Estimating the trade effects of the EU food quality policy

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PRELIMINARY DRAFT

Abstract

We investigate the relationship between international trade and product quality using the EU policy on Geographical Indications (GIs). Building on the quality sorting model of Crozet et al. (2012), we add constraints linking product quality to the adoption of the EU policy and different entry market costs according to the level of competition in the destination market. The main model predictions are empirically tested exploiting a new dataset collecting country information on GIs at HS 6-digit level and bilateral trade flows during the period 1996-2014. The main results show that GIs affect trade differently depending on whether GIs are produced in the exporter or importer country. In particular, the presence of GIs in the exporter country seems to exert a pro-competitive effect, while when registered only in the importer country GIs act as an anti-competitive measure.

Keywords: Geographical indicators, EU trade, Extensive-intensive margins, Export prices
JEL classification: F12, F14, Q18

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1 Introduction

Over the last years, the importance attached by consumers to the quality and safety of food products have been steadily increasing, with a specific attention on the link between health and diet as well as the diffusion of food products coming from abroad. These facts have increased the consumers demand for a credible information on the origin of foodstuffs, as well as of their nutritional attributes and the way they are produced (Caswell and Mojduszka, 1996; Grunert, 2005).

In this context, Geographical Indications (hereafter, GIs) have assumed a more valuable importance in overcoming asymmetric information problems linking the location where a food product is produced and its traditional quality attributes, a concept that has been summarized by the word terroir (Josling, 2006). Although they are widespread in different countries in the world, GIs are particularly important in the European Union (EU).

Besides the importance of GIs for consumers as guarantee of quality, the EU considers GIs an important economic resource for local producers. Indeed, the production of goods deeply rooted in the local geography and tradition, represents an important instrument for promoting rural development, allowing them to value quality and reputation traditionally linked to local communities and their production.

Over the last decades, the EU has designed rather elaborate regulations on GIs. At the international level, GIs are protected by the World Trade Organization (WTO) agreement on Trade-Related Aspects of Intellectual Property (TRIPS), although the protection at this level is lower than in the EU. The protection under the TRIPS can be circumvented for instance by indicating the true origin of the product (e.g. *Australian Feta*), or by translating the original name (e.g. *Parmesan Cheese*), or by associating the GI name with an expression indicating the similarity with the EU original product (e.g. *Prosciutto Parma*).[1]

The EU has strongly supported the increasing protection of GIs at the international level, claiming that the growing number of violations damage both consumers and producers. By contrast, among non-EU countries, GIs are often considered as property rights that can allow firms' products to increase their competitiveness (Josling, 2006). During the WTO trade negotiations these contrasting positions

[1] See Matthews, A. (2014). Geographical indications (GIs) in the US-EU TTIP negotiations. CAP Reform. EU (http://capreform.eu/geographical-indications-gis-in-the-us-eu-ttip-negotiations/).

have been a major point of contention in the last years between EU and non-EU countries. More recently, these tensions are emerging again in the case of the Transatlantic Trade and Investment Partnership (TTIP) agreement negotiation between EU and United States.

The lack of any agreement on increased protection of GIs, which instead has been reached instead with Canada within the Comprehensive Trade and Economic Agreement (CETA), is one of the points of contention that are hindering the positive conclusion of the whole agreement. Therefore, the protection of GIs is considered as a priority in the EU policy agenda.

As far as we know, few empirical contributions have focused on the role played by GIs in affecting international trade flows. Sorgho and Larue (2014) take the advantages of a panel data on 27 EU countries on aggregated flows of agri-food imports in order to investigate the effect of the diffusion of GIs on the intra-EU trade. Covering three years (1999, 2004 and 2009), and by applying the odds ratio gravity specification of Head and Mayer (2002), they built an indicator which accounts for the presence as well as for the number of GIs in each EU country. The main results show that GIs promote trade only when both the importing and exporting countries are GIs producers.

Focusing on wine export flows, Agostino and Trivieri (2014) study the effect of EU quality policies through the use of very disaggregated data and by adopting a gravity framework. They found that, firstly, quality wines produced in specific regions have higher trade values across time and destination areas than other wines and, secondly, that there exists a positive influence of GIs on the extensive margin of trade.

Duvaleix-Tréguer et al. (2015) use French custom firm level data matched with the list of firms of the French national institute responsible for the official designation, in order to identify those firms producing PDO cheese products. Their analysis provide evidence that GI certification has an impact both on the extensive and intensive trade margins and that GIs allow firms to charge higher export unit values.

Our analysis goes in the same direction of this strand of literature. In particular, we extend the quality sorting model of Crozet et al. (2012) to the EU quality policy, and we test the model predictions throughout a careful classification of all the EU GIs products at the HS 6-digit level.

Econometrically we adopt a panel framework through a Poisson Pseudo-Maximum Likelihood (PPML) estimator to account for heteroscedasticity and the large proportion of zero in the bilateral trade matrix. The analysis considers both the GIs effects on the extensive and the intensive margins of trade, as well as on export prices. As far as concerned, trade margins decomposition relies on the theoretical approach of Feenstra (1995) and Feenstra and Kee (2004).

The remainder of the paper is organized as follows. Section 2 describes the theoretical model which introduces the EU GI policy in a quality sorting model, Section 3 derives the estimable equations. Section 4 presents data and defines the sample we use for the empirical analysis while Section 5 shows the results. Section 6 concludes.

2 Introducing GIs in a quality sorting model

From a theoretical perspective, a study of the potential effects of the diffusion of GIs in shaping the intra-EU trade can be carried out within a firm-heterogeneity framework. The extensive and growing literature on this topic suggests that product quality represents a key determinant of firms' success in the international markets, as GIs represent a clear quality signal. This strand of literature has been inspired by the seminal work by Melitz (2003), where heterogeneous firms in a monopolistic competitive market produce horizontally differentiated goods which can be ranked according to a parameter, the total factor productivity, that define their export status. According to this model, as an effect of fixed export costs, more productive firms operate on the export market, while less productive firms are relegated to operate only domestically or they are driven out from the market. The evolution of this literature led to the inclusion of product quality in a firm heterogeneity model *a la* Melitz (2003), allowing firms to produce vertical differentiated goods. In these so called *quality sorting* models, more productive firms perform better in the export markets than less productive firms, as they produce higher quality products (see Verhoogen (2008); Baldwin and Harrigan (2011); Crozet et al. (2012); Kugler and Verhoogen (2012)).

Our theoretical model is built on the framework proposed by Crozet et al. (2012), representing one of the first formalization of a *quality sorting* model in a firm heterogeneity setting. We depart from their model firstly, by including additional constraints linking product quality to the adoption of the EU quality policy, and secondly, by introducing different entry market costs according to the level of competition in the destination market as a result of the production of GIs.

2.1 The model

Let's consider a generic firm F which has the possibility to produce a good j. If it is located in a specific geographical area α it can have the possibility to adopt a policy γ, which is aimed to promote the increase of the level of quality s of a good j:

$$s_{\alpha,\gamma|h}(j) > \bar{s}_{\alpha|h}(j) > s_{\alpha|h}(j) \tag{1}$$

with $\bar{s}_{\alpha|h}(j)$ as the average product quality in the area α and $s_{\alpha|h}(j)$ as the general quality level with h identifying a specific HS product sector. From now-on, for the sake of simplicity, we will refer to a generic level of quality $s(j)$, holding with respect to (1).

As in Crozet et al. (2012)[2], the sub-utility function, which is assumed to have a constant elasticity of substitution (CES), $\sigma > 1$, over a set Ω_d of goods j, available in country d, is defined as follow:

$$U_d = \int_{j\epsilon\Omega_d} \left([a_d(j)b[s(j)]q(j)]^{\frac{\sigma-1}{\sigma}} d_j \right)^{\frac{\sigma}{\sigma-1}} \tag{2}$$

with $q(j)$ as the j good's quantity. The $b(.)$ function includes quality into quantity equivalents while $a_d(j)$ are country (d) specific demand parameters on j, which account for firm-destination demand shocks.

In country d consumers are involved to spend an exogenous total amount X_d on j. Hence, the firm level market share at destination can be defined as the ratio between the export values $x_d(j)$ inclusive of trade costs, and X_d:

$$\frac{x_d(j)}{X_d} = \frac{\left[\frac{p_d(j)}{a(j)b[s(j)]}\right]^{1-\sigma}}{\int_{i\epsilon\Omega_d} \left[\frac{p_d(i)}{a(i)b[s(i)]}\right]^{1-\sigma} d_i} \varepsilon_d(j) \tag{3}$$

with $p_d(.)$ as product prices and $\varepsilon_d(j)$ being a dummy variable equal to 1 if the firm enters market d. Therefore, firm's profit maximization can be defined as the difference between revenues and costs, depending on products quantity, and a specific destination market entry cost (M_d):

$$\Pi_d(j) = [p_d(j) - C_d\tau_d]q_d(j) - M_d\varepsilon_d(j) \tag{4}$$

[2]The theoretical model presented in this section in mainly derived by the Crozet et al. (2012) model. Hence, as far as possibile, we voluntarily maintain the same notation so that a comparison among models can be easily applied.

Specifically, we define $p_d(j)$ as the cost, insurance and freight (CIF) prices:

$$p_d(j) = \frac{\sigma}{\sigma - 1} C_d \tau_d \tag{5}$$

depending on marginal costs C_d and on τ_d which identifies standard iceberg trade costs, with $\tau_d > 1$ and $\frac{\sigma}{\sigma-1}$ to be a constant mark-up. Therefore, relation (5) it is the consequence of CES and iceberg trade cost (i.e. constant markup over marginal costs).

In our framework, marginal costs C_d are increasing in quality (Crozet et al., 2012) and are subject to two additional constraints:

$$C_d = \begin{cases} c_f[s(j)] & \text{if } \alpha \wedge \gamma = 0 \\ c_f[s(j)] + \alpha\gamma c[s(j)] & \text{if } \alpha \wedge \gamma = 1 \end{cases} \tag{6}$$

The first case (i.e., $c_f[s(j)]$) holds whenever a firm is not located in a specific geographical area α and it does not adopt a specific policy on quality γ. In the vein of **?**, **?** and **?**, we include the second case which describes the situation of firms producing good j in area α and adopting policy γ. Therefore, the C_d cost term has two components: the first depends on s; the second is subject to the geographical constraint and is binding to the adoption of a specific quality policy. Following Kugler and Verhoogen (2012), we assume $C_d' > 0$ as the production of high quality products requires the use of high-priced input.

M_d is the destination-specific market entry cost defined as:

$$M_d \varepsilon_d(j) = \begin{cases} m_d \varepsilon_d(j) & \text{if in d,} \quad \gamma = 0 \\ m_d^* \varepsilon_d(j) & \text{if in d,} \quad \gamma = 1 \end{cases} \tag{7}$$

We assume $m_d^* \varepsilon_d(j) > m_d \varepsilon_d(j)$ so that, for an exporting firm, the entry cost is higher in a destination market where firms produce product j and comply with the quality policy γ. In this case, the competition is fiercer than in other markets, where neither firms producing product j comply with the quality policy γ nor product j is produced. This interpretation has been put forward firstly by Chambolle and Giraud-Héraud (2005), who argued that certification of origin can act as a non-tariff barrier, assuming that only domestic firm can opt for certification. This is often the result of a combination between quantity restrictions and a kind of quality cost subsidy.[3,4]

Substituting equation (6) and (7) into (4) and collecting all country-specific determinants of exports in A_d as the 'attractiveness' of d (Crozet et al., 2012), the export value can be defined as:

$$x_d(j) = \left(\frac{b[s(j)]}{C_d}\right)^{\sigma-1} A_d \eta_d(j) \varepsilon_d(j) \tag{8}$$

with $\eta_d(j)$ being the idiosyncratic demand shifter.
Given equation (8), firm's profit is positively related to the value of export, while it is negatively related to the cost of entry in the market d (if and only if $\varepsilon_d(j) = 1$):

$$\Pi_d(j) = \frac{x_d(j)}{\sigma} - M_d \varepsilon_d(j) \tag{9}$$

The model provides theoretical predictions on the potential effects of a quality policy, $s(j)$, such as the EU one, on GIs both with respect to the export and to the import side.

Taking the first derivative of equation (8) it can be show there exists a positive relation between quality and the export volume ($\frac{\partial x_d}{\partial s(j)} > 0$). As GIs represent a clear quality signal, this finding is in line with the standard predictions of the *quality sorting* models, where firms exporting higher quality products have better performance than other firms.

Moreover, plugging equation (8) in (9) the probability to export will be given by:

$$\mathbb{P}[\varepsilon_d(j) = 1] = \mathbb{P}([b(s_j)]/c[s(j)])^{\sigma-1} A_d \alpha_d(j) > \sigma M_d \varepsilon_d \tag{10}$$

so that the probability to export is increasing in the level of quality while is inversely related to firm costs.

Finally, considering conditions (7) and the assumption that $m_d^* \varepsilon_d(j) > m_d \varepsilon_d(j)$ we have that the

[3]In order to obtain a PDO or a PGI certification, producers have firstly to be placed in given territorial limits, and, secondly, they have to comply with strict rules of production. As a matter of facts, these certifications impose a restriction in the produced quantity.

[4]An example could help to clarify this point. Suppose we are considering a product category, e.g. citrus, and an exporting country, e.g. Italy, which counts one or more GIs on this category. In this case, the cost of entry in a market will be higher when considering a destination country, e.g. Spain, where GIs citrus are produced, and thus where there already exists domestic quality competition, than in a market, e.g. Sweden, where 100% of citrus are imported, and thus where there is not any domestic competition.

first derivative of equation (9) with respect to entry costs will be negative ($\frac{\partial \Pi_d}{\partial M_d} < 0$). This imply that the diffusion of GIs for a given sector in a given destination country could hinder firm export to that destination, acting as a non-tariff measure as in Chambolle and Giraud-Héraud (2005) model.

3 Econometric identification and measures

We investigate the relationship between international trade and GIs focusing on intra-EU trade market exploiting a panel data analysis. We estimate the theoretical model presented in Section 2 by decomposing country-product trade data in their extensive and intensive margins. Our strategy is consistent with (Helpman et al., 2007) and Santos Silva et al. (2014) who show how to estimate properly a firm-level model using such a decomposition of trade data.

We use three different dependent variables: trade/intensive margin, extensive margin, and price (expressed as f.o.b. price). These variables are derived, respectively, from equation (8), (10), (5).

Our benchmark empirical specification can be written as:

$$lnX_{od,ht} = \beta_0 + \sum \beta_n GI_{ht} + \epsilon_{d,t} + \epsilon_{o,t} + \epsilon_{od} + \epsilon_{ht} + \varepsilon_{od,ht} \tag{11}$$

with our dependent variable $X_{od,ht}$ being, alternatively, the volume of trade, the extensive or intensive margins and the export price, depending on origin o and destination d countries, on the h product sector and on a time dimension t.[5] GI_{ht} is the quality explanatory vector (Sorgho and Larue, 2014) with the β_n coefficients of interest varying on $n = 1, 2, 3$ which identifies the number of GIs in the exporting (if $n = 1$, $GI_{o,ht}$), importing (if $n = 2$, $GI_{d,ht}$) country or when both countries have GIs (if $n = 3$, $GI_{od,ht}$). $\epsilon_{d,t}$, $\epsilon_{o,t}$, ϵ_{od} and ϵ_{ht} are the exporter (importer) time fixed effects, the country-pair fixed effects, and the year and product-time fixed effects, respectively. The latter account for any shocks that affect global trade flows in a particular year and in a particular product-time group, respectively. Finally, $\varepsilon_{od,ht}$ is the error term.[6] By including origin and destination time FE, product time FE and bilateral FE, the β_n coefficients of interest estimate the effects on the dependent variable

[5] For the sake of simplicity, we have defined in equation (11) the product h as a generic product category. Note that h will be defined as HS 6 digit product line in the trade and price equation, while as HS 2 digit product line in the intensive and extensive margin equations.

[6] As the log of zero is undefined, we utilize the GI variable in level and the estimated coefficients (β_n) can be interpreted as semi-elasticities.

of a within country/tariff lines increase in the number of GIs, in comparison to the country tariff line without GIs which represents our benchmark.

There are two possible econometric estimators for relation (11). The main problem is the high presence of zeros in the bilateral trade flows, which in our specific case is very large due to the high level of disaggregation of our data. The literature tackled this problem applying either the Heckman selection correction as in Helpman et al. (2007), or the PPML estimator proposed by Santos Silva and Tenreyro (2006). Due to the panel structure of our dataset, we use the PPML estimator. Santos Silva and Tenreyro (2006, 2011) showed that this estimator is robust to different patterns of heteroscedasticity and measurement error, and is particularly suitable in the presence of many zeros.

In our case, taking the advantages of a panel data, we use the PPML estimator. Santos Silva and Tenreyro (2006, 2011) showed that they estimate trade equation consistently, which is robust to different patterns of heteroscedasticity and measurement error, and is well behaved in the presence of many zeros.

Finally, when we estimate equation (11) with the extensive margin, its double bound nature (i.e., between 0 and 1), implies that the partial effect of the regressors on the conditional mean of the dependent variable cannot be constant and must approach zero, as the conditional mean approaches its bound (Santos Silva et al., 2014). For this reason, they proposed a specific functional form directly derived from the Helpman et al. (2007) firm heterogeneity model. We estimate extensive margin equation using this new procedure as robustness check.

4 Data

4.1 GI policy indicator

An important effort of this paper has been dedicated to the GIs classification in accordance with the Harmonized System (HS) codes at the 6-digit level, which then allowed us to work at a very disaggregated product level data.

Starting from the European DOOR database (Database of Origin and Registration), which collects official information on all the registered EU geographical indications, we selected all the Protected geographical indications (PGI) and Protected designations of origin (PDO) products registered from

1996 to 2014.[7] Since the DOOR database does not classify products with any official classification, but it just distinguishes between broad product categories, we matched manually each of the registered GIs with the corrisponding HS classification codes at the 6-digit level.

Overall, the DOOR dataset includes 1,281 registered GI products, 52.69% IGP and 47.31% PDO. The classification methodology described above does not allow to find an exact correspondence for only 51 of these GI products, which have been consequently excluded from the empirical analysis.

The number of GI products registered by the 15 European Countries is 1,036, the 81.26% of total observations in the DOOR dataset. More than half are PDO products (530). However, as shown in Figure 1, during the observed period the number of registered PGI products increased more than PDO, leading to the current equal presence.

The concordance between the GI products of the DOOR database and the Harmonized System classification is summarized in Table 1 where the number of GIs are aggregated at 2-digit level. As it is evident from the figures, almost one to four of the GI products are classified in the 04-sector, which includes mainly cheeses. Among the eighteen 2-digit sectors identified by the classification process, six sectors, HS 02-04-07-08-15-16, represent the 85.87% of total GIs and, specifically the 92.12% of total PDO and 79.33% of total PGI. Thus, with the aim of studying the impact of GIs production on trade, we will study in depth these six sectors, by limiting our empirical analysis to them.

Among the total EU 15 GI products, 25% are from Italy with 33% of Italian PDO in the *Dairy* sector while almost 37% of IGP products in *Edible fruit and nuts; peel of citrus fruit or melons*. Slightly less France, representative for more than 20% of EU 15 GIs products mainly driven by the *Dairy* sector for PDO, and *Meat & edible meat offal* sector for PGI (55.9% and 54.39% respectively). Then Spain, Portugal and Greece; in particular, 45% of the PGI products from Portugal are in the *Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates* sector while 39.13% of the Greek PGI products are in the *Edible vegetables and certain roots and tubers* sector (see Table A.1 in Appendix).

Finally, according to the Broad Economic Categories (BEC), 88% of GIs products can be classified as final products. Thus, to study the possible pro-competitive or anti-competitive effect of the diffusion

[7] The distinction between PGI and PDO is related to the extent to which they have to comply with the required origin-quality link. In the PGI case, it is sufficient that one stage of the product process is carried out in a specific geographical area, while in the case of PDO all production stages must have to take place in the same defined area.

of GI products on trade in a country, we choose to focus only on products for final consumption and, following the BEC classification, we exclude both the GI products and the trade flows of HS 6-digit products that are classified as intermediate good (see Table A.2 in Appendix).

4.2 Trade data and measures

The overall sample contains HS 6-digit product information on intra-EU 15 bilateral trade flows from 1996, which represents the first year of GIs registration under the EU Regulation system, to 2014. To avoid potential bias in the estimation results, determined by the progressive enlargements occurred from 2004 to 2013, and the subsequent abolition of intra-EU tariffs, we maintain constant the sample of countries involved in the analysis, by focusing only on the EU 15. Indeed, the progressive increase in the market dimension and the diffusion of GIs in the New Member States could impact and distort the GIs effect on trade flows. Note that, by focusing only on intra-EU trade we have a key advantage in comparison to previous analyses. Indeed, due to the EU internal market, firms face neither tariff nor non-tariff measures (NTMs) when decide to export in a given destination market. This is of particular importance especially considering NTMs for two reasons. Firstly, because it is difficult (if not impossible) to build a consistent NTMs database with a time dimension; secondly, as many NTMs are actually quality and health standards, not controlling properly for them would make the identification of the GIs trade effect problematic.

Trade data come from the BACI database (Base pour l'Analyse du Commerce International) of CEPII (Centre d' Etudes Prospectives et d'Informations Internationales), which provides bilateral values (and quantities) of exports at the HS 6-digit disaggregation level. These data offer the advantage to correct, with a rigorous procedure, the potential discrepancies between import values, expressed as CIF, and export values, expressed as FOB (Gaulier and Zignago, 2010). Although this problem is not severe when we consider trade among European countries, the database improves the quality of the results when we measure the intensive and extensive trade margins, where, as shown below, exports from all the world countries is used.

To measure the extensive margin we follow Feenstra and Kee (2004). Let's $R^{h2}_{od,t}$ be the exporting country o's categories set exported (i.e., with positive trade flows) to the country d, in year t with $h2$ be the 2-digit level of the HS classification; R^{h2}_{dW} is the world categories set exported to the country d

over all the years considered. If $\bar{V}^{h2}_{dWh6}$ is the average value of the world's exports to country o of the category $h6$ over the years, then the bilateral extensive margin for industry sector $h2$ in year t is:

$$EM_{odh2,t} = \frac{\Sigma_{h6\epsilon R^{h2}_{od,t}} \bar{V}^{h2}_{dW,h6}}{\Sigma_{h6\epsilon R^{h2}_{dW}} \bar{V}^{h2}_{dW,h6}} \tag{12}$$

If $V^{h2}_{odh6,t}$ is the value of exports of country o to d of the category $h6$ at time t, the bilateral intensive margin in industry $h2$ is:

$$IM_{odh2,t} = \frac{\Sigma_{h6\epsilon R^{h2}_{od,t}} V^{h2}_{odh6,t}}{\Sigma_{h6\epsilon R^{h2}_{od,t}} \bar{V}^{h2}_{dW,h6}} \tag{13}$$

which compares the export trade values of country o to country d of products in a certain set of goods in year t with the average export trade values of the world to country d for the same set of products. Hence, it measures country o's overall market share within the set of categories it exports to d.

To reduce the large number of zero observations in the data, obtained after squaring the database, the average value of production for the years 2008–2010 was used. Thus, using FAOStat and EUROSTAT Prodcom databases for agricultural and food productions respectively, measured at HS 6-digit level, we dropped out the zero observations when the average production value in the exporter country was equal to zero. Thus, when a country results to be nor producer nor exporter of the good.[8]

5 Results

5.1 A first looks to the raw data

Figures 2 reports the average values of the two margins computed as in equation (12) and (13) for the EU trade, based on the BACI database and limited to the six agro-food sectors mainly involved in the GIs.

Country-products adopting GIs increase significantly the extensive margin over the whole period, while the extensive margin of the other countries has declined. Interpreting the data, countries producing GI products increase their number of exported varieties, passing from the 30% to close the 50% of the overall varieties imported by the importer countries. By contrast, during the whole period, both groups of countries have increased their intensive margin, thus the volume of varieties already

[8] The percentage of zero trade flow at 6-digit level estimation, as in equation (11) is 70%, while at 2-digit level is 18%.

exported, but with a strongly different pattern. Interestingly, the intensive margin of trade increases more than three times for exporter countries that produce GIs, while it grows slightly less for the others.

This preliminary look at the data provides some useful stylized facts. First, GIs country producers have sharply increased their food export varieties toward the EU in the past 20 years. Second, EU countries that are non-GIs producer have concentrated their food exports to the EU, in terms of categories already exported. Third, both groups of countries/industries have increased the intensive margin, but GIs producer countries show a stronger trend.

These preliminary findings seem to suggest a strong GIs trade effect on both the extensive and intensive margin. Obviously, these are simple correlations and trends. Next, to properly assess the role of GI policies in determining these patterns, we move to the econometric analysis.

5.2 Econometric results

In the first step of our empirical analysis we estimate a model exploiting a panel dataset (1996-2014) using two sets of data structure: one pooled over the main agro-food sectors involved in GIs, and the other one by considering separately each HS 2-digit sectors. All these estimations use trade data at 6-digit disaggregation level and are estimated with the PPML approach. Specifications always include fixed effects for importer, exporter, product, and country pair that are not reported in the table.[9]

Column (1) of Table 2 reports coefficients estimated using equation (11) pooling the data across all the HS 2-digit considered sectors. First of all, it is worth noting that our key GI coefficients are all statistically significant at the 99% level. In particular, the results show that when only the importer country produces GIs, the effect on trade flow is negative and significant. Quantitatively, this results suggests that the addition of a new GI in the importing country, when the exporter does not produce any GIs, decreases trade flows of about 3.6%. By contrast, when only the exporter country produces GI products, the effect on trade flows is positive and significant. In this case, the magnitude of the estimated coefficient suggests that a new GI produced in the exporting country, when the importing country does not produce any GIs, increases trade of about 5.4%. Finally, when both countries produce

[9]Because the model is, *de facto*, a bilateral gravity equation, bilateral variables such as distance, contiguity and language, instead of the dyad dummies, could be included in the model. Running the model with these variable included (and so omitting the dyadic dummies) we obtain similar results that however overstates the coefficients magnitude of our variables of interest, due to the insignificance effect of these bilateral variable in the context of intra-EU trade.

GIs, the estimated coefficient is positive and significant, and shows that one additional GI product in the importing country, when also the exporting country has GI products, increases trade of about 4.3%. Overall, these results are totally consistent with the predictions coming from our theoretical model. Indeed, the empirical result confirms that the adoption of a new GI always enhances trade flows when GIs are produced in the exporting country, while it seems to act as non-tariff measure when GIs exist only for the importer country. To check for the existence of a trend in the GIs adoption effect, we introduce an interaction term between GIs variables and year dummies. The results, synthesized on Figure 3, display different trends. There is a stable and always positive and significant effect on trade for exporting countries, that shows a slightly decreasing effect when also the importer country produce GIs.[10] By contrast, when GIs are produced only in the importer country, their effect, which is not always significant but systematically negative, shows higher variability over time and a general reduction of its anti-competitive effect.

To understand whether the number of GIs registered in the country acts differently within the 6 product groups considered (see Section 4), we estimate equation (11) by product. Results are reported in Table 2, columns (2) to (7). Even at sectoral level, the trade effect of a new GI in the exporting countries results to be positive and significant in almost all groups, although the magnitude of the estimated effect is quite different. The impact of GIs spans from 2-3% of trade increase for *Meat & edible meat offal* sector, to 23% and 60% for vegetables and fruits production, respectively. In these two sectors we do not observe any significant effect on trade when GIs are produced only in the importer country. A possible explanation for these different patterns is that the latter sectors include many product lines originating directly from agricultural activity. Thus, requiring specific factor endowments (natural resources), GIs does not modify the demand of these products on the importer country. Differently, new GIs in meats and oils sectors, with their negative and significant coefficients, seem to act as anti-competitive measure for the importer country.

Finally, the *Dairy produce; birds' eggs; natural honey* sector, with its 271 GI products, is the only sector where a new GI in the importer country determines a trade increase from a non-GIs country (coefficient $+0.04$). This pro-competitive effect could be explained by a higher demand of products in the GI producer country, due to an higher level of consumer's information, or, as suggested by

[10]To save on space, the estimates on which Figure 3 is based are not reported but are available on request.

Chambolle and Giraud-Héraud (2005), by a lower quality standard in the new GI that lead to a fiercer competition. Comparing our results with Sorgho and Larue (2014) is not easy as they measure the effect of an additional GI product on the border effect, namely the external and internal trade ratio, and obtaining mixed results. Limiting to results obtained using the PPML estimator, they find a significant effect only when the importing country has GIs, with a 3% reduction of this ratio, while no effect is observed on the exporter side of GIs production.

Table 3 reports the estimates of how the impact of GIs over trade can be decomposed into the extensive and intensive trade margins. The first, reported in column (1), shows the role played by GIs in opening new trade routes, or increasing the number of the exported varieties. The estimated coefficients are significant and in line with the effect observed at trade level, except when both countries have GIs. Thus, a new labelled quality product increases the number of varieties exported, when the importer does not have GIs. The GIs act as a catalysis to trade and it exerts a pro-competitive effect. By contrast, when GIs are in the importer country only their presence decreases the number of imported varieties and GIs act as anti-competitive measure. Finally and interestingly, it does not exert any effect when both countries produce GIs. These results confirm the positive effect exerted by GIs in creating new trade route that has been observed by Agostino and Trivieri (2014) for French wines and by Duvaleix-Tréguer et al. (2015) for French cheese, although the dimensions of these effect are not comparable.

The impact of GI on the intensive margin of trade (column 2) maintains the signs and the significance observed at trade level (see column (1) of Table 2); thus, it is negative when GIs are only in the importer country, with reduction of the share of its imports (over its average imports in the period) by 1.4 percentage points, and it is positive when GIs are only in the exporter country, with an increase of 1.2 points. Finally, the results highlight that when countries are both with GIs their increase in trade occur only through the increase of what they are already trading (the intensive margin) being the extensive margin not significant.

To check for robustness of the extensive margin results obtained using PPML estimator, we estimate equation (11) using a more appropriate estimator suggested by Santos Silva et al. (2014). Column (3) and (4) report and compare the coefficients obtained with PPML and the new SSTW procedure using only the positive extensive margin.[11] The estimated coefficients result strongly comparable in term of sign, dimension and significance, confirming the validity of the PPML estimator.

Finally, to analyze the impact of GIs on exports unit value, the previous estimations have been performed using the product unit value as dependent variable.[12] The preliminary results, reported on Table 4 and 5, show a similar pattern observed for trade flows. When GIs are produced only by the importer countries they induced a reduction of the export prices. By contrast, when GIs are produced by the exporter countries (or both) they induced a significant increase in the export unit values. All these results corroborate previous findings and are in line with the model predictions.

6 Conclusions

The present study analyzes the relationship between Geographical Indications and international trade between 15 EU countries. Starting from a simple extension of the *quality sorting* model of Crozet et al. (2012) in which we include additional constraints linking product quality to the EU quality policy and by introducing different entry market costs due to GIs production in the destination market, we derive three key testable predictions on the trade effect of the EU quality policy.

The econometric analysis confirms the model expectations, by showing that GIs affects trade differently, depending on who is the GI producer country. The effect on trade flows is positive, and steady over time, whenever a new GI is introduced by the exporter country, and this happens on both the intensive and extensive margin. By contrast, the effect observed when GIs are produced only by the importer country is negative, supporting the idea that GI could act as a non-tariff measure to trade. Finally, we also find similar relationship between GI and export prices.

Due to this *institutionalization of quality* protected under the EU regulation, we can state that EU producers gain on their intra-EU market in term of trade flows. Yet, what is the effect of GIs on extra-EU international market represents an important and complex question that calls for additional and future investigation.

[11]The estimations include only positive value of extensive margin due to the high number of dummies used and the convergence problem.

[12]Unit price is obtained by dividing export values and exports volumes reported by BACI database. We removed all zero value and the severe outliers value. The database strongly decreases the observations number, that move from more to 780,000 to 450,000, but the GIs impacts on trade flows do not change.

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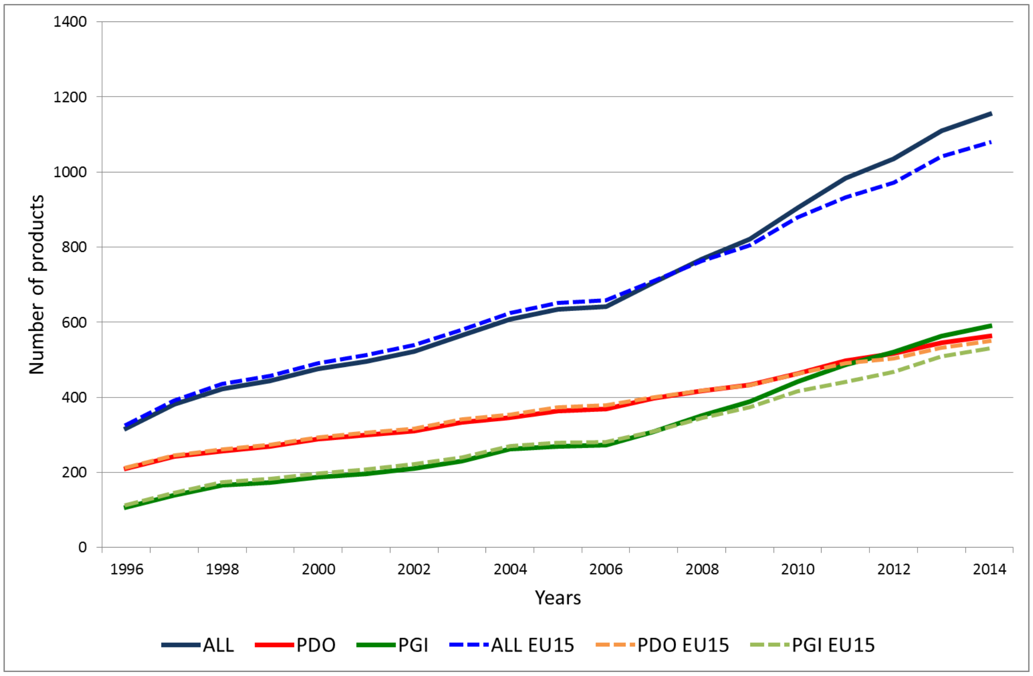
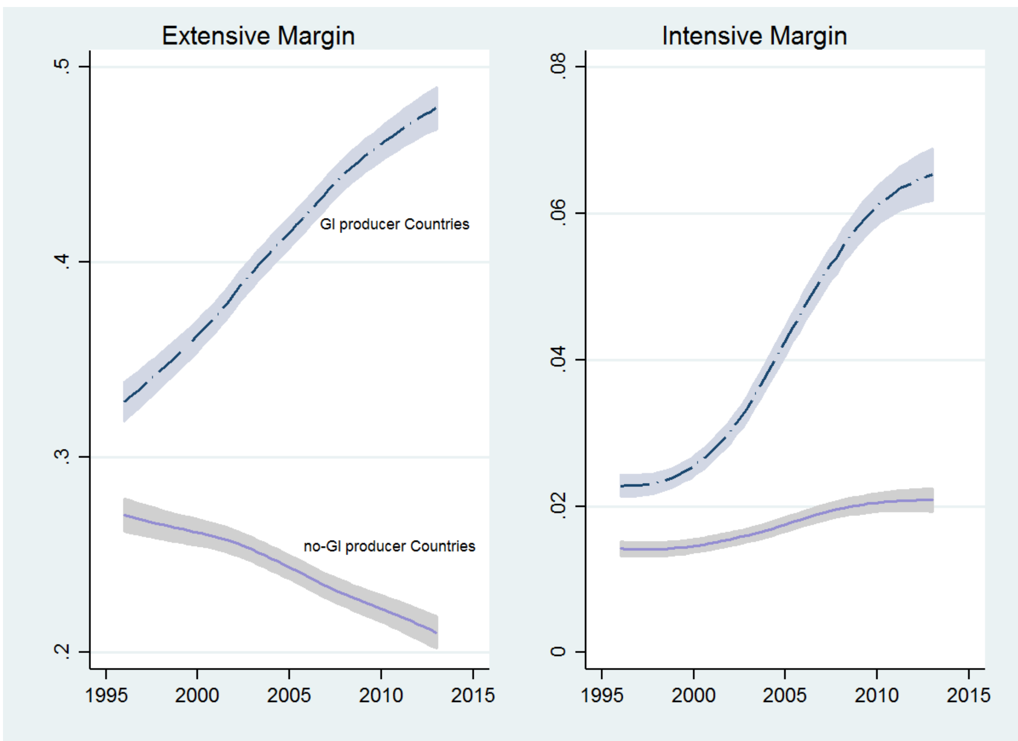
Figures

Figure 1: Distribution of GIs by year of registration



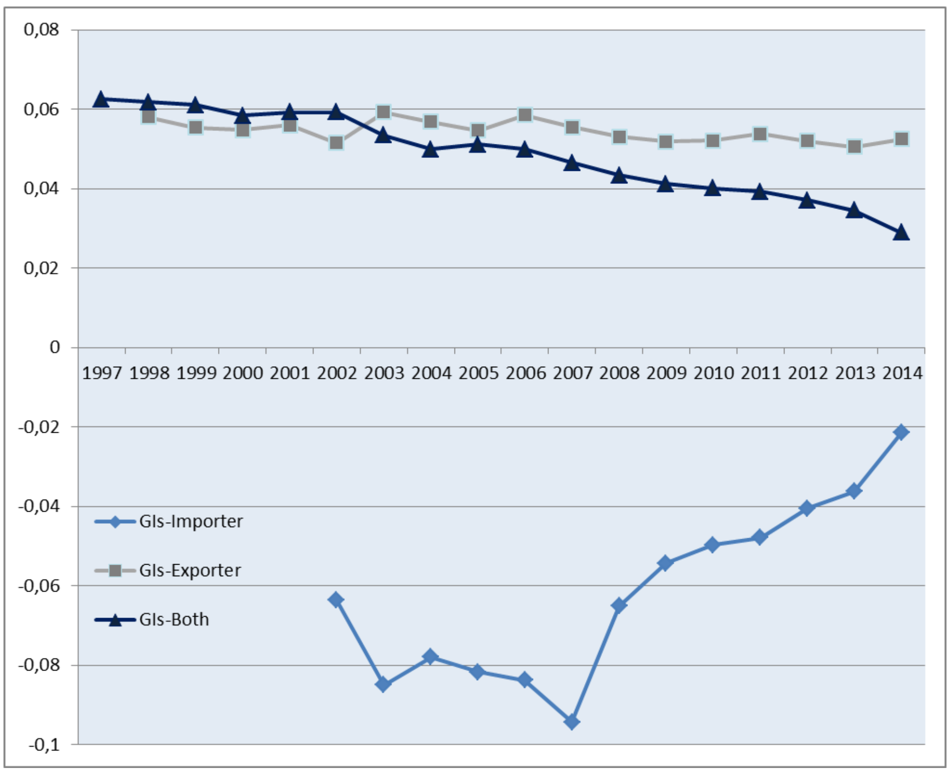
Sources: Authors' analysis based on DOOR dataset 1996-2014.

Figure 2: Extensive and Intensive trade margins in GIs producers countries vs non-GIs producers countries



Sources: Authors' analysis based on data described in the text.

Figure 3: Impact on trade of GIs production over the time in the three groups of countries



Sources: Authors' analysis based on data described in the text. *Notes:* All coefficients are significant at 10 per cent levels. Estimations include importer/exporter-year FE, product-year FE, importer-exporter FE, year FE.

Tables

Table 1: Number of HS2 GIs products

HS2 Classification	Total	PDO	PGI
04- Dairy produce; birds' eggs; natural honey; edible prod. of animal origin, not elsewhere specified or included	236	209	27
02- Meat and edible meat offal	194	60	134
07- Edible vegetables and certain roots and tubers	158	55	103
08- Edible fruit and nuts; peel of citrus fruit or melons	131	60	71
15- Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	108	100	8
16- Preparations of meat, of fish or of crustaceans, mollusks or other aquatic invertebrates	67	7	60
19- Preparations of cereals, flour, starch or milk; pastry cooks' products	43	3	40
03- Fish and crustaceans, mollusks and other aquatic invertebrates	27	7	20
22- Beverages, spirits and vinegar	26	7	19
12- Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder	11	5	6
17- Sugars and sugar confectionery	10	2	8
09- Coffee, tea, mate and spices	8	8	0
10- Cereals	8	4	4
20- Preparations of vegetables, fruit, nuts or other parts of plants	4	2	2
25- Salt; Sulphur; earths and stone; plastering materials, lime and cement	4	2	2
11- Products of the milling industry; malt; starches; inulin; wheat gluten	3	1	2
21- Miscellaneous edible preparations	2	0	2
51- Wool, fine or coarse animal hair; horsehair yarn and woven fabric	1	1	0

Source: Authors' analysis based on DOOR dataset 1996-2014; EU 15 sample restriction. In grey, the sectors considered for the empirical analysis.

Table 2: GIs effects on trade: panel estimates

Dependent variable: Trade flow	Main sectors (HS 02, 04, 07, 08, 15, 16) (1)	Meat (HS 02) (2)	Dairy (HS 04) (3)	Vegetables (HS 07) (4)	Fruits (HS 08) (5)	Oils (HS 15) (6)	Prep.fish (HS 16) (7)
GIs - importer	-0.0365***	-0.08***	0.04***	-0.03	-0.01	-0.08***	-0.03
	(0.0116)	(0.01)	(0.00)	(0.03)	(0.03)	(0.01)	(0.02)
GIs - exporter	0.0546***	0.03***	0.07***	0.21***	0.47***	0.12***	0.06***
	(0.0021)	(0.00)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)
GIs - both	0.0427***	0.03***	0.04***	0.04	0.12***	0.09***	0.02***
	(0.0015)	(0.01)	(0.00)	(0.02)	(0.03)	(0.00)	(0.00)
Fixed effects:							
Importer-year	yes	yes	yes	yes	yes	yes	yes
Exporter-year	yes	yes	yes	yes	yes	yes	yes
Importer-Exporter	yes	yes	yes	yes	yes	yes	yes
Product-year	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes
No. of obs.	786499	333992	172604	352019	347261	278091	163194
R-Sq	0.22	0.24	0.40	0.56	0.30	0.70	0.33

Sources: Authors' analysis based on data described in the text. *Notes:* Robust standard errors in parentheses. *, **, *** indicate significance at 1, 5 and 10 per cent levels, respectively. Constant and fixed effects not reported.

Table 3: GIs effects on Extensive and Intensive margin: panel estimates

Dependent variable:			*PPML*	*SSTW*
	Extensive Margin	Intensive Margin	Extensive Margin	
	(1)	(2)	(3)	(4)
GIs - importer	-0.0008**	-0.0138***	-0.0027***	-0.001***
	(0.0004)	(0.0018)	(0.0004)	(0.0002)
GIs - exporter	0.0027***	0.0118***	0.0016***	0.0016***
	(0.0002)	(0.0010)	(0.0002)	(0.0002)
GIs - both	-0.0001	0.0035***	0.0003***	0.0006***
	(0.0001)	(0.0005)	(0.0001)	(0.0001)
Fixed effects:				
Importer-year	yes	yes	yes	yes
Exporter-year	yes	yes	yes	yes
Importer-Exporter	yes	yes	yes	yes
Product-year	yes	yes	yes	yes
Year	yes	yes	yes	yes
No. of obs.	82225	82225	74284	74284
R-Sq	0.62	0.47	0.57	0.65

Sources: Authors' analysis based on data described in the text. *Notes:* Robust standard errors in parenthesis. Column 3 and 4 use only positive Extensive Margin, and compare PPML and the new SSTW estimation procedure. Column (4) reports the partial effect, instead of the SSTW estimated coefficients. *, **, *** indicate significance at 1, 5 and 10 per cent levels, respectively. Constant and fixed effects not reported.

Table 4: GIs effects on export unit value: panel estimates

Dependent variable: Unit price	Main sectors (HS 02, 04, 07, 08, 15, 16) (1)	Meat (HS 02) (2)	Dairy (HS 04) (3)	Vegetables (HS 07) (4)	Fruits (HS 08) (5)	Oils (HS 15) (6)	Prep.fish (HS 16) (7)
GIs - importer	-0.0070***	-0.0153***	-0.0007	0.0406***	-0.0650***	-0.0037***	-0.0101***
	(0.0006)	(0.0011)	(0.0014)	(0.0045)	(0.0079)	(0.0010)	(0.0021)
GIs - exporter	0.0039***	0.0038***	0.0104***	0.0400***	-0.1695***	0.0018***	0.0158***
	(0.0004)	(0.0008)	(0.0014)	(0.0032)	(0.0072)	(0.0005)	(0.0019)
GIs - both	0.0028***	0.0033***	0.0031***	0.0467***	-0.0051	-0.0006	0.0051***
	(0.0002)	(0.0012)	(0.0002)	(0.0042)	(0.0090)	(0.0005)	(0.0011)
Fixed effects:							
Importer-year	yes	yes	yes	yes	yes	yes	yes
Exporter-year	yes	yes	yes	yes	yes	yes	yes
Importer-Exporter	yes	yes	yes	yes	yes	yes	yes
Product-year	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes
No. of obs.	452538	91892	56613	93027	93744	62658	54604
R-Sq	0.52	0.40	0.44	0.33	0.44	0.44	0.21

Sources: Authors' analysis based on data described in the text. *Notes:* Robust standard errors in parentheses. *, **, *** indicate significance at 1, 5 and 10 per cent levels, respectively. Constant and fixed effects not reported.

Table 5: GIs effects on trade on the Unit value sample: panel estimates

Dependent variable: Trade flow	Main sectors (HS 02, 04, 07, 08, 15, 16) (1)	Meat (HS 02) (2)	Dairy (HS 04) (3)	Vegetables (HS 07) (4)	Fruits (HS 08) (5)	Oils (HS 15) (6)	Prep.fish (HS 16) (7)
GIs - importer	-0.0344***	-0.0808***	0.0376***	-0.0270	0.0137	-0.0995***	-0.0264
	(0.0110)	(0.0126)	(0.0125)	(0.0278)	(0.0309)	(0.0157)	(0.0188)
GIs - exporter	0.0514***	0.0271***	0.0870***	0.1797***	0.4677***	0.1099***	0.0545***
	(0.0022)	(0.0037)	(0.0106)	(0.0141)	(0.0220)	(0.0034)	(0.0068)
GIs - both	0.0425***	0.0244***	0.0415***	0.0195	0.1532***	0.0839***	0.0181***
	(0.0015)	(0.0087)	(0.0012)	(0.0253)	(0.0316)	(0.0026)	(0.0049)
Fixed effects:							
Importer-year	yes	yes	yes	yes	yes	yes	yes
Exporter-year	yes	yes	yes	yes	yes	yes	yes
Importer-Exporter	yes	yes	yes	yes	yes	yes	yes
Product-year	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes
No. of obs.	452538	91892	56613	93027	93744	62658	54604
R-Sq	0.22	0.24	0.39	0.57	0.29	0.72	0.32

Sources: Authors' analysis based on data described in the text. *Notes:* Robust standard errors in parentheses. *, **, *** indicate significance at 1, 5 and 10 per cent levels, respectively. Constant and fixed effects not reported.

Appendix: Tables

Table A.1: Number of GIs products by country of production

Country	**Total**	**PDO**	**PGI**
Italy	263	157	106
France	207	93	114
Spain	172	94	78
Portugal	124	64	60
Greece	94	71	23
Germany	77	9	68
Great Britain	54	23	31
Austria	13	8	5
Netherland	8	5	3
Belgium	7	3	4
Denmark	6	0	6
Ireland	5	1	4
Luxembourg	4	2	2
Sweden	4	1	3
Finland	3	2	1

Source: Authors' analysis based on DOOR dataset 1996-2014; EU 15 sample restriction.

Table A.2: DOOR and BEC classification

	Final	Intermediate	Total
IGP	430	76	506
	84.98	15.02	100.00
	46.99	62.81	48.84
PDO	485	45	530
	91.51	8.49	100.00
	53.01	37.19	51.16
Total	915	121	1.036
	88.32	11.68	100.00

Source: Authors' analysis based on DOOR dataset 1996-2014; EU 15 sample restriction.