Is the proliferation of private standards acting as a non-tariff trade barrier in agrifood trade? Evidence from Chilean grape exports

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Abstract

Purpose – The purpose of this paper is to describe and analyze the impacts that the recent proliferation of private and overlapping standards is having in the trade of agricultural products from developing countries.
Design/methodology/approach – In a first stage industry experts in the Chilean fresh fruit trading industry were interviewed to understand the perceived impact that private standards are imposing in the industry. These interviews allowed to identify the market case study, table grapes, the landscape of private standards and their prevalence in different countries. In a second stage, a gravity trade model for trade in table grapes was estimated, with a focus on the more stringent countries identified by experts in the first stage.
Findings – We show evidence that the proliferation of private standards required by large European retailers has diverted trade away from more stringent countries that require more certifications (and into less stringent European markets). We also show that the costs of these additional certifications have been shared by trading partners, via an increase in direct sales, as opposed to consignment (the traditional marketing mode), which is associated with higher prices.
Research limitations/implications – The impacts of the recent proliferation of private and overlapping standards in international trade needs to be better understood both by the legal and economic literature. While the use of private standards has been growing since the 1990s, there is a recent trend of large European retailers imposing their own and overlapping standards that needs to be better understood to inform policy.
Originality/value – While there is a thin literature on the impact of private standards on trade, most of this has studied the effects of the now de facto mandatory GlobalGAP certification. However, there is a recent trend by large European retailers of demanding their own private certifications, together with other already existing overlapping private standards. This study describes and analyzes the impacts of this rather new trend.

Keywords Private standards, Trade, Non-tariff trade barriers, Gravity model
Paper type Research paper

1. Introduction

Private standards that regulate and certify different aspects of the production process and attributes of agricultural products, from producer to consumer, have been steadily increasing since the 1990s. The proliferation of these standards has always been controversial because

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while they provide evident information for retailers and consumers, they may also cause harm to producers and consumers (Liu, 2009). Some of these standards are increasingly becoming *de facto* mandatory, like Global Good Agricultural Practices (GlobalGAP), which raises issues about their validity within the context of the World Trade Organization (WTO). Moreover, there has been a recent proliferation in the use of these private standards, particularly by large retailers in Europe, with uncertain impacts on trade.

European retail is extremely rigorous regarding fruit produces that may be displayed on its shelves. This is in part the result of the preferences of European consumers, who demand a greater sense of social responsibility, environmental protection and food safety (Angus and Westbrook, 2021). Private standards thus aid consumers in their goal of purchasing invisible but desirable attributes of their agricultural products, like being environmentally and socially sustainable (Almeida, 2008). In this regard, private certifications can be described as business to business risk management instruments. However, retailers have an incentive to segment markets creating their own competing and overlapping certifications. This market segmentation increases market power of retailers and, hence, may hurt consumers vis-à-vis more competitive markets.

With regards to trade specifically, private standards remain controversial. Some have argued that these private standards promote increased trade, promote better environmental outcomes and enhance labor protection. However, as additional costs in the production process, they may provoke the exclusion of poorer countries and small-scale producers from international markets. Farmers from developing countries have more difficulties in adjusting to production modes that require more sophisticated techniques, mainly due to difficulties in accessing new technologies and capital because additional costs are relatively higher for them (Gebrehiwet *et al.*, 2007; Rao *et al.*, 2021). There is also concern that private standards may be used as disguised barriers to trade (Du, 2018; Sonntag *et al.*, 2016).

While the empirical literature that examines the impacts of these private standards is thin, there is some evidence of the impacts of the GlobalGAP certification (see below), but little is known about the impacts on trade of the recent proliferation of competing and overlapping private standards set by large European retailers. This paper aims to study the impact of these additional certifications using Chilean exports of fresh table grapes as a case study, and the imposition in some European countries of the GlobalGAP Risk Assessment on Social Practice (GRASP) labor certification, in addition to the other retail-specific certifications. With the use of a gravity trade model, that represents Chilean grape exports to fifty destinations over the 2012–2019 period, we show evidence that these additional certifications have diverted trade away from more stringent countries that require more certifications into less stringent European markets. We also show that the costs of these additional certifications have been shared via an increase in direct sales, as opposed to consignment (the traditional marketing mode), which is associated with higher prices.

The next section of this paper reviews the evidence in the literature regarding impact of private standards and more stringent Sanitary and Phytosanitary (SPS) standards on trade. The following third section introduces the case of Chilean table grapes exports presenting insider understanding from interviews with industry experts. This is followed by a fourth section introducing the estimation method and describing data and a fifth section presenting and interpreting the main estimation results. Finally, the sixth section presents some robustness checks of the key results and the last section some concluding remarks.

2. Private standards and trade: the evidence

The role that private standards play within the WTO trading system is controversial. Some scholars believe that they should be regulated within the scope of the SPS or Technical Barriers to Trade (TBT) Agreements of the WTO (van der Zee, 2018). Other authors point out

that it is problematic that the standard setters of developed nations have bargaining power over standard takers (Mavroidis and Wolfe, 2017). Under these circumstances it is unlikely that imposed standards take into consideration the interests and contexts of the standard takers (Nelson and Tallontire, 2014). Given the growing proliferation of overlapping private standards which can act as disguised barriers to trade, many legal scholars are calling for an international regulation of these instruments (Mavroidis and Wolfe, 2017; Nelson and Tallontire, 2014; van der Zee, 2018; among others). However, WTO regulates public standards, not mutually agreed private standards. It is thus unclear that the WTO would address this issue.

There is also an empirical literature that has studied the impact of private standards, especially the case of GlobalGAP, which is increasingly becoming a *de facto* universal standard for most agricultural products entering developed countries' markets. To our knowledge, there are however no evaluations about the effect of these standards on environmental outcomes. In contrast, there is evidence that these certifications improve labor conditions. For example, Schuster and Maertens (2017) show that certifications increase labor empowerment, defined as workers' knowledge of their own rights, among farm workers of export-oriented farms such as in Peru. Colen *et al.* (2012), on the other hand, demonstrate that GlobalGAP certification increases wages and employment duration among farm workers of the horticultural sector in Senegal.

Empirical evidence also seems to support the hypothesis that private standards promote the exclusion of more vulnerable actors from international agricultural and food markets. For example, Ehrich and Mangelsdorf (2018) using a gravity trade model show that the implementation of the International Featured Standard (IFS) for processed food has a positive effect on the bilateral exports of several processed food categories. However, the estimated effects are robust only for high- and middle-income countries, but not significant for low-income countries. Furthermore, using firm-level panel data from Peruvian asparagus exporters, Schuster and Maertens (2013) show that the implementation of different private standards promotes vertical integration and the exclusion of small-scale farmers from export supply chains. Similar evidence, of small farms being excluded from participation in these certifications schemes is given for the case of Ghana by Annor *et al.* (2016) and Quartey *et al.* (2023). Farms with a GlobalGAP certification, nonetheless, have been shown to obtain higher prices for their produces in some contexts, for example, as the Kariuki *et al.*'s (2012) study of small-scale French beans producers in Kenya.

Whether private standards promote trade cannot be answered *a priori*, as there are countervailing effects. On one hand, the certification of producers is a sunk cost that once committed may induce producers to export more. However, as certifications impose costs that may be relatively high for some producers, they may exclude many farmers and actually discourage exports. Empirical evidence is also mixed. Using trade among EU-15 countries, Andersson (2019) shows that the implementation of the GlobalGAP certification increased trade value among European partners. However, using impact evaluation techniques, Schuster and Maertens (2015) show that the adoption of private standards did not have an impact on export performance in their sample of Peruvian asparagus producers.

A related literature has studied the impacts of SPS and TBT agreements. Like private standards, these agreements include quality and process standards, which impose additional costs on producers but, unlike their private counterparts, they are mandatory, unique and agreed among trading countries. Using a gravity trade model, Disdier *et al.* (2008) show that the implementation of the WTO SPS and TBT agreements significantly reduced exports from developing countries into the European Union (EU). Using case studies, other authors have shown that the strict EU SPS and TBT bilateral agreements have reduced exports from South Africa (Gebrehiwet *et al.*, 2007) and Chile (Melo *et al.*, 2014). However, other authors argue that SPS agreements initially reduce trade, but once

partners adjust to the requirements, trade is actually promoted, which is what Crivelli and Groeschl (2016) show with a large international dataset. Santeramo and Lamonaca (2019), furthermore, provide a meta-analysis of 155 different studies that have analyzed the impact of nontariff barriers (NTB) on trade, and report a large dispersion of estimates, which on average are slightly negative, but about half of the studies analyzed report positive impacts of NTB on trade. A separate literature studying the impact of maximum residue limits (MRL) included in SPS provides similar results. These standards may negatively impact agri-food exports of less developed countries (Ferro *et al.*, 2015) but, after a lag, these standards may promote exports from complying countries (Shingal *et al.*, 2021).

Our study contributes to this literature, by evaluating the impact of the imposition of the GRASP labor certification together with other retailer-specific private standards. These certifications have become *de facto* mandatory in some of the wealthiest EU members where most of the market is controlled by few large retailers (see below).

3. Case study description

The European fresh fruits market is well-known for the proliferation of different quality standards and food safety requirements that add complexity to the trade of these commodities. There is a growing trend of private actors like large retailers and importers imposing different standards and requirements on domestic and foreign suppliers (Thorstensen and Costa, 2015). Thus, supplying fresh fruit into supermarkets is an increasingly difficult task. Actually, the European retail sector already has in place a diverse set of quality standards, certifications and phytosanitary requirements (Henry de Frahan *et al.*, 2020). Therefore, the Chilean agri-food export sector, like other exporting countries, has the obligation to adapt to a large number of diverse private requirements. This section presents a brief review of these different standards. For ease of exposition we separate private standards into two aspects of these requirements: certifications and MRL.

3.1 Certifications

Certifications are third-party verification of food processing standards, validating both food safety aspects as well as overall quality management, including important aspects valued by consumers such as environmental and labor standards. These certifications are provided by private entities that, in exchange for a fee, risk their reputation to guarantee quality standards in the production and distribution processes. In this case, it is the production and handling of fresh fruit exports from Chile to the EU. The influence these certifications have achieved in the industry is such that, according to our interviews, the starting point for establishing a business relationship with any customer around the world requires the GlobalGAP certification and the European market is no exception.

GlobalGAP certifies agricultural management from pre-to post-harvest, based on food safety, traceability and environment protection, as well as everything related to the well-being of workers (GlobalGAP, 2020). Therefore, it is a fairly complete certification, although, not enough by itself. European retailers are increasingly demanding certifications that exclusively deal with the social and environmental aspects of production.

More recently, the ethical-social dimension of agricultural production and its related certifications have gained prominence in response to new consumer trends and increased awareness of the importance of socially sustainable practices. Supermarkets are an important sector promoting these types of private certifications. For example, for English supermarkets, exporters must have the Sedex certification, which focuses among other aspects on ethical-social dimensions. Unlike GRASP, which is actually an add-on to the GlobalGAP certification that covers social aspects of agricultural production, Sedex involves

completing an online questionnaire without on-field audits. If needed, it offers an additional component called Sedex Members Ethical Trade Audits (SMETA), which effectively includes audits and implies additional pecuniary costs. If dealing with Tesco supermarkets in the United Kingdom (UK), exporters must also comply with their exclusive certification: Tesco Nature Choice. This certification is integrated as an additional package to the GlobalGAP certification. Tesco Nature Choice addresses aspects related to safety, ethics and social responsibility. These are the fundamental certifications that fresh fruit exporters have identified as indispensable requirements, not counting other supermarket certifications such as Percorso Qualitá Conad (PQC) in Italy, Filiéres Qualité of the Carrefour retailer in many countries, Albert Heijn (AH) Excellent in the Netherlands, and other third party environmental and social certifications like SPRING and Rainforest certification (see Thorstensen and Costa, 2015, for a more extensive list of these private certifications).

3.2 Maximum residue limits

The MRL standard corresponds to the maximum concentration of an active substance legally allowed in agricultural and food products based on GAP. Regarding these limits, an important drawback faced by exporters is the absence of a globally harmonized standard. They must adapt to different limits established in SPS agreements that generally follow the different standards of the European Commission or the United States Department of Agriculture (USDA). There are yet other internationally agreed standards defined by the Codex Alimentarius. Adding to this landscape of publicly agreed international standards, private standards provide different MRL criteria, which are usually more restrictive than what countries agree to allow in their SPS agreements. Additionally, experimenting constant upgrading, MRL standards are rather dynamic, usually related to the development cycle of new agro-chemicals and the phasing out and prohibition of others.

3.3 Interviews with industry experts

To better understand how Chilean fresh fruit exports enter EU markets we conducted structured interviews with eight Chilean industry experts to understand better how producers and exporters perceive doing business with retailers all across Europe. Between October 2020 and November 2021, interviews were conducted with representatives of prominent fresh fruit exporting companies in Chile, such as Unifrutti, Copefruit, Gesex, Corporafruit, Core Export and Compañía Frutera Santa Marta. Additionally, discussions were held with Uvanova, a Chilean association of table grape producers and exporters, and with iQonsulting, a national consultancy specializing in data analysis, study development and advisory services for the fresh fruit export sector. Of the interviewed companies, three rank among the top ten Chilean fresh fruit exporters for the 2019/2020 season: Unifrutti with 100 kilotons (third leading exporter), Copefruit with 62 kilotons (eighth) and Gesex with 58 kilotons (ninth). The rest of the companies contacted show participation levels below 55 kilotons exported. All of these companies maintain business relationships with various markets, spanning Europe, the United States, Asia and Latin America. In the European continent, the main destinations include the Belgium, France, Germany, Italy, The Netherlands, Russia, Spain, the UK and the Scandinavian countries. Among the interviewees were directors and commercial managers, as well as those in charge of "certifications and safety," all of whom are experts in the European fresh fruit market. A clear consensus emerged from these interviews regarding how the industry perceives doing business in Europe.

With respect to certifications, industry experts express that complying with them is not a major difficulty. Instead the main issue is their multiplicity with the existence of two or three certifications that fulfill the same function. For example, the main goal of most exporters is to sell to as many supermarket retailers as possible. However, each of them requires different

certifications. In many instances the producer or exporter is compelled to attain an accreditation in a production aspect which is already covered in an existing certification simply because the specific retailer does not recognize it or demands its preferred certification. Despite the multiplicity of certifications, all interviewees agreed that meeting these private standards is not necessarily difficult. This is due to the country's longstanding record in agri-food exports, and the fact that certifications tend to develop as add-ons to the existing certification network, and hence involve adding new elements into already established processes.

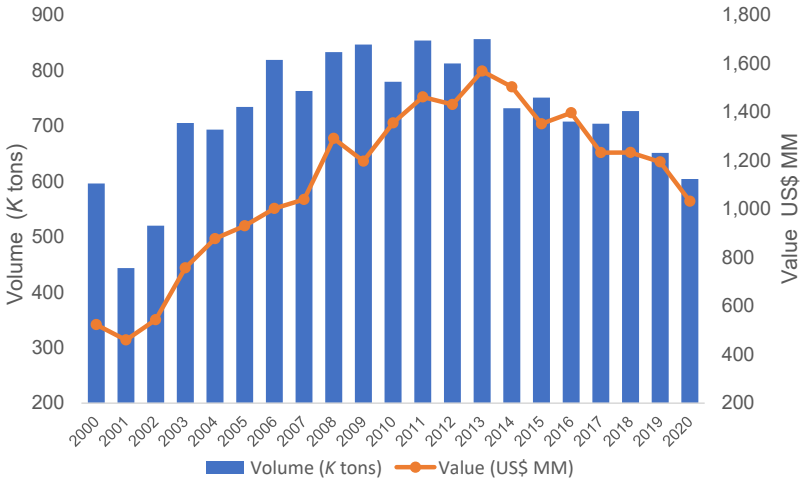
While the interviewed companies have different levels of participation in the European market, all must meet the minimum requirements to enter European markets. All experts interviewed expressed that the bare minimum is having the GlobalGAP certification. Interviewees agree that retailers in Germany, The Netherlands and Northern Europe, in addition to GlobalGAP, request the GRASP social practices certification from third party GlobalGAP. Interviewed industry experts agreed that the most demanding market, in terms of certifications and MRL standards is the German retail sector. Specifically, the German retailers usually require multiresidue analyses with thresholds equivalent to about a third of what is allowed by the EU and a molecular detection of a maximum of five different active substances. In this respect, industry experts tend to agree with the literature that generally places Germany as a good example regarding private standards (Sonntag *et al.*, 2016). In this context, industry experts agree that in the case of Chilean exports, meeting these requirements is particularly difficult in cases of table grapes and cherries, because the supply of these fruits requires more intensive use of agro-chemicals to allow the fruit to arrive in good conditions at destination.

The information shared by the experts provides the rationale for the analytical framework used to analyze the impact of these certifications and MRL standards on the Chilean exports of fresh fruits. In the first place, the analysis focuses on table grapes, both because as stated by experts complying with the required MRL standards is costlier for this fresh fruit than others, and because it is a fruit that has been exported by Chile for a longer period. Second, the analysis focuses on the Chilean exports of table grapes to Germany, the Netherlands, the UK and Northern Europe which according to experts are among the most demanding countries in terms of certifications and MRL. Furthermore, interviews suggested the period when a key discrete change in terms of prerequisites happened, which facilitates the evaluation of the impact of these new requirements on the Chilean bilateral exports of fresh fruits. For instance, the retail sector in Germany started demanding the GRASP certification specifically since 2016. As a result, Germany and the 2016–17 commercialization season are taken as references to evaluate the impact of private standards on the Chilean exports of table grapes.

3.4 The Chilean table grape export sector

As Figure 1 clearly shows, Chile is cutting back on its table grape exports since 2013, as both exports in value and volume have been on the decline. Production has similarly declined, from 2.9 million tons in 2012–13, to about 2.4 million tons in 2020, a drop of almost 20% according to food and agriculture database of the FAO figures. In other words, farmers and exporters are turning their resources to other more profitable crops. Different environmental and economic trends, both domestic and international explain this retraction.

Among the domestic drivers for the decline in grape production is a prolonged drought and an inevitable trend in rising labor costs due to both the appreciation of the Chilean peso and the competition with other growing sectors of the domestic economy. These medium-term trends have translated into a constant erosion of the competitiveness of the table grapes sector, causing many producers to switch to more mechanized crops with lower water requirements, for example, walnuts. However, there are also international drivers of this decline in table grape exports. The country has faced growing competition from other Southern hemisphere producers, notably Peru.



Source(s): Own elaboration using UN Comtrade data

Figure 1.
Evolution of Chilean table grape exports, 2000–2020

Another factor could be related to the proliferation of private standards that inflate the real costs of producing and exporting table grapes, which is precisely the hypothesis examined below.

The consulted industry experts agreed that compliance to private standards is no longer optional, but rather the starting point to obtain access to main retail outlets within the European markets. Large retailers directly move approximately 80–90% of fresh fruits in Europe. Hence, if the exporter is unable to meet the retailers' standards, the export lots risk being sold in spot markets, where fruit generally receives lower prices (C. Urban, personal communication; September 6, 2021).

Additionally, according to the consulted experts, European markets do not pay the best prices for imported fresh fruit: value can be 30–40% lower than what the North-American or Asian retails pay (I. Quiroz, personal communication, September 16, 2021). Inevitably exporters and markets sort fresh fruits accordingly and the fresh fruit quality shipped to Europe is consequently different (F. Casanova, personal communication, September 7, 2021). Another way to understand this sorting out of the fresh fruit is that the European consumers and markets value other nonobservable fresh fruit attributes beyond those traditionally considered: color, caliber, ripeness and sweetness. European markets value more attributes related to food safety and the production process (MRL standards and certifications related to environmental and social sustainability) and are therefore willing to pay for these attributes at the expense of more common quality aspects. For exporters, obtaining profitable prices is not an easy task. Supermarkets traditionally market their activities around the promise of offering the lowest prices, while at the same time international competition is increasing. Thus, it is worth asking why, despite all these restrictions, Europe remains an interesting market.

4. Model specifications and data

Below we examine the hypothesis that in a context where Europe does not pay the highest prices for fresh fruits, the higher costs of doing business with Europe as a result of the various and overlapping private certifications have triggered a measurable trade diversion to other destinations with higher returns. Furthermore, we attempt to answer to what extent private costs imposed by additional certifications are shared or absorbed by only one of the trading

parties. For addressing these two questions, we first determine the model specifications, then present the data in this section.

4.1 Model specifications

To answer these questions, a gravity trade model is fitted using data of Chilean table grape export flows, a methodology extensively used in the literature (Melitz, 2007; Disdier *et al.*, 2008; Emlinger *et al.*, 2008; Magee, 2008; Henry de Frahan and Nimenya, 2013; Agostino and Trivieri, 2014; Melo *et al.*, 2014; Abu Hatab, 2017; Ehrich and Mangelsdorf, 2018; Rajeev and Nagendran, 2020; among others). This model and its several specifications attempt to explain bilateral commercial flows based on the "economic gravity" of the trading partners, i.e. economy size or mass and distance or frictions. Several authors have contributed important enhancements to the basic model (Anderson, 1979; Bergstrand, 1985), being the study "Gravity with Gravitas" by Anderson and van Wincoop (2003), one of the most important as it estimates consistently and efficiently a trade gravity equation founded on economic theory while providing comparative statistics consistent with trade frictions (transport costs, market transactions, tariff and NTB). The Anderson and van Wincoop's (2003) gravity equation, however, holds for a one-sector economy where expenditure equals to output. For data at sector level under trade separability as in our case, Anderson and Van Wincoop (2004, p. 708) derive a more appropriate gravity equation on which we rely to develop our own specifications.

Starting from this Anderson and Van Wincoop's (2004, p. 708) sector gravity equation, we obtain a first specification:

$$\begin{aligned}\ln X_{ijt} = {} & \alpha + \beta_1 \ln Y_{it} + \beta_2 \ln E_{jt} + \beta_3 \ln Y_{wt} + \beta_4 \ln (1 + AVT_{ijt}) + \beta_5 \ln(\pi_{it} P_{jt}) \\ & + \beta_6 Language_{ij} + \beta_7 Contiguity_{ij} + \beta_8 Legal\_Origin_{ij} + \beta_9 Colonial\_Tie_{ij} \\ & + \beta_{10} TA_{ijt} + \beta_{11} RER_{ijt} + \beta_{12} Direct\_Sales_{ijt} + \beta_{13} New\_Norm_{ijt} \\ & + \beta_{14} Direct\_Norm_{ijt} + \sum_t \beta_t \cdot t + \varepsilon_{ijt}\end{aligned}$$

The dependent variable expressed by X_{ijt} corresponds to the sale value in nominal US dollars of table grape exports from Chile (i) to a given country destination (j) on a given year (t), implying that the underlying data has a panel structure. The model first includes the variables that describe the "gravitational forces" that promote and deter trade for the sector under study, that is the production in nominal US dollar value of table grapes in Chile (Y_{it}), the expenditure in nominal US dollar value for table grapes in the destination country (E_{jt}), the world (w) production in nominal US dollar value of table grapes (Y_{wt}), and the bilateral transport costs that is approximated by the bilateral insurance and freight costs in the form of an *ad valorem* transport cost rate (AVT_{ijt}) where the rate AVT_{ijt} is calculated as the ratio of the difference between the import unit value for table grapes in the importing country and the free-on-board (f.o.b.) price for table grapes from the exporting country over the f.o.b. price for table grapes as indicated in Anderson and Van Wincoop (2004). All these continuous variables are expressed in natural logarithm and their coefficients are interpreted as elasticities. Note, however, that we opt for the unrestricted specification of the trade gravity equation where the elasticities β_1, β_2, and β_3 can differ from one to allow for a more flexible export response in particular in response of trade costs or incomplete specialization.

The variable π_{it} takes care of the outward multilateral trade resistance in the exporting country i for the sector under study, that is the resistance to shipments from country i to its trading partners other than country j. Similarly, the variable P_{jt} takes care of the inward multilateral trade resistance in the importing country j for the sector under study, that is the

trade costs from suppliers other than country i to country j. These two multilateral trade resistance factors implied by theory are however unobservable. Among the three approaches outlined in Anderson and Van Wincoop (2004), we first approximate, for simplicity, these factors with consumer prices for table grapes in the exporting and importing markets respectively using the f.o.b. price in the exporting country and the domestic price in the importing country for table grapes. This approximation cannot measure properly the prices implied by theory because of missing information regarding some specific trade costs such as home market preferences and time and currency risks involved in international trade. In the second specification of the model we will therefore supplement this approximation with country-specific dichotomous variables. Not only the fixed-effect (FE) specification can capture the unobserved price effects but also potential trade resistance variables omitted in the gravity equation with, however, the assumption that these effects are time-invariant in the estimated equation. One solution is therefore to combine the use of export f.o.b. price in the exporting country and the internal price in the importing countries to account for time-variant differences in price competitiveness between importers along with the importing and exporting countries' fixed effects to account for the remaining trade resistance not included in those prices and the trade cost variables. This is the combination we implement in the second specification.

This first specification also includes, as common in the related literature, dichotomous variables that describe the magnitude of trade frictions, like common language ($Language_{ij}$), geographical contiguity ($Contiguity_{ij}$), legal tradition ($Legal\_Origin_{ij}$) and past colonial relationship ($Colonial\_Tie_{ij}$) that are all time invariant, and the existence of trade agreements (TA_{ijt}) between the partners that is time variant. The relative purchasing power of currencies, a strong time-variant trade determinant, is included as the real exchange rate (RER_{ijt}), a continuous variable defined as the purchasing power in terms of the importing country.

Furthermore, the specification includes additional time-variant variables that can shed light into the impact of additional private certifications on table grapes traded value. First, the specification includes a continuous variable that measures the proportion of the inter-partner trade flows commercialized as direct sales ($Direct\_Sales_{ijt}$). Other common commercialization modes include consignments, where the final price is determined on destination spot markets, and consignment with a guaranteed minimum price. Also, a dichotomous variable identified as (New_Norm_{ijt}) is included marking the commercialization seasons during which the GRASP certification in addition to retailer-specific certifications is required by most domestic market operators. This dichotomous variable takes the value of one from the 2016–17 season onwards for those countries that, according to the industry experts, are the most demanding in terms of this additional certifications, i.e. Belgium, Germany, The Netherlands and the UK. Finally, an interaction variable is included identified as $Direct\_Norm_{ijt}$, that is the product of the variables $Direct\_Sales_{ijt}$ and New_Norm_{ijt}. Supplementary certifications required by domestic retailers inevitably translate into higher costs for the exporter. In this context, direct sales may be a mechanism by which exporters transfer to retailers at least a portion of these additional costs. Therefore, the variable $Direct\_Norm_{ijt}$ provides clues about how the additional cost of compliance with the new norm is distributed (see further discussion below). Finally, the specifications include seven commercialization season-fixed effects, capture by the vector of parameters, β_t.

With the time-invariant country characteristics included, we estimate this first specification as a random-effect (RE) model 1 assuming that the underlying model error ε_{ijt} is composed of a traditional mean zero, constant variance *iid* error ϵ_{ijt} and a trade partners specific error u_{ij}:

$$\varepsilon_{ijt} = u_{ij} + \epsilon_{ijt}.$$

This first estimation allows us to control specifically for the time-invariant country characteristics commonly included in trade gravity equations. However, to account better for multilateral trade resistance as explained above, we also estimate this specification but without the time-invariant country characteristics as a FE model 2, an approach that has become more commonly used in many empirical studies as reported in Head and Mayer (2014, p. 136). The FE model has the advantage of capturing any other trade resistance that could still be omitted in the original Anderson and Van Wincoop's (2004) gravity equation and, hence, removing some potential estimation bias. It also imposes much less structure on the trade gravity equation (Head and Mayer, 2014, p. 150).

4.2 Data

All information related to sale method, volume exported, sales value, destination and means of transportation, is obtained from the "Data Sur" platform, a private consolidator of trade data using invoices presented to the Chilean customs agency [1]. As it records individual transactions, i.e. export invoices, this dataset contains information regarding international trade which is not traditionally available in commonly used trade datasets, like the UN Comtrade, or organization for economic co-operation and development (OECD) trade.

This dataset records the mode of transportation (air, ground or sea) and the mode of commercialization, which we make use of in this study. Modes of commercialization consist in four types: direct sales, consignment, consignment with a minimum price, and others. Direct sales correspond to transactions where the final price is agreed before shipping out. Consignment includes an estimated export price, but the final price of the exported lot is determined on destination spot markets when the produce is finally sold. Consignment with a minimum price is a similar agreement, where the consignee, i.e. the importer in the transaction, agrees to a minimum price, which may eventually be higher if the produce garners a higher price when liquidated in spot markets.

Trade data is annually aggregated, but instead of calendar years, shipping seasons are used to be in line with the calendar around which the fruit industry actually organizes itself. Seven shipping seasons starting from 2013, the first season available with complete detailed information, to 2018 are considered in the analysis. As Chile is in the Southern hemisphere, the shipping season is defined from August of the preceding year to July of the current year, with most trade activity occurring in the months of March and April. Only country destinations with yearly export values of more than US$150,000 and with a maximum of one year of missing information are included. Using these two criteria fifty country destinations are included in the analysis, with no missing values.

Domestic and global trade grape production, Y_{it} and Y_{wt} respectively, are obtained from the FAOSTAT database. Apparent grape consumption of the importing country, E_{jt}, is calculated using the FAOSTAT database as the result of domestic production minus exports, plus imports. The *ad valorem* transport cost rate $(1 + AVT_{ijt})$ is calculated as the observed ratio of the import unit value to the f.o.b. price using the UN Comtrade database. The multilateral trade resistance term $(\pi_{it}P_{jt})$ is calculated as the product between Chile's global f.o.b. price obtained from the UN Comtrade database and the importer producer price P_{jt} using the FAOSTAT database. The other common explanatory variables used by the gravity trade model are obtained from the *Centre d'Études Prospectives et d'Informations Internationales* (CEPII) platform, among them geographic variables such as contiguity, as well as cultural variables such as common language, legal tradition and colonial relationship [2]. The CEPII platform is also used for other indicators such as the bilateral trade agreements. Finally, information regarding the exchange rates is obtained from the International Monetary Fund, which is used to calculate the annual real exchange rates.

5. Results

Table 1 shows the results of the gravity models using the RE specification in the first column, and the country FE specification in the second column. Before analyzing the detailed results, we test the validity of the RE estimation with the Hausman-Wu test. The test with a p-value of 0.77 does not reject the null hypothesis that the FE and RE estimates being structurally equivalent. Given this specification test result, there is no evidence of inconsistency in using the RE model. However, if unobserved trade frictions are considered important in this market, the fixed effect specification may be the preferred specification. The models, furthermore, have a fit between 22 and 27%. The model also fits better cross-country variation than the time-series variation.

The same table shows that the gravity variables do explain bilateral trade flows. Local grape production *expansion* does not significantly increase exports. Consider that about 25–30% of annual grape production is exported and that the wine industry is another

Independent variables	Model 1 ln(value)	Model 2 ln(value)
$\ln(Y_{it})$	0.5487	0.54
	(0.5879)	(0.5837)
$\ln(E_{jt})$	0.4795***	0.5170**
	(0.1181)	(0.1656)
$\ln(Y_{Wt})$	−3.3430*	−3.3539
	(1.9749)	(2.0122)
$\ln(1 + AVT_{ijt})$	−0.4031	−0.4207
	(0.3129)	(0.3075)
$\ln(\pi_{it}P_{jt})$	0.1005	0.0969
	(0.0719)	(0.0734)
Language_{ij}	1.2074*	
	(0.7254)	
Contiguity_{ij}	−1.3389**	
	(0.6446)	
$(\text{Legal Origin})_{ij}$	−0.8451	
	(0.5890)	
$(\text{Colonial Tie})_{ij}$	−1.3405	
	(0.9083)	
$(\text{Trade Agreement})_{ijt}$	−0.2267	−0.2104
	(0.2153)	(0.2266)
(RER_{ijt})	0.0159***	0.0158***
	(0.0036)	(0.0035)
$(\text{Direct Sales in \%})_{ijt}$	0.0774	0.116
	(0.3060)	(0.3044)
$(\text{New Norm})_{ijt}$	−0.4979***	−0.5076***
	(0.1230)	(0.1312)
$(\text{Direct\_Norm})_{ijt}$	2.2552**	2.2213*
	(1.1688)	(1.1838)
Constant	60.8821*	60.5552*
	(31.9367)	(32.4605)
Season Fixed Effects	Yes	Yes
Country Fixed Effects	No	Yes
Observations	350	350
Destinations	50	50
R-squared	0.2761	0.2123

Note(s): Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Authors' estimations using data described above

Table 1. Estimates of the gravity models for Chilean grapes exports using the random-effect (model 1) and the fixed-effect (model 2) specifications

important consumer of domestic grape production. Furthermore, global grape production appears to have a large impact on exports (elasticity of −3.3), but this effect is only marginally significant in the RE model. Distance, in this model measured economically by the implicit AVT does not negatively affect exports. This is likely due to Chile's geographic position, which is distant from all major markets. In terms of the friction variables, the common language acts as a promoter of bilateral trade flows, while contiguity discourages grape exports. The latter is an expected result given that neighbors Argentina and Peru are actually competitors in the international table grapes market. The other friction variables included are not significant, however, they are still included as relevant control variables. The real exchange rate is significant at the 1% level and has an implied elasticity of about 1.5 (note RER_{ijt} is an index normalized to 100 and not expressed in logs). This implies that on average if a foreign currency increases by 10% the capacity to buy Chilean pesos, Chilean grape exports grow by 15%. However, the unit elasticity cannot be statistically rejected.

We turn our attention to the variables that are the focus of this study. We find that the new certifications in 2016–17 have an effect of diverting trade, but only after controlling for the share of exports that are marketed as direct sales (as opposed to other sale methods, most commonly consignment). The overall effect of the new norms depends on two coefficients, those of *New_Norm* and *Direct_Sales*, and is shown in Table 2 to be not significant when evaluated at sample means. However, the coefficients in Table 1 show that the new norms have a trade diverting effect after controlling for direct sales, and that the new norms promote more direct sales.

The variable *Direct_Sales*, which represents direct sales with supermarkets and other large intermediaries, does not increase the traded value in the gravity models. In other words, countries with a larger portion of direct sales in the inter-country trade do not trade more. This is consistent with what experts suggested in the interviews. However, the individual trade records show that direct sales receive prices that on average are about 33% higher: US$2.05/kg versus US$1.55/kg, with these differences being significant at any standard significance level. Given that the new certifications promote more direct sales, this result suggests that the costs of new certifications are being shared with the importers in the form of increased direct sales that are traded at higher prices.

	Model 1				Model 2			
			Standard error				Standard error	
	Marginal effect	Wald	Delta method	vGS Approx.	Marginal effect	Wald	Delta method	vGS Approx.
New norm	−0.107		0.175	0.830	−0.122		0.178	0.816
Direct sales	0.130	0.303			0.168	0.302		

Note(s): The marginal effect of the new norm regime is estimated as the percentage change in exports from moving from one regime to the other. The literature has shown that in this semilogarithmic specification the marginal impact of the dummy variable can be approximated by $exp[\beta_{13} + \beta_{14} \cdot \overline{Direct\ Sales}] - 1$, where the bar indicates mean values, see for example (van Garderen and Shah, 2002), from where we obtain their approximation to the standard error of this nonlinear estimator (vGS Approx. in the table). In the case of direct sales, the marginal effect corresponds to a semielasticity and estimated by $\beta_{12} + \beta_{14} \cdot \overline{New\ Norm}$.
Source(s): Authors' estimations using data described above

Table 2.
Marginal effects of the new 2016–17 certifications evaluated at sample means

6. Robustness checks

Like in any gravity trade model, one cannot be certain that a dummy (new certification in this case) captures a causal effect as other concomitant changes may be occurring in the same countries that imposed the new certification. In such cases the researcher may spuriously attribute the effect of those other changes to the new certifications and regulation. Acknowledging these limitations, one can test the sensitivity of the results presented above to changes in the definitions of the new certifications dummy, which is what is presented in this section.

First, we test the sensitivity of the estimated results to different definitions of the starting shipping season for the requirements of additional private certifications. Following the experience of the consulted experts, the regime change was established in the 2016–17 shipping season. Just to test the robustness of the model, in the first two columns of Table 3, we establish different hypothetical starting points for the new regime. If the new certifications regime was not the cause of the negative effect in trade value detected in the previous section, but instead the effect was due to more stringent standards in general of the identified European countries, then we would observe a negative effect of the *New_Norm* variable when we change the starting date for the new regime. However, Table 3 shows that the new regime dummy still has a negative value, but it is about one-seventh of the estimated parameter in Table 1, and is not significant, when the date for the new regime is changed. This particular result strengthens the interpretation of Table 1 results, as it is not the countries that have a negative trade effect, but those countries: Belgium, Germany, The Netherlands and the UK starting in the season 2016–17 when their main traders started requesting additional private certifications like GRASP.

Additionally, in Table 3, we use Italy, Poland, Portugal and Spain as placebo countries to test whether the negative effect found with the original countries more prone to impose private certifications is really an impact of the selected years. We purposely select as placebo countries European countries that the consulted experts identified as more lenient in terms of requiring additional certifications. Again, the results strengthen the interpretation of the original model presented in Table 1. The results in the third and fourth columns of Table 3 mirror the results of the first table, except for the variables that include the *New_Norm* variable. As a result of the new certification, these "more lenient" countries receive relatively more Chilean grape exports. Altogether these results are consistent with the trade deviation identified in Table 1. When private traders in Belgium, Germany, The Netherlands and the UK started requesting additional certifications, Chilean grape exports deviated from these countries, and some of this trade deviation was directed towards European countries that did not require these additional certifications like Italy, Poland, Portugal and Spain.

Econometric model selection could be another source of variability for the main results presented. In Table 1, two econometric approaches to the gravity specification were presented, with robust results in terms of the effect of both the *New_Norm* regime and its interaction with the *Direct_Sales* variable. As an additional check, the same model was estimated using the Arellano Bond approach (unreported), confirming the main qualitative results presented here.

This sensitivity analysis does not amount to a proof of causality. However, it describes a consistent story. As a response to the demands of their consumers and probably also as a market differentiation strategy, major European retailers in North West Europe started requesting additional certifications to sell invisible attributes that their consumers value, like lower environmental impact and higher labor standards. Inevitably, additional certifications translate into higher costs of doing business, but also according to consulted experts to fruit of lower quality in terms of observable attributes (caliber, color, sweetness, etc.). The higher costs of doing business translated into a measurable trade deviation. However, we also show that part of these additional costs incurred by additional certifications was shared by trading partners, with an increase in direct sales that on average give higher returns for exporters than traditional sales on consignment.

	Different definitions of certification regime change date		Placebo countries: Italy, Poland, Portugal, Spain	
	Model 2 ln(value)	Model 2 ln(value)	Model 1 ln(value)	Model 2 ln(value)
$\ln(Y_{it})$	0.6317	0.6325	0.6523	0.6593
	(0.5860)	(0.5865)	(0.5973)	(0.5921)
$\ln(E_{jt})$	0.5524**	0.5444**	0.4831***	0.5367**
	(0.1740)	(0.1714)	(0.1159)	(0.1642)
$\ln(Y_{Wt})$	−3.9212*	−3.9307*	−4.0492*	−4.1606*
	(2.0530)	(2.0365)	(2.0757)	(2.1050)
$\ln(1 + AVT_{ijt})$	−0.4419	−0.428	−0.4068	−0.4305
	(0.3091)	(0.3077)	(0.3152)	(0.3105)
$\ln(\pi_{it}P_{jt})$	0.0874	0.0869	0.1009	0.0957
	(0.0735)	(0.0733)	(0.0682)	(0.0697)
Language_{ij}			1.2337*	
			(0.7185)	
Contiguity_{ij}			−1.3534**	
			(0.6457)	
$(\text{Legal origin})_{ij}$			−0.8704	
			(0.5875)	
$(\text{Colonial Tie})_{ij}$			−1.424	
			(0.9030)	
$(\text{Trade agreement})_{ijt}$	−0.1996	−0.1993	−0.2112	−0.1881
	(0.2262)	(0.2254)	(0.2154)	(0.2277)
(RER_{ijt})	0.0156***	0.0156***	0.0151***	0.0150***
	(0.0035)	(0.0035)	(0.0036)	(0.0035)
$(\text{Direct sales in \%})_{ijt}$	0.0967	0.0937	0.0784	0.1185
	(0.3054)	(0.3049)	(0.3044)	(0.3018)
$(\text{New norm})_{ijt}$	0.0767	0.0408	0.3097**	0.3178**
	(0.2162)	(0.1858)	(0.1120)	(0.1124)
$(\text{Direct\_Norm})_{ijt}$	0.4866	0.7419	−1.0303	−0.9302
	(1.0804)	(1.0586)	(0.9691)	(0.9820)
Constant	0.6317	0.6325	0.6523	0.6593
	(0.5860)	(0.5865)	(0.5973)	(0.5921)
Season fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	No	Yes
Observations	350	350	350	350
Destinations	50	50	50	50
R-squared	0.2122	0.2133	0.2155	0.2163

Note(s): To test the sensitivity of results the "new norm" dummy has different definitions. In the first two columns, the original countries that imposed the new certification (Belgium, Germany, The Netherlands and the UK) are maintained, but the dummy takes value one starting in the season 2015–16 in column one, and 2014–15 in column 2. In columns 3 and 4, the placebo countries (Italy, Poland, Portugal and Spain) are assigned a value of one instead of the original countries for the same period as in Table 1, starting in season 2016–17

Source(s): Authors' estimations using data described above

Table 3.
Robustness checks of the gravity models for Chilean grapes exports

7. Conclusions

Despite of growing hurdles for Chilean fresh fruit exporters in terms of competing and overlapping certifications requested by European retailers, and despite that these same markets do not pay higher prices compared to other destinations, these destinations remain coveted for Chilean table grape exporters. First, there is a value for Chilean exporters to participate in European markets as a signal of their ability to meet the highest standards of food safety, environmental protection and social sustainability. Also, European markets are valuable as part of the exporters' strategy of having as diversified as possible portfolio of customers, to adapt in the ever-changing international markets conditions.

On the other hand, private standards have an important role to play in fresh produce markets, where information is imperfect. Consumers may decide to demand and pay for non-observable attributes like environmental and social sustainability. Certifications are a vehicle to trade these attributes. However, the proliferation of overlapping and competing standards that certify the same attributes, i.e. social sustainability, looms large as an important drawback in agri-food markets. The market segmentation induced by large retail chains, by promoting their own certifications, reduces competition and most likely translates to higher prices for consumers. Moreover, the existence of overlapping and competing certifications for the same attributes increases the cost for producers to deliver those attributes that consumers are demanding. This implies that European consumers are most likely not purchasing their desired unobservable traits at the most efficient prices.

This study shows that these inefficiencies are translated into a deviation of trade from the most stringent EU countries to other countries, including less stringent EU countries. Also, this study shows that these additional costs of new private standard requirements are being shared by trading partners via an increase in higher paying direct sales.

However, the identified trade deviation should call into question possible welfare losses induced by the existence of many overlapping and competing private standards in both trading partners. Chile is a high middle income country with ample expertise in this export sector and has a modern logistic infrastructure. Therefore, it could have an advantage vis-à-vis its competitors when meeting these new standards. Nonetheless, we find that these new private standards are displacing trade. These results provide an economic argument for the call in the legal literature to reign over these certifications in pursuit harmonization of standards and win-win outcomes under the setting of the WTO and other international organizations.

Finally, this study is limited by the reduced time span over which the new overlapping and competing certifications have been required by large European retailers. Thus, the results presented here should be interpreted with care, as an early indication while more evidence is gathered.

Notes

1. Data downloaded in April 2021, from http://www.datasur.com
2. Data available at http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp

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