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Economic Transition and Product Quality: Evidence from Post-Comecon EU Trade data.*

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Abstract

Reflecting concerns regarding product quality raised by countries experiencing post-Comecon economic transitions, this investigation analyzes trade flows within the EU, focusing on former centrally planned members. We detect systematic negative deviations in the average export quality of these nations directed towards more established EU economies, even after accounting for bilateral economic development disparities. These deviations, diminishing over time, are notably absent in the exports of established EU members and incoming trade flows from outside the EU. The emerging pattern points to a unique characteristic of the EU's internal market, underscoring the necessity for further scholarly examination of quality assessments amid economic integration efforts in post-transition European nations.

JEL Classification: F10, F40, P20.

Keywords: Developing Countries, EU, Former Centrally Planned Countries, Import Origin, International Trade, Market Segmentation, Nonhomothetic preferences, Pricing-to-market, Product Quality, Transition Economies, Trade Liberalization.

1 Introduction

In the wake of the 1989 events that culminated with the dissolution of the Comecon, several former centrally planned (hereafter, $\mathcal{C}$) European countries engaged in the transition to a market economy. After a decade of economic turbulence, the transition began to stabilize. Eleven $\mathcal{C}$ countries negotiated membership and eventually joined the European Union (EU). The media and political attention turned

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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 price and quality of goods supplied to European $\mathcal{C}$ countries by the traditionally decentralized (hereafter, $\mathcal{M}$) existing EU members, chiefly the neighboring Austria and Germany. The pioneering initiatives promoted by single countries (especially those in the Visegrád group) opened the way for several EU inquiries, reports, and directives. These political actions lasted for nearly ten years and led to extensive media coverage, which occasionally escalated into speculations about producers' and retailers' potentially discriminatory conduct towards consumers from the newly incorporated $\mathcal{C}$ members.[1]

Is there evidence of *abnormal* discrepancies in price and quality of products traded by $\mathcal{C}$ and $\mathcal{M}$ economies in customs data? Two aspects need to be considered when tackling this issue. On the one hand, exporters adjust their products and prices based on the specific conditions of the destination market, while importers choose goods based on their spending power and willingness to pay for quality. Income heterogeneity is a central driver of these dynamics (Feenstra and Romalis, 2014). Given the distinct stages of development of $\mathcal{C}$ and $\mathcal{M}$ countries at the turn of the century (see Figure 1 in the next section), it is expected that these countries would source diverse products from the international market. These stylized facts, which *ordinarily* imply price and quality disparities, are well-established and, as such, unlikely to cause a public outcry. On the other hand, the early stages of $\mathcal{C}$ countries' economic transition involved exceptional trade liberalization, which had the potential to increase competition, improve input sourcing, foster technology transfers, expand market size, and enable economies of scale (Edwards, 1993). These processes often take time to fully develop, and the resulting frictions might have disrupted typical decision-making in the aftermath of Comecon's dissolution, exacerbating price and quality disparities between the two sets of countries. Could the resulting deviations from ordinary outcomes have contributed to the $\mathcal{C}$ countries' concerns?

To address this question, we use extensive data from the Eurostat databases at the product level, complemented by countries' income and productivity indicators from the IMF and the World Bank. Our study focuses on the years 2000-2007. This interval represents the period leading to the heated discussion over the $\mathcal{C}$ countries' concerns, avoiding the initial turbulence of $\mathcal{C}$ countries' transition from planned to market economies and the later impact of the Great Recession. We delve into the diverse patterns in the price and quality of products traded between countries in different *blocks* ($\mathcal{M}$-to-$\mathcal{C}$ and $\mathcal{C}$-to-$\mathcal{M}$) and within the same block (respectively, $\mathcal{M}$-to-$\mathcal{M}$ and $\mathcal{C}$-to-$\mathcal{C}$). Specifically, we investigate systematic deviations from the average disparities that typically characterize bilateral flows between nations with heterogenous per-capita income and productivity levels. The analysis is articulated into two sets of exercises distinctly examining *unit values* (each bilateral flow's value-to-volume ratio yielding a measure of average price at the product level) and *inferred quality*. The latter measures product quality levels as quantitative market share residuals after controlling for unit values and is grounded in a theoretical framework following Khandelwal, Schott, and Wei (2013) and Jaimovich, Madzharova, and Merella (2023).[2]

[1] Heated discussions within the European Commission and the European Parliament eventually resulted in an amendment to the Unfair Commercial Practices Directive, approved in 2019 to address this issue. See Item [43] in the Webpage List. Appendix A summarizes the chronology of events leading to the Directive.

[2] The methodology is further refined considering supply-side heterogeneity following Feenstra and Romalis (2014) and Merella and Santabárbara (2016).

The stepping stone of our investigation is that the lack of market experience in $\mathcal{C}$ countries and the time needed to adapt to a liberalized trade environment could have led to price or quality deviations. In particular:

Conjecture 1. $\mathcal{C}$ consumers, newly exposed to a diverse product range after decades under central planning, might have perceived $\mathcal{M}$ products as superior. This perception could have steered market outcomes towards higher prices for $\mathcal{M}$ products compared to $\mathcal{C}$ products of the same quality or identical prices for $\mathcal{M}$ products of lower quality.

Conjecture 2. $\mathcal{C}$ producers, novices in product diversification and facing consumers in $\mathcal{M}$ countries accustomed to a well-assorted market, might have been perceived as offering substandard goods. This perception could have led to $\mathcal{C}$ products being priced lower than $\mathcal{M}$ products of the same quality or requiring a higher-quality standard to elicit the same price.

We separately examine transactions involving exporters within and outside the EU to discern whether our findings relate to the profound changes experienced by European $\mathcal{C}$ countries following the fall of the Iron Curtain. Our study reveals a notable trend: within the EU, we observe a negative differential in both unit value and inferred quality deviations from ordinary outcomes when inspecting $\mathcal{C}$-to-$\mathcal{M}$ flows relative to $\mathcal{M}$-to-$\mathcal{M}$ ones. Conversely, this pattern does not hold when comparing $\mathcal{M}$-to-$\mathcal{C}$ and $\mathcal{C}$-to-$\mathcal{C}$ trading, nor in any case when transactions involve extra-EU exporters.[3]

Our results sustain Conjecture 2 within the intra-EU trade context. We find no evidence supporting Conjecture 1, revealing that concerns in $\mathcal{C}$ countries likely arise from nuanced factors like market-specific niches or broader economic issues, underscoring the originality of our insights in this area. The study's outcomes are robust to a number of controls, different productivity measures, and across two subperiods (2000-2002 and 2003-2007). The exercises involving the two separate and successive intervals unveil a decrease in the negative differentials' magnitude for European $\mathcal{C}$ products in $\mathcal{M}$ markets over time. This trend suggests that these differentials, while persistent, tend to diminish as agents become more familiar with the new open-to-trade environment — a reflection of the challenges new market entrants face compared to established incumbents. Such observations align with the building blocks of concepts such as *extended gravity*, where firms expand trade routes to markets with similar characteristics to lessen the burden of the entry cost (Morales, Sheu, and Zahler, 2019), and *incumbency*, indicating the reduced cost of accessing foreign markets for earlier entrants (Föllmi, Schetter, and Torin, 2022).

The paper sits at the intersection of the literatures investigating the relationship between product quality and economic development (Fajgelbaum, Grossman and Helpman 2011; Jaimovich and Merella, 2012, 2015) and the effects of trade liberalization in post-Comecon countries (Rodrik, 1994; Nannicini and Billmeier, 2011; Irwin, 2024). On the one hand, it builds on seminal work showing that more developed countries import and export higher-quality goods (Hallak, 2006; Verhoogen, 2008), taking into account the substantial gap in per-capita GDP between $\mathcal{C}$ and $\mathcal{M}$ country blocks during 2000-2007.[4] On the

[3] The qualitative similarity of the two sets of results is expected since unit values have been often used to proxy quality (see, e.g., Schott, 2004). Inferring product quality from market share residuals tackles potential confounding factors in price setting, such as heterogeneous input costs and bilateral pricing-to-market strategies (Khandelwal, 2010; Simonovska, 2015).

[4] Further evidence on income disparities implying that consumers and producers exchange products at different quality levels in the international markets depending on their trade partners can be found in Hummels and Klenow (2005), Bastos and Silva (2010), and Manova and Zhang (2012). Indeed, we find that import prices behaved consistently with these observations (see Table 3 in Section 3).

other hand, it investigates the potential effects of *economic inertia* in transition economies (Campos and Coricelli, 2002; Nuti, 2023) on price and quality levels of products traded internationally. Our work also relates to the contributions investigating how exporters adjust product quality levels and prices based on the importing country's economic stability and competitive landscape through market segmentation and pricing-to-market (Goldberg and Verboven, 2005; Arkolakis et al., 2019), and to the strands of the psychology and marketing literatures showing that adjusting product perception and influencing customer value are gradual, time-consuming learning processes (Alba and Hutchinson, 1987; Woodruff, 1997).

Our modeling strategy is parsimonious and abides by the typical frameworks in the literature. The nature of the custom data at our disposal prevents further analysis to seek the primary causes of the observed price and quality differentials. Underlying factors impacting these differentials could include, on the demand side, inertia in consumer preferences' adjustments to new sets of products (Batra et al., 2014), the role of the country of origin in shaping product quality beliefs (Schooler and Sunoo, 1969; Han, 1989) and preferential attitudes towards imports in developing countries (Heslop and Papadopoulos, 1993). Such differentials may also arise from structural supply-side differences in transition economies (Winiecki, 2002; Kandogan, 2006) and the heterogeneous impact of foreign direct investments (De Mello, 1997; Paul and Feliciano-Cestero, 2021). The paper's primary contribution is revealing systematic product evaluation gaps at the block level between $\mathcal{C}$ and $\mathcal{M}$ countries, offering a foundation for future research to unravel and understand these complex trade dynamics in greater detail.

The structure of the paper is as follows. Section 2 describes the data and estimation strategy. Section 3 discusses the empirical analysis involving unit values. Section 4 presents a simple model of consumer demand with heterogeneous evaluation of goods originating from the different country blocks to infer product quality. Section 5 illustrates our analysis based on inferred quality, which we perform empirically using regression equations derived from the model's predictions. Section 6 concludes.

2 Description of data and empirical strategy

This paper investigates whether evidence of price and quality differentials at the country-block level in the aftermath of Comecon's dissolution can be systematically found in international trade data. As such, our empirical analysis resorts to volumes and values traded across countries at the product level. Customs data are a notoriously rich source of these observations. We begin by illustrating our dataset, which is primarily drawn from the COMEXT database managed by Eurostat, the Statistical Office of the European Commission. This dataset is supplemented by data sourced from the International Monetary Fund's World Economic Outlook database and the World Bank's World Development Indicators. Subsequently, we illustrate the empirical strategy pursued in the next sections.

Data. Eurostat's 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. Therefore, 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. 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.

A sensitive choice we must make is the period to consider in our study. The two central aspects to weigh up in our decision concern the proximity to (i) the event of the $\mathcal{C}$ countries' economic systems switching from centralized to unplanned (beginning in 1991) and (ii) the emergence of the $\mathcal{C}$ countries' concerns regarding the relative price and quality levels of products reaching their markets from EU $\mathcal{M}$ members (starting at the end of the first decade of the XXI century). COMEXT includes data on these countries from 1999. This date is ideal for taking up our analysis since it follows the initial instability experienced by $\mathcal{C}$ countries during their transition to a market economy.[5] However, COMEXT offers data on former centrally planned countries only for Slovakia in 1999. The set of $\mathcal{C}$ countries extends to 4 in 2000, 9 in 2001, and all 11 nations in 2002.[6] Since accession to the EU for eight such countries occurred in 2004, potential economic and statistical disruption suggests avoiding including 2003-2005 and limiting the benchmark dataset to 2000-2002.[7] Nevertheless, we extend the dataset five years to 2007 to produce robustness checks. We do not include the subsequent years to avoid the instability caused by the 2008 financial crisis and its aftermath. Therefore, the resulting 2000-2007 interval has the advantage of including the earliest reliable data for the analysis of post-Comecon events and the latest stable trade flow records preceding the heated discussion regarding heterogeneity of products traded in $\mathcal{C}$ and $\mathcal{M}$ countries.

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 empirical analysis concerning import prices presented in the next section and inferred quality levels reported in Section 5. We exclude undifferentiated goods from our investigation since we look into product quality differentials. We adopt Rauch's (1999) classification, which separates differentiated products from those traded on an organized exchange or reference-priced. Along with distinguishing between $\mathcal{C}$ and $\mathcal{M}$ importers and exporters, we complement these data with values and quantities of domestic goods, countries' human capital and income per head, 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. This measure is, in turn, used to calculate the total market volume in computing products' quantitative market shares. Data on per capita GDP (purchasing power parity, 2011 international dollars) are sourced from the International Monetary Fund's World Economic Outlook database. The Human Capital Index is compiled by the World Bank.

Using a similar framework to the one presented in Section 4, 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

[5] 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 crises that hit the region in 1997 and 1998. See Roaf, Atoyan, Joshi, and Krogulski (2014) for a review of the economic transition of the relevant countries.

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

[7] The eight $\mathcal{C}$ economies that were granted accession to the EU in 2004 are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia.

Table 1.

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 (total)	82,863	83,842	85,556	84,087	91,099
No. varieties ($\mathcal{C}$ exp.)	18,382	19,594	20,336	19,437	22,837
No. obs. (total)	340,888	367,061	411,366	1,119,315	2,170,323
No. obs. ($\mathcal{C}$ exp.)	62,171	73,194	85,106	220,471	490,291
No. obs. ($\mathcal{C}$ 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 ($\mathcal{C}$)	42	42	42	42	42
No. importers (total)	18	23	25	22	27
No. importers ($\mathcal{C}$)	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.

bypass the endogeneity issues that arise when bringing regression equations based on demand systems to the data, we use them as a benchmark in computing a suitable composite dependent variable.[8] However, HS 3-digit codes require a relatively high level of aggregation across products. Furthermore, the estimates are unavailable for three of the eleven $\mathcal{C}$ countries featured as importers in our dataset (Bulgaria, the Czech Republic, and Estonia). For this reason, we also utilize the US 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 US 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

[8] For a discussion of the issues arising when estimating this type of regression equation, see, e.g., Berry (1994) and Feenstra (1994).

US price elasticities, though the outliers are identified within each product category at the HS 6-digit level.[9]

Table 1 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 2000-2002) and pooled into two disjoint periods (2000-2002 and 2003-2007). Overall, the dataset features almost 3.3 million observations (gross of the reductions applied to price elasticity outliers), with an average of more than 870,000 (710,000) concerning $\mathcal{C}$-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.

Geographical notation. Each country in the world belongs to either of two blocks, which we generically denote $\mathcal{B} = \{\mathcal{C}, \mathcal{M}\}$, with $\mathcal{C}$ indicating former centrally planned economies and $\mathcal{M}$ the historically decentralized ones. In our setting, all countries are exporters (denoted by x). We distinguish them by EU membership. Formally, we let $\mathcal{R} = \{\mathcal{EU}, \mathcal{W}\}$, with $\mathcal{EU}$ comprising EU countries and $\mathcal{W}$ the rest of the world. Importers (denoted by j) are all EU members. As a result, we identify four exporter areas resulting from all region-block combinations (i.e., $x \in \mathcal{R} \cap \mathcal{B}$, $\forall \mathcal{R}, \mathcal{B}$) and two importer areas discerned by country block (i.e., $j \in \mathcal{EU} \cap \mathcal{B}$, $\forall \mathcal{B}$). Furthermore, we let $\mathcal{J} = \{j, US\}$ denote the data source for product price elasticity estimations, distinguishing between EU countries (j) and the United States (US).

Empirical strategy. The dataset resulting from the procedure detailed above is the building block of our empirical analysis. Our objective is to identify systematic discrepancies in the price and quality of products sourced from one country-block and reaching another, compared to those traded within the same block. We proxy product prices and qualities using *unit values* and *inferred qualities*, respectively. Unit values are average prices, calculated for each product as the value-to-volume ratios of trade flows between specific importers and exporters. Inferred qualities capture the average valuation consumers assign to imported products, with higher quality attributed to imports with higher market shares, conditional on price. We partition trade flows at the country-block level using indicator functions, corresponding to three of the four combinations of $\mathcal{C}$ and $\mathcal{M}$ country-blocks as importers and exporters. For clarity, we devise a short nomenclature for key concepts used repeatedly in the analysis, illustrated in Table 2, which also reports the mathematical notation introduced in the following sections.

We implement this strategy quantitatively by estimating the correlation between the variables of interest (unit values and inferred qualities) and country-block indicator functions using pooled regressions, controlling for the market specificities of the product considered and the established income- and productivity-related stylized facts emerging from existing studies concerning the observed trade patterns. Indeed, perhaps the most challenging issue we face is disentangling the impact of a centrally planned past from that due to the development stage of $\mathcal{C}$ countries relative to their $\mathcal{M}$ counterparts. The issue arises from considering two aspects in conjunction. First, as Figure 1 illustrates, all $\mathcal{C}$ countries' average incomes per head were lower than those of $\mathcal{M}$ countries during 2000-2007 (the time frame of our analysis). Second, extensive literature shows that unit values correlate with the importer's and exporter's

[9] 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.
Glossary of key terms.

Term	Description	Notation
Unit value	Average price of a given product and bilateral flow at the country level	$p^{\mathcal{R}}_{j,x_s,t}$
Adjusted unit value	Difference between the actual unit value and the prediction based on income- and productivity related linkages	$\tilde{p}^{\mathcal{R}}_{j,x_s,t}$
Unit value deviation	Average adjusted unit value for a given bilateral flow at the country-block level	$\gamma^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$
Unit value differential	Difference between unit value deviations across importer-blocks for a given exporter block	$\gamma^{\mathcal{R}}_{\mathcal{B}'',\mathcal{B}'} - \gamma^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$
Inferred quality	Mean consumers' valuation of a given product and bilateral flow at the country level	$z^{\mathcal{R},\mathcal{J}}_{j,x_s,t}$
Adjusted inferred quality	Difference between the actual inferred quality and the prediction based based on income- and productivity-related linkages	$\tilde{\theta}^{\mathcal{R},\mathcal{J}}_{j,x_s,t}$
Inferred quality deviation	Average adjusted inferred quality for a given bilateral flow at the country-block level	$\varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{B},\mathcal{B}'}$
Inferred quality differential	Difference between inferred quality deviations across importer-blocks for a given exporter-block	$\varsigma^{\mathcal{R}}_{\mathcal{B}'',\mathcal{B}'} - \varsigma^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$

Note. The table reports the short nomenclature for some central notions repeatedly considered in our analysis. The first column defines the term. The second column provides a brief description. The third column associates the term with the relevant mathematical notation, where s indicates the product, t the time period, and the remaining subscripts and superscripts are defined in the subsection 'Geographical notation' above. The full mathematical notation is formally introduced in the appropriate sections below.

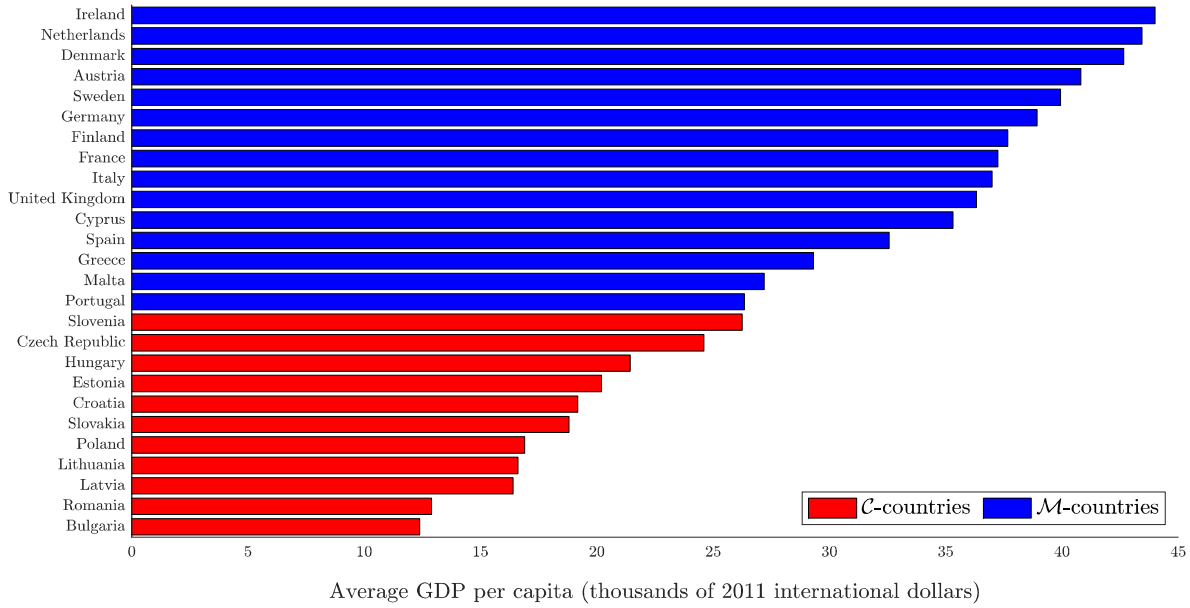
income per head.[10] As a result, any influence that being a former centralized economy might have on the variables of interest could be biased, if not reversed, by such income-related linkages.

To disentangle the two effects, we adopt a conservative approach and perform a two-step regression analysis. First, we estimate the impact of the importer's income and the exporter's productivity on each variable of interest. The resulting residuals are referred to as *adjusted unit values* and *adjusted inferred qualities*. In the second step, we use these adjusted variables to assess the effect of the indicator functions, isolating the variation in the variables of interest not explained by importer income. By design, these adjusted values have a zero mean across the entire dataset. However, their means can differ significantly

[10] Hereafter, we refer to the introductory section for a discussion of the relevant literature.

Figure 1.

EU members' average income per head in the period 2000-2007.



Note. The figure portrays the average per capita GDP (PPP, thousands of 2011 international dollars) for the EU members in the period from 2000 to 2007. The countries are split in two subsets. The bottom subset (labelled '$\mathcal{C}$-countries') comprises members that experienced centrally planned economic systems in their past; the top one ('$\mathcal{M}$-countries') those that did not.

when data are partitioned into the four bilateral flows at the country-block level. The second regression provides a measure of deviations from the zero-mean adjusted values for each bilateral flow, termed *unit value deviations* and *inferred quality deviations*.

The final step of our analysis tests whether there is a statistically significant difference between the deviations of the variables on interest concerning a given exporter block across the pair of importer blocks. We refer to these differences as *unit value differentials* and *inferred quality differentials*. Differences that are statistically different from zero may be interpreted as evidence of product price/quality variations in trade flows occurring within and across country blocks, beyond the dissimilarities due to the heterogeneous stages of development of the trading partners. To investigate whether the evidence pertains solely to European countries, we compare the results based on intra-EU data with those obtained by examining trade flows originating from exporters outside the Union (hereafter referred to as *extra*-EU).

The next section examines the relationship between importing from a given country block and the unit values of the traded goods. In the subsequent sections, we investigate the analogous relationship by looking into inferred quality levels.

3 Import price analysis

We begin by examining *unit values*, which measure the average prices of traded products.[11] Formally, we run the first-step regression

$$p^{\mathcal{R}}_{j,x_s,t} = \gamma^{\mathcal{R}}_{Y_j} \log Y_{j,t} + \gamma^{\mathcal{R}}_{Y_x} \log Y^{\mathcal{R}}_{x,t} + \mathbb{D}_{s,t} + \tilde{p}^{\mathcal{R}}_{j,x_s,t}, \tag{1}$$

where s indicates the product category, j the importer, x the exporter, t the year, $\mathcal{R} = \{\mathcal{EU}, \mathcal{W}\}$ the exporters' region (EU, rest of the world), Y the log per capita GDP, and $\mathbb{D}$ the set of dummies. For each exporter's region $\mathcal{R}$, the log unit value of product s imported by j from x in year t is denoted by $p^{\mathcal{R}}_{j,x_s,t}$; the relevant *adjusted unit value* by $\tilde{p}^{\mathcal{R}}_{j,x_s,t}$. Columns 1 and 3 of Table 3 report our findings for intra-EU and extra-EU trade flows, respectively.

In line with the existing literature, the coefficients of the importer's and exporter's log per capita GDP are positive and statistically significant in both exercises. This result indicates the existence of unit value variations across countries with different per-capita incomes after controlling for the stage of development of their trading partners and the product market conditions in a given year.

The second-step regression reads

$$\tilde{p}^{\mathcal{R}}_{j,x_s,t} = \gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{M}} + \tilde{\gamma}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}} \mathbb{I}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}} + \tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}} \mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}} + \tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}} \mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}} + \varepsilon^{\mathcal{R}}_{j,x_s,t}, \tag{2}$$

where $\mathcal{M}$ and $\mathcal{C}$ respectively indicate established decentralized economies and former centrally planned countries as before, $\mathbb{I}$ denotes an indicator function, and ε is the estimation residual. The subscripts involving country-blocks refer to the importer first, then the exporter. That is, the generic indicator function $\mathbb{I}^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$, with $\mathcal{B},\mathcal{B}' = \{\mathcal{C},\mathcal{M}\}$, identifies trade flows between an importer from block $\mathcal{B}$ and an exporter from block $\mathcal{B}'$.

By regressing the adjusted unit values against the indicator functions, we investigate potential systematic price variations across bilateral trade flows at the country-block level that are not explained by heterogeneous income and productivity levels, considering the whole set of imports and accounting for product-year specificities. More precisely, the constant $\gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{M}}$ captures the *unit value deviation* prevailing in the trade flows within the country block $\mathcal{M}$; the indicator function' regression coefficient $\tilde{\gamma}^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$, with $(\mathcal{B},\mathcal{B}') \neq (\mathcal{M},\mathcal{M})$, expresses the discrepancy between $\gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{M}}$ and the unit value deviation in trade flows from $\mathcal{B}$ to $\mathcal{B}'$, which therefore reads $\gamma^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'} \equiv \gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{M}} + \tilde{\gamma}^{\mathcal{R}}_{\mathcal{B},\mathcal{B}'}$. Columns 2 and 4 of Table 3 report our findings for intra-EU and extra-EU trade flows, respectively. The coefficients $\tilde{\gamma}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}}$ and $\tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}}$ are negative and statistically significant, while $\tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}}$ is not. Products from $\mathcal{C}$ countries invariably undergo a downward-adjustment in their prices relative those observed in trade flows between $\mathcal{M}$ countries, regardless of the EU block served.

The empirical exercise is conducive to provide evidence on the conjectures regarding cross-block product evaluation differences discussed in the introductory section. Specifically, we are interested in substantiating whether:

Hypothesis 1. $\mathcal{C}$ markets attribute a premium to products originating from $\mathcal{M}$ countries, which would result in a positive unit value differential between the flows ($\mathcal{C}$,$\mathcal{M}$) and ($\mathcal{M}$,$\mathcal{M}$): i.e., $\gamma^{\mathcal{R}}_{\mathcal{C},\mathcal{M}} - \gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{M}} = \tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}} > 0$;

[11] We refer to Table 2 in the previous section for a description of our analysis' key terms, which are emphasized in *italics* when they first appear in the section to ease their identification.

Table 3.

Unit value deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries.

	(1) $p^{\mathcal{EU}}_{j,x_s,t}$	(2) $\tilde{p}^{\mathcal{EU}}_{j,x_s,t}$	(3) $p^{\mathcal{W}}_{j,x_s,t}$	(4) $\tilde{p}^{\mathcal{W}}_{j,x_s,t}$
$\log Y_{j,t}$	0.212***		0.462***	
	(0.024)		(0.059)	
$\log Y^{\mathcal{R}}_{x,t}$	0.275**		0.297***	
	(0.117)		(0.043)	
$\mathbb{I}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}}$		– 0.222***		– 0.193**
		(0.049)		(0.075)
$\mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}}$		– 0.047		0.039
		(0.031)		(0.067)
$\mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}}$		– 0.141**		– 0.181***
		(0.051)		(0.064)
Observations	515,661	515,661	362,931	362,931
R^2	0.660	0.009	0.575	0.005

Note. The table reports the results of two pairs of estimations: Columns 1 and 2 involve EU countries ($\mathcal{R} = \mathcal{EU}$); Columns 3 and 4 the rest of the world ($\mathcal{R} = \mathcal{W}$). Columns 1 and 3 illustrate the estimation of (1); Columns 2 and 4 of (2). All estimations include product-year fixed effects, with robust standard errors (in parentheses) clustered by exporter. Significance levels: ***0.01; **0.05; *0.10.

Table 4.

Tests on parameter restrictions (unit value differentials).

	(1) value	(2) F-test	(3) p-value
$\gamma^{\mathcal{EU}}_{\mathcal{C},\mathcal{M}} - \gamma^{\mathcal{EU}}_{\mathcal{M},\mathcal{M}}$	– 0.047	2.30	0.141
		(1, 26)	
$\gamma^{\mathcal{EU}}_{\mathcal{C},\mathcal{C}} - \gamma^{\mathcal{EU}}_{\mathcal{M},\mathcal{C}}$	0.081***	9.48	0.005
		(1, 26)	
$\gamma^{\mathcal{W}}_{\mathcal{C},\mathcal{M}} - \gamma^{\mathcal{W}}_{\mathcal{M},\mathcal{M}}$	0.039	0.35	0.555
		(1, 155)	
$\gamma^{\mathcal{W}}_{\mathcal{C},\mathcal{C}} - \gamma^{\mathcal{W}}_{\mathcal{M},\mathcal{C}}$	0.012	0.10	0.754
		(1, 155)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table 2. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

Hypothesis 2. $\mathcal{M}$ markets penalize imports from the $\mathcal{C}$ block, which would produce a positive unit value differential between the flows ($\mathcal{C}$,$\mathcal{C}$) and ($\mathcal{M}$,$\mathcal{C}$): i.e., $\gamma^{\mathcal{R}}_{\mathcal{C},\mathcal{C}} - \gamma^{\mathcal{R}}_{\mathcal{M},\mathcal{C}} = \tilde{\gamma}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}} - \tilde{\gamma}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}} > 0$.

Table 4 illustrates in the first (respectively, last) two rows the results of parameters restriction tests performed on the estimations concerning within-EU (resp., extra-EU) exporters reported in Column 2 (resp., Column 4) of Table 3. The first and third rows merely confirm the results of Table 3: the unit value differential between the flows ($\mathcal{C}$,$\mathcal{M}$) and ($\mathcal{M}$,$\mathcal{M}$) is not significantly different from zero (i.e., Hypothesis 1 is rejected). The second and fourth rows show that the unit value differential between the flows ($\mathcal{C}$,$\mathcal{C}$) and ($\mathcal{M}$,$\mathcal{C}$) is positive and statistically significant only when dealing with data on EU $\mathcal{C}$ exporters. This finding suggests that the unit value deviation concerning products from the $\mathcal{C}$ block of EU countries is lower in $\mathcal{M}$ than in $\mathcal{C}$ markets. We cannot, therefore, exclude that $\mathcal{M}$ markets penalize products imported from European $\mathcal{C}$ countries (i.e., Hypothesis 2 cannot be rejected). Furthermore, no substantial unit value deviation arises when looking at trade flows originating from the rest of the world. The negative bias towards $\mathcal{C}$ imports seemingly pertains to trade flows within the EU only.

Tables C.1 and C.2 in Appendix C show that the estimates are robust to an alternative first-step regression specification inspired by the theoretical predictions regarding product quality discussed in Section 4 below. In particular, the alternative estimation features an extended set of fixed effects and an importer-exporter log income per head interaction term. Among other aspects, the fixed effects deal with heterogeneity in the retail sector (at the importer-product-year level) and in the marketing and distribution costs (at the exporter-year level). Specificities in the latter at a deeper level (exporter-product-year) may trigger the type of bias we seek to identify. Because of this potentially causal link, our analysis purposely avoids separating the two phenomena.

As discussed above, several contributions in the literature have considered a product unit value a proxy for its quality level. One might consequently contemplate interpreting the evidence regarding unit value differentials between $\mathcal{C}$ and $\mathcal{M}$ markets as resulting from varying product evaluation in the quality dimension. However, the unit value analysis may not suffice to identify quality heterogeneity, since confounding effects might materialize when comparing trade flows reaching the two blocks of countries. For example, different degrees of competition intensity could lead to distinct pricing-to-market strategies, which could, in turn, have assorted impacts on product prices (Atkeson and Burstein, 2008).

We follow the literature and infer product quality levels using quantitative market shares after controlling for prices. To this baseline setting, we add some supply-side structure and examine the importer's product quality selection from a given exporter to disentangle the potential effect of heterogeneous quality evaluation from other channels exerting bilateral influence at the country level. The following section describes the model that guides our reasoning and produces the relevant testable predictions.

4 A model with heterogeneous product quality evaluation

We set up a simple framework for studying product selection and inferring product quality. We consider a generic importer j and let $s \in \mathcal{S}$ index the large number of products traded between countries. Every exporter $x \in \mathcal{X}$ offers many versions of each product. Among these, country j optimally selects one version to import. We define a *variety* as the version of product s imported by j from country x and denote it $x_s \in \mathcal{X}_s$. Therefore, importer j has one domestic variety ($x_s = j_s$) and several imported

varieties ($x_s \neq j_s$) of every product s. The complete derivations of the formal expressions shown below are relegated to Appendix B.

Preferences. Country j has a representative household. We model their choice as the solution of a two-step problem, in which the household decides on (i) how to allocate resources across varieties, taking the choice of each variety version as given, and (ii) which version to consume per variety, taking the resources allocated to each of them as given. We assume that the representative household j's utility of consuming variety x_s is

$$u_{j,x_s} = \lambda_{j,x_s}^{\frac{1}{\sigma_s - 1}} q_{j,x_s}, \tag{3}$$

which we aggregate across exporters and products to obtain the preference representation

$$U_j = \prod_{s \in \mathcal{S}} \left[\left(\sum_{x_s \in \mathcal{X}_s} \lambda_{j,x_s}^{\frac{1}{\sigma_s}} q_{j,x_s}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{\frac{\sigma_s}{\sigma_s - 1}} \right]^{\alpha_s}. \tag{4}$$

The CES specification (4) 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 (4) features a two-tier aggregator. The outer Cobb-Douglas aggregator bundles *products* $s \in \mathcal{S}$, each associated to the share $\alpha_s \in (0,1)$ with $\sum_{s \in \mathcal{S}} \alpha_s = 1$. The inner CES aggregator bundles *varieties* $x_s \in \mathcal{X}_s$, for each product s, with an elasticity of substitution $\sigma_s \geq 1$.[13] The remaining elements of the preference specification are $q_{j,x_s} \geq 0$, which denotes the quantity consumed of variety x_s in country j, and the demand shifter $\lambda_{j,x_s} \geq 0$, specific to country j and variety x_s.

Resource allocation over varieties. We first solve the representative household's problem of maximizing (4) subject to a standard budget constraint and taking variety selection (and hence the values of product quality and demand shifter) as given. From the first-order conditions of the constrained problem, we derive the demand function for variety x_s in country j

$$q_{j,x_s} = \Gamma_{j,s} p_{j,x_s}^{-\sigma_s} \lambda_{j,x_s}, \tag{5}$$

with

$$\Gamma_{j,s} \equiv (\alpha_s P_j Y_j)^{\sigma_s} \left(\sum_{x'_s \in \mathcal{X}_s} \lambda_{j,x'_s}^{\frac{1}{\sigma_s}} q_{j,x'_s}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{-\sigma_s},$$

where p_{j,x_s} is the price of variety x_s in country j, Y_j indicates real expenditure (j-th representative household's income, or country j's income per head), and P_j is the price index associated to Y_j. Demand exhibits the typical structure of this type of model: it increases linearly in the demand shifter and declines in the price, with price elasticity taking the value $-\sigma_s$. The term $\Gamma_{j,s}$ varies across importers and products.[14]

[12] The main difference between our setup and the one in Broda and Weinstein (2006) is that we let the domestic varieties be nested within the variety aggregator of each product. Other examples of CES preference representation in applied international trade can be found in Feenstra (1994), Khandelwal, Schott, and Wei (2013), and Jaimovich, Mazdharova, and Merella (2023).

[13] Since the Cobb-Douglas aggregator entails a unit elasticity of substitution across goods, $\sigma_s \geq 1$ means that the elasticity *across* products is standardized to one and it cannot be larger than the elasticity *within* products.

[14] The term $\Gamma_{j,s}$ is instead invariant to the negligible impact of variety x_s within the aggregator due to the large number of varieties considered.

Optimal variety selection. The representative household selects the optimal variety version, which impacts the demand shifter and producer's pricing through product quality, taking (5) as a constraint. To solve this problem, we need some additional structure on the shifter and price to link these two elements of the model to the quality level (denoted by $\theta_{j,x_s} > 1$) of variety x_s consumed in country j.

We let the demand shifter be

$$\lambda_{j,x_s} = e^{\varsigma} \theta_{j,x_s}^{1+\eta \log Y_j}. \tag{6}$$

The exponent of product quality governs the nonhomothetic behavior of preferences. The demand shifter raises with income (larger Y_j), signaling the greater household's appetite for quality, and increasingly so for higher quality varieties (larger θ_{j,x_s}). The parameter η regulates the intensity of this effect. The parameter ς exerts an additional influence on the importer j's evaluation of the variety sourced from exporter x. More precisely, the parameter's value depends onto which block of countries the importer and exporter pertain. It may accordingly take four different values (one for each $\mathcal{C}$-$\mathcal{M}$ combination): formally, $\varsigma = \varsigma_{\mathcal{B},\mathcal{B}'}$, with $\mathcal{B}, \mathcal{B}' = \{\mathcal{C}, \mathcal{M}\}$. Note that the functional form of the demand shifter allows insulating the market's predisposition towards an exporter block from the quality levels of the varieties actively supplied by the single exporters.

We define the price function as

$$p_{j,x_s} = \tau_{j,x_s} \kappa_x e^{\theta_{j,x_s}^{\upsilon} (\kappa_x \varphi_s)^{-1}}, \ \upsilon > 1, \tag{7}$$

where $\tau_{j,x_s} > 0$ collects any bilateral importer-exporter element influencing the price of the traded variety other than quality, $\kappa_x > 0$ measures the exporter's efficiency in producing higher-quality products (and also wages in efficiency units), $\varphi_s > 0$ allows for the efficiency to vary across different products, and $\upsilon > 1$ is a technological parameter dictating the cost of product quality upgrading. Note that the exporter's level of development impacts the price in two ways. A larger value of κ_x means higher wages (captured by the term multiplying the exponential function), which imply higher prices for all products exported by x, and a more efficient production of high quality varieties (captured by the term at the exponent), whose prices become relatively cheaper.

The representative household's problem consists of maximizing (3) subject to the constraints represented by the expressions in (5)-(7). The problem's solution leads to the expression identifying the optimal variety

$$\theta_{j,x_s} = \left(\frac{\kappa_x \varphi_s}{\upsilon} \frac{1 + \eta \log Y_j}{\sigma_s - 1} \right)^{\frac{1}{\upsilon}}. \tag{8}$$

Wealthier consumers (larger Y_j) import higher quality goods from more efficient exporters (higher κ_x). Note that, due to the absence of interaction between quality level and market predisposition in (6), the optimal variety selection does not depend on the value of ς.

Quantitative market shares. We let $m_{j,x_s} \equiv q_{j,x_s}/Q_{j,s}$ be the quantitative market share of variety x_s in country j, where $Q_{j,s} \equiv \sum_{x_s \in \mathcal{X}_s} q_{j,x_s}$ defines the aggregate quantity of product s consumed in country j across all varieties x_s. Using (5), the quantitative market share reads

$$m_{j,x_s} = p_{j,x_s}^{-\sigma_s} \lambda_{j,x_s} \Omega_{j,s}, \tag{9}$$

where $\Omega_{j,s} \equiv \left(\sum_{x_s \in \mathcal{X}_s} p_{j,x_s}^{-\sigma_s} \lambda_{j,x_s} \right)^{-1}$ is a country- and product-specific collective term, which corresponds to the harmonic mean of price-quality ratios, adjusted for the price sensitivity, of the varieties of product s supplied to market j.

Taking logs of (9) and using (6) and (8) leads to

$$z_{j,x_s} \equiv \log m_{j,x_s} + \sigma_s \log p_{j,x_s} = \phi_{Y_j,\kappa_x} \log Y_j \times \log \kappa_x + \psi_x + \delta_{j,s} + \tilde{\theta}_{j,x_s}, \tag{10}$$

with $\phi_{Y_j,\kappa_x} = \eta/\upsilon$, $\phi_{\kappa_x} = (1/\upsilon)\log \kappa_x$, and $\delta_{j,s} \equiv \frac{1+\eta \log Y_j}{\upsilon} \log\left(\frac{1+\eta \log Y_j}{\sigma_s - 1}\frac{\varphi_s}{\upsilon}\right) + \log \Omega_{j,s}$.

We can read (10) as a regression equation, where the independent variable z_{j,x_s} is a function of the quantitative market share and price of variety x_s in country j, the income-productivity interaction term is the dependent variable, ψ_x and $\delta_{j,s}$ respectively discipline exporter and importer-product specificities, and $\tilde{\theta}_{j,x_s}$ is the regression residual, from which we isolate ς exploiting the equation

$$\tilde{\theta}_{j,x_s} = \varsigma + \epsilon_{j,x_s}, \tag{11}$$

where ϵ_{j,x_s} is the error term of the residual decomposition. We may then interpret ς as the *inferred quality deviation* produced by the heterogeneous bilateral product quality evaluation at the country-block level.

5 Import quality analysis

Using the dataset illustrated in Section 2, we proceed with empirical evidence based on *inferred quality differentials* using the expressions in (10) and (11).[15] The analysis mirrors that performed in Section 3 on unit value differentials. Note that the last section abstracted from referring explicitly to time for notation ease. Since we use annual data for several years in our pooled regressions, we add the subscript t to every time-varying element of (10) and (11). Furthermore, as explained in Section 2, we use two sets of price elasticity estimates to compute the independent variable in (10). We let $\sigma_s^{\mathcal{J}}$ denote the generic price elasticity, with $\mathcal{J} = \{j, US\}$, where j (resp., US) indicates that the elasticity was estimated using data on importer j (resp., the United States).

Restating the independent variable as $z_{j,x_s,t}^{\mathcal{R},\mathcal{J}} \equiv \log m_{j,x_s,t}^{\mathcal{R}} + \sigma_s^{\mathcal{J}} \log p_{j,x_s,t}^{\mathcal{R}}$, the regression equation reads[16]

$$z_{j,x_s,t}^{\mathcal{R},\mathcal{J}} = \phi_{Y_j,\kappa_x}^{\mathcal{R},\mathcal{J}} \log Y_{j,t} \times \log \kappa_{x,t}^{\mathcal{R}} + \psi_x^{\mathcal{R}} + \delta_{j,s,t} + \tilde{\theta}_{j,x_s,t}^{\mathcal{R},\mathcal{J}}, \tag{12}$$

where $\tilde{\theta}_{j,x_s,t}^{\mathcal{R},\mathcal{J}}$ represents the *adjusted inferred quality* of variety x_s in country j at time t when sourced from region $\mathcal{R} = \{\mathcal{EU}, \mathcal{W}\}$.

Recall from (11) that the inferred quality deviations are embedded in the adjusted inferred quality $\tilde{\theta}_{j,x_s,t}^{\mathcal{R},\mathcal{J}}$. Following a similar line of reasoning as in Section 3, we perform a residual decomposition through indicator functions identifying the trade flows' origin-destination pairs at the country-block level. Formally, we estimate

$$\tilde{\theta}_{j,x_s,t}^{\mathcal{R},\mathcal{J}} = \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{R},\mathcal{J}} + \tilde{\varsigma}_{\mathcal{M},\mathcal{C}}^{\mathcal{R},\mathcal{J}} \mathbb{I}_{\mathcal{M},\mathcal{C}}^{\mathcal{R}} + \tilde{\varsigma}_{\mathcal{C},\mathcal{M}}^{\mathcal{R},\mathcal{J}} \mathbb{I}_{\mathcal{C},\mathcal{M}}^{\mathcal{R}} + \tilde{\varsigma}_{\mathcal{C},\mathcal{C}}^{\mathcal{R},\mathcal{J}} \mathbb{I}_{\mathcal{C},\mathcal{C}}^{\mathcal{R}} + \epsilon_{j,x_s,t}^{\mathcal{R},\mathcal{J}}, \tag{13}$$

where $\mathbb{I}_{\mathcal{B},\mathcal{B}'}^{\mathcal{R}}$, with $\mathcal{B}, \mathcal{B}' \neq (\mathcal{M}, \mathcal{M})$, is an indicator function taking value one when the importer belongs to block $\mathcal{B}$ and the exporter to $\mathcal{B}'$, and zero otherwise. The constant $\varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{R},\mathcal{J}}$ captures the *inferred quality*

[15] As in Section 3, we refer to Table 2 in Section 2 for a description of our key terms, which are emphasized in italics upon their first appearance to aid identification.

[16] The set of fixed effects is intended to capture, among other features, heterogeneity in the retail sector at the importer-product-year level and in the marketing and distribution costs at the exporter-year level. As explained in Section 3, variations in marketing and distribution costs at the exporter-product-year level may indeed trigger the type of bias we seek to identify. We refrain from separating the two phenomena due to such a potentially causal link.

deviation prevailing in the trade flows within the country block $\mathcal{M}$. The indicator functions' coefficients express the same concept in terms of variations relative to $\varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{M},\mathcal{M}}$: Hence, the remaining values that inferred quality deviations can take are $\varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{B},\mathcal{B}'} = \varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{M},\mathcal{M}} + \tilde{\varsigma}^{\mathcal{R},\mathcal{J}}_{\mathcal{B},\mathcal{B}'}$, for all $(\mathcal{B},\mathcal{B}') \neq (\mathcal{M},\mathcal{M})$.

We are interested in comparing the inferred quality deviations between $\mathcal{C}$ and $\mathcal{M}$ markets for imports originating from a specific country block. From the viewpoint of the interpretation suggested by our model, and in line with the conjectures stated in the introductory section, we wish to establish whether:

Hypothesis 1. $\mathcal{C}$ markets attribute a premium to products originating from $\mathcal{M}$ countries, which would result in a positive inferred quality differential between the flows ($\mathcal{C}$,$\mathcal{M}$) and ($\mathcal{M}$,$\mathcal{M}$): i.e., $\varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{M},\mathcal{M}} = \tilde{\varsigma}^{\mathcal{R},\mathcal{J}}_{\mathcal{C},\mathcal{M}} > 0$;

Hypothesis 2. $\mathcal{M}$ markets penalize imports from the $\mathcal{C}$ block, which would produce a positive inferred quality differential between the flows ($\mathcal{C}$,$\mathcal{C}$) and ($\mathcal{M}$,$\mathcal{C}$): i.e., $\varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{R},\mathcal{J}}_{\mathcal{M},\mathcal{C}} = \tilde{\varsigma}^{\mathcal{R},\mathcal{J}}_{\mathcal{C},\mathcal{C}} - \tilde{\varsigma}^{\mathcal{R},\mathcal{J}}_{\mathcal{M},\mathcal{C}} > 0$.

Main findings. Column 1 of Table 5 illustrates the results of estimating (12) in the benchmark case considering intra-EU trade flows in 2000-2002, measuring the exporter's productivity with log per capita GDP, and computing the dependent variable using importer-specific price elasticity estimates. The coefficient $\phi^{\mathcal{EU},j}_{Y_j,\kappa_x}$ is positive and statistically significant as expected. In the presence of nonhomothetic preferences, wealthier importers demand higher quality products, more efficiently supplied by more productive countries. Column 2 reports the estimates of the coefficients in (13) based on the adjusted inferred qualities. We observe a general heterogeneity in inferred quality deviations across importer's and exporter's blocks. Relative to the deviation observed within the $\mathcal{M}$ block's trade flows, products originating from $\mathcal{C}$ countries appear penalized in both blocks. Somewhat surprisingly, $\mathcal{M}$ products do not command an additional premium in the $\mathcal{C}$ block.

We repeat the exercise using United States' price elasticity estimates. The ensuing results, outlined in Columns 3 and 4, show that our findings remain qualitatively intact. We observe that the magnitude of the first-step regression coefficient declines by about 24%. We note a similar drop in the inferred quality deviation of products traded within the $\mathcal{C}$ block (relative to those exchanged within the $\mathcal{M}$ block). The coefficient referring to $\mathcal{C}$ products' deviation in $\mathcal{M}$ markets remains virtually unchanged.

Table 6 details the outcomes of the parameter restriction tests designed to determine whether inferred quality deviations for products originating from a specific country block vary across markets in different blocks. The first row confirms that $\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{M}}$ is not significantly different from zero, suggesting that no inferred quality differential arises for $\mathcal{M}$ products and that Hypothesis 1 should be rejected. The second row indicates that $\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{C}}$ is positive and statistically significant. Hence, we cannot exclude that products originating from the $\mathcal{C}$ block are penalized in $\mathcal{M}$ markets, and Hypothesis 2 cannot be rejected. The third and fourth rows confirm such findings using the alternative set of price elasticities (US). We observe that the magnitude of the estimates rises, with the statistically significant coefficient increasing by more than 60%. It is noteworthy that these findings result from an analysis that includes a wider range of countries and is conducted at a more refined product disaggregation level.

We proceed to assess whether the negative inferred quality differentials detected above are likely linked to the events following the Iron Curtain fall or relate to the more general notion of countries having a centralized economic system. We address this issue by performing our analysis again, this

Table 5.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries ($\mathcal{EU}$ exporters).

	(1) $z^{\mathcal{EU},j}_{j,x_s,t}$	(2) $\tilde{\theta}^{\mathcal{EU},j}_{j,x_s,t}$	(3) $z^{\mathcal{EU},US}_{j,x_s,t}$	(4) $\tilde{\theta}^{\mathcal{EU},US}_{j,x_s,t}$
$\log Y_{j,t} \times \log \kappa^{\mathcal{EU}}_{x,t}$	0.730***		0.552***	
	(0.223)		(0.171)	
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{M},\mathcal{C}}$		– 1.140***		– 1.145***
		(0.300)		(0.295)
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{C},\mathcal{M}}$		– 0.016		– 0.083
		(0.141)		(0.152)
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{C},\mathcal{C}}$		– 0.784**		– 0.617*
		(0.320)		(0.304)
Observations	515,226	515,226	539,237	539,237
R^2	0.733	0.018	0.753	0.016

Note. The table reports the results of two pairs of estimations concerning EU exporters: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table 6.

Tests on parameter restrictions (inferred quality differentials, $\mathcal{EU}$ exporters).

	(1) value	(2) F-test	(3) p-value
$\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{M}}$	– 0.016	0.01	0.908
		(1, 26)	
$\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{C}}$	0.356***	9.26	0.005
		(1, 26)	
$\varsigma^{\mathcal{EU},US}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{EU},US}_{\mathcal{M},\mathcal{M}}$	– 0.083	0.30	0.589
		(1, 26)	
$\varsigma^{\mathcal{EU},US}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{EU},US}_{\mathcal{M},\mathcal{C}}$	0.528***	41.65	0.000
		(1, 26)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table 4. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

Table 7.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries ($\mathcal{W}$ exporters).

	(1) $z^{\mathcal{W},j}_{j,x_s,t}$	(2) $\tilde{\theta}^{\mathcal{W},j}_{j,x_s,t}$	(3) $z^{\mathcal{W},US}_{j,x_s,t}$	(4) $\tilde{\theta}^{\mathcal{W},US}_{j,x_s,t}$
$\log Y_{j,t} \times \log \kappa^{\mathcal{W}}_{x,t}$	0.219*		0.238***	
	(0.116)		(0.084)	
$\mathbb{I}^{\mathcal{W}}_{\mathcal{M},\mathcal{C}}$		0.201		0.285
		(0.603)		(0.631)
$\mathbb{I}^{\mathcal{W}}_{\mathcal{C},\mathcal{M}}$		0.097		0.101
		(0.145)		(0.127)
$\mathbb{I}^{\mathcal{W}}_{\mathcal{C},\mathcal{C}}$		– 0.167		– 0.129
		(0.375)		(0.361)
Observations	360,871	360,871	372,943	372,943
R^2	0.698	0.000	0.720	0.001

Note. The table reports the results of two pairs of estimations concerning non-EU exporters: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table 8.

Tests on parameter restrictions (inferred quality differentials, $\mathcal{W}$ exporters).

	(1) value	(2) F-test	(3) p-value
$\varsigma^{\mathcal{W},j}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{W},j}_{\mathcal{M},\mathcal{M}}$	0.097	0.45	0.503
		(1, 155)	
$\varsigma^{\mathcal{W},j}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{W},j}_{\mathcal{M},\mathcal{C}}$	– 0.368	1.60	0.208
		(1, 155)	
$\varsigma^{\mathcal{W},US}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{W},US}_{\mathcal{M},\mathcal{M}}$	0.101	0.62	0.431
		(1, 155)	
$\varsigma^{\mathcal{W},US}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{W},US}_{\mathcal{M},\mathcal{C}}$	– 0.414	1.52	0.219
		(1, 155)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table 4. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

time on the observed trade flows originating from extra-EU exporters. Tables 7 and 8 provide an account of this exercise's outcomes. As expected, the first-step estimations (Columns 1 and 3 of Table 7) align with those obtained examining intra-EU trade. Compared to our benchmark exercises, the coefficients' magnitudes drop drastically (to one-third when considering the importer's elasticities; to less than half with United States' elasticities).

The second-step estimations (Columns 2 and 4 of Table 7) reveal no statistically significant inferred quality differentials across any country-block combinations. The parameter restriction tests (Table 8) support this result: none of them reject the null hypothesis of no variation in inferred quality deviations across importers' blocks for products originating from a given exporters' block (regardless of whether we consider the $\mathcal{C}$ or $\mathcal{M}$ set of countries). We conclude that the phenomenon is specific to the EU and, as such, is likely surfacing due to the intensified trade liberalization between $\mathcal{C}$ and $\mathcal{M}$ countries that followed the Iron Curtain fall, which boosted bilateral flows both at the intensive and extensive margin.

Robustness checks. We perform two sets of robustness exercises. The first set addresses the concern that the exporters' log per capita GDP may not represent an ideal measure of their productivity level. Tables 9 and 10 summarize our findings when the same routine as above is executed after replacing income per head with the World Bank's Human Capital Index. The results are generally confirmed, although we record a decline in the statistical significance of the first-step estimates (Columns 1 and 3 of Table 9) accompanied by a rise in the magnitude of the coefficients expressing inferred quality deviations (Columns 2 and 4 of Table 9) and their differentials (specifically, the one concerning trade flows from $\mathcal{M}$ importers towards $\mathcal{C}$ exporters, Table 10).

The second set of exercises analyzes the trade flows observed in 2003-2007. The goal is twofold. On the one hand, we wish to test the validity of our findings against a set of data in a different time interval. On the other hand, opting for a successive adjacent period allows us to assess whether the inferred quality differentials are likely to persist over time. Tables 11 and 12 illustrate the outcomes of this exercise. The results are analogous to the ones obtained with the benchmark study. Relative to the latter, there is a spike in the statistical significance of the coefficients estimating the inferred quality deviations involving $\mathcal{C}$ exporters (Columns 2 and 4 of Table 11) and a decline of over 20% in the magnitude of the corresponding cross-block differentials (Rows 2 and 4 of Table 12), which nevertheless remain positive and highly significant. These findings still support Hypothesis 2 and suggest that the penalty $\mathcal{M}$ markets inflict on $\mathcal{C}$ products is persistent, although its extent shows a tendency to decline over time.

Lastly, Appendix C contains outcome reports on some additional exercises, which confirm our findings in some interesting dimensions. In particular, two additional sets of results are robust to replacing income per head with Human Capital Index as a measure of the exporter's productivity; namely: (i) Tables C.3 and C.4 confirm the absence of quality deviations in trading with extra-EU exporters (as depicted by the benchmark exercise reported in Tables 7 and 8 above); (ii) Tables C.5 and C.6 restate the presence of a negative deviation in $\mathcal{M}$ markets towards $\mathcal{C}$ imports within the EU between 2003 and 2007 (as described in Tables 11 and 12 above).

Table 9.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries (with $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) $z_{j,x_s,t}^{\mathcal{EU},j}$	(2) $\tilde{\theta}_{j,x_s,t}^{\mathcal{EU},j}$	(3) $z_{j,x_s,t}^{\mathcal{EU},US}$	(4) $\tilde{\theta}_{j,x_s,t}^{\mathcal{EU},US}$
$\log Y_{j,t} \times \log \kappa_{x,t}^{\mathcal{EU}}$	0.679*		0.577*	
	(0.388)		(0.308)	
$\mathbb{I}_{\mathcal{M},\mathcal{C}}^{\mathcal{EU}}$		– 2.402***		– 2.332***
		(0.187)		(0.198)
$\mathbb{I}_{\mathcal{C},\mathcal{M}}^{\mathcal{EU}}$		– 0.077		0.116
		(0.128)		(0.141)
$\mathbb{I}_{\mathcal{C},\mathcal{C}}^{\mathcal{EU}}$		– 1.544**		– 1.400***
		(0.202)		(0.205)
Observations	515,226	515,226	539,237	539,237
R^2	0.724	0.075	0.745	0.065

Note. The table reports the results of two pairs of estimations concerning EU exporters: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table 10.

Tests on parameter restrictions (inferred quality differentials, with $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) value	(2) F-test	(3) p-value
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{EU},j} - \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{EU},j}$	– 0.077	0.36	0.555
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{EU},j} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{EU},j}$	0.858***	44.16	0.000
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{EU},US} - \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{EU},US}$	– 0.116	0.68	0.418
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{EU},US} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{EU},US}$	0.932***	80.36	0.000
		(1, 26)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table 4. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

Table 11.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries (2003-2007).

	(1) $z^{\mathcal{EU},j}_{j,x_s,t}$	(2) $\tilde{\theta}^{\mathcal{EU},j}_{j,x_s,t}$	(3) $z^{\mathcal{EU},US}_{j,x_s,t}$	(4) $\tilde{\theta}^{\mathcal{EU},US}_{j,x_s,t}$
$\log Y_{j,t} \times \log \kappa^{\mathcal{EU}}_{x,t}$	0.388**		0.476***	
	(0.173)		(0.137)	
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{M},\mathcal{C}}$		– 1.127***		– 1.121***
		(0.298)		(0.295)
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{C},\mathcal{M}}$		0.018		– 0.046
		(0.111)		(0.133)
$\mathbb{I}^{\mathcal{EU}}_{\mathcal{C},\mathcal{C}}$		– 0.862***		– 0.705**
		(0.303)		(0.289)
Observations	946,394	946,394	1,207,108	1,207,108
R^2	0.735	0.018	0.755	0.015

Note. The table reports the results of two pairs of estimations concerning the period 2003-2007: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table 12.

Tests on parameter restrictions (inferred quality differentials, 2003-2007).

	(1) value	(2) F-test	(3) p-value
$\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{M}}$	0.018	0.26	0.873
		(1, 26)	
$\varsigma^{\mathcal{EU},j}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{EU},j}_{\mathcal{M},\mathcal{C}}$	0.265**	5.95	0.022
		(1, 26)	
$\varsigma^{\mathcal{EU},US}_{\mathcal{C},\mathcal{M}} - \varsigma^{\mathcal{EU},US}_{\mathcal{M},\mathcal{M}}$	– 0.046	0.12	0.733
		(1, 26)	
$\varsigma^{\mathcal{EU},US}_{\mathcal{C},\mathcal{C}} - \varsigma^{\mathcal{EU},US}_{\mathcal{M},\mathcal{C}}$	0.416***	24.11	0.000
		(1, 26)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table 4. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

6 Conclusion

This study has systematically explored price and quality disparities in post-Comecon international trade data within the EU market. We have considered two blocks of countries comprising former centrally planned economies on the one hand and established market economies on the other. We have identified deviations in bilateral flows at the country-block level from the *ordinary* disparities that would characterize the transactions involving countries at different stages of development. By comparing the deviations involving a given country-block exporter, our robust empirical analysis, grounded in a comprehensive dataset from Eurostat, has revealed *abnormal* disparities in the trade flows sourced from former centrally planned states, whereas we have found no evidence of them in those originating from established market economies. Our findings also suggest that such abnormal disparities tend to decline over time. When repeated utilizing data on extra-EU exporters, our exercises document the absence of extra-ordinary price and quality disparities in the trade flows reaching the EU between suppliers from former centrally planned and established market nations.

The negative abnormal disparity characterizing trade flows from former centrally planned to established market economies relative to those occurring within the first block suggests that the exceptional trade liberalization experienced by the European former centrally planned countries after the Iron Curtain fall might have played a role in disrupting the typical market outcomes occurring at the international level between countries at different stages of development. From this perspective, our modeling choice suggests an interpretation of our findings in terms of biases in the evaluation of products depending on their country-block of origin. More precisely, price and quality disparities might also reflect varying consumers' perception of quality at the country-block level in response to the destination market's location and the product's origin.

This perspective provides an intuitive link between our study's motivational and analytical dimensions, framing its findings at the turn of the century. During this period, consumers and producers from former centrally planned countries, as newcomers to the global market, encountered an environment with products specifically tailored to the preferences and economic conditions of the destination market. The lack of market experience in those source countries and the time required to adapt to such an environment could have led to differentials in trade outcomes.

It should be noted, however, that the empirical exercises we presented could be rationalized with alternative modeling choices. For example, analogous regression equations could be derived from a framework abstracting from consumers' heterogeneous product evaluation while considering structural supply-side differences at the country-block level. In this respect, the available data do not facilitate identifying the origin of the negative differentials in the evaluation of products sourced from former centrally planned countries. Similar considerations led us to purposely elect not to model nor empirically investigate the retail sector, which we posit is intrinsically part of the mechanism yielding systematic price and quality differentials, regardless of the demand-side or supply-side nature of the fundamental forces from which these stem.

Notably, the absence of evidence regarding abnormal disparities in trade flows originating from the block of established market economies provides no supporting evidence for the former centrally planned countries' concerns that initially motivated our investigation. In line with the presumption that producers from established market economies are experienced in tailoring their products to the economic situation

they face at destination, it might be expected that the potential frictions in transactions with former centrally planned countries would be reduced by such producers anticipating the demand conditions in the supplied market. At any rate, the data indicate that former centrally planned countries' concerns likely arise from specific market conditions or broader economic challenges.

The integration into the EU market poses unique challenges and opportunities for former centrally planned economies, particularly concerning product quality. In light of the observed negative evaluation differentials characterizing these countries' exports, this reality necessitates tailored policies to aid the productive sectors of these economies in overcoming barriers and achieving competitive quality standards. Moreover, the lack of similar differentials in trade with non-EU countries suggests specific intra-EU market mechanisms at play, meriting further investigation.

Our findings contribute significantly to the discourse on economic integration and the assessment of trade quality in post-transition economies, bridging gaps in understanding the relationship between product quality and market dynamics. Recognizing the study's constraints, we highlight the imperative for subsequent research that utilizes data conducive to causal interpretations, which will deepen insights into the interrelation of product quality, market perception, and the broader narrative of economic integration.

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Appendix

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

In 2004, the European Union was 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 Central and Eastern European countries, 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 began lamenting the allegedly lower quality of imported products, even when these were presented as the same products with identical brands and names. 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.[17] About 58% of people considered the differences in quality levels significant. Another 28% thought that there were 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 funded a topical University of Chemistry and Technology Prague's Research Project.[18] 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

[17] See Item [44] in the Webpage List.

[18] See Item [45] in the Webpage List.

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.[19]

Although studies on perceived differences in quality referred mainly to food, other products were also 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.[20] Albeit the results are not robust and often criticized by the producers for their 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.[21] 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.[22] After subsequent discussions among the bodies of the European Union, The European Parliament approved an amendment to the Unfair Commercial Practices Directive in 2019.[23] The obligation to provide clear information on different compositions, which was pivotal in the original proposal, disappears from the Directive. The final document clarifies that 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.[24] 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.[25] The study evaluated 1,380 samples of 128 food products from 19 Member States and found 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 found no 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.[26] 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 were also sensorially perceived differently. However, the discrepancies were almost unrecognizable unless the composition was strikingly different.

[19] For instance, Luncheon sold in Germany contained meat in larger quantities and of higher quality. Other products like 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.

[20] See Item [46] in the Webpage List.

[21] See Item [47] in the Webpage List.

[22] See Item [48] in the Webpage List.

[23] See Item [43] in the Webpage List.

[24] See Item [47] in the Webpage List.

[25] See Item [49] in the Webpage List.

[26] See Item [50] in the Webpage List.

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.[27] From that date, it was 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 would apply when "justified by legitimate and objective facts and the food would provide easily accessible and sufficient information on the different composition or properties."[28]

B. Mathematical derivations

Derivation of eq. (5). Consider country-j representative household's problem of maximizing the objective function (4) subject the budget constraint

$$\sum_{s\in\mathcal{S}}\sum_{x_s\in\mathcal{X}_s} p_{j,x_s}q_{j,x_s} \leq P_jY_j. \tag{14}$$

Letting ν denote the Lagrange multiplier on this constraint, we may write the Lagrangian

$$\mathcal{L} = \prod_{s\in\mathcal{S}}\left(\sum_{x_s\in\mathcal{X}_s}\lambda_{j,x_s}^{\frac{1}{\sigma_s}}q_{j,x_s}^{\frac{\sigma_s-1}{\sigma_s}}\right)^{\frac{\alpha_s\sigma_s}{\sigma_s-1}} + \nu\left(P_jY_j - \sum_{s\in\mathcal{S}}\sum_{x_s\in\mathcal{X}_s} p_{j,x_s}q_{j,x_s}\right),$$

from which we obtain the first-order condition

$$\frac{\partial\mathcal{L}}{\partial q_{j,x_s}} = \frac{\alpha_s}{q_{j,x_s}}\frac{\lambda_{j,x_s}^{\frac{1}{\sigma_s}}q_{j,x_s}^{\frac{\sigma_s-1}{\sigma_s}}}{\sum_{x_s\in\mathcal{X}_s}\lambda_{j,x_s}^{\frac{1}{\sigma_s}}q_{j,x_s}^{\frac{\sigma_s-1}{\sigma_s}}}U_j - \nu p_{j,x_s} = 0, \quad \forall\, x_s\in\mathcal{X}_s,\, s\in\mathcal{S},\, j\in\mathcal{J}, \tag{15}$$

where we have assumed that the budget constraint binds.

Rearranging, multiplying the whole expression by q_{j,x_s} and summing over the set $\mathcal{X}_s$ yields

$$\alpha_s\frac{\sum_{x_s\in\mathcal{X}_s}\lambda_{j,x_s}^{\frac{1}{\sigma_s}}q_{j,x_s}^{\frac{\sigma_s-1}{\sigma_s}}}{\sum_{x_s\in\mathcal{X}_s}\lambda_{j,x_s}^{\frac{1}{\sigma_s}}q_{j,x_s}^{\frac{\sigma_s-1}{\sigma_s}}}U_j = \alpha_sU_j = \nu\sum_{x_s\in\mathcal{X}_s} p_{j,x_s}q_{j,x_s}.$$

Furthermore, summing over the set $\mathcal{S}$, imposing the parameter restriction $\sum_{s\in\mathcal{S}}\alpha_s = 1$, and recalling that the aggregate expenditure is $\sum_{s\in\mathcal{S}}\sum_{x_s\in\mathcal{X}_s} p_{j,x_s}q_{j,x_s} = P_jY_j$, we have

$$U_j = \sum_{s\in\mathcal{S}}\alpha_sU_j = \nu\sum_{s\in\mathcal{S}}\sum_{x_s\in\mathcal{X}_s} p_{j,x_s}q_{j,x_s} = \nu P_jY_j.$$

Replacing this result into (15) and rearranging, we obtain the country-j demand function (5) of variety x_s. ■

Derivation of eq. (8). Using (3), (6), (7), and taking (5) into account, the representative household's problem reads

$$\begin{aligned}
\sup_{\theta_{x_s}} u_{j,x_s}(\theta_{x_s}) &= \lambda_{j,x_s}^{\frac{1}{\sigma_s-1}}q_{j,x_s},\\
s.t.\ q_{j,x_s} &= \Gamma_{j,s}p_{j,x_s}^{-\sigma_s}\lambda_{j,x_s},\\
\lambda_{j,x_s} &= e^{\varsigma}\theta_{j,x_s}^{1+\eta Y_j},\\
p_{j,x_s} &= \tau_{j,x_s}\kappa_x e^{\theta_{j,x_s}^{\upsilon}(\kappa_x\varphi_s)^{-1}}.
\end{aligned}$$

[27] See Item [51] in the Webpage List.

[28] See Item [47] in the Webpage List.

Plugging the constraints into the objective function, we can rewrite the problem as an unconstrained variant as

$$\sup_{\theta_{x_s}} u_{j,x_s}\left(\theta_{x_s}\right) = \Gamma_{j,s}\tau_{j,x_s}^{-\sigma_s}\kappa_x e^{\frac{\sigma_s\varsigma}{\sigma_s-1}}\theta_{x_s}^{\frac{\sigma_s}{\sigma_s-1}(1+\eta Y_j)}e^{-\sigma_s\theta_{j,x_s}^{\upsilon}(\kappa_x\varphi_s)^{-1}}.$$

The problem's first-order condition is

$$\frac{\sigma_s}{\sigma_s-1}\left(1+\eta Y_j\right)\frac{u_{j,x_s}\left(\theta_{j,x_s}\right)}{\theta_{j,x_s}} - \frac{\sigma_s\upsilon}{\kappa_x\varphi_s}\theta_{j,x_s}^{\upsilon}\frac{u_{j,x_s}\left(\theta_{j,x_s}\right)}{\theta_{j,x_s}} = 0.$$

The problem's second-order condition for a maximum is satisfied since

$$u''_{j,x_s}\left(\theta_{j,x_s}\right) = -\sigma_s\frac{u_{j,x_s}\left(\theta_{j,x_s}\right)}{\theta_{j,x_s}}\left(\frac{1+\eta Y_j}{\sigma_s-1}\frac{1}{\theta_{j,x_s}} + \frac{\upsilon\left(\upsilon-1\right)}{\kappa_x\varphi_s}\theta_{j,x_s}^{\upsilon-1}\right) \leq 0.$$

Rerranging the first-order condition, we obtain (8). ■

Derivation of $u''_{j,x_s}\left(\theta_{j,x_s}\right)$. Note that the first derivative of $u_{j,x_s}\left(\theta_{j,x_s}\right)$ reads

$$u'_{j,x_s}\left(\theta_{j,x_s}\right) = \sigma_s\left(\frac{1+\eta Y_j}{\sigma_s-1}\frac{1}{\theta_{j,x_s}} - \frac{\upsilon}{\kappa_x\varphi_s}\theta_{j,x_s}^{\upsilon-1}\right)u_{j,x_s}\left(\theta_{j,x_s}\right).$$

Then, the second-order derivative is

$$\begin{aligned} u''_{j,x_s}\left(\theta_{j,x_s}\right) = \sigma_s u_{j,x_s}\left(\theta_{j,x_s}\right)\frac{\partial}{\partial\theta_{j,x_s}}\left(\frac{1+\eta Y_j}{\sigma_s-1}\frac{1}{\theta_{j,x_s}} - \frac{\upsilon}{\kappa_x\varphi_s}\theta_{j,x_s}^{\upsilon-1}\right) \\ + \sigma_s\left(\frac{1+\eta Y_j}{\sigma_s-1}\frac{1}{\theta_{j,x_s}} - \frac{\upsilon}{\kappa_x\varphi_s}\theta_{j,x_s}^{\upsilon-1}\right)\frac{\partial u_{j,x_s}\left(\theta_{j,x_s}\right)}{\partial\theta_{j,x_s}}. \end{aligned}$$

where the second addend on the right-had side vanishes since, at the optimum, $\partial u_{j,x_s}\left(\theta_{j,x_s}\right)/\partial\theta_{j,x_s} = 0$. ■

Derivation of eq. (9). We define the aggregate consumption of good s across all varieties j_s in country i as

$$Q_{i,s} \equiv \sum_{j_s\in\mathcal{J}_s} q_{j_s} = \alpha_s^{\sigma_s}P_i^{\sigma_s}Y_i^{\sigma_s}\left(\sum_{j_s\in\mathcal{J}_s}\lambda_{i,j_s}^{\frac{1}{\sigma_s}}q_{j_s}^{\frac{\sigma_s-1}{\sigma_s}}\right)^{-\sigma_s}\sum_{j_s\in\mathcal{J}_s}p_{j_s}^{-\sigma_s}\lambda_{i,j_s}. \tag{16}$$

Imposing the identity $m_{i,j_s} \equiv q_{i,j_s}/Q_{i,s}$, using (5) and (16), and simplifying, we obtain (9). ■

Derivation of eq. (10). Taking logs of (9) yields

$$\log m_{j,x_s} = -\sigma_s\log p_{j,x_s} + \log\lambda_{j,x_s} + \log\Omega_{j,s}.$$

Rearranging, using the definition of z_{j,x_s} and (6), we obtain

$$z_{j,x_s} = \varsigma + \left(1+\eta\log Y_j\right)\log\theta_{j,x_s} + \log\Omega_{j,s},$$

from which exploiting (8) we get

$$z_{j,x_s} = \frac{1+\eta\log Y_j}{\upsilon}\log\left(\frac{\kappa_x\varphi_s}{\upsilon}\right) + \log\left(\frac{1+\eta\log Y_j}{\sigma_s-1}\right) + \log\Omega_{j,s} + \varsigma.$$

Rearranging and using the definitions of ϕ_{Y_j,κ_x}, ψ_x, and $\delta_{j,s}$ leads to (10). ■

C. Additional tables

Table C.1.

Unit value deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries.

	(1) $p^{\mathcal{EU}}_{j,x_s,t}$	(2) $\tilde{p}^{\mathcal{EU}}_{j,x_s,t}$	(3) $p^{\mathcal{W}}_{j,x_s,t}$	(4) $\tilde{p}^{\mathcal{W}}_{j,x_s,t}$
$\log Y_{j,t} \times \log Y^{\mathcal{R}}_{x,t}$	0.082*		0.053**	
	(0.048)		(0.022)	
$\mathbb{I}^{\mathcal{R}}_{\mathcal{M},\mathcal{C}}$		– 0.189***		– 0.177**
		(0.049)		(0.073)
$\mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{M}}$		– 0.002		0.021
		(0.029)		(0.054)
$\mathbb{I}^{\mathcal{R}}_{\mathcal{C},\mathcal{C}}$		– 0.131**		– 0.157**
		(0.050)		(0.062)
Observations	515,226	515,226	360,871	360,871
R^2	0.693	0.008	0.615	0.005

Note. The table reports the results of estimations as per equations (12)-(13) with log unit values replacing the independent variable. All estimations include importer-product-year fixed effects, with robust standard errors (in parentheses) clustered by exporter. Significance levels: ***0.01; **0.05; *0.10.

Table C.2.

Tests on parameter restrictions (unit value differentials).

	(1) value	(2) F-test	(3) p-value
$\gamma^{\mathcal{EU}}_{\mathcal{C},\mathcal{M}} - \gamma^{\mathcal{EU}}_{\mathcal{M},\mathcal{M}}$	– 0.002	0.01	0.939
		(1, 26)	
$\gamma^{\mathcal{EU}}_{\mathcal{C},\mathcal{C}} - \gamma^{\mathcal{EU}}_{\mathcal{M},\mathcal{C}}$	0.058**	4.77	0.038
		(1, 26)	
$\gamma^{\mathcal{W}}_{\mathcal{C},\mathcal{M}} - \gamma^{\mathcal{W}}_{\mathcal{M},\mathcal{M}}$	0.021	0.16	0.693
		(1, 155)	
$\gamma^{\mathcal{W}}_{\mathcal{C},\mathcal{C}} - \gamma^{\mathcal{W}}_{\mathcal{M},\mathcal{C}}$	0.020	0.35	0.556
		(1, 155)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table C.1. The columns indicate the values of the restriction, the F-test (degrees of freedom in parentheses), and the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

Table C.3.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries ($\mathcal{W}$ exporters, $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) $z_{j,x_s,t}^{\mathcal{W},j}$	(2) $\tilde{\theta}_{j,x_s,t}^{\mathcal{W},j}$	(3) $z_{j,x_s,t}^{\mathcal{W},US}$	(4) $\tilde{\theta}_{j,x_s,t}^{\mathcal{W},US}$
$\log Y_{j,t} \times \log \kappa_{x,t}^{\mathcal{W}}$	0.315		0.437***	
	(0.195)		(0.094)	
$\mathbb{I}_{\mathcal{M},\mathcal{C}}^{\mathcal{W}}$		– 0.336		– 0.216
		(0.654)		(0.688)
$\mathbb{I}_{\mathcal{C},\mathcal{M}}^{\mathcal{W}}$		0.136		0.139
		(0.113)		(0.104)
$\mathbb{I}_{\mathcal{C},\mathcal{C}}^{\mathcal{W}}$		– 0.652		– 0.590
		(0.436)		(0.417)
Observations	352,189	352,189	364,129	364,129
R^2	0.708	0.002	0.726	0.002

Note. The table reports the results of two pairs of estimations: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table C.4.

Tests on parameter restrictions (inferred quality differentials, $\mathcal{W}$ exporters, $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) value	(2) F-test	(3) p-value
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{W},j} - \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{W},j}$	0.136	1.44	0.233
		(1, 115)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{W},j} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{W},j}$	– 0.316	1.58	0.211
		(1, 115)	
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{W},US} - \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{W},US}$	0.139	1.78	0.185
		(1, 115)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{W},US} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{W},US}$	– 0.374	1.45	0.230
		(1, 115)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table C.3. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.

Table C.5.

Inferred quality deviations between $\mathcal{C}$-countries and $\mathcal{M}$-countries (2003-2007, $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) $z_{j,x_s,t}^{\mathcal{EU},j}$	(2) $\tilde{\theta}_{j,x_s,t}^{\mathcal{EU},j}$	(3) $z_{j,x_s,t}^{\mathcal{EU},US}$	(4) $\tilde{\theta}_{j,x_s,t}^{\mathcal{EU},US}$
$\log Y_{j,t} \times \log \kappa_{x,t}^{\mathcal{EU}}$	0.987***		0.794**	
	(0.328)		(0.286)	
$\mathbb{I}_{\mathcal{M},\mathcal{C}}^{\mathcal{EU}}$		– 2.154***		– 2.079***
		(0.190)		(0.203)
$\mathbb{I}_{\mathcal{C},\mathcal{M}}^{\mathcal{EU}}$		0.016		– 0.066
		(0.105)		(0.120)
$\mathbb{I}_{\mathcal{C},\mathcal{C}}^{\mathcal{EU}}$		– 1.602***		– 1.354***
		(0.208)		(0.199)
Observations	946,394	946,394	1,207,108	1,207,108
R^2	0.729	0.062	0.750	0.053

Note. The table reports the results of two pairs of estimations: Columns 1 and 2 involve the importer elasticities; Columns 3 and 4 the United States'. Columns 1 and 3 estimate (12) and include importer-product-year fixed effects; Columns 2 and 4 estimate (13). Standard errors (in parentheses) are robust and clustered by exporter in all specifications. Significance levels: ***0.01; **0.05; *0.10.

Table C.6.

Tests on parameter restrictions (inferred quality differentials, 2003-2007, $\log \kappa_{x,t}^{\mathcal{EU}} = H_{x,t}^{\mathcal{EU}}$).

	(1) value	(2) F-test	(3) p-value
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{EU},j} - \varsigma_{\mathcal{M},\mathcal{M}}^{\mathcal{EU},j}$	0.016	0.02	0.883
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{EU},j} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{EU},j}$	0.552***	22.55	0.000
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{M}}^{\mathcal{EU},US} - \varsigma_{\mathcal{M},M}^{\mathcal{EU},US}$	– 0.066	0.31	0.585
		(1, 26)	
$\varsigma_{\mathcal{C},\mathcal{C}}^{\mathcal{EU},US} - \varsigma_{\mathcal{M},\mathcal{C}}^{\mathcal{EU},US}$	0.725***	75.39	0.000
		(1, 26)	

Note. The table reports the results of two sets of parameter restriction tests performed on the coefficients reported in Columns 2 and 4 of Table C.5. Column 1 indicates the point estimate values of the restrictions; Column 2 the value of the F-test (with the relevant degrees of freedom in parentheses underneath); Column 3 the associated p-value. Significance levels: ***0.01; **0.05; *0.10.