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Trade effects of geographical indication policy: The EU case

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Abstract

Using a new detailed dataset on country-product information on European Union (EU) Geographical Indications (GIs), we study the impact of this food quality policy on trade margins over the 1996–2014 period. We consider the effect of GIs on both intra- and extra-EU trade margins (extensive and intensive), as well as on export (and import) unit values. Our main results show that GIs affect trade flows differently depending on whether GIs are produced by the exporter or importer country. The presence of GIs in the exporter country systematically exerts a positive trade effect on both the extensive and intensive trade margin. When registered only in the importer country, GIs seem to act weakly as a trade-reducing measure, at least at the intensive trade margin. In addition, GIs positively affect export prices, consistent with the idea that GI products are perceived by consumers as higher quality goods. Importantly, extra-EU trade margins react similarly to those on intra-EU trade. These results have clear and interesting implications concerning the EU strategy of promoting the protection of GIs worldwide.

Keywords: *EU geographical indications; export unit values; food quality; trade margins.*

JEL classifications: *F12, F14, Q18.*

1. Introduction

In recent decades, few topics have been so controversial in international trade talks as the intellectual property rights (IPR) protection of geographical indications (GIs).[2]

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[2]The adoption of Trade Related Aspects of Intellectual Property (TRIPs) in 1994, together with the Uruguay Round Agreement on Agriculture, did not resolve the disagreement between the European Union and 'Anglo-American' countries. In short, while the TRIPS established a strong intellectual property rights (IPR) protection for wines and spirits in Art. 23, the IPR protection for other products including agricultural products and foodstuffs, defined in Art. 22, is significantly weaker.

Trade Effects of Geographical Indication Policy: The EU case

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Abstract: Using a new detailed dataset on country-product information on European Union (EU) Geographical Indications (GIs), we study the impact of the EU food quality policy on trade margins over the 1996-2014 period. We consider the GIs effect on both intra- and extra-EU trade margins (extensive and intensive), as well as on export (and import) unit values. Main results show that GIs affect trade flows differently depending on whether GIs are produced by the exporter or importer country. The presence of GIs in the exporter country systematically exerts a positive trade effect on both the extensive and intensive trade margin. When registered only in the importer country, GIs seem to act weakly as a trade-reducing measure, at least when the intensive trade margin is considered. In addition, GIs positively affect export prices, consistently with the idea that GI products are perceived by consumers as higher quality goods. Importantly, extra-EU trade margins react similarly to those on intra-EU trade. These results have clear and interesting implications concerning the EU strategy of promoting the protection of GIs worldwide.

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1. Introduction

In recent decades, few topics have been so controversial in international trade talks as the intellectual property rights (IPR) protection of geographical indications (GIs).[2] Countries worldwide continue to quarrel on the nature, the scope, and the enforcement of GI protection nationally and internationally (Calboli and Wee Loon, 2017). This conflict has been the subject of bilateral and multilateral talks for more than 20 years, as well as of trade disputes within the World Trade Organization (WTO).

GIs have a long history in Europe, that starts in 1883 with the convention of Paris for the protection of industrial property (Josling, 2006). It is in 1992 that the European Union adopts the first Regulation (EEC) No 2081/92, defining the conditions for registration of GI agricultural products and foodstuffs as protected.[3] The European Union (EU) policy on "quality schemes for agricultural products and foodstuffs" aims to protect, both domestically and internationally, the name of specific products, in order to promote 'their unique characteristics, linked to their geographical origin as well as traditional know-how.[4] Therefore products can be classified as GIs if they can be linked to the place where they are made.[5]

At the international level, the failure in reaching an agreement on multilateral trading rules within the WTO Doha Development Round, triggered a new waves of international trade arrangements negotiated on a bilateral basis, where both the European Union (EU) and the United States (US), have had some success in extending their particular view concerning the protection system of GIs. The free trade agreements (FTAs) of the EU concluded with South Korea, Singapore, Vietnam and Japan, and the "Comprehensive Economic and Trade Agreement" (CETA) with Canada, are important examples where for the first time specific GI provisions have been formally included in the EU FTAs. At the same time, the US in its FTA with Asian countries, the so called "Trans-Pacific Partnership" (TPP), promoted its trademark

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[2] The adoption of Trade Related Aspects of Intellectual Property (TRIPs) in 1994, together with the Uruguay Round Agreement on Agriculture, did not resolve the disagreement between the European Union and "Anglo-American" countries. In short, while the TRIPS established a strong intellectual property rights (IPR) protection for wines and spirits in art. 23, the IPR protection for the rest of products including agricultural products and foodstuffs, defined in art. 22, is significantly weaker.

[3] This framework was repealed in 2006 by the Regulation (EC) No 510/2006 and then in 2013, by the Regulation (EU) No 1151/2012 of the European Parliament on 'quality schemes for agricultural products and foodstuffs'.

[4] EU Commission website: https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/ certification/ quality-labels/quality-schemes-explained_en

[5] In particular, a distinction between Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) can be done in accordance 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 production stages must have to 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 PGIs products, the agricultural raw material can be sourced anywhere, and can also come from abroad.

system view on how GIs should be protected, a view that contrasts with the one of the EU (Matthews, 2016).[6]

From an economic point of view, the nature of the Transatlantic disagreement over GIs can be attributed to their possible pro- or anti-competitive effect (Chambolle and Giraud-Heraud, 2005; Josling, 2006; Marette et al. 2008). This is because, on the one hand, the idea of including the geographic origin of the product on a label is a crucial element for correcting consumer information asymmetries (Marette and Crespi, 2003). Hence, using a GI label as a proxy for information about the consumer attributes of a good may have some economic justification (Lance et al. 2007; Moschini and Menapace, 2014). On the other hand, as discussed in Josling (2006, p. 339) "if linking quality to land merely provides a rent to those who own the land, and reduces competition by newcomers who could otherwise find ways to reproduce the land-based attributes through other means, then such linkage would be less obviously beneficial."

This tension between more consumers' information and less competition (Marette and Crespi, 2003; Zago and Pick, 2004) may raise problems at both national and international level (Josling, 2006; Marette et al., 2008). In fact, GI labels may entail trade distortions or impede the entry of producers who cannot comply with specific requirements. As stressed by Josling (2006), the asymmetric information argument and the extent to which GIs induced a pro- and/or anti-competitive effect is difficult to be established a-priory, and should be investigated and addressed empirically. The present contribution, by investigating if there exists an export-promoting and/or import-reducing effect of the European Union GIs, makes an attempt to move a step forward in that direction.

More specifically, this paper contributes to better understand the international trade dimension of the EU GI policy extending previous evidence in several directions. In particular, we try to answer the following research questions: does the EU GI policy contribute to improving exports performance of agri-food products in the international markets? To what extent the diffusion of GIs in the importing countries represents a protection device against import competition? Does the GI trade policy affect differently intra- vs. extra-EU trade flows? Is there any GIs effect on export (and import) prices?

To answer these questions our analysis builds on the few early published works investigating empirically the relationship between GIs and trade (Sorgho and Larue 2014,

[6] Note that, countries such as Mexico, South Korea, Japan and Vietnam, are both signatories of the TPP with the US, and free trade agreements with the EU. Because the provisions of GIs protection included in these FTAs reflect, alternatively, the rather different US and EU perspective, this raise potential problems and confusion about the protection of GIs in these countries (see Matthews, 2016).

2018; Agostino and Trivieri, 2014), and provides three main novelties. First, we test our research questions by building a new dataset on the EU quality policy throughout a careful classification of *all* the EU GI products at the Harmonized System (henceforth HS) 6-digit level, over the 1996-2014 period. This new dataset allows us to exploit the within country-sector variation in the number of GIs, to properly identify their trade effects. Thus, our empirical exercise is robust to endogeneity bias that normally impinge this kind of analysis, such as omitted variables bias, and it is close in spirit to a differences-in-differences research design. In addition, we also control for endogeneity bias due to reverse causality between trade and GIs, by adopting an approach based on instrumental variables (IV). Second, we focus our analysis separately on intra-EU and extra-EU trade. Such a distinction is necessary as these trade patterns are based on different presumptions in terms of tariffs and non-tariffs barriers, and, perhaps more importantly, because the GI policy is set at the EU level, and it is only rarely recognized by extra-EU countries. However, both cases are equally interesting to study as they may provide important policy implications on different grounds. Our paper is the first one that takes into account all these important differences. Finally, unlike previous papers, we consider a direct measure of trade margins, based on the theoretically-founded decomposition of overall trade into the extensive and intensive margins. This computation, originally proposed by Feenstra (1995) and further developed by Hummels and Klenow (2005) and Feenstra and Kee (2008), presents the main advantage of accounting for the economic weight of traded products, as more in depth discussed in the data section of the paper.

Our main results show that, on average, GIs affect trade flows differently depending on whether the GI policy is implemented in the exporter or importer country. Considering intra-EU trade, our main findings suggest that 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 (weakly) act as a trade reducing measure against exporting countries not producing them. In addition, GIs seem to allow firms to charge higher export unit values. Interestingly, when extra-EU trade are considered, we find a considerable similarity of the GI trade effects to those on intra-EU trade, both in terms of the direction and magnitude of the effects.

The remainder of the paper is organized as follows. Section 2 discusses the relevant literature on the economics of GIs, with a special focus on trade issues. Section 3 presents the data and defines the sample we used for the empirical analysis. Section 4 proposes an empirical strategy based on the decomposition of trade flows in their respective intensive and extensive margins that is consistent with firm-level trade models that emphasized heterogeneity in product quality, while Section 5 discusses the results. Finally, Section 6 derives some concluding comments.

2. Related literature

In the last decades, the economics of GIs has attracted growing interest. A large part of the literature investigated the extent to which, and under which specific market arrangement, certification and labelling tools can address market failures due to asymmetric information (e.g. Marette and Crespi, 2003; Zago and Pick, 2004; Langinier and Babcock, 2008; Moschini et al., 2008), the related consumers' and producers' welfare effect under different market arrangements (e.g. Mérel and Sexton, 2012; Desquilbet and Monier-Dilhan, 2015; Lence et al., 2007; Menapace and Moschini, 2012; Yu and Bouamra-Mechemache, 2016), and the economics and politics of GI regulations (e.g. Deconinck and Swinnen, 2014; Landi and Stefani 2015; Deconinck et al., 2015).

An issue stressed, especially, in the early literature, is the extent to which the signaling effect of GI – due to more consumer information on the origin and quality of products – more than compensate the collusion effect of the GI policy – due to the potential loss in competition induced by the market restriction of the GI protection policy (see, e.g., Marette and Crespi, 2003; Zago and Pick, 2004; Lance et al., 2007; Mérel, 2012). Other contributions, instead, by recognizing that GIs are essentially public goods, and are used by many firms simultaneously, investigated their welfare consequence in a perfect competitive setting (see Moschini et al., 2008; Mèrel and Sexton, 2012; Menapace and Moschini, 2012; Moschini and Menapace, 2014).[7]

From an analytical point of view, which assumption is more pertinent for modelling GIs is a choice complicated by the fact that in the EU, similar GI rules are applied to different products, operating in different countries with different market structures, rendering generalizations somewhat problematic. In addition, the large majority of the contributions on the economics of GIs, does not consider *directly* the potential implications stemming from a situation where the level of competition in the domestic market is also affected by international competition due to trade liberalization.

[7] The relevance of collusion effects and the idea of GI as "agricultural production clubs", appear to be inconsistent with the institutional set setup of GIs in the EU. This is because, any producer who abides to the code of rules for a GI, within the given geographical area, can produce the GI, i.e. there is free entry (see Menapace and Moschini 2012, 544).

With few notable exceptions (see Josling, 2006; Marette et al. 2008; Chambolle and Giraud-Heraud 2005), the analysis of the GI trade effect has been mainly focused on the legal issues of intellectual property rights protection (e.g. Kireeva and O'Connor, 2010; O'Connor, 2014; Matthews, 2016; Calboli and Wee Loon, 2017; Gangjee, 2017; Biénabe and Marie-Vivien, 2017). However, more recently a few contributions started to investigate empirically the extent to which GIs affect trade flows (Sorgho and Larue 2014, 2018; Agostino and Trivieri, 2014; Duvaleix-Treguer et al. 2018).

A good starting point is represented by the analysis of Marette et al. (2008). These authors argued that the globalization wave of the last decades increased the need for quality signals because consumers are now progressively less aware of the origin and quality of products in the marketplace. They also stressed that as an effect of international competition, if the fixed costs of quality certification and innovation are particularly high, then we can assist to market concentration and a reduction of the varieties into the domestic market. They quoted the model of Shaked and Sutton (1987), that predicts how the increase in market size due to trade liberalization, translates into an increase of the level of concentration, and a subsequent reduction in the number of product varieties. This consideration is important because it rises the issue of studying the GI trade effect, not just on the export side, but focusing also on their effects on the import side trade margins, i.e. the number of imported varieties and their import intensity.

Chambolle and Giraud-Heraud (2005) highlighted the possible import restriction content of GIs, by arguing that this EU policy incorporated both quantity restriction and a sort of quality costs subsidy. They used a model of strategic trade policy, with two firms located in Home and Foreign competing in the Home market, where a domestic firm, as an effect of the GI certification, positions itself as a higher quality producer. A similar import restrictive effect of GIs can be found in simple extensions of firm-heterogeneity trade model *a la* Melitz (2003). For example, Abel-Koch (2013) developed a trade model where quality standards and certification requirements, such as GIs, raise fixed costs of market access for both domestic producers and foreign exporters. The model predicts that, the implementation of an anti-competitive regulations (as in the case of GIs) can never be a social optimum, because the positive effect of a certification on the aggregate profits of home firms, is always dominated by the loss in the home number of available varieties.[8] Yet, this result could be reversed when the certification of origin is implemented to reduce a consumption externality – i.e.

[8] In this setting, certification costs force the least efficient firms to exit and shift profits to the most efficient firms. Thus certification requirements work similarly to a non-tariff barriers to trade by shifting profits both within and across countries.

information asymmetry – whenever the increase in the consumers surplus attributable to the externality reduction, more than compensate the decrease in the number of home available varieties.

To sum up, following the discussion in Josling (2006), the trade impacts of GIs are mainly a direct consequence of the potential suitability of the domestic regulatory framework to provide the appropriate level of protection and information. If consumers are over-protected, the level of imports in the domestic market will be lower than the optimal level, as well as the level of export from domestic producers will be too high. On the other hand, if consumers will be under-protected by the GI policy, the level of imports of low quality goods will be too high domestically, but the level of export from domestic producers too low, because the lack of information will adversely hit sales of the product with the geographically linked quality attribute (Josling, 2006, p. 343). Because these factors tend to be country and sector/product specific, on average, what is the actual trade effect of GIs tends to be an empirical question.

The empirical evidence on the GI trade effect to date is limited. Just a handful of papers quantitatively investigated the extent to which the EU GI policy affects international trade and, more importantly, only one published paper focused simultaneously on both the export and import side, though at the aggregate level and considering intra-EU trade flows only.

The first contribution that evaluated the trade effect of GI has been by Sorgho and Larue (2014), who applied the odd ratio gravity specification of Head and Mayer (2000). Using a cross-section of 27 EU countries and aggregated agri-food trade, the authors showed that GIs promote trade only when both the importing and exporting EU countries are GIs producers, an effect mainly attributed to consumer information. A potential limitation of the result lies in the aggregation level of the analysis. Indeed, considering only the overall agri-food trade, many sectoral information and heterogeneity of the GI trade effects are lost.

A step forward has been provided by Agostino and Trivieri (2014), by using a theory-driven gravity equation in a panel data context (Baier and Bergstrand 2009). Focusing on wine exports from France, Italy and Spain, they were able to 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. However, by focusing only on wine, the results are less informative about the GI international trade issue, because this product (like spirts) are within the few GIs that received special protection in international market.

Sorgho and Larue (2018), extended their 2014 paper by emphasizing heterogeneity in consumer preferences over GIs. Using disaggregated trade data within the EU, they showed that GI-products have ambiguous effects on intra-EU trade, a finding attributed to the heterogeneity of consumer preferences, and the reputation of the product considered. While reputation is clearly an important driver of the export success of many GIs, by working on *all* the GIs produced in the EU, irrespective of their market relevance, the results of Sorgho and Larue (2018) are somewhat pre-determined. Indeed, they also included in the analysis several products that are commercialized and known by only local (or regional) consumers, and that are not really relevant in the international markets.[9]

Finally, using French custom data matched with firm-level data of PDO cheese producers, Duvaleix-Treguer et al. (2018) were able to show that GI certification increases firms' exports through both the extensive and intensive trade margins, but not export unit values.[10] All these results appear to hold on the EU markets, and less so in the extra-EU one. While there are several advantages in using firm-level trade, particularly to better identify mechanisms, the source of variability exploited by Duvaleix-Treguer et al. (2018) has been only cross-sectional, rendering the identification of the GI trade effect prone to potential omitted variables bias.

In the present paper we extend this early empirical literature in several directions. First, we built a new database where all the EU GIs are classified at the HS 6-digit level. This allows us to work with a broader coverage of products and for a longer time period than previous works. Second, we investigate both intra- and extra-EU trade flows. As the GI issue is getting more and more relevance not only within the EU borders, our analysis provides an overall view of the trade effect of the GI policy. Third, the reliability of our results stems, on the one hand, from the use of a more rigorous empirical approach based on panel data econometrics, which better accounts for different endogeneity issues. On the other hand, the use of trade margins that are computed based on a theoretically founded approach and that account for the economic weight of traded products provides further credence to our results.

Our paper is also related to the emerging literature on quality and trade. Starting from the seminal contribution of Linder (1961), Falvey and Kierzkowski (1987), and Flam and

[9] It is important to emphasize that, as showed by AND-International (2012), the overall sales value of EU certified GIs (excluding wine) in 2010, was equal to around €15.8 billion, of which, 78% 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). Because in 2010 the external EU food trade was equal to about €57 billion, this means that GIs, overall, represented just 2% of the total value of extra-EU food exports.

[10] Interesting, Duvaleix-Treguer et al. (2018) by comparing GI certified firms to non-certified ones, showed that the former have better performance than the later for their non-labelled products in the EU market, suggesting that firms producing GIs gain in reputation also with respect to other (non-GI) products.

Helpman (1987), a growing literature investigated the influence of product quality on international trade in firm-heterogeneity models (Melitz, 2003; Bernard, 2003), showing that heterogeneity in product quality is a key driver of firms' export success (see Baldwin and Harrigan, 2011; Kugler and Verhoogen, 2012; Crozet et al., 2012; Crinò and Epifani, 2012; Curzi and Olper, 2012; Hallack and Sivadasan, 2011).

Two important elements of this trade literature are relevant when considering the case of GIs. First, to the extent to which the EU GI regulatory policy effectively induces a process of product quality upgrading, then we have quite clear predictions about its trade effects. That is, firms adopting a GI quality policy, and thus producing higher quality goods, on average, should export more through both the extensive and intensive trade margins. In addition, because export price is increasing in the marginal cost and thus in the quality of the exported goods, we expect that firms exporting GIs will charge, on average, higher export unit values.

Second, an overwhelming difficulty of this literature is how to measure the unobserved product quality. Early contributions used as proxy for quality, unit values from trade or firm level data (Baldwin and Harrigan, 2011; Manova and Zhang, 2012), standard certification such as ISO 9000 (Hallak and Sivadasan, 2011), quality rating from wine guides (Crozet et al. 2012), and firms' characteristics linked to product and process innovations (Crinò and Epifani, 2012; Curzi and Olper, 2012). From this perspective, the contribution of the present study is to exploit an important quality policy that institutionalized food quality standards (and labels) at the EU level, in order to characterize the quality of traded products.

3. Data and variables

Our analysis focuses both on intra-EU and extra-EU agri-food trade. The two analyses share the same objective, but they are based on a slight different presumptions. When considering the EU internal market rules, firms face neither tariff nor non-tariff measures when deciding to export in a given EU destination market. Thus, when working with only intra-EU trade our strategy delivers a "clean" test of the potential GI trade effect, ruling out other potential confounding factors. Similarly, to avoid potential bias determined by the progressive EU 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.

When considering extra-EU trade, we focus on import and export flows of EU15 countries. In order to properly identify the GI trade effect, in this context we need to account for the possible overlapping effect of trade policy. Specifically, we account for the presence of non-tariff measures, particularly sanitary and phytosanitary standards (SPS), by relying on a new data set that provides information on WTO notifications of this important source of (possible) trade barriers. This is important because several SPS measures can have trade effects similar to GIs. In addition, we control for *ad valorem* bilateral tariffs using data coming from the UNCTAD-Trains database. This analysis allows us to assess, from the export side, whether the supposed higher quality of EU GI products is recognized outside the EU market, irrespective of whether these market have their own GI policy or not. Considering the import side, our analysis is aimed at better understanding if the presence of GIs in the EU market represents a trade hurdle for extra-EU exporting firms, due to the higher quality competition induced by the EU GI policy.

It is important to keep in mind that when working on external EU trade, the analysis raises some questions about the cross-country comparability of the GI measure, given the current impossibility to construct a GI variable, accounting also for information at sectoral/product level for the extra-EU trade partners. However, it is important to highlight that this limitation only affects the comparability of (intra-EU vs extra-EU) results, when both trading partners are GI producers. In other words, the estimated GI effect when *only* the exporter or the importer are GI producers, *ceteris paribus*, are comparable in the two analyses, and, thus, potentially informative and interesting.

3.1 GI policy indicator

An important effort of this paper has been devoted to the GIs classification in accordance with the Harmonized System (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 geographical indications, we selected all the PDO/PGI registered from 1996 to 2014. Since the DOOR database does not classify products with any official (trade) classification, we matched manually each of the registered GIs with the corresponding HS classification at the 6-digit level. In addition, with the aim of minimizing 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.[11]

Overall, the DOOR dataset at the time of the data extraction (2016), included 1,281 registered GI products, 52.69% PGI and 47.31% PDO. The classification methodology does not allow finding an exact correspondence for 51 of these GI products only, which have been consequently excluded from the analysis. The number of GIs registered by the EU15

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

countries is 1,036, correspondent to the 81.26% of total observations in the DOOR, with more than half being PDO products (530).[12] Figure 1 shows a representation of both the number of new PDO and PGI registered each year, and the cumulative number of GIs over the 1996-2014.[13] Overall, two patterns emerge: a strong yearly variation in the number of new registered GIs and the steadily increase of the total number of GIs over the observed period.[14]

The cross countries distribution of GIs is quite concentrated. More than 80% of GIs is indeed produced in only five countries: Italy, France, Spain, Portugal and Greece (see Table A.1 in Appendix). Considering the HS 2-digit sectors, six of them (Dairy, Meat, Vegetables, Fruit, Oils and Meat & Fish preparations) represent 85.87% of total GIs, 92.12% of PDOs, and 79.33% of PGIs.[15] In addition, the GI product lines associated with these six HS 2-digit sectors account for a relevant trade share, representing more than 25% of total intra-EU agri-food trade.[16] By contrast, in the others residual HS 2-digit sectors, trade associated to product lines with GIs are, on average, below 4% of intra-EU trade in these product lines. Thus, in the empirical analysis, we focused the attention on these six HS 2-digit sectors.

Our final GI variable used in the empirical analysis is the total number of GIs of a country in a specific HS 6-digit product line, obtained summing up all the GI products that are present in the country in that specific product line, in year *t*.

Because in the last decade a few non-EU countries have progressively implemented a GI food quality policies, we collected also information to classify GI products of the EU trading partners, accordingly.[17] However, we encountered difficulty in collecting this information at the product line level. Thus, when working with the external EU trade we are force to classify non-EU countries just as producers or not of GIs using a simple 0/1 dummy, losing the product line information. As a matter of fat, this data limitation renders the comparability of

[12] It is worth noting that any change in the GI regulation or any amendment introduced in all the registered GIs does not lead to a replacement of an "old" GI product with a new and upgraded one. Once a new GI is registered, the DOOR database keeps track of all these kind of changes, which are then shown within the relevant documentation in each GI own web page. As a consequence, a new GI appears in the list of registered GI products only once. From this perspective, a double counting in our GI variable is not possible.

[13] 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).

[14] It is worth noting that the time span between the date where an application gets the certification and the date when the GI is then registered, varies case by case. This difference is mainly based on bureaucratic issues (e.g. imperfect documentation) or for instance on complains raised by other EU member countries.

[15] Note that, although official numbers do not exist, there exists conventional wisdom that the total share of the value of production and trade of these products over all the EU GIs is well above these numbers. This is because the percentages presented above are computed considering solely the number of GIs, rather than the value of their production or export.

[16] 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.

[17] More specifically, in the construction of the dataset on extra-EU GIs we used the World Intellectual Property Organization (WIPO) statistics, integrated with other information searched at single country level. Here two examples: i) the Japan GI policy, (www.maff.go.jp/e/policies/intel/gi_act/) that entered into force in 2015; ii) Café de Colombia (www.cafedecolombia.com) that entered into force in 2007.

the intra-EU vs. extra-EU trade analysis, less than perfect but still informative as discussed above.

Table A.2 in the appendix lists the countries with a GI policy "comparable" to the EU one, and the respective year that has seen the first GI product registered.[18] Sources of these information come from single country reports on the GI and from the World Intellectual Property Right (WIPO) reports on Geographical Indications.

3.2 Trade data and other measures

The overall sample contains information at the HS 6-digit level on intra-EU15 and extra-EU15 bilateral trade flows from 1996 (the first year of GIs registration under the EU regulatory system) until 2014.[19] 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 results when we measure the extensive and intensive trade margins, where exports from all the world countries is used (see Appendix B).

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. For an application of these decomposition to agro-food trade, see Scoppola et al. (2018); Appendix B presents how these trade margins are derived and formally computed.

In addition to the variable described above, as already mentioned, the extra-EU analysis considers also ad-valorem bilateral tariffs, taken from the Unctad-Trains dataset, and a proxy

[18] Note, out of 40 extra-EU trading partners used in the analysis, only 8 have in place a GI policy (see Tables A2 and A3).
[19] Non-European countries included in the extra-EU analysis account globally the 80% of extra-EU trade. The 40 extra-EU countries are listed in Appendix, Table A.3.

for NTMs, based on the WTO notifications of SPS measures. The SPS data, that does not have a bilateral dimension, are based on the WTO I-TIP database which reports countries' NTMs notified at the WTO, and accounts in our analysis for the number of SPS measures at the HS 4-digit level in each importing country.

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 results to be neither producer nor exporter of the goods, based on FAOSTAT and EUROSTAT Prodcom data.[20]

Figure 2 reports the average values of trade margins computed as in equation B1 and B2 reported in Appendix B, for both intra-EU (top panel) and extra-EU (bottom panel) trade, averaging over the agri-food sectors considered. Intra-EU countries producing GIs increase systematically the number of exported varieties (extensive margin) passing 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 reduced the level of extensive margin in the observed period. Both groups of countries have increased their intensive margin, but with a different pattern: for GI exporter countries the intensive margin of trade increases more than three times. When considering extra-EU trade a similar pattern emerges, although now the difference between the growth rate of the extensive and intensive trade margins for GI- versus non-GI producers are less remarkable than the one highlighted in the case of intra-EU trade.

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

4. Empirical model and identification

Our empirical strategy envisages to test the trade effect of the EU GI policy, both on the intra-EU and extra-EU markets, through a decomposition of country-product trade data in their respective extensive and intensive trade margins, and considering also export prices (expressed as f.o.b. unit values). As it is shown by Helpman et al. (2008) and Santos Silva et al. (2014), predictions coming from a firm-level trade models 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.

[20] After this procedure, the percentage of zero trade flows at HS 6-digit level is 70%, while at HS 2-digit level is 18%. Moreover, for extra-EU analysis only, we limit the dataset to non-EU countries that globally account for the 80% of food trade with the EU countries.

Our benchmark specification, when considering intra-EU trade, can be written as:

(1) $$lnX_{od,ht} = \beta_0 + \beta_1 GI_{o,ht} + \beta_2 GI_{d,ht} + \beta_3 GI_{od,ht} + \\ + \epsilon_{d,t} + \epsilon_{o,t} + \epsilon_{od} + \epsilon_{ht} + \epsilon_t + \varepsilon_{od,ht}$$

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.[21] 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.[22] $GI_{o,ht}$ represents the number of GIs in the exporting country in a given product line, 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.[23]

In the equation (1), the terms $\epsilon_{d,t}$ and $\epsilon_{o,t}$ are the importer- and exporter-time fixed effects (FE); ϵ_{od} are the country-pair fixed effects; ϵ_{ht} and ϵ_t are the product-time and year fixed effects, respectively. Finally, $\varepsilon_{od,ht}$ is the error term. It is important to note that the inclusion of origin and destination time FE, product-time FE and bilateral FE, leads the β_1, β_2 and β_3 coefficients on the GI variables to identify the trade effects exploiting the within country-pair product line variation in the number of GIs (relative to non-GI product lines), accounting for any unobserved heterogeneity at the country, bilateral, sector/product and time level. Thus, our research design is close to a difference-in-difference identification strategy.

It is worth noting that we do not have information on the share of trade attributable to GIs in none of the considered HS 6-digit product line, and, thus, we are not able to disentangle the GI vs. non-GI effect within the same product line. However, it is reasonable to assume that a higher number of GIs in a product line, tends to be positively correlated with the share of GI trade in this line. From this perspective, one may argue that our dependent variables are

[21] Note that we have defined the product h as a generic product category, although it will present two different levels of aggregation. Specifically, h will be defined as HS 2-digit product line in the intensive margin, the extensive margin, and the overall trade (defined as combination of the two margins) equations. By contrast, h will be defined as HS 6-digit product level in the trade and price equations.

[22] 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.

[23] Note that by using the number of GIs in a given country-product line, rather than a dummy variable approach as in Sorgho 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 of our identification strategy.

measured with errors.[24] However, when the measurement error occurs in the dependent variable, and it is statistically independent from the explanatory variables, this causes a higher asymptotic variance and lower t-statistics, with respect to the case where it would have been not measured (Wooldridge, 2009: 316-318). As a consequence a measurement error in our dependent variables, if any, would lead to an attenuation bias in our estimations.[25]

When focusing on extra-EU trade, our empirical model is slightly different:

(2)
$$lnX_{od,ht} = \beta_0 + \beta_4 GI_{o,ht} + \beta_5 GI_{d,ht} + \beta_6 GI_{o,ht} * dGI_{d,t} + \beta_7 GI_{d,ht} * dGI_{o,t} + \\ + \gamma\, T_{od,ht} + \epsilon_{d,t} + \epsilon_{o,t} + \epsilon_{od} + \epsilon_{ht} + \epsilon_t + \varepsilon_{od,ht}.$$

In particular, the variable $GI_{o,ht}$ ($GI_{d,ht}$) now represents the number of GIs in the exporting (importing) EU country-product line, while $dGI_{d,t}$ ($dGI_{o,t}$) is a dummy equal to 1 if the extra-EU importing (exporting) country has a GI policy in place at time t, and zero otherwise.[26] The interaction of these two variables allows us to distinguish the GI effect on EU trade flows whether extra-EU importer (exporter) country produces GIs or not.[27] Finally, the term $T_{od,ht}$ in equation (2) includes policy related trade costs, i.e. bilateral tariffs and NTMs as discussed above.

Given the well-known problem of many zeros in bilateral trade and the panel structure of our datasets, both equation (1) and (2) are estimated by using the Poisson Pseudo Maximum Likelihood (PPML) estimator, to avoid the incidental parameter problem of the first stage (Probit) Heckman selection model in a panel fixed effects context. 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.[28] In addition, as robustness check, we also perform instrumental variable (IV) regressions with the purpose to control for potential endogeneity bias due to reverse causality. As discussed better

[24] There might be the case that a GI is not exported or internationally traded. It is worth noting that in the occurrence of this situation does not lead to a measurement error in our explanatory variable. This is because our GI variable does not proxy for the number of GIs that are internationally traded and we do not make any assumption on this issue. We observed and measure the number of new GIs that a country registered in each tariff lines - irrespective whether these GIs are exported or not - leaving to the data to speak about their possible trade effect.

[25] Note in addition that, the actual structure of trade data allows us to test a difference-in-difference model, by comparing our trade outcomes pre- and post-introduction of a new GI. If GIs would have their own code, it would be not possible to estimate such an empirical model.

[26] Note that we do not have information on which products are produced by extra-EU countries under the GI policy. Our dummy variable allow to distinguish only between countries that have introduced their own GI policy in the considered period, and those that do not have any GI policy. The non-EU countries with a GI policy in place, and the year of implementation, are reported in Table A.2.

[27] The $dGI_{o,t}$ ($dGI_{d,t}$) term is omitted from the equation as it is already accounted for by the exporting (importing) country-time dummy.

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

below, in the IV regressions the number of GIs is instrumented by the (average) number of GIs in adjacent industries.

5. Econometric results

All regressions are estimated through the PPML approach considering two sets of specifications that differ for the level of products aggregation. First of all, we present our results testing the GI trade effect on intra-EU trade. Second, we propose a similar analysis considering extra-EU trade.

5.1 The effect of GIs on intra-EU trade

Table 2 summarizes our main results when considering overall intra-EU15 trade, by pooling data across all the HS 2-digit sectors considered in the analysis.[29] Column (1) reports the results for the extensive margin of trade. The effect of a new GI in the exporting country is positive and significant (p-value<0.01) when the importer does not produce any GI. Instead, the GI effect is negative when only the importer or both countries are GI producers, although the effect is insignificant in the latter case. Quantitatively, a new GI in the exporting countries increases the 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 suggests the existence of a positive GI trade effect driven by the extensive margin, i.e. the creation of new trade routes. This result is consistent with what has been observed by Agostino and Trivieri (2014) for wines and by Duvaleix-Tréguer et al. (2018) for French cheese, with the important qualification that this effect holds true, *on average*, for all the main sectors characterized by GIs.

Considering the impact of GIs on the intensive margin of trade (column 2), 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. Quantitatively, the magnitude of the estimated effects suggests that a new GI produced in the importing country, when the exporting country does not produce any GI, reduces the intensive margin by about 1.4% points. When only the exporting country

[29] Because the model is, *de facto*, a bilateral gravity equation, bilateral variables such as distance, contiguity, language etc. could be included in the model in spare of 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 insignificance effect of these bilateral variables in the context of intra-EU trade.

produces GIs, the intensive margin increases by about 1% points. Finally, when both countries produce GIs, one additional certified product increases the intensive margin by 0.3% points. All these effects are significant at the 1% level. Finally, column 3 presents the results relative to overall trade, here defined as the product of the extensive and intensive trade margins.[30] The overall pattern and magnitude of the effects are similar to the ones detected for the intensive trade margin.

Until now we worked at HS 2-digit level, a level of aggregation imposed by the necessity to measure the two margins of trade. This level of aggregation when working with the overall trade could induce aggregation bias. For this reason, in column (4) we report results by estimating the GI effect on overall intra-EU trade at the HS 6-digit level. Confirming our expectation, the results although point in the same direction are quantitatively different, with a magnitude of the estimated effect (in absolute terms) significantly greater. Now, a new GI in the exporting country HS 6-digit tariff line, induced a trade increase of about 3.9% points (p-value<0.01) in comparison to HS 6-digit tariff lines without GIs.[31] From an economic point of view, this it is not an irrelevant effect. As before, the adoption of a new GI enhances trade when both countries produce GI (+ 1,8%), but it acts as a trade reducing measure when GIs exist only in the importer country (–5.2%), *ceteris paribus*.[32] All these effects are estimated with high precision (p-value<0.01).

Column 5 of Table 2 presents the results concerning the GIs effect on exports' unit values. This focus 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. Our results suggest that when GIs are produced by the exporter country only, or by both countries, the EU quality policy induces a statistically significant increase in the export unit values, with a semi-elasticity of 0.72% and 0.44% points, respectively.[33] In contrast, the presence of GIs in the importer countries only is associated to a significant reduction of countries' export unit values (–0.32%). It is worth nothing that the last result cannot be rationalized by any theoretical model. However, a possible interpretation

[30] Indeed, as shown by equation B3 in Appendix B, the product of the two margins equals bilateral trade, when country and sectoral fixed effects are included in the equation.

[31] We also estimate the GI effect on overall trade separately for each of the HS 2-digit sectors considered in the analysis. The results are presented in Appendix (Table A.4). It is worth noting that while the trade promoting effect is largely confirmed in all the considered sectors, the effects when only the importing countries present GIs are more heterogeneous. Note in addition that the magnitude of the obtained results are not strictly comparable across sectors, although the sectoral specification does not constraint country-pair fixed effects to be equal across sectors.

[32] We also check whether, when both countries produce GIs, the GI trade effect is mainly driven by new GI in the importer or exporter country. Results show very similar effects (see Table 2.bis in the online Appendix). Thus, the $GI_{od,t}$ positive effect on trade occurs independently of its origin.

[33] Note that, as before, the estimated coefficient of the price equation captures the variation in average unit value after a new GI is introduced, in a certain product line, in comparison to the average unit value of non-GI product lines.

is that countries exporting non-GI products in country-sectors characterized by the presence of GIs, where the quality competition is fiercer, may opt for a price-competition, rather than to compete on quality.[34]

These results have relevant implications, as they suggest that the adoption of the EU quality policy allows a clear process of quality upgrading. Indeed, as showed 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 (country of origin) quality differentiation, these results seem to confirm the effectiveness of the EU GI 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. In fact, since exporters cannot compete on the level of quality set 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 clearly welfare implication for the EU consumers, as they may perceive imported non-GI products as a cheaper alternative of domestic GI products.

A comparison of our results with previous findings is not easy, as, to the best of our knowledge, there are no published papers in the literature working on such a large scale sample of products (and time) 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 products on the EU countries' border effect (i.e. the external to 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) is the only GI producer, they find a weak negative (positive) trade effect, thus exactly the opposite of our results. Differences in the data used (aggregated vs disaggregated), and the econometric approach (cross-sectional vs panel data) are probably at the roots of these differences in results.

5.2 GIs effects on extra-EU trade

Table 3 summarizes our main findings considering the effect of the diffusion of GIs on the intensive and extensive (extra-EU) trade margins (measured at HS-2 digit level), as well as on total trade and export unit values (as before considered at the HS 6-digit level). The key difference of extra-EU regressions are that now we include controls for trade policy, namely tariffs and SPS standards. In addition, as explained in the specification section, when working

[34] Similarly to the case of overall trade, also in the case of unit value we test the GI effect separately for each of the HS 2-digit sectors considered in the analysis. The results are shown in Appendix A.5. The above patterns obtained on the pooled sample are often confirmed, with the main exception of the significant and negative effect for fruits in the first row of Column (4).

with external-EU trade we are forced to measure the presence of GIs in the non-EU destination countries, with a country 0/1 dummy, and this clearly reduces somewhat the comparability of the two analyses, at least from this perspective.

Starting with the additional controls included in these extra-EU trade regressions, as can be seen at the bottom of Table 3, both tariffs and SPSs systematically exert a negative effect on both trade margins (columns 1 and 2), and on overall trade (columns 3 and 4). In addition, the effect on export unit value of both tariffs and SPSs variables are positive, as expected, but only the SPS estimated coefficient is statistically significant.

Similarly to intra-EU trade, the results on the extensive trade margin confirm that a new GI in the EU exporting country, on average, increases the number of (extra-EU) exported varieties (see column 1). The magnitude of these effect suggests that a new GI induces an increase of around 0.6%[35] or 0.2% points of the extensive margin, depending on whether the importer country recognizes GIs or not, respectively. Interesting, the size of these effects are of the same order of magnitude with the result obtained for intra-EU trade and is qualitatively similar with results reported in Duvaleix-Treguer et al. (2018).[36] In contrast, the effect of a new GI in 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% points), with the largest reduction detected when the non-EU exporting country produces GIs.[37]

Column (2) reports the impact of GIs on the intensive margin of trade. The results partially confirm the export-creation and import-reducing effect of EU-GIs. However, the positive impact of a new GI on the volume of products already exported by the EU, 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 producing GIs. The last results is somewhat counterintuitive in comparison to what we find at the EU level. However, it is important to bearing in mind that when working at the extra-EU level, the extent to which non EU countries are GI producers can be only measured at the country, instead of country-product, level rendering the comparison problematic.

The impact of GIs on overall trade, as defined in column (3) by combining the extensive and intensive margins, confirms the above findings. The addition of a new GI increases EU countries exports' of 2.88% (1.96%), and reduces European imports of 3.47% (1.60%),

[35] This results is obtained by adding to the coefficient relative to GIs-EU-exporter (0.018), the one concerning the GIs-EU-exp. * $dGI_{d,t}$, namely when the non-EU importing countries produce GIs (0.041).

[36] To test if the use of the extensive margin measured with the Feenstra and Kee (2008) approach drives previous results, we estimate also the export probability using a linear probability model (LPM) with the dependent variable equal to 1 when trade flows are positive, and zero otherwise. The results confirm the sign of the GI variables also over export probability (see Table 3.bis in the online Appendix).

[37] Numerically: 0.0163+0.0125=0.0288.

depending on whether (or not) extra-EU countries have their own GI policy, respectively. Note that, the export-increasing effect is explained by both the increase of the intensive and extensive margins, instead the import-reducing effect is mainly the result of the extensive margin of trade. Thus, the production of GIs for an average EU country, 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. In contrast, the negative GI effect on the import side is largely attributable to the extensive margin. The last finding may suggest that for an extra-EU firm, sending a product into the EU market where GIs are present, implies additional fixed costs of exporting, such as specific marketing and promotion costs, to contrast the higher vertical competition in the EU destination.

Column 4 of Table 3 presents the results of running the regression on overall trade at HS 6-digit. A new GI in the EU exporting country significantly increases the external trade of about 7.1% points (p-value<0.01), irrespective whether the destination country do produce or not GIs. When considering the EU as importer, the results suggest a negative and significant effect when extra-EU countries does not produce GIs, and, thus, in line with the results obtained for the intensive trade margin. This negative effect is strongly reduced when the extra-EU exporters produce GIs,[38] a result that once again confirms the presence of aggregation bias when working at HS 2-digit level.[39]

Finally, the effects of GIs on extra-EU export unit values are reported in column 5 of Table 3. In line with the results obtained for the intra-EU trade analysis, when GIs are produced by the exporter country, there is a statistically significant increase in the export unit value, that ranges from an average increase of the EU 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. In contrast, the presence of GIs in EU-importer country seems to be not associated with any significant variation on import unit value.[40]

5.3 Robustness check: IV regressions

Our results presented so far are based on econometric specifications that use country-pair, country- and sectoral-time fixed effects. As it is well known from the empirical trade

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[38] Numerically: -0.2105+0.2058=-0.0047

[39] We run the same estimation, as in column 4, separately for each of the considered HS 2-digit sectors. The results are shown in Appendix, Table A.6, and confirm a positive GIs trade effect in all the considered sectors; by contrast, the import side negative (and significant) effect of GIs is detected only for dairy, fruits and preparation of fish sectors. Note that, due to convergence problems, we run these sectoral equations using an OLS estimator and positive trade flows (log(trade)).

[40] The results obtained considering each sector separately are presented in Table A.7. Overall they confirm the above findings when we consider the (positive) effects over EU-export unit value, with the only exception of the fruits sector where we find a significant and negative effect (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. As for Table A.6 we run these equation using OLS estimator.

literature (see Baier and Bergstrand, 2007) this specification strongly reduces the risk of endogeneity bias due to selection and omitted variables. However, the interpretation of our findings as causal is still problematic if endogeneity bias due to reverse causality is at work. This problem may be induced, for example, in situations where the decision to create and joining a particular GI certification is also the consequence of the *past* level of market share and of the reputation gained by the exporting firms producing a particular product. Indeed, though many EU GIs are of relatively recent origin, in some circumstances GIs have ancestral origins that predate the enactment of the EU regulatory system (Lence et al., 2007).[41] This mechanism may lead to biased results symmetrically in both the exporter and importer side.

Addressing this source of endogeneity bias is challenging, because finding good instruments for the diffusion of the number of GI to run an instrumental variable (IV) regression is difficult. Following Chen and Mattoo (2008) and Fontagnè et al. (2015), the strategy we propose is to instrument the number of GIs in each HS 6-digit product, by using the (average) number of GIs in adjacent industries, i.e. industries classified in the same HS 2-digit sector, excluding the number of GIs of the instrumented HS 6-digit product line. The intuition is that if there is a GI in a certain product line, it is likely that a GI will be also present in products that are similar, i.e. products in the same HS 2-digit.

As discussed by Chen and Mattoo (2008), this is a plausible instrument for two main reasons. First, agri-food sectors classified in the same HS 2-digit industry – such as cheese and butter, or apples and pears – are likely to have similar characteristics, some of which may influence the diffusion of GIs. Second, the number of GIs in an adjacent industry, should not be *directly* correlated with the trade volume in another particular industry. Of course, there can be also reasons why the instrument is not fully exogenous. First, because pre-existing trade can cause GIs at the 2-digit level,[42] and secondly because the high level of GI concentration in few countries, increases the probability of finding GI in adjacent industries in those countries, raising potential problems for our instrument. However, note that, even in this case, namely when the instrument is not fully exogenous, our IV strategy can be at least informative to understand the direction of the endogeneity bias in OLS regressions, i.e. whether our previous results are over- or under-estimating the true GI effect.

[41] Consider the case of a GI in the exporting country. The addition of a GI in a very competitive country-product line may indeed lead to reverse causality since the estimated increase in exports may be due either to an actual increase in that product due to the adoption of the policy, or because the GI has been introduced in a country-product line already competitive in the past.

[42] We account for this potential additional issue following what suggested by Wooldridge (2002) and implemented by Baier and Bergstrand (2007). Specifically, we regress our dependent variables on lagged and forward values of our instruments, to see whether pre-existing trade causes GIs at the 2-digit level. The results confirm that the forward GI at t+1, is never statistically significant, i.e. GIs changes are strictly exogenous to trade flows changes (see Table 4.bis in the online Appendix).

The very high number of fixed effects included in our specification forced us to run the IV regressions using a least square estimator, instead of the PPML one, due to convergence problems.[43] In column (1) and (3) of Table 4 (Table 5), we show the results obtained from the estimation of our main equation through OLS for intra-EU (extra-EU) trade. These results suggest that a change in the estimation procedure (from PPML to OLS) induces only minor changes in the parameters previously estimated and reported in columns (4) and (5) of Table 2 (Table 3), rendering our IV strategy informative.

The first-stage of the IV regressions suggests that our instruments explain a relevant variation of the number of GIs in contiguous sectors (see Appendix C). The first-stage F-statistic is indeed systematically higher than the critical value of 10, rejecting the risk of weak instruments (Stock and Yogo, 2005). Considering intra-EU trade, the second-stage IV results for the overall trade reported in Table 4 (Column 2) strongly confirm our findings when GIs are produced by the exporters only, or when both countries produce GIs. The magnitude of the IV estimated effect show that, if any, previous results tend be bias downward, namely the *true* GI export-promotion effect is probability larger in magnitude when simultaneity bias are controlled for. Differently, when GIs are produced by only the importing country, previous findings appear to be less robust. In fact, the estimated effect turns from negative to positive when IV regression is implemented, although this effect is not statistically different from zero. Thus, the import-reducing effect of GIs appears to be sensitive to the estimation method, suggesting that we cannot derive clear conclusions from this side.

The results of the IV regression for the export unit value (column 4) show robust GIs price effects when GIs are produced by both countries. In contrast, when only exporters produce GIs the results show a barely-significant price effect and this effect is mainly driven by the fruit sector.[44] In fact, by removing from the IV regression the HS 08 sector, the estimated GI effect on export unit value turns out to be significant at 1% level (Column 5).

The second-stage IV results for extra-EU GIs impact are presented in Table 5. Overall when the GI effect is measured considering EU exports, IV results are totally consistent with the OLS ones. Importantly, as in the intra-EU case, the magnitude of the IV effect suggest that the direction of the bias of our baseline regressions, if any, tends to be downward. Thus, the positive effect of a new GI on extra-EU exports and unit value appears to be robust to

[43] Specifically we use the STATA command *reghdfe* (high dimensionality fixed effects) that in its PPML version does not yet include the IV option. Note that, using the IV estimator we run the trade regression including only positive trade flows as the dependent variable is now transformed in log (trade) and the log of zero is indefinite. Clearly, this is not the case for the export unit value equations, where zeros are not present.

[44] Indeed, as discussed above (see footnote 39), in the fruits sector the presence of GIs in the exporter country displays an unexpected negative and significant effect on the export unit value (see Column 4, Table A.5).

potential endogeneity concerns. By contrast, the results are only partially confirmed when we consider the EU import effect of GIs. Here, an additional GI in an HS 6-digit line seems to lead to an increase in European imports from the extra-EU countries non-producing GIs and, at the same time, to a reduction of the import unit value.[45] Thus, on the import side, overall, the IV results suggest that our findings are less robust for both the intra and extra-EU trade.

6. Concluding remarks

The present paper analyzed the relationship between Geographical Indications and international trade within EU15 countries and between EU15 and extra-EU countries. We exploit an original dataset on GI products classify at HS 6-digit level, to investigate their effects on trade margins (extensive and intensive), and on import and export prices. Econometrically, the GI effect is identified through a difference-in-difference research design, using also instrumental variables approach.

With reference to the research questions put forward in the introduction, our main findings can be summarized as follow: *i.* the EU GI policy does promote export of agri-food products; *ii.* On the import side, the EU quality policy may, eventually, incorporate some *weak* trade reducing elements; *iii.* our results show a positive GI effect on the price of exported agri-food products; *iv.* the EU GI policy proved to affect similarly intra-EU and extra-EU trade, although with some caveats on the comparability of the two set of results.

Two main economic implications can be drawn from these econometric results. First, the strong GI export-promotion effect uncovered by the analysis appears fully consistent with firm-heterogeneity trade models that emphasized heterogeneity in products quality as main drivers of export performance. In fact, our findings showed that country-sectors producing more GIs have higher export unit values, namely export higher quality goods, and export more through both the extensive and intensive trade margins, according with the predictions of quality sorting models (e.g. Crozet et al. 2012). Second, our results do not clearly support an anti-competitive trade effect of GIs on the import side. Baseline regressions do show that the diffusion of GIs in the importing countries seems to act like a non-tariff measure. However, this finding is not supported by instrumental variable regressions, for both intra-EU and extra-EU trade flows. This nuance effects of GIs on the import side, is also reinforced by the weak effect on the import unit values, that switch from negative to positive or to insignificant on passing from the PPML specification to the IV one.

[45] Similar to the intra-EU trade, this finding could suggest that, due to the increasing quality of products in the EU importing countries, extra-EU countries non-producing GIs progressively decide to opt for a price competition, as they cannot compete on quality.

The present analysis has several caveats, mainly related to the difficulty of tracing in the data if the traded products are GIs or not. This forces researchers who have the objective of capturing the GI trade effect, to use proxy for the GI relevance, such as their number as in the present study. However, this approach may overlook important economic dimensions related to the GI weight and potential for international trade. This is an overwhelming problem of current production and trade statistics, that can be only solved at an institutional level. From this perspective, a key direction for future researches on the GI trade effect should be to exploit (custom) micro-data matched with GI certified firm-level information. A movement in this direction may significantly improves our understanding of the mechanisms governing the GI trade effects.

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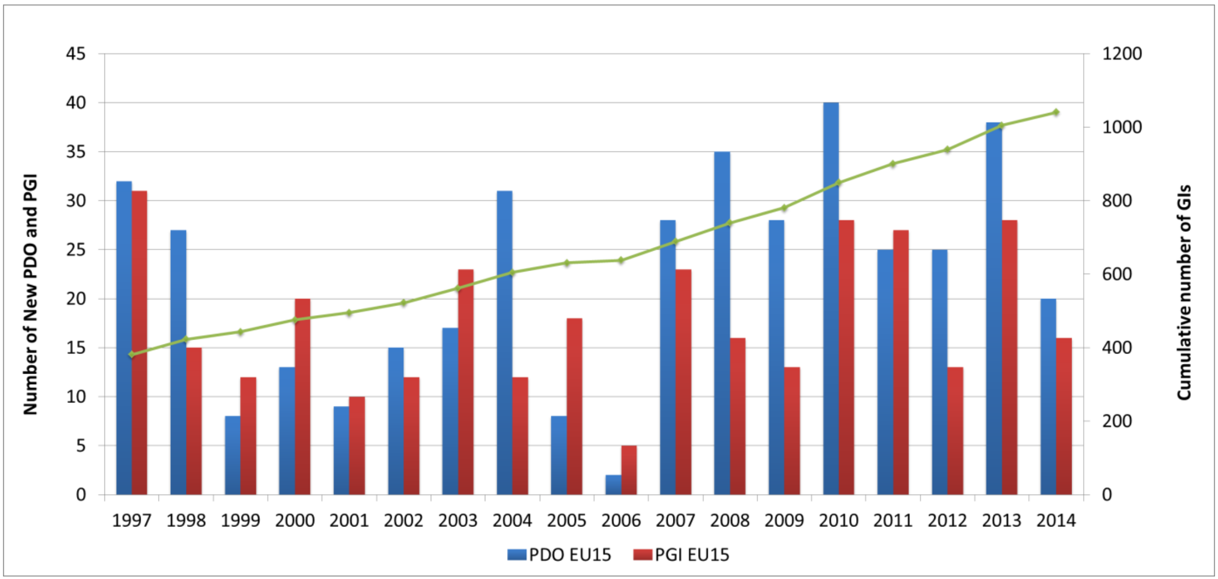
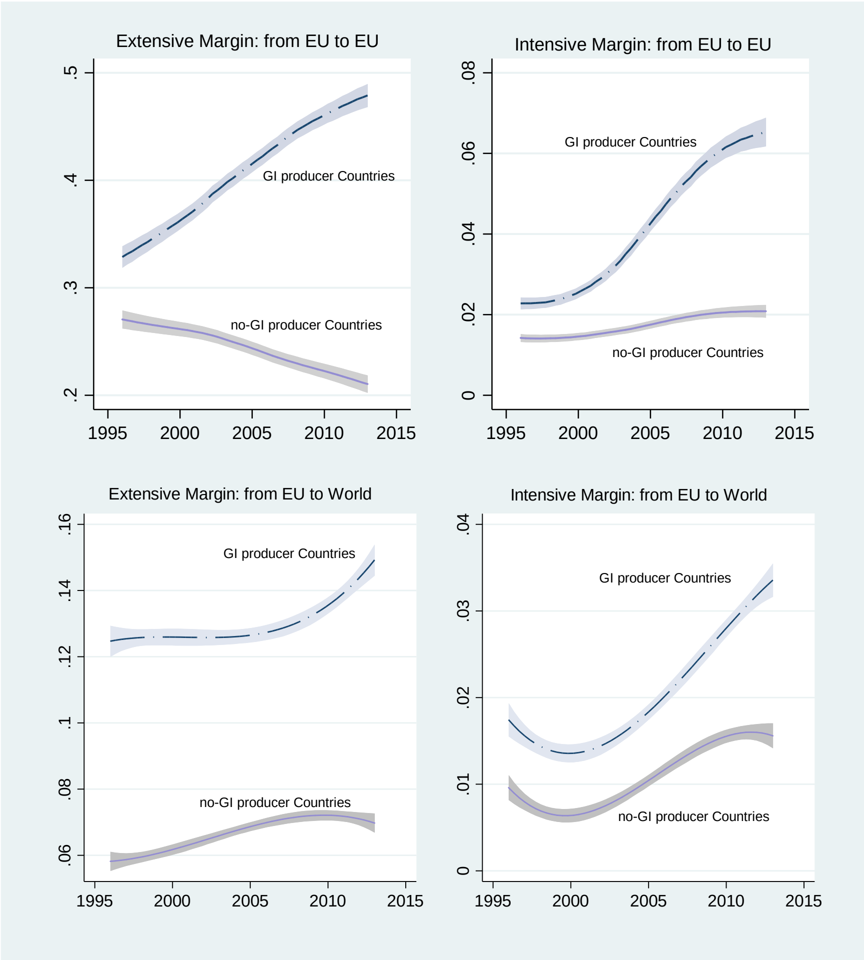
Figures

Figure 1. Distribution of GIs by year of registration



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

Figure 2. Extensive and Intensive trade 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) margin, and their 95% confidence interval (computed using Stata's command for local polynomial smooth plots with CIs lpolyci), calculated across GI and no-GI producer countries both for intra-EU and extra-EU trade.

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. Effects of GIs on intra-EU trade outcomes

Dependent variable:	Extensive Margin	Intensive Margin	Trade Ext*Int	Trade	Unit Value
				Main sectors	
	(1)	(2)	(3)	(4)	(5)
Gis – exporter	0.0027***	0.0118***	0.0102***	0.0393***	0.0072***
	(0.0002)	(0.0010)	(0.0011)	(0.0028)	(0.0005)
Gis – importer	-0.0008**	-0.0138***	-0.0168***	-0.0521***	-0.0032***
	(0.0004)	(0.0018)	(0.0020)	(0.0118)	(0.0006)
Gis – both	-0.0001	0.0035***	0.0024***	0.0182***	0.0044***
	(0.0001)	(0.0005)	(0.0005)	(0.0026)	(0.0003)
Dummy:					
Importer-year	yes	yes	yes	yes	yes
Exporter-year	yes	yes	yes	yes	yes
Importer-Exporter	yes	yes	yes	yes	yes
Product-year	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
No. of obs.	88,550	88,550	88,550	917,566	452,446
Adj R^2	0.62	0.46	0.58	0.22	0.52

Notes: The table reports PPML regressions. Extensive and intensive margins are measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). All the regressions include data on the following sectors: HS 02, 04, 07, 08, 15, 16. Columns 1 to 3 use HS 2-digit sector data and report (in parenthesis) robust standard errors clustered by country pairs-product HS 2-digit. Columns 4 and 5 use HS 6-digit product data and report robust standard errors clustered by country pairs-product HS 6-digit. Constant and fixed effects not reported.

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

Table 3. Effects of GIs on extra-EU trade outcomes

Dependent variable:	Extensive Margin	Intensive Margin	Trade HS 2-digit	Trade HS 6-digit	Unit Value HS 6-digit
	(1)	(2)	(3)	(4)	(5)
GIs–EU–exporter	0.0018***	0.0216***	0.0196***	0.0710***	0.0054***
	(0.0004)	(0.0016)	(0.0014)	(0.0073)	(0.0008)
GIs–EU–exp * $dGI_{d,t}$	0.0041***	0.0011	0.0092***	-0.0060	-0.0034**
	(0.0012)	(0.0031)	(0.0031)	(0.0113)	(0.0014)
GIs–EU–importer	-0.0163***	0.0007	-0.0160***	-0.2105**	0.0010
	(0.0007)	(0.0024)	(0.0020)	(0.0906)	(0.0036)
GIs–EU–imp * $dGI_{o,t}$	-0.0125***	-0.0226***	-0.0187***	0.2058**	-0.0018
	(0.0016)	(0.0042)	(0.0041)	(0.0875)	(0.0064)
log(1+tariff)	-0.7742***	-0.5607***	-0.5310***	-0.9155***	0.0101
	(0.0218)	(0.0849)	(0.0799)	(0.3515)	(0.0305)
Log(1+SPS)	-0.1037***	-0.1669***	-0.2040***	-0.2000**	0.0420***
	(0.0063)	(0.0235)	(0.0230)	(0.0991)	(0.0091)
Dummy:					
Importer-year	yes	yes	yes	Yes	Yes
Exporter-year	yes	yes	yes	Yes	Yes
Importer-Exporter	yes	yes	yes	Yes	Yes
Product-year	yes	yes	yes	Yes	Yes
Year	yes	yes	yes	Yes	Yes
No. of obs.	148,364	148,364	148,364	638,512	447,840
Adj R^2	0.62	0.46	0.55	0.21	0.49

Notes: The table reports PPML regressions. Extensive and intensive margins are measured using the theoretically-founded decomposition of trade proposed by Feenstra and Kee (2008). All the regressions include data on the following sectors: HS 02, 04, 07, 08, 15, 16. Columns 1 to 3 use HS 2-digit sector data and report (in parenthesis) robust standard errors clustered by country pairs-product HS 2-digit. Columns 4 and 5 use HS 6-digit product data and report robust standard errors clustered by country pairs-product HS 6-digit.

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

Table 4. GI effects on Intra-EU trade and export unit values: instrumental variables (IV) regressions

Dep. variable:	Log(Trade Flow)		Log(Unit Value)		
	LSDV	IV	LSDV	IV	IV
	(1)	(2)	(3)	(4)	(5)
GIs - exporter	0.1097***	0.2377***	0.0075***	0.0092*	0.0183***
	(0.0095)	(0.0370)	(0.0013)	(0.0053)	(0.0054)
GIs - importer	-0.0279***	0.0091	-0.0022*	0.0069	0.0073
	(0.0072)	(0.0356)	(0.0012)	(0.0051)	(0.0054)
GIs - both	0.0433***	0.0824***	0.0048***	0.0136***	0.0153***
	(0.0072)	(0.0215)	(0.0009)	(0.0027)	(0.0028)
No. of obs.	452,446	452,446	452,446	452,446	358,702
Adj R^2	0.44	0.44	0.66	0.66	0.66

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. In Columns (1) and (3): Least Squares with Dummy Variables (LSDV) estimator; in columns (2), (4) and (5) instrumental variables regression (see text); in column (5) the regression omits the HS 08 sector. All regressions include importer/exporter-year FE, product-year FE and bilateral FE. Constant and fixed effects not reported.

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

Table 5. GI effects on Extra-EU trade and export unit values: instrumental variables (IV) regressions

Dep. variable:	Log(Trade Flow)		Log(Unit Value)	
	LSDV	IV	LSDV	IV
	(1)	(2)	(3)	(4)
GIs-EU-exporter	0.0904***	0.1316***	0.0030***	0.0229***
	(0.0014)	(0.0144)	(0.0004)	(0.0049)
GIs-EU-exp*$dGI_{d,t}$	-0.0297***	-0.0533**	-0.0065***	-0.0366***
	(0.0028)	(0.0259)	(0.0009)	(0.0086)
GIs-EU-importer	-0.0260***	0.0422**	0.0056**	-0.0403***
	(0.0058)	(0.0181)	(0.0025)	(0.0066)
GIs-EU-imp*$dGI_{o,t}$	0.0232	-0.0597	-0.0024	0.0441***
	(0.0169)	(0.0411)	(0.0043)	(0.0155)
log(1+tariff)	-0.6999***	-0.7140***	-0.0106	-0.0229
	(0.0305)	(0.0310)	(0.0145)	(0.0147)
Log(1+SPS)	-0.1997***	-0.1987***	0.0420***	0.0446***
	(0.0080)	(0.0081)	(0.0037)	(0.0037)
No. of obs.	497,462	497,462	497,462	497,462
Adj R^2	0.21	0.21	0.39	0.39

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. In Columns (1) and (3): Least Squares with Dummy Variables (LSDV) estimator; in columns (2), (4) instrumental variables regression (see text). All regressions include importer/exporter-year FE, product-year FE and bilateral FE. Constant and fixed effects not reported.

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

Appendix A

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

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. (*) Country included in the final analysis.

Table A.3. Extra-EU countries included in the analysis

Algeria	Korea, South
Angola	Libya
Argentina	Malaysia
Australia	Morocco
Belarus	New Zealand
Bosnia and Herzegovina	Nigeria
Brazil	Norway
Canada	Papua New Guinea
Chile	Peru
China	Philippines
Colombia	Russia
Costa Rica	Saudi Arabia
Croatia	Singapore
Ecuador	South Africa
Egypt	Switzerland
Hong Kong	Thailand
India	Turkey
Indonesia	Ukraine
Israel	United Arab Emirates
Japan	United States

Notes: Non-EU countries included in the extra-EU analysis.

Table A.4. GIs effect on overall trade by sector – intra-EU trade

Trade	(1) Meat (HS 02)	(2) Dairy (HS 04)	(3) Vegetables (HS 07)	(4) Fruits (HS 08)	(5) Oils (HS 15)	(6) Prep.fish (HS 16)
GIs - exporter	0.0515***	0.0380***	0.0945***	0.3395***	0.1225***	0.0577***
	(0.0051)	(0.0063)	(0.0129)	(0.0369)	(0.0041)	(0.0064)
GIs - importer	-0.0576***	0.0060	-0.0008	-0.1623***	-0.1207***	-0.0283**
	(0.0166)	(0.0074)	(0.0370)	(0.0358)	(0.0285)	(0.0120)
GIs - both	0.0635***	-0.0001	0.1216***	0.0930***	0.0921***	0.0199***
	(0.0114)	(0.0008)	(0.0131)	(0.0260)	(0.0031)	(0.0052)
No. of obs.	185,900	95,433	195,026	190,684	158,119	87,456
Adj R^2	0.24	0.39	0.57	0.29	0.71	0.32

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. All regressions include importer/exporter-year FE, and bilateral FE. Constant and fixed effects not reported.

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

Table A.5. GIs effect on exports' unit values by sector – intra-EU trade

Unit Value	(1) Meat (HS 02)	(2) Dairy (HS 04)	(3) Vegetables (HS 07)	(4) Fruits (HS 08)	(5) Oils (HS 15)	(6) Prep.fish (HS 16)
GIs - exporter	0.0148***	0.0111***	0.0059	-0.0848***	-0.0012*	0.0153***
	(0.0014)	(0.0015)	(0.0047)	(0.0088)	(0.0007)	(0.0020)
GIs - importer	-0.0034**	0.0005	0.0102	0.0118*	-0.0069***	-0.0097***
	(0.0014)	(0.0014)	(0.0064)	(0.0067)	(0.0009)	(0.0019)
GIs - both	0.0118***	0.0056***	0.0153***	0.0083	-0.0028***	0.0048***
	(0.0015)	(0.0003)	(0.0053)	(0.0087)	(0.0007)	(0.0008)
No. of obs.	91,892	56,613	93,027	93,744	62,658	54,604
Adj R^2	0.40	0.44	0.33	0.44	0.44	0.21

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. All regressions include importer/exporter-year FE, and bilateral FE. Constant and fixed effects not reported.

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

Table A.6. GIs effect on overall trade by sector – extra-EU trade

Dependent variable: Log(Trade flow)	(1) Meat (HS 02)	(2) Dairy (HS 04)	(3) Vegetables (HS 07)	(4) Fruits (HS 08)	(5) Oils (HS 15)	(6) Prep.fish (HS 16)
GIs-EU-exporter	0.0319	0.0933***	0.1596***	0.5317***	0.0890***	0.0698***
	(0.0234)	(0.0055)	(0.0346)	(0.0651)	(0.0072)	(0.0239)
GIs-EU-exp*$dGI_{d,t}$	-0.0371	-0.0157*	-0.0911	-0.1319	-0.0204**	-0.0172
	(0.0516)	(0.0083)	(0.0657)	(0.1377)	(0.0103)	(0.0391)
GIs-EU-importer	-0.0062	-0.0342***	0.1886***	-0.1396**	0.0207	-0.1428***
	(0.0758)	(0.0093)	(0.0531)	(0.0594)	(0.0168)	(0.0300)
GIs-EU-imp*$dGI_{o,t}$	0.0162	0.0000	0.0059	-0.0016	0.0329	-0.2718*
	(0.1179)	(0.0000)	(0.0876)	(0.1426)	(0.0230)	(0.1608)
log(1+tariff)	-0.5667**	-0.8910***	-0.6786*	-2.4032***	-1.7293***	-0.6843**
	(0.2587)	(0.2574)	(0.3810)	(0.4076)	(0.6296)	(0.3187)
Log(1+SPS)	-0.2156***	0.2905**	-0.6691***	-0.3267**	-0.4597	-0.5249***
	(0.0554)	(0.1130)	(0.2096)	(0.1411)	(0.3252)	(0.1199)
No. of obs.	51,235	52,034	142,206	142,342	29,949	80,909
Adj R^2	0.29	0.33	0.25	0.30	0.40	0.33

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. All regressions include importer/exporter-year FE, and bilateral FE. Constant and fixed effects not reported.

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

Table A.7. GIs effect on exports' unit values by sector – extra-EU trade

Dependent variable: Log(Unit Value)	(1) Meat (HS 02)	(2) Dairy (HS 04)	(3) Vegetables (HS 07)	(4) Fruits (HS 08)	(5) Oils (HS 15)	(6) Prep.fish (HS 16)
GIs-EU-exporter	0.0264***	0.0038***	0.0047	-0.1089***	0.0040***	0.0049
	(0.0069)	(0.0007)	(0.0076)	(0.0141)	(0.0008)	(0.0048)
GIs-EU-exp*$dGI_{d,t}$	0.0208	-0.0008	-0.0158	-0.0202	-0.0079***	0.0051
	(0.0219)	(0.0014)	(0.0223)	(0.0571)	(0.0023)	(0.0069)
GIs-EU-importer	0.0259**	0.0187***	-0.0059	-0.0617***	0.0024	0.0063
	(0.0119)	(0.0048)	(0.0090)	(0.0140)	(0.0062)	(0.0067)
GIs-EU-imp*$dGI_{o,t}$	-0.1756	0.0000	0.0197	0.0035	-0.0100	0.0573***
	(0.1784)	(0.0000)	(0.0164)	(0.0345)	(0.0095)	(0.0194)
log(1+tariff)	-0.1368*	0.1020**	0.0700	0.0824	0.2409*	0.0377
	(0.0764)	(0.0463)	(0.0772)	(0.0844)	(0.1321)	(0.0944)
Log(1+SPS)	0.0294	0.0691**	0.0508	0.1363***	0.0130	0.1847***
	(0.0181)	(0.0290)	(0.0508)	(0.0317)	(0.0687)	(0.0296)
No. of obs.	45,730	49,136	121,044	130,454	27,627	73,148
Adj R^2	0.55	0.54	0.41	0.52	0.58	0.36

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. All regressions include importer/exporter-year FE, and bilateral FE. Constant and fixed effects not reported.

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

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

The decomposition of trade into two margins, originally proposed by Feenstra (1994) and further developed by Hummels and Klenow (2005) and Feenstra and Kee (2008) has two main advantages. The first is that it results theoretically grounded. Indeed, as shown by Feenstra (1994), the two indexes are consistent with the consumer price theory, and can be formally derived by exploiting the property of the constant elasticity of substitution (CES) utility function. The second is because it takes into account the economic weight of the products. Indeed, the use of a simple counting of the number of traded products as measure of the extensive margin, albeit transparent, could be flawed by the assumption that products have the same economic weight.

The measurement of extensive and intensive margins precedes as follow. 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.

Note, moreover, that the product of the two margins equals the share of country *o* on the world exports to *d*:

(B3) $$EM_{odh2,t} * IM_{odh2,t} = \frac{\sum_{r \in R_{od,t}^{h2}} V_{odh6,t}^{h2}}{\sum_{r \in R_{dW}^{h2}} \bar{V}_{dWh6}^{h2}} = \frac{X_{odh2,t}}{\bar{X}_{dh2}}$$

where $X_{odh2,t}$ is the total export of product sector $h2$ from o to d and $\bar{X}_{dh2}$ is total imports of $h2$ by country *d.* Thus the product of two margins equals total bilateral exports as a fraction of the destination country's average (world) imports. In a gravity context, this relation has an intuitive appeal, as the log of coefficients of the extensive and intensive margins added together yields exactly the traditional gravity coefficients, once importer-country-sector fixed effects sweep out the term $\bar{X}_{dh2}$, are included.

Appendix C

Table C1. First Stage of IV regressions of Table 4

	GIs - exporter		GIs - importer		GIs - both	
GIs - exporter	0.3902		-0.0083	**	-0.0250	***
(instrument)	(0.025)		(0.004)		(0.008)	
GIs - importer	-0.0052	***	0.4107	***	-0.0362	***
(instrument)	(0.006)		(0.025)		(0.008)	
GIs - both	-0.0305	***	-0.0410	***	0.6382	***
(instrument)	(0.008)		(0.009)		(0.057)	
No. of obs.	452,446		452,446		452,446	
Adj R^2	0.24		0.20		0.50	
Weak id. F-st	243.61		269.19		120.66	

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. Instrumental GI variables are the (average) number of GIs in the adjacent industries. Weak id. F-st reports the test of Kleibergen-Paap Wald F-statistic. All regressions include importer/exporter-year FE, product-year FE and bilateral FE. Constant and fixed effects not reported.

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

Table C2. First Stage of IV regressions of Table 5

	GIs-EU-Exporter	GIs-EU-exp $*dGI_{d,t}$	GIs-EU-Importer	GIs-EU-imp $*dGI_{o,t}$
GIs-EU-Exporter	0.2217***	-0.0178***	-0.0026**	0.0004**
(instrument)	(0.0077)	(0.0019)	(0.0007)	(0.0001)
GIs-EU-exp $*dGI_{d,t}$	-0.064***	0.3312***	0.001***	0.0002**
(instrument)	(0.023)	(0.0217)	(0.0006)	(0.0001)
GIs-EU-Importer	-0.0393***	-0.0079***	0.7584***	-0.0029***
(instrument)	(0.004)	(0.0008)	(0.0243)	(0.001)
GIs-EU-imp $*dGI_{o,t}$	0.0215***	0.0037***	0.1039***	0.8837***
(instrument)	(0.0052)	(0.0009)	(0.032)	(0.0222)
log(1+tariff)	0.3128***	-0.1491***	-0.0427***	-0.0033***
	(0.0652)	(0.0155)	(0.0041)	(0.0008)
Log(1+SPS)	-0.0125	0.0368***	0.0125***	0.0010***
	(0.0122)	(0.0056)	(0.0014)	(0.0003)
No. of obs.	497,462	497,462	497,462	497,462
Adj R^2	0.2281	0.1339	0.1885	0.1978
Weak id. F-st	873.23	230.30	982.86	1586.09

Notes: robust standard errors clustered by country pairs-product HS 6-digit in parenthesis. Instrumental GI variables are the (average) number of GIs in the adjacent industries. Weak id. F-st reports the test of Kleibergen-Paap Wald F-statistic. All regressions include importer/exporter-year FE, product-year FE and bilateral FE. Constant and fixed effects not reported.

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