Resisting Foreign Competition in the Food Industry. Labor Cost vs. Product Quality *

Zohra Bouamra-Mechemache† Carl Gaigné‡ Stéphane Turolla§

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Abstract

This paper examines the determinants of international competitiveness at the industry level by using a structural gravity model. We focus on the relative role of cost-related and quality-related competition in import ratios (the ratio of imports to the domestic demand met with domestic production). From data on EU intra-trade flows, our results suggest that the import penetrations are significantly shaped by quality and labor cost factors. However, the magnitude of their effects are relatively low compared to border effects.

Keywords: International competitiveness; Labor cost; Product quality; Border effect.

JEL Classification: F12; F14; F60.

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†TSE, INRA, Université Toulouse Capitole, Manufacture des Tabacs, 21 allée de Brienne, 31015 Toulouse Cedex 6

‡INRA, UMR 1302 SMART LERECO, 4 Allée Adolphe Bobierre, 35000 Rennes Cedex, France; email: carl.gaigne@inra.fr.

§INRA, UMR 1302 SMART LERECO, 4 Allée Adolphe Bobierre, 35000 Rennes Cedex, France; email: stephane.turolla@inra.fr.

1 Introduction

The international competitiveness of domestic industries is of great concern for policy-makers. For instance, the European Commission established a High Level Forum starting in 2010 on this issue and initiated studies to analyze the competitiveness of the European food and drink industry sector (ECSIP consortium, 2016). Empirical evidence shows that, in numerous industries, developed countries experienced a relative rise in their import ratios: a higher share of domestic demand comes from foreign production (see the next section). There is a considerable amount of controversy about the origin of this increase. Although there are different sources of absolute advantage for a country, the relative importance of costs and prices has attracted a great deal of interest (through labor cost and productivity) and product quality. Even if lower unit labor costs are expected to improve competitiveness, Kaldor (1978) was among the first to show that, over the long term, market shares for exports and relative unit costs or prices tend to move together (the so-called Kaldor paradox). However, competitiveness improvements can be due to higher quality of products that may explain the positive correlation between market share and prices. Surprisingly, we lack empirical evidence on the respective impact of cost-related competition and quality-related competition on trade patterns.

The objective of this article is to assess the respective role of labor cost and product quality in international competitiveness. We focus on bilateral trade flows between countries *within* the EU because (i) EU is a free trade area that allows us to control for the role of trade policies in international trade (such that tariffs, non-tariff measures, bilateral agreements, ...) (ii) EU is made of a large number of countries characterized by heterogeneous labor and food markets that implies large variations across countries in labor cost and product quality; (iii) EU delivers an original dataset as this dataset provide information for European countries at the 4-digit NACE level for the period 1995-2015 and match accounting data from Eurostat on Structural Business Statistics that allows us to exploit also variations in labor cost and labor productivity across industries.

We use a gravity equation of trade to check whether the labor cost and product quality, relative to that of its competitors, can help explaining the rise of the substitution of domestic production with imports from foreign countries. More precisely, we adopt a structural approach by modeling the micro-foundations of import ratios explicitly. To measure the international competitiveness, we could use the export market share of a country-industry pair by comparing the unit labor costs relatively to the EU28. We prefer to use the import ratio to compare the unit labor cost between *country pairs* (the home country and the origin country). Hence, we study the competitiveness of a national industry in the domestic market, *e.g.* the exposure of national industries to foreign competition.

To analyze quality related factors, we need to compute an index of product quality at the year-country-product level. Prices are an imperfect measure of the quality of goods. A rise in prices can reflect higher wage rate or lower productivity and, in turn a lower demand. However, the impact of prices on sales could be lower, even reversed, if the increase in price is due to a rise in quality. Indeed, consumers make their choice with respect to quality-adjusted price. We follow the methodology developed in Khandelwal et al. (2013) to compute the product quality at the year-country-product level. For a same price, if the purchased quantity of a good that a country imports from foreign country is higher than the purchased quantity of a good produced domestically, then the home country produces a good of lower quality. Our index of product quality is based on this principle.

We show that labor cost and product quality do have an impact on our international competitiveness measure. We also conduct simulations to evaluate the impact of labor cost differences between France and Germany and quality differentials between France and Italy. For a large majority of industries, labor costs are lower in Germany than in France. It follows that applying a labor cost equals to the labor cost prevailing in Germany would induce a decrease of 3 percentage points of total food import expenditures, which corresponds to almost 600 million euros. Perceived quality of Italian products is on average slightly larger than that of French products. Despite this low gap, applying the quality prevailing in Italy to French food industries would reduce French import expenditures by more than 900 million euros, which corresponds to 4.4% of total imports. However, we show that the impact of labor and quality remains much lower than the border effect. For example, we show that if border-related costs in serving France is identical to that in serving Germany, the share of domestic consumption covered by imports in France would increase by a factor of 2.1. We also find that even though labor costs, productivity, and perception of product quality would be identical in France and in Germany, Germany exports will be around 2.5 times higher than France exports as the border-related costs incurred by French industries to serve the other European countries are much higher that the border-related costs borne by German industries.

This article relates to the literature on the role of labor cost in international competitiveness. While there is a range of the literature focusing on firm productivity in EU countries, only few analysis is devoted to the role of product quality and labor cost in international competitiveness. In general, articles focus on border effects that is policy barriers (tariffs and non tariff barriers) and border costs unrelated to policy barriers such as consumer 'home bias' preferences. Olper and Raimondi (2008a) showed that the consumer home bias dominates the effect of policy barriers in food trade.

Our paper contributes to the literature on the effect of labor cost on export performance by exploiting the difference across industries, countries and year. Very little empirical work has studied the impact of unit labor costs on international competitiveness. Altomonte et al. (2012) use EU firm-level survey data to show how unit labor costs affect the probability of being an exporter. They argue that total factor productivity plays a key role in international competitiveness while the effect of unit labor costs is rather low. Decramer et al. (2016) and Malgouyres and Mayer (2018) confirm this finding using Belgian and French firm-level data, respectively. Both studies show that a 10% increase in unit labor costs leads to a 2% decrease in exports. Decramer et al. (2016) conclude that the effect of labor cost is rather limited and the use of unit labor cost as a competitiveness indicator is not appropriate. However, Decramer et al. (2016) show the magnitude of the labor cost effect on export performance is higher for more labor-intensive firms. Gan et al. (2016) also show that regionally-driven changes in the minimum wage faced by Chinese exporters affect their competitiveness. They find that the effect of unit labor cost is not strong. A 10% increase in the minimum wage is associated with a 0.9 percentage-point decrease in the probability of exporting goods and a 0.9% decline in export sales, conditional on exporting. From macro data, the literature shows that the role of unit labor costs in export performance is modest. Technological choice, R&D spending, and investment in human capital appear to be more appropriate indicator of international competitiveness (Cardoso et al., 2012).[1] The low impact of labor cost on export performance is not surprising as it has been shown more successful exporters hire more skilled workers and pay higher wages (Verhoogen, 2008).

Recent trade literature shows that product quality plays an important role in international trade. For a given product, more successful exporters have been shown to sell higher-quality goods at higher prices (Manova and Zhang, 2017). Curzi and Olper (2012), who use R&D and innovation to proxy quality, confirm this positive relationship between product quality and export performance in the food sector. Using data on French Champagne producers, Crozet et al. (2012) find that quality (measured as quality ranking by experts) increases both the probability of market entry and the exported values. Duvaleix-Treguer et al. (2018) also shows that the EU quality label allows certified cheese producers to improve their export performance. Our product quality measurement allows us to study different food industries and to consider differences in perception of product quality across countries and over time.

The rest of the paper is organized as follows. The next section presents the key evolution of international competitiveness in the EU. Section 3 outlines the modeling framework used in the study, and Section 4 discusses data and measurement issues. In Section 5, we present the estimation results with and without distinguishing the factors of competitiveness and conduct some counterfactual simulations to assess the impact of labor cost and quality on competitiveness. Finally, Section 6 provides some concluding

[1]Impact of relative costs on international competitiveness has also been studied in international macroeconomics. This literature focuses on exchange rate pass-through into export prices. The exchange rate can have an impact on price competitiveness. Depreciation of the national currency will result in an improvement in price competitiveness. We do not explore the role of exchange rate in the evolution of import ratios.

remarks.

2 International competitiveness

Compared to other countries, the trade balance for EU seems to improve over time while economic performance, measured as the industry share in total manufacturing, labor productivity or value added, is lower than other countries as USA, Australia, Brazil and Canada.

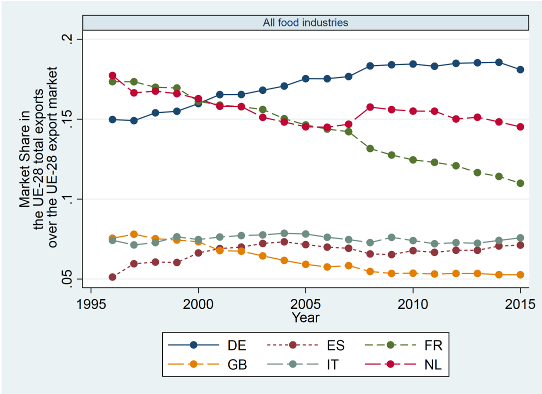
Such an issue is also at stake within EU food industries, which compete on the EU markets. For instance, the French poultry industry is decreasing compared to other EU countries even if the domestic consumption in France has increased: the share of imports in domestic consumption has grown from 15 percent in 2000 to 30 percent in 2015 (Chatellier and Magdelaine, 2015). One of the main factor highlighted to explain this difference in competitiveness between the French poultry industry and the German poultry industry is the difference in the unit cost of labor between countries, the labor cost representing half of the difference in slaughter cost between France and Germany according to Chotteau et al. (2017). More largely than the poultry sector, Besson and Dedinger (2015) pointed out that the French food industry often comply about differences in labor costs with many partner countries such as Germany, Belgium, Denmark, Spain, Italy, Netherlands and Poland. They report a decrease in their competitiveness for many food products and in particular for the meat industry.

Our data confirms the heterogeneity in international competitiveness in the intra-EU market. Figure (1) shows that Germany, Netherlands and France are the main exporters of food products on the EU market followed by Italy, Spain and Netherlands. However the competitiveness of the different countries on the export market changed with time. While Germany was the third exporter on the EU market in 1995, the share of German food exports regularly increased such that it became the main exporter in the EU. On the contrary, France and the Netherlands (and Great Britain in a lesser extend) became less and less competitive on the export market while smaller exporters' market shares increased (Spain in particular).[2] Comparing panel (a) and panel (b) of Figure (1), it does not seem that member countries' export market shares for animal products follow a much different trend from the general trend observed on the global food market.

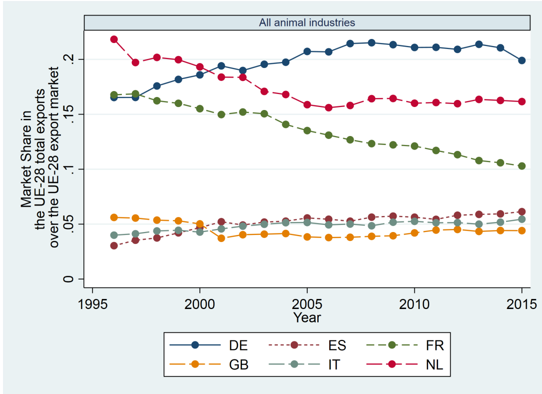
Competitiveness is much more mixed when considering the competition an industry faces in its own domestic country. It can be measured with import penetration ratio such as the ratio of imports on own domestic net supply. Then, It can be observed that Germany exports more food products than France, Italy or Spain but the import

[2]Export market shares of the main EU exporters follow the same evolution pattern at the EU and at the world level. However, the rise of German exports is more important in the EU than on the world markets.

Figure 1: Export Market Share (Intra-EU Market) for Selected EU Member Countries



(a) All food products



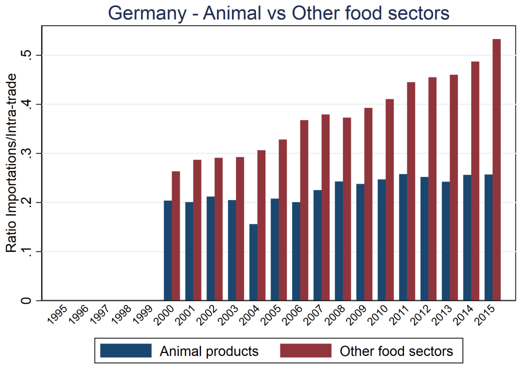
(b) All animal products

ratio in Germany is higher than in the other selected member countries (Figure 2). The import ratio for food products increases in time for all countries but at different rate, with the highest rate for Germany. For animal sectors, the import ratio is similar to ratio observed at the whole food industry level for Great Britain and Italy but is much smaller for Germany, France and Italy. In addition, in those countries, it increases at a lower rate for the animal sectors compared to the whole food industry. This heterogeneity both between sectors and between countries raises questions about which economic factors explain differences in competitiveness.

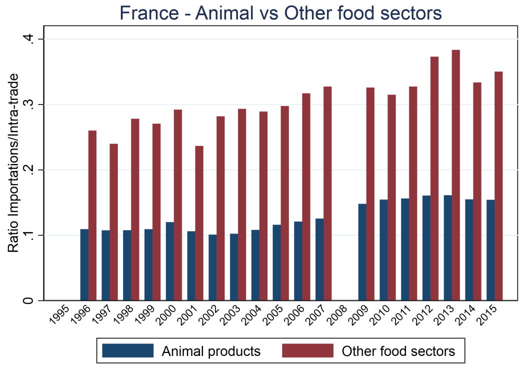
3 Model

We propose to approximate the competitiveness of an industry in a given country by its capacity to resist to the competitive pressure exerted by foreign competitors in the domestic market. Our goal is to explain the ratio of bilateral imports to domestic sales by relative price and non-price competitiveness factors while controlling for relative country size and trade impediments (e.g., distance, tariff and non-tariff barriers). To this end, we follow recent developments in the trade literature and we ground our empirical specification on a theoretically-founded gravity equation. The gravity model is very popular in international economics and is very intuitive (for more details, see Yotov et al., 2016). The gravity model of international trade predicts that bilateral trade flows depend on the size of origin and destination countries and on bilateral trade costs (distance, trade policy,...). Its predictive power is high. The gravity model fits well trade data. This explains why gravity models are widely used to explain trade patterns. The gravity equation of trade has solid theoretical foundations (Head and Mayer, 2014). This property makes the gravity model appropriate for counterfactual analysis, such as quantifying the effects of competitiveness factors such as labor cost and product quality.

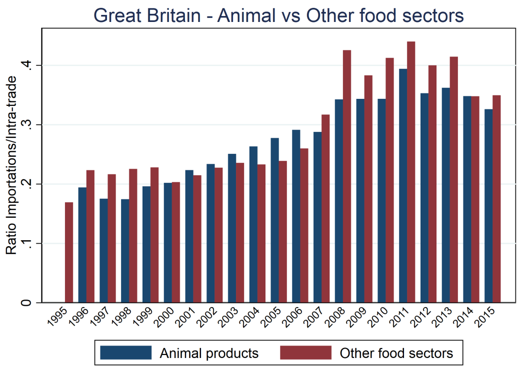
Figure 2: Import Penetration Ratios for Selected Member Countries



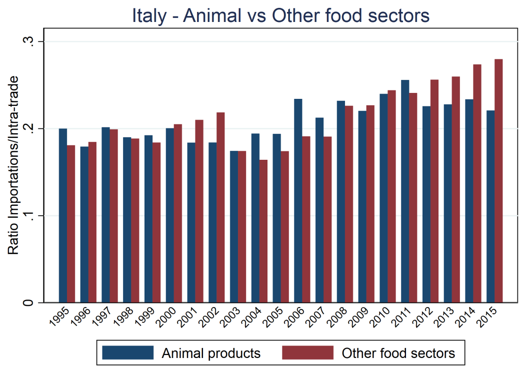
(a) Germany



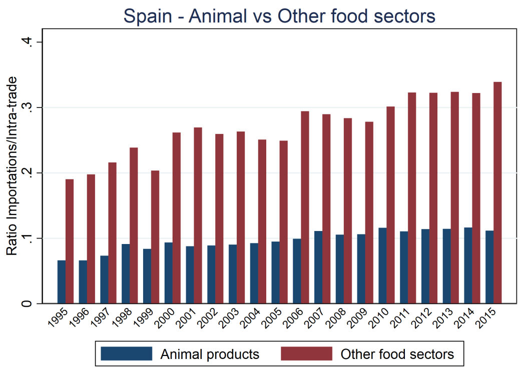
(b) France



(c) Great Britain



(d) Italy



(e) Spain

Notes: Netherlands has not be included in Figure b. Netherlands can be an intermediary country for other EU countries' exports to the rest of the world. Thus, import statistics for this country can be biased.

We follow the approach proposed by Head and Mayer (2000), which consists to purge the monadic terms of the importing country from the gravity equation by normalizing (log) bilateral imports of a given country by trade with self. The main advantage of the *log odds* specification is to relax the hypothesis of identical preferences across sourcing countries that is implicitly imposed with the fixed-effects approach. By allowing asymmetric demands between domestic and foreign goods, this approach made possible the estimation of bilateral border effects and inspired a large body of empirical research on the evolution and the determinants of border effects (e.g., Fontagné et al., 2005; Olper and Raimondi, 2008a,b). Furthermore, an additional important feature of this approach draws our attention. By making explicit the role of exporter capability in trade flows generated despite capturing it by a fixed-effect, the *log odds* specification offers an interesting framework to analyze the exporter competitiveness along multiple dimensions. Concretely, the approach allows to derive a "structural" gravity equation where the amounts spend between foreign and domestic goods is a function of relative price and non-price determinants of foreign goods net of consumer preferences and trade impediments. It is then possible to quantify the impact of various competitiveness factor on the trade openness at the country-industry level and conduct counterfactual exercises.

We derive our gravity equation from the monopolistic competition model of trade of Dixit and Stiglitz (1977) and Krugman (1980) (hereafter DSK model). The DSK model assumes that each country, labeled with subscript i, has n_{ik} firms producing a unique variety of product k with identical technologies. Varieties are horizontally and vertically differentiated and firms face identical demands (denoted q). It results that firms can exert market power and set prices as a (constant) markup over marginal cost.

On the demand side, consumers in each country are assumed to have identical Cobb-Douglas preferences over differentiated products $U_i = \Pi_k U_{ik}^{\delta_{ik}}$ where U_{ik} is a strictly increasing and strictly concave upper-tier utility function that is twice continuously differentiable in all its arguments and δ_{ik} is the standard expenditure shares with $\sum_k \delta_{ik} = 1$. The utility resulting from the consumption of each differentiated product is given by:

$$U_{ik} = \left(\sum_{j=1}^{N} \sum_{h=1}^{n_{jk}} \left(\lambda_{ijk} q_{ijkh}\right)^{\frac{\sigma_k - 1}{\sigma_k}} \right)^{\frac{\sigma_k}{\sigma_k - 1}}$$

where $h = 1, \cdots, n_{jk}$ denotes a variety of product k exported by country j, q_{ijkh} the quantity consumed, and $\sigma > 1$ represents the constant elasticity of substitution. The term λ_{ijk} can be interpreted as the quality perceived by consumers living in country i for products k imported from country j. The term λ_{ijk} also captures the fact that consumer i could value differently varieties of the same quality according to their geographical origin (e.g., a consumer could prefer domestic goods from foreign goods or could prefer products imported from countries sharing common cultural characteristics). Therefore, products are both horizontally and vertically differentiated. More formally, we assume that:

$$\lambda_{ijk} = \theta_{jk}^{\beta_k} \exp\left[-B_{ij}\left(\gamma_k - \eta_k CL_{ij} - \mu_k CB_{ij}\right)\right] \tag{1}$$

where θ_{jk} represents the quality of product k and B_{ij} is a dummy variable equal to one for $i \neq j$. An increase in β_k signals greater appreciation for vertically differentiated products.

Our specification introduces systematic preferences for home-produced goods $\gamma_k > 0$ (*e.g.*, a home bias effect). However, sharing a common language (CL) or a common border (CB) mitigate this home bias.

Solving the consumer's maximization problem yields the C.I.F. value of imports of country i from j:

$$m_{ijk} \equiv p_{ijk}q_{ijk} = \lambda_{ijk}^{\sigma_k-1} n_{jk} p_{ijk}^{1-\sigma_k} P_{ik}^{\sigma_k-1} E_{ik} \tag{2}$$

where p_{ijk} is the price of imported varieties paid by the end consumer i and $P_{ik} \equiv \left(\sum_j \lambda_{ijk}^{\sigma_k-1} n_{jk} p_{ijk}^{1-\sigma_k}\right)^{1/(1-\sigma_k)}$ corresponds to the quality-adjusted price index in country i. It follows that two trading partners are indirectly connected with third countries through the price index. A lower price or a higher quality in country i for product k implies lower imports of country i from country j. Equation (2) corresponds to the standard CES demand function where bilateral imports are modeled as a function of the share of the total expenditure of the importing country $E_{ik} \equiv \sum_j m_{ijk}$ (including domestic sales) and a preference shifter λ_{ijk}. The expenditure share depends on relative quality-adjusted prices (p_{ijk}/λ_{ijk}).[3]

Delivering goods between or within countries is not costless. Hence, the price paid by consumer i corresponds to the factory-gate price p_{jk} plus trade costs. The trade costs include *ad valorem* bilateral tariffs T_{ijk} and transport costs τ_{ijk}. Following Krugman's model, we adopt the formulation of "iceberg transport costs" meaning that $\tau_{ijk} \geq 1$ units must be shipped to deliver one unit of variety in country i. We specify a functional form for τ_{ijk}. Shipping costs are assumed to be a function of distance, costs of cross-border shipments (border effect) and a random component. Formally, we assume:

$$\tau_{ijk} = d_{ij}^{\delta_k^d} \exp\left[-B_{ij}\left(\delta_k^b - \delta_k^{cl} CL_{ij} - \delta_k^{cb} CB_{ij}\right) + e_{ijk}\right] \tag{3}$$

where d_{ij} is the distance between two trading partners and e_{ijk} is the random component that is normally distributed. Our specification considers that transport costs are lower when two countries share a common language CL_{ij} or a common border CB_{ij} due to lower communication costs.

It results the following multiplicative form for the delivered price:

$$p_{ijk} = d_{ij}^{\delta_k^d} \exp\left[-B_{ij}\left(\delta_k^b - \delta_k^{cl} CL_{ij} - \delta_k^{cb} CB_{ij}\right) + e_{ijk}\right] (1 + T_{ijk})\, p_{jk} \tag{4}$$

where the distance proxies for transport costs and trade barriers encompass both tariffs and non-tariff barriers. As we focus on trade within EU, we have $T_{ijk} = 0$. Note that the fixed costs associated with bilateral trade are not modeled. However, their role in trade

[3]As noted by Head and Mayer (2000), the expression of the CES demand is invariant whether we consider that firms sell to final consumers or intermediate firms. This property is particularly relevant given the large part of intermediated trade in the food sector.

are implicitly captured in our estimations. This point is discussed below.

Unlike previous studies, and thanks to the detail level of our data, we are able to decompose the factory-gate price into price and non-price competitiveness determinants. Precisely, we specify marginal cost of production in country j as function of unit labor costs (ω_{jk}), unit price of intermediate products (r_{jk}), and total factor productivity (A_{jk}). We assume that $A_{jk} = \varphi_{jk}\theta_{jk}^{-\alpha_k}$ where $\theta_{jk}^{-\alpha_k}$ is a productivity shifter which decreases with product quality θ_{jk}. Lower productivity due to higher quality can be caused by a more thorough selection of ingredients and/or additional production tasks. Assuming that monopolistic competition prevails and inputs are aggregated by using a Cobb-Douglas technology, the equilibrium prices are given by:

$$p_{jk} = \frac{\sigma_k}{\sigma_k - 1}\frac{\theta_{jk}^{\alpha_k}}{\varphi_{jk}}\omega_{jk}^{\zeta_k} r_{jk}^{1-\zeta_k}. \tag{5}$$

Given that firms are homogeneous in the DSK model and face identical demand, the number of varieties is proportional to production, $n_{jk} = v_{jk}/p_{jk}q_{jk}$. Using this expression as well as the formulations of preferences (Equation 1) and of delivered price (Equations 4-5), it is straightforward to show that the (log) of the ratio of bilateral imports from j to i to trade with self is written as:

$$\begin{aligned}\ln\left(\frac{m_{ijkt}}{m_{iikt}}\right) \quad = \quad & \ln\left(\frac{v_{jkt}}{v_{ikt}}\right) - (\sigma_k - 1)\left[(\gamma_k + \delta_k^b) - (\eta_k + \delta_k^{cl})CL_{ij} - (\mu_k + \delta_k^{cb})CB_{ij}\right] \\ & - (\sigma_k - 1)\,\delta_k^d \ln\left(\frac{d_{ij}}{d_{ii}}\right) + \sigma_k \ln\left(\frac{\varphi_{jkt}}{\varphi_{ikt}}\right) - \sigma(1-\zeta_k)\ln\left(\frac{r_{jt}}{r_{it}}\right) \\ & \left[(\sigma_k - 1) - \frac{\sigma_k\alpha_k}{\beta_k}\right]\ln\left(\frac{\theta_{jkt}}{\theta_{ikt}}\right)^{\beta_k} - \sigma_k\zeta_k \ln\left(\frac{\omega_{jkt}}{\omega_{ikt}}\right) + \varepsilon_{ijkt} \end{aligned} \tag{6}$$

where m_{iit} is the C.I.F value of trade with itself and $\varepsilon_{ijkt} = (\sigma_k - 1)\,(e_{ijkt} - e_{iikt})$. Note that time subscript t is now introduced. Our interest variabes are product quality and labor cost. It is expected that $(\sigma_k - 1)\beta_k - \sigma_k\alpha_k > 0$. This condition ensures that the marginal gain associated with a higher quality is superior to its marginal cost. If this inequality is not satisfied, firms would produce at the minimum quality level due to fixed costs associated with quality (see Gaigné and Larue, 2016). The strength of this quality effect depends on consumers preferences (β_k) and the elasticity of marginal cost to change in product quality (α_k). If consumers value weakly quality, quality effect would be close to zero. Further, the relative weight of imports from a trading partner depends negatively of relative labor costs. The magnitude of this effect increases with the elasticity of marginal cost to change in labor cost (ζ) and the intensity of competition on product market (σ_k). Tougher competition among producers makes trade patterns more sensitive to relative labor costs.

4 Data and Measurements

To estimate our gravity equation, we need information on bilateral trade flows of processed foods and national accounting data on food industry taking into account the heterogeneity among sectors within food industry.

Eurostat's Structural Business Statistics (SBS), available for the period 1995-2015, allows us to have information on food industry at the disaggregated level for each EU member countries. This database reports aggregate indicators on production based on firms' accounting data at the 4-digit NACE level and displayed by country. The SBS give information on the number of employees, production value or labor cost, for instance. The data are collected from annual enterprise surveys and tax files, and corresponds to a complete record of European food firms. Note, however, that a non-negligible number of country-industry-year triple are missing due to confidential purposes.[4] This missing data issue mainly concerns small countries (like Malta, Luxembourg, Estonia) or countries with high concentrated industries (e.g. Denmark, Netherlands). Summary statistics on the number of industries are reported in Table 5.

Finally, from the SBS database, we can compute proxies for productivity φ_{it} and labor costs ω_{it}. The term φ_{it} is proxied by a measure of labor productivity defined as the value of sales per full-time equivalent employee. The literature has proposed a direct measure of the total factor productivity by using the methodology initiated by Olley and Pakes (1996). However, in our case, we cannot implement this approach because we have no information on capital and price index of inputs for each industry/country pair. However, from French data on food firms, we know that the total factor productivity and the sales per capita are highly correlated. Note also that we do not use the value-added per employee because this variable also captures the quality effect.

We define labor costs ω_{it} as salary costs (wages plus employers' social security costs) per full-time equivalent employee. This measure accounts for labor costs of regular and temporary employees but not for posted workers that are employed by subcontractors.[5] This failure implies that our labor cost measure may be overestimated for some industries because posted workers could be less expensive and represent a non-negligible part of the labor force. Even though our estimations control for heterogeneity among sectors, the difference between countries can be significant within the same industry. For instance, France, Belgium and Austria complained about Germany's practices and its massive use of posted workers in the slaughtering industry (Wagner and Refslund, 2016).[6] Unfortunately, we are not aware of any data sources that collect detailed information on posted

[4]Data are classified as confidential if (i) the number of firms by country-industry-year triple is below a given threshold or (ii) when one or two firms dominate the industry. The number of firms and dominance thresholds are yet defined at the country level.

[5]Costs of posted workers are reported as provision of services in accounting data.

[6]This development is deemed as anti-competitive as a way in the slaughtering German industry. This practice is often cited as social dumping and generates hot debates among EU members.

workers and their prevalence at the industry level across EU member countries. Thereby, we have to keep in mind those labor costs caveats when interpreting our results.

Data on bilateral trade flows of processed foods among European countries for the period 1995-2015 comes from the COMEXT database of Eurostat which reports annual bilateral trade flows for each European country at the product level (CN 8-digit classification). For the purpose of our study, we aggregate the data at the industry level (NACE 4-digit classification).[7] The bilateral imports are reported in C.I.F values (in thousand of euros) and cover all of the 31 food industries of the 4-digit NACE Rev.2.

The estimation of Equation (6) requires additional information. A first problem arises with the determination of internal-trade, m_{ii}, given the lack of information at the industry level on the total amount spend for domestic goods in available statistics. We then apply the now standard approach proposed by Wei (1996) and construct a measure of m_{ii} by approximating internal-trade by the overall production of the country minus its total exports. Production values are given by Eurostat's SBS (in million of euros), and supplemented by the UNIDO Industrial Statistics database.

A second problem arises from the measure of product quality θ_{jt}. The estimation of an index of quality at the origin country-industry-year level is challenging. From our trade data at the industry level, we can infer quality by implementing the methodology by Khandelwal et al. (2013) based on import demand equations. More precisely, given the assumptions of the model, the quality for each origin country-industry-year observation can be estimated by using the volume of imports of country j from country i given by ($q_{ijkt} = \lambda_{ijkt}^{\sigma_k - 1} P_{ikt}^{\sigma - 1} E_{ikt} p_{ijkt}^{-\sigma_k}$). For a given price, a product with a higher quantity is assigned a higher quality. The variable λ_{ijkt} is estimated for each origin-destination-industry-year observation as the residual of the following OLS regression:

$$\log q_{ijkt} + \sigma_k \log p_{ijt} = \mathbf{FE}_{ikt} - (\sigma_k - 1)\left[\gamma_k - \eta_k CL_{ij} - \mu_k CB_{ij}\right] + \nu_{ijkt} \qquad (7)$$

with $\mathbf{FE}_{ikt} = \log\left[E_{ikt}(P_{ikt})^{\sigma_k - 1}\right]$. We consider $\sigma_k = 5$ which corresponds to the elasticity estimates associated with food product reported in Ossa (2015). Hence, estimated quality perceived by foreign consumers is $\hat{\theta}_{ijkt}^{\beta_k} = \exp[\hat{\nu}_{ijkt}/(\sigma_k - 1)]$. Then, our measure of quality at the origin country-industry-year level is given by $\hat{\theta}_{ikt}^{\beta_k} = \sum_j \frac{m_{ijkt}}{m_{ikt}} \exp[\hat{\nu}_{ijkt}/(\sigma_k - 1)]$ which is a trade-weighted average of quality perceived by foreign consumers. This measure of quality is the best indicator of consumer perception in the domestic country that we can compute with the data at hand even if it is not a direct quality measure.

Distances are computed using the methodology developed by Mayer and Zignago (2005). As pointed out by Head and Mayer (2000, 2002), how distances are calculated can

[7] Note that the period of study spans over two revisions of the statistical classification of economic activities in the European Community, namely NACE Rev.1.1 and NACE Rev.2. Once the different databases matched, we convert NACE Rev.1.1 codes into NACE Rev.2 codes using the correspondence table providing by Eurostat.

strongly influence the estimate of trade impediments and then constitute a critical issue. The methodology employed consists to compute intra-national (d_{ii}) and international bilateral distances (d_{ij}) using a consistent approach based on location of the main cities of a country. Precisely, distances are computed using a weighted arithmetic average of bilateral distances between cities where the weights correspond to the share of the city in the overall country's population. Distance data are made available in the CEPII gravity dataset, among which we also obtain information about countries sharing a common border or language.[8]

The final dataset is an unbalanced panel of composed of 110362 observations. Descriptive statistics by country are reported in Table 1. There is a lot of heterogeneity in the data. For instance, labor productivity is the highest in Belgium, the Netherlands, Great Britain, Finland and France with more than 78970 euro of sales per employee while the average productivity in the EU is 49580 euro per employee (see Table 1). In average on the period and industry, the labor costs amounts to 26 330 euro per employee but varying from 3790 euro in Bulgaria to 44350 in Belgium as shown in Table 1. Average estimated quality measures are also very different from one country to another, varying from 0.36 for Malta to 4.47 for Great Britain. More descriptive statistics on estimated residual quality is provided in Table 7. It should be noticed however that the quality indicator can be biased because we cannot control for the importing/exporting country. It results that, for a country that faces a high demand for its products (even if they are not produced in the country), the quality indicator is high (for a given price).Then for some country such as Netherlands for bottled water or Great Britain for wine, the high quality measure can be explained by their product platform position in the EU. These values are heterogeneous not only depending on the products but also depending on the bilateral trade partner. We provides some examples for meat (Table 8), meat products (Table 9), dairy (Table 10) and wine (Table 11) in Appendix A. The perception of quality differs greatly from one importing country to another, such that the mean quality per exporter reflects a wide range of possible values.

[8]See http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8.

Table 1: Descriptive Statistics (by country-industry-year)

ISO2	Output (in €million)	Value-added (in €million)	Turnover (in €million)	Labor cost per employee (in €1,000)	Nb employees	Labor productivity (in €1,000)	Quality	GDP per capita (in $ US)	Land per capita (in sq. Km)
AT	601.65	173.99	652.99	37.35	3513.38	65.42	1.51	38939.36	10186.52
BE	1360.12	262.19	1433.47	44.35	4289.46	78.97	1.96	36652.69	3122.35
BG	149.03	30.50	162.46	3.79	4254.46	8.52	1.53	6511.22	14960.64
CY	55.18	16.09	61.79	18.90	590.63	31.39	1.18	17480.64	8727.65
CZ	432.36	87.93	493.96	11.08	5421.15	22.11	2.18	17077.76	7612.62
DE	5045.36	1149.51	5488.49	38.73	28797.20	63.85	2.69	37234.76	4363.43
DK	628.92	166.32	676.41	39.31	3543.46	68.88	3.03	45813.88	7942.47
EE	76.31	18.47	85.17	11.56	1141.33	21.78	1.48	14189.56	33763.67
ES	2558.50	551.40	2719.38	29.71	12186.18	60.10	2.56	23974.35	11720.12
FI	356.10	90.42	382.48	38.56	1658.07	71.65	1.31	38076.58	63819.47
FR	4360.89	957.39	4826.79	40.90	20084.22	70.18	2.77	32902.54	8685.96
GB	3768.12	1137.37	4109.90	34.49	19147.40	76.88	4.47	34972.26	4023.96
GR	403.78	122.24	441.02	22.51	3179.61	44.88	1.94	24157.94	11885.63
HR	188.95	56.04	215.58	12.46	3123.03	24.52	1.29	13650.64	13134.38
HU	323.14	67.83	367.93	11.01	4356.61	29.74	2.03	10763.79	9254.72
IE	702.42	146.46	745.27	33.45	2730.44	64.56	2.09	43332.32	16834.69
IT	3423.99	665.38	3566.75	32.09	14900.82	64.02	3.07	29629.54	5178.93
LT	137.59	28.31	145.41	7.49	2599.03	16.16	1.40	10223.49	20404.47
LU	84.34	42.09	93.76	28.84	1070.84	46.77	0.75	80164.76	5443.83
LV	85.09	21.35	90.83	6.09	2241.53	12.92	0.92	9408.58	29480.30
MT	17.47	5.44	17.57	10.54	247.23	24.51	0.36	13868.99	795.29
NL	1961.89	381.48	2141.78	43.22	6593.89	78.51	3.40	37343.13	2594.12
PL	1364.80	297.76	1490.88	11.30	15158.81	34.08	2.65	10807.74	8180.18
PT	446.67	100.45	491.35	17.44	4353.07	33.71	1.37	18865.03	8837.19
RO	318.43	68.90	350.46	4.71	8274.53	10.66	1.31	6665.22	11486.66
SE	620.93	155.56	692.38	39.57	3197.80	58.31	2.23	43771.37	49147.59
SI	106.72	27.96	123.60	18.16	1093.83	29.59	0.81	21529.70	9978.24
SK	118.83	24.10	141.66	9.13	1840.44	17.65	0.97	13420.38	9099.23
EU-28	**1519.03**	**346.32**	**1642.83**	**26.33**	**8522.39**	**49.58**	**2.13**	**26224.60**	**14115.23**

Notes: Figures correspond to mean values by importer-industrie-year.

5 Results

5.1 Basic specification

We first estimate a simplified version of the gravity Equation (6) where the factory-gate price p_j is not decomposed into competitiveness factors but, instead, proxied by an aggregate price level as traditionally done in the literature (Head and Mayer, 2000). The purpose of estimating this basic specification is to compare the estimates obtained with previous studies on food trade, and discuss some potential endogeneity concerns when estimating the gravity equation. We use the price level of gross domestic product (GDP) expressed relative to the United States as a proxy for factory-gate prices.[9] This measure is defined at the national level and then suffers less from endogeneity concerns than industry-national price levels.

We report in Table 2 the OLS estimates of the basic specification with clustered errors at the importer-exporter pair level. Note that our estimations include industry-year fixed effects. Hence, we exploit variation across country pairs. As observed in Column (1), all the estimated coefficients have the expected sign and are highly significant. The estimated coefficient of relative output is equal to 0.89 and it is quite near the unitary value predicted by theory. The ratio of bilateral imports to domestic sales is negatively impacted by relative prices but the derived price elasticity is, however, surprisingly low. As expected, the trade elasticity of relative distance is negative. Further its large value, close to one, confirms previous findings showing that distance curbs trade of food products more intensively than for other manufacturing products (see Olper and Raimondi, 2008a; Sorgho and Larue, 2014).

In Column (2), we augment the basic specification of the gravity equation by introducing two measures of factor endowments (i.e., GDP per capita and land per capita). The idea is to account for endowment differences across countries that could significantly influence trade flows and that are assumed to be only controlled by relative output in the first specification. For instance, a low border effect may be explained by a relative small (high) land endowment of the importer (exporter) putting it in a situation of net importer (exporter) (trade dependency (advantage) vis-a-vis of the outside) to fulfill internal demand of food products. This is basically what we observe in column (2): both endowment measures have a positive impact on trade flows and reduce the estimate of the border effect. Further it appears that the introduction of these two variables considerably increases the absolute value of the point estimate of relative prices, yielding an estimated price elasticity above unity. This abrupt change in the point estimate of relative prices suggests that the specification in column (1) was plagued by an endogeneity problem. This is not surprising because theoretically demand, production, and prices are simulta-

[9]The data come from the Penn World Table v.9.0 (see Feenstra et al., 2015). Descriptive statistics are provided in Table 1.

Table 2: Gravity model estimates - Benchmark

Dependent variable	$\ln(m_{ijkt}/m_{iikt})$	$\ln(m_{ijkt}/m_{iikt})$	$\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$
	(1)	(2)	(3)
Ln relative output	0.8955***	0.9280***	
	(0.0183)	(0.0202)	
Ln relative GDP (price level)	-0.3709***	-1.2860***	-1.1298***
	(0.1024)	(0.2965)	(0.3054)
Ln relative GDP/capita		0.4502***	0.3140**
		(0.1453)	(0.1476)
Ln relative land/capita		0.1759***	0.2406***
		(0.0517)	(0.0458)
Ln relative distance	-1.1111***	-1.2386***	-1.3452***
	(0.0729)	(0.0770)	(0.0682)
Contiguity	1.2224***	1.0900***	0.9823***
	(0.1414)	(0.1424)	(0.1337)
Common language	1.1692***	1.1721***	1.1819***
	(0.2157)	(0.2015)	(0.1989)
Common Euro currency	0.8078***	0.8357***	0.8563***
	(0.0990)	(0.0976)	(0.0963)
Constant (Border)	-4.2185***	-3.9402***	-3.7030***
	(0.1828)	(0.1916)	(0.1700)
Year-Industry FE	Yes	Yes	Yes
R^2	0.5516	0.5547	0.4379
Observations	102270	102270	102270

Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.

neously determined in the model. Moreover, it is likely that prices (as well as production) are correlated with the residual of the gravity equation due to omitted variables, such as quality, that explain both sides of the gravity equation.[10]

In column (3), we then test the sensitivity of our results to the potential endogeneity of the relative production variable. We follow the solution proposed by Head and Mayer (2000) and we impose a unit elasticity on relative production as specified in the DSK model. Basically, this is equivalent to subtract relative production to the left-hand side variable. We observe significant changes in the estimated coefficients. The absolute value of the distance coefficient goes up, capturing a greater part of the trade reduction effect at the expense of the border effect. The estimated coefficient of relative prices also differs substantially, but varies in an unexpected way as it suggests that production and prices are negatively correlated.

According to the gravity literature, the constant term can be interpreted as the "border effect", meaning a measure of the difficulty to trade outside the national borders net of the effects of relative size, price, and other trade impediments accounting for in the regression. Given our specification, the constant captures both the impact of border-related

[10]See Erkel-Rousse and Mirza (2002) for an in-depth discussion on endogeneity issues related to the estimation of gravity equations and some solutions proposed.

cost and home bias.[11] As expected, we obtain a highly significant negative value for the constant since intra-trade largely exceeds cross-border trade in the EU. The magnitude of the estimated coefficient reveals that crossing the border between EU countries reduces trade, on average, by a factor of $40\,[= \exp(3.70)]$.[12] While derived based on a larger number of countries and industries, our estimate is in line with that of Olper and Raimondi (2008a) whose obtained a point estimate of -4.194 for the border effect between EU countries. Finally, we observe that sharing a common language and a common border more than triple imports values relative to domestic trade. The effect is less pronounced for the adoption of the Euro currency but still highly positive and statistically significant.

5.2 Introducing factors competitiveness

We now turn to the estimation of the gravity equation as specified in Equation (6). By decomposing factory-gate prices in several competitiveness factors, we are interested to observe which component influences the most bilateral trade. Given that the gravity estimates are subject to an endogeneity bias for the relative production, we choose to constrain to one the elasticity on relative production. We introduce sequentially the price and non-price factors competitiveness in order to detect some potential issues with one of them. The estimation results are presented in Table 3.

In column (1), we introduce labor costs defined at the country-industry-year level as a determinant of prices. The relative labor cost per employee is defined as the labor cost in the exporting country relative to the labor cost in the importing country. As expected, the estimated elasticity is highly significant and negative, which confirms that labor costs do have an impact on bilateral trade. The higher the cost of labor faced by exporting firms in the bilateral trade, the lower the share of imports in domestic food expenses. Moreover, all other coefficients remain significant and of the same order of magnitude as in the basic specification reported in column (3) of Table 2.

Because labor costs can also affect productivity, we control for productivity to isolate the impact of labor cost on competitiveness. Results are provided in column (2). Introducing the relative productivity as an explanatory variable change only the labor cost coefficient. The other coefficients remain relatively stable. The elasticity of the relative labor cost is reduced and divided by two when productivity is introduced, which

[11]The estimation of border effects has generated a rich and vast literature (see McCallum, 1995; Head and Mayer, 2000; Anderson and van Wincoop, 2003, for pioneering works). It is usually conveyed by introducing border dummies, one for each potential bilateral combination of countries/regions. However, since the primary interest of this paper does not rely on the estimation of the magnitudes of intra-EU border effects, we choose to control for an average border effect inside EU and not broken up the constant term.

[12]Putting this figure in perspective, it appears that crossing the border between EU countries is equivalent to multiplying internal distance by a factor of 15.81 $[= \exp(-3.70/-1.34)]$. Given that the average internal distance inside EU countries is 129 kilometers, this corresponds on average to an increase of the distance traveled by 2040 km $[= 15.81 \times 129]$ once crossed the national borders.

Table 3: The Effect of Competitiveness Determinants on Trade Flows

Dependent variable: $\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$				
	(1)	(2)	(3)	(4)
Ln relative labor costs	-0.4022***	-0.2049**	-0.1855**	-0.4852***
	(0.0646)	(0.0803)	(0.0805)	(0.0897)
Ln relative productivity		-0.1960***	-0.2430***	-0.3109***
		(0.0461)	(0.0453)	(0.0539)
Ln relative quality			0.2166***	0.6553***
			(0.0287)	(0.0334)
Ln relative GDP/capita	0.2438***	0.2174**	0.1840**	0.8461***
	(0.0846)	(0.0853)	(0.0867)	(0.0999)
Ln relative land/capita	0.1906***	0.1814***	0.2303***	-0.1354***
	(0.0464)	(0.0466)	(0.0469)	(0.0463)
Ln relative distance	-1.2792***	-1.2729***	-1.3973***	-1.9362***
	(0.0673)	(0.0670)	(0.0681)	(0.0882)
Contiguity	1.0728***	1.0798***	0.9688***	0.7447***
	(0.1340)	(0.1346)	(0.1346)	(0.1289)
Common language	1.1644***	1.1646***	1.1537***	0.5089**
	(0.2040)	(0.2046)	(0.1999)	(0.2281)
Common Euro currency	0.8069***	0.8060***	0.8411***	0.7516***
	(0.0956)	(0.0955)	(0.0951)	(0.0881)
Constant (Border)	-3.8189***	-3.8336***	-3.5697***	-2.4089***
	(0.1683)	(0.1676)	(0.1697)	(0.2019)
Year-Industry FE	Yes	Yes	Yes	No
Importer-Year-Industry FE	No	No	No	Yes
R^2	0.4381	0.4388	0.4414	0.6060
Observations	110362	110362	109304	109304

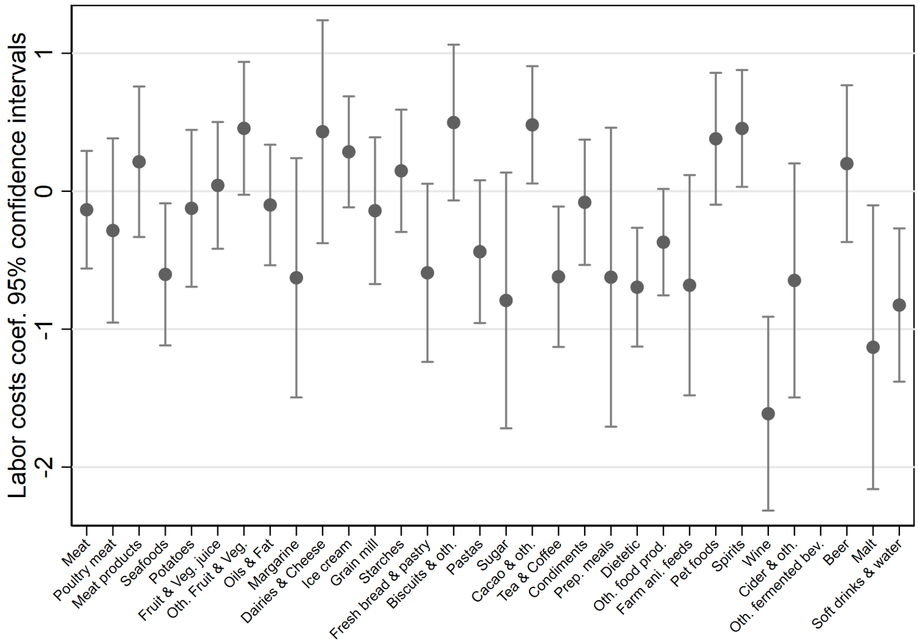
Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.

highlights the importance to take into account the collinearity between the two variables. Surprisingly, we find a significant negative effect for productivity: a higher productivity in the domestic country relative to exporting country increases the share of imports in domestic expenditures from the trading partners. This result is not counter-intuitive given the level of aggregation by food category in our data. At this level of aggregation, import data include imports of final commodities but also purchases of input needed to produce those final commodities. Thus our result indicates that the more productive a domestic food sector is, the more the domestic expenditures for input procurement in this sector.

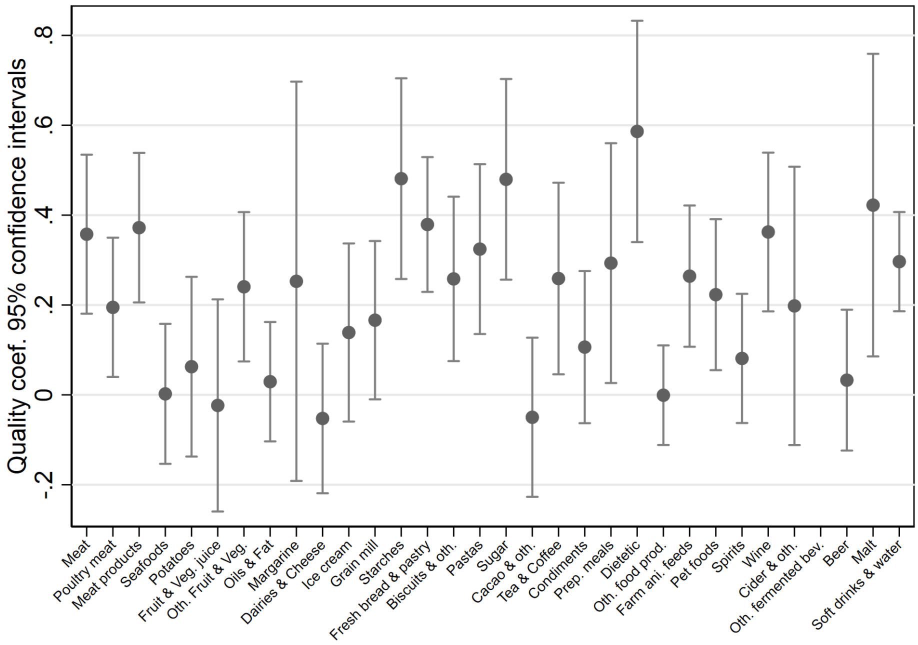
In column (3), we also introduce the relative quality at the country-industry level as a determinant of prices. As expected, the elasticity of the competitiveness indicator with respect to quality is positive and highly significant. The share of imports from the trading partner in the domestic expenditures increases with the perception of product quality supplied by the trading partner. Even though product quality implies higher prices, the import ratio decreases when the product quality provided by domestic producers increases.

In column (4), we introduce importer-year-industry fixed effects instead of year-

Figure 3: Factor competitiveness estimates by industry



(a) Relative labor costs



(b) Relative quality

Notes: The "other fermented beverages" industry is removed due to an insufficient number of observations.

industry fixed effects. Hence, this estimation exploits the variation across origin countries for a given destination-year-industry triplet. We therefore control for time varying competitiveness components of the importer-industry pair. Results show that elasticities of import ratios to a change in labor cost and product quality are multiplied by two while the border effect decreases, which is also the case for the coefficients of land endowment, contiguity, common language and euro currency.

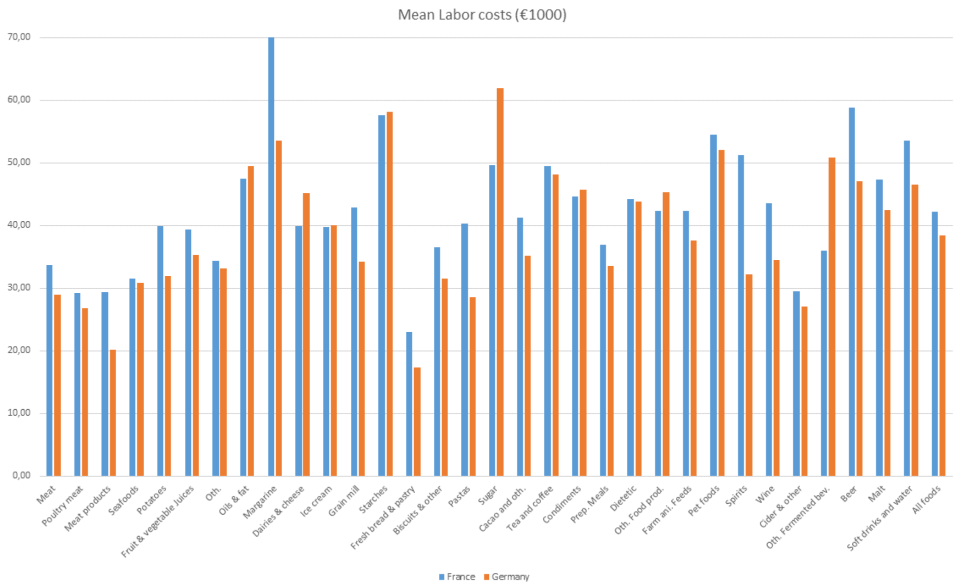
As livestock industries use relatively more labor than the other industries, we examine whether the impact of factors competitiveness on import flows differ for livestock industries compared to other food industries. We focus on four specific sectors (beef meat, poultry meat, meat based products and milk and dairy products). Results are provided in Table 14 of Appendix C. We find that results for the meat sectors are similar to results for the food sector. In addition, we do not find any significant differences among livestock sectors for labor cost and quality effects. More generally, results are robust for all food sectors. Figure 3 plots the confidence intervals for labor cost and quality coefficient estimates by industry. The mean elasticity for relative labor cost is negative and positive for relative quality for almost all sectors. However, results are heterogeneous from one sector to another.

5.3 Counterfactual exercices

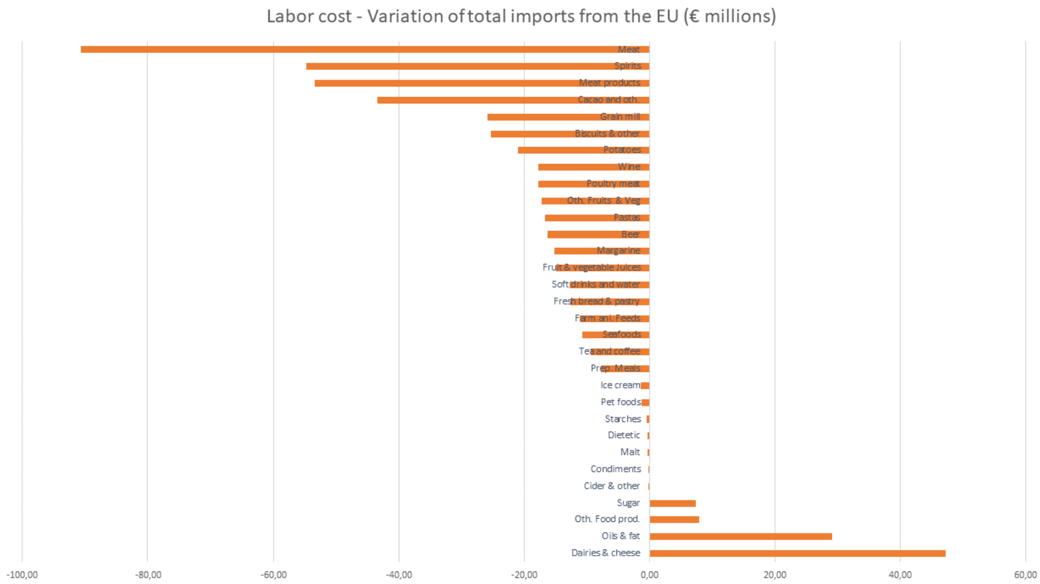
To better visualize the effect of differences in labor costs and quality perception between EU countries, we proceed with simulations on how a change in these two competitiveness factors would affect the competitiveness outcome. We consider two counterfactual scenarios to highlight the impact of two common views on differences in competitiveness. Using the results associated with column 3 of Table 3, we thus evaluate the expected change in the ratio of imports if (i) the unit labor cost in France reaches the level observed in Germany, (ii) product quality in France is equivalent to the one evaluated in Italy (for each industry). Results of the two counterfactual scenarios are provided in Table 12 and 13 in Appendix B.

We first analyze the counterfactual analysis associated with labor cost. For all food sectors except oils and fat, dairy and cheese, sugar and other food products, labor costs are lower in Germany. The magnitude of the difference in labor costs between the two countries can be very low for some industries but is significant for other including meat and meat products (cf. Part (a) of Figure 4). It follows that applying a labor cost equals to the labor cost prevailing in Germany would induce a decrease of 3 percentage points of total food import expenditures, which corresponds to almost 600 million euros. In percentage point, meat products, margarine, farm animal feeds and spirit are the most affected food industries while imports of meat are the most reduced in value with a reduction of more than 90 million euros.

Figure 4: Results of counterfactual scenarios - Labor costs

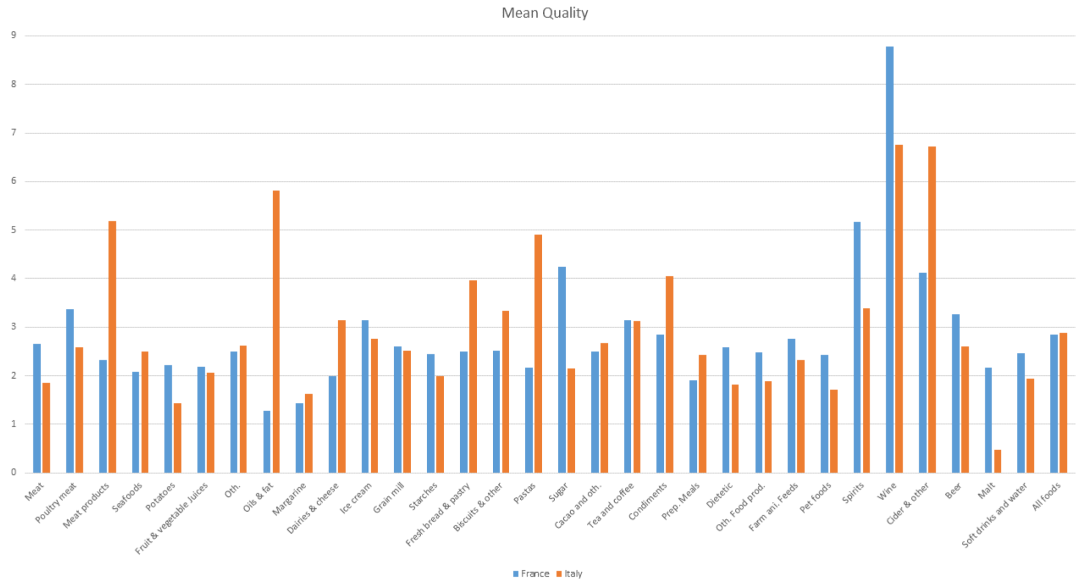


(a) Relative labor costs

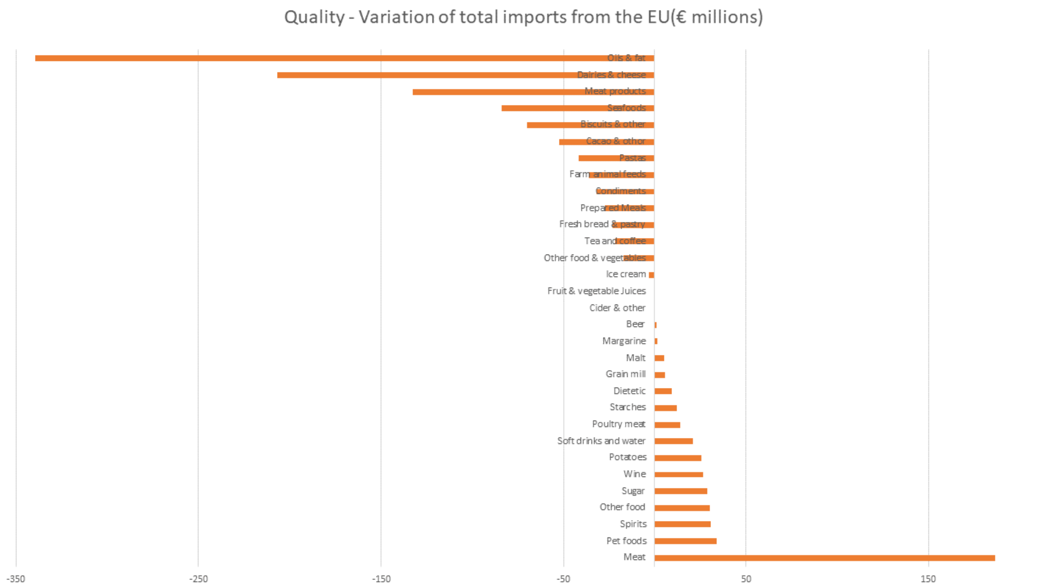


(b) Impact on imports

Figure 5: Results of counterfactual scenarios - Quality



(a) Mean quality indicator



(b) Impact on imports

Table 4: Border Effect Estimates

Dependent variable: $\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$					
By importer			By exporter		
Country	Coef.	S. E.	Country	Coef.	S. E.
UE27 to AT	-2.9809***	(0.2313)	AT to EU27	-3.1279***	(0.1538)
UE27 to BE	-1.1335***	(0.2767)	BE to EU27	-1.7546***	(0.2042)
UE27 to BG	-2.9193***	(0.2660)	BG to EU27	-4.4052***	(0.1747)
UE27 to CY	-1.3247***	(0.4390)	CY to EU27	-2.5009***	(0.2335)
UE27 to CZ	-2.0702***	(0.2514)	CZ to EU27	-3.8753***	(0.2559)
UE27 to DE	-2.0130***	(0.2071)	DE to EU27	-2.2519***	(0.1670)
UE27 to DK	-0.9486***	(0.2988)	DK to EU27	-2.0292***	(0.2092)
UE27 to EE	-3.0139***	(0.4339)	EE to EU27	-3.9251***	(0.3929)
UE27 to ES	-2.7814***	(0.2115)	ES to EU27	-3.2026***	(0.1880)
UE27 to FI	-4.1725***	(0.2840)	FI to EU27	-4.7993***	(0.2431)
UE27 to FR	-2.7793***	(0.1934)	FR to EU27	-3.1768***	(0.1882)
UE27 to GB	-1.2220***	(0.1746)	GB to EU27	-2.9881***	(0.1859)
UE27 to GR	-2.3431***	(0.2600)	GR to EU27	-3.3805***	(0.2222)
UE27 to HR	-3.5785***	(0.2686)	HR to EU27	-5.2348***	(0.2357)
UE27 to HU	-3.2247***	(0.2435)	HU to EU27	-3.6496***	(0.1683)
UE27 to IE	-2.8527***	(0.3032)	IE to EU27	-3.0731***	(0.1697)
UE27 to IT	-2.3514***	(0.1956)	IT to EU27	-2.7998***	(0.1950)
UE27 to LT	-3.0728***	(0.3452)	LT to EU27	-3.7003***	(0.2472)
UE27 to LU	-3.4901***	(0.6011)	LU to EU27	-3.5988***	(0.3820)
UE27 to LV	-3.8710***	(0.3475)	LV to EU27	-4.5059***	(0.3432)
UE27 to MT	0.7297	(0.4784)	MT to EU27	-1.8456***	(0.4439)
UE27 to NL	-0.7616***	(0.2511)	NL to EU27	-1.2036***	(0.1857)
UE27 to PL	-3.1768***	(0.1818)	PL to EU27	-3.7098***	(0.1987)
UE27 to PT	-2.1186***	(0.2840)	PT to EU27	-3.0492***	(0.2051)
UE27 to RO	-3.6814***	(0.2200)	RO to EU27	-4.9395***	(0.1826)
UE27 to SE	-3.3992***	(0.2390)	SE to EU27	-4.3550***	(0.2106)
UE27 to SI	-3.5715***	(0.3152)	SI to EU27	-3.8599***	(0.2010)
UE27 to SK	-3.5384***	(0.2433)	SK to EU27	-4.0795***	(0.2319)
Additional covariates	Yes			Yes	
R^2	0.8760			0.8752	
Observations	109304			109304	

Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.

We then comment the counterfactual analysis related to change in product quality. Perceived quality by foreign consumers of Italian products is slightly larger than that of French products. Despite this low gap, applying the quality prevailing in Italy to French food industries would reduce French import expenditures by more than 900 million euros, which corresponds to 4.4% of total imports (see Table 13). However, the competitive advantage for quality between Italy and France is very heterogeneous between food industry (Part(a) of Figure 5). As shown in Part (b) of Figure 5, three industries are highly affected given our simulation results: oils and fat, dairy and cheese and meat products. The import ratios associated with those three categories of product would decline by 30, 9, and 18 percentage points respectively. The effects of product quality on import ratios are much higher than that of labor costs.

We also simulate the impact of changes in border-related costs to compare with the effects of labor cost and product quality on import penetration. The constant (or, equivalently, the border effect) reported in Table 3 corresponds to EU average border effect. According to column (3) of this Table, the magnitude of the estimated coefficient reveals that crossing the border between EU countries reduces imports, on average, by a factor of 35 $[= \exp(3.56)]$. In other words, on average during the period 1995-2015, each EU country traded around 35 times more within its national borders than with another country of the EU, all things being equal. In order to take into account the difference across importers and across exporters, we run the same regression that in column (3) of Table 3 but the constant is alternatively replaced by importer dummies and exporter dummies. The results associated with importer dummies are reported in the left-panel of Table 4. The market access difficulties faced by exporters vary across EU importer countries. The estimated border effect falls to 7.5 $[= \exp(2.01)]$ when the importer is Germany and to 16 $[= \exp(2.77)]$ when the importer is France.[13] It follows that if border-related costs in serving France is identical to that in serving Germany, the import ratio of France would increase, on average, by a factor 2.1 $[= \exp(2.77 - 2.01)]$. Clearly, the effects of labor and product quality on trade pattern are low relatively to border effects.

Interestingly, according to results reported in the right-panel of Table 4, the border-related costs incurred by French industries to serve the other European countries are much higher that the border-related costs borne by German industries. All things being equal, the share of domestic consumption covered by imports from France is around 2.5 times $[= \exp(3.17 - 2.25)]$ lower than imports from Germany. In other words, even though production costs, productivity, and perception of product quality would be identical in France and Germany, Germany exports will remain higher than France exports.

6 Conclusion

In this paper, we examine the determinants of international competitiveness at the level of industry by using a structural gravity model. Our analysis focuses on the relative role of cost-related and quality-related competition in import penetrations. We have computed an index of product quality year-country-product level as prices are an imperfect measure of the quality of goods. The SBS database allows us to to exploit variations in labor cost and perceptions of product quality between countries and across (4-digit) industries over the period 1995-2015. From data on trade within EU, our results suggest that the import penetrations are significantly shaped by quality factors and labor cost. The magnitude of the effect of product quality appears to be higher that the impact of labor

[13]This difference among countries can be attributed to the fact that countries have different industrial compositions. Indeed, we show that the border effects vary across industries (see column (1) of Table 15 in Appendix C). The product markets that are the most difficult to enter for an exporter are meat products, fresh bread and pastry, and beverage industry, perhaps reflecting a strong home bias of final consumers. However, our estimations control for heterogeneity across industries.

impact. Nevertheless, our analysis suggests that the impact of labor and quality remains much lower than the border effects (trade costs unrelated to distance and home bias in consumption). For example, we show the border-related costs incurred by French industries to serve the other European countries are higher that the border-related costs borne by German industries. We find that even though labor costs, productivity, and foreign consumers perception of product quality would be identical in France and in Germany, Germany exports will be around 2.5 times higher than France exports.

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Appendix

A Data

Table 5: Descriptive Statistics

Country	Panel	Number of industries																				
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
AT		25		19	20	27	18	22	24	24	25	22	28	25	26	26	27	25	24	26	24	21
BE		24	25	24	24	25	25	22		25	24	24	25	26	19	28	29	27	29	29	29	29
BG						1	1	1	1	1	1	22	21	23	26	26	24	23	23	23	23	24
CY							18	21	19	19	21	21	22	20	20	20	20	20	20	21	21	21
CZ													18	22							1	20
DE						27	29	29	29	29	29	29	29	29	30	30	30	30	30	30	30	30
DK		13	15	18	16	12	12	14	11	10	14	14	10	13	12	15	15	12	13	16	16	18
EE							3	3	5	12	11	12	11	10	11	13	11	9	11	16	18	17
ES		32	31	31	31	31	30	31	31	31	31	31	30	30	30	30	30	30	30	30	30	32
FI		23	25	26	26	23	20	24	25	25	24	24	26	28	23	22	24	24	26	25	23	27
FR			30	32	32	33	32	32	33	33	32	31	31	32			28	30	32	32	28	30
GB			27	27	25	27	20	25	23	22	22	22	23	22	27	17	15	16	18	22	17	19
GR										32	32	32	32	32	30	31	31	31	29	29	29	29
HR															12	13	12	19	15	17	20	21
HU						26	25	28	29	31	31	31	30	30	31	29	30	32	30	29	29	27
IE		9	7	10	10	10	10	13	7	12	7	11	9	14	14	13	12	10	12	12	10	10
IT		30	31	30	31	30	33	33	32	30	29	30	32	30	31	31	31	30	30	30	30	30
LT							20	24	20	25	24	20	21	23	20	23	22	22	22	22	23	25
LU						3	3	5	5	5	5	3	3	3	4	4	3	3	3	2	2	3
LV						12	12	12	13	12	13	12	12	15	15	15	12	13	13	16	14	14
MT						13	13	15	13		13	13		13	5	4	7					2
NL		17	18	18	17	18	16	17	18	16	16	17	21	18	7	10	10	10	10	10	9	9
PL									26	27	27	27	27	27	28	28	30	30	30	30	30	30
PT						23	27	28	27	22	20	22	15	13	27	27	27	27	25	27	27	27
RO							1	21	26	23	22	21	26	24	23	23	23	23	23	21	23	23
SE		11	12	17	18	17	17	19	17	20	19	19	21	20	20	20	21	21	21	21	22	21
SI									17	18	9	17	18	19	20	17	19	19	19	23	21	12
SK							22	25	26	24	24	23	25	26	22	22	24	25	23	23	26	26

Notes:

Table 6: Descriptive Statistics (Bilateral countries)

Variable	Obs	Mean	S.D.	P10	P25	P50	P75	P90	Min	Max
Relative output	110362.00	17.59	112.93	0.04	0.20	1.16	6.83	28.12	0.00	10232.83
Relative labor costs	110362.00	1.99	2.84	0.25	0.56	1.05	2.15	4.68	0.02	48.50
Relative productivity.	110362.00	1.75	3.51	0.23	0.48	0.95	1.77	3.85	0.00	349.36
Relative quality	109304.00	2.04	10.29	0.31	0.57	1.09	2.11	4.12	0.00	2868.99
Relative GDP (price level)	102270.00	1.13	0.51	0.57	0.81	1.02	1.32	1.86	0.25	4.24
Relative GDP/capita	110362.00	1.63	1.71	0.31	0.62	1.06	1.98	3.64	0.05	18.50
Relative land/capita	110362.00	1.85	3.13	0.24	0.47	0.96	1.95	4.02	0.01	83.81
Relative distance	110362.00	13.93	27.73	3.12	4.86	8.00	13.99	21.62	1.19	435.35
Contiguity	110362.00	0.15	0.36	0.00	0.00	0.00	0.00	1.00	0.00	1.00
Common language	110362.00	0.05	0.21	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Common Euro currency	110362.00	0.33	0.47	0.00	0.00	0.00	1.00	1.00	0.00	1.00

Notes: .

Table 7: Descriptive Statistics - Residual quality (by country-industry-year)

ISO2	Obs	Mean	S.D.	P10	P25	P50	P75	P90	Min	Max
AT	405.00	1.51	1.13	0.50	0.85	1.30	1.81	2.60	0.14	10.87
BE	403.00	1.96	0.77	1.15	1.43	1.84	2.36	2.93	0.63	8.14
BG	241.00	1.53	1.60	0.41	0.71	1.15	1.75	2.36	0.09	11.47
CY	291.00	1.18	1.43	0.29	0.43	0.74	1.32	2.37	0.08	10.79
CZ	54.00	2.18	1.12	1.26	1.50	1.91	2.40	3.44	0.82	7.34
DE	497.00	2.69	0.80	1.76	2.15	2.66	3.14	3.71	0.57	5.64
DK	209.00	3.03	1.27	1.87	2.19	2.63	3.66	4.65	0.61	8.95
EE	133.00	1.48	0.86	0.57	0.84	1.41	1.83	2.65	0.22	5.72
ES	634.00	2.56	2.64	1.00	1.50	2.02	2.68	3.69	0.39	26.69
FI	454.00	1.31	0.95	0.42	0.64	1.10	1.67	2.48	0.10	7.98
FR	547.00	2.77	1.56	1.56	1.99	2.41	2.96	4.13	0.58	11.51
GB	422.00	4.47	2.60	2.10	2.84	3.78	5.36	7.45	0.80	18.75
GR	340.00	1.94	1.96	0.65	1.03	1.56	2.19	3.01	0.08	22.88
HR	120.00	1.29	0.73	0.58	0.74	1.05	1.74	2.27	0.19	3.51
HU	406.00	2.03	1.47	0.78	1.14	1.71	2.27	3.72	0.11	8.87
IE	193.00	2.09	2.69	0.66	0.90	1.45	2.36	4.65	0.15	33.19
IT	611.00	3.07	1.96	1.39	1.90	2.63	3.59	5.13	0.20	14.49
LT	247.00	1.40	0.92	0.51	0.79	1.21	1.69	2.51	0.16	5.16
LU	44.00	0.75	0.53	0.26	0.41	0.62	0.88	1.72	0.09	2.52
LV	182.00	0.92	0.48	0.41	0.62	0.88	1.13	1.41	0.04	3.24
MT	66.00	0.36	0.31	0.08	0.17	0.31	0.40	0.65	0.01	1.77
NL	246.00	3.40	1.70	1.73	2.24	2.92	4.30	5.64	0.82	9.81
PL	376.00	2.65	1.49	1.10	1.63	2.28	3.37	5.08	0.22	10.04
PT	391.00	1.37	1.01	0.51	0.75	1.13	1.57	2.51	0.12	8.26
RO	322.00	1.31	1.00	0.34	0.66	1.11	1.64	2.42	0.04	7.25
SE	352.00	2.23	1.32	0.85	1.31	1.98	2.72	3.93	0.38	8.76
SI	184.00	0.81	0.66	0.30	0.41	0.64	1.02	1.42	0.11	5.94
SK	314.00	0.97	0.60	0.33	0.54	0.85	1.27	1.80	0.07	4.18
Total	8684.00	2.13	1.79	0.58	1.02	1.77	2.68	3.89	0.01	33.19

Notes: Figures correspond to mean values by importer-industrie-year. .

B Results of counterfactual scenarios

We provide results of the change in labor cost scenario in Table 12 and in the quality in Table 13.

Table 8: A Sample of the Estimated Quality - Meat

Exporter \ Importer	DE	ES	FR	GB	IT	**All importers**
DE		4.27	2.41	4.60	4.17	**3.15**
ES	3.13		2.05	3.71	2.57	**2.36**
FR	2.24	0.85		3.90	2.32	**2.04**
GB	4.41	2.86	8.59		3.35	**2.63**
IT	3.38	1.49	1.40	2.51		**1.81**

Notes: Figures correspond to mean values by importer-exporter-year for a given industry.

Table 9: A Sample of the Estimated Quality - Meat Products

Exporter \ Importer	DE	ES	FR	GB	IT	**All importers**
DE		4.73	3.26	4.55	4.25	**3.28**
ES	4.52		1.91	3.50	1.35	**2.39**
FR	2.26	1.70		2.71	1.11	**1.86**
GB	2.75	2.29	2.23		1.03	**1.77**
IT	9.71	2.35	3.01	6.65		**3.40**

Notes: Figures correspond to mean values by importer-exporter-year for a given industry.

Table 10: A Sample of the Estimated Quality - Dairies & Cheese

Exporter \ Importer	DE	ES	FR	GB	IT	**All importers**
DE		3.03	1.52	2.67	2.73	**2.66**
ES	1.84		1.24	1.27	1.66	**1.02**
FR	2.39	1.16		3.85	1.02	**2.33**
GB	2.16	1.73	4.25		2.59	**2.18**
IT	2.15	3.80	1.76	6.76		**3.00**

Notes: Figures correspond to mean values by importer-exporter-year for a given industry.

Table 11: A Sample of the Estimated Quality - Wines

Exporter \ Importer	DE	ES	FR	GB	IT	**All importers**
DE		2.21	2.03	4.24	1.77	**2.10**
ES	5.47		0.87	5.56	1.94	**2.86**
FR	7.25	11.31		25.61	13.07	**9.20**
GB	5.06	23.36	14.14		7.23	**4.92**
IT	7.55	5.21	1.31	6.30		**3.30**

Notes: Figures correspond to mean values by importer-exporter-year for a given industry.

C Additional results

We provide some additional results in Tables 14, 15 and 16.

Table 12: France with German Labor Costs

		Mean labor cost			Total imports	Mean import ratio							Δ (in €million)		
		in €1,000		Δ (in %)	from EU	Observed	Δ (in %)			Pct. change			Total imports from EU		
		France	Germany		(in €million)	(in %)	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95
Meat	1011	33.71	28.96	-14.09	2525.43	18.95	-3.35	-3.38	-3.29	-0.34	-0.34	-0.33	-90.59	-91.38	-88.88
Poultry meat	1012	29.26	26.86	-8.20	569.27	11.23	-2.38	-2.67	-2.04	-0.18	-0.21	-0.16	-17.60	-19.78	-15.11
Meat products	1013	29.32	20.20	-31.12	660.94	6.96	-6.82	-8.57	-5.07	-1.27	-1.60	-0.95	-53.28	-66.92	-39.59
Seafoods	1020	31.59	30.86	-2.30	1440.95	59.12	-0.72	-2.39	1.10	-0.09	-0.29	0.13	-10.68	-35.64	16.32
Potatoes	1031	39.95	31.99	-19.92	406.00	123.10	-4.29	-6.35	-2.26	-2.38	-3.52	-1.25	-20.96	-31.02	-11.03
Fruit & Veg. Juices	1032	39.41	35.37	-10.26	660.01	73.89	-2.00	-2.24	-1.72	-0.60	-0.67	-0.52	-14.83	-16.65	-12.74
Oth. Fruits & Veg.	1039	34.30	33.16	-3.34	1401.76	28.04	-1.06	-2.10	0.07	-0.16	-0.32	0.01	-17.07	-33.78	1.15
Oils & Fat	1041	47.52	49.50	4.15	1059.16	65.71	2.43	-4.02	9.53	1.47	-2.44	5.78	29.10	-48.21	114.30
Margarine	1042	70.44	53.62	-23.88	187.59	47.96	-4.44	-5.64	-3.24	-5.25	-6.68	-3.84	-15.11	-19.23	-11.06
Dairies & Cheese	1051	39.93	45.19	13.17	2181.62	9.36	1.94	0.95	3.01	0.17	0.08	0.26	47.19	23.22	73.12
Ice cream	1052	39.81	40.09	0.72	169.09	23.17	-0.68	-2.41	1.15	-0.11	-0.40	0.19	-1.27	-4.49	2.15
Grain mill	1061	42.82	34.18	-20.17	580.27	19.36	-4.02	-4.18	-3.80	-0.61	-0.63	-0.57	-25.81	-26.80	-24.38
Starches	1062	57.60	58.22	1.08	291.16	11.65	-0.13	-0.14	-0.11	-0.01	-0.01	-0.01	-0.41	-0.44	-0.34
Fresh bread & pastry	1071	23.01	17.30	-24.80	212.78	1.41	-4.97	-5.28	-4.61	-0.53	-0.56	-0.49	-12.57	-13.36	-11.66
Biscuits & oth.	1072	36.54	31.52	-13.75	911.11	42.08	-2.43	-2.94	-1.91	-0.41	-0.50	-0.32	-25.26	-30.53	-19.85
Pastas	1073	40.25	28.57	-29.04	257.58	26.48	-6.10	-6.20	-5.94	-1.62	-1.65	-1.58	-16.59	-16.88	-16.16
Sugar	1081	49.65	61.94	24.73	180.22	6.07	3.67	2.99	4.42	0.29	0.24	0.35	7.27	5.93	8.75
Cacao & Oth.	1082	41.32	35.22	-14.76	1448.41	31.54	-2.67	-3.91	-1.43	-0.55	-0.80	-0.29	-43.26	-63.38	-23.29
Tea & Coffee	1083	49.53	48.16	-2.77	528.34	28.31	-1.43	-1.97	-0.83	-0.24	-0.34	-0.14	-9.25	-12.73	-5.37
Condiments	1084	44.67	45.70	2.31	336.43	42.13	-0.01	-0.56	0.59	-0.00	-0.19	0.20	-0.05	-2.35	2.45
Prep. Meals	1085	37.00	33.62	-9.13	496.23	11.30	-1.54	-1.85	-1.22	-0.10	-0.12	-0.08	-7.70	-9.23	-6.08
Dietetic	1086	44.22	43.88	-0.75	86.67	5.28	-0.23	-0.68	0.24	-0.02	-0.05	0.02	-0.28	-0.82	0.29
Oth. Food prod.	1089	42.39	45.26	6.77	660.66	22.65	1.10	-0.60	2.95	0.14	-0.07	0.36	7.83	-4.25	20.95
Farm ani. Feeds	1091	42.33	37.59	-11.21	133.51	1.30	-2.85	-3.62	-2.06	-0.46	-0.59	-0.34	-11.06	-14.10	-8.01
Pet foods	1092	54.51	52.03	-4.54	386.11	35.80	-0.29	-1.36	0.86	-0.02	-0.07	0.05	-1.17	-5.55	3.51
Spirits	1101	51.29	32.20	-37.23	673.66	39.38	-7.24	-7.60	-6.84	-0.55	-0.58	-0.52	-54.73	-57.48	-51.68
Wine	1102	43.62	34.50	-20.91	453.80	181.21	-3.85	-5.26	-2.35	-0.24	-0.33	-0.15	-17.71	-24.21	-10.81
Cider & Oth.	1103	29.52	27.10	-8.22	8.21	1.84	-0.20	-1.36	1.05	-0.01	-0.05	0.04	-0.01	-0.08	0.06
Oth. Fermented bev.	1104				35.93	50.82									
Beer	1105	58.78	47.07	-19.92	369.68	13.37	-3.84	-4.77	-2.91	-1.49	-1.85	-1.13	-16.24	-20.18	-12.33
Malt	1106	47.38	42.44	-10.42	11.17	10.11	-1.87	-4.23	0.48	-0.26	-0.58	0.07	-0.21	-0.48	0.05
Soft drinks & water	1107	53.54	46.59	-12.97	460.02	8.14	-2.33	-2.41	-2.23	-0.33	-0.34	-0.32	-12.66	-13.07	-12.13
All food industries		**42.23**	**38.42**	**-9.02**	**20102.52**	**14.63**	**-2.58**	**-2.60**	**-2.52**	**-0.33**	**-0.33**	**-0.32**	**-594.32**	**-598.95**	**-580.80**

Notes:

Table 13: France with Italian Quality

		Mean quality			Total imports	Mean import ratio							Δ (in €million)		
				Δ (in %)	from EU	Observed	Δ (in %)			Pct. change			Total imports from EU		
		France	Italy		(in €million)	(in %)	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95
Meat	1011	2.65	1.85	-30.25	2525.43	18.95	7.10	6.40	7.79	0.64	0.58	0.70	186.24	167.88	204.22
Poultry meat	1012	3.37	2.59	-23.06	569.27	11.23	1.96	1.47	2.47	0.14	0.11	0.18	13.76	10.35	17.35
Meat products	1013	2.32	5.18	123.37	660.94	6.96	-17.85	-18.84	-16.81	-3.07	-3.24	-2.89	-132.56	-139.91	-124.88
Seafoods	1020	2.08	2.50	20.31	1440.95	59.12	-5.32	-5.59	-5.05	-0.67	-0.71	-0.64	-83.86	-88.12	-79.68
Potatoes	1031	2.22	1.43	-35.39	406.00	123.10	5.46	4.36	6.53	2.82	2.25	3.37	25.33	20.24	30.30
Fruit & Veg. Juices	1032	2.19	2.07	-5.69	660.01	73.89	-0.09	-0.11	-0.08	-0.03	-0.03	-0.02	-0.66	-0.77	-0.54
Oth. Fruits & Veg.	1039	2.50	2.62	4.99	1401.76	28.04	-1.13	-1.39	-0.86	-0.16	-0.19	-0.12	-17.30	-21.25	-13.15
Oils & Fat	1041	1.28	5.81	355.09	1059.16	65.71	-29.70	-29.89	-29.49	-16.36	-16.46	-16.24	-339.34	-341.50	-336.93
Margarine	1042	1.44	1.63	13.06	187.59	47.96	0.64	-0.36	1.63	0.42	-0.23	1.05	1.50	-0.84	3.79
Dairies & Cheese	1051	2.00	3.15	56.95	2181.62	9.36	-8.99	-9.86	-8.08	-0.71	-0.78	-0.64	-206.79	-226.83	-185.79
Ice cream	1052	3.15	2.76	-12.37	169.09	23.17	-1.79	-2.52	-1.02	-0.26	-0.36	-0.15	-3.16	-4.46	-1.80
Grain mill	1061	2.60	2.51	-3.56	580.27	19.36	0.93	0.89	0.97	0.13	0.12	0.14	5.71	5.45	5.98
Starches	1062	2.44	2.00	-17.91	291.16	11.65	3.84	3.79	3.90	0.23	0.23	0.23	11.90	11.75	12.07
Fresh bread & pastry	1071	2.50	3.96	58.05	212.78	1.41	-9.71	-10.76	-8.61	-0.95	-1.05	-0.84	-23.36	-25.89	-20.71
Biscuits & oth.	1072	2.51	3.34	32.97	911.11	42.08	-7.10	-7.64	-6.54	-1.12	-1.20	-1.03	-70.23	-75.56	-64.66
Pastas	1073	2.17	4.90	126.07	257.58	26.48	-15.90	-16.35	-15.42	-3.81	-3.92	-3.70	-41.89	-43.08	-40.64
Sugar	1081	4.25	2.15	-49.45	180.22	6.07	15.26	14.70	15.83	1.10	1.06	1.14	28.87	27.80	29.95
Cacao & Oth.	1082	2.50	2.68	7.14	1448.41	31.54	-3.35	-3.66	-3.04	-0.63	-0.69	-0.57	-52.23	-56.93	-47.31
Tea & Coffee	1083	3.15	3.13	-0.78	528.34	28.31	-3.53	-3.88	-3.17	-0.55	-0.60	-0.49	-21.71	-23.83	-19.48
Condiments	1084	2.84	4.06	42.69	336.43	42.13	-7.18	-8.09	-6.22	-2.55	-2.88	-2.21	-31.93	-35.99	-27.68
Prep. Meals	1085	1.90	2.43	28.31	496.23	11.30	-5.47	-5.85	-5.08	-0.36	-0.39	-0.34	-27.33	-29.23	-25.36
Dietetic	1086	2.58	1.81	-30.05	86.67	5.28	7.99	7.10	8.87	0.52	0.46	0.57	9.15	8.13	10.15
Oth. Food prod.	1089	2.48	1.89	-23.87	660.66	22.65	4.40	4.36	4.45	0.49	0.49	0.50	29.98	29.68	30.33
Farm ani. Feeds	1091	2.76	2.33	-15.29	133.51	1.30	-9.36	-10.34	-8.32	-1.52	-1.68	-1.35	-36.23	-40.05	-32.23
Pet foods	1092	2.42	1.71	-29.14	386.11	35.80	8.24	7.35	9.10	0.45	0.40	0.49	33.70	30.08	37.25
Spirits	1101	5.16	3.39	-34.28	673.66	39.38	4.25	3.91	4.62	0.30	0.27	0.32	30.66	28.21	33.32
Wine	1102	8.78	6.75	-23.14	453.80	181.21	5.74	5.08	6.43	0.35	0.31	0.39	26.41	23.39	29.58
Cider & Oth.	1103	4.13	6.72	62.95	8.21	1.84	-10.06	-13.09	-6.84	-0.35	-0.45	-0.24	-0.64	-0.83	-0.43
Oth. Fermented bev.	1104				35.93	50.82									
Beer	1105	3.26	2.61	-19.86	369.68	13.37	0.24	-0.38	0.85	0.09	-0.14	0.30	0.97	-1.55	3.44
Malt	1106	2.16	0.47	-78.35	11.17	10.11	39.92	35.96	43.82	3.41	3.07	3.75	4.98	4.48	5.46
Soft drinks & water	1107	2.47	1.94	-21.74	460.02	8.14	4.04	2.97	5.09	0.54	0.40	0.69	20.87	15.33	26.30
All food industries		**2.84**	**2.89**	**1.88**	**20102.52**	**14.63**	**-4.43**	**-4.72**	**-4.12**	**-0.52**	**-0.56**	**-0.49**	**-973.32**	**-1036.87**	**-905.27**

Notes:

Table 14: A focus on livestock sectors

Dependent variable: $\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$		
	(1)	(2)
Ln relative labor costs	-0.2197***	-0.2049**
	(0.0825)	(0.0829)
Ln relative labor costs × Animal	0.0440	0.0689
	(0.0817)	(0.0818)
Ln relative productivity	0.1462***	0.1965***
	(0.0484)	(0.0478)
Ln relative productivity × Animal	0.2411***	0.2204***
	(0.0816)	(0.0822)
Ln relative quality		0.2131***
		(0.0297)
Ln relative quality × Animal		-0.0238
		(0.0378)
Ln relative GDP/capita	0.2356***	0.1993**
	(0.0854)	(0.0868)
Ln relative land/capita	0.1804***	0.2264***
	(0.0465)	(0.0470)
Ln relative distance	-1.2744***	-1.3954***
	(0.0671)	(0.0682)
Contiguity	1.0794***	0.9716***
	(0.1346)	(0.1346)
Common language	1.1640***	1.1527***
	(0.2046)	(0.1998)
Common Euro currency	0.8065***	0.8407***
	(0.0954)	(0.0950)
Constant (Border)	-3.8305***	-3.5737***
	(0.1679)	(0.1701)
Year-Industry FE	Yes	Yes
R^2	0.4398	0.4421
Observations	110362	109304

Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.

Table 15: Border Effect Estimates

Dependent variable: $\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$		
By industry		
Industry	Coef.	S. E.
Meat	-3.2874***	(0.1785)
Poultry meat	-3.4757***	(0.1862)
Meat products	-4.6808***	(0.1847)
Seafoods	-2.2397***	(0.1871)
Potatoes	-3.6779***	(0.1982)
Fruit & Veg, juices	-3.0891***	(0.1993)
Oth. Fruits & Veg,	-2.3909***	(0.1706)
Oils & Fats	-3.2611***	(0.2041)
Margarine	-3.4614***	(0.2607)
Dairies & Cheese	-3.9339***	(0.1811)
Ice cream	-2.9316***	(0.1881)
Grain mill	-3.5486***	(0.1933)
Starches	-2.9931***	(0.1890)
Fresh bread pastry	-6.0550***	(0.1846)
Biscuits & Oth.	-2.6342***	(0.1776)
Pastas	-4.1363***	(0.1904)
Sugar	-4.8981***	(0.2230)
Cacao & Oth.	-2.6913***	(0.1744)
Tea & Coffee	-3.5749***	(0.1857)
Condiments	-3.0980***	(0.1778)
Prep. meals	-1.8478***	(0.2076)
Dietetic	-3.1807***	(0.2075)
Oth. Food prod.	-2.3373***	(0.1686)
Farm ani. Feeds	-5.6357***	(0.1750)
Pet foods	-1.9651***	(0.1918)
Spirits	-3.4068***	(0.1952)
Wine	-3.8686***	(0.2166)
Cider & Oth.	-4.1029***	(0.2798)
Oth. fermented bev.	-1.1183	(0.8909)
Beer	-5.9704***	(0.1922)
Malt	-4.2668***	(0.2417)
Soft drink & water	-4.3187***	(0.1861)
Additional covariates	Yes	
R^2	0.8928	
Observations	109304	

Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.

Table 16: Additional Results

Dependent variable: $\ln(m_{ijkt}/m_{iikt}) - \ln(v_{jkt}/v_{ikt})$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln relative labor costs	-0.2079**	-0.0391	-0.1967**	-0.2061**	-0.1382	-0.1800**	-0.1807**
	(0.1054)	(0.0829)	(0.0795)	(0.0907)	(0.0907)	(0.0856)	(0.0781)
Ln relative productivity	0.1988**	0.1545***	0.2334***	0.2344***	0.1875***	0.2485***	0.2675***
	(0.0856)	(0.0456)	(0.0458)	(0.0545)	(0.0544)	(0.0491)	(0.0478)
Ln relative quality	0.2144***	0.2294***	0.2141***	0.2247***	0.2266***	0.2169***	0.2099***
	(0.0291)	(0.0273)	(0.0293)	(0.0314)	(0.0318)	(0.0292)	(0.0290)
Ln relative EBE	-0.0383						
	(0.0423)						
Ln relative material/employee		0.5525***					
		(0.0630)					
Ln relative material/turnover			0.1140				
			(0.1024)				
Ln relative energy/employee				0.1319***			
				(0.0287)			
Ln relative energy/turnover					0.1002***		
					(0.0309)		
Ln relative ratio of labor costs/material						0.0364	
						(0.0834)	
Ln relative ratio of investment/employee							0.0617***
							(0.0228)
Ln relative GDP/capita	0.1507*	0.1765**	0.1916**	0.1087	0.0944	0.1891**	0.1565*
	(0.0870)	(0.0852)	(0.0862)	(0.0985)	(0.0987)	(0.0864)	(0.0849)
Ln relative land/capita	0.2279***	0.1996***	0.2319***	0.2235***	0.2122***	0.2325***	0.2213***
	(0.0472)	(0.0463)	(0.0469)	(0.0503)	(0.0507)	(0.0471)	(0.0478)
Ln relative distance	-1.4049***	-1.3129***	-1.4030***	-1.4014***	-1.3952***	-1.4031***	-1.4147***
	(0.0678)	(0.0651)	(0.0687)	(0.0734)	(0.0741)	(0.0697)	(0.0673)
Contiguity	0.9701***	1.1214***	0.9651***	1.0209***	1.0270***	0.9663***	0.9635***
	(0.1332)	(0.1320)	(0.1349)	(0.1554)	(0.1558)	(0.1349)	(0.1362)
Common language	1.1270***	0.9966***	1.1545***	1.0826***	1.0832***	1.1487***	1.1275***
	(0.1996)	(0.2270)	(0.1998)	(0.2120)	(0.2113)	(0.1989)	(0.2045)
Common Euro currency	0.8216***	0.5607***	0.8490***	0.7782***	0.7768***	0.8445***	0.8336***
	(0.0954)	(0.0967)	(0.0950)	(0.1012)	(0.1016)	(0.0954)	(0.0954)
Constant	-3.5204***	-2.4562***	-3.5631***	-3.4806***	-3.4939***	-3.4991***	-3.5359***
	(0.1684)	(0.2125)	(0.1709)	(0.1863)	(0.1883)	(0.2521)	(0.1665)
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes Yes
R^2	0.4506	0.4514	0.4421	0.4529	0.4525	0.4419	0.4466
Observations	103421	109148	108952	87853	87853	109148	99581

Notes: Clustered standard errors at the importer-exporter pair level reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively.