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Potable Intellectual Property: WTO TRIPS and EU Geographical Indication Wines

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Abstract:
The World Trade Organization (WTO) protects Geographical Indication (GI) wines such as Bordeaux and Chianti. However, there is scant empirical evidence on the effectiveness of this protection. We use a triple difference strategy, comparing the differential growth of GI exports to non-GI exports, for WTO joiners versus non-joiners. Our triple difference panel data analysis of EU wine exports from 1995 to 2019 finds a significant effect. When countries join the WTO, their import of GI wines increases by about 25% more than non-GI wines, compared to non-joiners. Our findings suggest that the EU policy of also including wine GIs in bilateral agreements is an attempt to further improve enforcement of GI protection in third countries.

Keywords: Geographical Indications, Wine, WTO, Intellectual Property, TRIPS

JEL codes: F13, O34, Q17

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1 Introduction

Article 23 of the WTO agreement on Trade-Related Aspects of Intellectual Property (TRIPS) provides international protection for so-called Geographical Indication (GI) wines such as Bordeaux, Champagne, and Chianti (Addor & Grazioli, 2005; Barham, 2003; Broadbent & McMillian, 1998; Hughes, 2006; Raustiala & Munzer, 2007; WTO, 1994). WTO members have to provide legal means to "prevent use of a geographical indication identifying wines for wines not originating in the place indicated by the geographical indication in question [...] even where the true origin of the goods is indicated".

Past research has found that GI wines have higher export values and volumes (Agostino & Trivieri, 2014; Raimondi et al., 2020). This may be related to the (perceived) higher quality of GI wines (Crozet et al., 2012). However, without legal protection and enforcement, GIs are attractive targets for imitation or fraud (EUIPO, 2016). Despite the topic's relevance, there is scant empirical evidence on whether TRIPS protection of GI wines increased GI wine exports – by displacing GI imitations, for instance. This paper addresses that gap by analyzing EU wine exports from 1995 to 2019. It contributes to the literature on trade and intellectual property by identifying the trade effects of TRIPS from WTO accessions.

Exports to new WTO joiners can be used to study whether TRIPS increases exports of EU GI wines. Because the WTO covers all areas of trade, the decision to join the WTO seems unlikely to be driven by changes in the global wine trade. Hence, we regard countries joining the WTO as a suitable natural experiment to identify the effects of the TRIPS provisions on wine exports. Past literature has established that the WTO has increased agricultural trade (Grant & Boys, 2012) and that TRIPS has led to an increase in patent-intensive exports (Duggan et al., 2016; Ivus, 2010; Smith, 1999), but to the best of our knowledge, there has been no research on TRIPS and GI exports.

This paper contributes to the literature on international trade and trade agreements by zooming in on specific provisions rather than looking at the overall effect of trade agreements, which we know to be positive but heterogeneous (Baccini, 2019; Baier et al., 2019). More specifically, it looks at intellectual property, an area of growing attention and importance (Osgood & Feng, 2018). It contributes to the literature on regulating food and wine (Meloni et al., 2019; Swinnen & Vandemoortele, 2011) by identifying the effect of international intellectual property standards on wine exports.

We use a triple difference strategy, comparing the differential growth of GI exports to non-GI exports, for WTO joiners versus non-joiners. We implement this strategy using a three-way fixed effects estimator. We find that there is indeed an overall positive effect of WTO TRIPS on the exports of GI wines. We also test the robustness of our results using the Callaway and Sant'Anna (2021) approach, by running two separate differences-in-differences (DiD) regressions on GI exports and non-GI exports, and then taking the difference of those. The resulting triple difference estimator is similar in magnitude to our three-way fixed effects estimator, indicating that staggered treatment and heterogeneous effects are not significantly affecting the three-way fixed effects estimator.

In terms of mechanisms, one likely channel is the displacement of existing GI wine imitations, which may have to be renamed after WTO accession to be compliant with TRIPS. Consistent with this proposed mechanism, we find a larger estimated effect for countries with higher prior wine consumption before WTO accession.

2 The protection of Geographical indications

A GI protects a product with "a given quality [...] essentially attributable to its geographical origin" (WTO, 1994). It is a type of collective intellectual property right, entitling only producers within the designated area to use the name (Marette et al., 2008). The EU protects over 1,700 wine GIs, of which over 90% are from the Southern Five: France, Greece, Italy, Portugal, and Spain (Huysmans & Swinnen, 2019). The current EU system, which also protects foods such as Parma ham or Feta cheese, is based on century-old protection systems for wine in those countries (Haeck et al., 2019; Meloni & Swinnen, 2018, 2013; Stanziani, 2004).

Because of EU activism, countries worldwide have been setting up or expanding GI systems. However, the US has been critical of the notion of GIs, seeing them as a tool of EU protectionism (Josling, 2006; Watson, 2016). This is consistent with the idea that enforcing intellectual property abroad benefits domestic producers while potential costs to foreign consumers and producers lack political weight (Grossman & Lai, 2004; Scotchmer, 2004).

Outside of the EU, GI wines are protected by the WTO. The WTO was founded in 1995 as the follow-up to the General Agreement on Tariffs and Trade. It is the most important international organization related to trade, having over 160 members and covering the vast majority of world trade.[1] However, some members only joined after its creation – see Table A.1 in the Appendix. China joined in 2001 (Cheng, 2023; Liu & Ma, 2020) and Russia

[1] See https://www.wto.org/english/thewto_e/thewto_e.htm for the latest numbers.

in 2012. Smaller new members include Bulgaria (1996), Croatia (2000), Vietnam (2007), and Ukraine (2008).

Since the WTO affords weak international protection for food GIs (TRIPS Article 22), it is not surprising that the EU has sought to expand protection for its food GIs through bilateral free trade agreements (Curzi & Huysmans, 2022; Evans & Blakeney, 2006; Huysmans, 2022; Moir, 2016; Slade et al., 2019). More puzzling is that the EU regularly includes wine GIs in annexes of trade agreements, even though they are supposed to be already strongly protected based on Article 23 of TRIPS.

In practice, Article 23 still allows a lot of freedom to WTO member states in how exactly to implement the required protection (Geuze, 2009; Menapace & Moschini, 2014; O'Connor and Company, 2007). In addition, TRIPS Article 24 exempts WTO member states from protecting GIs that are considered generic in their territory. Famously, the US considers Champagne to be the generic term for a kind of sparkling wine rather than necessarily referring to the French GI (Jay & Taylor, 2013; Menapace & Moschini, 2014). Finally, as of yet, there is no multilateral register listing all GIs of WTO members.[2] The bottom line is that, in spite of the strong wording of Article 23, actual protection of wine GIs may require registering them one by one as GIs or trademarks in target markets (Mustacich, 2011; O'Connor and Company, 2007).

Registering individual GIs in target WTO member states, while sometimes difficult and costly (O'Connor and Company, 2007), does seem to work. Bordeaux was registered as a

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[2] In 2019, the EU acceded to the Geneva Act of the Lisbon Agreement on Appellations of Origin and Geographical Indications, which entered into force in February 2020. This act facilitates the international registration of GIs at the World Intellectual Property Organization (Gervais, 2009).

GI in China in 2015 and Champagne in 2013. Several successful actions against fake Bordeaux wine in China have been carried out since (Mercer, 2020; Mustacich, 2018). While WTO membership does not automatically provide strong de facto protection for all GI wines, it does empower GI wine producers. Arguably, in keeping with TRIPS Article 23, WTO members will find it more difficult to refuse or delay applications or complaints from foreign GIs.

3 Data and methods

Our analysis aims to identify whether TRIPS protection of GI wines increased exports of EU GI wines, above and beyond the general effect of importers acceding to the WTO. To accomplish this, we use Pseudo-Poisson Maximum Likelihood (PPML) regressions for our main results. A battery of fixed effects controls for confounders in a triple difference setup. For instance, importer-time effects control for the general trade-promoting effects of WTO accession through lower tariffs. Importer-product fixed effects control for baseline levels of GI and non-GI imports. Product-time fixed effects control for the potentially increased worldwide popularity of GI wines over time.

The data covers exports of wine (Harmonized System trade code 2204) by the biggest 7 EU exporters (representing over 90% of exports) to the most significant 100 importers (representing over 99% of imports) over the period 1995-2019. The TRIPS effect is identified based on variation at the importer-product-time level, particularly in the sales of GI wines in countries that acceded to the WTO during the observation window. Notably, both China and Russia acceded to the WTO during this period, in 2001 and 2012, respectively.

At the level of eight-digit Combined Nomenclature (CN8) trade lines, GI and non-GI wines can be separated, as well as prices and quantities. The following subsection explains how we aggregate CN8 codes on an annual basis into two products: GI wines and non-GI wines.

3.1 Data

Trade data is internationally organized in the Harmonized System, with three detail levels and 2, 4, and 6-digit trade codes: HS2, HS4, and HS6. For instance, the HS2 chapter '22' refers to beverages, spirits, and vinegar. Within that, the HS4 code '2204' covers wine, and the HS6 code '220410' covers sparkling wine. More fine-grained trade codes differ internationally. The EU uses an 8-digit system called the Combined Nomenclature (CN8). For instance, for the year 2019, CN8 code '22041011' refers to Champagne.

The analysis covers all CN8 codes in the HS4 class 2204 (wine) from 1995 to 2019. Throughout these years, several changes have been made in classifying CN8 codes. The reasons vary, e.g., new member states with new wines joining or a desire to have trade data available at a different level of detail. Products may be merged, split out, or reassigned (Le Roy et al., 2014; Pierce & Schott, 2012). Changes are documented in the EU system RAMON, and annual CN8 tables can be found on the website of the Finnish customs department.[3] For instance, since 2017, Cava has CN8 code '22041013' and Prosecco '22041015'. Before 2017, both were part of code '22041093' for other sparkling wine. And before 2010, those same wines were in code '22041099'.

Since we are interested in the effect of TRIPS on GI exports, we group CN 8-digit codes into two categories: GIs and non-GIs. For this purpose, first, all CN8 codes for each year

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[3] See http://ec.europa.eu/eurostat/ramon/ and https://tulli.fi/en/statistics/combined-nomenclature-cn/previous-years.

were classified according to their level of protection, namely PDO/PGI protection or no protection.[4] Then, we sum up yearly import data into the two categories, GIs and non-GIs. This strategy allows us to trace aggregated GI vs. non-GI exports over time without resulting in problems due to changes in the CN8 classification.

To limit the amount of constant zero observations (which lack identifying variation), a selection of exporting and importing countries was made, based on 2019 exports, for HS4 code 2204. On the exporting side, the Southern Five (France, Greece, Italy, Portugal, and Spain) were complemented by the next biggest EU exporters, i.e., Germany and the United Kingdom. Together, these seven countries cover approximately 93% of 2019 wine exports. On the importing side, the biggest 100 importing countries were retained, covering over 99% of 2019 EU wine exports.

Annual CN8 trade data 1995-2019 for the seven exporters and the 100 importers was taken from Eurostat Comext.[5] Over the 25-year period, a total of 2,495 CN8-years are involved, i.e., each year about 100 CN8 codes were in use on average. To avoid results driven by outliers or issues with data quality, we drop observations with import value falling below the 1st percentile or above the 99th percentile with respect to every product-destination-year. Moreover, we also dropped all the CN 8-digit codes referring to bulk wines (containers of 2 liters or more) for both GI and non-GI wines, as well as all

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[4] Before 2008, EU wines were classified into "quality wines produced in specified regions" and "table wines". In 2008, they were reclassified into either "wines with a GI" (all of the former quality wines plus table wines that obtained a PGI, such as the French *Vin de Pays* or Italian *Indicazione Geografica Tipica*) or "wines without a GI". The CN8 trade codes underwent a major restructuring in 2009, taking effect in 2010.

[5] See http://epp.eurostat.ec.europa.eu/newxtweb/. The REPORTER being one of the seven exporting countries identified previously, the PARTNER being the 100 biggest importing countries identified previously, the PRODUCT being all CN8 codes in the 2204 category. The PERIOD used was 1995 up to and including 2019. Lastly, EXPORT was expressed in the value in euros.

observations relating to grape must. We made this choice because GI wines are likely to be high-quality products, while bulk wines (which are rarely classified as GIs) and grape must are usually considered lower quality and thus do not represent suitable counterfactuals.

After trimming the CN8-level data in this way, we aggregate to two products: GI wine and non-GI wine. With seven exporters, 100 importers, two products (GI or not), and 25 years of data, our final database consists of about 35,000 observations.

For importing countries, their year of WTO accession was taken from the WTO website.[6] This was used to construct the dummy variable *TRIPS*, which is 1 for observations covering exports of GIs to partners that have joined the WTO, and zero otherwise. This variable is a triple interaction between a country being treated with WTO accession, the time period being post accession, and the product being affected by TRIPS. In order to account for the time needed to implement TRIPS, the main estimation will use a lag, so that *TRIPS* is 1 where the WTO was joined at the latest 1 calendar year earlier. Table A.1 in the Appendix shows the 21 countries among the 100 biggest importers of EU wine that joined the WTO during the period of study. These are the countries that are used for the identification of the TRIPS effect.

Import tariffs are set by importers at the HS6 level. For each CN8 code, we take the HS6 tariff that applies to it. When aggregating to GI and non-GI, we take the simple average over the tariffs of the CN8 codes involved.

[6] See https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm.

3.2 Methods

Our main specification is a structural gravity model with fixed effects. Traditional gravity models use control variables like distance and the GDP of exporter and importer. Structural gravity models replace these controls with fixed effects (J. E. Anderson & Van Wincoop, 2003; Baier & Bergstrand, 2007). Their theoretical concern is mostly with multilateral resistance and with the endogeneity of trade agreements, respectively. As they show conceptually, multilateral resistance terms can be eliminated using country fixed effects (J. E. Anderson & Van Wincoop, 2003). Endogeneity of trade agreement concerns can be eliminated using bilateral exporter-importer fixed effects (Baier & Bergstrand, 2007). Our approach is more stringent than the basic structural gravity models, because of our triple difference identification approach. Hence we require more and higher-dimensional fixed effects.

Our method is essentially a triple difference estimator (Gruber, 1994; Olden & Møen, 2022). This approach has been used previously in trade settings (Duggan et al., 2016; Frazer & Van Biesebroeck, 2010; Van Biesebroeck et al., 2022). Our approach intuitively follows from a precise formulation of our research question: do the imports of GI wines go up more than non-GI wines after WTO accession? This shows that we want to take the difference of both GIs vs non-GIs, and before and after WTO accession, compared to countries not joining the WTO.

In a basic difference-in-difference setting, there are treated units (WTO accession states) and non-treated units (non-accession states). A popular way of estimating difference-in-difference models is by using two-way fixed effects for time and units. In a triple difference setting, within treated units there are affected and unaffected groups.[7] In our setting, the affected group is GI products. We are interested in the effect of TRIPS provisions. Since TRIPS only affects GI products, we know that non-GI products are unaffected. Of course, both GI and non-GI products are affected by the general effects of WTO accession. This is precisely why we need to compare GI wines to non-GI wines, to eliminate the overall WTO effects.

Our identifying assumption is that, absent TRIPS, GI wine exports would be affected the same as non-GI wine exports. Because GI wines may generally be of higher quality, they may also benefit differentially from WTO accession. This would threaten our identification. To probe whether this is the case, we will also estimate specifications where we progressively trim away low-quality non-GI wines and high-quality GI wines.

A triple difference estimator can be interpreted as the difference between two difference-in-difference (DiD) estimators (Gruber, 1994; Olden & Møen, 2022). In our case, a DiD estimator for GI products after WTO accession, and a DiD estimator for non-GI products after WTO accession. Just like DiD estimators can be implemented using two-way fixed effects (TWFE), triple difference estimators can be implemented using three-way fixed effects (Frazer & Van Biesebroeck, 2010; Strezhnev, 2023).

In our case, we want to exploit variation at the importer-product-time (*jct*) level. Hence the three fixed effects we need for identification are importer-time *jt*, importer-product *jc*, and product-time ct. Because we also have information about exporters, we make our

[7] In the seminal triple difference paper about the introduction of mandated maternity benefits, the affected group is married women of child-bearing age (Gruber, 1994).

specification even more stringent to *ijc*, *ijt*, and *ct* fixed effects. The importer-time effects also eliminate non-GI specific increases in wine imports due to globalization and changing tastes (K. Anderson & Pinilla, 2021). The *ct* fixed effects also control for the introduction of new GI wines over time.

To estimate our model, we use the regression technique of Pseudo-Poisson Maximum Likelihood (PPML). PPML represents the state-of-the-art technique in trade models where zero trade flows often occur (J. E. Anderson & Van Wincoop, 2003; Correia et al., 2020; J. M. C. Santos Silva & Tenreyro, 2011; J. Santos Silva & Tenreyro, 2006). The use of PPML avoids the issues of incidental parameters and separation, which can occur in the presence of a large share of zero observations while using fixed-effects models. Moreover, it has been demonstrated that PPML is a consistent estimator in the presence of heteroscedasticity and measurement errors (Santos Silva and Tenreyro, 2006, 2011). Using PPML, we estimate the following structural gravity equation:

$$x_{ijct} = \beta_0 + \beta_1 TRIPS_{jct} + \beta_2 \left(1 + Tariff_{jct}\right) + \gamma_{ijt} + \gamma_{ijc} + \gamma_{ct} + \varepsilon_{ijct} \quad (1)$$

where x_{ijct} is our dependent variable (the natural logarithm of export value), i refers to the exporting EU country, j to the importing country, c to a product category (i.e., GIs vs. non-GIs), and t to a given year.[8] $TRIPS_{jct}$ is our variable of interest. It is one for observations covering exports of GI wines to importing countries that have joined the WTO at the latest one calendar year earlier. $TRIPS_{jct}$ is a triple interaction between a country being treated with WTO accession, the time period being post accession, and the

[8] Note that PPML does not use the log-linearized form as displayed, but estimates the multiplicative exponentiated version, hence preserving zero-trade observations.

product being affected by TRIPS. The underlying variables are excluded from the equation because they are nested within the fixed effects. $Tariff_{jct}$ is a control for average tariffs on (non-)GI wines at the importer-time level.

When estimating equation (1), our coefficient of interest is β_1. Our estimation exploits variation at the jct level by including three sets of fixed effects: exporter–importer-time (γ_{ijt}), exporter-importer-product (γ_{ijc}), and product-time (γ_{ct}). Finally, ε_{ijct} is the error term.

3.2.1 Robustness checks and extensions

As GI wines are likely to be considered products of higher quality than non-GI wines, we test the robustness of our results to the progressive exclusion of high-quality GIs and low-quality non-GIs. This test aims to make the counterfactual (i.e., non-GI wines) as close as possible to the treated product categories (i.e., GI wines). To run this test, we rely on the popular approach to estimate quality from trade data proposed by Khandelwal, Schott, and Wei (2013), which is based on the presumption that, after controlling for price, products sold in higher quantities are associated with higher quality. The details of this approach are reported in the Appendix A. We then run our main estimation (1) progressively dropping data for non-GI wines of quality below the lower percentiles and for GI wines with quality level above the higher percentiles.

Recent evidence from the literature suggests that DiD estimates are potentially misleading when there are differences in the timing of treatment and heterogeneity in the treatment effect (Callaway & Sant'Anna, 2021; de Chaisemartin & D'Haultfœuille, 2020; Goodman-Bacon, 2021). Luckily, for the TWFE estimator the statistical packages CSDID has been developed that allows researchers more insight into the underlying parameters and to average them in different ways (Rios-Avila et al., 2021). However, such packages are as yet unavailable for triple differences, even though the same problems can occur in that setting (Strezhnev, 2023).

Even though there are no statistical packages for triple differences with staggered treatment, one can still benefit from the CSDID package by applying it to the two underlying DiD estimators, and then taking the difference (Olden & Møen, 2022). We will use this approach as a comparison for our three-way fixed effect estimator.

A way to visualize DiD with staggered treatment is by plotting the difference between treated and untreated with respect to the number of years before or after treatment. This can be plotted as an event study, which also allows to check for parallel trends before treatment. The equivalent for triple difference is to visualize the two constituent DiDs: for non-GIs and for GIs. The triple difference can then be seen as the difference between the two lines post treatment.

3.2.2 Mechanism

A plausible mechanism for positive TRIPS export effects would the displacement of existing imitation wines, which would have to be renamed to be compliant. The displaced non-GI wines could be locally produced, or imported from any country worldwide. To probe this potential mechanism, we test whether the effect depends on the amount of wine consumed domestically prior to the WTO accession of the destination country. To do that, we include the interaction between our TRIPS variable and the mean of wine consumption (World Health Organization data) before the sample period. The inclusion of the interaction variable then allows for a conditional effect related to prior wine consumption.

Note that this exercise is not about separating the extensive and intensive margins of exports (new destinations versus more exports to existing destinations). Rather, the idea of conditioning on prior wine consumption comes from our proposed mechanism: the displacement of imitations. These imitations are most likely to be produced in the importing country itself, or in third countries outside of the EU and the importer. Hence to probe the mechanism it is important to be able to control for total prior wine consumption in the importing countries.

4 Results and discussion

4.1 Main results and mechanism test

Table 1 shows the results of our main triple difference structural gravity PPML models. The structural gravity model is a stringent specification since it includes exporter-importer-time (*ijt*), exporter-importer-product (*ijc*) and product-time (*ct*) fixed effects. As column 1 shows, in this stringent specification our TRIPS variable is positive and statistically significant at the 5% level. For the PPML estimator, the percentage change in trade flows from a change in a dummy variable is computed as $\exp(\hat{\beta}) - 1$.The coefficient of 0.222 hence corresponds to an estimated effect of about 25%. When an importing country joins the WTO, exports of GI wines to the country go up about 25% more than those of non-GI wines, compared to non-joiners. This finding suggests that the protection of wine GIs in TRIPS generates some of the desired effect from the EU's point of view.

To assess the robustness of the results related to endogeneity concerns, we conduct a placebo test whether the pre-existing level of wine exports causes countries to obtain WTO accession. To do that, we follow Wooldridge (2002) and Baier and Bergstrand (2007) by augmenting our main specification with future changes of the TRIPS variable (i.e., one year before WTO accession). The results in column 2 show that the forward value of the TRIPS variable is positive and non-statistically significant. Therefore, TRIPS changes are strictly exogenous to export flow changes.

Table 1: Effect of TRIPS on wine imports: PPML regressions 1995-2019

PPML on Export (ijct)	(1)	(2)	(3)	(4)
	Main model	Placebo	WTO duration	Prior wine consumption
$TRIPS_{jct}$	0.222**		0.185	0.218**
	(0.100)		(0.138)	(0.105)
$TRIPS_{lead}$		-0.089		
		(0.116)		
$TRIPS_{jct}$ * Log WTO years			0.047	
			(0.099)	
$Wine1995_j$ * $TRIPS_{jct}$				0.152
				(0.149)
Average $Tariff_{jct}$	-0.203	-0.201	-0.204	Yes
	(0.197)	(0.191)	(0.197)	
Exporter-Importer-Time ijt FE	Yes	Yes	Yes	Yes
Exporter-Importer-Product ijc FE	Yes	Yes	Yes	Yes
Product-Time ct FE	Yes	Yes	Yes	Yes
Observations	34618	31696	34618	32640

Note: Estimations are based on PPML regressions. *, **, *** indicate significance at 90%, 95% and 99% confidence levels, with standard errors clustered at the importer-product-time level jct.

Moreover, we test whether the TRIPS effect changes over time. To do that, we interact our TRIPS variable with the number of years since the importing country joined the WTO. The results in column 3 show that our TRIPS variable remains positive but loses statistical significance. However, the interaction term coefficient controlling for the number of years a country has joined the WTO is also positive. This suggests that the TRIPS effect is not significantly increasing over time.

Finally, to probe the mechanism of displacement of imitations, we augment our main model with the average wine consumption in 1995 and its interaction with our primary variable of interest, TRIPS. The results are shown in column 4. The linear TRIPS coefficient remains positive and statistically significant. However, its magnitude decreases and the interaction term between TRIPS and a priori wine consumption is positive though not significant. This is compatible with the displacement of imitations being a mechanism.

However, displacement of imitations is clearly not the only mechanism, since the main effect remains positive and significant. As an alternative, complementary mechanism, perhaps TRIPS protection gives increased confidence to firms that investing in setting up exports is worthwhile. Or, post-TRIPS, GI wines can charge higher prices due to a lower threat of being undercut in price by imitations.

4.2 Robustness to quality trimming

The results shown so far present evidence of the positive effect of the protection guaranteed by TRIPS on GI wine exports. Our empirical analysis further explores this relationship by checking the composition of the sample and making sure the GI wines are comparable to non-GI wines in terms of how they would be affected by WTO accession, excluding TRIPS.

As mentioned in the introduction, as GI wines are usually meant to be much higher quality than non-GI, one can argue that the latter do not represent a reliable counterfactual. If this is true, our results may be biased. To get rid of this potential bias, after estimating the quality of the imported products at the CN8 level using the Khandelwal et al. (2013) approach, we progressively trim our data by excluding extreme values of product quality for higher-quality GI wines and the lower-quality GI wines, such that the level of quality of the products in the sample can be closer, thus making the non-GI group a more robust counterfactual for GI wines.

Table 2: Effect of TRIPS on wine imports with quality trimming

	(1)	(2)	(3)	(4)	(5)
	Trimming Quality 1st-99th	Trimming Quality 5th-95th	Trimming Quality 10th-90th	Trimming Quality 20th-80th	Trimming Quality 25th-75th
$TRIPS_{jct}$	0.222**	0.316***	0.480***	0.222**	0.251**
	(0.105)	(0.113)	(0.099)	(0.108)	(0.121)
Average $Tariff_{jct}$	-0.373**	-0.352**	-0.362**	-0.341**	-0.445***
	(0.158)	(0.166)	(0.149)	(0.144)	(0.146)
Exporter-Importer-Time ijt FE	Yes	Yes	Yes	Yes	Yes
Exporter-Importer-Product ijc FE	Yes	Yes	Yes	Yes	Yes
Product-Time ct FE	Yes	Yes	Yes	Yes	Yes
Observations	33556	33196	32692	31554	31040

Note: Estimations are based on PPML regressions. *, **, *** indicate significance at 90%, 95% and 99% confidence levels, with standard errors clustered at the importer-product-time level *jct*. Lower quality non-GI and higher quality GI CN8 codes are trimmed to only use GI and non-GI wines that are more comparable in quality.

We base this robustness check on the estimation of the structural gravity approach. The results are presented in Table 2. In column 1 we show the results when trimming data for non-GI wines with quality falling below the 1^{th} percentile and dropping GI wines with quality above the 99^{th} percentile. The next columns show the effect of progressive trimming until the 25^{th} and 75^{th} percentile, i.e. only using the bottom half GIs and the top half non-GIs in terms of quality. If anything, the effect size increases with moderate trimming. Trimming beyond the 10^{th} percentile, the effect size decreases but remains positive and significant. Hence we conclude that our TRIPS effect is not a spurious result due to (non-)GI wines being differentially affected by WTO provisions, because GI wines have different quality from non-GI wines.

4.3 Further trade integration after WTO accession

Table A.2 shows the robustness of our results when dropping countries that joined the EU or which signed a trade agreement with the EU after joining the WTO. EU or FTA accession may differentially affect GI and non-GI imports, threatening our identification. However, excluding the affected countries does not materially affect our results. Column 1 excludes only EU joiners (Bulgaria, Estonia, Latvia, Croatia, Lithuania). Column 2 additionally excludes FTA partners (Ecuador, Panama, Georgia, and Ukraine).

4.4 Staggered treatment and heterogeneous effects

In this section we show the results of a robustness check using the Callaway and Sant'Anna (2021) approach. This requires taking the log of exports and dropping zero-trade observations. To be able to use the same observations as our PPML approach and not lose zero observations, we take the log of export value +1. We use the Stata CSDID package (Rios-Avila et al., 2021) and the not yet treated as a comparison group.

Column 1 of Table 3 shows the results concerning the WTO effect on GI wine exports. This estimation is therefore a simple DiD approach. The "Pre_avg" variable presents an average coefficient not statistically different from zero, confirming a parallel pre-treatment trend (as always, parallel trends post treatment is a counterfactual assumption that cannot be tested). The "Post_avg" coefficient displays average treatment effect on the treated (ATT), averaged over all post-treatment observations. In column 2 we show the DiD results concerning the WTO effect on non-GI wines. Column 3 gives the difference between the two DiD results: the difference between the WTO effect on GI exports versus non-GI exports, or in other words the triple difference TRIPS effect. The effect magnitude, 0.299, is comparable to our main three-way fixed effects effect size of 0.222 in column 1 of Table 1. It corresponds to a 35% increase rather than a 25% increase of GI wine exports after TRIPS.

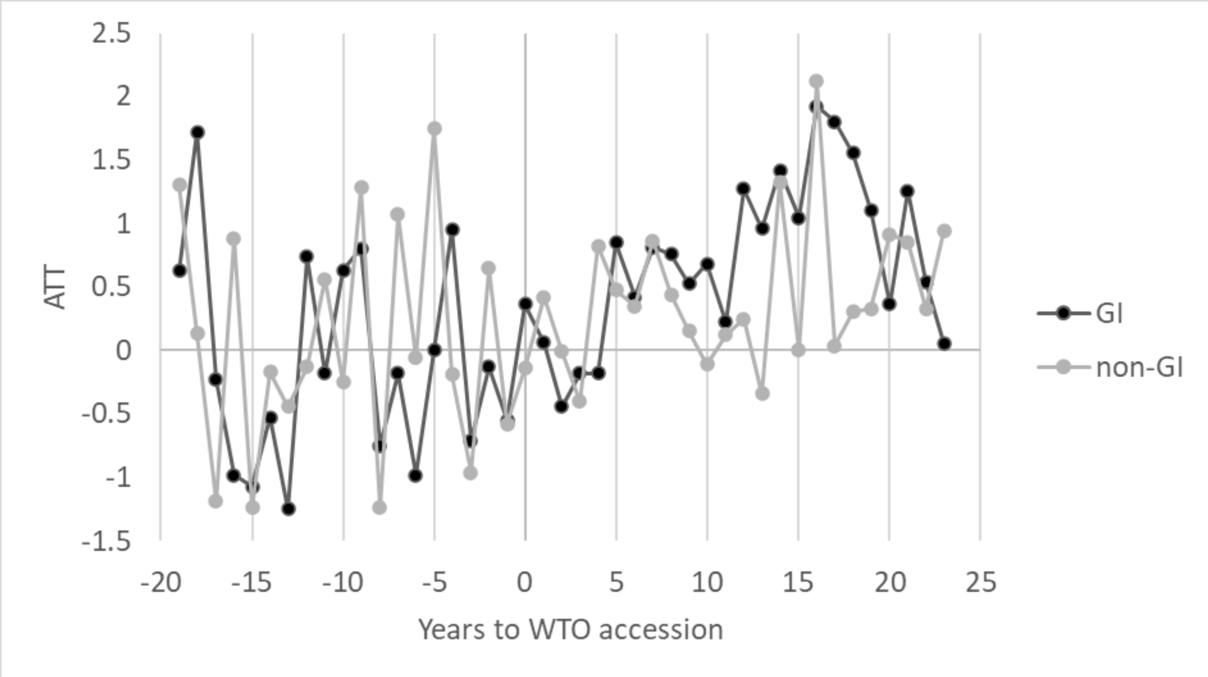
Table 3: Controlling for staggered treatment with heterogeneous effects

	GI DiD	Non-GI DiD	Triple difference DDD
Pre_avg	-0.112	0.059	-0.169
	(0.147)	(0.135)	
Post_avg	0.716*	0.417	0.299
	(0.396)	(0.524)	

Note: All outcomes are log-transformed, taking the log of exports+1 to avoid losing zero observations. The treatment group comprised states that first enter the WTO in a given year, the comparison group comprised states that have not yet entered the WTO. Coefficients were estimated using Callaway and Sant'Anna's (2021) approach and the "csdid" commands in Stata (Rios-Avila et al., 2021). Covariates include distance, tariffs, GDP per capita(exporter and importer), time trend, exporter fixed effects. Bootstrapped standard errors clustered at the importer level in parentheses, *p < .05. **p < .01. ***p < .001.

Now, we present the results of an event study. Figure 1 overlays plots of the GI and non-GI event studies to explore the triple difference. Overall, for the post-treatment period there appears to be an increase in exports of wine of any kind. For GI wines, however, the effect is overall larger than for non-GI wines (comparing the Post_avg coefficients from Table 3). This is again consistent with the result presented in Table 1, showing a positive TRIPS effect.

Figure 1: Event study graph of DiD of GI and non-GI exports



Note: All outcomes are log-transformed, taking the log of exports+1 to avoid losing zero observations. The treatment group comprised states that first enter the WTO in a given year, the comparison group comprised states that have not yet entered the WTO. Coefficients were estimated using Callaway and Sant'Anna's (2021) approach and the "csdid" commands in Stata (Rios-Avila et al., 2021). Covariates include distance, tariffs, GDP per capita(exporter and importer), time trend, exporter fixed effects. Bootstrapped standard errors clustered at the importer level in parentheses, *p < .05. **p < .01. ***p < .001.

4.5 Limitations

Our analysis has some limitations. In particular, identification depends on the absence of certain taste shocks around the time of accession. If the taste for GI wines specifically has increased in importers after they joined the WTO, we have no way of eliminating that shock, since it occurs at the importer-product-time (*jct*) level just like our variable of interest, $TRIPS$. One may worry that such a taste shock occurred in some of the accession countries.

5 Conclusion

This article has used EU wine export data 1995-2019 to assess whether the intellectual property provisions of the WTO boost exports of Geographical Indication wines such as Bordeaux and Chianti. We exploit the fact that the EU separates GI and non-GI wine export data, and the natural experiment that several countries joined the WTO after its creation, presumably not because of trade in wine. We use a triple difference setup, with a PPML estimator.

We find that exports of GI wines go up about 25% more to WTO-joiners than non-GI wines to those joiners compared to non-joiners, i.e., there seems to be a positive effect of TRIPS provisions on GI wine exports. This effect appears to be larger for importing countries with prior wine consumption, suggesting that one of the mechanisms is the displacement of prior imitation wines, which have to change names to become TRIPS-compliant. However, the displacement of imitations seems to be a modest part of the overall effect, which is consistent with the TRIPS effect on patented pharmaceuticals in India after its WTO accession (Duggan et al., 2016). Future research may seek to leverage firm-level data to explore the mechanisms further.

Our results suggest that enforcement of GI protection improved after WTO accession. However, judging from the EU's actions, it still seems to be worried about enforcement. Indeed, even though on paper TRIPS Article 23 protects GI wines very strongly, the EU often lists individual GI wines for protection under bilateral trade agreements or GI-specific agreements. A case in point is China: in 2021, 20 years after its WTO accession, China has agreed to protect a list of 100 EU GIs, including some GI wines that should already have been protected under TRIPS (Ferrante, 2021).

To conclude, the protection of GI wines under WTO TRIPS Article 23 is very strong on paper. A PPML triple difference analysis of EU wine exports over the period 1995-2019 indeed finds a significant effect on GI wine exports. In this light, the EU policy of including wine GIs in bilateral agreements can be seen as an attempt to further improve enforcement of GI protection in third countries.

We have not conducted a welfare analysis of the TRIPS effect. However, higher GI exports clearly benefit the EU GI producers, while potentially displaced imitations abroad suffer (Grossman & Lai, 2004; Scotchmer, 2004). The displaced imitations or foreclosed future imitations are likely to have been produced in the importing country or a third-party exporter outside of the EU and the importer. The effect on consumers is two-fold. On the one hand, they benefit from increased information (Menapace & Moschini, 2014). When they buy a wine with a GI name, they will have more certainty that it is the genuine EU GI wine. On the other hand, the comparability to generic wines having to adopt different names may decrease. And the price of the GI wine may increase. The net welfare effect on foreign consumers hence depends on consumer tastes and their quality equation (Huysmans & van Noord, 2021).

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6 Appendix

Appendix A. Estimating product quality: The Khandelwal, Schott and Wei (2013) approach

In what follows we report in detail the approach proposed by Khandelwal, Schott and Wei (2013), on which we relied on to estimate product quality in our empirical analysis. Assume consumers' preferences for a given product *c* (at the CN8 level of detail), produced in a country *i*, whose combination represents the variety *v*, are defined by the following CES utility function:

$$U = \left[\int_{v \varepsilon V} [\lambda(v) q(v)]^{\frac{\sigma-1}{\sigma}} dv\right]^{\frac{\sigma}{(\sigma-1)}} \tag{A.1}$$

Where $q(v)$ stands for the quantity of *v*; $\lambda(v)$ represents product quality; σ >1 is the elasticity of substitution. Starting from this utility function, the demand in a country *j* for the variety *v* at time *t*, is defined by the maximization of A.1, under the usual budget constraints as follows:

$$q_{jvt} = \lambda_{jvt}^{\sigma-1} p_{jvt}^{-\sigma} P_{jt}^{\sigma-1} Y_{jt} \tag{A.2}$$

where p_{jvt} and λ_{jvt} indicates, respectively, the price ad the quality attached by consumers in country *j* to the variety *v.* The price index in the importing country *j* is defined by P_{jt} , while Y_{jt} indicates the relative income in country *j* at time *t*. Product quality is then estimated from the log-linearization of A.2 as follows:

$$lnq_{jvt} + \sigma_{jc} lnp_{jvt} = \alpha_c + \alpha_{jt} + e_{jvt} \tag{A.3}$$

where α_c and α_{jt} denote, respectively, product and importer-time fixed effects, while e_{jvt} indicates the error term. Quality is then estimated as the residual from A.3 as follows

$$Quality = \hat{\lambda}_{jvt} \equiv \hat{e}_{jvt}/(\sigma - 1) \tag{A.4}$$

In our empirical application, we estimate product quality of wines exported by the main EU producers in about 100 importing countries over the period 1996-2019. In the estimation we use data on country-product specific elasticity of substitution, σ, from Broda & Weinstein (2006). For countries with missing data, we imputed the median value of $\sigma = 3$.

Table A.1: WTO accessions among 100 biggest importers of EU wines, 1996-2019

Country	WTO accession
Angola	1996
Bulgaria	1996
Ecuador	1996
Qatar	1996
United Arab Emirates	1996
Congo	1997
Democratic Republic of the Congo	1997
Panama	1997
Estonia	1999
Latvia	1999
Albania	2000
Croatia	2000
Georgia	2000
China	2001
Lithuania	2001
Taiwan	2002
Cambodia	2004
Viet Nam	2007
Ukraine	2008
Russian Federation	2012
Kazakhstan	2015

Table A.2: Effect of TRIPS on wine imports excluding EU and FTA accession countries

	(6)	(7)
	Excluding EU joining countries	Excluding EU joining countries & FTA Partners
$TRIPS_{jct}$	0.225**	0.258**
	(0.104)	(0.108)
Average $Tariff_{jct}$	-0.203	-0.234
	(0.198)	(0.218)
Exporter-Importer-Time ijt FE	Yes	Yes
Exporter-Importer-Product ijc FE	Yes	Yes
Product-Time ct FE	Yes	Yes
Observations	32994	31838

Note: Estimations are based on PPML regressions. *, **, *** indicate significance at 90%, 95% and 99% confidence levels, with standard errors clustered at the importer-product-time level jct.