The International Competitiveness of Geographical Indications: Hype or Hope?

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Title: The international trade impacts of Geographical Indications: hype or hope?

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Abstract

The growing international competition has increased the incentive of preserving local expertise by preventing its use by a third party whose product does not conform to the applicable standards. This is one of the main objectives of the Geographical Indication quality scheme. Geographical Indications (GIs) play an increasingly important role in trade negotiations between the EU and other countries. However, to what extent GIs support international trade is not clear. This paper reviews the economic literature on the internalization effects of GIs, discusses data sources and meta-analyses papers estimating the trade effects of the GI policy scheme. Most of the existing studies agree on an average positive effect of GIs on trade. Our meta-analysis shows that the premium is however lower for wines and PDOs, products adopting stricter regulations. Lower effects are estimated by analysis conducted at aggregated spatial levels (country) or limited to specific case studies. By contrast, effects are more consistent when using cross-category data and for studies providing evidence from European GIs.

Keywords: geographical indications, trade agreements, trade flow, meta-analysis

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1. INTRODUCTION

Geographical Indication (GI) is a sign used on agri-food products that have a specific geographical origin and possess qualities and reputation that are essentially (Protected Geographical Indications - PGI) or exclusively (Protected Designation of Origin - PDO) due to spatially embedded natural and human factors (EU Reg. No.2012/1151, food; EU Reg. No.2013/1308, wine; EU Reg. No.2019/787, spirit; EU Reg. No.2014/251, aromatised wines). GIs, by definition, represent a guarantee of the uniqueness of a product embedded in the environmental characteristics and cultural know-how of a given region (Vaquero-Piñeiro, 2021; WTO, 1994). In an increasingly standardized and global market, GIs offer producers opportunities to differentiate their products (Menapace and Moschini, 2012), obtain a price premium (Huysmans and Swinnen, 2019), support innovation (FAO, 2018) and higher demand from abroad (Sorgho and Larue, 2018). GIs are protected in several countries through different approaches to safeguard local expertise and avoiding that high-quality local products will be crushed by industrialized global competitors (Raimondi et al., 2020). On 1 January 2020, the EU GIs scheme included 3,286 registered GIs (EC, 2020). The primary users of this quality scheme are the southern EU Member States, which register seven times more food GIs per capita than in other EU countries (Huysmans and Swinnen, 2019). In lead Italy and France, both in terms of numbers and revenues (EC, 2020). GIs from these countries are significantly also more likely to be protected in trade agreements (Huysmans, 2020).

Although GIs occupy a relatively small niche in agriculture world trade, in 2017, the value of GI exports accounted for 31.42 billion (42% of the GIs' sales): 20% for intra-EU trade and 22% for extra-EU; 90% of GI exports is generated by wines or spirits (EC, 2019a). A consensus on the real effects of GIs on international advantages has not yet reached, however. Despite the vast literature on GIs, with some relevant exceptions (Huysman, 2020; Raimondi et al., 2020), papers quantitatively evaluating the linkage between GIs and internazionalization are scant and mainly focused on estimating trade effects (Chilla et al., 2020).

Trade activities (i.e., import/export) are those in which GIs are more directly involved. GIs were introduced into international trade treaties during the Uruguay Round with the TRIPs Agreement in 1995 (Art.15). Since then, this form of certification has attracted attention across the world, and nowadays more than 200 bilateral and multilateral WIPO and WTO agreements include GIs regulations. The European *sui generis* system is the most articulated and comprehensive scheme of protecting GIs (Zappalaglio and Mikheeva, 2021).[5] It treats GIs on a par with intellectual property rights (Gangjee, 2020). In the USA, GIs are protected within the collective certification trademark system, while China, the foreign country with the largest number of registered GIs, has recognised the European *sui generis* scheme (Hu, 2020; Song, 2018). Australia adopts a *sui gener*is registration system for wines, but not for other food products (Van Caenegem and Nakano, 2020). In July 2020, the new Russian Law of GIs came into force taking the EU system and the Geneva Act of the Lisbon Agreement as models (Zappalaglio and Mikheeva, 2021).

Inspecting the official databases on GIs, a lack of viable data emerges (See Section 3 for a detailed discussion about data sources). EAmbrosia is the official register of EU GIs. For each GI, it provides general legal information, regulation documents and Product Specifications, but it does not include any additional data on, for example, production, added value or trade flows.[6] GIview, the new WIPO database, contains only technical information as well.[7] Some basic quantitative data are provided by Eurostat and the Farm Accountancy Data Network, but with severe limitations in terms of statistical representativeness and coherence across different countries.

Although existing studies concerning the nexus between GIs and trade experience a significant difference in empirical strategies, data, and research design, which conduct to different evidence and

[5] According to the WIPO definition, the term sui generis is used in intellectual property law to describe a regime designed to protect rights that fall outside the traditional patent, trademark, copyright, and trade-secret doctrines. What makes an intellectual property right system a sui generis one is the modification of some of its features so as to properly accommodate the special characteristics of its subject matter, and the specific policy needs which led to the establishment of a distinct system.

[6] eAmbrosia centralised information on GIs previously held on three databases: DOOR, e-Spirit-Drinks and e-Bacchus. eAmbrosia database available at: https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/

[7] GIview database available at: https://www.tmdn.org/giview/

results, to the best of our knowledge, there is no attempt in the literature to summarise and explain variation in empirical results. This study aims to fill this gap by (i) collecting studies focusing on GIs' trade impacts and (ii) critically discussing evidence obtained. Operationally, we conduct a systematic literature review, compile a dataset of empirical studies evaluating the effects of GIs on trade and use a meta-analysis to explaining the heterogeneity in the results.[8]

Our results show that GIs yield an overall increase in intra and extra EU trade, however with some difference in the magnitude of the premium. Lower impacts emerge for estimations looking at wines and PDO GIs, suggesting that stringer regulations may induce a lower premium in international markets. Studies conducted at the country level or focusing on specific case studies (e.g., countries) yield lower effects. By contrast, effects are more consistent when using cross-category data contrary to the use of cross-category data.

This paper consolidates the state of academic research in this field by going beyond a simple qualitative review and compare papers' results performing a meta-analysis.

The paper is organised as follows. Section two reviews the literature, with a specific focus on the trade effects of GIs. Section three presents existing data sources and discusses their weaknesses and strengths. Section four presents the meta-analysis of the existing evidence and related results. Section five concludes.

2. LITERATURE REVIEW

The literature on the economic effects of GIs is rich (for recent literature reviews see Torok et al., 2020 and Dias and Mendes, 2018). The first group of empirical studies investigate the impact of GIs as quality labels on product differentiation (Altomonte et al., 2006), premium price (Haeck et al., 2019), consumers' purchasing decisions and their willingness to pay (Marchesini et al., 2007). According to Moschini et al. (2008), consumers are the main beneficiaries of GIs, as GIs solve

[8] Meta-analysis is a methodology for reviewing the literature to explain variation in empirical results of papers investigating the same phenomenon. This approach has become more and more popular in economics, including in international trade (Cipollina and Salvatici, 2010) and agri-food literature (Deselnicu et al., 2013).

information asymmetry. The second group of papers discusses the role of GIs as a territorial development strategy (Bowen, 2010) and the linkage between GIs and socio-economic development (Bonanno et al. 2020; Cei et al., 2018). Lastly, several contributions attempt to study the microeconomic values of GIs for farmers (Belletti et al, 2017) and actors involved along the supply chains (Vandecandelaere et al., 2020; Menapace and Moschini, 2014).

GIs are expected to have an impact also on the EU's internal and external trade working as a sort of property right (Gangjee, 2020) and non-tariff measure (Chambolle and Girard-Heraud, 2005). On the one hand, GIs represent the possibility to trace agri-food choices to the origins and reduce information asymmetries (Giovannucci et al., 2009), on the other trade plays a key role in creating the *terroir* reputation (Meloni and Swinnen, 2018).[9]

However, studies quantitatively evaluating the international trade effects of GIs are scanter, in favour of a large body of theoretical contributions debating on GIs in trade agreements (Prescot et al., 2020; Saavedra-Rivan, 2012) and different types of trademarks (Goebel and Groeschl, 2014). The majority of these empirical analyses belong to sectorial studies and investigate the economic value of trading GIs at the micro (i.e. firm/product) or country level. The former use custom data and apply microeconomic models, whereas data on trade flows (i.e. quantity and values) and general equilibrium models are mostly used by the latter. Impacts are estimated on trade quantity and values, together with intensive and extensive trade margins (Raimondi et al., 2020; Duvaleix-Treguer et al., 2018). Conversely, rarer are contributions considering the effects of GIs on the participation to Global Value Chains (GVC) (Greenville et al., 2017; Mancini, 2013) and, to the best of our knowledge, papers have never discussed the impacts on other type of internationalisation channels, such as Foreign Direct Investments.

[9] A terroir is an area in which collective knowledge of the interactions between the identifiable physical and biological environment and applied vitivinicultural practices develops, providing distinctive characteristics for the products originating from this area. (Resolution OIV/Viti 333/2010 OIV). More generally, this notion is used for a delimited geographical space where collective tacit know-how has been constructed over the years as a culmination of informal interactions between natural and human factors (Cross et al., 2011; Josling, 2006).

2.1 THE TRADE EFFECTS OF GIS

Overall, there is optimism about the effects of GI on international trade. GIs are likely to reduce information asymmetry between producers and consumers, and potentially enhance trade (Raimondi et al, 2019; Josling, 2006).

Sorgho and Larue (2014) find that the total volume of trade increases only if both importing and exporting countries have products protected as a GI, whereas a trade-diverting effect arises for importing countries without GIs. A more optimistic view has been provided by Agostino and Trivieri (2014). They find a positive relation between GIs and (i) bilateral trade export values and (ii) extensive margin (i.e. new trade routes) for wines produced in Italy, France and Spain. This positive effect increases over time. They find also an additional effect on the probability of exporting. Conversely, volumes increase only in the case of high-income destination markets. The role of the heterogeneity in destination markets has been stressed also by Sorgho and Larue (2018) investigating the incidence of GIs on bilateral trade flows. They conclude that, due to local consumers' preferences, GIs can increase as well as decrease trade flows. Controversial results have also been highlighted by Leufkens (2017) concerning the monetary value of agricultural export and the role of GIs in creating bilateral trade between the EU and third countries. While in the case of wine and spirits, GIs increase bilateral trade only if these products are highly protected, in the case of other agricultural products additional effects exist only in tandem with lower protection levels.

In the case of the French cheese industry, Duvaleix-Treguer et al. (2018) find positive effects of PDOs on trade extensive margin, but no effects on the intensive margin. Also in the case of Italian firms, as highlighted by Curzi and Olper (2012), PDOs increase (i) export intensity (i.e. ratio of exports) and (ii) the number of export destinations. This evidence has found support in Raimondi et al. (2020). They show that in 15 European countries while GIs promote an increase in exports of agri-food products (i.e. extensive margin), but for importers, GIs may result in some weak trade reducing elements. These impacts are similar for intra-EU and extra-EU trade.

With specific regard to premium pricing, literature seems to converge. Brooks (2003) estimates a premium for GIs upon wine import price and find that Italian and French wines are the products that benefit more. An increase in the export relative price of around 20–30% for foreign-origin specialty ham with GIs has been found by Schamel (2007). Looking at a developing country like India, Mulik and Crespi (2011) confirm the benefits of the per-unit export price of protecting local GIs. Duvaleix-Treguer et al. (2018) find that the price of exported PDOs increase by 11.5% on average. Raimondi et al. (2020) corroborate these results.

Some studies have investigated other nuances of the relation between GI and trade. Torok and Jambor (2016) focus on the symmetric comparative advantage in the EU ham sector and find a positive effect. Huysmans (2020) provides one of the few empirical studies that estimate the probability that a GI in a specific category from a specific country is listed in a trade agreement: trade agreements are more likely to protect GIs with higher sales value. However, Jambor et al. (2020) find that the number of GIs do not seem to count in supporting the willingness to establish a trade agreement, especially at the regional level. These results are confirmed by Curzi and Huysmans (*forthcoming*). By looking at the cheese sector, they conclude that, within the EU, the legal protection of GIs does not generally lead to significant additional exports above and beyond the general export-promoting effects of the Free Trade Agreement.

Regarding the empirical setting, the majority of these studies exploit gravity model frameworks and panel data estimations. Mulik and Crespi (2011) is the contribution looking at the longest time span, from 1970 to 2003. Country level analyses are the most frequent, followed by sectorial studies. Sometimes, as in Curzi and Huysmans (*forthcoming*) and Leufkens (2017), data on product and national trade flow are combined to investigate the within country-sector dynamics.

As highlighted by the literature, studies report different estimates and there is a significant difference in sample sizes, data, outcome variables and how accounting for the presence of GIs and a consensus on it has not been reached yet (Chilla et al., 2020).

3. DATA SOURCES: EXISTING AND FUTURE OPPORTUNITIES

Considering the official databases on GIs, a lack of viable data emerges: a common harmonized dataset for EU countries exist neither at the territorial nor the firm level.

Since 2019, eAmbrosia is the official register for agri-food products and wines that have either applied to become a GI or TSG (i.e., Traditional Specialty Guaranteed), or that are now registered as a GI or TSG.[10] Users can search for specific GIs and find information on: product type (food, wine, spirit or aromatized wines), GI type (PDO, PGI, GI or STG), legal status (applied, published or registered), product category and date of application/publication/registration. Product Specifications and legal documents are also attached. On the one hand, eAmbrosia has the strength of reporting the updated list of GIs registered in the EU. On the other hand, it provides information categorized in text format (i.e. pdf or html), which is no suitable way for econometric and statistical analysis. In any case, eAmbrosia provides only legal information; data on GI productions (e.g., value, quantity or trade flows) are absent. In aiming at assisting anti-fraud authorities, the EU has recently built up the GIview portal. It collects a sort of ID card for every single GI with the same legal information provided by eAmbrosia, and: (i) the list of third countries that have recognized the specific GI, (ii) the type of GI as in agreement and (iii) the entry into force date. GIview is made open to national authorities and to groups of producers to upload extended data, such as maps, photographs, product description, sustainability statements, and other information. As in the case of eAmbrosia, the complete list is not accessible for the download: users can download GI cards, but one by one in separate pdf files.

For different aims, the EU collects information on European agriculture and rural development. Data on market prices, production and international trade are constantly updated, but figures on GIs are not always included and, when exist, they are aggregated at the country or

[10] More information available at: https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/

sectoral level and provided only for few specific agri-food products. [11] Since 2003 the EU provide data on trade value and volume by product category differentiation (no-GI, PDO and PGI), but only for the wine sector.[12] At NUTS2 level, Eurostat regional statistics do not provide information on GIs.[13] FADN, which is representative at the regional level, does not report harmonised data on GIs as well, given that questions on GIs are not mandatory. Each MS decides if include them in the survey, or not. At the local level, obtaining data is even more challenging. Researches can rely on some national surveys, but they tend to be aggregated data, managed by local authorities or producers' organisations characterized by a short time span and strict privacy disclosures. For instance, in Italy, the national statistical office (ISTAT) has realised the number of farmers and agri-food processors involved in the GI production by product category at the NUTS3 level since 2004. This information is also available at the municipality level, but only for 3 years (2014, 2015 and 2016) and with no product category differentiation.[14]

An alternative is to rely on micro-data at product or firm level, such as custom data. However, data constraints are as severe as at the territorial level. FADN is the only source of microeconomic data based on harmonised bookkeeping principles, but, as stated above, it does not report information on GIs for all countries. Moreover, (i) it does not include data on GIs trade, (ii) information on firms' location is often provided only at the country/regional level and (iii) data are available only under request to liaison agencies in compliance with privacy constraints.

Therefore, a key question remains: to what extent are existing databases viable to evaluate the GI scheme from a quantitative perspective? To conduct robust analysis, researchers would need to have the time-space variability of these scheme at the local level. Data at the regional or country level are not the appropriate level of analysis, given the rules of assignment of GIs: the so-called

[11] More information available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agriculture_statistics_at_regional_level#:~:text=There%20were%2010.5%20million%20farms,(13.5%20%25)%20in%20Poland.&text=The%204.0%20million%20farms%20in,EU's%20total%20agricultural%20economic%20output

[12] Database available at: https://agridata.ec.europa.eu/extensions/DataPortal/agricultural_markets.html

[13] Database available at: https://ec.europa.eu/eurostat/web/agriculture/data/database

[14] Database available at: http://asc.istat.it/ASC/

region of origin refers to an area of specific neighbouring municipalities, which is significantly smaller and distinct in comparison to provinces or regions. Although legal documents and Product Specifications contain the list of Local Administrative Units included within the production area, existing databases do not allow users to download a dataset in csv or Excel format. [15] Users need to cope and paste data or to scribe them by exploiting specific data mining routines. The majority of authors have addressed these issues by focusing on the country level, losing local heterogeneity (e.g., urban-rural, economic structure, farms' average performances), or by limiting the analysis to specific case studies, which tend to be the most well-known GIs and performant countries (e.g., Macedo et al., 2020; Emlinger and Lamani, 2018). Results may be, therefore, misleading and future researches are needed.

Based on these facts, in the next section, we will meta-analyse the econometric literature on GIs trade impacts.

4. META-ANALYSIS: DATA, MODEL AND RESULTS

In foreign markets, apart from their role in overcoming asymmetric information, literature has proposed ambiguous effects of GIs: GIs can potentially enhance trade, but also possibly divert trade. To dig this heterogeneity, we meta-analyse the quantitative literature on GI trade impacts.

Born in the medical field, meta-analysis has been implemented by many economics studies for reviewing the literature and explaining variation in empirical results of papers investigating the same phenomenon (Hunt, 1997). Despite some constraints in the number of examinable papers, this approach has become more and more popular in trade (Cipollina and Salvatici, 2010) and agri-food literature (Lagerkvist and Hess, 2011).[16] Santeramo and Lamonaca (2019) have used this methodology

[15] LAU are a subdivision of the NUTS 3 regions covering the whole economic territory of the Member States. More information available at: https://ec.europa.eu/eurostat/web/nuts/local-administrative-units.

[16] The meta-analysis approach would require a large number of experiment and replications for validation purposes, however, in economic fields, these studies are uncommon, and, therefore, meta-analyses with numerous samples are difficult to conduct.

to investigate the effects of no-tariff measures on agri-food trade, whereas Deselnicu et al. (2013) estimate the GI premium price variation.

In early 2021, we collected English-language papers from the most significant online databases for academic articles (e.g., Scopus and Web of Science), including national and international reports, by using a set of *ad hoc* keywords related to GIs and international competitiveness.[17] We consider only studies explicitly focusing on GIs. We did not take into consideration papers generically discussing local agri-food systems, given that local is a relative concept with different declinations and nuances (Bowen and Mutersbaugh, 2014), and analysis assessing non-agri-food GIs (EC, 2019b).

From the online databases, we find 462 items. After excluding duplicates and an initial screening based on title and abstract, 106 articles remained. We reviewed these papers, excluding that contributions turned out not to be empirical and identified 12 studies. However, we had to removed one of them because of the lack of estimations' standard errors. The final sample is composed of 11 studies, for a total of 257 observations (estimations).[18]

4.1 *Meta-Analysis model*

The standard meta-analysis model regresses estimated coefficients on their standard errors and a set of controls variables to explain the findings variation in the literature. Since meta-analysis errors are likely to be heteroskedastic (Stanley, 2005), we divide the OLS equation by the individual standard errors and estimate the following Weighted Least Square (WLS) model:[19]

$$Y_{ij}/SE_{ij} = \alpha + \beta_1(1/SE_{ij}) + \beta_2 X_{ij}/SE_{ij} + \delta_j + \delta_t + \delta_{jt} + \varepsilon_{ij} \qquad (1)$$

[17] The following words have to be included in the abstract, title or subject of the paper: Geographical Indication* OR Protected Designation of Origin OR Protected Geographical Indication AND trade, export*, import*, international*, WTO, TRIPS, FTA, Free Trade Agreements, GVC, Global Value Chain*.
We considered only published studies with peer-review process to control for unchecked researches (Cipollina and Salvatici, 2010).

[18] Studies in many cases reported more than one estimations, but considering a single estimation for each study generates misleading results (Bijmolt and Pieters, 2001). Taking into account multiple estimates allows us to test for correlation between and within papers.

[19] The use of WLS for meta-analysis is consolidated in the literature, such as in Deselnictu et al. (2013), Cipollina and Salvatici (2010) and Lagerkvist and Hess (2010).

where *Yij* is the reported estimation *i* of the study *j*, *SEij* is the related standard error and *Xij* is the control matrix referring to the characteristics potentially responsible of systematic variation from other results in the literature. *Yij/SEij* captures the t-statistic. Fixed effects comprise paper (δ_j), publication year (δ_t) and within paper-year (δ_{jt}) fixed-effects. ε is the error term. Robust standard errors are specified by the Jackknife procedure (Davidson and MacKinnon, 2004), as it is common in meta-analysis studies (Lagerkvist and Hess, 2011).

Our set of explanatory variables control for the diversity of the results from both methodological and GIs phenomenon perspectives (see Table A1 in the Appendix for definition and descriptive statistics).

The first group of explanatory variables refers to study-specific controls.

The first potential bias arises from the lack of suitable quantitative data to evaluate the impacts of GIs at the micro-level, especially in the long run. Studies have addressed this issue by estimating effects on a single aggregate level of analysis or focusing on specific case studies (around 90%, and half of them focuses on country case studies). Country and sector levels are the most widespread. For instance, all the studies exploiting Gravity Equilibrium Models use country data. Only a few exploit cross-category data to investigate within country-sector effects (such as Sorgho and Larue, 2017).

In order to remove from the estimated effect any possible bias due to research design, we include a *Country data* dummy equal to 1 if the original studies are conducted at the country level,a *Cross-category* dummy coded 1 for analysis using cross-category data and a *Case study* dummy is associated with papers following this research approach. Moreover, we control for studies focusing in the EU.
Recalling that the effects of GIs on trade are likely to generate economic benefits in the long run (Agostino and Trivieri, 2014), we include an interaction variable between the variable coded 1 if the original study uses a panel data setting and the number of years covered by the panel.

Omitted variables issues can also affect the estimated trade impact, which will be upward-biased if the omitted variables and the GI (our variables of interest) are positively correlated. A possible solution is to consider sector or importer and exporter countries fixed effects (e.g., Sorgho and Larue,

2017). In setting up the dataset, we take into consideration this aspect (one dummy for studies including FE). However, because of strong collinearity, it was not possible to estimate the effects of GIs while controlling for studies considering fixed effects. Regarding possible methodological bias, we include also dummies accounting for differences in estimation procedures.[20]

A second potential mistake arises from the fact that different measures of GI are used. The most frequent measures are the total number of GIs produced (64% of estimations) and a binary variable, coded 1 if the observation (country/firm) benefits from at least one GI labelling (36%). As endogeneity and selection bias looms in this approach, in our model, we consider a *GIs variable* accounting 1 if in the original study GIs are computed as dummies.

In addition, another problem emerges from the fact that studies tend to treat GIs as a whole neglecting the differences between product categories (e.g., food *vs* wine) or GI types (PDO *vs* PGI). This approach is likely to bias estimations. To control for this, we include (i) a dummy with value 1 for estimations focusing only at PDOs (30%) and (ii) a dummy that accounts for models evaluating the effect on trade only for wine GIs (63%). The wine sector is categorized as a market characterized by a long tradition of GI certification (Ugaglia et al., 2019).

Estimation differences can be caused also by authors' and research centres' characteristics. Therefore, we include binary variables coded 1: (i) if authors are affiliated to University, rather than to a different type of research centres (74%) and (ii) if the affiliation is located in the EU (65% of observations, 7 up to 11 papers).

We acknowledge that the estimation can be mediated by publication impact (i.e., estimation with positive and significant coefficient) (Salvatici and Cipollina, 2010), and therefore we distinguish statistically significant positive (199 estimations) from negative and not significant effects.

Last but not least, our model includes publication years and paper fixed effects to account for between and within correlation, which should be expected for estimations belong to the same studies.

[20] In the sample we have: 40 models estimated by Poisson pseudo maximum likelihood (PPML), 56 by Ordinary Least Square, 18 by Instrumental Variables, 16 by Logit, 42 by Probit and 4 by Tobit.

The main limitation of the meta-analysis is the arbitrary selection of the studies whose external validity and credibility, in terms of research design and empirical strategies, can widely vary (Ashnfelter et al., 1999). Therefore, we have (i) selected only papers published after a peer-reviewed process in scientific journals and (ii) added the control variables related to methodological approaches. The selection of explanatory variables is also particularly challenging. The intent is to incorporate as much information as possible about the literature sample. However this may lead to multi-collinearity among controls and, to solve it, we have weighted all variables in the model by the inverse of the standard error of the dependent variable. In this way, we avoid that more reliable estimates are confounded by observations subject to a larger standard error.

In addition, there may be a sort of publication impact driven by the preference for significant results (Stanley, 2005).[21] We have addressed this issue by (i) the inspection of the funnel plot (Figure A1, in the Appendix), (ii) the Egger test (confirming the symmetry of the funnel graph) and (iii) referring to the t-values (*Yij/SEij*) in the estimation model.

Lastly, we check the between-study variation computing the H^2 and I^2 tests (Higgins et al., 2003).[22]

4.2 *Results*

The estimated effect of GIs on trade range from -1.04 to 2.47, with a positive mean of 0.10.

60% report positive coefficients (135 estimations negative ones). 127 estimations are statistically significant, 49%. Results are reported in Table 1. The baseline model (column 1) has been re-estimated augmented by methodological related dummies (column 2) and considering publication impact (column 3).

Results show that studies focusing on the wine sector tend to estimate much lower impacts on trade, as well, papers looking at PDOs command a trade effect 13% lower. The negative and

[21] Publication bias arises when the decision of whether to publish a study's results depends on the significance of the obtained results. Studies with nonsignificant results can be suppressed for publication.

[22] H^2 provides a possible measure of the degree of heterogeneity, while I^2 statistic captures the percentage of variability in point estimates that is due to heterogeneity, rather than sampling variation. In our analysis, the p-value of the homogeneity test is 0.000, so there is statistical evidence of the between-study heterogeneity. We performed a subgroup analysis considering the paper at which estimations belong to as moderator. Sometimes, indeed, the heterogeneity can be explained by some study-level covariates, also known as moderators.

significant coefficient highlights a downward bias in these studies. Conversely, the measure used to account for GI seems to not cause estimation distortion.

As far as research design concern, findings show a huge downward bias for the analysis conducted at the country level or presenting specific case studies. This evidence is in line with the hypothesis of misleading results driven by the lack of appropriate data.

Lower premium emerges also in the case of studies using panel data setting.

On the other hand, we find a positive and significant coefficient for cross-category data: those studies that use both country and product data to characterized trade flow tend to overestimate the impact of GIs on trade.

In terms of methodology, tobit estimations tend to provide higher premiums.

Table 1: Meta-analysis of GIs trade effects

Independent variables	(1) WLS	(2) WLS	(3) WLS
1/SE	11.298** (4.947)	11.348** (4.947)	11.373** (4.946)
PDO	-13.777*** (5.801)	-13.787*** (5.801)	-13.820*** (5.801)
Wine	-31.102** (13.028)	-31.123** (13.027)	-31.202*** (13.026)
GIs variable	0.026 (0.212)	0.027 (0.212)	0.026 (0.213)
Country data	-38.570** (10.557)	-38.597** (16.301)	-38.691** (16.300)
Long run studies	-0.509*** (0.213)	-0.509*** (0.213)	-0.511*** (0.213)
Cross-category data	29.591*** (12.386)	29.612*** (12.386)	29.686*** (12.385)
Case study	-35.207*** (14.736)	-35.231*** (14.735)	-35.319*** (14.734)
Affiliation	50.211*** (20.958)	52.204*** (20.957)	50.330*** (20.955)
Europe based affiliation	8.161*** (3.416)	8.167*** (3.416)	8.187** (3.416)
European GIs	13.777*** (5.765)	13.789*** (5.765)	13.824*** (5.765)
PPML		-1.406 (1.062)	-1.409 (1.074)
Logit		*based level*	*based level*
Tobit		7.779*** (2.850)	7.667*** (2.903)
Probit		-1.654	-1.877

		(1.467)	(1.638)
OLS		-2.096***	-2.077**
		(0.813)	(0.826)
IV		-2.096**	-1.178
		(0.813)	(2.292)
Other estimation models		-1.764	-1.943
		(1.360)	(1.515)
Publication impact			0.002
			(0.004)
	Yes	Yes	Yes
Publication year fixed effects	Yes	Yes	Yes
Paper fixed effects	Yes	Yes	Yes
R-squared (adj)	0.809	0.810	0.809
Prob>F	0.000	.	.
SE of regression	4.646	4.639	4.646
Observations	257	257	257

Note: ***p<0.01, **p<0.05, *p<0.1 Dependent variable: estimation coefficient. All the variables have been weighted by the inverse of the standard error of the dependent variable. Robust (Jackknife) standard errors in parentheses. Fixed effects at the paper and year level.

In order to assess the credibility of our results, we re-estimate the model in a panel data setting exploiting both random and multilevel mixed-effect regressions. Obtaining results are robust and in line with baseline estimations (Table A2 in the Appendix).

5. CONCLUSIONS

In this paper, we have reviewed the economic literature on the trade effects of GIs, discussed the data sources available and meta-analysed studies estimating the trade effects of GI differentiation. Overall, all existing studies highlight a positive impact of GI: they represent a relevant policy tool for identifying and endorsing local forms of production on a global scale. However, while GIs constitute an effective legal protection and differentiation tool in global markets, the magnitude of competitive benefits associated with GIs varies across markets and products.

Our meta-analysis shows that lower premium in terms of international trade are associated to estimations looking at the GI wine market. These results are in line with evidence that processed agri-food products benefit the least from GI differentiation (Deselnicu et al. 2013)

A reason can be that GIs are likely to be not the main product differentiation tool for wines given that, for more expensive products, as wines can be, the individual reputation (e.g., wineries names and

grape variety) can prevail over the collective one (Costanigro et al., 2010). Especially in countries without a strong wine's culture, such as the UK, the easier-to-understand varietal wines and brands gave generic wines an advantage (Pomarici et al., 2021). In addition, international markets, especially extra-EU, are predominantly the destination of bulk wine surplus (Anderson and Golin, 2004).

The role of GIs is even more complex for PDOs. Their more stringent regulations appear to induce a lower premium in international markets. PDO certification is the most demanding: every part of the production, processing and preparation must take place within a specific area. Even if PDOs may signal increased benefit for consumers, it is presumable that the difference between PDOs and other types of GIs is not perceived by foreign consumers and, therefore, it is not determinant to capture larger premiums in international markets (Menapace and Moschini, 2012). Methodological choices can produce upward biased: logit estimations are much more likely to produce trade positive effects. Studies conducted at the country level or focusing on specific case studies yield lower effects, contrary to the use of cross-category data.

This paper is the first contribution that attempts to verify and explain, the different estimates of the GI trade effects. Generally, reviewing the existing body of empirical research on GIs and trade has highlighted the difficulties in estimating the real socio-economic effects of GIs, especially at the territorial level. Evaluations require granularity and accuracy of territorial data at hand, which are rarely met. In this perspective, we are working on a new dataset. The aim is to create a panel dataset capable to support the research on the GIs impacts with machine-readable data available at the level of Local Administrative Units (LAU)-year for all GIs in Europe. We consider the list of all the GIs in eAmbrosia as a starting point and we are digitalizing the legal information and the paragraph of Product Specifications devoted to the demarcated geographical area. This dataset will be one of a kind: it is a multi-year panel dataset that reconstructs the time-space variability of all the GI at the local level since the 1970s, the trade patterns and the socio-economic and environmental conditions of the regions of origin.

Testing the sensitivity of existing studies will be important to generalize policy implications for the GI scheme. The choice of investing in local peculiarities and expertise can, in fact, condition foreign attractiveness (e.g., FDI and multinationals) and the participation in international trade and GVCs. In this sense, understanding the effects of embedded production systems, such as GIs, on local openness and the related consequences on local development should be the subject of future research efforts. In the case of GIs, for instance, the production process is not geographically fragmented and GIs (final good) tend to be sold directly to foreign end markets. This production organization and the down-stream position along the GVCs may have, thus, relevant implications for agri-food producers and local actors. Although in this paper we do not draw conclusions about the impact of GIs trade flows on farmers and producers welfare, it remains on our future research plan.

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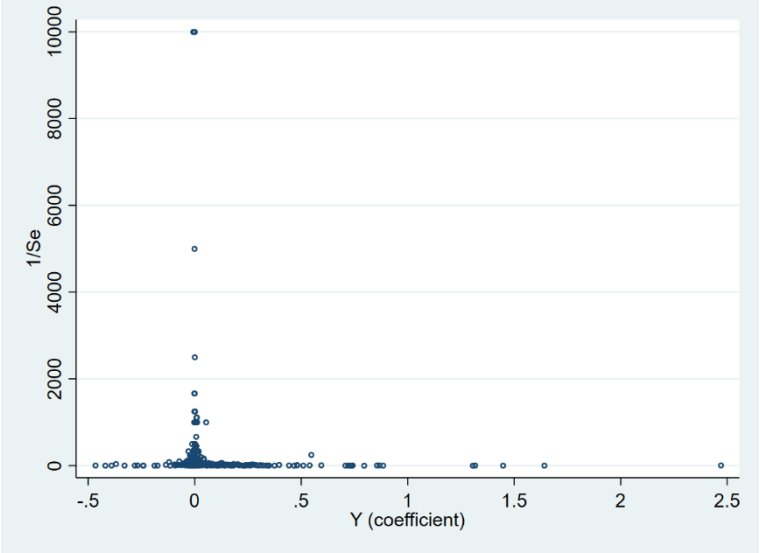
APPENDIX

Table A1: Explanatory variables

Variable	Description	Mean	Std	Min	Max
SE	Standard error of individual estimation	0.101	0.184	0.000	1.246
Wine	Dummy variable coded 1 if the study focuses on the wine sector, 0 otherwise	0.630	0.484	0	1
PDO	Dummy variable coded 1 if the study focuses on PDOs, 0 otherwise	0.307	0.462	0	1
GIs variable	Dummy variable coded 1 if GIs have been measured by a binary variable, 0 otherwise	0.354	0.479	0	1
Country data	Dummy variable coded 1 if the analysis is conducted at the country level, 0 otherwise	0.724	0.448	0	1
Long run studies	Interaction between a dummy variable coded 1 if the analysis is conducted by using panel data (0 otherwise) and the number of years under analysis	6.630	8.502	0	1
Cross-category	Dummy variable coded 1 if the analysis is conducted by using cross-category data (product, sector, countries), 0 otherwise	0.770	0.421	0	1
Case study	Dummy variable coded 1 if the analysis is conducted by focusing on a case study, 0 otherwise	0.887	0.317	0	1
Affiliation	Dummy variable coded 1 if Authors work in University, 0 otherwise	0.437	0.743	0	1
Europe based affiliation	Dummy variable coded 1 if Authors' affiliation is located in the EU, 0 otherwise	0.649	0.477	0	1
Europe GIs	Dummy variable coded 1 if study provides evidence from European GIs	0.704	0.457	0	1
Country focus	Dummies accounting for the countries on which the study focuses	1.723	0.913	1	4
Estimation model	Dummies accounting for estimation procedures: Poisson Pseudo Maximum Likelihood (PPML); Logit; Tobit; Probit; OLS; IV; Other	2.789	2.102	0	6
Publication impact	Dummy variable coded 1 if estimations show a positive and significant impact of GIs on trade	0.494	0.501	0	1
Publication year	Publication year				

Note: In the estimation model, all these variables have been weighted by the inverse of the standard error of the dependent variable.

Figure A1: Funnel graph of individual estimates



Note: In the absence of publication bias, the diagram has to reassemble an inverted funnel, wide at the bottom for small sample studies and narrowing as it rises. 1/SE is the inversion of estimation standard error.

Table A2: Meta-analysis of GIs trade effects, panel data estimations

Independent variables	(1) Fixed effects	(2) Multilevel mixed-effect regression
1/SE	15.348** (7.684)	11.373*** (0.077)
Wine	-41.871** (20.375)	-31.201*** (0.245)
PDO	-18.544** (9.021)	-13.820*** (0.104)
GIs variable	-0.171 (0.333)	0.027*** (0.000)
Country data	-51.991** (23.385)	-38.690*** (0.295)
Long run studies	-0.685** (0.334)	-0.511*** (0.004)
Cross-category data	39.833** (19.372)	29.686*** (0.232)
Case study	-47.392** (23.047)	-35.319*** (0.275)
Affiliation	67.521** (32.731)	50.329** (0.396)
Europe based affiliation	10.993** (5.344)	8.187*** (0.062)
Estimation model dummies	Yes	Yes
European GIs	Yes	Yes
Publication impact	Yes	Yes
Publication year fixed effects	Yes	Yes
Paper fixed effects	Yes	Yes
R-squared	0.782	-

Observations	257	257
Groups	71	10

Note: ***p<0.01, **p<0.05, *p<0.1 Dependent variable: estimation coefficient. All the variables have been weighted by the inverse of the standard error of the dependent variable. Robust standard errors in parentheses. Fixed effects at the paper and year level.