0.142	0.616
observations per equation	26,922	5,203	15,600	34,281
R2	0.35	0.08	0.29	0.58
Share of equations with negative and significant price coefficient			53%	
No. of equations			156	
IV2 (full set of instruments: non-variety and variety specific instruments)				
price coefficient	-0.014	-0.010	-0.003	0.000
price coefficient, p-value	0.190	0.000	0.009	0.366
nest coefficient	0.652	0.496	0.851	1.017
nest coefficient, p-value	0.046	0.000	0.000	0.000
overidentifying restrictions, p-value	0.111	0.000	0.000	0.023
observations per equation	22,294	4,182	13,254	28,558
R2	0.57	0.46	0.63	0.73
Share of equations with negative and significant price coefficient			59%	
No. of equations			156	
Hausman Test , p-value	0.731	0.443	0.999	1.000

Note: the table reports several moments of the distribution of the estimates of the coefficients of price and nest term (computed as the variety import share for a given product), based on 189 separate demand functions, one for each NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The log of importer's per capita GDP is included as a regressor, along with other determinants of quality, namely: variety, year and importer effects. The component of quality measure unrelated to income is estimated as the sum of these three effects plus the error term. Each panel of the table refers to a different set of regressions: the top panel summarizes the results obtained using the ordinary least square (OLS) estimator; the mid panel those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the bottom panel those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). The Hansen-Sargan test is used to assess the over-identifying restrictions. The Hausman test assesses the validity of the full set of instruments. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 7. Benchmark estimation results: coefficients of log GDP by 4-digit sector.

Sector (NACE-4)	OLS	IV1	IV2	Sector (NACE-4)	OLS	IV1	IV2
1411	2.221 ***	-3.774	1.599 ***	**2630**	9.164 ***	1.551	9.803 ***
1422	-0.595	-0.579	-1.643 *	**2651**	-8.270 ***	-9.463 ***	-7.875 ***
1512	4.901 ***	0.106	-1.801	**2652**	9.771 ***	12.372 ***	9.858 ***
1520	0.535 ***	0.078	0.484 *	**2653**	8.730 ***	9.058 ***	7.770 ***
1541	-2.371 ***	-7.440 ***	-8.403 ***	**2660**	5.071 ***	1.675	4.794 ***
1542	-0.344	1.098	-0.040	**2661**	3.445 ***	-1.539	1.259
1570	4.550 ***	4.312 ***	7.708 ***	**2662**	-0.798	0.455	0.467
1572	5.367 ***	5.606 ***	5.788 ***	**2663**	19.678 ***	16.172 **	28.237 ***
1581	5.980 ***	5.761 ***	5.871 ***	**2664**	6.938 ***	5.841 ***	7.014 ***
1582	-4.881 ***	-5.115 ***	-3.116 ***	**2665**	-5.294 ***	0.048	-3.482 **
1584	0.806 ***	-0.450	0.878 ***	**2666**	-9.924 ***	-13.984	-10.483 ***
1585	-5.971 ***	-4.795 ***	-5.112 ***	**2670**	0.925 ***	0.757	0.568 **
1586	2.634 ***	2.710 ***	2.920 ***	**2710**	-4.301 ***	-4.163 *	-5.753 ***
1587	-0.708 **	-1.580	-1.489 *	**2721**	-1.629 ***	-1.132	-2.071 ***
1588	8.812 ***	8.650 ***	7.224 ***	**2722**	3.200 ***	7.231 ***	2.821 ***
1591	-4.391 ***	-13.315 ***	-12.001 ***	**2731**	5.709 ***	4.261 ***	3.421 ***
1592	-4.343 ***	-3.693	-3.998 **	**2732**	-2.081 ***	3.012	-2.614
1593	30.623 ***	26.503 ***	29.984 ***	**2733**	-1.559 ***	-0.887	-2.029 *
1594	2.782 ***	2.749	4.545 ***	**2734**	-0.799 ***	-3.158	-0.565 **
1595	10.057 ***	24.122	11.882	**2741**	10.005 ***	8.330 ***	6.525
1596	5.491 ***	-0.434	2.006 *	**2742**	2.957 ***	2.430 **	3.013 ***
1597	-6.776 ***	-12.182 **	-8.124 ***	**2743**	0.377	-1.514	-2.496
1598	3.280 ***	4.082 ***	3.625 ***	**2811**	-0.062	0.231	0.450
1600	-3.523 ***	-3.595 ***	-3.697 ***	**2812**	5.299 ***	4.641 ***	5.868 ***
1710	5.965 ***	6.815 ***	5.678 ***	**2821**	2.697 ***	0.801	3.244 ***
1720	5.906 ***	7.173 ***	6.295 ***	**2862**	2.324 ***	3.683 ***	2.585 ***
1740	4.517 ***	3.915 ***	4.199 ***	**2871**	6.430 ***	6.312 ***	6.391 ***
1751	2.478 ***	2.611 ***	2.744 ***	**2872**	3.494 ***	3.700 ***	3.554 ***
1753	-0.015	-0.204	0.179	**2873**	-1.545 ***	10.002	-1.430 ***
1760	0.555 ***	1.890	1.921 ***	**2874**	0.518 ***	3.020 *	0.747 ***
1772	8.611 ***	8.992 ***	8.925 ***	**2875**	0.235 ***	-0.366	0.120
1810	1.708 ***	1.860 ***	1.723 ***	**2911**	4.114 ***	3.857 ***	5.016 ***
1821	8.254 ***	7.458 ***	7.100 ***	**2912**	9.208 ***	8.378 ***	8.382 ***
1822	0.531 ***	-0.963 ***	0.018	**2921**	-0.421	-2.716 *	-0.958 ***
1823	12.483 ***	13.032 ***	12.771 ***	**2923**	4.271 ***	3.533 **	4.229 ***
1824	3.325 ***	4.589 ***	3.393 ***	**2931**	2.964 ***	0.268	0.495
1830	-10.572 ***	-12.563 ***	-11.695 ***	**2941**	6.835 ***	6.549 ***	6.909 ***
1910	6.521 ***	13.861 ***	8.636 ***	**2942**	-1.121 ***	-2.391 *	-1.069 ***
1920	2.850 ***	3.286 ***	2.993 ***	**2951**	-2.546 ***	-0.431	-2.153 ***
1930	2.812 ***	1.747 ***	2.742 ***	**2952**	1.109 ***	-1.198	-0.190
2030	0.012	1.698	1.146	**2953**	-3.273 ***	-8.085 *	-3.268 ***
2040	0.635 *	2.103 ***	1.657 ***	**2954**	0.819 ***	0.143	0.529 ***
2052	6.382 ***	5.393 ***	6.140 ***	**2972**	0.146	-0.637	-0.572
2121	0.935 ***	0.920 ***	1.081 ***	**3001**	-4.219 ***	-5.969 ***	-5.288 ***
2122	-2.157 ***	-2.207 ***	-2.002 ***	**3002**	-8.959 ***	-10.582 ***	-10.141 ***
2123	0.974 **	-1.761	-2.424	**3120**	-0.052	0.276	-0.096
2124	8.527 ***	7.304 ***	9.776 ***	**3130**	20.084 ***	18.971 ***	19.448 ***
2125	1.509 ***	1.909 **	1.568 ***	**3140**	-12.637 ***	-17.434 ***	-15.083 ***
2222	0.970 ***	1.039 ***	1.045 ***	**3150**	1.753 ***	-0.157	0.980 ***
2224	-4.052 ***	-2.808	-3.725 ***	**3161**	2.295 ***	2.691 ***	2.112 ***
2411	4.694 ***	1.276	1.251	**3162**	-3.463 ***	-3.825 ***	-3.728 ***
2412	-0.462 ***	-0.178	-0.604 ***	**3210**	1.642 ***	-5.703	2.420 ***
2430	1.357 ***	1.656 ***	1.269 ***	**3220**	1.456 ***	1.379 ***	1.117 *
2441	8.829 ***	2.770	8.229 ***	**3230**	22.391 ***	20.475 ***	21.715 ***
2442	5.621 ***	10.791	6.671 ***	**3310**	-2.106 ***	-1.511	-2.891 ***
2451	3.519 ***	5.154 ***	3.562 ***	**3320**	1.351 ***	3.073 ***	1.520 ***
2452	2.817 ***	4.393 ***	2.827 ***	**3340**	1.107 ***	0.806	1.156 ***
2461	4.249 ***	5.474 *	6.294	**3410**	2.152 ***	3.830 ***	2.797 ***
2462	-2.077 ***	-2.482	-1.873 ***	**3430**	9.396 ***	9.603 ***	9.648 ***
2463	-0.083	-1.148	-1.358	**3511**	-7.119 ***	7.025	-8.730 ***
2464	-2.677 ***	-5.075	-2.605 ***	**3512**	7.165 ***	7.720 ***	7.482 ***
2466	-1.653 ***	0.353	0.572	**3530**	-14.404 ***	-15.963 ***	-14.091 ***
2511	4.549 ***	4.483 ***	4.478 ***	**3541**	1.762 ***	0.897	1.075 **
2512	6.836 ***	-6.832	-1.225	**3542**	-7.089 ***	-7.744 ***	-7.008 ***
2521	1.005 ***	-2.465	0.763 ***	**3543**	-3.376 ***	-2.663 ***	-2.726 ***
2522	-2.449 ***	-3.158 ***	-3.151 ***	**3550**	1.784 ***	0.525	1.443 ***
2524	2.625 ***	2.697 ***	2.608 ***	**3611**	-0.825 ***	0.658	-0.873 ***
2611	4.960 ***	2.789 **	4.757 ***	**3612**	-8.141 ***	-8.341 ***	-8.100 ***
2612	4.707 ***	3.096 ***	3.695 ***	**3613**	-0.951 ***	-5.353	-1.725 ***
2613	0.724 *	-2.523 **	-2.127 *	**3614**	-0.912 ***	-3.516 *	-0.898 ***
2614	4.316 ***	6.525 ***	5.679 ***	**3615**	7.277 ***	20.594	7.034 ***
2621	3.247 ***	3.638 ***	3.504 ***	**3630**	-8.872 ***	-9.392 ***	-8.506 ***
2622	9.590 ***	9.191 ***	9.327 ***	**3640**	2.554 ***	2.328 ***	2.432 ***
2623	-5.933 ***	-5.939 ***	-5.907 ***	**3650**	1.254 ***	-4.489 **	-0.469
2624	16.053 ***	-4.483	-6.477	**3662**	0.928 ***	0.649 **	0.631 **
2625	15.751 ***	10.478 *	15.206 ***	**3663**	-1.430 ***	-1.839 ***	-1.787 ***
2626	4.364 ***	6.861 ***	4.174 ***	**3999**	6.063 ***	1.627	6.368 ***

Note: the table reports the estimated coefficients of the log of importer's per capita GDP for each demand function at NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The variety unit value and a nest term (computed as the variety import share for a given product) are included as regressors, along with other determinants of quality, namely: variety, year and importer effects. The component of quality measure unrelated to income is estimated as the sum of these three effects plus the error term. Each column of the table refers to a different set of regressions: the left column summarizes the results obtained using the ordinary least square (OLS) estimator; the mid column those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the right column those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). Asterisks denote level of significance of the null hypothesis (coeff = 0) of 10% (*), 5% (**) or 1% (***). **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 8. Summary of estimation results with Linder term: price and nest coefficients.

	mean	1st quartile	median	3rd quartile
OLS				
price coefficient	-0.003	-0.003	0.000	0.000
price coefficient, p-value	0.065	0.000	0.000	0.003
nest coefficient	0.898	0.869	0.905	0.936
nest coefficient, p-value	0.000	0.000	0.000	0.000
observations per equation	26,177	4,397	15,146	33,836
R2	0.81	0.76	0.81	0.86
Share of equations with negative and significant price coefficient			62%	
No. of equations			156	
IV1 (non-variety specific instruments)				
price coefficient	-0.090	-0.076	-0.010	-0.001
price coefficient, p-value	0.237	0.001	0.085	0.422
nest coefficient	0.246	-0.123	0.592	1.000
nest coefficient, p-value	0.192	0.000	0.030	0.326
overidentifying restrictions, p-value	0.341	0.000	0.176	0.704
observations per equation	26,436	5,077	15,348	33,798
R2	0.32	0.06	0.23	0.54
Share of equations with negative and significant price coefficient			39%	
No. of equations			156	
IV2 (full set of instruments: non-variety and variety specific instruments)				
price coefficient	-0.013	-0.010	-0.002	0.000
price coefficient, p-value	0.213	0.000	0.048	0.419
nest coefficient	0.524	0.159	0.824	1.035
nest coefficient, p-value	0.087	0.000	0.000	0.023
overidentifying restrictions, p-value	0.126	0.000	0.000	0.070
observations per equation	21,888	4,037	13,060	28,173
R2	0.50	0.22	0.55	0.72
Share of equations with negative and significant price coefficient			55%	
No. of equations			156	
Hausman Test , p-value	0.733	0.392	0.998	1.000

Note: the table reports several moments of the distribution of the estimates of the coefficients of price and nest term (computed as the variety import share for a given product), based on 189 separate demand functions, one for each NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The log of importer's per capita GDP and a Linder term (computed as the absolute value of the difference in per capita GDP between importer and exporter) are included as regressors, along with other determinants of quality, namely: variety, year and importer effects. The component of quality measure unrelated to income is estimated as the sum of these three effects plus the error term. Each panel of the table refers to a different set of regressions: the top panel summarizes the results obtained using the ordinary least square (OLS) estimator; the mid panel those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the bottom panel those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). The Hansen-Sargan test is used to assess the over-identifying restrictions. The Hausman test assesses the validity of the full set of instruments. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 9. Summary of estimation results without GDP regressor: price and nest coefficients.

	mean	1st quartile	median	3rd quartile
OLS				
price coefficient	-0.003	-0.003	-0.001	0.000
price coefficient, p-value	0.059	0.000	0.000	0.002
nest coefficient	0.898	0.865	0.904	0.936
nest coefficient, p-value	0.000	0.000	0.000	0.000
observations per equation	27,060	4,690	15,629	34,576
R2	0.80	0.74	0.80	0.86
Share of equations with negative and significant price coefficient			82%	
No. of equations			156	
IV1 (non-variety specific instruments)				
price coefficient	-0.103	-0.105	-0.014	-0.001
price coefficient, p-value	0.215	0.000	0.068	0.347
nest coefficient	0.457	0.123	0.671	0.997
nest coefficient, p-value	0.162	0.000	0.013	0.253
overidentifying restrictions, p-value	0.351	0.001	0.189	0.741
observations per equation	26,922	5,205	15,600	34,281
R2	0.33	0.08	0.25	0.55
Share of equations with negative and significant price coefficient			50%	
No. of equations			156	
IV2 (full set of instruments: non-variety and variety specific instruments)				
price coefficient	-0.014	-0.010	-0.002	0.000
price coefficient, p-value	0.206	0.000	0.035	0.399
nest coefficient	0.628	0.478	0.824	1.013
nest coefficient, p-value	0.070	0.000	0.000	0.006
overidentifying restrictions, p-value	0.111	0.000	0.000	0.017
observations per equation	22,294	4,182	13,254	28,558
R2	0.54	0.39	0.62	0.73
Share of equations with negative and significant price coefficient			57%	
No. of equations			156	
Hausman Test , p-value	0.758	0.602	0.999	1.000

Note: the table reports several moments of the distribution of the estimates of the coefficients of price and nest term (computed as the variety import share for a given product), based on 189 separate demand functions, one for each NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. Regressors also include the determinants of quality, namely: variety, year and importer effects (and do NOT include an importer GDP term). Quality is estimated as the sum of these three effects plus the error term. Each panel of the table refers to a different set of regressions: the top panel summarizes the results obtained using the ordinary least square (OLS) estimator; the mid panel those obtained with an instrumental variable estimator using a subset of non-variety specific instruments only (IV1); the bottom panel those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). The Hansen-Sargan test is used to assess the over-identifying restrictions. The Hausman test assesses the validity of the full set of instruments. **Source:** authors' calculations based on the dataset described in Section 3.1.

Table 10. Regressions of quality measures on importer's log GDP by 4-digit sector.

Sector (NACE-4)	OLS	IV1	IV2	Sector (NACE-4)	OLS	IV1	IV2
1411	1.575 ***	1.650 ***	1.651 ***	**2626**	0.846 ***	0.462 *	0.776 ***
1422	1.407 ***	0.958 ***	1.015 ***	**2630**	3.818 ***	3.948 ***	3.772 ***
1512	0.232 ***	-1.170 ***	-1.363 ***	**2651**	0.454 *	0.854 **	0.422
1520	-0.757 ***	-1.402 ***	-1.425 ***	**2652**	1.405 ***	-2.191 ***	0.894 **
1541	0.127	-3.969 ***	-3.136 ***	**2653**	2.514 ***	3.057 ***	2.666 ***
1542	0.956 ***	11.775 ***	5.739 ***	**2660**	2.212 ***	0.928	2.082 ***
1570	2.386 ***	1.389 ***	2.807 ***	**2661**	1.666 ***	1.313 **	1.218 ***
1572	0.285	0.348	0.204	**2662**	1.223 ***	1.539 ***	1.395 ***
1581	1.421 ***	1.053 ***	1.358 ***	**2663**	2.136 **	0.778	1.926 *
1582	0.696 ***	-8.855 ***	3.115 ***	**2664**	1.357 ***	0.557	1.390 ***
1584	0.632 ***	0.704 ***	0.740 ***	**2665**	-1.191 ***	-0.418	-0.966 ***
1585	1.998 ***	1.725 ***	1.666 ***	**2666**	0.315 **	0.788 ***	0.895 ***
1586	-0.078	0.571 **	1.029 ***	**2670**	2.476 ***	2.538 ***	2.766 ***
1587	1.172 ***	2.054 ***	0.522 ***	**2710**	-0.451 ***	-1.592 ***	-1.941 ***
1588	1.912 ***	1.293 ***	1.727 ***	**2721**	0.021	-0.073	-0.175 *
1591	1.323 ***	0.438	0.660 **	**2722**	1.639 ***	1.601 ***	1.482 ***
1592	1.647 ***	1.831 ***	1.726 ***	**2731**	1.116 ***	-0.469 *	-0.951 ***
1593	5.778 ***	4.844 ***	5.027 ***	**2732**	-1.097 ***	-2.810 ***	-3.049 ***
1594	0.558 ***	0.853 ***	0.689 ***	**2733**	2.305 ***	2.889 ***	1.628 ***
1595	4.269 ***	5.087 ***	4.556 ***	**2734**	0.949 ***	0.456 ***	0.896 ***
1596	-0.507 ***	-0.950 ***	-0.513	**2741**	-1.898 ***	-2.434 ***	-2.418 ***
1597	-1.576 ***	-1.813 ***	-2.076 ***	**2742**	0.730 ***	-1.501 ***	1.050 ***
1598	1.980 ***	2.664 ***	2.316 ***	**2743**	0.925 ***	-3.468 ***	-0.649 ***
1600	2.459 ***	4.715 ***	0.704	**2811**	2.180 ***	2.849 ***	2.362 ***
1710	1.926 ***	-0.821 ***	0.616 ***	**2812**	0.522 ***	0.526 ***	0.580 ***
1720	2.360 ***	2.129 ***	1.798 ***	**2821**	1.036 ***	1.248 ***	1.249 ***
1740	1.669 ***	0.746 ***	1.511 ***	**2862**	0.988 ***	0.932 ***	1.292 ***
1751	-0.548 ***	-0.531 ***	-0.254 ***	**2871**	1.240 ***	1.209 ***	1.378 ***
1753	0.076	-0.429 ***	0.056	**2872**	0.000	0.245 **	0.025
1760	-0.128 **	-4.962 ***	-3.201 ***	**2873**	0.367 ***	-0.424	0.091 *
1771	4.197 ***	-6.506	-0.776	**2874**	0.864 ***	0.018	1.051 ***
1772	2.340 ***	1.659 ***	1.733 ***	**2875**	-0.037	-0.677 ***	-0.173 ***
1810	0.072	0.053	0.056	**2911**	0.238 ***	-0.813 ***	-0.517 ***
1821	-1.204 ***	-1.385 ***	-1.014 ***	**2912**	1.042 ***	0.732 ***	0.750 ***
1822	2.388 ***	1.109 ***	1.806 ***	**2921**	-0.447 ***	-1.081 ***	-0.676 ***
1823	1.547 ***	2.231 ***	2.621 ***	**2923**	1.173 ***	1.075 ***	1.406 ***
1824	-0.106 ***	-1.446 ***	-0.565 ***	**2931**	0.739 ***	1.709 ***	0.817 **
1830	2.798 ***	1.420 ***	2.063 ***	**2941**	-1.154 ***	-1.735 ***	-1.278 ***
1910	6.120 ***	8.365 ***	6.170 ***	**2942**	-0.401 ***	-0.639 ***	-0.623 ***
1920	0.028	-0.254 ***	-0.359 ***	**2951**	-1.232 ***	-1.435 ***	-1.603 ***
1930	0.701 ***	0.418 ***	0.618 ***	**2952**	-1.200 ***	-1.380 ***	-1.498 ***
2030	0.266 ***	-0.887 ***	-1.140 ***	**2953**	0.037	-0.962 ***	-0.379 ***
2040	0.302 ***	0.872 ***	0.694 ***	**2954**	-0.283 ***	-0.790 ***	-0.741 ***
2052	0.777 ***	-0.230	0.403 ***	**2972**	-0.284 ***	-0.315 **	-0.464 ***
2111	-0.476	-0.508	-0.389	**3001**	-0.134	-0.124	-0.071
2121	1.094 ***	2.313 ***	1.206 ***	**3002**	1.003 ***	0.218	0.567 ***
2122	1.667 ***	1.288 ***	1.948 ***	**3120**	-0.559 ***	-2.371 ***	-0.629 ***
2123	3.900 ***	1.000	0.825 *	**3130**	-0.865 ***	-2.430 ***	-1.578 ***
2124	-0.306	-0.717 **	0.160	**3140**	1.371 ***	1.082 ***	0.755 ***
2125	1.498 ***	0.000	1.190 ***	**3150**	0.715 ***	0.171	0.009
2222	0.375 ***	0.539 ***	0.546 ***	**3161**	0.774 ***	0.865 ***	0.795 ***
2224	0.197	1.031 ***	0.772 ***	**3162**	0.616 ***	0.376 ***	0.211 **
2411	0.684 ***	-0.078	-0.320	**3210**	-0.994 ***	-1.221 ***	-2.091 ***
2412	-0.613 ***	-0.369 ***	-0.565 ***	**3220**	0.157	0.133	0.122
2430	0.702 ***	1.041 ***	0.910 ***	**3230**	-2.337 ***	-5.005 ***	-5.175 ***
2441	-1.598 ***	1.178	-1.826 ***	**3310**	-3.295 ***	-4.354 ***	-3.673 ***
2442	-1.494 ***	-2.665 ***	-1.863 ***	**3320**	-0.737 ***	-1.318 ***	-1.013 ***
2451	0.991 ***	-0.027	1.088 ***	**3340**	-0.829 ***	-1.613 ***	-1.684 ***
2452	1.228 ***	-1.527 ***	1.188 ***	**3410**	1.555 ***	2.114 ***	2.147 ***
2461	2.394 ***	3.082 ***	2.064 ***	**3430**	1.612 ***	1.707 ***	1.744 ***
2462	0.064	0.133	0.101	**3511**	5.458 ***	-0.097	5.147 ***
2463	0.294 ***	-4.013 ***	-6.474 ***	**3512**	-4.061 ***	-4.166 ***	-4.293 ***
2464	-0.045	-1.490 *	-1.169 ***	**3530**	-3.140 ***	-6.287 ***	-5.591 ***
2466	0.327 ***	0.364 **	1.158 ***	**3541**	2.359 ***	2.719 ***	2.686 ***
2511	-0.512 ***	-0.455 ***	-0.503 ***	**3542**	1.777 ***	1.614 ***	1.586 ***
2512	0.437 **	0.415	0.078	**3543**	2.207 ***	2.217 ***	2.272 ***
2521	-0.018	-1.787 ***	-0.564 ***	**3550**	2.076 ***	0.406 **	1.696 ***
2522	0.618 ***	-0.006	-0.101	**3611**	2.177 ***	3.316 ***	2.440 ***
2524	0.802 ***	0.970 ***	0.945 ***	**3612**	-0.101	-0.024	-0.129 *
2611	-2.038 ***	-1.326 ***	-1.678 ***	**3613**	1.258 ***	-3.656	0.906 ***
2612	1.219 ***	1.169 ***	1.079 ***	**3614**	2.350 ***	1.099 ***	2.253 ***
2613	-0.898 ***	0.294	0.430 **	**3615**	1.627 ***	-0.234	1.874 ***
2614	2.150 ***	4.126 ***	3.265 ***	**3630**	-0.179 ***	-0.054	-0.029
2621	0.481 ***	0.744 ***	0.604 ***	**3640**	-0.867 ***	-0.820 ***	-0.847 ***
2622	3.182 ***	2.353 ***	3.095 ***	**3650**	-1.387 ***	-4.657 ***	-5.107 ***
2623	0.345 ***	0.205 **	0.478 ***	**3662**	1.271 ***	1.006 ***	1.085 ***
2624	-1.934 ***	-0.966	-1.542 *	**3663**	0.727 ***	0.599 ***	0.439 ***
2625	5.388 ***	1.882 ***	3.894 ***	**3999**	2.123 ***	1.235 ***	2.844 ***

Note: the table reports the estimated coefficients of the log of importer's per capita GDP for each demand function at NACE 4-digit sector. The dependent variable is the log of the variety market share in a given sector. A variety is defined as a product (according to the NACE 8-digit classification) imported from a given country. The variety unit value, a nest term (computed as the variety import share for a given product), and a Linder term (computed as the absolute value of the difference in per capita GDP between importer and exporter) are included as regressors, along with other determinants of quality, namely: variety, year and importer effects (and do NOT include an importer GDP term). Quality is estimated as the sum of these three effects plus the error term. Each column of the table refers to a different set of regressions: the left column summarizes the results obtained using the ordinary least square (OLS) estimator; the mid column those obtained with an instru- mental variable estimator using a subset of non-variety specific instruments only (IV1); the right column those obtained with an instrumental variable estimator using the full set of variety and non-variety specific instruments (IV2). Asterisks denote level of significance of the null hypothesis (coeff = 0) of 10% (*), 5% (**) or 1% (***). **Source:** authors' calculations based on the dataset described in Section 3.1.

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