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Vincenzo Merella

Josef Taušer

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Vincenzo Merella† Josef Taušer‡

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Abstract

In the last two decades, initiatives promoted by the media and national public officials of several European former centrally planned (FCP) countries have induced the EU to produce inquiries, reports, and directives regarding products' price and quality differentials between FCP and non-FCP markets. From a theoretical standpoint, the FCP countries' concern involves market segmentation and pricing-to-market. We investigate this issue empirically by examining custom data. We find that such differentials exist and can be rationalized by standard international trade theories. In particular, analogous evidence obtains by inspecting intra-EU trade and when the analysis is extended to exporters worldwide, showing that the matter is global and does not pertain solely to EU producers. Therefore, our findings suggest that the FCP countries' concerns may be unwarranted.

JEL Classification: F10, F40, P20.

Keywords: EU, Former Centrally Planned Countries, Import Composition, International Trade, Market Segmentation, Pricing-to-market.

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†VŠE, Prague; University of Cagliari; and BCAM, University of London. Address: W. Churchilla 1938/4, 130 67 Prague 3, Czech Republic. Email: merella@unica.it.

‡VŠE, Prague. Address: W. Churchilla 1938/4, 130 67 Prague 3, Czech Republic. Email: josef.tauser@vse.cz.

1 Introduction

In the wake of the 1989 events that culminated with the dissolution of the Soviet Union, several European former centrally planned (FCP) countries engaged in the transition to a market economy. After a decade of economic turbulence, the transition began to stabilize. Eleven FCP countries negotiated membership and eventually joined the European Union. The media and political attention turned from the initial concerns regarding the new institutional design and the massive privatization of state-owned assets to political affairs related to the accession to an integrated economic area. One matter that caught the public interest was the quality of goods supplied to FCP countries by existing EU members, chiefly the neighboring Austria and Germany. The pioneering initiatives promoted by single countries (especially those belonging to the Visegrád Group) opened the way for several inquiries, reports, and directives within the EU. These political actions lasted for nearly ten years and led to extensive media coverage, which occasionally escalated to speculations about producers' and retailers' potentially discriminatory conduct towards consumers of the newly incorporated FCP countries.[1]

Despite the clamor, economists have paid little attention to this issue. The FCP countries' concern involves allegedly aggressive *market segmentation* and *pricing-to-market*; strategies used by exporters to adjust their products' quality levels and prices to demand in the importing country depending on the stability of local economic conditions and the competition faced in the destination market. While several authors analyze these strategies, to our best knowledge, no contribution systematically investigates whether (i) goods' price and quality differentials exist between FCP and non-FCP markets, nor whether such differentials (ii) represent deviations from standard international trade theories and (iii) a distinctive feature of the EU.[2] We aim to fill this knowledge gap by examining custom data disaggregated at the product level. The first set of exercises focuses on trade flows between EU members. We find a robust discrepancy in prices and quality levels of imports and argue that the typical producers' strategies can explain such discrepancies. We then repeat our analysis after extending the dataset to the whole set of available exporters around the globe and show that the matter is global and does not hinge on producers being located in the EU. Therefore, our findings suggest that the FCP countries' concerns may be unwarranted.

The fundamental mechanism that generates the observed quality differentials is driven by consumers seeking foreign goods to find a better match to their ideal price-to-quality ratio than domestic goods. The mechanism draws on the link between consumer income and product quality.[3] A large gap exists

[1] These actions resulted in intensive discussions within the European Commission and the European Parliament, which eventually approved an amendment to the Unfair Commercial Practices Directive in 2019 to address this issue. See Item [29] in the Webpage List.

[2] Market segmentation typically concerns the nonhomothetic behavior of demand along the quality dimension and results in selecting specific products to ship to each destination country (see, e.g., Goldberg and Verboven, 2005; Flach, 2016; Rodrigue and Tan, 2019). Pricing-to-market chiefly relates to competition elements and results in adjusting prices to the particular markets to which exporters supply their products (see, e.g., Atkeson and Burstein, 2008; Simonovska, 2015; Arkolakis, Costinot, Donaldson and Rodríguez-Clare, 2019).

[3] Theoretical foundations on the link between product quality and importer income can be found, e.g., in Fajgelbaum, Grossman and Helpman (2011) and Jaimovich and Merella (2012, 2015). For seminal work on investigating the relationship empirically, see Schott (2004), Hallak (2006), and Verhoogen (2008). See also Feenstra and Romalis (2014) and Merella and Santabarbara (2016) for refined methods considering supply-side heterogeneity.

in per-capita GDP between FCP and non-FCP countries.[4] The consequence of this income disparity is that consumers in the two sets of countries pursue different product quality levels, both locally and in the international markets.[5] This event enables producers' market segmentation strategies.[6] As a result, the quality of imports in FCP countries is lower in absolute terms and higher relative to the quality of their local goods. This implication is in line with the "shipping the good apples out" paradigm (Hummels and Skiba, 2004) and the evidence of stronger trade intensity between countries at a similar stage of development (Choi, Hummels and Xiang, 2009; Fieler, 2011).

Using custom data has several advantages, ranging from the number of countries to the large set and granular disaggregation level of products included in the dataset. Product heterogeneity, however, also represents an obstacle when comparing prices and quality levels across goods. We mitigate this issue by anchoring prices and qualities of imports to their domestic counterparts. Specifically, as typical in the international trade literature, we first let a good's *variety* be identified by the pair exporter-product, its *unit value* by the ratio of bilateral trade's value to volume, and its *quantitative market share* as the ratio of bilateral to total trade's volume. Then, we express both variables in relative terms to their domestic counterparts. We also define a dichotomic variable for *FCP importers*.

We preliminarily examine price differentials by studying the association between relative unit values and the FCP importer dummy. Our results show that the relative unit value differential between FCP and non-FCP countries is positive and statistically significant. We may also interpret the finding as indicating the presence of product quality differential since previous evidence on quality differentiation has relied chiefly on unit values as a proxy of quality. However, unit values disallow to discern between prices and quality levels associated with goods' varieties, preventing the analysis of these two variables' correlation that would help detect the presence of dual pricing and thereby foster or lessen FCP countries' concerns. We measure product quality levels as relative quantitative market share residuals after controlling for unit values to reduce the potential impact of pricing-to-market on the proxy for product quality. Once again, we observe a positive and significant relationship between the quality measure and the FCP importer dummy, even when restricting the set of exporters to FCP countries. Similar results are obtained on a yearly basis and on pooled datasets comprising disjoint time-spans and on an extended dataset including all exporters worldwide.

A simple model guides our empirical exercises. Developing the model is worthwhile since we depart from the literature in expressing the imported varieties' quantitative market shares relative to the domestic one. The model is a version of the demand-side frameworks featured in, e.g., Khandelwal, Schott and Wei (2013) and Jaimovich, Madzharova and Merella (2021), adapted to a structure comprising two sets of countries (FCP and non-FCP). The quantitative market shares, which we use jointly with unit values to construct the quality measures, are derived from representative households' demand schedules

[4] In the data (period 2000-2002), the average per-capita GDP in FCP (respectively, non-FCP) EU members is €16,051 (resp., €41,846).

[5] Evidence showing that *import* prices correlate with the *importer*'s income per head indicates that FCP countries may source cheaper goods abroad. Likewise, complementary empirical findings on the correlation between *export* prices and *exporter*'s income per head suggest that the FCP domestic basket's composition varies similarly to the import basket. See, e.g., Hummels and Klenow (2005), Bastos and Silva (2010), and Manova and Zhang (2012). Indeed, we find that both import and domestic prices behave consistently with these observations (see Table 1 below).

[6] In the presence of heterogeneous levels of competition faced across different importers, pricing-to-market surfaces as an exporter's strategy along with market segmentation.

in a standard fashion. We assume that domestic products are nested within goods so that a domestic variety exists for each set of imported varieties. This feature allows us to write each imported variety's relative quantitative market share as a function of relative unit values and relative product quality. The product quality differential is identified as part of the quality measure by the FCP importer dummy after controlling for variety fixed effects to capture demand features for specific products sourced from distinct exporters and year fixed effects to control for time variations in the (common) EU demand patterns.

We use two sets of price elasticities estimations to compute the quality measures. The first set, produced by Broda, Greenfield and Weinstein (2006), provides price elasticity estimates for 73 countries worldwide. Since these estimations directly cover most of the importers in our dataset, we use this set for our benchmark exercises. The second set, produced by Broda and Weinstein (2006), comprises price elasticities estimated on US data and conveniently supplied at a more disaggregated level. We use the second set for our robustness exercises. Both sets of estimates are well-established, primarily because the authors conscientiously deal with the endogeneity issues that arise when bringing demand-based regression equations to the data due to producers simultaneously choosing goods' prices and quality levels.

The structure of the paper is as follows. The remaining of this section provides motivational evidence in terms of observed unit value differentials between FCP and non-FCP markets. Section 2 presents a simple model, used to obtain our regression equation. Section 3 describes the data and discusses the estimation strategy. Section 4 illustrates our empirical results, and Section 5 concludes.

Motivational evidence

Shortly after the accession to the European Union, consumers of several FCP members experienced a rising perception of differences in quality levels between the goods sold in their domestic markets and those supplied to non-FCP countries. This sentiment was revealed by several surveys and consequently investigated by FCP nations' official bodies in collaboration with research institutions, focusing on product composition.[7] The issue was investigated by country representatives at the national and EU level and resulted in changes in EU legislation followed by respective studies released by the European Commission.[8] The discussion also extended to the difference in prices of identical products sold in FCP and non-FCP countries.[9]

This subsection offers descriptive evidence based on intra-EU unit value differentials of imported varieties reaching FCP markets relative to those destined for other EU members. A variety is defined as a given product sourced from a specific exporter. The unit value of a variety is calculated as the ratio of value to volume of the relevant bilateral trade flow. The dataset used to perform the exercises presented here is the same as that employed later for our empirical analysis. Its implementation is described in Section 3. We also produce a stylized framework to guide the results' interpretation. The framework is described in Appendix A.2. Table 1 summarizes our findings.

The first two columns report the results of regressing the log of unit values on a dichotomic variable equal to one for FCP importers and zero otherwise for a different set of varieties. Both estimations

[7] See, e.g., Items [30]-[33] in the Webpage List.

[8] See Items [29] and [34]-[37] in the Webpage List.

[9] See, e.g., Item [38] in the Webpage List.

Table 1.

Unit value differential in FCP countries.

Dep. variable: Log unit value	(1) (absolute)	(2) (absolute)	(3) (relative)	(4) (relative)
FCP importer (dummy)	−0.4087***	−0.2163***	0.2748***	0.4392***
	(0.0458)	(0.0298)	(0.0345)	(0.0135)
Domestic varieties	Yes	No	No	No
FCP exporters only	No	No	No	Yes
Observations	7,190	459,918	459,918	92,477
R^2	0.9080	0.7580	0.8142	0.8403

Note. The table reports the coefficients produced by estimations in which a dummy for former centrally planned (FCP) countries is the independent variable. The dependent variable is the log of unit value. Unit values are computed as the ratio between a given country's values and volumes of locally produced or imported varieties. It is used in absolute terms in Columns (1) and (2) and relative terms (i.e., divided by the unit value of the domestic variety) in Columns (3) and (4). Data are described in Section 3. All estimations include year and variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and clustered by exporter in Columns (1) and (3). Significance levels: ***0.01; **0.05; *0.10.

feature year fixed effects to control for time variations in the market conditions and variety fixed effects to account for peculiarities in the trade patterns of specific products supplied by a given exporter. Column (1) summarizes the outcome of considering domestic varieties in isolation. The regression coefficient is negative and statistically significant, suggesting that lower unit values are observed in FCP markets for local products. Column (2) runs regression equation (8) based on imported varieties. The regression coefficient is again negative and highly significant. These results align with the evidence produced by a long string of contributions investigating the relationship between unit values and income per head of both importer and exporter, once considering the negative per-capita GDP differential between FCP and non-FPC countries. The substantial drop in the coefficient's magnitude in Column (2) relative to (1) is due to the rise (resp., fall) in unit values associated with the FCP (resp., non-FCP) markets (since both sets of unit values represent averages relative to exports flowing from both FCP and non-FCP countries).

We resort to *relative* unit values to tackle the confounding effect of considering heterogenous products' values and volumes in absolute terms. We calculate relative unit values as the ratio of imported to domestic varieties' unit values. The rationale for this choice is that similar specificities should impact the unit value of a given good, both locally produced and imported. In light of this line of reasoning, Column (3) repeats the same exercise as in (2), using the log of relative unit values as the dependent variable. The regression coefficient is positive and statistically significant, in line with what is suggested by a comparison between Columns (1) and (2). In Column (4), we run the same regression as in (3), restricting the exporters to FCP countries to check whether the absence of dual pricing is a plausible assumption. The regression coefficient is positive, statistically significant, and markedly higher than

the one reported in Column (3).[10] This finding suggests that the no-dual-pricing assumption is not counterfactual since the share of imports sourced from FCP countries is considerably larger in FCP than in non-FCP markets.[11]

As discussed above, unit values have been extensively used in the international trade literature as a proxy for product quality. From this perspective, the findings reported in Columns (3) and (4) would indicate that the quality of varieties imported from FCP countries is more pronounced in FCP markets, where trade is more intense, even when we control for the impact of market segmentation strategies by computing unit values of imported varieties relative to the quality of the domestic variety. However, looking into unit values prevents investigating potential discrepancies between prices and quality levels associated with given goods' varieties. Disentangling these two variables is particularly relevant in the case at hand since a negative correlation between them might suggest the presence of dual pricing, thereby providing support to the FCP countries' concerns.

The remaining of the paper investigates whether a similar result obtains when product quality is inferred from a demand system, a procedure that mitigates the effects of the pricing-to-market issue and distinguishes between varieties prices and quality levels. We also examine whether the scenario changes when exporters outside the EU (FCP and non-FCP) are included in the analysis to test whether our findings are specific to EU producers. The next section takes the first step towards achieving these goals by developing a model to construct relative product quality measures.

2 Model

We use a simple demand-side framework as a model to guide our empirical investigation. The model features a set of destination countries, indexed by $i \in \mathcal{I}$, and a representative household for each i. A subset of countries, denoted by $\mathcal{I}_{fcp} \subset \mathcal{I}$, identifies former centrally planned (FCP) economies. The representative household may consume units of a finite number of different goods indexed by $s \in \mathcal{S}$. Every good s is available in several varieties, indexed by $j_s \in \mathcal{J}_s$. The variety index is associated with the source country. Therefore, we have one domestic variety ($j_s = i$) and several imported varieties ($j_s \neq i$) for every good s.

The i-th representative household's preferences are represented by

$$Y_i = \prod_{s \in \mathcal{S}} \left[\left(\sum_{j_s \in \mathcal{J}_s} \lambda_{i,j_s}^{\frac{1}{\sigma_s}} q_{i,j_s}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{\frac{\sigma_s}{\sigma_s - 1}} \right]^{\alpha_s} . \tag{1}$$

The CES specification (1) is an adapted version of the one used by Broda and Weinstein (2006) and in many other contributions in the literature.[12] The right-hand side of (1) features a two-tier aggregator. The outer Cobb-Douglas aggregator bundles *goods* $s \in \mathcal{S}$, with sectoral shares $\alpha_s \in (0, 1)$. The inner

[10] A magnitude of the coefficient in Column (4) smaller than Column (3) would counterfactually require either a lower FCP-sourced import share in FCP than non-FCP countries or a sign flip of the coefficients reported in the first two columns. See Bullet 4 of Case I in Appendix A.2 for a formalized version of this rationale.

[11] The average FCP (resp., non-FCP) share of imports accrued by FCP exporters is 25.4% (resp., 11.3%) in value and 29% (resp., 14.9%) in volume. Note that the results reported in Columns (3) and (4) do not show that dual pricing is inconsistent with the data. This matter is, however, beyond the scope of this paper.

[12] The main difference between our setup and the one in Broda and Weinstein is that we let the domestic varieties be nested within the variety aggregator of each good. Other examples of CES preference representation in applied international

CES aggregator bundles *varieties* $j_s \in \mathcal{J}_s$, for each good s, with elasticity of substitution $\sigma_s > 0$. The remaining elements of the preference specification are q_{i,j_s}, which denotes the quantity consumed of variety j_s in country i, and the demand shifter λ_{i,j_s}, specific to country i and variety j_s.

From the first-order conditions of the representative household's constrained problem based on (1), we derive the demand function for variety j_s in country i

$$q_{i,j_s} = \alpha_s^{\sigma_s} P_i^{\sigma_s} Y_i^{\sigma_s} \left(\sum_{j_s \in \mathcal{J}_s} \lambda_{i,j_s}^{\frac{1}{\sigma_s}} q_{i,j_s}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{-\sigma_s} p_{i,j_s}^{-\sigma_s} \lambda_{i,j_s}, \tag{2}$$

where P_i is the price index associated to Y_i. We let $m_{i,j_s} \equiv q_{i,j_s}/Q_{i,s}$ be the quantitative market share of variety j_s in country i, where $Q_{i,s} \equiv \sum_{j_s \in \mathcal{J}_s} q_{j_s}$ defines the aggregate quantity of good s consumed in country i across all varieties j_s. Using (2), the quantitative market share reads

$$m_{i,j_s} = p_{i,j_s}^{-\sigma_s} \lambda_{i,j_s} \Omega_{i,s}, \tag{3}$$

where $\Omega_{i,s} \equiv \left(\sum_{j_s \in \mathcal{J}_s} p_{i,j_s}^{-\sigma_s} \lambda_{i,j_s} \right)^{-1}$ is a country- and good-specific collective term, which can be interpreted as the harmonic mean of price-quality ratios, adjusted for the price sensitivity, of the varieties of good s supplied to market i.[13]

Equation (3) also applies also to the domestic variety. Formally, letting $m_{i,i}^s$ be the quantitative market share, $p_{i,i}^s$ the price and $\lambda_{i,i}^s$ the quality of the domestic variety of good s, we have

$$m_{i,i}^s = \left(p_{i,i}^s \right)^{-\sigma_s} \lambda_{i,i}^s \Omega_{i,s}. \tag{4}$$

Dividing (3) by (4), we obtain the *relative* quantitative market share of variety j_s (to the domestic variety) in country i

$$\tilde{m}_{i,j_s} \equiv \frac{m_{i,j_s}}{m_{i,i}^s} = \frac{p_{i,j_s}^{-\sigma_s} \tilde{\lambda}_{i,j_s}}{\left(p_{i,i}^s \right)^{-\sigma_s}}, \tag{5}$$

where $\tilde{\lambda}_{i,j_s} \equiv \lambda_{i,j_s}/\lambda_{i,i}^s$ represents the deviation of variety j_s's quality measure from the domestic variety's.

We assume that the relative demand shifter $\tilde{\lambda}_{i,j_s}$ comprises three separate components, that is,

$$\tilde{\lambda}_{i,j_s} = \exp\left(\theta_{j_s} + \varsigma_i + \upsilon_{i,j_s} \right), \tag{6}$$

where the exponential form is taken for analytical convenience. The second term at the exponent on the right-hand side of (6), ς_i, is a taste shifter specific to country i. The third term, υ_{i,j_s}, is an i.i.d. zero-mean taste shock specific to country i and variety j_s; i.e., we assume that $E_{\mathcal{I},\mathcal{J}_s}\left(\upsilon_{i,j_s} \right) = 0$. As a result, the first term, θ_{j_s}, captures the *intrinsic* quality of variety j_s (the product quality after cleaning out country-specific shocks), relative to the domestic variety. Using (6) into (5), and taking logs, we get

$$\ln \tilde{m}_{i,j_s} = -\sigma_s \ln \tilde{p}_{i,j_s} + \theta_{j_s} + \varsigma_i + \upsilon_{i,j_s}. \tag{7}$$

where $\tilde{p}_{i,j_s} \equiv p_{i,j_s}/p_{i,i}^s$.

Our analysis aims to investigate the potential role of a former centrally planned economic system in influencing households' taste for product quality. To this end, we let the country-specific and variety-independent taste shifter $\varsigma_i = \varsigma_{fcp}$ for any country $i \in \mathcal{I}_{fcp}$, and $\varsigma_i = 0$ otherwise. As a result, the

trade can be found in, e.g., Feenstra (1994), Khandelwal, Schott and Wei (2013) and Jaimovich, Mazdharova and Merella (2021).

[13] See the appendix for a complete derivation of (2) and (3).

expected (log) demand shifter for variety j_s in an FCP country, $E_{\mathcal{I}}(\ln \lambda_{i,j_s} | i \in \mathcal{I}_{fcp}) = \theta_{j_s} + \varsigma_{fcp}$, differs from those relative to countries that never experienced a centrally planned economic system, $E_{\mathcal{I}}(\ln \lambda_{i,j_s} | i \notin \mathcal{I}_{fcp}) = \theta_{j_s}$, provided that $\varsigma_{fcp} \neq 0$. Equation (7) represents the baseline relationship upon which we build the empirical analysis. The next section discusses our estimation strategy after describing the implementation of the dataset, which collects the observations relevant to the analysis.

3 Data and estimation strategy

Our empirical analysis resorts to volumes and values traded at the product level. A notoriously rich source of this type of observations is customs data. For this reason, the paper relies on the COMEXT database managed by Eurostat, the Statistical Office of the European Commission. COMEXT reports trade statistics on the value and quantity of goods exchanged between EU members and traded by EU members from and to third countries at a finely disaggregated level. As such, COMEXT is an excellent building block for our investigation. For our purposes, sourcing data from COMEXT has two key advantages. First, it provides records on several countries that underwent centralized forms of economic activity. We refer to these countries as former centrally planned (FCP) economies. Second, it also provides records on other countries, members of the same economic area and fairly comparable in geographical and socio-economic aspects, that did not experience any centralized economic system.

Perhaps the most sensitive issue we face is choosing the period to consider in our study. An important aspect to weigh up in taking our decision concerns the proximity to the event of the FCP countries' economic systems switching from centralized to unplanned. COMEXT includes data on FCP countries since 1999. This date is ideal for taking up our analysis since it follows the initial instability experienced by FCP countries during their transition to a market economy.[14] However, COMEXT provides data only on the Slovak Republic for 1999. The set of FCP countries extends to 4 in 2000, 9 in 2001, and finally all the 11 nations from 2002.[15] Since accession to the EU occurred in 2004 for 8 FCP countries, potential economic and statistical disruption suggests avoiding including the years 2003-2005 and limiting the benchmark dataset to the period 2000-2002.[16] Nevertheless, we extend the dataset five years to 2007 to produce robustness checks.[17] We exclude undifferentiated goods from our investigation since we look into product quality differentials. We adopt Rauch's (1999) classification, which separates the differentiated products from those traded on an organized exchange or reference-priced.

COMEXT provides trade data at the CN8-digit product level. We use values and volumes of the imported products to compute the products' unit values, which play a role in the motivational evidence

[14] There is consensus that the most turbulent period of the economic transition that followed the 1989 events in Central and Eastern Europe ended with the series of crises that hit the region in 1997 and 1998. For a review of the economic transition of the FCP EU members, see, e.g., Roaf, Atoyan, Joshi and Krogulski (2014).

[15] Specifically, out of 27 EU members, 11 countries are FCP economies (in parenthesis, the first years the country appears as a COMEXT declarant): the Slovak Republic (1999); Estonia, Lithuania, and Romania (2000); Bulgaria, the Czech Republic, Hungary, Latvia, and Slovenia (2001); Croatia and Poland (2002).

[16] The eight FCP economies that were granted accession to the EU in 2004 are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia.

[17] We do not include the subsequent years to avoid the instability caused by the 2008 financial crisis and its aftermath. Incorporating more recent years far beyond (20+ years) of the 1989 events seems an unnecessary extension to our purposes, which look into the *existence* of a dissimilar product quality perception between FCP and non-FCP countries rather than its potential *persistence*.

presented in Section 1 and in the empirical results reported in Section 4. Along with distinguishing between FCP and non-FCP countries, we complement these data with values and quantities of domestic goods and estimated price elasticities. We infer data on domestic goods from the observations provided by Eurostat's PRODCOM database. Entries consist of values and quantities of total production, imports, and exports of products at a distinct 8-digit level classification, limiting the correspondence to the CN categorization at a 6-digit level. For each product, we use the difference between total production and exports (both in value and volume) as a proxy for local consumption of the domestic variety.

Using a similar framework to the one presented in Section 2, Broda, Greenfield and Weinstein (2006) produce price elasticity estimates at the HS 3-digit level for 73 countries in the world (we henceforth refer to this set as the *importers'* price elasticities). Since these estimates are well-established and allow us to bypass the endogeneity issues that arise when bringing regression equation (7) to the data, we use them as a benchmark in computing the composite dependent variable featured in equation (8) below.[18] However, HS 3-digit codes require a relatively high level of aggregation across products. Furthermore, the estimates are unavailable for three out of the eleven FCP countries featured as importers in our dataset (Bulgaria, the Czech Republic, and Estonia). For this reason, we also utilize the U.S. price elasticity estimates produced by Broda and Weinstein (2006), which have the advantage of being provided at the HS 10-digit level. We associate the U.S. price elasticities to COMEXT (and PRODCOM) products at the HS 6-digit level.

We deal with outliers by reducing the dataset in several dimensions to prevent our results from being driven or tainted by extreme values in the data. In line with the literature, values and quantities of each product are trimmed below the 5th and above the 95th percentile. The reduction applies to observations sourced from both the COMEXT and PRODCOM databases. We also trim the importers' price elasticities using the same strategy. Along this dimension, the excluded subset contains values that are, on average, larger than the included ones by a factor of 27 (specifically, the means on included and excluded price elasticities are 4.57 and 127.2, respectively). We operate a similar trimming also on the U.S. price elasticities, though the outliers are identified within each product category at the HS 6-digit level.[19]

Table 2 reports summary statistics of the dataset we use for our study. For a more transparent understanding of the data structure, the figures are provided annually (for the years 2000-2002) and pooled into two disjoint periods (2000-2002 and 2003-2007). Overall, the dataset features almost 3.3 million observations (gross of reductions applied to price elasticity outliers), with an average of more than 870,000 (710,000) concerning FCP importers (exporters). The upward trends in the number of products, varieties, and observations are possibly due to the growing set of EU declarants, classification adjustments, and international trading intensification. Moderate trends also appear in most entries for the period 2003-2007. This dataset is the building block of our empirical analysis. We use it to infer product quality using the price and quantity information it comprises and investigate whether the FCP markets' relative quality measures differ from those obtained for their non-FCP counterparts.

The procedure we adopt to achieve these goals is as follows. Recall the baseline relationship (7) in

[18] For a discussion of the issues arising when estimating regression equations derived from demand systems, see, e.g., Berry (1994) and Feenstra (1994).

[19] The results shown throughout the paper are robust to sensitivity analysis, which we perform along every dimension discussed in this paragraph. The relevant results are available from the authors upon request.

Table 2.

Summary statistics.

	(1) 2000	(2) 2001	(3) 2002	(4) 2000-2002	(5) 2003-2007
No. products	2,341	2,351	2,309	2,334	2,422
No. varieties	82,863	83,842	85,556	84,087	91,099
No. varieties (FCP)	18,382	19,594	20,336	19,437	22,837
No. observations	340,888	367,061	411,366	1,119,315	2,170,323
No. obs. (FCP exp.)	62,171	73,194	85,106	220,471	490,291
No. obs. (FCP imp.)	39,613	75,491	109,965	225,069	653,055
No. HS-6 categories	1,301	1,288	1,263	1,399	1,656
No. HS-3 categories	114	114	117	120	140
No. exporters (total)	215	218	219	217	219
No. exporters (FCP)	42	42	42	42	42
No. importers (total)	18	23	25	22	27
No. importers (FCP)	4	9	11	8	11

Note. The table reports summary statistics for the years from 2000 to 2002 [Columns (1)-(3)] and for the periods 2000-2002 [Column (4)] and 2003-2007 [Column (5)]. The number of varieties and observations are reported gross of reductions applied to price elasticities. The reported numbers of HS categories are net of such reductions. Product, categories, and varieties are treated as independent over time. Hence, the pooled datasets comprise yearly figure means for these variables, as well as for importers and exporters.

Section 2. In order to perform an empirical test of the hypothesis that the FCP countries' relative quality measures systematically differ from non-FCP countries' (i.e., $\varsigma_{fcp} \neq 0$), we define the dependent variable as $x_{i,j_s} \equiv \ln \tilde{m}_{i,j_s} + \sigma_s \ln \tilde{p}_{i,j_s}$. Using the dichotomic nature of θ_{j_s} and ς_i in (7), we write our regression equation as

$$x_{i,j_s} = D_{j_s} + D_{fcp} + \upsilon_{i,j_s}, \tag{8}$$

where D_{fcp} is an FCP country-specific dummy that captures the effect of ς_i and D_{j_s} is a variety-specific dummy that captures the effect of θ_{j_s}. The rationale is straightforward: after controlling for other factors, if any influence of having experienced a centrally planned economic system exists on product quality perception, then such influence should appear as a deviation, D_{fcp}, from the demand shifter, D_{j_s}.

We use two sets of values as measures for the price elasticity σ_s. Namely, the importers' price elasticities, denoted by σ_s^{imp}, and the US price elasticities, denoted by σ_s^{US}. The resulting dependent variables are denoted by x_{i,j_s}^{imp} and x_{i,j_s}^{US}, respectively. The next section brings regression equation (8) to the data.

Table 3.
Product quality differential in FCP countries.

	(1)	(2)	(3)	(4)
Dependent variable	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{US}	x_{i,j_s}^{US}
D_{fcp}	1.2313***	2.4062***	1.4103***	2.7960***
	(0.2374)	(0.1704)	(0.2228)	(0.1156)
FCP exporters only	No	Yes	No	Yes
Observations	357,970	72,725	377,777	76,832
R^2	0.6417	0.6639	0.6086	0.6455

Note. The table reports the coefficients produced by estimations for the period 2000-2002, in which a dummy for former centrally planned (FCP) countries is the independent variable. The dependent variable is the left-hand side of eq. (8), computed using importers' price elasticities in Columns (1) and (2) and US price elasticities in Columns (3) and (4). Data are described in Section 3. All estimations include year and variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1) and (3) and clustered by importer-product in Columns (2) and (4). Significance levels: ***0.01; **0.05; *0.10.

4 Empirical analysis

In the motivational evidence subsection of Section 1, we have shown that *relative* unit values, computed as the unit-value ratios of imported to domestic varieties, are systematically higher in FCP markets. In the attempt to shed light on the origin of the findings reported in Table 1, Section 2 has developed a model to derive a quality measure from a demand system. Inferring relative product quality through this procedure tackles the impact of pricing-to-market strategies by taking into account the quantitative market share reaction to price variations. We can thus attribute any systematic quality differential resulting from our exercises to the effect of market segmentation. Using the dataset illustrated in Section 3, we proceed to use regression equation (8) to produce our empirical result.

Table 3 summarizes the findings of the first set of exercises. The dependent variable is the observed equivalent of the relative quality measure plus a regression error term, interpreted as a zero-mean taste shock specific to the importer and the variety (the product-exporter pair). It is calculated in two versions. The first uses the importers' price elasticities estimated by Broda, Greenfield and Weinstein (2006) and is denoted by x_{i,j_s}^{imp}. The second version employs the importers' price elasticities estimated by Broda and Greenfield (2006) and is denoted by x_{i,j_s}^{US}. The independent variable is a dichotomic indicator equal to one for FCP importers and nil otherwise. All regressions include year fixed effects to capture period-specific market conditions and variety fixed effects to absorb trade peculiarities in given products sourced from a specific country. Column (1) and (2) concern x_{i,j_s}^{imp}, (3) and (4) x_{i,j_s}^{US}. Pairwise, columns differ in the set of exporters included in the analysis.

Columns (1) and (3) portray the outcome of the baseline regression. The coefficients of the FCP importer dummy are positive and statistically different from zero. These findings are suggestive of the

Table 4.

Product quality differential in FCP countries (yearly data).

	(1)	(2)	(3)	(4)	(5)	(6)
Year	2000	2000	2001	2001	2002	2002
Dependent variable	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}
D_{fcp}	0.8275**	2.0560***	1.4045***	2.7058***	1.2272***	2.3041***
	(0.3304)	(0.3135)	(0.2539)	(0.2074)	(0.2980)	(0.2701)
FCP exporters only	No	Yes	No	Yes	No	Yes
Observations	108,234	20,050	112,599	23,064	137,137	29,611
R^2	0.6630	0.6906	0.6533	0.6766	0.6157	0.6365
Dependent variable	x_{i,j_s}^{US}	x_{i,j_s}^{US}	x_{i,j_s}^{US}	x_{i,j_s}^{US}	x_{i,j_s}^{US}	x_{i,j_s}^{US}
D_{fcp}	0.8656**	2.5207***	1.4457***	2.9014***	1.5700***	2.8103***
	(0.3190)	(0.3171)	(0.2520)	(0.1902)	(0.2385)	(0.2434)
FCP exporters only	No	Yes	No	Yes	No	Yes
Observations	114,853	21,361	118,650	24,302	144,274	31,169
R^2	0.6080	0.6448	0.6107	0.6539	0.6075	0.6371

Note. The table reports the coefficients produced by estimations on yearly data for the period 2000-2002, in which the dependent variable is a function of the product's quantitative market share and unit value as specified in equation (8), computed using importers' price elasticities in the top panel and US price elasticities in the bottom panel. The independent variable is a dummy for former centrally planned (FCP) countries. Data are described in Section 3. All estimations include variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1), (3), and (5) and clustered by importer-product in Columns (2), (4), and (6). Significance levels: ***0.01; **0.05; *0.10.

existence of a positive differential in the relative quality measure between FCP and non-FCP markets. One should not attempt to rationalize this evidence by heterogeneous pricing-to-markets across the two sets of importers since consumers would react to higher prices by proportionally lowering demand, which now concurs to define the quality measure. We may then associate this result primarily with a perceived-quality effect of import basket composition due, in turn, to different productive capabilities and adopted market segmentation strategies across exporters.

We repeat the exercise restricting the set of exporters to FCP countries. We do so to investigate whether the effect found in the previous estimations is driven by products flowing from countries that did not experience a centralized form of economic activity, perhaps because these offer more selection in terms of product versions or FCP countries somehow have different marketing strategies when trading with each other for historical reasons. Columns (2) and (4) report our findings. The regression coefficients

Table 5.

Product quality differential in FCP countries (2003-2007).

	(1)	(2)	(3)	(4)
Dependent variable	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}
D_{fcp}	1.3898***	2.1965***	1.5173***	2.6655***
	(0.1514)	(0.0708)	(0.1847)	(0.0539)
FCP exporters only	No	Yes	No	Yes
Observations	687,761	159,637	758,771	178,664
R^2	0.6100	0.6166	0.5949	0.6136

Note. The table reports the coefficients produced by estimations for the period 2003-2007, in which a dummy for former centrally planned (FCP) countries is the independent variable. The dependent variable is a function of the product's quantitative market share and unit value as specified in equation (8), computed using importers' price elasticities in Columns (1) and (2) and US price elasticities in Columns (3) and (4). Data are described in Section 3. All estimations include year and variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1) and (3) and clustered by importer-product in Columns (2) and (4). Significance levels: ***0.01; **0.05; *0.10.

Table 6.

Product quality differential in FCP countries (all exporters worldwide).

	(1)	(2)	(3)	(4)
Dependent variable	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}
D_{fcp}	1.0946***	1.9735***	1.3087***	2.3527***
	(0.2166)	(0.1706)	(0.1854)	(0.1225)
FCP exporters only	No	Yes	No	Yes
Observations	580,998	110,007	614,646	116,625
R^2	0.6532	0.6619	0.6248	0.6380

Note. The table reports the coefficients produced by estimations with the complete set of exporters for the period 2000-2002, in which a dummy for former centrally planned (FCP) countries is the independent variable. The dependent variable is a function of the product's quantitative market share and unit value as specified in equation (8), computed using importers' price elasticities in Columns (1) and (2) and US price elasticities in Columns (3) and (4). Data are described in Section 3. All estimations include year and variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1) and (3) and clustered by importer-product in Columns (2) and (4). Significance levels: ***0.01; **0.05; *0.10.

remain positive and highly significant, and their magnitude records a slight rise. This result suggests that the difference in quality measures between FCP and non-FCP markets is more pronounced when looking at FCP exporters only, supporting the idea that the more intensive trading between FCP countries takes a larger toll on quality measures in non-FCP markets.

Table 4 illustrates the results obtained by looking into relation (8) using yearly data. This exercise aims to check whether our findings are sensitive to variations in the set of FCP importers included in the analysis. The table shows that there are non-negligible discrepancies in the magnitude of the regression coefficients when we consider four (the year 2000), nine (2001), and eleven (2002) importers. These discrepancies are consistent with our findings being driven by market segmentation matching the particular quality levels sought by consumers, implying a specific import basket composition. Note that the average share of FCP-sourced imports for the relevant subset of countries in terms of value (resp., volume) is 29.73% (resp., 33.37%) for the year 2000, 25.47% (resp., 29.16%) for 2001 and 25.43% (resp., 29%) for 2002. Calculating the ratios of the relevant pairs of regression coefficients, we may associate these values with the factors 2.48, 1.93, and 1.88, respectively. As a result, the decline in FCP-sourced import shares matches the reduction of the quality differential between the restricted and unrestricted set of exporters.

As a robustness check, Table 5 reports the results obtained by repeating the benchmark exercises on a dataset comprising observations from 2003 to 2007. Compared to Table 3, we note slight variations in the magnitude of the regression coefficients, upwards in Columns (1) and (3) and downwards in Columns (2) and (4). Such variations may also be understood in terms of import basket composition once one considers the rise of FCP-sourced import share in non-FCP countries (from 11.3% to 12.3% in value and from 14.9% to 15.3% in volume).

Finally, Table 6 outlines the findings obtained by extending the set of exporters to all the countries included in the COMEXT dataset.[20] The logic of this set of exercises is to explore whether the results are specific to EU producers or apply more generally worldwide. A comparison with Table 3 reveals a rise in the magnitude of all regression coefficients. Once again, the relevant FCP-sourced import shares are consistent with these observations. Relative to intra-EU trade, these shares grow in terms of value (resp., volume) to 22% (resp., 28%) in non-FCP markets and 34% (resp., 40%) in FCP markets.

5 Conclusion

In light of the media and political discussion regarding products' price and quality differentials traded within the EU between the former centrally planned (FCP) and the other members, the paper has investigated whether market segmentation and pricing-to-market strategies suffice to rationalize the issue. We have found that these two elements subsist and are in line with standard economic theory in the presence of imperfect competition. Specifically, market segmentation plays a central role in the emergence of quality discrepancies, as it matches the specific product quality levels sought by consumers and results in more intense trade links between FCP countries than across FCP and non-FCP countries.

We have used custom data to investigate the matter. We have controlled for market segmentation's effects by resorting to computations of imported goods' unit values to their domestic goods' counterparts.

[20] For robustness, Tables C.1 and C.2 in Appendix C replicate the exercises performed in Tables 4 and 5 using the extended dataset.

A simple model has guided the development of a relative quality measure based on relative quantitative market shares and unit values to control for the impact of pricing-to-market. Trade intensity explains the higher quality associated with FCP-sourced goods in FCP markets and the heterogeneous differentials across different sets of FCP importers. We have also shown that these results are robust to using observations from two disjoint periods.

The same analysis has produced comparable results when repeated to include the complete set of exporters worldwide available in the COMEXT database. This finding settles the EU products' quarrel since the mechanisms at work within the EU do not apply exclusively to EU producers. From this perspective, the outcome of our investigation has remarkable significance in policy terms. The initiatives at the national level and the subsequent media reportage on the matter led the EU institutions to steer the bureaucratic machinery towards inquiring and eventually deliberating over a concern that may not have solid foundations. Not only the taxpayer's money could have been invested in a wasteful venture. If taken further, it might also have produced detrimental outcomes by imposing regulations without robust evidence of a market failure.

On a final note, a comparison between the two sets of exercises has pointed out that the intra-EU trade intensity relative to the one towards the rest of the world explains the variation in products' quality differentials between FCP-sourced imports catered by EU and non-EU exporters. This evidence is suggestive of better matching of EU varieties to the particular quality levels (and price-to-quality ratios) pursued by EU consumers.

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Appendix

A.1. Chronology of actions on price/quality differential within the EU

In 2004, the European Union enlarged to include the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Slovakia, Poland, Slovenia, and Malta. It was a historical milestone in the transformation process of the countries in Central and East Europe, which could then be considered finalized. However, it was clear that a long way would remain to catch up with the existing member states in terms of economic development. A few years later, consumers in Central and East Europe started to feel the lower quality of imported products, even if these were presented as the same products with the same brand and name. In 2011, the Public Opinion Research Centre of the Czech Republic conducted an extensive questionnaire survey with more than 1,000 respondents focused on food safety and quality.[21] About 58% of people considered the differences in quality levels significant. Another 28% thought that there were

[21] See Item [30] in the Webpage List.

only minor differences. In both cases, the questions referred to the quality of imported products, whereas 71% of the respondents perceived locally produced goods as fine.

This general opinion was empirically confirmed in 2017 when the Ministry of Agriculture of The Czech Republic initiated the University of Chemistry and Technology Prague research project.[22] The project compared selected foods from the Czech Republic, Slovakia, Austria, Germany, and Hungary to determine whether products with different properties, such as composition, amount of ingredients, or product weight, were sold under the same name and packaging. The study tested 21 products sold in different countries under the same brand. The study found that thirteen were different, five slightly different, and three were identical. In addition, five products had other volumes with the same package size. Although the results were not strong enough to conclude that the quality of imported food to the Central European countries was significantly lower, some differences were considered significant.[23]

Although perceived differences in quality refer mainly to food, other products have also been tested for quality differences. The study mentioned above included an analysis of the composition of the washing powders. From a chemical standpoint, the study showed that the same washing powders have a significantly higher proportion of active ingredients in Austria and Germany. In several studies, an independent Czech consumer organization called dTest also dealt with differences in the quality of food and washing powders, toilet paper, toothpaste, and detergents.[24] Albeit results are not robust and often criticized by the producers for the weak methodology, they boosted political actions. Similar initiatives took place in Slovakia, Hungary, Poland, and Slovenia. Since the general results in all these countries confirmed lower quality of imported goods than Germany and Austria, these countries started coordinated actions in EU institutions to address the issue of quality differences.

In 2018, The European Parliament approved a report on dual product quality in the single market, presented by the Czech representative Olga Sehnalová.[25] The report calls for intensified work on dual food quality and emphasizes that food safety and quality and protecting consumers from confusion are among the EU's top priorities.[26] After subsequent discussions among the bodies of the European Union, The European Parliament approved an amendment to the Unfair Commercial Practices Directive in 2019.[27] The obligation to provide clear information on different compositions had disappeared compared to the original proposal. Furthermore, not every difference in composition would represent unfair commercial practices. Even substantial differences in the composition of a good supplied with the same packaging to different countries would still be possible if justified by legitimate and objective factors.[28] This solution was considered unsatisfactory by the Central and East European countries.

In 2019 European Commission released a study assessing differences in the composition of EU food products.[29] The study evaluated 1,380 samples of 128 food products from 19 Member States and found

[22] See Item [31] in the Webpage List.

[23] For instance, Luncheon sold in Germany contained meat in larger quantities and of higher quality. Other products like tea, Nutella, and Nestea had more sugar, added vitamins, and lower contents of artificial sweeteners. Some dairy products had slightly increased protein and fat and lower sugar content.

[24] See Item [32] in the Webpage List.

[25] See Item [33] in the Webpage List.

[26] See Item [34] in the Webpage List.

[27] See Item [29] in the Webpage List.

[28] See Item [33] in the Webpage List.

[29] See Item [35] in the Webpage List.

that 9% of products presented as the same across the EU had a different composition. Moreover, 22% of products offered similarly had a different composition. Simultaneously, the study did not find any consistent geographical pattern in differences and concluded that differences in composition do not mean differences in quality. Two years after, the second part of the study was conducted. This time, it focused on sensory differences in food products.[30] Trained experts for sensory properties tested the same products as those for which the first study found differences in composition. The analysis confirmed that products with different compositions are also perceived differently by sensory senses. However, the differences are almost unrecognizable unless the composition is significantly different.

In 2021, an amendment to the Food and Tobacco Products Act, which addresses the issue of dual food quality and amends the Consumer Protection Act, came into force in the Czech Republic.[31] From that date, it is forbidden to place on the Czech market food products that are "seemingly identical to food placed on the market in the other Member States of the European Union if the food supplied to the Czech market has a significantly different composition or properties." Exceptions apply when "justified by legitimate and objective facts and the food is provided with easily accessible and sufficient information on this different composition or properties."[32]

A.2. Stylized trade framework

Consider a world economy split into two regions, denoted by $r = C, D$, with $C \cap D \equiv \varnothing$. Region C comprise several former centrally planned countries, D the remaining countries (decentralized economies). Each country produces a single (composite) good, with unit value identical across countries belonging to the same region. Specifically, letting x denote a country when considered as an exporter, and m when considered as an importer, we have the following definitions:

i. the unit value of a good sourced from x to m is π_m^x, for all x and m: note that π_m^m refers to the domestic variety, and $\pi_m^x = \pi_m^r$ for all $x \in r$;

ii. the *relative* unit value of a good sourced from x to m is $\tilde{\pi}_m^x \equiv \pi_m^x / \pi_m^m$, for all $x \neq m$: note that $\tilde{\pi}_m^x = \tilde{\pi}_m^r$ for all $x \in r$;

iii. the average unit values of goods imported by m is $\pi_m = \alpha_m \pi_m^C + (1 - \alpha_m)\, \pi_m^D$, with $0 < \alpha_m < 1$;

iv. the *relative* average unit values of goods imported by m is $\tilde{\pi}_m = \alpha_m \tilde{\pi}_m^C + (1 - \alpha_m)\, \tilde{\pi}_m^D$.

Let now countries be denoted according to the region to which they belong: i.e., $c \in C$ and $\forall d \in D$. In light of the evidence illustrated in Section 1, the variables involved in this framework must obey the following stylized facts:

1. domestic goods are cheaper in C than D: i.e., $\pi_c^c < \pi_d^d$;

2.a. imported goods are cheaper (on average) in C than D: $\pi_c < \pi_d$;

2.b. the gap between imported goods' average unit values is narrower than for domestic varieties': $\pi_c^c / \pi_d^d < \pi_c / \pi_d$;

[30] See Item [36] in the Webpage List.

[31] See Item [37] in the Webpage List.

[32] See Item [33] in the Webpage List.

3. imported goods are *relatively* more expensive (on average) in C than D: $\tilde{\pi}_c > \tilde{\pi}_d$;

4. the gap between *relative* unit values is larger when looking at C-exporters only: $\tilde{\pi}_c^{c'}/\tilde{\pi}_d^c > \tilde{\pi}_c/\tilde{\pi}_d$, for all $c' \neq c$.

   Furthermore, it must be that the share of imports sourced from C is larger in C than D: $\alpha_c > \alpha_d$.

We consider two scenarios. The first one assumes absence of dual pricing. The second one allows for it. Both scenarios are consistent with the stylized facts listed above.

Case I. Absence of dual pricing. Suppose that unit values are lower in C than D and assume absence of dual pricing: i.e.,

$$\pi_C^C = \pi_D^C = \pi^C < \pi^D = \pi_D^D = \pi_C^D.$$

It follows that:

Variable	C-importer	D-importer
Domestic good' unit value	$\pi_c^c = \pi^C$	$\pi_d^d = \pi^D$
Imported goods' unit values	$\pi_c^{c'} = \pi^C$ $\pi_c^d = \pi^D$	$\pi_d^c = \pi^C$ $\pi_d^{d'} = \pi^D$
Average unit value of imports	$\pi_c = \alpha_c \pi^C + (1-\alpha_c)\pi^D$	$\pi_d = \alpha_d \pi^C + (1-\alpha_d)\pi^D$
Imported goods' relative unit values	$\tilde{\pi}_c^{c'} = 1$ $\tilde{\pi}_c^d = \pi^D/\pi^C$	$\tilde{\pi}_d^c = \pi^C/\pi^D$ $\tilde{\pi}_d^{d'} = 1$
Average relative unit value of imports	$\tilde{\pi}_c = \alpha_c + (1-\alpha_c)\pi^D/\pi^C$	$\tilde{\pi}_d = \alpha_d \pi^C/\pi^D + (1-\alpha_d)$

Using Definitions (i)-(iv), we obtain the following results:

1. Satisfied since by definition $\pi^C < \pi^D$.

2.a. Satisfied since since by definition $\alpha_d < \alpha_c$ and $\pi^C < \pi^D$: note that

$$\begin{aligned} \pi_c - \pi_d &= \alpha_c \pi^C + (1-\alpha_c)\pi^D - \left[\alpha_d \pi^C + (1-\alpha_d)\pi^D\right] \\ &= (\alpha_c - \alpha_d)\left(\pi^C - \pi^D\right) < 0. \end{aligned}$$

2.b. Satisfied since by definition $\pi^C < \pi^D$: rewrite the condition as $\pi_c \pi_d^d > \pi_c^c \pi_d$ and note that

$$\begin{aligned} \pi_d &= \alpha_d \pi^C + (1-\alpha_d)\pi^D < \alpha_d \pi^D + (1-\alpha_d)\pi^D = \pi^D = \pi_d^d, \\ \pi_c^c &= \pi^C = \alpha_c \pi^C + (1-\alpha_c)\pi^C < \alpha_c \pi^C + (1-\alpha_c)\pi^D < \pi_c. \end{aligned}$$

3. Satisfied since by definition $\pi^C < \pi^D$: note that

$$\begin{aligned} \tilde{\pi}_d &= \alpha_d \pi^C/\pi^D + (1-\alpha_d) < \alpha_d \pi^D/\pi^D + (1-\alpha_d) = \alpha_d + (1-\alpha_d) = 1, \\ 1 &= \alpha_c + (1-\alpha_c) = \alpha_c + (1-\alpha_c)\pi^C/\pi^C < \alpha_c + (1-\alpha_c)\pi^D/\pi^C = \tilde{\pi}_c. \end{aligned}$$

4. Satisfied due to $\pi_c < \pi_d$ from (2.i): note that

$$\begin{aligned}\frac{\tilde{\pi}_c}{\tilde{\pi}_d} &< \frac{\pi^D}{\pi^C}\frac{\tilde{\pi}_c}{\tilde{\pi}_d} = \frac{\pi^D}{\pi^C}\frac{\alpha_c + (1-\alpha_c)\,\pi^D/\pi^C}{\alpha_d\pi^C/\pi^D + (1-\alpha_d)} = \frac{\alpha_c\pi^C + (1-\alpha_c)\,\pi^D}{\alpha_d\pi^C + (1-\alpha_d)\,\pi^D} = \frac{\pi_c}{\pi_d} < 1,\\ 1 &< \frac{\pi^D}{\pi^C} = \frac{1}{\pi^C/\pi^D} = \frac{\tilde{\pi}_c^{c'}}{\tilde{\pi}_d^c},\end{aligned}$$

since by definition $\pi^C < \pi^D$.

Case II. Presence of dual pricing in region D. Suppose that unit values are lower in C than D and D's goods have higher unit value in region C than D: i.e.,

$$\pi_C^C = \pi_D^C = \pi^C < \pi_D^D < \pi_C^D.$$

It follows that:

Variable	C-importer	D-importer
Domestic good' unit value	$\pi_c^c = \pi^C$	$\pi_d^d = \pi_D^D$
Imported goods' unit values	$\pi_c^{c'} = \pi^C$ $\pi_c^d = \pi_C^D$	$\pi_d^c = \pi^C$ $\pi_d^{d'} = \pi_D^D$
Average unit value of imports	$\pi_c = \alpha_c\pi^C + (1-\alpha_c)\,\pi_C^D$	$\pi_d = \alpha_d\pi^C + (1-\alpha_d)\,\pi_D^D$
Imported goods' relative unit values	$\tilde{\pi}_c^{c'} = 1$ $\tilde{\pi}_c^d = \pi_C^D/\pi^C$	$\tilde{\pi}_d^c = \pi^C/\pi_D^D$ $\tilde{\pi}_d^{d'} = 1$
Average relative unit value of imports	$\tilde{\pi}_c = \alpha_c + (1-\alpha_c)\,\pi_C^D/\pi^C$	$\tilde{\pi}_d = \alpha_d\pi^C/\pi_D^D + (1-\alpha_d)$

Using Definitions (i)-(iv), we obtain the following results:

1. Satisfied since by definition $\pi^C < \pi_D^D$

2.a. Satisfied since since by definition $\alpha_d < \alpha_c$ and $\pi^C < \pi_D^D < \pi_C^D$: note that

$$\begin{aligned}\pi_c - \pi_d &= \alpha_c\pi^C + (1-\alpha_c)\,\pi_C^D - \left[\alpha_d\pi^C + (1-\alpha_d)\,\pi_D^D\right]\\ &< (\alpha_c - \alpha_d)\,\pi^C + (1-\alpha_c)\,\pi_D^D - (1-\alpha_d)\,\pi_D^D\\ &< (\alpha_c - \alpha_d)\left(\pi^C - \pi_D^D\right) < 0.\end{aligned}$$

2.b. Satisfied since by definition $\pi^C < \pi_D^D$ and $\pi^C < \pi_C^D$: rewrite the condition as $\pi_c\pi_d^d > \pi_c^c\pi_d$ and note that

$$\begin{aligned}\pi_d &= \alpha_d\pi^C + (1-\alpha_d)\,\pi_D^D < \alpha_d\pi_D^D + (1-\alpha_d)\,\pi_D^D < \pi_D^D = \pi_d^d,\\ \pi_c^c &= \pi^C = \alpha_c\pi^C + (1-\alpha_c)\,\pi^C < \alpha_c\pi^C + (1-\alpha_c)\,\pi_C^D < \pi_c.\end{aligned}$$

3. Satisfied since by definition $\pi^C < \pi_D^D$ and $\pi^C < \pi_C^D$: note that

$$\begin{aligned}\tilde{\pi}_d &= \alpha_d\pi^C/\pi_D^D + (1-\alpha_d) < \alpha_d\pi_D^D/\pi_D^D + (1-\alpha_d) = \alpha_d + (1-\alpha_d) = 1,\\ 1 &= \alpha_c + (1-\alpha_c) = \alpha_c + (1-\alpha_c)\,\pi^C/\pi^C < \alpha_c + (1-\alpha_c)\,\pi_C^D/\pi^C = \tilde{\pi}_c.\end{aligned}$$

4. Satisfied due to $\pi_c < \pi_d$ from (2.i): note that

$$\begin{aligned}\frac{\tilde{\pi}_c}{\tilde{\pi}_d} &< \frac{\pi_D^D}{\pi^C}\frac{\tilde{\pi}_c}{\tilde{\pi}_d} = \frac{\pi_D^D}{\pi^C}\frac{\alpha_c + (1-\alpha_c)\,\pi_C^D/\pi^C}{\alpha_d\pi^C/\pi_D^D + (1-\alpha_d)} = \frac{\alpha_c\pi^C + (1-\alpha_c)\,\pi_C^D}{\alpha_d\pi^C + (1-\alpha_d)\,\pi_D^D} = \frac{\pi_c}{\pi_d} < 1,\\ 1 &< \frac{\pi_D^D}{\pi^C} = \frac{1}{\pi^C/\pi_D^D} = \frac{\tilde{\pi}_c^{c'}}{\tilde{\pi}_d^c}.\end{aligned}$$

since by definition $\pi^C < \pi_D^D$.

B. Representative household's problem

Consider country-i representative household's problem of maximizing the objective function (1) subject the budget constraint

$$\sum_{s\in\mathcal{S}}\sum_{j_s\in\mathcal{J}_s} p_{i,j_s}q_{i,j_s} \leq P_iY_i. \tag{9}$$

Letting ν denote the Lagrange multiplier on the constraint (1), we may write the Lagrangian

$$\mathcal{L} = \prod_{s\in\mathcal{S}}\left(\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{i,j_s}^{\frac{\sigma_s-1}{\sigma_s}}\right)^{\frac{\alpha_s\sigma_s}{\sigma_s-1}} + \nu\left(P_iY_i - \sum_{s\in\mathcal{S}}\sum_{j_s\in\mathcal{J}_s} p_{i,j_s}q_{i,j_s}\right),$$

from which we obtain the first-order condition

$$\frac{\partial\mathcal{L}}{\partial q_{i,j_s}} = \frac{\alpha_s}{q_{i,j_s}}\frac{\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{i,j_s}^{\frac{\sigma_s-1}{\sigma_s}}}{\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{i,j_s}^{\frac{\sigma_s-1}{\sigma_s}}}Y_i - \nu p_{i,j_s} = 0, \quad \forall\, j_s\in\mathcal{J}_s,\, s\in\mathcal{S},\, i\in\mathcal{I}, \tag{10}$$

where we have assumed that the budget constraint binds.

Rearranging, multiplying the whole expression by q_{i,j_s} and summing over the set $\mathcal{J}_s$ yields

$$\alpha_s\frac{\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{i,j_s}^{\frac{\sigma_s-1}{\sigma_s}}}{\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{i,j_s}^{\frac{\sigma_s-1}{\sigma_s}}}Y_i = \alpha_sY_i = \nu\sum_{j_s\in\mathcal{J}_s} p_{i,j_s}q_{i,j_s}.$$

Furthermore, summing over the set $\mathcal{S}$ and imposing the parameter restriction $\sum_{s\in\mathcal{S}}\alpha_s = 1$, we have

$$Y_i = \sum_{s\in\mathcal{S}}\alpha_sY_i = \nu\sum_{s\in\mathcal{S}}\sum_{j_s\in\mathcal{J}_{s,t}} p_{i,j_s}q_{i,j_s} = \nu P_iY_i,$$

from which we learn that the Lagrange multiplier equals the reciprocal of the price index, i.e. $\nu = P_i^{-1}$. Replacing this result into (10) and rearranging, we obtain the country-i demand function (2) of variety j_s.

We define the aggregate consumption of good s across all varieties j_s in country i as

$$Q_{i,s} \equiv \sum_{j_s\in\mathcal{J}_s} q_{j_s} = \alpha_s^{\sigma_s}P_i^{\sigma_s}Y_i^{\sigma_s}\left(\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{j_s}^{\frac{\sigma_s-1}{\sigma_s}}\right)^{-\sigma_s}\sum_{j_s\in\mathcal{J}_s} p_{j_s}^{-\sigma_s}\lambda_{i,j_s}. \tag{11}$$

Imposing the identity $m_{i,j_s} \equiv q_{i,j_s}/Q_{i,s}$, using (2) and (11), and simplifying, we obtain (3).

C. Additional tables

Table C.1.

Product quality differential in FCP countries (all exporters worldwide, yearly data).

	(1)	(2)	(3)	(4)	(5)	(6)
Year	2000	2000	2001	2001	2002	2002
Dependent variable	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}	x^{imp}_{i,j_s}
D_{fcp}	0.5447*	1.1044***	1.2704***	2.2535***	1.1219***	1.9956***
	(0.3169)	(0.2633)	(0.2181)	(0.2074)	(0.2982)	(0.2716)
FCP exporters only	No	Yes	No	Yes	No	Yes
Observations	178,014	30,309	181,191	34,497	221,793	45,201
R^2	0.6726	0.6862	0.6669	0.6781	0.6270	0.6346
Dependent variable	x^{US}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}	x^{US}_{i,j_s}
D_{fcp}	0.5967**	1.6964**	1.3658***	2.4578***	1.5011***	2.4738***
	(0.2996)	(0.7379)	(0.2152)	(0.4680)	(0.2171)	(0.3778)
FCP exporters only	No	Yes	No	Yes	No	Yes
Observations	190,687	32,532	190,454	36,329	233,505	47,764
R^2	0.6278	0.6368	0.6286	0.6500	0.6197	0.6286

Note. The table reports the coefficients produced by estimations with the complete set of exporters on yearly data for the period 2000-2002, in which the dependent variable is a function of the product's quantitative market share and unit value as specified in equation (8), computed using importers' price elasticities in the top panel and US price elasticities in the bottom panel. The independent variable is a dummy for former centrally planned (FCP) countries. Data are described in Section 3. All estimations include variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1), (3), and (5) and clustered by importer-product in Columns (2), (4), and (6). Significance levels: ***0.01; **0.05; *0.10.

Table C.2.

Product quality differential in FCP countries (all exporters worldwide, 2003-2007).

	(1)	(2)	(3)	(4)
Dependent variable	x_{i,j_s}^{imp}	x_{i,j_s}^{imp}	x_{i,j_s}^{US}	x_{i,j_s}^{US}
D_{fcp}	1.2862***	1.8660***	1.4804***	2.3148***
	(0.1207)	(0.0705)	(0.1383)	(0.0532)
FCP exporters only	No	Yes	No	Yes
Observations	1,141,053	253,543	1,264,659	286,311
R^2	0.6300	0.6258	0.6185	0.6214

Note. The table reports the coefficients produced by estimations with the complete set of exporters for the period 2003-2007, in which a dummy for former centrally planned (FCP) countries is the independent variable. The dependent variable is a function of the product's quantitative market share and unit value as specified in equation (8), computed using importers' price elasticities in Columns (1) and (2) and US price elasticities in Columns (3) and (4). Data are described in Section 3. All estimations include year and variety (product-exporter pair) fixed effects. Standard errors, reported in parentheses, are robust in all specifications and two-way clustered by importer-product and exporters in Columns (1) and (3) and clustered by importer-product in Columns (2) and (4). Significance levels: ***0.01; **0.05; *0.10.