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Santeramo, Fabio Gaetano and Lamonaca, Emilia and
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University of Foggia

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Fabio Gaetano Santeramo¹, Emilia Lamonaca, Gianluca Nardone, Antonio Seccia

University of Foggia - Italy

Abstract

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Our results suggest that country-specific NTMs tend to favour imports of wine. Differences emerge across market segments and types of regulations. In particular, the Technical Barriers to Trade favour (friction) bottled (bulk) wine; pre-shipment inspections enhance imports of bottled wine; the Sanitary and Phytosanitary Standards and the export-related measures are the most trade-enhancing NTMs, regardless of the market segment.

Keywords: Global trade; NTM; Policy; SPS; TBT.

JEL Classification codes: Q17, Q18, F13.

¹ Corresponding author: Fabio G. Santeramo, IATRC Member. Email: fabio.santeramo@unifg.it.

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1. Introduction

The negotiations of the World Trade Organisation (WTO), in the mid-1990s, has contributed to shape global trade of agri-food products. In particular, tariffs have substantially reduced, whereas non-tariff measures (NTMs) have increased. The proliferation of NTMs has led to a less transparent policy environment: the effects on trade have not been fully investigated nor clarified (Arita et al., 2017; Santeramo and Lamonaca, 2018a). This is true, in particular, for the wine sector, where high levels of tariffs and NTMs coexist. Relevant is the share of country-specific NTMs: the implementing country provides a set of standards that imports of specific trading partners have to satisfy before entering the domestic market (UNCTAD, 2017). Country-specific NTMs are frequently set in the occasion of trade agreements between implementing country and trading partners, in particular, if previous trade relationships already exist between them. As a result, wine trade is overregulated, and the level of overall intervention has been steady for years (Foster and Spencer, 2002; Anderson and Golin, 2004). Plausibly, governments tend to seek additional revenues through tariffs, and multilateral and country-specific NTMs (Schnabel and Storchmann, 2010; Storchmann, 2012).

A large literature has investigated the influence of NTMs on trade of agri-food products, and has provided mixed evidence: NTMs may be barriers (e.g. Anders and Caswell, 2009; Peterson et al., 2013; Ferro et al., 2015) or catalysts (e.g. Cardamone, 2011) for trade. Only few studies investigate if and how NTMs affect wine trade. Olper and Raimondi (2008) estimate the effect of NTMs on trade of processed food (e.g. spirits, wine, malt, drinks), concluding that NTMs play a trade reduction effect. On global trade of bottled wine, Dal Bianco et al. (2016) investigate the equivalence of NTMs with respect to tariffs, and find that Sanitary and Phytosanitary Standards (SPSs) do not seem to obstruct exports, while Technical Barriers to Trade (TBTs) have heterogeneous impacts on trade. Meloni and Swinnen (2017a, b) examine the impact of standards in wine trade between France and Greece, and conclude that standards reduce Greek exports. The contrasting evidence and the limited empirical literature on the effects of NTMs, in particular of country-specific NTMs, on wine trade call for more investigation: are country-specific NTMs trade-enhancing or trade-impeding? Which measures are the most (and the least) influential? Are these effects heterogeneous across different segments of the wine market?

By adopting a gravity model approach, we investigate how and to what extent country-specific NTMs influence global imports of wine. In particular, we disentangle the contribution of country-specific NTMs

mostly implemented on wine imports (SPSs, TBTs, pre-shipment inspections, export-related measures). We also discriminate the global effects of country-specific NTMs for different market segments of wine: sparkling, bottled, bulk, and musts. We focus on main exporters and main importers, and on trade occurred since 1991 until 2016.

The novelty of our paper derives by the level of details we reach in classifying trade regulations and market segments. The detailed analysis allows us to identify which regulation is the most influential, and which segments tend to react more to country-specific trade regulations.

The paper is organised as follows: section 2 details the evolution of trade and country-specific NTMs in the wine sector over the last twenty-five years; section 3 describes econometric procedures and sources of data; section 4 presents and discusses the empirical results; the last section concludes providing empirical and policy implications.

2. Non-tariff measures and trade: evidence from the wine sector

A rapid and dynamic evolution has affected the wine sector in recent decades, driven by changes in demand (Castillo et al., 2016), geographical redistribution of consumption (Aizenman and Brooks, 2008; Anderson and Nelgen, 2015) direction of trade flows (Mariani et al., 2012), and complementary determinants, such as novel types of policy interventions (Dal Bianco et al., 2016).

We consider wine imports of 24 countries and four market segments of wine (sparkling, bottled, bulk, and musts) (table 1): they cover more than 90% of global imports and exports' values and of global production volumes (Anderson and Pinnilla, 2017). They include developed (North, 62%) and developing (South, 38%) countries (United Nations, 2017), and are representative of Old World Producers (OWP, 46%) and New World Producers (NWP, 54%) (Anderson and Nelgen, 2015). Comparing average values of imports and exports¹, countries may be classified as net importers (NI, 62%) and net exporters (NE, 38%) (UN Comtrade, 2017).

¹Average values of imports and exports are computed over the period 1991-2016.

Table 1. Country classification and 2015-16 average imports (mln US\$) arranged by wine segments.

Countries	ISO-3	Classification			Imports (mln US\$)				
		<i>United Nations (2017)</i>	<i>Anderson and Nelgen (2015)</i>	<i>UN Comtrade (2017)</i>	<i>All wines</i>	<i>Sparkling</i>	<i>Bottled</i>	<i>Bulk</i>	<i>Musts</i>
Argentina	ARG	South	NWP	NE	0.4	0.7	0.1	1.2	0.0
Australia	AUS	North	NWP	NE	9.2	10.6	14.0	4.8	0.0
Belgium-Luxembourg	BEL	North	OWP	NI	0.0	0.0	0.0	0.0	0.0
Brazil	BRA	South	NWP	NI	8.2	2.2	17.5	0.1	0.0
Canada	CAN	North	NWP	NI	33.9	7.6	63.7	6.9	0.0
Chile	CHL	South	NWP	NE	0.2	0.7	0.1	0.0	0.0
China	CHN	South	NWP	NI	39.0	3.2	100.0	7.8	0.0
Denmark	DNK	North	OWP	NI	9.4	3.0	21.1	5.8	0.2
France	FRA	North	OWP	NE	9.6	3.0	17.1	12.3	0.9
Germany	DEU	North	OWP	NI	46.9	23.1	80.5	38.0	1.6
Hong Kong	HKG	South	NWP	NI	27.5	3.4	63.1	0.6	0.0
Ireland	IRL	North	OWP	NI	5.2	1.1	12.5	0.4	0.5
Italy	ITA	North	OWP	NE	6.6	13.0	2.8	8.0	1.5
Japan	JPN	North	NWP	NI	25.8	24.9	46.4	5.8	3.6
New Zealand	NZL	North	NWP	NE	2.6	2.7	3.2	1.4	0.0
Portugal	PRT	North	OWP	NE	2.6	1.9	1.5	5.9	1.9
Russian Federation	RUS	South	NWP	NI	13.4	8.1	21.6	6.9	0.0
Singapore	SGP	South	NWP	NI	7.3	13.9	9.1	0.2	0.0

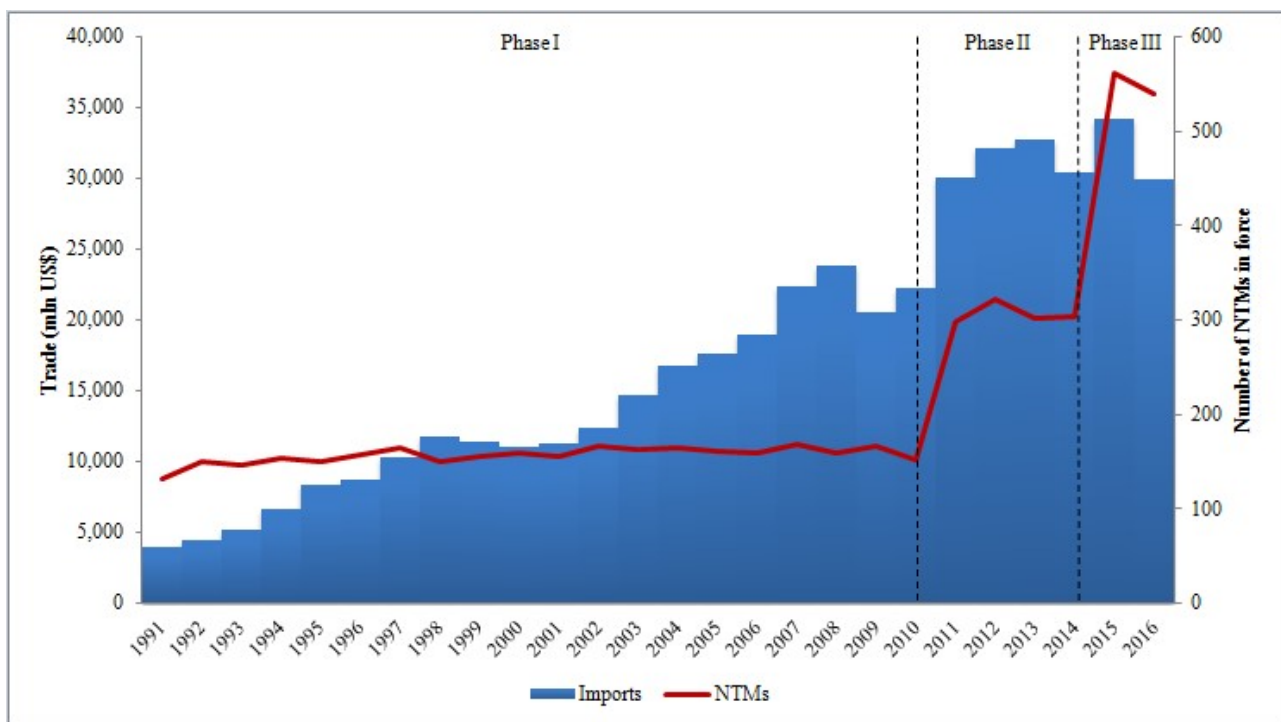
South Africa	ZAF	South	NWP	NE	0.5	1.3	0.3	0.0	0.0
Spain	ESP	North	OWP	NE	2.8	5.1	3.3	0.7	0.1
Sweden	SWE	North	OWP	NI	10.8	7.0	18.1	10.5	0.1
Switzerland	CHE	North	OWP	NI	14.7	8.3	33.1	5.1	0.7
United Kingdom	GBR	North	OWP	NI	59.9	41.7	124.0	30.5	0.2
United States	USA	North	NWP	NI	95.1	67.6	178.0	20.3	0.0

Source: elaborations on UN Comtrade (2017).

Notes: 'South' are developing economies, 'North' are developed economies; acronyms are New World Producers (NWP), Old World Producers (OWP), net exporter (NE), net importer (NI).

Imports show a notable growth in the period 1991-2008, due to increased consumption in non-producing countries, and a recover in 2011 after a reduction in 2009, due to the international economic crisis (figure 1). The increased consumption of non-producing countries (i.e. new world consumers, such as Asian countries) offset the gradual reduction of OWP's consumption (Anderson, 2013; Anderson and Wittwer, 2015). Emblematic is the case of China, whose consumption has increased from 5 to 16 million hl in a decade (from 2006 to 2016). In addition, volumes of production of OWP have been rather steady, whereas NWP have exponentially increased their production and exported quantities (from 78 to 7,885 million U.S.\$ in 1986-2016) (Anderson and Pinilla, 2017).

Figure 1. Trends in imports and country-specific non-tariff measures (NTMs) in the wine sector in 1991-2016.



Source: elaboration on UN Comtrade (2017) and UNCTAD (2017).

Comparing the evolution of average values of imports across decades (table 2), we find the highest increase from 2000-01 to 2010-11 for all wines (+95%). Differences emerge across market segments: since 1990, some wines have grown more than others. Sparkling and bottled wines increased the most (Pomarici, 2016; del Rey, 2018): bottled wines doubled from 1990-91 to 2000-01, and again from 2000-01 to 2010-11, while

in 2015-16 they have grown by 9%. Bulk wine has tripled from 2000-01 to 2010-11 (Mariani et al., 2012), while musts show a progressive downward trend after an increase from 1990-91 to 2000-01 (+23%).

Table 2. Wine imports by market segments: a comparison among 1990-91, 2000-01, 2010-11, and 2015-16 averages (mln US\$).

Wine segment	1990-91	2000-01	2010-11	2015-16
Sparkling	6	6	11	16
Bottled	10	20	40	44
Bulk	4	3	10	9
Musts	1	1	1	1
All wines	7	11	21	23

Source: elaboration on UN Comtrade (2017).

If we focus on 2015-16 (table 1), the United States (US), the United Kingdom (UK), Germany, China, and Canada are listed as top 5 for wines, in particular for bottled wine. It is worth noting that Germany, the UK, and the US have long been major destinations for wine exports, while Canada and China are the first traditional and non-traditional importing countries, respectively (Mariani et al., 2012). Relevant importers of sparkling wine are Japan and Singapore (that overstep China and Canada). Germany, the UK, and the US are leaders in imports of bulk wine, followed by France and Sweden. Musts (not imported by Russian Federation, New Zealand, and Argentina) cover a relevant share of wine imports for Japan and European countries (Portugal, Germany, Italy, and France).

Global trade patterns have considerably changed over time (table 3): trade between OWP has drastically reduced (from 65% to 27%, in 1996-2016) in favour of a relevant increase in imports of NWP (from 22% to 44% from OWP, and from 4% to 21% from NWP, in 1996-2016). In 2016, global imports are absorbed by NWP for 65% and by North for 77% (UN Comtrade, 2017). Changes in the relevance of countries' groups in global wine market are significant: NWP have gained increasing market shares, driven by North (e.g. the US, Canada, Australia, New Zealand).

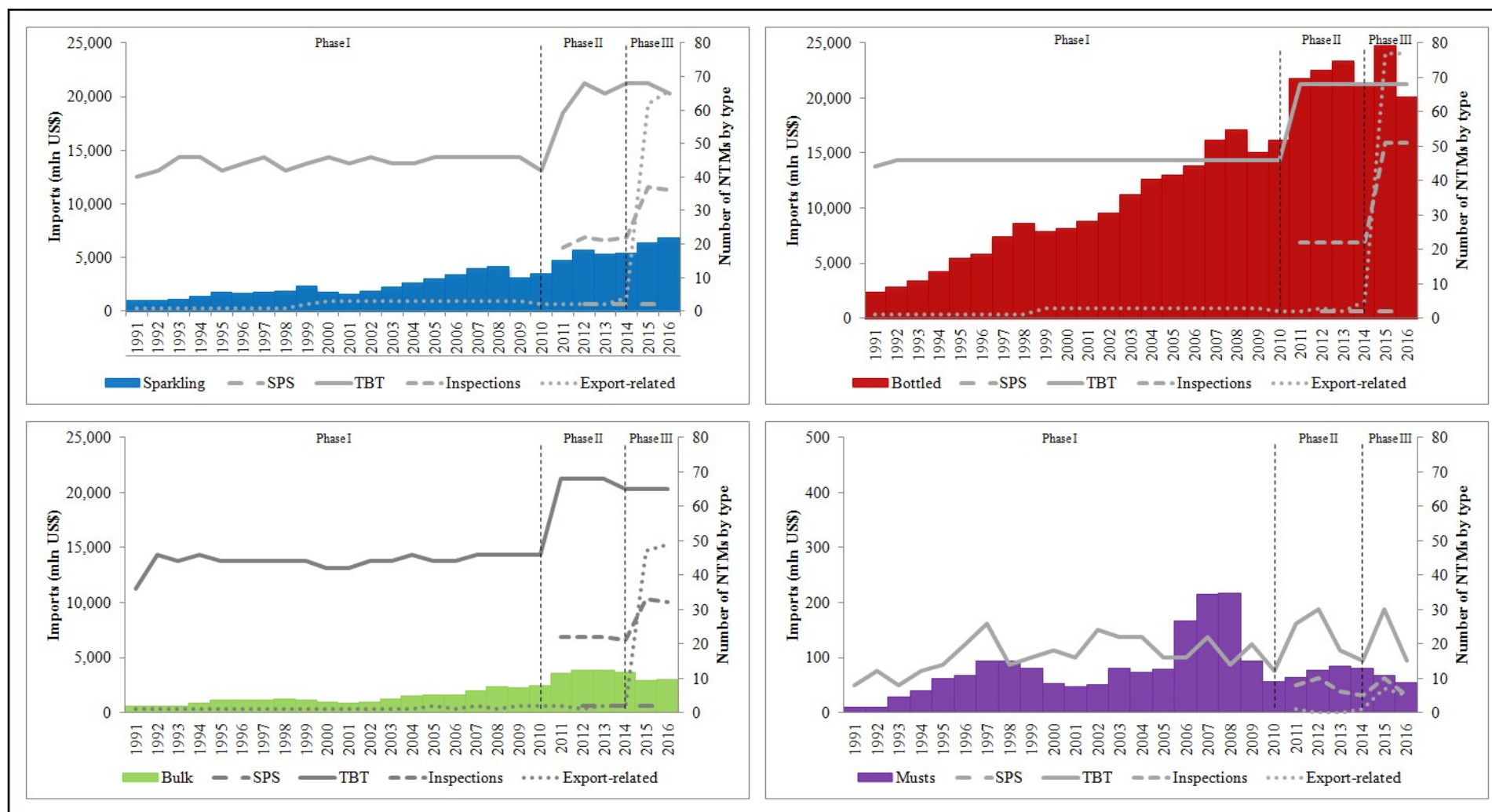
Table 3. Value of wine imports (mln US\$) arranged by trade patterns: focus on developed (North) and developing (South) countries, Old World Producers (OWP) and New World Producers (NWP), net importers (NI) and net exporters (NE).

Year	North-North	North-South	South-North	South-South
1996	7,900	432	334	11
2006	15,200	1,570	2,000	247
2016	20,700	2,410	6,050	926
Year	OWP-OWP	OWP-NWP	NWP-OWP	NWP-NWP
1996	5,630	730	1,940	381
2006	7,410	3,400	5,680	2,490
2016	8,190	2,420	13,100	6,290
Year	NI-NI	NI-NE	NE-NI	NE-NE
1996	642	7,390	57	584
2006	1,540	15,900	158	1,380
2016	1,990	26,000	208	1,870

Source: elaborations on UN Comtrade (2017).

Notes: In pairs of countries' groups, the former are importers and the latter are exporters.

Figure 2. Trends in imports and country-specific non-tariff measures (NTMs) in the wine sector in 1991-2016: detail by wine segments and types of NTMs.



Source: elaboration on UN Comtrade (2017) and UNCTAD (2017).

Notes: Types of NTMs are Sanitary and Phytosanitary Standard (SPS), Technical Barrier to Trade (TBT), Pre-shipment inspection (Inspections), Export-related measure (Export-related).

The level of country-specific non-tariff measures (NTMs), almost stable until 2010 (Phase I), has approximately doubled in 2011 (from 152 to 299 in 2010-2011) (Phase II) and again in 2015 (from 299 to 561 in 2011-2015) (Phase III) (figure 1). The level of policy intervention has progressively grown despite the recourse to NTMs, that occur in the WTO subcommittee, may take a long time. The exponential growth of NTMs since 2011 may be due to a plethora of determinants. *In primis*, the progressive increase of wine imports since 2000 (figure 1) may use wine market regulations in order to support local producers (Mariani et al., 2014). In addition, some of new importers, such as Russia and China, not being partner of Regional Integrated Areas may have larger room in implementing trade measures (Mariani et al., 2014). The sharp increase of NTMs may be also due to the growing concerns related to quality and safety of wine, and to environmental and ethical issues (Santeramo and Lamonaca, 2018b). In fact, in recent years NTMs have increased rapidly in order to prevent adulterations and frauds (Meloni and Swinnen, 2018). In particular, a relevant number of NTM is implemented by the US, Russian Federation, and Canada (respectively 246, 211, and 110 NTMs on average during 2015-2016) (UNCTAD, 2017): it is worth noting that the US and Canada are listed as top 5 net importers, whereas Canada is the first traditional importing countries (Mariani et al., 2012).

Country-specific NTMs on wine are heterogeneous (table 4): the most and the least adopted are Technical Barriers to Trade (TBTs, 75%) and Sanitary and Phytosanitary Standards (SPSs, 1%), respectively; others are pre-shipment inspections and export-related measures (24% in total).

Country-specific NTMs are also segment-specific (figure 2). TBTs are the most widespread across product categories: they account for 2/3 of total country-specific NTMs on sparkling (76%), bottled (74%), bulk (77%) wines and musts (77%) (table 4). For wines (sparkling and still), TBTs have been approximately constant until 2010 and sharply increased since 2011: the relevant increase in TBTs may explain the raise in total level of country-specific NTMs and the transition from 'Phase I' and 'Phase II' (see figure 1). For musts, TBTs have widely fluctuated from 10 to 30 during the period 1991-2016. SPSs and pre-shipment inspections

have been implemented only since 2011 for all segments: they represent only 1% of the overall intervention on wine (table 4). Relevant is the increase in the number of pre-shipment inspections and export-related measures since 2015 for wines (sparkling, bottled, and bulk): in particular, export-related measures are implemented by 5 out of 13 NWP (i.e. Australia, Canada, Russia, Singapore, and the US), while pre-shipment inspections are adopted in 3 out of 13 NWP (i.e. Canada, Russia, and the US) (UNCTAD, 2017). Their wide increase in 2015 may have determined the transition from ‘Phase II’ and ‘Phase III’ (see figure 1).

Table 5 lists and describes specific types of country-specific NTMs implemented for wine imports.

Table 4. Types of country-specific non-tariff measures (NTMs) implemented on imports of wine and of its market segments: incidence (%) on total NTMs in 1991-2016 (A) and number of NTMs in place in 1991 and in 2016 (B).

Types of NTM	All wines		Sparkling		Bottled		Bulk		Musts	
	A	B	A	B	A	B	A	B	A	B
Sanitary and Phytosanitary Standard (SPS)	1%	[0; 6]	1%	[0; 2]	1%	[0; 2]	1%	[0; 2]	0%	[0; 0]
Technical Barrier to Trade (TBT)	75%	[128; 213]	76%	[40; 65]	74%	[44; 68]	77%	[36; 65]	77%	[8; 15]
Pre-shipment inspections	12%	[0; 124]	11%	[0; 36]	12%	[0; 51]	11%	[0; 32]	13%	[0; 5]
Export-related measures	12%	[3; 197]	12%	[1; 66]	13%	[1; 77]	11%	[1; 49]	10%	[0; 5]

Source: elaboration on UNCTAD (2017).

Table 5. Classification and description of country-specific non-tariff measures (NTMs) implemented in the wine sector.

Chapter	Classification	Description
A	Sanitary and Phytosanitary Standards (SPSs)	Measures that are applied to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; to protect human life from plant- or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity.
A220	Restricted use of certain substances in food and feed and their contact materials	Restriction or prohibition on the use of certain substances contained in food and feed. It includes the restrictions on substances contained in the food containers that might migrate to food.
B	Technical Barriers to Trade (TBTs)	Measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement.
B330	Packaging requirements	Measures regulating the mode in which goods must be or cannot be packed, and defining the packaging materials to be used.
B420	TBT regulations on transport and storage	Requirements on certain conditions under which products should be stored and/or transported.
B830	Certification requirement	Certification of conformity with a given regulation: required by the importing country but may be issued in the exporting or the importing country.
C	Pre-Shipment inspections	Compulsory quality, quantity and price control of goods prior to shipment from the exporting country, conducted by an independent inspecting agency mandated by the authorities of the importing country.
C200	Direct consignment requirement	Requirement that goods must be shipped directly from the country of origin, without stopping at a third

		country.
C900	Other formalities, n.e.s.	Other formalities not elsewhere specified.
P	Export-related measures	Export-related measures are measures applied by the government of the exporting country on exported goods.
P130	Licensing- or permit requirements to export	A requirement to obtain a licence or a permit by the government of the exporting country to export products.
P500	Export taxes and charges	Taxes collected on exported goods by the government of the exporting country: they can be set either on a specific or an ad valorem basis.
P620	Certifications required by the exporting country	Requirement by the exporting country to obtain sanitary, phytosanitary or other certification before the goods are exported.
P690	Export measures, n.e.s.	Export measures not elsewhere specified.

Source: International Classification of Non-Tariff measures, February 2012 version (UNCTAD/DITC/TAB/2012/2).

Types of country-specific NTMs on wine imports differ across trade patterns (table 6). Country-specific NTMs implemented by NWP have more than tripled during the period 1996-2016 (from 76 to 240 in NWP-OWP trade, from 81 to 300 in NWP-NWP trade) (UNCTAD, 2017), whereas OWP, in general, adopt import tariffs and multilateral NTMs rather than country-specific NTMs (Rickard et al., 2014, 2017; Global Trade Alert, 2017²). Governments have substantially increased the use of technical measures in order to level off the tariff reduction and to protect domestic markets (Anderson and Golin, 2004): in 2016, North has implemented 126 TBTs against other developed countries (59%) and 87 TBTs to regulate imports from South (41%) (UNCTAD, 2017). There is almost no recourse to SPSs (in 2016, 6 SPSs have been implemented worldwide): in general, they concern trade of fresh products (Santeramo and Lamonaca, 2018b) and few standards have so far been defined by the Codex Alimentarius to regulate wine trade (Mariani et al., 2012, p. 35). Not negligible is the share of pre-shipment inspections (23%) and export-related measures (36%) in 2016: NWP have implemented them against OWP (about 43%) and other NWP (approximately 57%) (UNCTAD, 2017). Net importers adopt TBTs and pre-shipment inspections, while net exporters use SPSs only against other net exporters. Export-related measures are implemented both by net importers and net exporters.

The level of intervention is emblematic in trade between countries with similar levels of economic development: in North-North trade, country-specific NTMs have more than doubled in 2016, after a period of relative stability from 1996 to 2006; in South-South trade, absent until 2006, country-specific NTMs are 48 in 2016. In trade between countries with different levels of economic development, the number of policy measures changes drastically if imposed by North or by South: NTMs implemented by South against North are rather scant (87 measures in 2016) compared to NTMs adopted by North against South (169 measures in 2016) (UNCTAD, 2017). The frequent adoption of country-specific NTMs by developed countries may lead to a non-transparent trade policy environment (Athukorala and Jayasuriya, 2003; Fernandes et al., 2017): the consequences may be detrimental in particular for trade from developing countries of NWP (e.g. Argentina, Chile, Uruguay, South Africa), which have to find alternative outlet to their production (Santeramo and Lamonaca, 2018a).

² Available at: www.globaltradealert.org/ (accessed in December, 2017).

Table 6. Number and types of country-specific non-tariff measures (NTMs) implemented in the wine sector, arranged by trade patterns: focus on developed (North) and developing (South) countries, Old World Producers (OWP) and New World Producers (NWP), net importers (NI) and net exporters (NE).

Year	NTM	North-North	North-South	South-North	South-South
1996		99	58		
2006		95	60	4	
2016		236	169	87	48
	Sanitary and Phytosanitary Standards (SPSs)	6			
	Technical Barriers to Trade (TBTs)	126	87		
2016	Pre-shipment inspections	43	37	28	16
	Export-related measures	61	45	59	32
Year	NTM	OWP-OWP	OWP-NWP	NWP-OWP	NWP-NWP
1996				76	81
2006				72	87
2016				240	300
	Sanitary and Phytosanitary Standards (SPSs)				6
	Technical Barriers to Trade (TBTs)			102	111
2016	Pre-shipment inspections			55	69
	Export-related measures			83	114
Year	NTM	NI-NI	NI-NE	NE-NI	NE-NE
1996		27	31		
2006		26	33		
2016		103	169	5	10
	Sanitary and Phytosanitary Standards (SPSs)				3
	Technical Barriers to Trade (TBTs)	38	49		
2016	Pre-shipment inspections	21	43		
	Export-related measures	44	77	5	7

Source: elaboration on UNCTAD (2017), TRAINS NTMs: The Global Database on Non-Tariff Measures.

Notes: In pairs of countries' groups, the former are countries implementing NTMs and the latter are countries affected by NTMs.

3. Empirical strategy

In order to investigate the impact of country-specific non-tariff measures (NTMs) on global trade of wine, we use a standard gravity approach: bilateral trade is likely to depend on the economic masses, and on the economic distance between countries (Anderson and van Wincoop, 2003). Following Baldwin and Taglioni (2006), we proxy economic masses of importing (i) and exporting (j) countries with importer (β_i) and exporter (β_j) fixed effects, so to account for multilateral trade resistance terms. The fixed effects capture size effects, and control for the country-specific unobserved heterogeneity (Cardamone, 2011). We also use time fixed effects (β_t) to control for time-specific events.

We model NTMs as dummy variables, equal to 1 if a country-specific NTM is in place (0 otherwise): the dummy variable captures the extensive margins of the measure and allows us to detect the effect of having (or not) a country-specific NTM (Santeramo, 2017). The NTMs are time-specific (t), and related to the implementing country (i), the partner country (j), and the wine category (k)³:

$$\ln(X_{ij,k}) = \alpha + \sum_{i=1}^I \beta_i + \sum_{j=1}^J \beta_j + \sum_{t=1}^T \beta_t + \sum_{k=1}^K \gamma_k NTM_{ij,k} + \varepsilon \quad (1)$$

where $\ln(X_{ij,k})$ is the logarithm of (annual) imports of the k -th wine category between i and j , α is a constant, γ_k is the parameter of interest, and ε is the error term.

We estimate the model in equation (1) using the Poisson Pseudo-Maximum Likelihood (PPML) estimator. By assuming an additive error, the PPML estimator allows us to correct for heteroskedasticity in the error term, and to avoid selection bias due to exclusion of zero trade flows (Silva and Tenreyro, 2006). In addition, the related marginal effects tend to be more robust in terms of magnitude, and statistical and economic significance (Haq et al., 2013). We compute the effect (TE) of NTMs on import values in percentage terms, by exponentiating the coefficients of the PPML estimation procedure:

$$TE_k(\%) = (e^{\widehat{\gamma}_k} - 1) * 100 \quad (2)$$

³ The pedexes t have been omitted for clarity.

We also compute the maximum and the minimum TE , by adjusting the coefficient of interest by its standard error ($\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$)

We distinguish between net importers and net exporters in order to isolate potential differences in the effects of the country-specific NTMs on imports that may be due to the sign of the trade balance.

We use imports of four product categories, coded according to the Harmonised System (HS) 6-digit: ‘wine, sparkling’ (220410), ‘wine, still, in containers holding 2 l or less’ (220421), ‘wine, still, in containers holding more than 2 l’ (220429), ‘grape must’ (220430). We include all types of country-specific NTMs applied on wine imports: Sanitary and Phytosanitary Standards (SPSs), Technical Barriers to Trade (TBTs), pre-shipment inspections, and export-related measures. We collected bilateral annual data from the Global Database on Non-Tariff Measures for NTMs, and from the UN Comtrade database for imports. The dataset includes 24 countries (selected among the top importers, exporters and producers of wine), and cover data from 1991 to 2016.

4. Results and discussion

Results of the Poisson Pseudo-Maximum Likelihood (PPML) estimation (table 7) suggest that the trade effects of country-specific non-tariff measures (NTMs) are segment-specific, and differences emerge across types of NTMs⁴.

We find positive coefficients for Sanitary and Phytosanitary Standards (SPSs), pre-shipment inspections, and export-related measures: country-specific NTMs tend to facilitate global trade of wine. This is true, in particular, for SPSs: on average, the SPSs are the most influential on imports, with an effect on imports value ranging between 28.4% and 33.6% for all wines (table 8). Global imports also raise if pre-shipment inspections and export-related measures are implemented, but their impacts are not as large as those observed for the SPSs. Our results complement the findings of Dal Bianco et al. (2016), who focus on

⁴ We perform a sensitivity analysis by introducing in the model a set of gravity-type control factors: distance (expressed in log), contiguity (dummy), common language (dummy), WTO membership (dummy), and trade agreement (dummy). The gravity-type variables have the expected signs: the larger the distance, the lower the imports; vice-versa, imports are favoured if the parties are contiguous, or share a common language, or are WTO member, or join a trade agreement. As for types of NTMs, results are almost unchanged: the only differences are the loss of statistical significance for TBTs for bottled wine, pre-shipment inspection for all wine and bottled wine, and export-related measures for sparkling and bulk wine (although the signs are the same). We omitted results for brevity.

exports of wine. In particular, we found that SPSs enhance imports, while they found that SPSs have no impact on exports; we also found that technical measures have mixed effects on imports, while they conclude that technical measures are important frictions for exports. The two perspectives are divergent: in fact, exports may be frictioned due to the extra costs faced by producers to comply with more stringent regulations. Vice-versa, imports may be favoured due to the guarantee to enter in domestic market products of higher quality (that fulfil more stringent standards) (Xiong and Beghin, 2014; Santeramo, 2017).

As for the segment-specific analyses, we find that country-specific NTMs enhance trade, exception made for the Technical Barriers to Trade (TBTs), whose effects are segment-specific. Moreover, the SPSs and export-related measures are trade-enhancing: the formers affect imports of bulk wine (+37.7%), the latter lead to an exponential growth of musts' imports (+46.2%) (table 8). The effects of pre-shipment inspections are mainly due to their positive effect on bottled wine, whose imports increase by 5.1%. The TBTs impact bottled and bulk wine, but the evidence is mixed: imports of bottled wine are favoured (+4.1%), while imports of bulk wine are frictioned (-9.5%) (table 8). The differences we observe for bottled and bulk wine may be due to changes in the composition of import flows: during the last decades bulk wine has gained market shares to the detriment bottled wine (Castillo et al., 2016). Large volumes of bulk wine are imported and bottled in the target market: it is plausible that, compared to bulk wine, bottled wine meets technical standards (e.g. packaging requirements, regulations on transport and storage, certification requirements) and, as a consequence, it is likely to have great imports. Our findings are specular to those of Dal Bianco et al. (2016) also for the TBTs: for bottled wine, they suggest that an additional TBT impedes exports, while we show that the existence of TBTs favour imports.

We highlight how the trade effects of country-specific NTMs differ for net importers and net exporters (tables 9 and 10). TBTs and pre-shipment inspections are implemented only by net importers. TBTs are trade-enhancing for bottled wine (+4.1%), but trade-impeding for bulk wine (-10.4%) (table 10). The trade-impeding effect of TBTs for bulk wine of net importers may be due to the high specialisation of some competitors, that are net exporters of bulk wine (i.e. Australia, New Zealand, and Spain) (Mariani et al., 2012). Pre-shipment inspections increase imports of bottled wine. SPSs are adopted only by net exporters, and increase imports of wine. Export-related measures are always trade-enhancing.

Our results highlight that trade policy strategies are quite heterogeneous across countries. The net importers are frequent adopters of technical regulations (TBTs), and tend to impose formalities that should precede the shipments from exporting countries. The net exporters prefer measures aimed at ensuring food safety and preventing the dissemination of disease or pests (SPSs). Apart from specific differences, we may conclude that country-specific NTMs are trade-enhancing, both for net importers and net exporters.

Table 7. Results of the Poisson Pseudo-Maximum Likelihood (PPML) estimation.

Variables	All wine	Sparkling	Bottled	Bulk	Musts
Importer f.e.	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes	Yes	Yes
Time f.e.	Yes	Yes	Yes	Yes	Yes
Sanitary and Phytosanitary Standards (SPSs)	0.27 ***	0.24 ***	0.25 ***	0.32 ***	No
	(0.02)	(0.02)	(0.01)	(0.02)	
Technical Barriers to Trade (TBTs)	0.02	0.03	0.04 **	-0.10 **	-0.01
	(0.02)	(0.03)	(0.02)	(0.04)	(0.10)
Pre-shipment inspections	0.05 ***	0.03	0.05 ***	-0.04	0.08
	(0.02)	(0.03)	(0.02)	(0.04)	(0.11)
Export-related measures	0.10 ***	0.09 ***	0.09 ***	0.10 ***	0.38 ***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.06)
Constant	1.76 ***	2.19 ***	1.58 ***	2.12 ***	2.27 ***
	(0.02)	(0.03)	(0.03)	(0.08)	(0.08)
Observations	27,854	8,192	10,971	6,832	1,859
R-squared	0.46	0.66	0.76	0.60	0.54

Robust standard errors are in parentheses. *** and ** indicate statistical significance at 1% and 5%. ‘No’ signals the exclusion of regressors due to the lack of observations for specific measures in certain product categories between pairs of countries.

Table 8. Trade effects of non-tariff measures (NTMs) on imports value.

	All wine		Sparkling		Bottled		Bulk		Musts	
	$\widehat{\gamma}_k$	$\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$	$\widehat{\gamma}_k$	$\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$	$\widehat{\gamma}_k$	$\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$	$\widehat{\gamma}_k$	$\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$	$\widehat{\gamma}_k$	$\widehat{\gamma}_k \pm \widehat{\sigma}_{\gamma_k}$
Sanitary and Phytosanitary Standards (SPSs)	31.0%	[28.4%; 33.6%]	27.1%	[24.6%; 29.7%]	28.4%	[27.1%; 29.7%]	37.7%	[35.0%; 40.5%]		
Technical Barriers to Trade (TBTs)					4.1%	[2.0%; 6.2%]	-9.5%	[-13.1%; -5.8%]		
Pre-shipment inspections	5.1%	[3.0%; 7.3%]			5.1%	[3.0%; 7.3%]				
Export-related measures	10.5%	[8.3%; 12.7%]	9.4%	[6.2%; 12.7%]	9.4%	[7.3%; 11.6%]	10.5%	[7.3%; 13.9%]	46.2%	[37.7%; 55.3%]

Table 9. Results of the Poisson Pseudo-Maximum Likelihood (PPML) estimation: detail on net importers and net exporters.

Variables	All wine		Sparkling		Bottled		Bulk		Musts	
	Net	Net	Net	Net	Net	Net	Net	Net	Net	Net
	importers	importers	importers	importers	importers	importers	importers	importers	importers	importers
Importer f.e.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time f.e.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sanitary and Phytosanitary Standards (SPSs)	No	0.35 *** (0.02)	No	0.36 *** (0.03)	No	0.34 *** (0.02)	No	0.39 *** (0.03)	No	No
Technical Barriers to Trade (TBTs)	0.02 (0.02)	No	0.02 (0.03)	No	0.04 * (0.02)	No	-0.11 *** (0.04)	No	0.01 (0.18)	No
Pre-shipment inspections	0.04 ** (0.02)	No	0.02 (0.03)	No	0.04 ** (0.02)	No	-0.06 (0.04)	No	0.11 (0.18)	No

Export-related measures	0.08 *** (0.02)	0.22 *** (0.05)	0.07 *** (0.03)	0.16 * (0.10)	0.07 *** (0.02)	0.24 *** (0.06)	0.05 ** (0.03)	0.38 *** (0.09)	0.42 *** (0.16)	0.14 (0.09)
Constant	2.08 *** (0.02)	1.83 *** (0.03)	2.09 *** (0.05)	1.87 *** (0.05)	1.91 *** (0.03)	1.61 *** (0.05)	2.03 *** (0.10)	1.68 *** (0.14)	2.28 *** (0.12)	1.52 *** (0.3)
Observations	18,454	9,400	5,522	2,670	7,110	3,858	4,651	2,181	1,171	688
R-squared	0.41	0.47	0.67	0.65	0.74	0.73	0.62	0.55	0.55	0.64

Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10%. ‘No’ signals the exclusion of regressors due to the lack of observations for specific measures in certain product categories between pairs of countries.

Table 10. Trade effects of non-tariff measures (NTMs) on imports value: detail on net importers and net exporters.

	All wine		Sparkling		Bottled		Bulk		Musts									
	Net importers	Net exporters	Net importers	Net exporters	Net importers	Net exporters	Net importers	Net exporters	Net importers	Net exporters								
	$\hat{\gamma}_k$	$\hat{\gamma}_k \pm \hat{\sigma}_{\gamma_k}$	$\hat{\gamma}_k$	$\hat{\gamma}_k \pm \hat{\sigma}_{\gamma_k}$	$\hat{\gamma}_k$	$\hat{\gamma}_k \pm \hat{\sigma}_{\gamma_k}$	$\hat{\gamma}_k$	$\hat{\gamma}_k \pm \hat{\sigma}_{\gamma_k}$	$\hat{\gamma}_k$	$\hat{\gamma}_k \pm \hat{\sigma}_{\gamma_k}$								
Sanitary and Phytosanitary Standards (SPSs)		41.9% [39.1%; 44.8%]		43.3% [39.1%; 47.7%]		40.5% [37.7%; 43.3%]		47.7% [43.3%; 52.2%]										
Technical Barriers to Trade (TBTs)					4.1%	[2.0%; 6.2%]		- [-13.9%; - 6.8%]										
Pre-shipment inspections	4.1%	[2.0%; 6.2%]			4.1%	[2.0%; 6.2%]												
Export-related measures	8.3%	[6.2%; 10.5%]	24.6%	[18.5%; 31.0%]	7.3%	[4.1%; 10.5%]	17.4%	[6.2%; 29.7%]	7.3%	[5.1%; 9.4%]	27.1%	[19.7%; 35.0%]	5.1%	[2.0%; 8.3%]	46.2%	[33.6%; 60.0%]	52.2%	[29.7%; 78.6%]

5. Concluding remarks

Changes in trade regulations have largely influenced agri-food markets (Arita et al., 2017; Santeramo et al., 2017), and are modifying global trade of wine as well. The level of policy intervention (tariffs and non-tariff measures, NTMs) is remarkable in the wine sector (Dal Bianco et al., 2016). The trends in the level of policy interventions seems to follow the pattern of global trade, with relevant changes in the relative importance of groups of countries (Mariani et al., 2012). On top of a substantial regulation established through multilateral trade agreements, there has been a strong tendency to implement country-specific NTMs set in the occasion of trade agreements: their impact on trade is not always clear, nor quantified at global scale. We assessed the effects of country-specific NTMs on global imports of wine, through a gravity model approach. We quantified the effects for Sanitary and Phytosanitary Standards (SPSs), Technical Barriers to Trade (TBTs), pre-shipment inspections, and export-related measures, and conclude on differences observed for the segments of the wine market (sparkling, bottled, bulk, musts).

We found that country-specific NTMs favour trade, by increasing imports of wine. Moreover, we show that the effects of the SPSs are similar (and large) for all types of market segment (sparkling, bottled, and bulk). The TBTs favour (friction) bottled (bulk) wine. The pre-shipment inspections are relevant for bottled wine. The export-related measures always promote imports of wine.

Our analysis represents a first attempt to quantify the impacts of country-specific NTMs on trade of wine. Despite country-specific NTMs are expected to be pro-trade, we show that large differences exist across market segments and types of NTMs. The emphasis that we pose on this issue is beneficial for policymakers and entrepreneurs.

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