Strengthening European Food Chain Sustainability by Quality and Procurement Policy

Deliverable 4.5:

THE TRADE EFFECTS OF THE EUROPEAN UNION GEOGRAPHICAL INDICATIONS POLICY

February 2018

Contract number	678024
Project acronym	Strength2Food
Dissemination level	Public
Nature	R (Report)
Responsible Partner(s)	UMIL
Author(s)	V. Raimondi, C. Falco, D. Curzi, A. Olper
Keywords	Quality sorting model, EU Geographical indications, Extensive-intensive margins, Export unit values.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 678024.

Academic Partners

1. **UNEW**, Newcastle University (United Kingdom)
2. **UNIPR**, University of Parma (Italy)
3. **UNED**, University of Edinburgh (United Kingdom)
4. **WU**, Wageningen University (Netherlands)
5. **AUTH**, Aristotle University of Thessaloniki (Greece)
6. **INRA**, National Institute for Agricultural Research (France)
7. **BEL**, University of Belgrade (Serbia)
8. **UBO**, University of Bonn (Germany)
9. **HiOA**, National Institute for Consumer Research (Oslo and Akershus University College) (Norway)
10. **ZAG**, University of Zagreb (Croatia)
11. **CREDA**, Centre for Agro-Food Economy & Development (Catalonia Polytechnic University) (Spain)
12. **UMIL**, University of Milan (Italy)
13. **SGGW**, Warsaw University of Life Sciences (Poland)
14. **KU**, Kasetsart University (Thailand)
15. **UEH**, University of Economics Ho Chi Minh City (Vietnam)

Dedicated Communication and Training Partners

16. **EUFIC**, European Food Information Council AISBL (Belgium)
17. **BSN**, Balkan Security Network (Serbia)
18. **TOPCL**, Top Class Centre for Foreign Languages (Serbia)

Stakeholder Partners

19. **Coldiretti**, Coldiretti (Italy)
20. **ECO-SEN**, ECO-SENSUS Research and Communication Non-profit Ltd (Hungary)
21. **GIJHARS**, Quality Inspection of Agriculture and Food (Poland)
22. **FOODNAT**, Food Nation CIC (United Kingdom)
23. **CREA**, Council for Agricultural Research and Economics (Italy)
24. **Barilla**, Barilla Group (Italy)
25. **MPNTR**, Ministry of Education, Science and Technological Development (Serbia)
26. **Konzum**, Konzum (Croatia)
27. **Arilje**, Municipality of Arilje (Serbia)
28. **CPR**, Consortium of Parmigiano-Reggiano (Italy)
29. **ECOZEPT**, ECOZEPT (Germany)
30. **IMPMENT**, Impact Measurement Ltd (United Kingdom)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

In the present analysis we study the relationship between the European Union (EU) food quality policy on Geographical Indications (GIs) on trade flows. We derive hypotheses about the GIs trade effects from the trade model of Crozet et al. (2012), that emphasized the role of product quality in shaping the pattern of trade flows. The theoretical model delivers three predictions about the GI trade effects. First, an export-promotion effect of the GI policy that should affect both the probability to trade (extensive trade margin) and the volume of trade (intensive trade margin). Second, an import-reducing effect of the GI policy, due to an increase in vertical differentiation. Third, an average increase in the export unit values (prices) in countries where firms adopt the GI policy.

These hypotheses are empirically tested building a new dataset on country-product information on GIs, considering bilateral trade data over the 1996-2014 period. The analysis is differentiated by trade within the EU countries and trade between the EU and its main trading partners, given the potential different policy implications stemming from the two analyses.

Considering internal EU trade, the results show that GIs affect trade flows differently depending on whether GIs are produced in the exporter or importer country. In particular, the presence of GIs in the exporter country systematically exerts a positive trade effect on both the extensive and intensive margins. When registered only in the importer country, GIs seem to weakly act as trade-reducing measure, at least when the intensive trade margin is considered. In addition, GIs positively affect export unit values, consistently with the predictions of the theoretical model, and with the idea that GI policy induces a process of quality upgrading.

Moving to external-EU trade, overall the above results are confirmed both in the direction and magnitude of the effect, although some differences are worth noting. First, a new GI in the EU exporting countries increases trade through both the extensive (probability to trade) and intensive (trade volume) margins, as well as the export unit values. Consistently with the result at the intra-EU level, when the destination (non-EU) countries have a GI policy in place, then the GI trade effect is lower, probably as an effect of the higher competition there. However, on the EU import side we have not detected any effect of the GI policy on trade unit values of the exporting country.

Regarding the export promoting or trade reducing effect of GIs, our main findings indicate that the EU quality policy behaves as an export promoting device when implemented by exporters, but it incorporates also some trade reducing elements when analysed from the point of view of the importer country. The conceptual framework on which our empirical analysis is derived, highlighted additional entry market costs in country where firms adopt GI policy. Thus, an interpretation of our findings on the import side suggests that the adoption of the GI policy can induce a process of product differentiation, which makes vertical competition stronger. However, additional investigation is required to better understand if this represents the actual mechanism through which GI policy affects the trade pattern on the import side. The next Deliverable 4.6 will thus explore further the impact of the EU GI policy by also looking at the quality of the EU imported products.

LIST OF TABLES

LIST OF FIGURES

APPENDIX A

APPENDIX B

LIST OF ABBREVIATIONS AND ACRONYMS

CES – CONSTANT ELASTICITY OF SUBSTITUTION

EU – EUROPEAN UNION

GI – GEOGRAPHICAL INDICATION

NTM – NON-TARIFF MEASURE

OECD – ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

PDO – PROTECTED DESIGNATION OF ORIGIN

PGI – PROTECTED GEOGRAPHICAL INDICATION

SPS – SANITARY AND PHYTOSANITARY

WTO – WORLD TRADE ORGANIZATION

The Trade Effects of the European Union Geographical Indications Food Policy

Valentina Raimondi, Chiara Falco, Daniele Curzi, and Alessandro Olper

1. INTRODUCTION

Quality represents a key feature of agricultural and food products affecting, among other things, their success in international markets. However, the quantification of the role of quality in affecting trade flows is hindered by the practical difficulty in measuring quality, forcing researchers to use proxies, such as unit values computed from trade statistics (Crozet et al., 2012). This study proposes an analysis of the relation between trade and quality, exploiting the European Union (EU) Geographical Indications (GIs) quality schemes.

This policy is based on the protection of GIs, and represents an important instrument to highlight the quality and the tradition of agri-food products, to preserve their characteristics determined by geographical factors, human local knowledge and production methods (Agostino and Trivieri, 2014).[1]

The EU quality policy represents an original case study to investigate the quality and trade linkage, mainly for two reasons. First, the importance attached by consumers to the quality and safety of food products has been steadily increasing in the last decades (Caswell and Mojduszka, 1996; Grunert, 2005). In this context GIs have assumed growing importance in the attempt to reduce asymmetric information problems, by linking the location where a good is produced to its traditional quality attributes. Second, the EU considers GIs as a significant economic resource for local producers, as goods deeply rooted in the local tradition can represent an important instrument to promote rural development (European Union, 2012). Thus, the use of the EU quality policy to study the nexus between trade and product quality could represent an indirect way to test whether this (voluntary) market regulation may act as export promoting or trade reducing policy, an issue that has traditionally raised concerns and growing tensions between the EU and its main trading partners (Josling, 2006).[2]

At the international level, GIs are protected by the World Trade Organization (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), though the protection at this level is significantly lower than in the EU.[3] 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 more often considered as property rights that can allow firms' products to increase their

[1] The EU food quality policy on GIs distinguishes between protection system of designation of origin (PDO) and geographical indication (PGI), with the former more restrictive than the latter in terms of characteristics of the production process. The EU GI system was established in 1992 (EC Regulation 2081/92) and then revised in 2006 (EC Regulation 510/2006), also as a consequence of a WTO dispute with Australia and the USA.

[2] For example, the EU GI regulation has been subject of a WTO trade dispute raised by the US (and Australia), which led to a Dispute Settlement Panel in 2003. In short, the final decision of the Panel ruled that the EU GI legislation was not in compliance with the WTO's TRIPS provisions, mainly because it failed to give a protection to foreign countries producers (e.g. trademark holders) comparable to that of the EU GI. See Josling (2006) for an extensive discussion on this trade dispute.

[3] 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 style*). See Matthews (2014) for further discussion.

competitiveness (Josling, 2006) and, eventually, to act as a non-tariff measure (NTM) to trade (Chambolle and Giraud-Heraud, 2005). During the WTO Doha round these contrasting positions have been a major point of contention between the EU and non-EU countries. Recently, this tension is emerged in the case of the Transatlantic Trade and Investment Partnership (TTIP) agreement between the EU and United States.[4]

To date, only few studies have empirically tested the role of GIs in affecting international trade. Sorgho and Larue (2014), using a panel of 27 EU countries and working on aggregated agri-food trade data, show that GIs promote trade *only* when both the importing and exporting countries are GIs producers. Agostino and Trivieri (2014), focusing on wine exports from France, Italy and Spain, show that high quality wines produced in specific regions (GIs wine) have better performance abroad, both through the extensive (probability to trade) and the intensive (trade volume) trade margins. Finally, Duvaleix-Treguer et al. (2015), using French custom data matched with firm-level data of PDO cheese producers, show that GI certification increases firms' exports through the extensive and intensive trade margins, but not export unit values.

Our analysis builds on these early works and provides three main novelties. First, theoretically, we adapt the *quality sorting* model of Crozet et al. (2012) by linking product quality to the firm adoption of the EU quality policy and accounting for different entry market costs according to the level of competition in the destination market. Second, we test the key model predictions by building a new dataset on the EU quality policy throughout a careful classification of *all* the EU GI products at the World Customs Organization (WCO) Harmonized System (henceforth HS) 6-digit level, over the 1996-2014 period. Third, because the model considers also the GI effects on the extensive margin of trade (as well as the intensive margin and export prices), we adopt, at the empirical level, the theoretical decomposition of trade margins proposed by Feenstra (1995) and Feenstra and Kee (2004, 2008).

The results show that the GIs affect trade flows differently, depending on whether the GIs are produced in the exporter or importer country. The GIs strongly increase both exporters' extensive and intensive trade margins, especially when destination countries are not producers of GIs. When both countries produce GIs, the effect is lower in magnitude and driven mainly by the intensive trade margin. This is because on the import side GIs tend to act weakly as a trade reducing measure against exporting countries not producing them. In line with the expectations, GIs allow firms to charge higher export unit values. Finally, and importantly, these findings are confirmed for both internal- and external EU trade flows.

Our paper contributes to the literature on the economic effects of GI. This literature has been attracting growing interest in various aspects, such as the ability of certification and labelling tools in alleviating market failures (Zago and Pick, 2004; Langinier and Babcock, 2008; Moschini et al., 2008); on consumers' and producers' welfare effect of the GIs' provision of quality (Mérel and Sexton, 2012; Desquilbet and Monier-Dilhan, 2015; Lence et al., 2007; Menapace and Moschini, 2014; Yu and Bouamra-Mechemache, 2016); and, more recently, the economics and politics of GI regulations (Deconinck and Swinnen, 2014; Landi and Stefani 2015; Deconinck et al., 2015). To date, the only published paper that explicitly addressed the possible trade protectionist effect of GIs is the one by Chambolle and Giraud-

[4] Interestingly, within the Comprehensive Trade and Economic Agreement with Canada (CETA), the EU was able to reach an agreement with increased protection of GIs. For an extensive discussion of both the CETA and other international issues related to EU GI policy, see Moir (2016).

Heraud (2005).[5] By combining both a quantity restriction and a sort of quality cost subsidy, these authors argue that EU GIs could act as a non-tariff barrier to trade. Our model and empirical evidence are not in contradiction with this prediction.

Our paper is also related to the literature on quality and trade. Starting from the contributions of Melitz (2003) and Bernard et al. (2003), several works extended these firms heterogeneity models by incorporating heterogeneity in product quality as the main driver of firms' export success (see Verhoogen, 2008; Baldwin and Harrigan, 2011; Kugler and Verhoogen, 2012; Crozet et al., 2012; Fajgelbaum et al., 2011; Crinò and Epifani, 2012; Curzi and Olper, 2012).

An overwhelming difficulty of this research has been related to the measure of the unobserved product quality. Early contributions used, as proxy for quality, unit values from trade or firm level data (e.g. Baldwin and Harrigan, 2011; Manova and Zhang, 2012), standard certification such as ISO 9000 (e.g., Hallak and Sivadasan, 2011) and, more recently, quality rating from wine guides as in Crozet et al. (2012). The novelty of our study is that, in order to characterize the quality of traded products, we exploit the effect of an important (voluntary) policy that institutionalized food quality standards (and labels) at the EU level.

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 and discusses identification issues. Section 4 presents the data and defines the sample used for the empirical analysis, while Section 5 discusses the results. Section 6 concludes.

2. THEORETICAL FRAMEWORK

Our theoretical framework is built on the quality sorting firm-heterogeneity trade model of Crozet et al. (2012). We add two extensions to this model: first, we link product quality to the firm's adoption of the EU quality policy; second, we introduce different entry market costs according to the level of competition in the destination market, as a result of GIs production. [6]

2.1. Introducing GIs in a quality sorting model

Consider a generic firm F producing a good j. If the firm is located in a specific geographical area α it can have the possibility to adopt a given certification policy γ, which is aimed to promote the increase of the quality level s of the good j. Suppose that the quality of the product j produced in that area according to the quality policy γ, is higher than the average quality of a generic product j produced in the same area, such that:

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

with $\bar{s}_{\alpha|h}(j)$ as the average quality level, with h identifying a specific HS product.[7] From now on, for the sake of simplicity, we will refer to a generic level of quality $s(j)$, holding with respect to (1).

[5] Bureau, Marette and Schiavina (1998) showed that opening the domestic market to foreign products that are perceived to be of lower quality than domestic products, may lead to market inefficiencies (e.g., adverse selection), which in turn may offset some of the benefits of trade liberalization. For a more general analytical discussion about the (possible) protectionist effects of quality standard, see Marette (2015), Swinnen at al. (2015) and Olper (2017).

[6] Because the model is very similar to Crozet et al. (2012), we report mainly those equations necessary to understand our key predictions, by also maintaining the same notation. For a full derivation of the model refer to the original paper (as well as their working paper version).

[7] Note that relation (1) holds on average. Therefore, it does not rule out situations where a generic product j obtained within the area α, without adopting the quality policy γ, is of higher quality than $s_{\alpha,\gamma|h}(j)$.

The demand side of the model is based on a sub-utility function with standard constant elasticity of substitution (CES), σ>1, over the set of varieties j_d available in the destination country d. Consumers' utility in each country depends on the quantity consumed of good j and its relative quality. In addition, utility depends on destination-specific preference parameters, $a_d(j)$, which captures country-level deviations in utility relative to a particular firm-level quality $s(j)$. [8]

On the production side, firms' profit will depend on product quantity (q_d), and on a destination-specific market entry cost (M_d), while cost, insurance and freight (CIF) prices (p_d) depend on marginal costs (c) and on standard iceberg trade costs $(\tau_d > 1)$. [9] Firms maximize profit in each destination market such that $\Pi_d(j) = \{p_d\,(j) - c\tau_d|q_d(j)\} - M_d\varepsilon_d(j)$, where $\varepsilon_d(j)$ is a dummy variable equal to 1 if the firm enters the market d (0 otherwise).

Marginal costs c are increasing in quality, $\partial c/\partial s(j) > 0$, implying that, conditional to (1), the marginal cost for the production of product j in the area α, by joining the quality policy γ, is higher than the marginal cost for the production of a generic product j in the same area, not adopting the quality policy γ.[10]

A key assumption of our model is such that the destination-specific market entry cost, M_d, depends also by whether or not firms in the destination countries comply with the quality policy γ:

(2) $$M_d = \begin{cases} m_{Fd} & if \quad \gamma = 0 \\ m^*_{Fd} & if \quad \gamma = 1 \end{cases}$$

so that, for a generic exporting firm F, the entry cost is higher in a destination market where (domestic) firms produce product j and comply with the quality policy γ, $m^*_{Fd} > m_{Fd}$. In this case, intuitively, the competition is fiercer than in other markets where no firms producing product j comply with the quality policy γ. This is due to the fact that markets where GIs are present are characterized by higher vertical competition than other markets with no GIs. Hence, in order to export and be competitive in these markets, firms have to "spend more" in destination-specific market strategy.[11] For example, suppose we are considering a product category, e.g. citrus, and an exporting country, e.g. Italy, which has 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, such as Spain, where GIs citrus are produced and, thus, where there already exists domestic quality competition, as opposed to a market, such as Sweden, where 100% of citrus are imported, and thus where there is no other competition from domestic producers.

Under this setting, and defining the *attractiveness* A_d of each destination due to size and relative accessibility, the export value of the firm in each destination will be equal to:

[8] Parameters $a_d(j)$ are interpreted as demand shocks due to cross-country variation in the tastes for the good made by firm *F* (see Crozet et al. 2012).

[9] Specifically, $p_d(j) = \frac{\sigma}{\sigma-1}c[s(j)]\tau_d$, namely price is a constant markup over marginal costs, with $\sigma > 1$ the elasticity of substitution. This is the standard assumption of Melitz type models, based on CES preferences.

[10] Besides depending on quality *per se* (e.g. higher quality inputs), higher marginal costs could also arise from the costs of the adoption of a specific quality policy.

[11] Note, exporting firm could decide not to compete on quality in a market destination with GIs, but just on price. Interestingly, if this is the case, then exporting unit value in that destination could be lower. As we will show later, this is what happen for extra-EU firms, exporting in EU tariff lines with GIs.

(3) $$x_d(j) = \left(\frac{b[s(j)]}{c}\right)^{\sigma-1} A_d a_d(j)\varepsilon_d(j).$$

Because the gross profit-to-sales ratio in the model is given by 1/σ, due to the constant mark-up, the net contribution to firm profits of destination d will be equal to:

(4) $$\Pi_d(j) = \frac{x_d(j)}{\sigma} - M_d\varepsilon_d\ (j)..$$

Hence, conditional to entry in the market destination d $\varepsilon_d(j) = 1$, firm's profit is positively related to the value of export, while it is negatively related to the cost of entry in that market.

2.2. Main model predictions

Relations (3) and (4), together with assumptions (1) and (2), provide the basis to draw predictions of the effects of a certified quality policy on trade, both with respect to the export and the import sides. The model delivers three key predictions.

First, given (3) there exists a positive relationship between quality and the export value (x_d), namely $\partial x_d/\partial s(j) > 0$, meaning that firms adopting a GI quality policy, and thus producing higher quality goods, will export more. A similar prediction can be drawn considering the probability to export, namely the extensive margin.[12] Therefore, the model predicts that the EU quality policy should increase firms' exports, both through the extensive and intensive margins.

Second, because from equation (4) firms' profit in destination d is decreasing in specific market entry cost, i.e. $\partial\Pi_d/\partial M_d < 0$, and similarly for the probability to export, if condition (2) holds, namely $m^*_{Fd}(j) > m_{Fd}(j)$, then the diffusion of GIs for a given sector in a given destination could hinder firms exports to that destination, i.e. $\partial x_d/\partial M_d(j) < 0$. This conclusion is similar to the one put forward firstly by Chambolle and Giraud-Heraud (2005), who argued that certification of origin can act as a non-tariff barrier, operating like an import quota and a sort of quality cost subsidy.[13]

Finally, an additional prediction of the model is related to the firm's export prices which are increasing in marginal cost and thus in the quality of the exported goods, namely $\partial p^*_d(j)/\partial s(j)$, with $p^*_d(j)$ the free on board (FOB) export price. For this reason, we expect that firms exporting GI food products will charge, on average, higher export unit values. However, considering the import side in market-destinations producing GIs, the price effect is ambiguous because it will depend also by the, non-modelled, policy strategy of the exporting firm in that destination.

A final consideration is related to the *attractiveness* term A_d in equation (3). This term is the consequence of both destination size, and relative trade costs (accessibility) of each destination market, i.e. tariffs and non-tariff measures (NTMs). This consideration is important because, when considering internal EU trade flows, both tariffs and NTMs are zero, due to the common market rules. Yet, this is not the case when external EU trade is

[12] Formally the extensive margin is $\mathrm{P}[\varepsilon_d(j) = 1] = P[(b[s(j)]/c[s(j)])^{\sigma-1}A_d a_d(j) > \sigma M_d$ (see Crozet et al. 2012). Hence, the probability to export is increasing in the adoption of the quality policy, *ceteris paribus*.

[13] This is because, in order to obtain a PDO or a PGI certification, producers have first to be placed in defined territorial limits, and, second, they have to comply with some strict rules of production. As a matter of fact, these certifications impose more or less explicit rules on the restriction in the produced quantity. See Lence et al. (2007) for a discussion concerning the supply control nature of some EU GIs, also in comparison with the US system of *certification marks*.

considered. For this reason, the analysis of the GIs effect on internal vs external EU trade, will be investigated using two different empirical model.

3. EMPIRICAL MODEL AND IDENTIFICATION

Our empirical strategy envisages to test the main predictions coming from our firm-level theoretical model, through the decomposition of country-product trade data in their respective extensive and intensive trade margins. As it is shown by Helpman et al. (2008) and Santos Silva et al. (2014), theoretical predictions coming from a firm-level trade model can be properly estimated using such a decomposition of trade flows, because when firms produce differentiated products, these *firm-level* margins translate into *product-level* margins.

We study the GIs' impact on international trade flows, studying their effect on the overall trade, the intensive and extensive margins, and the export prices (expressed as f.o.b. unit values). Our benchmark specification can be written as:

$$lnX_{od,ht} = \beta_0 + \beta_1 GI_{o,ht} + \beta_2 GI_{d,ht} + \beta_3 GI_{od,ht} + \\ +\gamma\, T_{od,ht} + \epsilon_{d,t} + \epsilon_{o,t} + \epsilon_{od} + \epsilon_{ht} + \epsilon_t + \varepsilon_{od,ht} \tag{4}$$

with the dependent variable, $X_{od,ht}$, being, alternatively, one of our variables of interest (i.e. overall trade, intensive/extensive margins, export price) from the origin o to the destination country d, in the h product line at time t.[14] β_1, β_2 and β_3 are the coefficients to be estimated on the quality variables $GI_{o,ht}$, $GI_{d,ht}$, and $GI_{od,ht}$, respectively.[15] $GI_{o,ht}$ represents the number of GIs in the exporting country in a given country-product category, and accounts for a situation where only the exporter has GIs in that product line. $GI_{d,ht}$ accounts for the opposite scenario, representing the number of GIs of the importing country in a given product line, when only the importer (and not the exporter) has GIs in that product line. Finally, $GI_{od,ht}$ represents the sum of the number of GIs of exporter and importer in a given product line, and accounts for a scenario where both countries have GIs in that product line.[16]

It is worth noting that the number of GIs in each tariff line can be viewed as a proxy of the degree of vertical differentiation in a given country-product line. Hence, considering condition (1) of the theoretical model, our empirical counterpart is such that the average quality of goods in each product line h, is assumed to be an increasing function of the number of GIs in that product line, namely $\bar{s}_h(GI)$ with $\partial\bar{s}_h/\partial GI_h > 0$.

The term $T_{od,ht}$ in equation (4) includes policy related trade costs, i.e. tariffs and NTMs, relevant when the analysis considers external EU trade. Finally, $\epsilon_{d,t}$, $\epsilon_{o,t}$, ϵ_{od}, ϵ_{ht} and ϵ_t are the importer, exporter time fixed effects (FE), the country-pair fixed effects, and the product-time and year fixed effects, respectively. The last two account for any potential shocks that can affect global trade flows in a particular year and product-time group, respectively. The inclusion of origin and destination time FE, product-time FE and bilateral

[14] For the sake of simplicity, we have defined in equation (4) 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.

[15] As the log of zero is undefined, we use the GI variable in level and the estimated coefficients (β_1, β_2 and β_3) can be interpreted as semi-elasticities.

[16] By using the number of GIs in a given country-product line, rather than a dummy variable approach as in Sorgo and Larue (2014), we are able to capture the effect of the introduction of an additional GI in a given product-line, significantly increasing the time variation in our variable of interest, an important property for our identification strategy.

FE, allows the β_1, β_2 and β_3 coefficients on the quality variables to identify the trade effects of a country-product line deviation (from the respective mean) in the number of GIs (relative to non-GI product lines), accounting for any unobserved heterogeneity at the country, sector/product and time level. Thus, the identification is equivalent to a difference-in-difference research design. Finally, $\varepsilon_{od,ht}$ is the error term.

Given the well-known problem of many zeros in bilateral trade and the panel structure of our dataset, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator to avoid the incidental parameter problem of the first stage (Probit) Heckman model. Santos Silva and Tenreyro (2006, 2011) showed that this estimator is robust to different patterns of heteroscedasticity and measurement errors, and it is particularly suitable in the presence of many zeros. Standard errors are always clustered by country pair-product at HS 6-digit (or HS 2-digit) level.[17]

Note that the benchmark equation (4) is slightly different when we consider extra-EU trade only. In particular, the quality variable $GI_{o,ht}$ ($GI_{d,ht}$) now represents the number of GIs in the exporting (importing) European country-product line, while $dGI_{d,t}$ ($dGI_{o,t}$) is a dummy equal to 1 if the importing (exporting) country produces GIs at time t, zero otherwise. The interaction of these two variables allows to distinguish the GIs effect on European trade flows when importer (exporter) country produces GIs or not. Thus, considering the external EU trade, the specification becomes:

$$lnX_{od,ht} = \beta_0 + \beta_4 GI_{o,ht} + \beta_5 GI_{d,ht} + \beta_6 GI_{o,ht} * dGI_{d,t} + \beta_7 GI_{d,ht} * dGI_{o,t} + \\ + \gamma\, T_{od,ht} + \epsilon_{d,t} + \epsilon_{o,t} + \epsilon_{od} + \epsilon_{ht} + \epsilon_t + \varepsilon_{od,ht} \tag{5}$$

4. COUNTRY SAMPLE, DATA AND VARIABLES

Our empirical analysis focuses on two different country samples: one considers only intra-EU trade, the other considers extra-EU trade. This choice is motivated by several grounds. First, due to the EU internal market rules, EU firms face neither tariff nor non-tariff measures when deciding to export in a given EU destination market. This is of particular importance for our identification strategy, because it is not trivial to properly control for non-tariff measures (NTMs) in a panel data context. Indeed, the majority of NTMs are quality and health standards, particularly sanitary and phytosanitary standards (SPS) and, as such, the difficulty to build a time-varying proxies for them, renders the identification of the GI trade effect with extra-EU partners more problematic. In addition, when GI products are considered, the most relevant market is by far the EU one. For example, AND-International (2012) estimated that the overall sales value of certified GI foods (excluding wine) in 2010 was equal to €15.8 billion, of which 78% was sold in the domestic market, 16% exported within the EU market, and only 6% exported in the extra-EU market (mainly US, Switzerland, Canada and Japan). In 2010, the external EU trade was equal to about €57 billion, meaning that GIs represented no more than 2% of the total value of extra-EU food exports.

Thus, our strategy is to start from a "clean test" of the potential GI trade effects, ruling out other potential confounding factors, such as SPS standards. Similarly, to avoid potential bias determined by the progressive enlargements occurred from 2004 to 2013, and the subsequent abolition of intra-EU tariffs (and NTMs), we decided to focus on the EU15 old member states only.

[17] Note that when clustering the standard errors at country pairs level we obtain similar results.

However, in a second step, an analysis that focuses on extra-EU trade will be carried out. To this purpose, a new dataset based on WTO notifications of SPS measures has been used to proxy for this important source of trade barriers. Ad valorem bilateral tariffs come from the UNCTAD-Trains database.

4.1. GI policy indicator

An important effort of this paper has been devoted to the classification of GIs in accordance with the HS codes at the 6-digit level. Starting from the European DOOR database (Database of Origin and Registration), which collects official information on all the registered EU GIs, we selected all the PDO/PGI registered from 1996 to 2014.[18][19] Since the DOOR database does not classify products with a classification that match trade data, we matched manually each of the registered GI with the corresponding HS classification at the 6-digit level. In addition, with the aim to minimize measurement errors in the classification, because GIs are only thought as goods for final consumption, we considered only HS product lines defined by the Broad Economic Categories (BEC) for final use. Thus we exclude those GIs classified as intermediate goods.[20]

Overall, the DOOR dataset, excluding TSG, includes 1,281 registered GI products, 52.69% PGI and 47.31% PDO. The classification methodology does not allow to find an exact correspondence for 51 of these GI products, which have been consequently excluded from the analysis. The number of GIs registered by the EU15 countries is 1,036, correspondent to the 81.26% of total observations in the DOOR, with more than half being PDO products (530). Figure 1 shows a representation of both the number of new PDO and PGI registered each year (bars), and the cumulative number of GIs over the 1996-2014 period (green line).[21] Overall, two patterns emerge: a high yearly variability in the number of new registered GIs and a steadily increase in the total number of GIs over the observed period.

The cross-country distribution of GIs is high concentrated. More than 80% of GIs is produced in five countries: Italy, France, Spain, Portugal and Greece (Table A.1 in Appendix A). Considering the HS 2-digit sectors, six of them (codes 02, 04, 07, 08, 15 and 16),[22] represent 85.87% of total GIs, of which 92.12% are PDO and 79.33% are PGI. Note, the GI product lines associated with these six HS 2-digit sectors account for a relevant trade share, representing more than 25% of total EU agri-food trade.[23] By contrast, in the other residual HS 2-digit sectors, trade associated to product lines with GIs are, on average, below 4%.

[18] We exclude from our analysis the Traditional Speciality Guaranteed (TSG), mainly because they are less relevant for EU15 countries traditionally producing GIs.

[19] 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 production process is carried out in a specific geographical area, while in the case of PDO all the production stages must take place in the same geographical area. As a consequence, for PDO products the agricultural raw materials have to be obtained within a specific geographical area. In the case of PGI products, the agricultural raw material can be sourced anywhere, and often come from abroad.

[20] Not surprisingly, more than 88% of the GIs resulted classified in the BEC category for final consumption.

[21] Note that, for illustrative purpose, to better highlight the yearly variability, we omit the first year of policy implementation (i.e. 1996), as there was a massive introduction of GIs (i.e. 328 GIs, of which 214 PDO and 114 PGI).

[22] These HS2 digit codes are, respectively: Meat & edible offal (02); Dairy products (04); Edible vegetables (07); Edible fruits and nuts (08); Animal or vegetable fats and oils (15); Preparation of meat, of fish or of crustaceans (16). See Table 1, for additional details.

[23] The lines that are interested by GIs are the 25% of the 263 lines reported on these six sectors. Within each HS 2-digit sector the percentage ranges from 43% (HS-07) to 2% (HS-15) of product lines.

Thus, the analysis presented below will focus only on these most representative six HS 2-digit sectors.

Because in the last decade a few EU trade partners have progressively implemented food quality policies, similar to the EU GIs, we also collected information to match each product-lines of the EU trading partners, accordingly. This additional GI information will be used when considering the external-EU food quality policy analysis. Table A.2 in Appendix A, lists the extra-EU countries with GI policy similar to the EU one, and the respective year in which the first GI product has been registered. Sources of these information come from single country reports on the GI and from the World Intellectual Property Right (WIPO) reports on GIs.

4.2. Trade data and other trade policy measures

The overall sample contains product information at the HS 6-digit level on intra-EU15 (or on extra-EU15) bilateral trade flows from 1996 (the first year of GIs registration under the EU Regulation system) until 2014. Trade data come from the BACI database (Base pour l'Analyse du Commerce International) of CEPII (Centre d'Etudes Prospectives et d'Informations Internationales). 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 between European countries, the database improves the "quality" of the measured trade indices (extensive and intensive trade margins), because this calculation require also the use of exports from all the world countries.where.

Recently, a number of papers have used a direct approach to decompose the impact of policies on the extensive and intensive trade margins, such as the number of products exported within a certain industry/category or exports concentration indexes (see Cadot et al., 2011; Dennis and Shepherd 2011; Persson and Wilhelmsson 2013). The simple count of the products number, although transparent, is flawed by the assumption that products have the same economic weight, which might not be the case. To overcome this limitation, we follow Feenstra and Kee (2004) who proposed a theoretically-founded decomposition of trade into two margins, taking into account the economic weight of the products. This measure is very similar to a count of the exported varieties within a certain industry, but is weighted by comparisons with other reference countries, such as the rest of the world or the world as a whole. Appendix B describes the methodology to measure both the extensive (EM) and intensive trade margins (IM) using the Feenstra and Kee (2008) approach.

In addition to the variable described above, the extra-EU analysis considers also ad-valorem bilateral tariffs, taken from the UNCTAD-Trains dataset, and a proxy for NTMs, based on the WTO notifications of SPS measures. The information from the WTO data, provides information concerning the notifying importing country, the product covered (HS 4-digit level) and the type of notified NTMs.[24]

Finally, to reduce the large number of zero observations in the data obtained after squaring the bilateral trade matrix, we used the average value of production for the years 2008–2010, to drop those zeros that are relative to countries which do not produce or export the considered product, on the basis of FAOSTAT and EUROSTAT Prodcom data.[25]

[24] In the dataset at HS 2-digit level (intensive/extensive trade margin) we used as measure of SPSs the highest numbers of notifications reported in the subheading at 4-digit.

[25] After this procedure, the percentage of zero trade flows at HS 6-digit level is 70%, while at HS 2-digit level is 18%.

Figure 2 reports the average values of the two margins computed as in equations (B1) and (B2) of the Appendix B, concerning the EU trade for the six agro-food sectors considered. Countries producing GIs have increased systematically the number of exported varieties raising from 30% in 1996 to about 50% in 2014 of the overall varieties imported by the considered countries. In contrast, countries that are non-GI producers have reduced the level of extensive margin in the observed period. Both groups of countries have increased their intensive margin, but with a different pattern: the intensive margin of trade increases more than three times for GI exporter countries.

Interestingly, a similar pattern also emerges when the EU external trade is considered (see Figure 3). Indeed, though less starkly than before, also the extensive and intensive margins of EU countries exporting to international markets display a growth rate that is significantly higher for GI-producers than for non-GI producer countries.

This preliminary look at the data seems to suggest a strong trade promoting effect of GIs on both the extensive and intensive margin. However, these are simple correlations and trends. The next section investigates empirically the role played by the GIs on trade flows.

5. RESULTS

All regressions are estimated through the PPML approach considering two sets of specifications that differ for the level of product aggregation. First of all, trade volume and export unit value regressions are run with data at HS 6-digit level. Second, when considering the extensive and intensive trade margin, regressions are run at the HS 2-digit level, as these indicators are measured at this level of product aggregation (see equations in Appendix B).

5.1. GIs effects on intra-EU bilateral trade

Table 2 displays the results for overall intra-EU trade, where the dependent variable is the value of trade in goods at HS 6-digit.[26] Column (1) reports coefficients estimated pooling the data across all the HS 2-digit sectors considered in the analysis. Results show that when only the importer country produces GIs, the effect on trade flows is negative, though significant at 10% level only. In contrast, when only the exporter country produces GIs, the effect is positive and estimated with high precision (p-value < 0.01). A similar effect, although slightly lower in magnitude, is estimated when both countries produce GIs.[27]

Quantitatively, the magnitude of the estimated coefficients suggests that a new GI produced in the importing country, when the exporting country does not produce any GI, reduces imports by 3.6%. When only the exporting country produces GIs, trade increases by 5.4%, thus a relevant effect from an economic point of view. Finally, when both countries produce GIs, one additional certified product increases trade by 4.3%. These results are consistent with the predictions coming from the theoretical model. Thus, the adoption of a new GI enhances trade flows when GIs are produced in the exporting country or when both countries produce GI, while it seems to weakly act as a trade reducing measure when GIs exist only in the importer country, *ceteris paribus*.

[26] Because the model is, *de facto*, a bilateral gravity equation, bilateral variables such as distance, contiguity, language etc. could be included in the model by removing the country-pair fixed effects. When running the model with these variables included (and so omitting pair fixed effects) we obtain similar results that however overstate the coefficients magnitude of our GI variables of interest, due to the not significant effect of these bilateral variables in the context of intra-EU trade.

[27] We also estimated whether the GI trade effect is mainly driven by new GIs in the importer or exporter country, finding a very similar effect. Thus, when both countries produce GIs, the positive effect on trade occurs independently of its origin.

In order to study the potential existence of a trend in the GIs adoption effect, we run a specification by interacting GI variables with time dummies. Figure 4 plots the magnitude of the coefficients obtained from this specification, and shows a positive and significant trade effect when exporting countries produce GIs. This effect is stable over time when only exporting countries produce GIs (upper panel), while it presents a decreasing evolution over time when also the importer country is a GI producer (middle panel). In contrast, when GIs are produced in the importer country only, the estimated negative effect is less stable in both size and significance level, and displays a sizeable reduction over time (lower panel).

Columns 2 to 7 in Table 2 present the results of estimating equation (4) separately for each of the HS 2-digit sectors considered in the analysis. From these results it is clear that the negative effect detected in the pooled sample when only the importer country produces GIs, seems to be mainly driven by the Oils sector, whereas the GI trade effect in other sectors, although still negative, is barely or not statistically significant. When considering the case of GIs produced by the exporter country only, the trade effect of the introduction of a new GI is positive and significant in all the HS 2-digit sectors, although the magnitude of the estimated effect is quite heterogeneous. The impact of a new GI on trade spans from 3% for the meat and edible meat offal, to 20% and 45% for vegetables and fruits respectively. Finally, when considering the case where both countries produce GIs, we find in all the considered sectors a positive trade effect due to the introduction of a new GI, although it is statistically significant only in the dairy and oils sectors.[28]

A comparison of our results with previous literature is not easy, as, to the best of our knowledge, there are no published papers working with such a large scale sample of products and detailed level of disaggregation. At the empirical level, we could only compare our results with those of Sorgho and Larue (2014), who measured the effect of GI product on the EU countries' border effect (i.e. the external and internal trade ratio), at the aggregated agri-food level. The authors find evidence of a trade promoting effect of the EU quality policy only when considering the case of both exporting and importing countries as GI producers. When the exporter (importer) country is the only GI producer, a weak negative (positive) trade effect is found, thus exactly the opposite of our results. A possible explanation of this conflicting evidence can be attributed to an aggregations bias, which has been proved to be a quite common issue in the estimation of the policy elasticity in the empirical trade literature (see Hummels, 2001; Bektasoglu et al. 2016).

5.2. The effect of GIs on intra-EU extensive and intensive margins

A relevant effort of our analysis is devoted to study to what extent GIs affect the extensive and intensive trade margins. Going back to the theoretical model, our main predictions suggest that GI certifications should increase firms' exports by affecting both margins, at least when only the exporter produce GIs. Table 3 reports the results of this decomposition. Considering first the impact of GIs on the extensive margin – i.e. the number of exported varieties – the results in Column 1 suggest that the effect of GIs is significant only when exporter country introduces a new GI in a product line where the importer does not produce any GI. From this perspective, GIs prove to act again as catalyst for trade by exerting an export-promoting effect. Quantitatively, a new GI in the exporting country increases the

[28] The magnitude of the results obtained is not strictly comparable across sectors, because this (sectoral) specification does not constrain country-pair fixed effects to be equal across sectors. We also run a pooled specification by interacting GIs variables with sectoral dummies. The results, not reported in this paper but available upon request, do not significantly change in magnitude and sign, except for 'meat & edible meat offal', where the GI effects are not significant.

extensive margin by about 0.27% points. As we consider the extensive margin at the HS 2-digit level, it is worth noting that the addition of new GIs may also induces an increase in the exports of other non-GI products within the same product category. In this respect, the presence of GIs in a given country product line may foster a quality-reputation effect (see Menapace and Moschini, 2014), which is beneficial also for non-GI products. Overall, this result confirms the positive trade effect exerted by GIs in creating new trade routes, which has been observed by Agostino and Trivieri (2014) for wines and by Duvaleix-Tréguer et al. (2015) for French cheese, with the important consideration that this effect holds true, on average, for all the main sectors characterized by GIs.

Finally, as expected, the impact of GI on the intensive margin of trade (Column 2) confirms the same patterns of signs and significance observed in the case of the overall trade (see Column 1 of Table 2). Thus, the EU quality policy appears to act as trade-reducing measure when only the importer produces GIs, and as trade enhancing measure when GIs are produced by the exporter, or both countries produce GIs.

5.3. The effect of GIs on intra-EU export unit values

Our focus on export unit values represents an important element of the analysis, as it may provide some additional insights, in particular relative to the effect of the EU GI policy on countries' pricing and quality export strategies. The results of these regressions are reported in Table 4. Considering all sectors pooled together (Column 1), consistently with the model predictions, we find that when GIs are produced only by the exporter country, or by both exporter and importer, the EU quality policy induces a significant increase in the export unit values. In contrast, the presence of GIs only in the importer countries is associated to a significant reduction of countries' export unit values. It is worth nothing that the last result has not a theoretical prior. A possible interpretation of this finding is that countries exporting non-GI products in country-sectors characterized by the presence of GIs, and, thus, where the quality competition is fiercer, may opt for a price-competition, rather than to compete on quality. As we will show in Section 5.4 below, a similar effect is also found when extra-EU trade is considered.

Quantitatively, the size of the estimated effects suggests that the production of a new GI in the importing countries when the exporter does not produce GIs, induces an average reduction of the exporter unit value of about –0.7%, hence not an irrelevant effect from an economic point of view. When considering the cases of GIs produced by the exporter country only, or by both exporter and importer, the magnitude of the effects is slightly lower but still meaningfully from an economic point of view and precisely estimated.

When considering separate regressions for each sector (Columns 2-7), the above patterns obtained on the pooled sample are largely confirmed, with the only exception of the positive and significant sign for vegetables in the first row of Column (4), and the significant negative effect for fruits in the second row of Column (5).

In our view, these results have relevant implications, as they suggest that the adoption of the EU quality policy allows a clear process of quality upgrading.[29] Indeed, as shown by Khandelwal (2010), the price of a product may represent itself a good proxy for quality, when products are vertically differentiated. Since the scope of the GI policy is to promote quality

[29] Note that the estimated coefficients are capturing the variation in average unit values before and after the introduction of a new GI is in a certain product line, in comparison to the average unit value of non-GI product lines.

differentiation, these results seem to confirm the effectiveness of the EU quality policy in this respect. In addition, the negative effect exerted by the presence of GIs in the importer country when the exporter country does not produce any GIs, may have relevant implications as well. This result suggests that since exporters cannot compete on the level of quality set and reputation by the importer (GI producer), they make a sort of race to the bottom in terms of quality, by competing on price. This finding may have clear welfare implication for consumers, which could be even more relevant when considering imports coming from extra-EU countries.[30]

5.4. GIs effects on extra-EU trade

This section presents the results of estimating equation (5) to study the GI effects on extra-EU trade. Table 5 reports the results of the GI effects on the intensive and extensive trade margins, as well as on total trade, measured at HS-2 digit level. Column (1) reports the impact of GIs on the extensive margin. Results confirm that also for extra-EU trade, a new GI in the EU exporting country, on average, increases the number of exported varieties. The magnitude of these (positive and significant) effects suggest that a new GI induces an increase of 0.6% or 0.2% of the extensive margin, depending on whether the importer country produces GIs or not, a result qualitatively comparable with the analysis of Duvaleix-Treguer et al. (2017). In contrast, the effect of a new GI on the EU-importer country reduces of a larger amount the extensive margin of the third countries' exports to the EU (between 1.6% and 2.9%), with the largest reduction when the non-EU exporting country produces GI (0.0163+0.0125=0.0288). This, apparently counterintuitive, result is totally consistent with what we find in the analysis of intra-EU trade.

Column (2) reports the impact of GI on the intensive margin of trade. The results partially confirm the export-creation and import-reducing effect of EU-GIs. However, the positive impact on the volume of what is already exported by EU countries producing a new GI, is not affected by the presence of GIs in the importing (non-EU) countries. Instead, the negative impact on EU imports is significant only when goods come from an extra-EU country that produces GIs.

Finally, the impact of GIs on overall trade, as defined in Column (3) by combining extensive and intensive margins, shows a strong positive effect of a new GI, that increases European country exports between 1.96% and 2.88%, and reduces European imports between 1.60% and 3.47%. While the export-increasing effect is driven by both the intensive and extensive margin increase of European exporters, the import-reducing effect is exerted mainly/only by the extensive margin of trade. In other words, producing GIs for an average EU firms, induces an increase in both the probability to export in extra-EU destinations, as well as an increase in the volume of products already traded. On the contrary, the negative EU-GI effect on the import side is largely driven by the extensive margin.

In order to study how GIs affect the European exports toward non-EU countries, we estimated equation (5) by considering *only* extra-EU exports flows of European countries at HS-6 digit level. The results, reported in Table 6, clearly show that when a European country produces a new GI, the effect on exports is positive and significant. In particular, Column (1), which refers to the results from the pooled data across all the considered sectors, shows that a new

[30] As a robustness test, in order to assess whether our results suffer for potential endogeneity problems, we estimate our trade and unit value equations using IV regressions. We conclude that our results are fairly robust to reverse causality or other endogeneity bias, *ceteris paribus*.

GI in the EU exporting country increases the external trade from 4.7% to 7.1%, depending on whether the destination country produces or not GIs. This result seems to contraddict the previous one, obtained with a different aggregation data, suggesting that, when analysed at HS 6-digit level, the presence of a GI acts as import-reducing measure also for extra-EU countries. This effect was not observed at a more aggregated level where, by contrast, a global quality-reputation effect seems to prevail.

The estimations at HS 6-digit level for each of the HS 2-digit sectors considered are reported in Columns (2) to (7) of Table 6. The results show that the introduction of a new GI exerts a positive trade effect in all the considered sectors, confirming what observed at the aggregated level and also in the intra-EU analysis. Only for meat and edible meat offal the impact is not significant, while for the other sectors the magnitude of the effect spans from 4% (Oil) to 30% (fruit production). The interaction term, generally negative, is significant only in the dairy sector, showing that a new GI increases the exports of the sector by 4.3% or by 7.9%, depending on whether the importer country produces GIs or not.

Finally, the effects of GIs on extra-EU export unit values are reported on Table 7. Column (1) shows the results obtained considering all the pooled sectors. We find that, consistently with the model predictions and in line with what obtained for the intra-EU trade analysis, when GIs are produced by the exporter country, there is a significant increase in the export unit value. Quantitatively, the size of this effect ranges from an average increase of the European exporter unit value of about 0.5%, when the importer country does not produce GIs, to an increase of 0.2%, when the importer produces GIs. By contrast, the presence of GIs in EU-importer country does not seem to be associated with any significant variation on import unit value.

When considering each sector separately (Columns 2-7), the previous patterns are confirmed only if we consider the (positive) effects over EU-export unit value, with the only exception of the significant and negative effect for fruits (the same result has been obtained in intra-EU trade analysis). In contrast, the effect of GIs on EU import unit value presents more heterogeneous results among the six sectors. Deliverable 4.6 conducts a deep analysis on this point, studying the GIs impact on the quality of agri-food goods that are imported to the EU from extra-EU countries.

6. CONCLUDING REMARKS

The present study analyzed the relationship between Geographical Indications and international trade within EU15 countries and between EU15 and extra-EU countries. Starting from a simple extension of the quality sorting model of Crozet et al. (2012), linking product quality to the EU quality policy, and considering different market entry costs conditional to the GI production, we derive testable hypotheses on the effect of the EU quality policy on different trade margins. The predictions are tested exploiting an original dataset of GI products at the tariff lines level.

The econometric analysis confirms the model predictions by showing that GIs affect trade differently, depending on whether the trade partners are GI producers. The effect on trade flows is positive, and steady over time, whenever the exporter country introduces a new GI, and this happens at both the extensive and intensive trade margin. By contrast, the effect observed when only the importer country produces GIs is always negative, though less precisely estimated in the intra-EU trade, and works mainly through the intensive trade margin. This result gives some support to the idea that GIs could also act as a trade-reduction

measure, a hypothesis previously suggested by Chambolle and Giraud-Heraud (2005). Importantly, we also uncovered similar relationships between GIs and export unit values. In fact, export prices tend to rise only when the exporter (or both EU countries) are GI producers, but systematically shrink when GIs are produced (only) in the same tariff line of the destination country. These additional findings on export unit values, on the one hand, corroborate our main model predictions and, on the other hand, suggest that the EU food quality policy appears effective in inducing a process of quality upgrading.

Moving to external-EU trade, overall the above results are confirmed in both the direction and magnitude of the effect, though some remarkable differences come out from the analysis. First, a new GI in the EU exporting countries increases trade through both the extensive and intensive margins, as well as the export unit value. Consistently with the finding at the intra-EU level, when the destination (non-EU) countries have a GI policy in place, then the GI trade effect is lower, probably as an effect of the higher competition there.

However, on the EU import side we have not detected any effect of the GI policy on the trade unit value of the exporting country. In the next Deliverable 4.6, the impact of the EU GI policy will be investigated, by also considering other dimensions, such as the quality of the exported products.

Regarding the specific research question that motivated this study, namely the export promoting or trade reducing effect of GIs, our main findings indicate that the EU quality policy behaves as an export promoting device when implemented by exporters, while it also entails some trade reducing elements, when analysed from the point of view of the importer country. The conceptual framework on which our empirical analysis is derived, does highlight additional entry market costs in countries where firms adopt GI policy. Thus, on the import side, the findings suggest that the adoption of GI policy can induce a process of product differentiation, rendering vertical competition stronger.

Tables:

Table 1. Number of GIs products aggregated at HS2-digit level

HS2 Classification	PDO	PGI	Total
04- Dairy produce; birds' eggs; natural honey; edible products of animal origin (…)	209	27	236
02- Meat & edible meat offal	60	134	194
07- Edible vegetables and certain roots and tubers	55	103	158
08- Edible fruit and nuts; peel of citrus fruit or melons	60	71	131
15- Animal or vegetable fats and oils and their cleavage products (…)	100	8	108
16- Preparations of meat, of fish or of crustaceans (…)	7	60	67
- Others (03, 09, 10, 11, 12, 17, 19, 20, 21, 22, 25, 51)	42	105	147

Source: Authors' computation based on the DOOR dataset 1996-2014 (see text).

Table 2. Trade effects of GIs at overall and sectoral level (intra EU trade)

Dependent variable: Trade flow							
	All Sectors+	Meat (HS 02)	Dairy (HS 04)	Vegetables (HS 07)	Fruits (HS 08)	Oils (HS 15)	Prep.fish (HS 16)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GIs - importer	-0.0363*	-0.0845*	0.0340	-0.0170	-0.0022	-0.1048***	-0.0194
	(0.0202)	(0.0446)	(0.0280)	(0.0858)	(0.0955)	(0.0371)	(0.0571)
GIs - exporter	0.0545***	0.0333**	0.0683***	0.2081***	0.4548***	0.1184***	0.0611***
	(0.0061)	(0.0133)	(0.0198)	(0.0432)	(0.0655)	(0.0113)	(0.0181)
GIs - both	0.0426***	0.0213	0.04215***	0.0313	0.1116	0.0885***	0.0211
	(0.0052)	(0.0301)	(0.0042)	(0.0720)	(0.0914)	(0.0080)	(0.0159)
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.	786742	155687	82282	163080	160037	130353	79069
Adj R^2	0.2182	0.2417	0.3919	0.5679	0.2926	0.7129	0.3237

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. In Column (1), (+) All sectors are defined as HS 02, 04, 07, 08, 15, 16. Constant and fixed effects not reported.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

Table 3. GI effects on the Extensive and Intensive margin (intra EU trade)

Dependent variables:	Extensive Margin	Intensive Margin
	(1)	(2)
Gis – importer	-0.0008	-0.0138**
	(0.0011)	(0.0062)
Gis – exporter	0.0027***	0.0118***
	(0.0007)	(0.0033)
Gis – both	-0.0001	0.0035**
	(0.0004)	(0.0016)
Fixed effects:		
Importer-year	yes	yes
Exporter-year	yes	yes
Importer-Exporter	yes	yes
Product-year	yes	yes
Year	yes	yes
No. of obs.	82225	82225
Adj R^2	0.62	0.46

Notes: the two margins are measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Robust standard errors clustered by country pairs-product HS 2-digit in parenthesis. Constant and fixed effects not reported.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

Table 4. GI effects on export unit value at overall and sectoral level (intra EU trade)

Dependent variable: Unit Value							
	All Sectors+	Meat (HS 02)	Dairy (HS 04)	Vegetables (HS 07)	Fruits (HS 08)	Oils (HS 15)	Prep.fish (HS 16)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GIs - importer	-0.0070***	-0.0153***	-0.0007	0.0406***	-0.0650***	-0.0037**	-0.0101**
	(0.0013)	(0.0023)	(0.0027)	(0.0102)	(0.0182)	(0.0015)	(0.0042)
GIs - exporter	0.0039***	0.0038*	0.0104***	0.0400***	-0.1695***	0.0018*	0.0158***
	(0.0012)	(0.0023)	(0.0034)	(0.0077)	(0.0185)	(0.0010)	(0.0044)
GIs - both	0.0028***	0.0033	0.0031***	0.0467***	-0.0051	-0.0006	0.0051**
	(0.0006)	(0.0032)	(0.0006)	(0.0095)	(0.0192)	(0.0010)	(0.0023)
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
Adj R^2	0.52	0.39	0.44	0.33	0.44	0.44	0.21

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. In Column (1), (+) All sectors are defined as HS 02, 04, 07, 08, 15, 16. Constant and fixed effects not reported.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

Table 5. GI effects on the Extensive and Internsive margin (extra EU Trade)

Dependent variable:	Extensive Margin (1)	Intensive Margin (2)	Trade (Intensive*Extensive) (3)
GI-EU_exporter	0.0018***	0.0216***	0.0196***
	(0.0004)	(0.0016)	(0.0014)
EU_exporter * extra-EU GI	0.0041***	0.0011	0.0092***
	(0.0012)	(0.0031)	(0.0031)
GI-EU_importer	-0.0163***	0.0007	-0.0160***
	(0.0007)	(0.0024)	(0.0020)
EU_importer * extra-EU GI	-0.0125***	-0.0226***	-0.0187***
	(0.0016)	(0.0042)	(0.0041)
Log(1+tariff)	-0.7742***	-0.5607***	-0.5310***
	(0.0218)	(0.0849)	(0.0799)
Log(1+SPS)	-0.1037***	-0.1669***	-0.2040***
	(0.0063)	(0.0235)	(0.0230)
Fixed effects:			
Importer-year	yes	yes	yes
Exporter-year	yes	yes	yes
Importer-Exporter	yes	yes	yes
Product-year	yes	yes	yes
Year	yes	yes	yes
No. of obs.	148,364	148,364	148,364
Adj R^2	0.62	0.46	0.55

Notes: the two margins are measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). Trade is obtained combining Intensive and Extensive margin. Robust standard errors clustered by country pairs in parenthesis. Constant and fixed effects not reported.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

Table 6. GI effects on EU15 export flow at overall and sectoral level (extra EU trade)

Dependent variable: EU15 Export Trade flow							
	All Sectors+	Meat (HS 02)	Dairy (HS 04)	Vegetables (HS 07)	Fruits (HS 08)	Oils (HS 15)	Prep.fish (HS 16)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GIs-EU_exporter	0.0715***	0.0170	0.0786***	0.1686***	0.3012***	0.0417***	0.1077***
	(0.0070)	(0.0267)	(0.0122)	(0.0518)	(0.0868)	(0.0087)	(0.0251)
EU_expoter* extra-EU GI	-0.0247**	0.0759	-0.0359**	0.1048	-0.1200	-0.0053	-0.1100
	(0.0112)	(0.0597)	(0.0164)	(0.1644)	(0.1217)	(0.0159)	(0.0699)
Log(1+tariff)	-1.4851***	-3.0199**	-2.8505***	-0.6124	-3.3249***	-6.9488**	-3.1548***
	(0.5458)	(1.2685)	(0.6691)	(0.7352)	(1.2244)	(2.9657)	(0.7957)
Log(1+SPS)	-0.1441	-0.3855**	0.1303	-0.3839	0.1869	-0.7523	-0.4122
	(0.0888)	(0.1651)	(0.1816)	(0.5392)	(0.3751)	(0.7567)	(0.4023)
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.	792,746	118,275	118,611	197,317	170,578	53,080	134,238
Adj R^2	0.22	0.22	0.40	0.24	0.23	0.83	0.47

Notes: robust standard errors clustered by country pairs in parenthesis. In Column (1), (+) All sectors are defined as HS 02, 04, 07, 08, 15, 16. Constant and fixed effects not reported.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

Table 7. GI effects on export unit value at overall and sectoral level (extra EU trade)

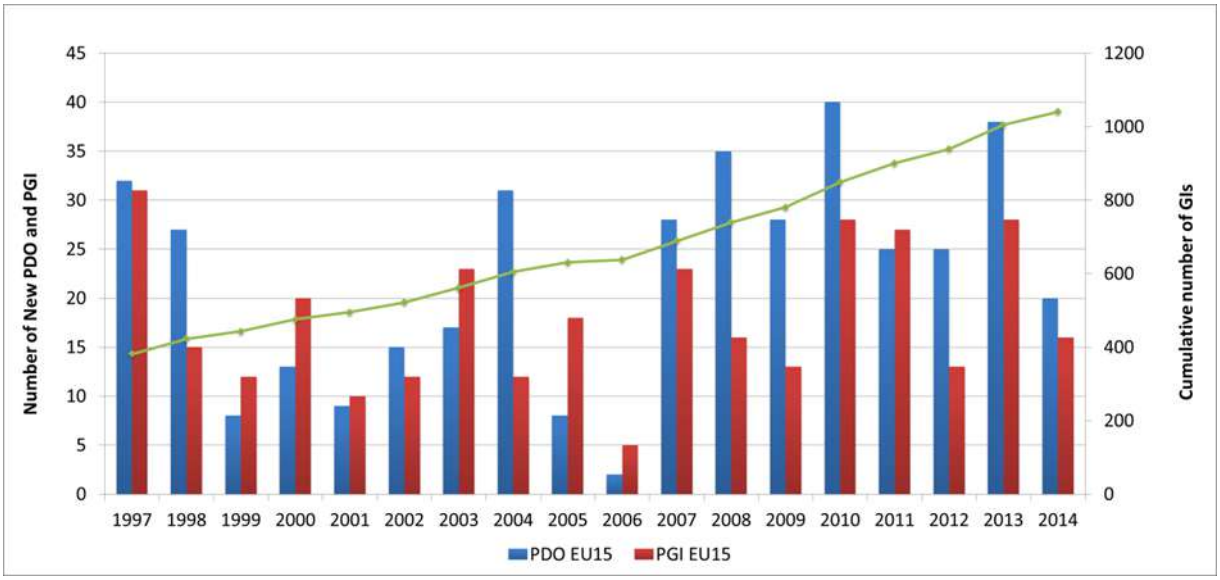
Dependent variable: Log of Export Unit Value							
	All Sectors+	Meat (HS 02)	Dairy (HS 04)	Vegetables (HS 07)	Fruits (HS 08)	Oils (HS 15)	Prep.fish (HS 16)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GIs-EU_exporter	0.0054***	0.0264***	0.0038***	0.0047	-0.1089***	0.0040***	0.0049
	(0.0008)	(0.0069)	(0.0007)	(0.0076)	(0.0141)	(0.0008)	(0.0048)
EU_exporter* extra-EU GI	-0.0034**	0.0208	-0.0008	-0.0158	-0.0202	-0.0079***	0.0051
	(0.0014)	(0.0219)	(0.0014)	(0.0223)	(0.0571)	(0.0023)	(0.0069)
GIs-EU_importer	0.0010	0.0259**	0.0187***	-0.0059	-0.0617***	0.0024	0.0063
	(0.0036)	(0.0119)	(0.0048)	(0.0090)	(0.0140)	(0.0062)	(0.0067)
EU_importer* extra-EU GI	-0.0018	-0.1756	0.000	0.0197	0.0035	-0.0100	0.0573***
	(0.0064)	(0.1784)	(0.0000)	(0.0164)	(0.0345)	(0.0095)	(0.0194)
Log(1+tariff)	0.0101	-0.1368*	0.1020**	0.0700	0.0824	0.2409*	0.0377
	(0.0305)	(0.0764)	(0.0463)	(0.0772)	(0.0844)	(0.1321)	(0.0944)
Log(1+SPS)	0.0420***	0.0294	0.0691**	0.0508	0.1363***	0.0130	0.1847***
	(0.0091)	(0.0181)	(0.0290)	(0.0508)	(0.0317)	(0.0687)	(0.0296)
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.	447,840	45,730	49,136	121,044	130,454	27,627	73,148
Adj R^2	0.49	0.55	0.54	0.41	0.52	0.58	0.36

Notes: robust standard errors clustered by country pairs in parenthesis. In Column (1), (+) All sectors are defined as HS 02, 04, 07, 08, 15, 16. Constant and fixed effects not reported. OLS estimation procedure.

*, **, *** indicate significance at 90%, 95% and 99% confidence levels, respectively.

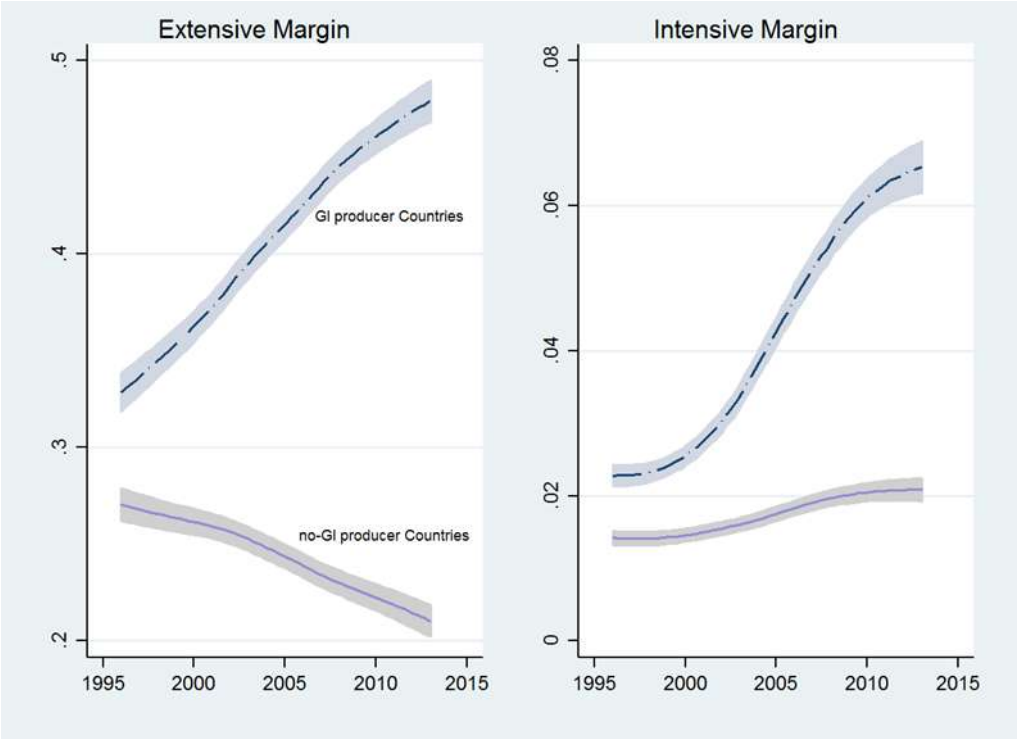
Figures:

Figure 1. Distribution of GIs by year of registration



Source: Authors' analysis based on DOOR data. The green line represents the cumulative representation of GIs over the analyzed period, while the blue and red bars graphically represent the yearly number of new PDO and PGI introduced respectively. The first year of the policy implementation (1996) has not been included for illustrative purpose, as a massive number of GIs had been introduced (i.e. 328 GIs, of which 214 PDO and 114 PGI).

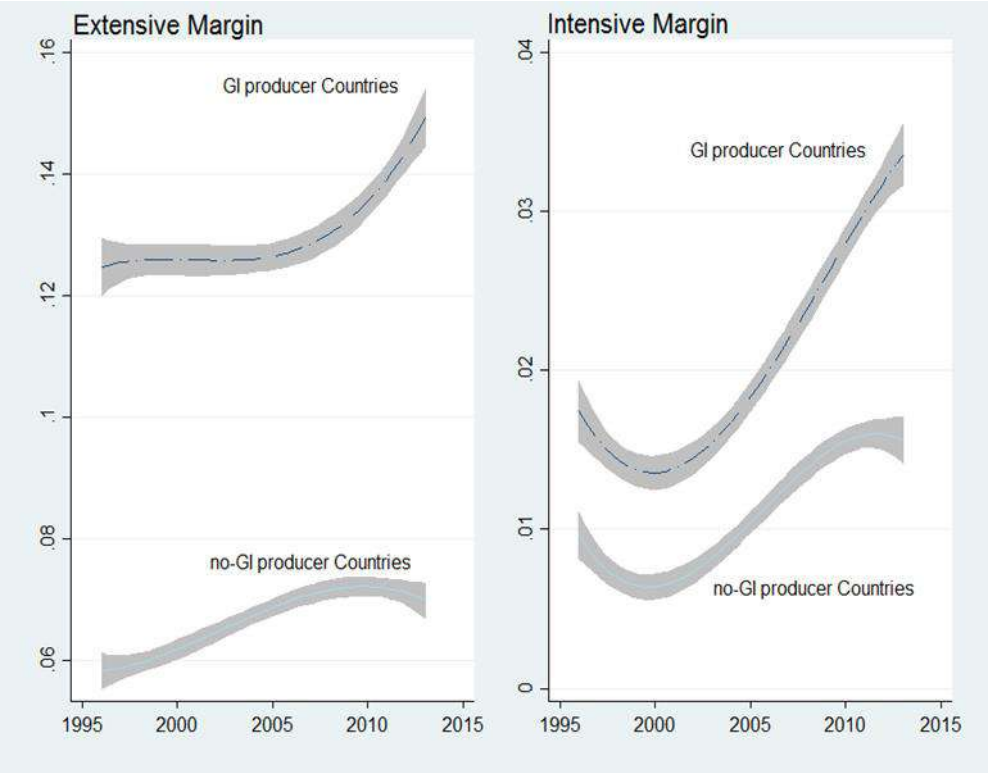
Figure 2. Intra-EU Extensive and Intensive margins: GIs vs non-GIs producer countries



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

Notes: The figures show the evolution of the (smoothed) average extensive (intensive) intra-EU margin, and their 95% confidence interval (computed using Stata's command for local polynomial smooth plots with CIs lpolyci), calculated across EU GI and EU no-GI producer countries.

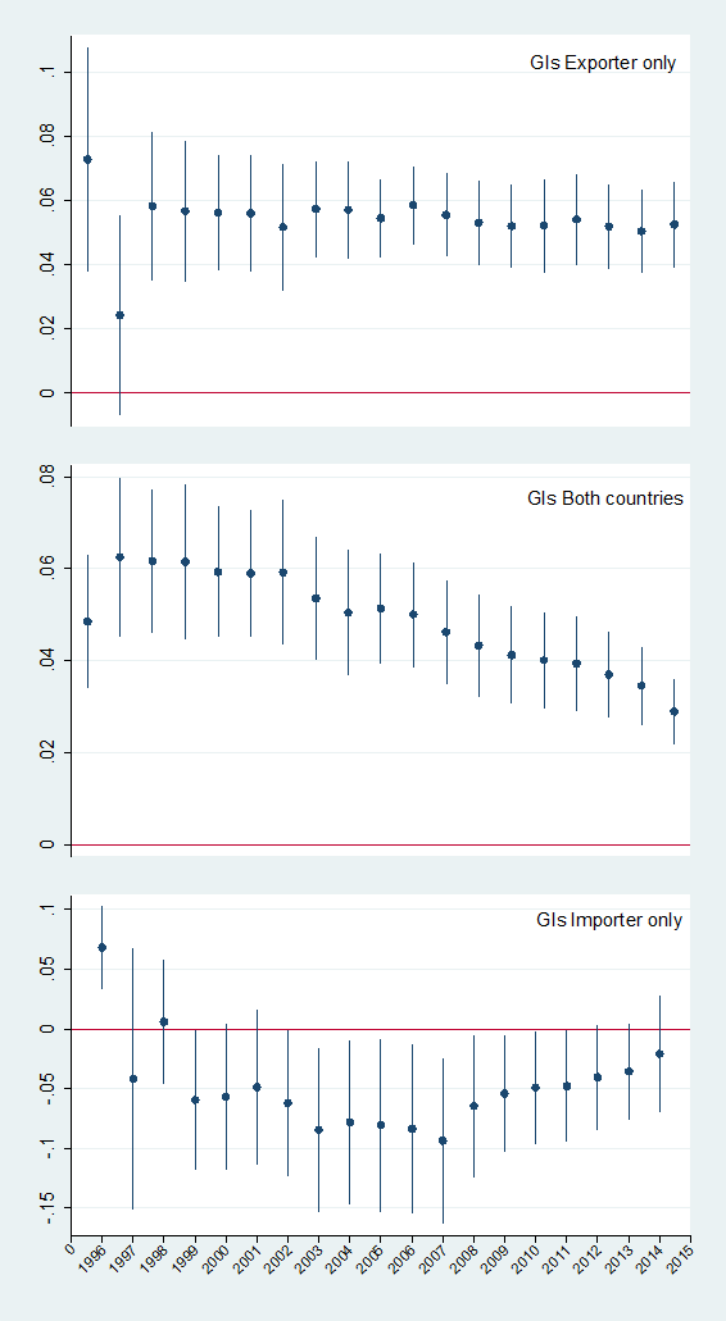
Figure 3. Extra-EU Extensive and Intensive margins: GIs vs non-GIs producer countries



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

Notes: The figures show the evolution of the (smoothed) average extensive (intensive) extra-EU export margin, and their 95% confidence interval (computed using Stata's command for local polynomial smooth plots with CIs lpolyci). The figure is calculated considering EU GI and EU no-GI producer countries exporting to extra-EU markets.

Figure 4. GI (Intra-EU) Trade effects: Stability of the estimated effect over time



Notes: The figure reports GIs effect over time, estimated with equation (4), as in Column (1) of Table 2, but using the interaction term between GIs variables and year dummies. The figure reports all estimated coefficients, bar shows 95% confidence intervals. The estimation includes importer/exporter-year FE, product-year FE, importer-exporter FE, and year FE.

Appendix A

Appendix A 1 - Table A.1. Number of PDO and PGI products by country

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

Source: Authors' calculations based on DOOR dataset, 1996-2014. EU15 sample restriction.

Appendix A 2 - Table A.2. Extra-EU Countries with GI products

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Vietnam			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mexico					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Venezuela					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Argentina						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bolivia							x	x	x	x	x	x	x	x	x	x	x	x	x	x
S.Korea							x	x	x	x	x	x	x	x	x	x	x	x	x	x
India									x	x	x	x	x	x	x	x	x	x	x	x
Thailand									x	x	x	x	x	x	x	x	x	x	x	x
Peru										x	x	x	x	x	x	x	x	x	x	x
Colombia												x	x	x	x	x	x	x	x	x
Cambodia															x	x	x	x	x	x
Morocco															x	x	x	x	x	x
Georgia																x	x	x	x	x
Guatemala																			x	x
Japan																				x

Source: Authors' calculations

Appendix B 1. Feenstra and Kee (2004) measures of the extensive and intensive margin

Let's $R_{od,t}^{h2}$ 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_{dW}^{h2} accounts for the set of world categories exported to the country d over all the considered years. Next, defining $\bar{V}_{dW,h6}^{h2}$ as the average value of the world's exports to country d of the category $h6$ over time, then the bilateral extensive margin for industry $h2$ in year t is

(B1) $$EM_{odh2,t} = \frac{\sum_{h6\epsilon R_{od,t}^{h2}} \bar{V}_{dW,h6}^{h2}}{\sum_{h6\epsilon R_{dW}^{h2}} \bar{V}_{dW,h6}^{h2}}$$

Similarly, let's $\bar{V}_{odh6,t}^{h2}$ be the value of exports of country o to d of the category $h6$ at time t, then the bilateral intensive margin in industry $h2$ is

(B2) $$IM_{odh2,t} = \frac{\sum_{h6\epsilon R_{od,t}^{h2}} \bar{V}_{odh6,t}^{h2}}{\sum_{h6\epsilon R_{od,t}^{h2}} \bar{V}_{dW,h6}^{h2}}$$

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 value 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.

REFERENCES

AND-International (2012). Value of production of agricultural products and foodstuffs, wines, aromatized wines and spirits protected by a geographical indication. Study Commissioned by the European Commission, available online from: https://ec.europa.eu/agriculture/sites/agriculture/files/external-studies/2012/value-gi/final-report_en.pdf.

Agostino, M. and Trivieri, F. (2014). Geographical indication and wine exports. An empirical investigation considering the major European producers. *Food Policy*, 46: 22–36.

Amiti, M., and Khandelwal, A.K. (2013). Import competition and quality upgrading. *The Review of Economics and Statistics*, 95(2): 476–490.

Baldwin, R. and Harrigan, J. (2011). Zeros, Quality, and Space: Trade Theory and Trade Evidence. *American Economic Journal: Microeconomics*, 3(2): 60–88.

Bektasoglu, B., Engelbert, T. and Brockmeier, M. (2016). The Effect of Aggregation Bias: An NTB-Modelling Analysis of Turkey's Agro-Food Trade with the EU. *The World Economy*, 10.1111/twec.12444. (forthcoming).

Bernard, Andrew B., Eaton, J., Bradford J. and Kortum, S. (2003). Plants and Productivity in International Trade, *American Economic Review*, 93(4): 1268-1290.

Bureau, J.C., Marette, S. and Schiavina, A. (1998). Non-tariff Trade Barriers and Consumers' Information: The Case of the EU-US Trade Dispute over Beef. *European Review of Agricultural Economics,* 25(4): 437-62.

Cadot, O., Carrère C. and Strauss-Kahn V. (2011). Export Diversification: What's behind the Hump? *The Review of Economics and Statistics,* 93(2): 590-605.

Caswell, J. A. and Mojduszka, E. M. (1996). Using Informational Labeling to Influence the Market for Quality in Food Products. *American Journal of Agricultural Economics*, 78(5): 1248–1253.

Chambolle, C. and Giraud-Heraud, E. (2005). Certification of origin as a non-tariff barrier. *Review of International Economics*, 13(3): 461–471.

Chen, M. X. and Mattoo, A. (2008). Regionalism in standards: good or bad for trade? *Canadian Journal of Economics*, 41(3): 838–863.

Crinò, R. and Epifani, P. (2012). Productivity, Quality and Export Behavior. *Economic Journal*, 122(565): 1206–1243.

Crozet, M., Head, K., and Mayer, T. (2012). Quality Sorting and Trade: Firm-level Evidence for French Wine. *Review of Economic Studies,* 79(2): 609–644.

Curzi, D. and Olper, A. (2012). Export behavior of Italian food firms: Does product quality matter? *Food Policy*, 37(5): 493–503.

Deconinck, K. and Swinnen, J. (2014). The economics of planting rights in wine production, *European Review of Agricultural Economics*, 42(3): 419-440.

Deconinck, K., Huysmans, M. and Swinnen, J. (2015). The Political Economy of Geographical Indications. LICOS Discussion Paper 372/215.

Dennis, A. and Shepherd, B. (2011). Trade Facilitation and Export Diversification. *The Word Economy*, 34(1): 101-22.

Desquilbet, M. and Monier-Dilhan, S. (2015). Are geographical indications a worthy quality label? A framework with endogenous quality choice, *European Review of Agricultural Economics*, 42(1): 129-150.

Duvaleix-Treguer, S., Emlinger, C., Gaigne, C., and Latouche, K. (2015). Quality and export performance evidence from cheese industry. 145th EAAE Seminar, Parma, Italy.

European Union. (2012). Regulation on quality schemes for agricultural products and foodstuffs. *Official Journal of the European Union* 1151/2012: L 343/1–L 343/29.

Fajgelbaum, P., Grossman, G. G. M. and Helpman, E. (2011). Income Distribution, Product Quality, and International Trade, *Journal of Political Economy*, 119(4): 721-765.

Feenstra, R. C., and Kee, H. L. (2004). On the Measurement of Product Variety in Trade, *American Economic Review,* 94(2): 145–149.

Feenstra, R.C. and Kee, H. L. (2008). Export Variety and Country Productivity: Estimating the Monopolistic Competition Model with Endogenous Productivity. *Journal of International Economics,* 74(2): 500-514.

Feenstra, R. C. (1995). Estimating the effects of trade policy. Ch. 30 in Grossman, G. M. and Rogoff, K. (Eds). *Handbook of International Economics*, 3: 1553–1595.

Fontagné, L., Orefice, G., Piermartini, R. and Rocha, N. (2015). Product standards and margins of trade: Firm-level evidence, *Journal of International Economics*, 97(1): 29-44.

Gaulier, G. and Zignago, S. (2010). Baci: International trade database at the product-level. the 1994–2007 version. Working Paper 23, CEPII Research Center.

Grunert, K. G. (2005). Food quality and safety: consumer perception and demand, *European Review of Agricultural Economics*, 32(3): 369–391.

Hallak J. C. and Sivadasan, J. (2011). Firms' Exporting Behavior Under Quality Constraints. Working Papers 628, Research Seminar in International Economics, University of Michigan.

Helpman, E., Melitz, M. and Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2): 441–487.

Hummels, D. (2001). Toward a Geography of Trade Costs. GTAP Working Papers 1162, Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

Josling, T. (2006). The war on terroir: Geographical indications as a transatlantic trade conflict. *Journal of Agricultural Economics*, 57(3): 337–363.

Khandelwal, A. (2010). The Long and Short (of) Quality Ladders. *Review of Economic Studies*, 77(4): 1450-1476.

Kugler, M. and Verhoogen, E. (2012). Prices, Plant Size, and Product Quality. *Review of Economic Studies*, 79(1): 307–339.

Landi, C. and Stefani, G**.** (2015). Rent Seeking and Political Economy of Geographical Indication Foods, *Agribusiness* 31 (4): 543–563.

Langinier, C. and Babcock, B. A. (2008). Agricultural Production Clubs: Viability and Welfare Implications. *Journal of Agricultural & Food Industrial Organization*, 6(1): 1-31.

Lence, S., Marette, S., Hayes, D. and Foster, W. (2007). Collective marketing arrangements for geographically differentiated agricultural products: welfare impacts and policy implications. *American Journal of Agricultural Economics* 89: 947–963.

Manova K. and Zhang Z. (2012). Export Prices Across Firms and Destinations. *The Quarterly Journal of Economics*, 127(1): 379-436.

Marette, S. (2015). Non-Tariff Measures When Alternative Regulatory Tools Can Be Chosen. *Journal of Agricultural & Food Industrial Organization*, 14(1): 1-17.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6): 1695–1725.

Menapace, L. and Moschini, G. (2014). Strength of Protection for Geographical Indications: Promotion Incentives and Welfare Effects, *American Journal of Agricultural Economics*, 96(4): 1030-1048.

Mérel, P. and Sexton R. J. (2012). Will Geographical Indications Supply Excessive Quality? *European Review of Agricultural Economics,* 39(4): 567–587.

Metthews, A. (2014). Geographical indications (GIs) in the US-EU TTIP negotiations. In CAPReform.EU

Moir, H. (2016). Geographical indications: EU policy at home and abroad. Paper presented at "IP Statistics for Decision Makers (IPSDM) conference" Sydney, Australia.

Moschini, G. C., Menapace, L. and Pick, D. (2008). Geographical indications and the provision of quality. *American Journal of Agricultural Economics,* 90(3): 794–812.

Olper, A. (2017). The political economy of trade-related regulatory policy: environment and global value chain. *Bio-based and Applied Economics,* 5(3): 287-324.

Persson, M. and Wilhelmsson, F. (2013). EU Trade Preferences and Export Diversification, IFN Working Paper 991. Stockholm: Research Institute of Industrial Economics.

Santos Silva, J. and Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, 88(4): 641–658.

Santos Silva, J. and Tenreyro, S. (2011). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2): 220–222.

Santos Silva, J., Tenreyro, S. and Wei, K. (2014). Estimating the extensive margin of trade. *Journal of International Economics*, 93(1): 67–75.

Sorgho, Z. and Larue, B. (2014). Geographical indication regulation and intra-trade in the European Union. *Agricultural Economics*, 45(1): 1–12.

Stock, J. and Yogo, M. (2005). Testing for Weak Instruments in Linear IV Regression. In: Andrews D.W.K. (Ed.) *Identification and Inference for Econometric Models*. New York: Cambridge University Press, 80-108.

Verhoogen, E. A. (2008). Trade, quality upgrading, and wage inequality in the mexican manufacturing sector. *The Quarterly Journal of Economics*, 123(2): 489–530.

Yu, J. and Bouamra-Mechemache, Z. (2016). Production standards, competition and vertical relationship, *European Review of Agricultural Economics,* 43(1): 79–111

Zago, M. A. and Pick, D. (2004). Labeling policies in food markets: private incentives, public intervention, and welfare effects. *Journal of Agricultural and Resource Economics,* 29(1): 150–165.

The Strength2Food project in a nutshell

Strength2Food is a five-year, €6.9 million project to improve the effectiveness of EU food quality schemes (FQS), public sector food procurement (PSFP) and to stimulate Short Food Supply Chains (SFSC) through research, innovation and demonstration activities. The 30-partner consortium representing 11 EU and four non-EU countries combines academic, communication, SMEs and stakeholder organisations to ensure a multi-actor approach. It will undertake case study-based quantitative research to measure economic, environmental and social impacts of FQS, PSFP and SFSC. The impact of PSFP policies on nutrition in school meals will also be assessed. Primary research will be complemented by econometric analysis of existing datasets to determine impacts of FQS and SFSC participation on farm performance, as well as understand price transmission and trade patterns. Consumer knowledge, confidence in, valuation and use of FQS labels and products will be assessed via survey, ethnographic and virtual supermarket-based research. Lessons from the research will be applied and verified in 6 pilot initiatives which bring together academic and non-academic partners. Impact will be maximised through a knowledge exchange platform, hybrid forums, educational resources and a Massive Open Online Course.

www.strength2food.eu