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An empirical analysis of world wine trade

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Doctoral dissertation

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LIST OF ABBREVIATIONS

ARCA	Additional Revealed Comparative Advantage
CD	Cross-sectional Dependency
CEPII	Centre de recherche francais dans le domain de l'économie international (Research and Expertise Centre on the World Economy)
CMO	Common Market Organisation
ECB	European Central Bank
EU	European Union
EUROSTAT	European Union Statistical Database
FAO	Food and Agriculture Organisation of the United Nation
GDP	Gross Domestic Product
NRCA	Normalised Revealed Comparative Advantage
NWW	New Wine World
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OWW	Old Wine World
OIV	Organisation Internationale de la Vigne et du Vin
PCSE	Panel Corrected Standard Error
PTM	Pricing to Market
PPML	Pseudo-Poisson Maximum Likelihood
RCA	Revealed Comparative Advantage
RTA	Regional Trade Agreement
UK	United Kingdom
USA	Unites States of America
WDI	World Development Indicator
WITS	World Integrated Trade Solution
WTO	World Trade Organisation

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"Comparative advantage appears to be
the outcome of a number of factors,
some measurable, others not,
some easily pinned down,
others less so."

Béla Balassa, 1965
Trade liberalisation and "revealed" comparative advantage

1 INTRODUCTION

In a recent semi-centenary period, important changes could be observed on the world wine market. However, what is happening is significantly different in European wine regions (in other words: Old Wine World) comparing to the New Wine World.

The New World wine producer countries can be defined in the global wine market as countries discovered by the Europeans during the Exploration and Conquest of America and Southern Hemisphere. Wine-producing countries such as the USA, Argentina, Australia, South Africa, Chile and New Zealand belong to New World's country group (Murphy, 2000). Old World wines refer primarily to wines that are produced in the European continent (or in the proximity of Europe e.g. the Near East) and come from regions with a long documented history and wine culture.

Since 1980, the world's total vineyard area had been decreasing continuously due to the traditional producers while New World wine producers became significant and strengthened their activity in international and in the European markets. Furthermore, New World countries increased their vineyards by new plantations thus accounted for a notable boost of wine production and trade. In addition, the New Wine World had a large and growing wine consumption (Labys and Cohen, 2004) and they also gained increasing market shares at the same time as the Old World's market shares have declined (Anderson and Norman, 2003).

The European Union (EU) is the world's leader in wine production, with nearly half of the global vineyards and approximately 65 percent of production by volume (USDA, 2015, p. 3). In EU, the member states hold the largest export market shares worldwide, more specifically: France is the world leader in value and Italy in volume on the export market for bottled wine while Spain is the world leader in value and volume for bulk wine (European Commission, 2014, p. 39). However, since the 80s, France, Italy and Spain have suffered a remarkable drop in domestic wine consumption at the same time as New World's countries have increased their production potential and induced new demand in foreign markets (Cembalo et al., 2014). Initially, the USA, Australia and later emerging wine exporter countries such as Chile, New Zealand and South Africa have gained increasing market shares both in volumes and in values exported (Morrison and Rabellotti, 2014 p. 2). Meanwhile totally new market players have also come up such as China.

These new players endanger the position of traditional wine producers by exporting high amount of low-priced quality wines to European wine markets thus conquering export market from Old Wine World. At this time, almost half of the global wine is consumed outside of a country of production; by contrast, this fact can be rarely associated without an extra trade cost (Bianco et. al., 2014).

Moreover, after 2008, the European wine industry was strongly affected by changing regulations of the Common Agricultural Policy (CAP) for wine, with a particularly attractive grubbing-up prime that has lead a very large share of wine producers in EU member states to ask to benefit from this measure (OIV, 2013 p. 10).

However, small wine producers in EU such as Hungary, Croatian, Slovakia, Slovenia and Romania also tried to maintain their market position on international wine market they had less benefit from the new market environment.

While in Hungary the decades-long decline in wine consumption has slowed during the past years, as a result of a stronger demand for quality wines, the demand for imported products also increased (USDA, 2015). In recent decades, Hungary had a significant drop in wine production and trade in accordant with the changing EU CMO regulation. Moreover, Hungary has lost a significant part of their export market share due to the increasing market competition, EU supply restrictions and the higher trade advantage of New World competitors.

Besides the small countries, these market trends also had a negative effect on the market share, the market dominance and the trade competitiveness of major European wine exporter countries. Although the market power of European Wine World had been declining year by year, the traditional wine producers still remained competitive market players and have higher wine export share than New World’s competitors.

Furthermore, the changes on global wine market historically have been accompanied by a geographical relocation of wine consumption due to the colonisation and migration. The European conquistadors such as Spain, Portugal, France, England and the Netherlands colonised the lands in America, Africa, Asia and Oceania during the Age of Discovery. These explorer countries colonised much of the world, conquered the territory and opened new trade routes in the 16^{th}, 17^{th} and 18^{th} centuries. The first fleet of British ships arrived in Sydney in 1788 and established a penal colony. The first known record of successful grape production in Australia dates back to 1791 when two bunches of grapes were cut in the Governor's garden located in Sydney (Australian Government, 2015).

Most of the conquerors had a period of almost complete power in world trade thus reshaped the culture and the language spoken in their colonies hence brought in the culture of winemaking and established new trade relation with them. Consequently, besides economic aspects wine trade has a geographical and a cultural dimension as well.

In the globalised world, the analysis of international trade has been gaining growing importance in international economics. To better understand how global trade has evolved, it is important to understand how countries traded with another, to assess the trade performance, comparative advantage and to analyse factors influencing trade costs. The increasing number and availability of international trade statistics provided by World Bank, WTO, OECD, United Nations and European Union's EUROSTAT databases facilitated to calculate plenty of econometric trade models.

More and more importance can be attributed to the analysis of international wine trade, confirmed by the establishment of European (EAWE) and American Association of Wine Economists (AAWE) that organise conferences and publishing scientific journals especially in the field of wine economics.

However, several types of research are published investigating the global wine industry and trade (Dascal, 2002; Anderson 2003; Anderson 2013; Bianco et al. 2013b, 2014; USDA 2015; European Commission, 2014; OIV, 2015), a comprehensive analysis investigating the recent situation of world wine trade by econometric models discovering deeper factors is understudied yet.

To date, there has been limited attention to analysing the trade competitiveness (Anderson, 2003; Van Rooyen at al., 2010; Anderson, 2013) and long-term export specialisation patterns in the wine industry. The recent studies are focusing only on a given country or country groups; in contrast, the analysis of the determinants of wine trade competitiveness including the global market players is missing part of the literature.

However, historical and cultural background are key factors of the international trade (Tinbergen 1962; Anderson 1979; Anderson and van Wincoop 2003; Bacchetta et al., 2012) they can also have an influence on wine trade relations. This research field is scarcely investigated in wine trade literature, especially considering all of the most important market players and their trade relations.

Since the quantity of wine exported by the traditional wine world has dropped due to the quality upgrading, the EU countries are still dominants players in the wine trade.

Therefore, it is important to investigate how the world largest traditional wine producers can compete in their foreign wine export markets. Such preliminary studies can be only found in crop, meat or beer industry (Saghaian and Reed, 2004; Griffith and Mullen, 2001; Fedoseeva and Werner, 2014) while analysing the export markets in wine industry is still ignored.

The objective of the research is to investigate the aspects of international wine trade by three different trade models based on representative samples covering major wine exporter and importer countries in the world.

1.1 Research strategy

This research is an empirical study that can be divided into three main parts reflecting the research fields analysed (Table 1). The major empirical chapters follow the second (introductory) chapter that presents a general outline of world wine sector and trade.

1. The first part of my empirical research provides insight into the export competitiveness of major wine producer countries on global markets and investigates the determinants of wine trade competitiveness at country level (Chapter 3).
2. The second part of the dissertation covers the factor influencing trade costs among major market players and their trading partners in the global wine industry and reveals the cultural-linguistic factors behind wine trade (Chapter 4).
3. The third part researches the role of exchange rates effects and the price discrimination behaviour of the biggest traditional wine exporters across their export markets (Chapter 5).

In order to analyse the research topics mentioned above my dissertation posts five research questions and tests fifteen hypotheses (described in the main empirical chapters of the dissertation). In order to analyse the world wine industry and trade, I applied three trade models, in particular: comparative trade advantage (Ricardo, 1817; Balassa, 1965), gravity model of international trade (Tinbergen, 1962; Anderson and van Wincoop, 2003) and pricing to market (PTM) model (Krugman, 1987; Knetter, 1993; Goldberg and Knetter, 1997). The aim of the applied models is to evaluate the changes in comparative advantage of wine export, to take into consideration the role of trade costs in the wine trade and to explore the pricing strategy of major European market

players with the help of econometric methods (Table 1). I employ a representative sample of world wine industry[1] (32 wine exporter and importer countries). The wine trade data of my research derived from World Bank (World Bank, 2014a) and EUROSTAT (2015) database in HS-6 level, product code 2204[2] for all empirical models. To date, such complex research exploring the key factors behind wine trade is missing from the trade literature.

Table 1. – Structure of the dissertation

Empirical parts	Research field	Applied methods or trade model	Theoretical background	Chapters
Introductory part	Analysis of world wine industry and trade	descriptive statistics		Chapter 2
First part	Investigation of the export competitiveness and determinants of the comparative trade advantage	Balassa indices econometric model of revealed comparative advantage	Ricardo, 1817; Balassa, 1965; Couillard and Turkina, 2014; Sarker and Ratnasena, 2014	Chapter 3
Second part	Modelling the factors influencing wine trade costs	gravity model of international trade	Tinbergen, 1962; Anderson and van Wincoop, 2003	Chapter 4
Third part	Assessment of pricing strategy of major wine market players	pricing to market – PTM model	Krugman, 1987; Knetter, 1993; Goldberg and Knetter, 1997	Chapter 5

Source: own composition

My dissertation structured as follows: Chapter 2 analyse the situation of world wine industry and trade between 2000 and 2013, Chapter 3–5 investigate the five research questions and covers the three major empirical parts of the research. All subsections of chapters outline the research questions; present the theoretical framework, the review of relevant literature, the applied methodology and the results of regression models. The final Chapter summarises the results of empirical parts, draws the conclusions and discusses the paper.

[1] Algeria, Argentina, Australia, Austria, Bulgaria, Canada, Chile, China, Croatia, Cyprus, Czech Republic, France, Georgia, Germany, Greece, Hungary, Italy, Lebanon, Malta, Moldova, New Zealand, Portugal, Romania, Russia, Slovakia, Slovenia, South Africa, Spain, Switzerland, Turkey, United Kingdom, United States

[2] Product code 2204 comprises wine of fresh grapes, including fortified wines and grape must.

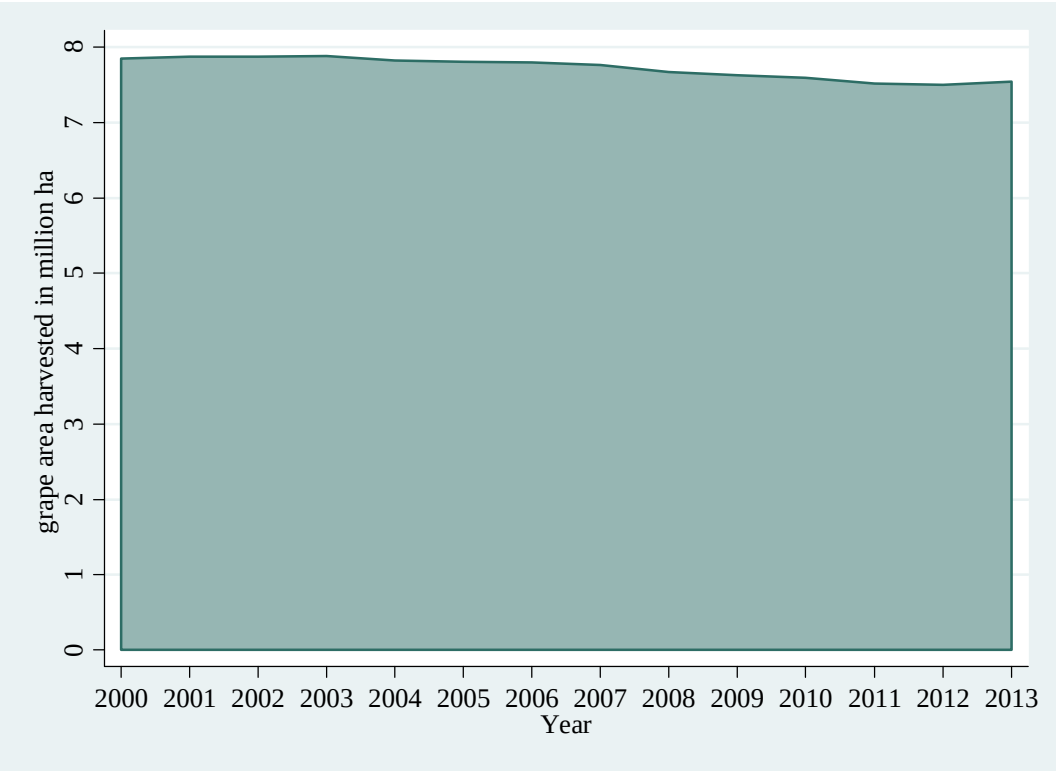
2 ANALYSIS OF WORLD WINE INDUSTRY

There are more than one million winemakers in the world, producing around 3 billion cases of wine each year (Morgan Stanley, 2013). Global demand for wine is rising year by year. The global wine industry has been changing its shape, while the Old Wine World (OWW) is gradually losing its dominance as the world's vineyard, New World wine producers (NWW) and consumers emerging such as USA, Argentina, Chile and China.

2.1 Global wine statistics

The global wine statistics (OIV, 2015) shows that worldwide area under vines has decreased by 4,5 % from 7.85 million to 7.5 million ha, between 2000 and 2013 (Figure 1).

Figure 1. – Evolution of grape area harvested in the world, 2000–2013

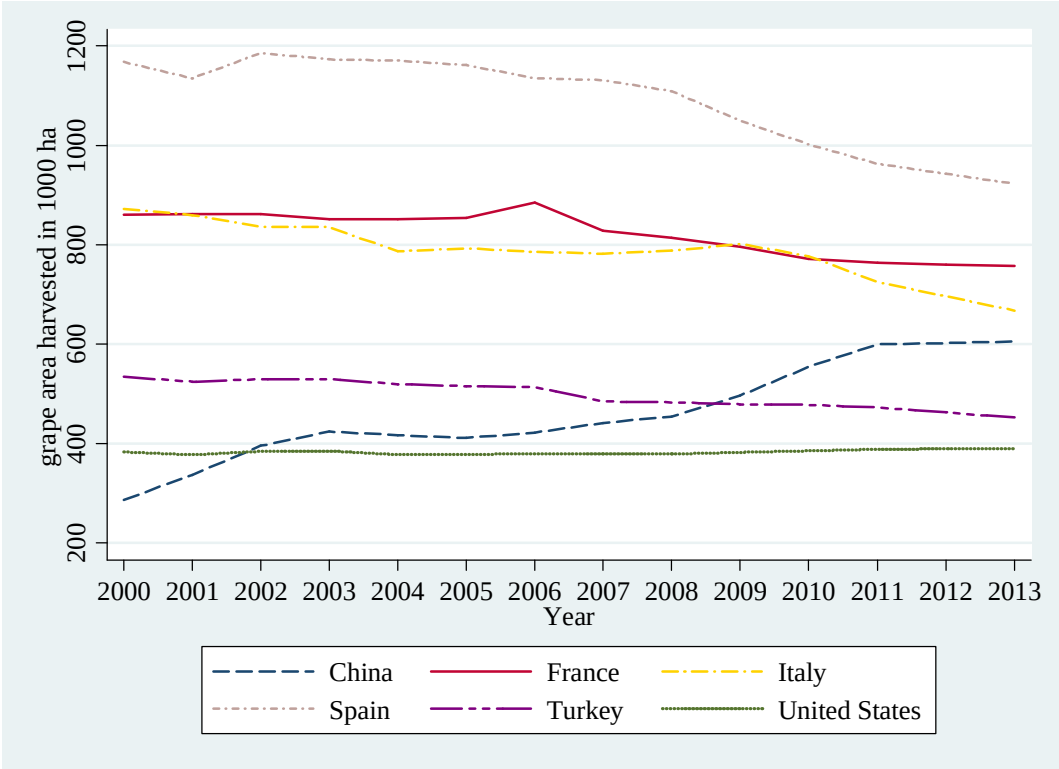


Source: Own calculations based on OIV (2015) database

The overall vineyard of the European continent decreased by 135 000 ha. This shrinking was mainly due to the implementation of the European Union CMO policy[3] for wine between 2008 and 2009 (OIV, 2013 p 10).

We can observe the most significant decrease in grape area harvested in traditional wine producer countries (Figure 2). Due to the CMO reform, the particularly attractive vineyard grubbing-up prime has led to a high share of winemakers in EU member states to reduce their grape land significantly mainly in Spain, Italy, France, Portugal and Hungary (OIV, 2013 p. 10).

Figure 2. – Evolution of grape area harvested in top wine producers, in thousand hectares, 2000–2013



Source: Own calculations based on OIV (2015) database

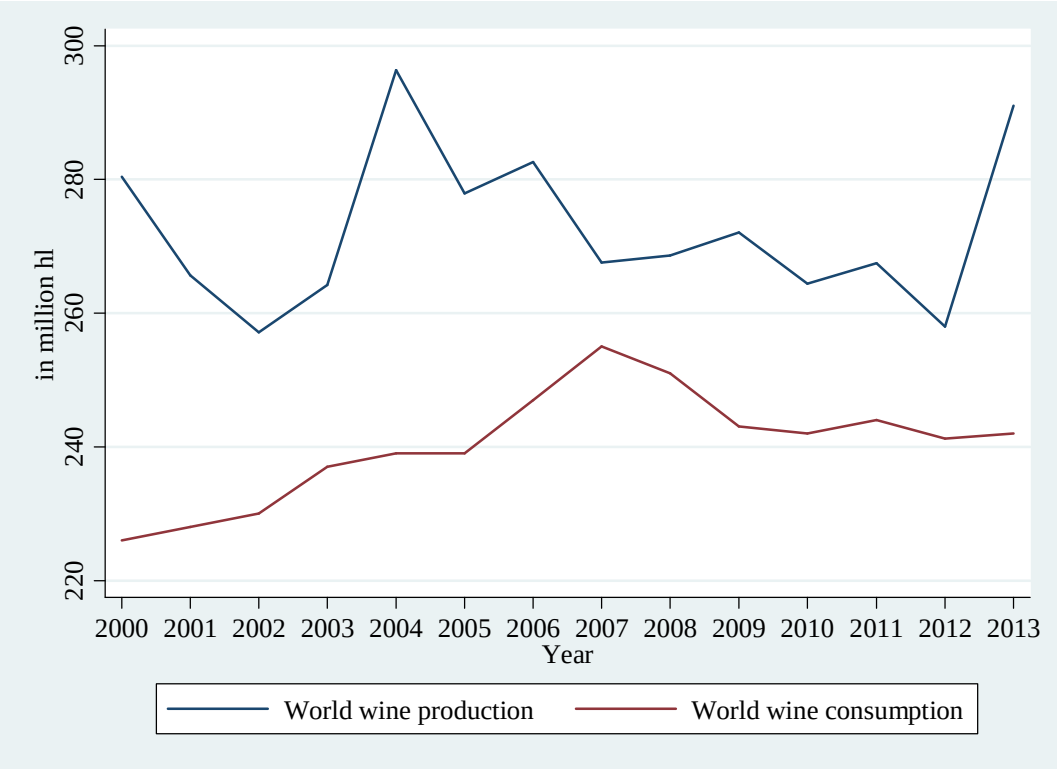
While the grape land has been diminishing in traditional wine producers, the New World countries increased their vineyards by new plantations, especially in South America, USA and China (Figure 3). Moreover, these countries and this region can be considered as the main vineyard growth centre of the world (OIV, 2014). In the past

[3]In April 2008, the EU Council of Ministers reformed the Common Market Organization (CMO) for wine. The regulations aimed to reduce overproduction, phase out expensive market intervention measures and to make EU wine more competitive on the world wine market.

decade, the vineyard acreage in China has extended by 110%, from 286,000 ha to 605,000 ha. Therefore China also became a significant wine market player by expanding its production potential. However, Turkey[4] obviously grows grapes mainly for raisins and grape juice consumption and not for wine products; the size of Turkish grape land area is also remarkable (400 000 ha).

The world wine production varied between 253.7 and 296.4 million hl between 2000 and 2013 (Figure 3).

Figure 3. – World wine production and consumption, in million hl, 2000–2013



Source: Own calculations based on OIV (2015) database

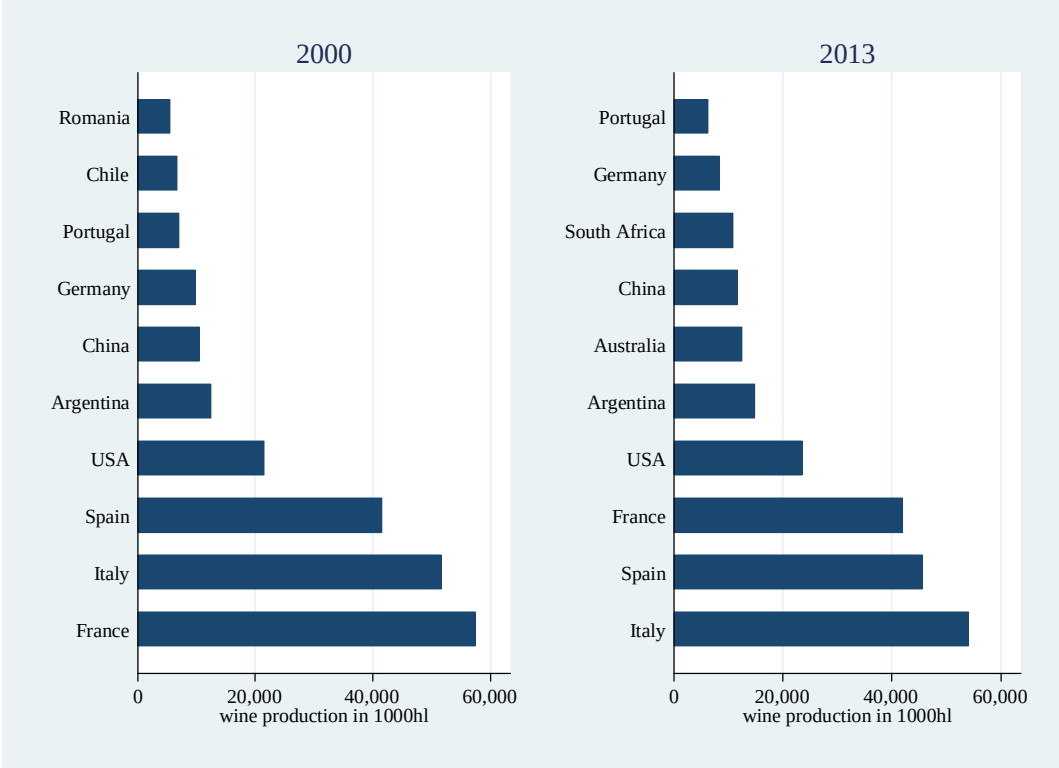
The difference between production and consumption (altered between 12.5-59.5 million hl) was very high (59.5 million hl) in the beginning of the period due to the overproduction while it is reduced significantly after 2006 and dropped back under 50 million hl by 2013. Wine consumption has a growing tendency rather outside of European continent, by contrast, since decades in EU member states consume less wine.

[4] Turkey has 7 wine regions. The wine regions called Thrace and the Sea of Marmara are responsible for nearly 40% of Turkey's wine production.

In spite of its decreasing vineyards and production in Europe, the top 3 wine producer – France, Italy and Spain – were able to preserve its market position in the world wine trade (Figure 4) followed by the USA and Argentina.

On the other hand, the wine production in the New World continued to increase during the analysed period. The Argentinean wine industry achieved 15.2 million hl (+1 % in 2013); New Zealand registered a new record with 3.2 million hl (+29 % in 2013), production of South Africa reached 11 million hl (+4 % in 2013) while the United States also accounted for a high level of production with 22.5 million hl in 2013 (OIV, 2014).

Figure 4. – Wine productions by top 10 producers of sample countries, in 1000 hl, 2000 and 2013

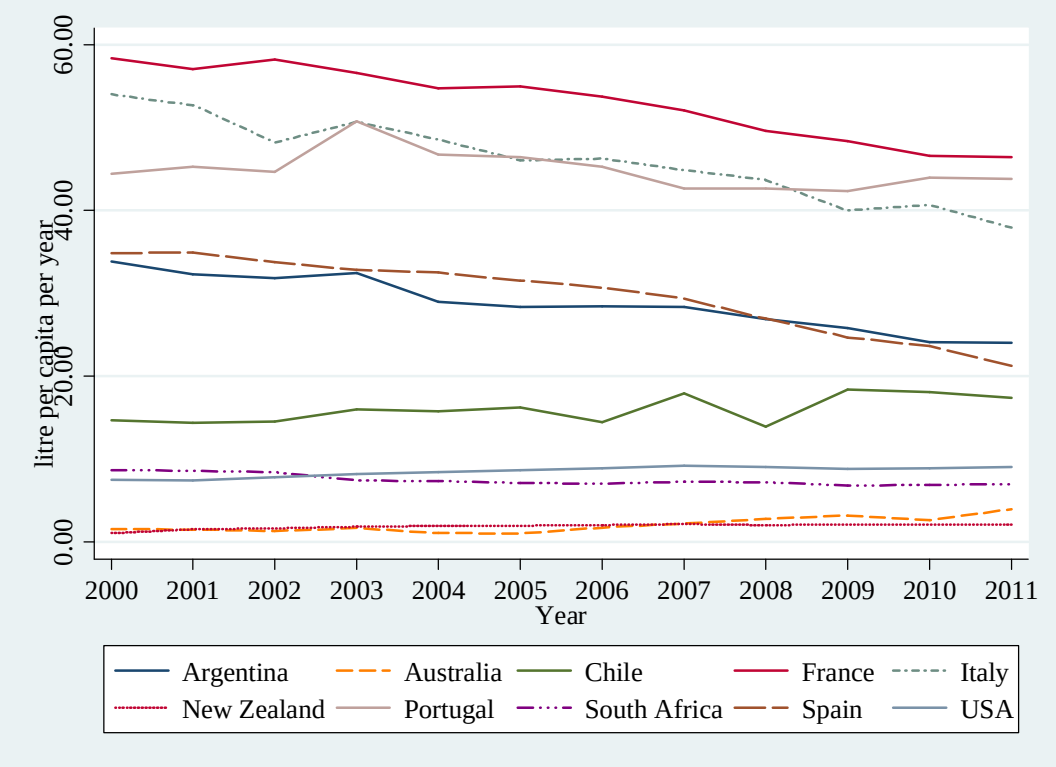


Source: Own calculations based on OIV (2015) database

Furthermore, the traditional wine producing countries with high levels of consumption had a fast decrease in domestic demand while New World countries with traditionally lower consumption levels have shown an increasing tendency (Bianco et al., 2013a). The wine consumption has been falling especially in southern European countries, where changing consumption habits and preferences e.g. substitution of other beverages, offensive marketing of import wines and outdoor drinking affected the

overall demand (USDA, 2012 p. 6-7). The period of 2000–2013 has been characterised by a transfer of wine consumption: in fact about 40% of the wine is consumed outside European countries, compared to 30% in 2000 (OIV, 2014). The statistics of per capita wine consumption illustrate that Australia, New Zealand, Chile and USA were able to increase their demand for wine between 2000 and 2011[5] (Figure 5) while France, Italy and Spain consumed less wine than in the beginning of the period.

Figure 5. – Per capita wine consumption, by country, 2000–2011



Source: Own calculations based on OIV (2015) database

The following section investigates the world wine trade, the position of market leaders and the evolution of market share for major wine producer countries, between 2000 and 2013.

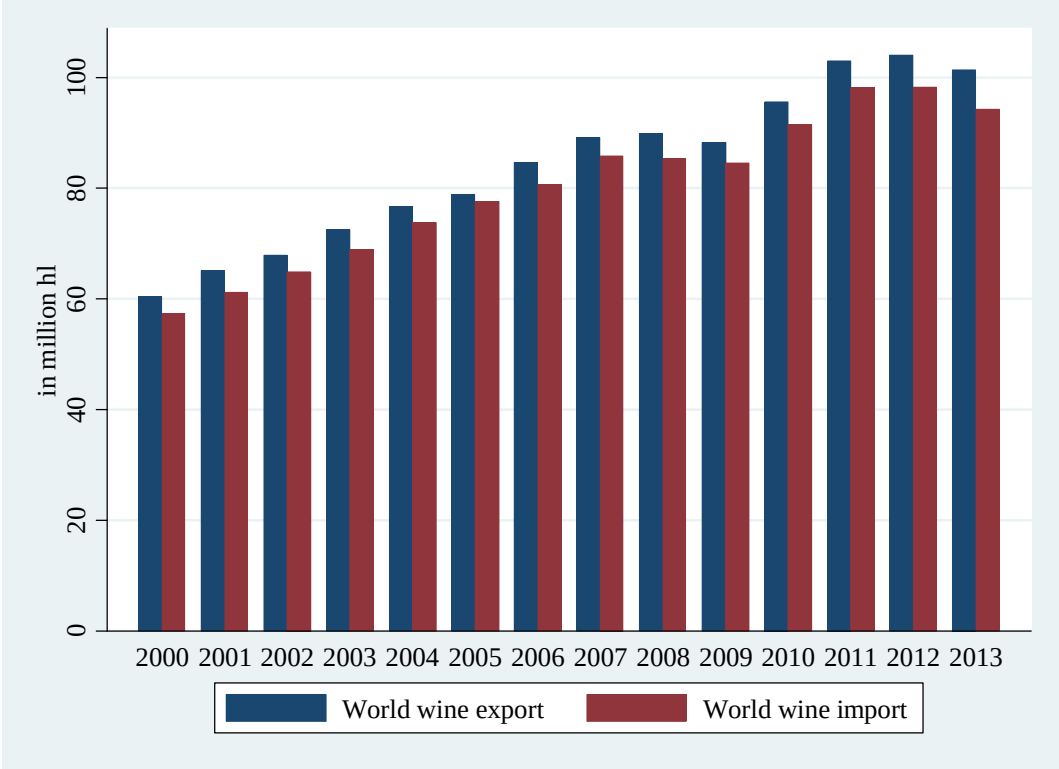
2.2 Evaluation of world wine trade

The world wine market is a progressively internationalised sector. The statistics of International Organisation of Vine and Wine (OIV) show that wine trade has increased

[5] The wine consumption statistics of OIV are available only until 2011.

significantly in volume and in value during the analysed period. The wine export went up from 60.2 to 101.3 million hl while wine import rose from 57.3 to 94.2 million hl between 2000 and 2013 (Figure 6).

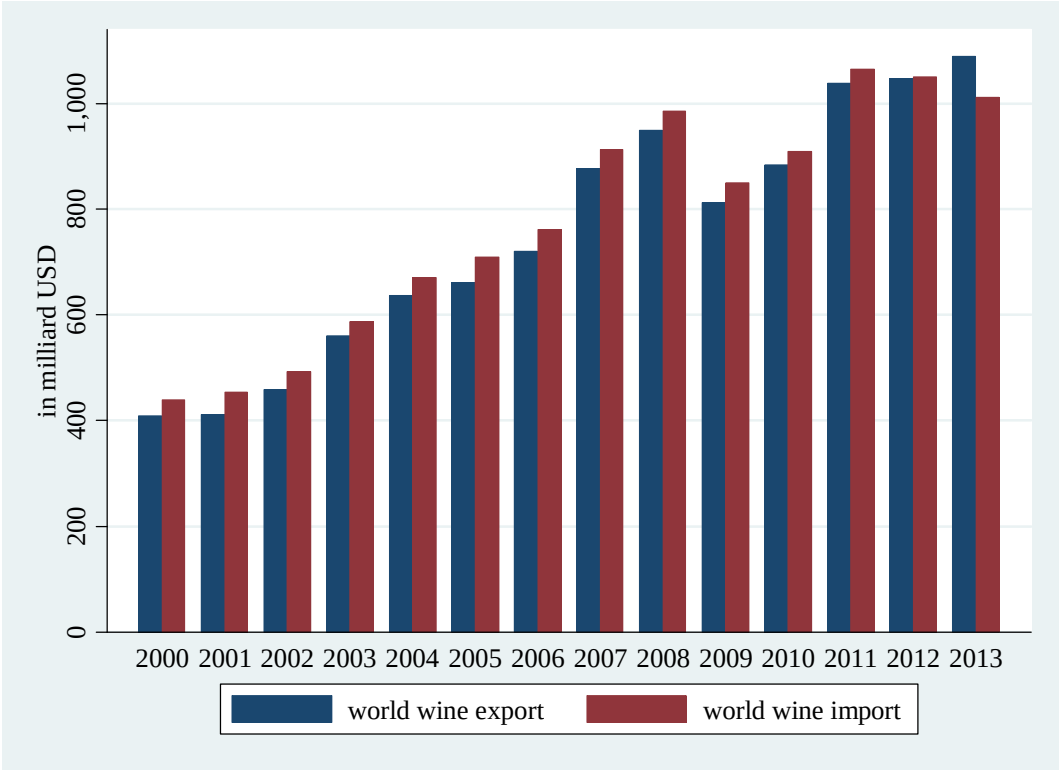
Figure 6. – Development of world wine trade, in million hl, 2000–2013



Source: Own calculations based on OIV (2015) database

Based on World Bank World Integrated Trade Solution's (WITS) data (World Bank, 2014a), the world wine trade in value has more than doubled (by 600 milliard USD) from 2000 to 2013 (Figure 7). The share of wine production traded globally has also nearly doubled during this period. While 30% of the wine consumed in the world was imported in 2000 this share reached more than 40% in 2013 (OIV, 2014). We can also observe two important features of the global wine trade pattern. Firstly, a rapid growth has occurred after the EU enlargement in 2004. Secondly, there was a considerable drop in 2008 due to global economic crises. After the year of 2008, the crisis had multiple effects on world wine trade: it reduced the wine production; slowed the international market down and affected negatively the wine consumption. Furthermore, it contributed to the upward trend of trade in bulk wines (OIV, 2012). On the other hand, the wine trade has already recovered from the crisis for 2011 and continued to grow.

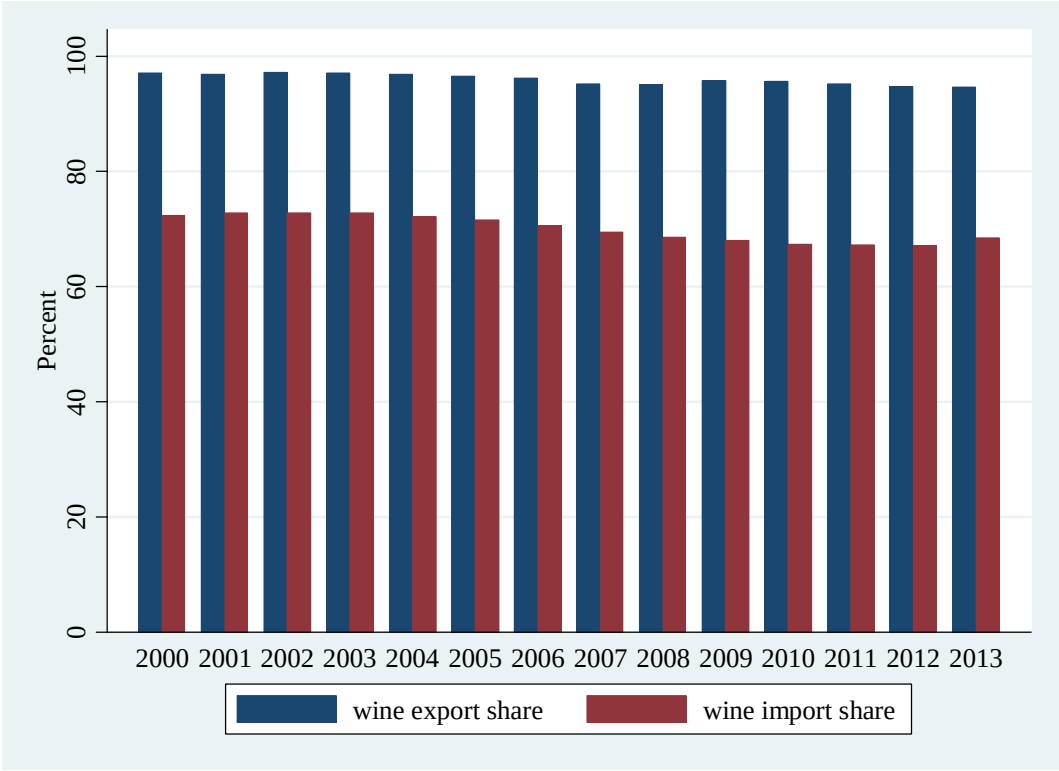
Figure 7. – Development of world wine trade, in milliard dollars, 2000–2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

The graphs confirm that the selected 32 wine producer and consumer countries (see Chapter 3) play a significant role in the world wine trade. The export share of sample countries in world wine export has been above 90 percent while the proportion of import has varied around 60-70 percent (Figure 8). These statistics confirm that samples countries can represent a significant percentage of world wine trade.

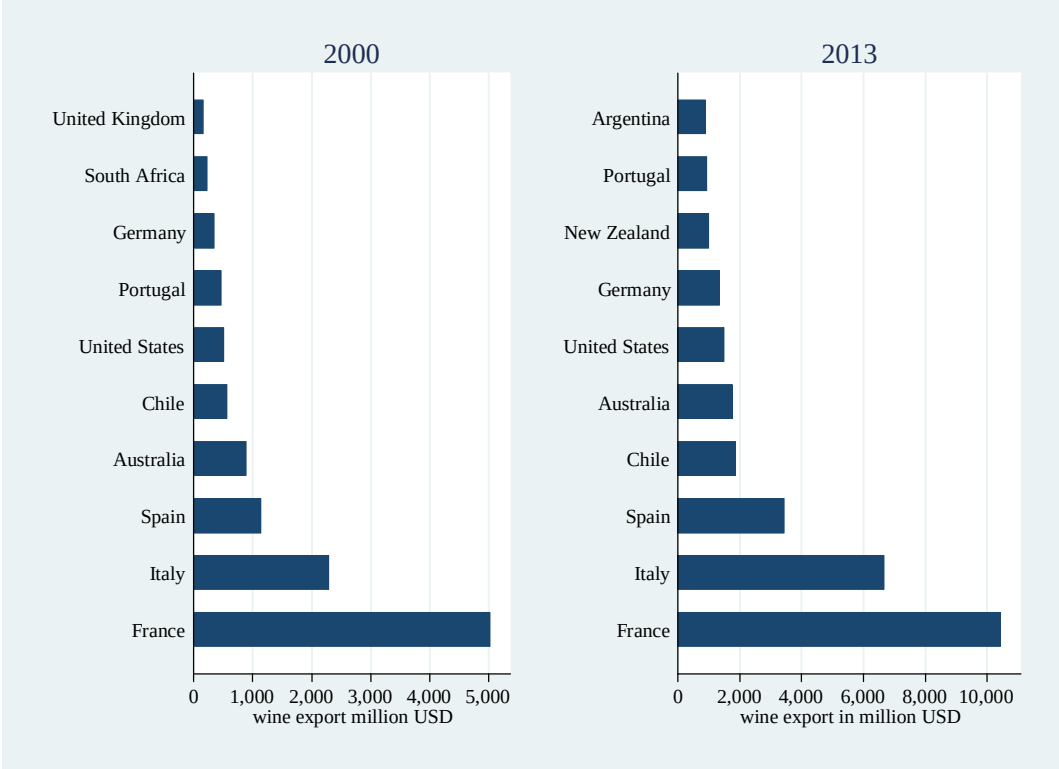
Figure 8. – The share of sample countries in the world wine trade, 2000–2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a).

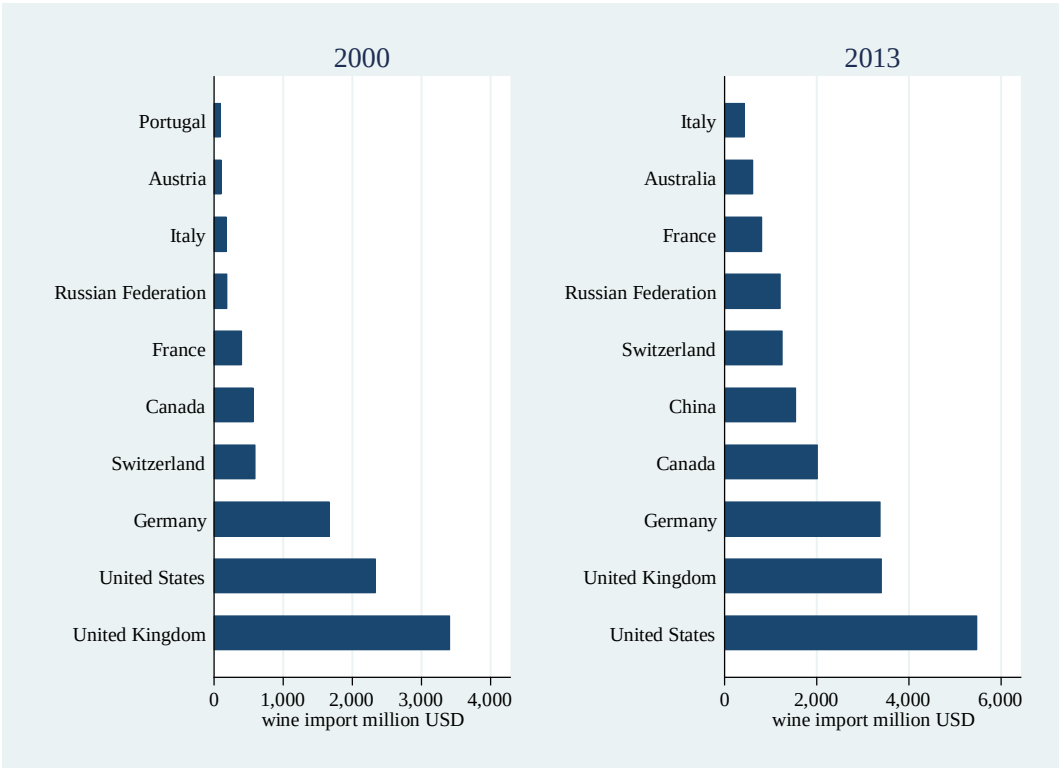
European countries were able to conserve their leading position on the world wine market during the analysed period. It should be mentioned that several EU countries can be considered also as significant wine importers in the world, in particular: the UK, Germany, Netherlands, Belgium, France and Sweden (OIV, 2012). As regards the largest wine exporter countries in value, France, Italy, Spain, Australia and Chile were ranked among the first five places in the world wine trade from 2000 to 2013 (Figure 9). Regarding the most important wine importer countries, the UK and the USA boosted their demand for wine in 2000 and in 2013. Moreover, Germany, Switzerland, Canada, China and France also imported notable amount of wine from the world market (Figure 10).

Figure 9. – Top 10 wine exporters by sample countries, in million USD, 2000 and 2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

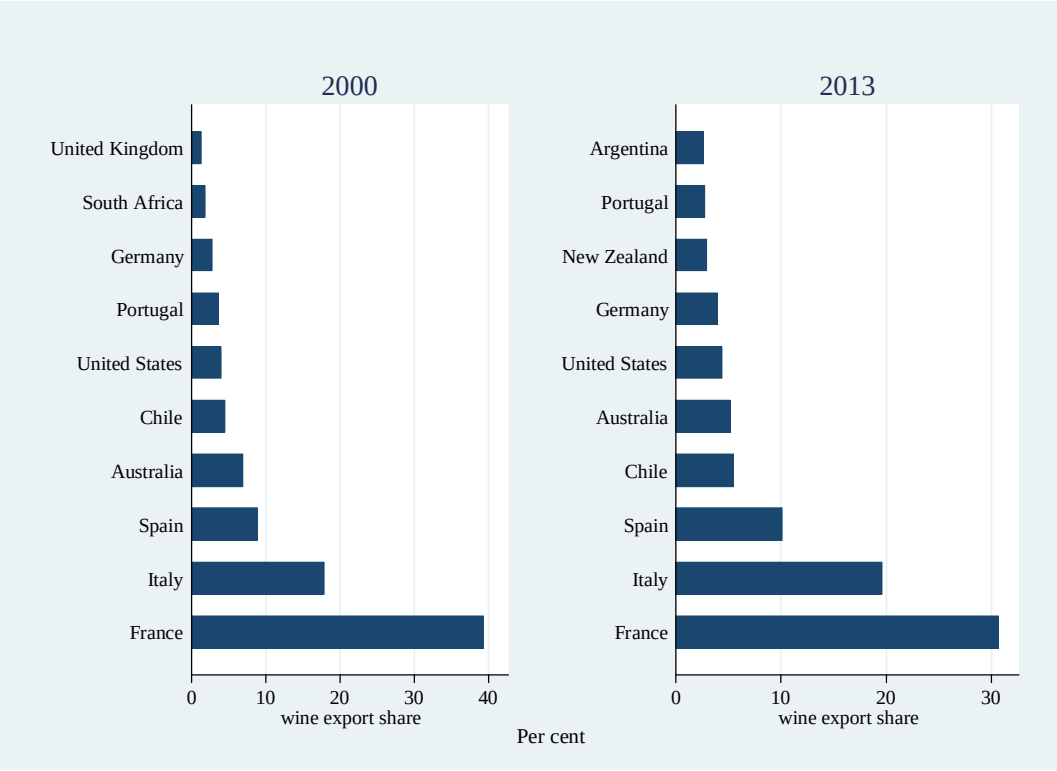
Figure 10. – Top 10 wine importers, by sample countries, in million USD, 2000 and 2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a).

The relative position of wine exporters has changed over time: especially a few small European countries e.g. Hungary, Croatia, and Slovenia could not keep their relative share in the world markets while the major European wine producers – France, Italy and Spain – were able to maintain their leading position in global wine export with decreasing trend (Figure 11).

Figure 11. – The share of sample countries in the world wine trade, in 2000 and in 2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a).

In summary, instead of the decreasing vineyard area, the world wine trade has been growing continuously suggesting higher production and higher quality of wines exported compared to the beginning of the period. While European Old Wine World was gradually losing its dominance, New Wine World (e.g. USA, Australia, Chile, New Zealand and China) were expanded their vineyards and broaden their production potential. The biggest wine exporters (France, Italy and Spain) have been losing their export share, market dominance while Australia, Chile, USA and China became more significant players in the world trade.

Small European wine exporters such as Hungary, Croatia, and Slovenia can be considered as the main losers of this period. The changing CAP regulations in the EU,

the increasing competition and the progressively globalised trade hit negatively the wine export competitiveness of these minor countries.

The Chapter has shown that selected 32 countries play a significant role in the world wine industry, it illustrates that the sample provides an accurate basis to analysing world wine trade.

The research continues with the major empirical parts of the dissertation. The Chapter 3 analyses the comparative advantage and investigates its determinant in international wine trade at a country level. In the fourth Chapter, I present the literature, the estimation methods and regression results for gravity models exploring wine trade costs. In the fifth Chapter, I calculate the pricing to market model between the major European exporters and their export destinations in order to analyse the export pricing of major market players. Finally, the sixth Chapter concludes and discusses the results.

3 ANALYSING THE DETERMINANT OF COMPARATIVE ADVANTAGE IN INTERNATIONAL WINE TRADE

With trade liberalisation on global wine markets, the crucial factor for long-term business survival is the export competitiveness, which determines opportunities in the business prosperity of wine products on the world wine market. On the global wine markets, different traditional and New World countries play the role of global leaders in wine export competitiveness.

Since the 80s the market dominance of the European traditional wine exporter countries has been permanently failing in the world wine market while the New World wine producers have extended their export to world markets and became significant in the global wine industry (Cembalo et. al., 2014).

Regarding the wine production, terroir, tradition, and technology are particular importance for country's comparative advantage (Anderson, 2013, p. 5.). Old Wine World have comparative advantage in tradition, history and culture, by contrast, changing consumer tastes and preferences on the demand side created an international market opportunity for the New World wines (Halliday, 1996). However, New World wine producers also have advantages such as higher productivity while wine traditions may decrease this factor (Tóth and Gál, 2014, p. 98).

Between 2000 and 2013, EU wines improved their overall competitive position in the world market in value terms, despite an overall loss of market shares in volume (European Commission, 2014, p. 76).

To date, there has been limited attention to the wine export competitiveness and the export specialisation patterns of global market leaders. We cannot find a relevant study in wine economics literature that deals with the factors affecting wine trade competitiveness at a country level. Therefore my first research question (RQ1) aims to discover how the relevant market players can keep their position in a rising global competition and determine the driving forces enhancing international trade competition.

Research question 1 (RQ1): What determines a country's comparative advantages in world wine market?

This chapter aims to identify the revealed comparative advantages by major global competitors in world wine industry by Balassa (1965) type comparative advantage indices. Firstly, the chapter investigates which countries are more competitive then it discovers which wine producers are the winners and the losers of the last decades in international trade.

Secondly, it conducts consistency tests and checks the possible convergence of revealed comparative advantage indices using panel unit root tests. Finally, it investigates the main driving forces of global wine export competitiveness using panel regression models. The econometric models test six hypotheses and explain the determinants of the comparative advantage considering the factor endowments, productivity, market size, wine quality and the role of free trade in the wine industry.

3.1 Theoretical framework

In the early part of the 19th century, David Ricardo introduced the classical comparative cost theory of gains from trade, also known as the theory of comparative advantage. The Ricardian comparative advantage relies on differences in factor endowment and in technology across countries to explain trade patterns (Maneschi, 1998). This theory states that a country has a comparative advantage over another in producing a particular good if it can produce that good at a lower relative opportunity cost or price prior to trade (Philippot, 2010, p. 1781). According to Ricardo (1817), the best for each country is to export those goods which have the greatest relative cost advantage and to import goods which are relatively more costly to produce (Norton et al., 2010 p. 325). The Ricardian concept of trade highlights the advantages of freer trade and the positive role of trade liberalisation.

In 1965, a Hungarian economist Béla Balassa in his article *"Trade Liberalisation and Revealed Comparative Advantage"* developed a measurement of revealed comparative trade advantage calculating the relative advantage or disadvantage of a certain country in a certain class of goods as evidenced by trade flows. Balassa's comparative trade advantage is measured by different index numbers (revealed comparative advantage, RCA; revealed trade advantage, RTA; revealed competitiveness, RC indices etc.) based on the concept of Ricardian trade theory. The limitation of Balassa's measurement technique is that governments often intervene to limit imports and exports usually explained by lobbying power among those who gain and those who lose from these

interventions (Norton et al., 2010 p. 325). Moreover, the theory of comparative advantage assumes perfect competition on international markets plus homogeneous commodities traded are identical in the various countries (Gandolfo, 2014 p. 159).

3.2 Literature on revealed comparative advantage

Liesner (1958) was among the first to use post-trade data in order to measure comparative advantage. He researched the effects of Great Britain's entry into the European Union. Since the work of Balassa (1965), a vast amount of literature was dedicated to analysing the revealed comparative advantages of international trade. Most of the early studies on comparative advantages have focused on industrial products afterwards agri-food sectors were also researched.

Fertő and Hubbard (2003) conducted research on the analysis of revealed comparative advantages in Hungarian agri-food sectors and identified eleven competitive product groups. Fertő (2008) analysed the evolution of agri-food trade patterns in Central European countries and found trade specialisation to be mixed. For particular product groups, greater variation was observed, with generally stable (unstable) patterns of variation for product groups with a comparative disadvantage (advantage). Serin and Civan (2008) found that Turkish fruit juices and olive oils to be highly competitive in European markets. Qineti et al. (2009) analysed the competitiveness and comparative advantage of Slovak and EU agri-food trade in relation with Russia and Ukraine and concluded that comparative advantage had been lost for a number of product groups over time, though results for individual product groups varied significantly. Bojnec and Fertő (2009) researched for agro-food trade competitiveness of Central European and Balkan countries and showed that bulk primary raw agricultural commodities had higher and more stable relative trade advantages compared to consumer-ready foods, implying competitiveness shortcoming in food processing and in international food marketing. Bojnec and Fertő (2012) investigated the impact of EU enlargement on agro-food export performance of New Member States of EU over 1999–2007. They found longer duration for exporting higher value-added, specialised consumer-ready food and more competitive niche agro-food products. Bojnec and Fertő (2014) analysed the agri-food competitiveness of European countries and showed that most of the old EU-15 member states experienced a greater number of agri-food products having a longer duration of revealed comparative export advantages than most of the new EU-12

member states have. Jámbor (2013) assessed the comparative advantages and specialisation of the Visegrád Countries' agri-food trade and concluded that comparative advantages decreased after EU accession in all countries in 2004, suggesting a weakening stability of competitive positions. Sahinli (2013) analysed the comparative advantages of the agriculture sectors of Turkey and the European Union and suggested the EU was more competitive in the majority of the products. Jámbor (2014) identified the country-specific determinants of horizontal and vertical intra-industry agri-food trade between the New Member States and the EU-27 from 1999 to 2010. He revealed that EU accession has had positive impacts on intra-industry trade suggesting that economic integration fosters trade. Fertő and Jámbor (2015) investigated the drivers of vertical intra-industry trade in Hungarian agri-food sector with the European Union. Their results suggested that factor endowments were negatively while the economic size was positively and significantly related to vertical intra-industry trade.

However, the competitiveness of agri-food sector is already well-researched field; there are only limited studies that deal with competitiveness or comparative advantages of wine trade at country level.

Bozsik (2005) conducted research on the evaluation of Hungarian wine competitiveness on foreign markets by relative trade advantage indices (RXA, RMA, RTA, RC) suggesting that Hungary had comparative advantage only in bottled white wines, between 1997 and 2003. Boriraj (2008) attempts to provide a comprehensive analysis of Australian wine industry based on the economic theories of trade and modelled the wine export and import relationships. As results of Balassa's and Vollrath's revealed competitive advantage indices, among wine producing countries, Australia has a comparative advantage in wines.

Anderson (2013) analysed the Georgian wine industry focusing on the determinants of comparative advantage with revealed comparative advantage index (RCA). He found that there are three important determinants of a country's comparative advantage in wine production: terroir, tradition, and technology. Anderson and Wittwer (2013) forecasted the future trends of global wine market for 2018 by considering the impact of real exchange rate changes on trade and competitiveness. They confirmed that real exchange rates have played a dominant role in the fortunes of some countries' wine markets in recent years. They suggest that the role of China in global wine markets is likely to become increasingly prominent. To date, China had already become the most

important wine-consuming country in Asia. Van Rooyen et al. (2010) assessed the competitiveness performance in the wine industry in South Africa using relative trade advantage (RTA) indices. They concluded that to be competitive in the world is to continue to be in a position to trade successfully. In conclusion, wine sector would be competitive when it is able to continuously trade in global level at qualities and prices that are as good as or better than their competitors. Vlahović et al. (2013) analysed the world wine export, the current world trends and explored the export structure in the international wine market. They concluded that in the future, a stagnation of international trade can be expected. The European Commission (2014) published a study on the competitiveness of European wines by several methods that examined seven markets: China, Japan, Russia, USA, Denmark, Germany and the United Kingdom. It concludes that the main EU competitors belong to the New World countries such as Argentina, Australia, Chile, New Zealand, South Africa and the USA. Despite the increasing research attention on comparative advantage indices, analysing the determinants of comparative advantage in wine trade by econometric methods is quietly missing part of the literature (Table 2).

So far, only Couillard and Turkina (2014), Sarker and Ratnasena (2014) have done such a research that investigated the determinants of country's international competitiveness and comparative advantage in agri-food trade. Couillard and Turkina (2014) analysed the effects of free trade agreements on the competitiveness employing econometric model in the dairy sector. Their results suggest that free trade agreements have a positive impact on comparative advantages of the dairy sector. Moreover, Sarker and Ratnasena (2014) analysed the competitiveness of Canadian wheat, beef and pork sectors using data from 1961 to 2011 by panel econometrics. Their results suggest that the competitiveness of the Canadian wheat sector can be enhanced if the relative labour cost of meat is lower.

Table 2. – Studies analysing revealed comparative advantage in wine sector

Authors	Data and industry	Methodology	Results
Bozsik (2005)	Hungarian wine trade data to EU markets	RCA indices and analysis of market share	A positive competitiveness is revealed in the case of Hungarian quality, bottled, white wines. In all other categories Hungary is faced with a lack of competitiveness.
Boriraj (2008)	data of Australian wine industry	inter- and intra-industry trade and the wine export and import relationships Balassa's and Vollrath's RCA indices	Australia has a comparative and competitive advantage in wines. The trade liberalisation shows a positive impact on the supply of wine exports
Van Rooyen et al. (2010)	wine industry data of South Africa	relative trade advantage (RTA) index, wine business confidence ratings	South Africa's wines are increasingly internationally competitive, recently this trend started to show a decline
Anderson (2013)	Georgian wine data compared with other wine-exporting countries, 1995–2011	determinants of comparative advantage with index (RCA)	determinants of a country's comparative advantage in wine production are terroir, tradition and technology
Anderson and Wittwer (2013)	44 individual countries and seven composite regions	impact of real exchange rate changes on competitiveness, scenario analysis	real exchange rates played a dominant role in countries' wine market's growth of the world's wine trade is driven by China's import demand
Vlahović et al. (2013)	world wine export data of FAO between 2001 and 2011	Standard statistical and mathematical methods, wine export import and trade analysis	A stagnation of international trade can be expected in the future.
European Commission (2014)	European wine producer countries	examine seven markets (China, Japan, Russia, USA, Denmark, Germany and the United Kingdom)	the main EU competitors are New World countries such as Argentina, Australia, Chile, New Zealand, South Africa and the USA
Econometric models calculated by Balassa's comparative advantage			
Couillard and Turkina (2014)	dairy sector from a longitudinal cross-national perspective	effects of free trade agreements on the competitiveness (RCA index),econometric model of competitiveness	free trade agreements allow countries with a comparative advantage in the dairy sector to become more competitive in terms of production, markets share and trade balance; the effects of FTAs vary according to agreement type
Sarker and Ratnasena (2014)	Canadian beef and pork sectors, 1961–2011	determining the drivers of competitiveness by econometric model	Exchange rates are important drivers of international competitiveness of beef and pork sectors in Canada.

Source: own composition

3.3 Methodology: measuring comparative advantage

The most widely used indicator in empirical trade analysis is based on the concept of revealed comparative advantage (RCA) index, which was developed by Balassa (1965). The Revealed Comparative Advantage (B) index is defined as follows:

$$RCA_{ij}=B_{ij}=\left(\frac{X_{ij}}{X_{it}}\right)\Big/\left(\frac{X_{nj}}{X_{nt}}\right) \qquad (1)$$

where X represents exports, *i* is a country, *j* is a commodity, *t* is a set of commodities, and *n* is a set of countries, which are used as the benchmark export markets for comparisons. It measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries, e.g. the global agri-food exports. If B >1, then a country's agri-food comparative export advantage on the global market is revealed.

Despite some critiques of the RCA index as a static export specialization index, such as the asymmetric value problem and the problem with logarithmic transformation (De Benedictis and Tamberi, 2004), the importance of the simultaneous consideration of the import side (Vollrath, 1991), and the lack of a sound theoretical background (Costinot et al., 2012; Leromain and Orefice, 2013), it remains a popular tool for analyzing export competitiveness in empirical trade literature. In order to check the robustness of the results I apply three additional revealed comparative advantage indices (RTA, ARCA and NRCA).

Vollrath (1991) offered an alternative specification of revealed comparative advantage, known as the Relative Trade Advantage (RTA), which accounts for exports as well as imports.

$$RMA_{ij}=\left(\frac{M_{ij}}{M_{it}}\right)-\left(\frac{M_{nj}}{M_{nt}}\right) \qquad (2)$$

$$RTA=RXA-RMA=\left(X_{ij}/X_{it}\right)/\left(X_{nj}/X_{nt}\right)-\left(M_{ij}/M_{it}\right)/\left(M_{nj}/M_{nt}\right) \qquad (3)$$

where M denotes the imports, *i* is a country, *j* is a commodity, *t* is a set of commodities and *n* is a set of countries. If RTA>0, then a relative comparative trade advantage is revealed, i.e. a sector in which the country is relatively more competitive in terms of its trade.

To eliminate the problems of asymmetric nature of RCA index Hoen and Oosterhaven (2006) introduce an additive index of revealed comparative advantage:

$$ARCA_{ij} = \left(\frac{X_{ij}}{X_{it}}\right) - \left(\frac{X_{nj}}{X_{nt}}\right) \quad (4)$$

The ARCA index ranges between -1 and +1 with 0 demarcation point.

Yu et al. (2009; 2010) adopted an alternative measure to assess the dynamics of comparative advantage, utilizing the NRCA (normalized comparative advantage) index to improve certain aspects of original RCA index in static patterns in comparative advantage to be appropriate export specialization index for comparison over space and the changes in comparative advantage and its trends over time. Yu et al. (2009) define the NRCA as follows:

$$NRCA_{ij} = \left(\frac{E_{ij}}{E}\right) - \left(\frac{E_i}{E}\right)\left(\frac{E_j}{E}\right) \quad (5)$$

where E denotes total world trade, E_{ij} describes country i's actual export of commodity j in the world market, E_i is country i's export of all commodities and Ej denotes export of commodity j by all countries. If NRCA>0, a country's agri-food comparative advantage on the world market is revealed. The distribution of NRCA values is symmetrical, ranging from −1/4 to +1/4 with 0 being the comparative-advantage-neutral point.

3.3.1 Robustness test

However in macro panels, nonstationarity deserves more attention, to run models on panel econometrics, time series dimension of data also should be taken into consideration. Time series investigation of the convergence hypothesis in economic literature often relies on unit root tests. The rejection of the null hypothesis is commonly interpreted as evidence that the time series have converged to their equilibrium state, since any shock that causes deviations from equilibrium eventually drops out. To check convergences or divergence in the revealed comparative advantage indices, several types of panel unit root tests with and without time trend specifications, respectively, as a deterministic component are used: Im et al. (2003), ADF–Fisher Chi–square, and PP–Fisher Chi–square (Maddala and Wu, 1999; Choi, 2001). Furthermore, Levin-Lin-Chu (2002), Harris-Tzavalis (1999) and Breitung (2000) unit root test were also run on dependent along with independent variables.

Moreover, in the empirical analysis of convergence, the assumption of cross-sectional independence appears to be unreasonable according to the literature, because various

studies using cross-country data indicate that time series are contemporaneously correlated (Breitung and Pesaran, 2008). Thus, I also investigate the potential for cross-sectional dependence (CD) in the comparative advantage indices, applying Pesaran (2004) CD test. As it revealed evidence of cross-sectional dependence, I employed second generation panel unit root tests. However, various second generation panel unit root tests require a panel dataset with a large time dimension, like Bai and Ng (2004) test. As in my dataset, the time dimension is relatively small (14 years), therefore I use Pesaran (2007) test, which performs accurately also with small sample period (Moscone and Tosetti, 2009).

On the other hand, it should be highlighted that for a small time period, panel unit root tests have low power and there is the potential risk of concluding that the whole panel is non-stationary even when there is a large proportion of stationary series in the panel (Baltagi, 2005, p. 247).

3.4 Employed data

Here I employ panel databases[6] incorporating the majority of world wine producer countries for the time period of 2000–2013. The sample consists of annual export-import data of 32 countries covering 24 traditional and 8 New World wine producers (Table 3); identical wine exporter countries are available for the second empirical model (Chapter 4).

[6] Dependent variables and most of the independent variables are strongly balanced while other independent variables are unbalanced.

Table 3. – Sample countries for revealed comparative advantage

All Country names (32)			
Old World (24)			**New World (8)**
Algeria	Germany	Romania	Argentina
Austria	Greece	Russia	Australia
Bulgaria	Hungary	Slovak Republic	Canada
Croatia	Italy	Slovenia	Chile
Cyprus	Lebanon	Spain	China
Czech Republic	Malta	Switzerland	New Zealand
France	Moldova	Turkey	South Africa
Georgia	Portugal	United Kingdom	United States

Source: Own composition based on the sample

I apply a number of scale and dummy variables referring to factor endowment, production factors, market size, trade liberalisation, export unit values. The wine export and import data were obtained from World Bank World Integrated Trade Solutions (WITS) on-line database (World Bank, 2014a), used at HS-6 level, product code 2204[7] targeted to the world market (all country). The variables representing the determinants of revealed comparative advantage derived from World Bank World Development Indicators (WDI) database (World Bank, 2014b); Food and Agriculture Organization of the United Nations (FAO) database (FAO, 2014) and the data of World Trade Organisation (WTO, 2014).

3.5 Econometric specifications and hypothesis

The competitive advantage can determine by low-cost labour or access to natural resources (Porter, 1998). Each country can gain from trade by exporting products at a lower relative cost as compared to another country. The lower costs can derive from land-intensive or capital-intensive products (Norton et al., 2010). The adoption of labour-saving technology can help poorer countries with rapidly rising real wages retain their comparative advantage in what traditionally had been labour-intensive industries. This means that poorer countries need to find sources of comparative advantage other than just low wages (Anderson, 2013). Some agricultural products are rather land intensive, but wine production inquiries capital and skilled labour as well. On the other hand, the role of the agricultural employment is not neglected for the wine industry. The

[7] Product code 2204 comprises wine of fresh grapes, including fortified wines and grape must.

competitiveness of wine sector depends on territorial characteristics ranging from natural resources to production factors and techniques (Pappalardo et al., 2013). Anderson (2013) reinforce that there are three important determinants of a country's comparative advantage in wine production such as terroir, tradition and technology. Therefore, factor endowments could be a key element of comparative advantage in the wine sector.

The country-specific determinants of intra-industry trade in wines can be divided into five factors (Boriraj, 2008): economic development; country size; geographical proximity; economic integration and trade barriers.

While trade theory holds that tariff reductions should increase trade flows, the empirical literature on the effects of WTO membership has produced surprisingly ambiguous results. Rose (2004) reports a wide range of empirical specifications that produce no WTO effects. Tomz et al. (2007) use Rose's data but include de facto WTO membership, to find positive WTO trade effects. Eicher and Henn (2011) employ a comprehensive approach that minimises omitted variable bias to show that all specifications produce one consistent result: WTO effects on trade flows are not statistically significant while Preferential Trade Agreements (PTA) produce strong but uneven trade effects.

The "New World" wine producing countries can be defined as those countries discovered by the European explorers during the sixteenth century (Murphy, 2000). At present, countries such as Argentina, Australia, Chile, South Africa, New Zealand and the USA called New World, have a large and growing wine production and consumption (Labys and Cohen, 2004). Anderson and Norman (2003) also reported that the New World producers have gained exceptionally increasing market shares while the Old World's market shares have declined. Based on this empirical evidence, I focus on six categories of explanatory variables determining wine trade's comparative advantage, in particular:

1. Factor endowments: grape area harvested (lngrapeland), agricultural employment (lnagrempl);
2. Wine productivity variable: grape yields (lnYield);
3. Market size: country's population (lnPop);
4. Wine quality represented by wine export unit value (lnUVX),
5. A variable (NWW) distinguishes between Old or New Wine Word;
6. A policy variable illustrating the level of trade liberalisation (WTO effect).

Based on the empirical econometric models of Couillard and Turkina (2014), Sarker and Ratnasena (2014), I establish a panel regression model explaining wine trade competitiveness.

In my model, the indicators of competitiveness as dependent variables are represented by Balassa's RCA and its additional indices (RTA, ARCA and NRCA) calculated for wine trade relating to world wine market (all countries), between 2000 and 2013. In accordance with previous empirical research of comparative advantage the following hypotheses are tested here, reflecting the first research question (RQ1):

H1.1: Higher factor endowments increase a country's comparative advantage on world wine market.

Factor endowments play a significant role in the wine industry (Anderson, 2003; Anderson, 2013; Boriraj, 2008) influencing positively the trade competitiveness.

I employ log of harvested grape area (*lngrapeland*) as a proxy of specific wine production factor endowments. However, wine production is also a labour intensive sector; therefore, an additional variable representing the labour force included as employment in agriculture in percent of total employment (*lnagrempl).*

Most professionals suggest that trade-off exists between the quantity of grape and the quality of wine produced. If so, increasing grape yields to reduce costs also lowers wine quality (Thornton, 2013 p. 61). In addition, OIV confirms that wine productivity is growing especially in the countries that produce non-fermented products and table grapes (OIV, 2012). Therefore, a negative sign is expected for the estimated coefficient of grape yield variable. The production factor of wine industry is represented by grape yield (lnYield) data in hectogram per hectares (hg/ha) derived from FAO (2014) database.

H1.2: Higher grape productivity in the wine industry weakens the competitiveness of wine export because higher grape yields result in a lower quality of wine.

Taking the set of products available on a market the home bias means that consumers often prefer to buy home goods, therefore, trade cost reflected in higher prices of imports or weaker distribution networks for imported goods (Friberg et. al., 2010). Anderson and van Wincoop (2004) suggest that the trade between two Canadian

provinces is 20 times greater than trade between a Canadian province and the USA due to the home bias. Hence, higher size (population) of a given wine exporter or importer country does not necessary foster comparative advantages. Market size of a wine producer country is measured by country's population (lnPOP) in absolute value (number of country's inhabitant). Data comes from World Bank World Development Indicator (World Bank, 2014b).

H1.3: Larger market size negatively influences the comparative advantages of world wine trade due to home bias.

According to Alcalá (2016), in the case of several products a positive correlation can be shown between the export unit value and the exporting country's revealed comparative advantage (RCA), where the unit value (lnUVX) is interpreted as a proxy for quality. By contrast, Fertő and Bojnec (2015) revealed different results that export unit value is negatively associated with comparative advantages on export quality improvement.
As concerns the relationship between wine export values and volumes: we can observe that for France, New Zealand, Australia and the USA, market shares in value are larger than market shares in volume, therefore; these countries achieve, on average, a higher unit value (average prices) of wine export. In particular, New Zealand and France are competitive in terms of high-quality wines, both in bottles and bulk wine (European Commission, 2014 p. 39). Bisson et al. (2002) reinforce that in the USA, consumers have chosen to drink more expensive wine in a search for quality, a trend that seems to be true for European wine consumption as well. In my model, the wine export unit value captures the quality of exported wine.

H1.4: The better the quality of wine exported is, the higher comparative advantages of wine trade are.

The reason why most types of political initiatives aimed at facilitating market access and generating competitive advantage (European Commission, 2014, p. 142) free trade agreements have a significant role in trade advantage. The tariff reductions should increase trade flows indicating positive WTO effects (Tomz et al., 2007). As a result, the subsequent hypothesis tests the effect of free trade on wine export:

H1.5: Free trade agreements can enhance the competitiveness of wine trade by reducing trade barriers and lowering trade costs.

A dummy variable captures the possible impacts of WTO membership. It takes value one if a particular country is the member of WTO, otherwise zero (WTO, 2014). In the recent decades, New Word wine producers have extended their vineyards at a much faster pace than the Old World (OIV, 2014). Consequently, their wine exports have grown faster implying that variables are likely to have behaved differently between Old and New Wine World. Tóth and Gál (2014) confirmed that it is a significant difference between the major Old and New World winemaking countries in terms of technical efficiency. In addition, wine policies in traditional wine producers are often claimed to be responsible for the decreasing competitiveness of wine industry. For this reason, the model implies a variable to distinguish between Old and New World wine producers, included by a dummy (NWW) equals to 1 if a country belongs to New Wine World, 0 otherwise.

H1.6: New World wine exporter countries perform better in trade on global wine market due to the higher technical efficiency.

The description of variables and expected sign of estimated coefficients are presented in Table 4. The detailed statistics of variables can be found in Annex 1.

Table 4. – Employed variables and data sources

Independent variables	Description	Data sources	Expected sign
lngrapeland	Grape area harvested in ha	FAO (2014)	+
lnagempl	Employment in agriculture in per cent of total employment	FAO (2014)	+
lnPop	A country's population in absolute value (inhabitant per country)	World Bank WDI (2014b)	-
lnUVX	Wine export unit value in USD (wine export value/export quantity in HS-6 level, product code 2204)	World Bank WITS (2014a)	+
WTO dummy	1 if a particular country is member of WTO, 0 otherwise	WTO (2014)	+
lnYield	grape yield in Hg/Ha	FAO (2014)	-
NWW dummy	1 if a country is a part of New Wine World, 0 otherwise	Internet sources	+

Source: own composition

Based on these hypotheses I estimate the following equations between revealed comparative advantage indices and its determinants:

$$RCA_{it}=\alpha + \beta_1 lngrapeland_{it} + \beta_2 agricultural\ employment_{it} + \beta_3 lnPOP + \beta_4 UVX_{it} + \beta_5 WTO_t + \beta_6 lnYield_t + \beta_7 NWW_{it} + u_i \quad (6)$$

I apply several techniques to equation (6) in order to check the robustness of the results. There are some additional issues to be addressed when such panel models are estimated. First, heteroscedasticity may occur because comparative advantage may be more volatile in small than in large countries. The panel dataset is also subject to the existence of autocorrelation. Probably contemporaneous correlation across panels may also occur. Preliminary analysis – Wooldridge (2002) test for autocorrelations and Pesaran CD tests – confirms the presence of heteroscedasticity; autocorrelation and cross-sectional dependence (see section 3.6.2).

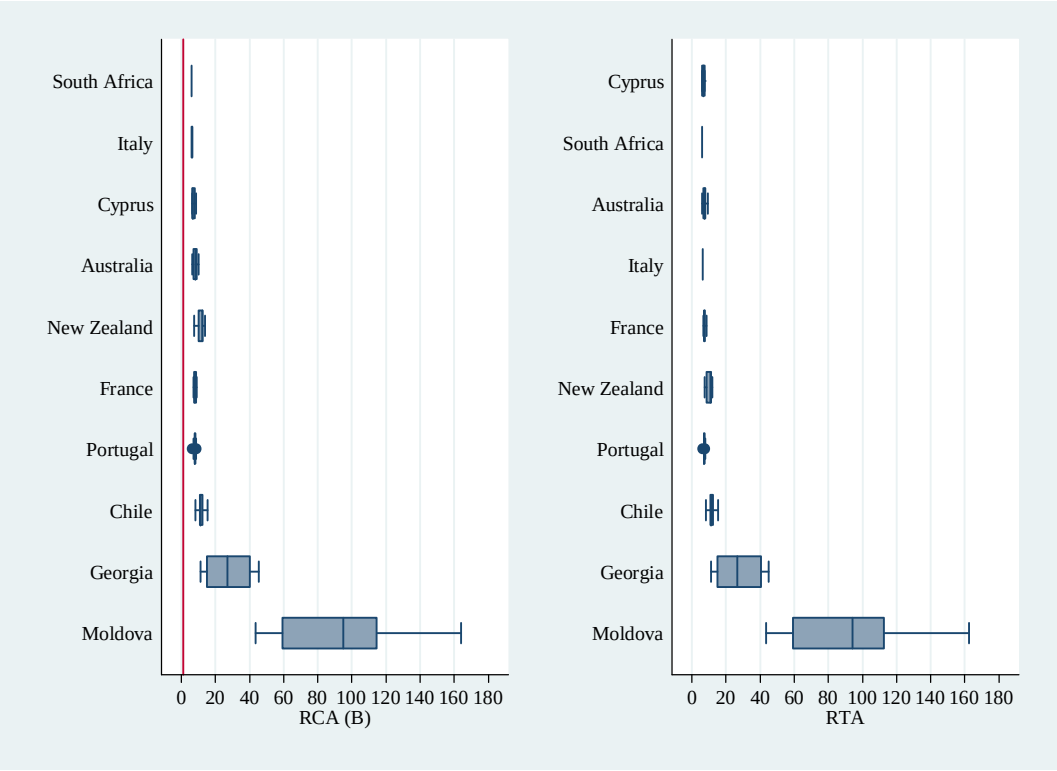
Since the analysed period is shorter than cross-sectional unit, to deal with issues of contemporaneous correlation, panel corrected standard error model (PCSE) is applied which controls for heteroscedasticity, the AR(1) type of autocorrelation and contemporaneous correlation across panels (Beck and Katz, 1995; 1996). My panel data set includes 32 major wine exporter countries and 14 years period (2000–2013) with 448 observations. However, dependent variables are strongly balanced; this condition is not held for all independent variables. Wine trade data is based on World Bank database in HS-6 code[8]. All revealed comparative advantage indices are calculated from wine export and import data of World Bank World Integrated Trade Solutions (WITS) database, wine exported to world wine market (World Bank, 2014a).

3.6 Empirical results

Based on different revealed comparative advantage indices (Figure 12 and Figure 13) we can find competitive wine exporters in traditional (France, Italy, Spain, Portugal, Cyprus, Georgia, Moldova) and in the New World (Argentina, Australia, Chile, New Zealand, South Africa) wine producer countries as well. Figures of all sample countries are comprised in Annex 1.

[8] Product code 2204 comprises wine of fresh grapes, including fortified wines and grape must.

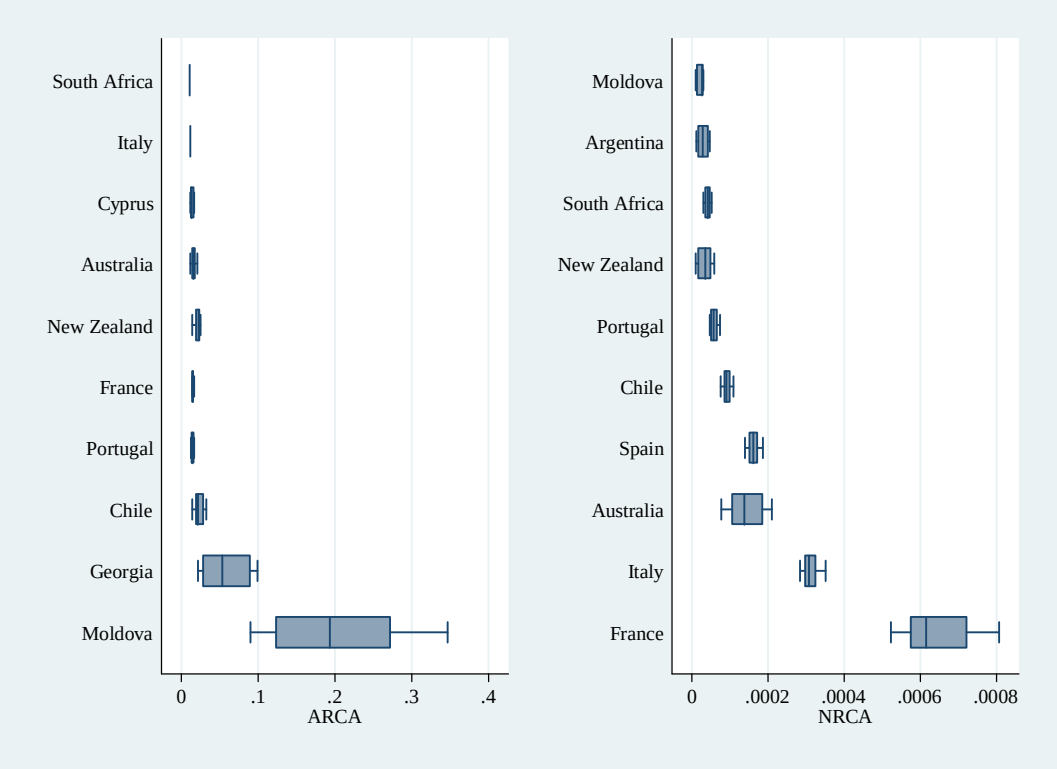
Figure 12. – Boxplots for top 10 RCA and RTA indices, by sample countries, 2000–2013



Source: Own calculations based World Bank WITS database (World Bank, 2014a)

On the other hand, the standard deviations of sample data are high for Moldova and Georgia in case of RCA (34.6 and 12.9), RTA (34.2 and 12.9) and ARCA (0.2 and 0.06) indices, although it shows the highest competitiveness. It is probably caused by the agricultural trade distortion policies. Anderson (2013) reinforces Georgia's strong comparative advantage in terms of wine export in the past decade. The tradition of Georgian wine industry has been the key domestic influences on its comparative advantage in wine production. By contrast, the international competitiveness of Georgian wineries also has been heavily influenced by its long-established trade relations with Russia (Anderson, 2013). Based on the boxplots of first three indices Moldova, Georgia, Chile, New Zealand and France are the most competitive wine exporters (Figure 12 and 13).

Figure 13. – Boxplots for top 10 ARCA and NRCA indices by sample countries, 2000–2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

On the contrary, the dynamic comparative advantage indices (NRCA) rank France, Italy, Spain, Australia and Chile among the top five most competitive wine exporters. Regarding the comparative disadvantages, I find that the lowest revealed competitiveness indices (Annex 1) belong to China (NRCA and ARCA) and UK (RCA and ARCA). In conclusion, the biggest Euro-Mediterranean and the Southern Hampshire wine exporters are the best-performing countries at the world level.

3.6.1 Consistency tests of RCA indices

The graphical analysis suggests that the general pattern of revealed comparative advantage for the four indices is similar. The usual interpretation of an RCA index is that it identifies the extent to which a country has a comparative (dis)advantage in a product. Ballance et al. (1987) offer two other interpretations: that the index provides a ranking of products by the degree of comparative advantage; and that the index identifies a binary type demarcation of products based on comparative advantage and

comparative disadvantage. Referring to these three interpretations as cardinal, ordinal and dichotomous, they suggest a test of consistency for each index.

The consistency test of the indices – as cardinal measures of comparative advantage – is based on the correlation coefficient between paired indices in all years (Table 5). Of the six possible pairings, only three (RCA, RTA and ARCA) show a high level of correlation (≥0.99). The NRCA indices are weakly correlated (0.09) to the other three indices. The test suggests that the indices are not consistent as cardinal measures of comparative advantage.

Table 5. – Pairwise correlation coefficients between RCA indices

	RCA	RTA	ARCA	NRCA
RCA	1.0000			
RTA	0.9985	1.0000		
	(0.000)			
ARCA	0.9973	0.9955	1.0000	
	(0.000)	(0.000)		
NRCA	0.0925	0.1019	0.091	1.0000
	(0.050)	(0.031)	(0.054)	

Note: p-values in parentheses

Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

The consistency test of indices as ordinal measures is similar to the Spearman rank correlation coefficient for each pairing. Results indicate that the indices are strongly consistent in ranking product groups by revealed comparative advantage, with correlation coefficients being higher than 0.82 (Table 6).

Table 6. – Spearman rank correlation indices between RCA indices

	RCA	RTA	ARCA	NRCA
RCA	1.0000			
RTA	0.8810	1.0000		
ARCA	0.9918	0.8749	1.0000	
NRCA	0.8325	0.8644	0.8263	1.0000

Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

The test of the indices as a dichotomous measure is simply the share of product groups in which both of the paired indices suggest a comparative advantage or comparative disadvantage. As results of dichotomous tests RCA, ARCA, and NRCA indices are

fully consistent. The RTA indices are also reasonably consistent with the share being higher than 0.8. We can obtain similar results if we repeat the consistency tests year by year. These simple tests shed light on the sensitivity of any conclusions based on the RCA indices. They confirm that the indices are less consistent as cardinal measures, in accordance with the findings of Ballance et al. (1987); Fertő and Hubbard (2003). However, the test results offer more support for use of indices as an ordinal or binary measure of comparative advantage. Accordingly, we can conclude that the RCA measures are useful proxies in determining whether or not a country has a comparative advantage in wine, though less useful in indicating the extent of any comparative advantage.

3.6.2 Results of unit root tests

Before analysing the determinants of revealed comparative advantage (RQ 1), the variables were pre-tested by panel unit root tests with time-trend and without time-trend specifications. The empirical results of the different panel unit root tests provide support for the existence of the panel unit root hypothesis for the majority of the indices, except ADF, PP, IPS test for RCA and IPS tests for ARCA and NRCA indices (Table 7). This implies that the comparative advantage indices are mostly non-stationary, rejecting the hypothesis of convergence in the dynamics of the comparative advantages.

By contrast, based on the majority of Levin-Lin-Chu (2002), Harris-Tzavalis (1999), Breitung (2000) unit root tests we cannot reject the hypothesis of stationary (see Annex 1). As concerns, the explanatory variables, tests indicate that only some of the variables are non-stationary (Annex 1).

Table 7. – Panel unit root tests for RCA indices, 2000–2013 (p-values)

	without trend			with trend		
	IPS	ADF	PP	IPS	ADF	PP
RCA	0.7402	0.0415	0.0415	0.0001	0.1545	0.1545
RTA	0.9238	0.6205	0.6205	0.1615	0.4858	0.4858
ARCA	0.5412	0.6696	0.6696	0.0000	0.1028	0.1028
NRCA	0.8699	0.6895	0.6895	0.0000	0.1826	0.1826

Note: IPS (Im, Pesaran and Shin W-stat), ADF (ADF - Fisher Chi-square), PP (PP - Fisher Chi-square)

Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

In order to obtain more robust results, I apply Pesaran (2007) second generation panel unit root tests employing 0-2 year lags (assuming that the effects of comparative advantage cannot occur more than 2 years in the wine trade).

Pesaran (2007) tests reinforce previous results and it finds strong evidence for the existence of panel unit root in all comparative advantage indices. In other words, RCA indices are diverging over time (Table 8).

Table 8. – Pesaran (2007) panel unit root tests (p values)

	without trend			with trend		
lags	0	1	2	0	1	2
RCA	0.728	0.923	0.876	0.958	1.000	0.981
RTA	0.998	0.965	1.000	1.000	1.000	1.000
ARCA	0.614	0.063	0.219	0.980	0.823	0.919
NRCA	0.962	0.941	0.997	0.932	0.738	0.999

Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

In case of small time period, panel unit root tests have weak power and there is the potential risk of concluding that the whole panel is non-stationary even when there is a large proportion of stationary series in the panel (Baltagi, 2005, p. 247). In addition, only few independent variables are non-stationary, plus explanatory variables are not strongly balanced (contain missing values) therefore panel cointegration test cannot be calculated.

I also test the cross-sectional dependence (CD) in various comparative advantage indices. The tests show mixed results (Table 9). For the RCA index, we cannot reject hypothesis of cross-sectional independence (p=0.624), while tests provide evidence of cross-sectional dependence for RTA, ARCA and NRCA indices (p<0,05).

Table 9. – Cross-sectional dependence (CD) tests

Variable	CD-test	p-value
RCA	-0.49	0.624
RTA	6.72	0.000
ARCA	2.20	0.028
NRCA	2.17	0.030

Source: Own calculations based on World Bank WITS database (World Bank, 2014a).

The Wooldridge (2002) panel autocorrelation (serial correlation) test[9] confirms the existence of first order autocorrelation (p=0.0000) in all regression variables (Table 10).

Table 10. – Tests for autocorrelation in panel data

Wooldridge (2002) test	Model 1 (p-values)	Model 2 (p-values)
RCA	0.0000	0.0000
RTA	0.0000	0.0000
ARCA	0.0000	0.0000
NRCA	0.0000	0.0000

Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

Since the RCA index is cross-sectional independent (compared to RTA, ARCA and NRCA), I use panel feasible generalised least squares (xtgls) estimation for RCA model. On the contrary, I employ panel corrected standard error estimation (xtpcse) for RTA, ARCA and NRCA indices assuming serial correlation (AR1) and cross-sectional dependency (CD) across panels.

3.7 Regression results

Table 11 illustrates the regression results for factors determining comparative advantage. Regarding the factor endowment component, we can conclude that the expansion of harvested grape area increases production and hence the comparative advantage of wine exports for all models (H1.1). The agricultural employment also positively influence wine exports, except in the case of NRCA specification, proving that wine industry is a labour intensive sector (H1.1). My results support another argument of factor endowment such as agricultural employment is an important factor of a country's comparative advantage in wine trade.

A country's population has a negative impact on wine trade competitiveness (H1.3) indicating that the largest (most populated) countries are not necessarily the most competitive wine exporters in the world e.g. China, Russia, and Canada.

The wine export unit value representing the quality of wine exported is associated positively with comparative trade advantage (H1.4). The negative coefficient of grape yield reveals that trade-off exists between wine quality and quantity (H1.2).

[9] Under the null hypotheses assume no serial correlation between residuals.

Furthermore, in line with theoretical expectations, WTO membership is positively associated with the wine export competitiveness (H1.5). Finally, the sign of NWW coefficients confirms that New World wine producers perform better in wine trade hence their export competitiveness is higher than traditional wine producers (H1.6).

11. Table – Regression results for RCA indices

VARIABLES	(1) xtgls RCA (AR1)	(2) xtpcse RTA (AR1)	(3) xtpcse ARCA (AR1)	(4) xtpcse NRCA (AR1)
lngrapeland	2.211**	2.747***	0.00454***	3.30e-05***
	(0.963)	(0.533)	(0.00104)	(2.84e-06)
lnagempl	6.562***	6.587***	0.0134***	-1.81e-05***
	(1.532)	(1.858)	(0.00418)	(2.77e-06)
lnPop	-3.277***	-3.145***	-0.00560***	-1.79e-05***
	(1.189)	(0.800)	(0.00157)	(7.83e-07)
lnUVX	0.640	0.403*	0.00151***	4.30e-06***
	(0.572)	(0.244)	(0.000525)	(1.47e-06)
WTO	11.32**	10.19***	0.0231***	7.03e-06***
	(4.854)	(3.089)	(0.00715)	(2.25e-06)
lnYield	-3.747**	-4.978***	-0.00850**	-8.49e-06*
	(1.489)	(1.795)	(0.00384)	(4.35e-06)
NWW	6.953*	8.517***	0.0155***	-4.35e-05***
	(3.979)	(1.970)	(0.00392)	(9.96e-06)
Constant	57.73**	61.13***	0.107**	9.78e-05**
	(23.46)	(20.96)	(0.0431)	(4.19e-05)
Observations	388	388	388	388
R-squared		0.162	0.123	0.248
Number of country	31	31	31	31

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: AR(1) – assuming serial correlation

Source: Own calculations based on World Bank WITS database (World Bank, 2014a.

In sum, the estimations confirm that the variables analysed can determine wine trade competitiveness. Moreover, the results are strongly robust for most of the indicators of comparative advantages (RCA, RTA, and ARCA).

3.8 Conclusions and limitation

This chapter I evaluated the competitiveness of wine export employing four revealed comparative advantage indices (RCA, RTA, ARCA and NRCA). The calculated RCA

indices imply that besides traditional countries (Italy, France, Spain, Portugal, Georgia and Moldova), the New World wine producers also (Argentina, Australia, Chile, New Zealand, South Africa) exhibit a strong comparative advantage in the wine trade.

Consistency tests confirm that applied trade indices perform very well in terms of binary and ordinal measures while they work less efficient as a cardinal indicator. The panel unit root tests provide a strong support for the existence of unit root in dependent variables indicating a divergence in comparative advantage indices at the world markets, over time. Since the unit root test of independent variables suggests mixed result and panel time period is relatively small, plus explanatory variables are unbalanced, cointegration tests are not held for my database.

Because of the cross-sectional dependency and the serial correlation, I employed panel corrected standard error (PCSE) for RTA, ARCA and NRCA model and feasible generalised least squares (GLS) estimations for RCA assuming cross-sectional independence. Regression estimates show that grape yield and country's population influence negatively the revealed comparative advantages, while factor endowments (agricultural employment, grape area harvested) and wine quality (export unit value) have positive impacts on the wine trade competitiveness. In addition, New Wine World performs better in international trade plus WTO agreements enhance wine trade competitiveness. The estimated coefficients confirm the hypothesis analysed on revealed comparative advantage in the wine industry. The results provide new evidence for the determinants of competitiveness and identify the major factor of trade advantage.

It should be noted that the models also have a few limitations. Firstly, the variables were measured at the macro level. Secondly, the estimated models assumed competitive wine markets and homogenous wine products across countries. Panel unit root tests had mixed results: panel data contained small time period and independent variables were unbalanced (contain missing values) that limited the power of tests.

The following chapter explores the determinants of wine trade cost in the global wine market.

4 THE ROLE OF TRADE COSTS IN WORLD WINE TRADE

At the end of the 20th century, France, Italy and Spain have suffered a remarkable drop in domestic wine consumption while New World wine producers have increased their production potential and induced new demand in foreign markets (Cembalo et. al., 2014). These changes also have been accompanied by a geographical relocation of wine consumption (Aizenman and Brooks, 2008), for instance, by increasing wine consumption in North America and Asia. Currently, almost half of the global wine is consumed outside of a country of origin generally accompanied by extra trade costs (Bianco et. al., 2014).

The effect of cultural and geographical similarity on trade cost has already been proved in international trade literature by the help of gravity models. According to Tinbergen (1962) the size of bilateral trade flows between any two countries can be approximated by the so-called "gravity equation" on the analogy of the Newtonian Gravitation theory.

After Tinbergen (1962), Anderson (1979) provided a theoretical basis for gravity models. In work of Anderson (1979), Bergstrand (1985; 1989), Eaton and Kortum (2002), Helpman et al. (2008) and Chaney (2008) also improved the model and contributed to the trade gravity literature.

The gravity equation (Anderson and van Wincoop, 2003) is evidence for a relationship between the size of economies, their distances and the amount of their trade. According to the gravitation model of trade, physical and cultural proximity (language, tradition and history) between exporting and importing countries are related to costs of trade (Bacchetta et al., 2012).

A few articles were already published in international literature on wine trade explored by gravity equation models (Dascal, 2002; Bianco, 2013b; Fertő et al. 2013; Lombardi et al., 2016) However, we cannot find relevant comprehensive study including the most important wine exporter countries analysing the impact of cultural-linguistic clusters on trade costs. Therefore my second empirical part investigates the geographical and cultural dimension of wine trade costs. More specifically it responds to question: do culturally similar country clusters have supplementary trade advantages; are they trading more with each other than with other different clusters. This chapter aimed to answer the following research question:

Research question 2 (RQ2): What factors influence costs of wine trade between wine producers and their trading partners?

For that purpose, I establish a gravity model in order to investigate the bilateral wine trade of relevant wine exporters and their trading partners. Moreover, I investigate the effect of geographical distance, trade liberalisation and cultural variables on trade costs.

4.1 Theoretical framework

In 1962, Jan Tinbergen described the patterns of bilateral aggregate trade flows between two countries as proportional to the gross national products (GDP) of those countries and inversely proportional to the distance between them influencing trade costs by the analogy with Newton's universal law of gravitation (Tinbergen, 1962). Newton's law of gravitation states that: *"any two bodies in the universe attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them"* (Newton, 1729). Similarly, the gravity equation is relating to the relationship between the sizes of the economy, the distances between them, and the amount of their trade (Bacchetta et al., 2012).

The gravity models have been used to refer to a variety of different specifications to determining bilateral trade flows and estimating factors of trade costs. A number of slightly different specifications of the gravity equation exist in the trade literature. Moreover, the gravity equation can be derived from several theory-consistent estimation methods. One estimator may be preferred for certain types of data; in general, more methods could be used to ensure robustness (Head and Mayer, 2013 p. 6). All gravity specifications can identify transport and transaction costs for goods and services traded (Head and Mayer, 2013 p. 14).

Most of the gravity models work with a single factor of production and hence Gross Domestic Products (GDP). The gravity models can be divided into two major categories: "*demand-side*" or "*supply-side*" derivations (Head and Mayer, 2013 p. 14).

The earliest formula of the gravity equation for trade was worked out by Anderson (1979).

The gravity equation is based on standard symmetric monopolistic competition assumptions derived by multiple authors. It assumes that each country has firms supplying one variety each to the world from a home-country production site. Utility

features a constant elasticity of substitution between all varieties available in the world (Head and Mayer, 2013 p. 15). Eaton and Kortum (2002) derive a gravity equation from the constant elasticity of substitution based on the approaches in approximately every respect and the results they obtain a remarkable similarity. According to Bergstrand (1985, 1989), the gravity model is a direct implication of monopolistic competition model of Krugman (1980). Helpman et al. (2008) and Chaney (2008) obtained gravity model from a theoretical model of international trade in differentiated goods with firm heterogeneity. The trade relationship posited by the gravity equation has been confirmed over several decades in empirical studies (Gandolfo, 2014).

4.2 Literature review on gravity model in wine trade

However, gravity trade models are popular, only limited articles are available in international trade literature that investigates the wine trade by gravity equations (Table 12). Pinilla and Serrano (2008) analysed the long-term determinants of Spanish table wine exports by gravity panel data estimation technique between 1871 and 1935. Their model results showed that Spanish table wine was exported to countries with large growing markets that were close both culturally and geographically. Dascal et al. (2002) employed a gravity model in order to analyse the main factors affecting the trade flows of wine in EU-12 countries for the period 1989–1997. Their results revealed that wine trade was positively influenced by an increase in GDP per capita since a country's greater income promotes trade. De Blasi et al. (2007) examined the magnitude of the trade flows for high-quality wine from Italy to its main importing countries analysed by the gravity model. They concluded that the enlargement of the EU provided a better opportunity for the high-quality Italian wine exporters. Fertő et al. (2013) investigated the impact of communication costs on the wine export focusing on the EU-27 for a period of 1998–2011. They applied various specifications to a gravity model from Tobit, Heckman to Poisson estimation. Their results supported the validity of standard gravity model variables like market size, trade costs, common language and colonial links. Bianco et al. (2013b) analysed the Argentinean wine industry by gravity model. They concluded that wine flows can be basically explained by the importer countries' economic and political characteristics. In addition, the lack of free trade agreements with the European Union and North America revealed a significant weakness for Argentinean wineries.

Table 12. – Gravity studies in wine industry

Authors	Data and industry	Methodology	Results
Pinilla and Serrano (2008)	Long-term determinants of Spanish table wine exports, 1871 and 1935	gravity panel data	Spanish table wine was exported to countries with large growing markets that were close both culturally and geographically
Dascal et al. (2002)	The main factors affecting trade flows of wine in EU-12 countries for the period 1989–1997.	gravity model approach	wine trade was positively influenced by an increase of GDP per capita, since greater income promotes trade
De Blasi et al. (2007)	Trade flows for high quality wine from Italy to its main importing countries	gravity model	EU provided better opportunity for the high quality Italian wine exporters
Fertő et al. (2013)	Investigating the impact of communication costs on the wine export focusing on the EU-27 trade for a period of 1998–2011.	various specifications to a gravity model (Tobit, Heckman selection models Poisson estimation)	validity of standard gravity model variables like market size, trade costs, common language and colonial links
Bianco et al. (2013b)	Argentinean wine industry	gravity model	wine flows can be basically explained by the importer countries' economic and political characteristics, the lack of free trade agreements revealed a significant weakness for Argentinean wineries
Bianco et al. (2014)	Impact of trade barriers, trade costs impeding exports, transport, tariffs, technical barriers and sanitary and phytosanitary standards	gravity model	regulations can adversely affect trade providing useful information to policy-makers involved in negotiations on trade frictions
Lombardi et al. (2016)	Intra-EU trade of the world's major wine exporters	augmented version of the gravity model, investigating transportation costs, demand and supply gaps between origin and destination countries, on the size of bilateral trade flows	results highlight the differences between bulk and bottled wine, providing useful information for European producers and policy-makers involved on regulation of wine sector

Source: own composition

Bianco et al. (2014) investigated the impact of trade barriers on the world wine trade focusing on costs impeding exports, including transport, tariffs, technical barriers as well as sanitary and phytosanitary standards. Their gravity model was estimated using

data from the main importing and exporting countries between 1997 and 2010. Their results identify which regulations can adversely affect trade providing useful information to policy-makers involved in negotiations on trade frictions. Lombardi et al. (2016) analysed the intra-EU trade of the world's major wine exporters such as Italy, France and Spain employing augmented version of the gravity model. They had taken into account the effects of transportation costs, as well as demand and supply gaps between origin and destination countries, on the size of bilateral trade flows.

Empirical gravity models are focusing only a given country (France, Italy, Spain or Argentina) or region (EU) neglecting the global wine trade. These studies mentioned do not account for the entire major world wine exporter countries. In addition, the effect of cultural similarity on wine trade was not investigated yet such factors as language cluster variables. These research gaps motivated me to establish a gravity model for world major wine exporter countries and to take into account the wine trading relations between culturally similar and common language spoken countries.

4.3 Methodology

Applying gravity model requires some basic assumptions on trade. In general, a crucial assumption that whatever the price, a country will consume at least some of every good from every country (Anderson, 1979). All goods are traded, all countries trade and in equilibrium, national income is the sum of home and foreign demand for a unique good that each country produces (e.g. GDP). For this reason, larger countries import and export more products (Bacchetta et al., 2012). The higher transport costs generally reduce trade flows that can be represented by the value of export or import. In this study, I employ standard gravity model for a representative sample of world wine exporter countries. The standard formula of gravity equation can be calculated as follows (Anderson and van Wincoop, 2003):

$$X_{ij} = G * S_i * M_j * \varphi_{ij} \qquad (7)$$

where X_{ij} is the value of exports from *i* to *j*,

M_j denotes importing country's GDP,

S_i comprises exporter's GDP,

G is a variable (constant) that does not depend on *i* or *j* such as the level of world liberalisation,

φ_{ij} represents the ease of exporter *i* to access of market *j*.

The log-linear model of gravity equation can be calculated by taking the natural logarithms of equation (7) (Bacchetta et al., 2012):

$$lnX_{ij} = lnG + lnS_i + lnM_j + ln\varphi_{ij} \qquad (8)$$

A number of variables are generally used to capture trade costs such as bilateral distance, islands-landlocked countries, common borders, common language or cultural features such as colonial history, common religion that are usually thought to be stable over time (Bacchetta et al., 2012). Although culture shifts over time, it may change more when countries are more exposed to international trade. Therefore, it is important to consider the measures of culture that can change over time (Head and Mayer, 2013).

There is much evidence of these proxies e.g. transport costs increase with distance. In addition, trade costs are probably lower for countries whose have a common language or other relevant cultural character because they are likely to know more about each other and to understand better each other's culture or business practices (Bacchetta et al., 2012).

Sharing a religion has also been shown to raise trade (Kang and Fratianni, 2006; Linders and de Groot, 2006). The religious similarity is a variable created from data on religion from La Porta et al. (1999), who provide the percentage of a country's residents who identify as Catholic, Protestant, Muslim, or other religions.

The relationship between physical distance and cultural distance deserves special attention in gravity relations. Countries tend to group together geographically because a culture spreads first to those areas nearest its origin (Ronen and Shenkar, 1985, p. 444).

However, cultural proximity and geographic proximity are not necessarily associated. Three countries pertaining to the Anglo-Saxon cluster such as Australia, the UK, and the United States are located in three different continents due to the colonisation and immigration (Ronen and Shenkar, 1985).

To measure the cultural distance between the home and the host country, Ronen and Shenkar (1985) and Triandis (1994) clustered countries based on their relative similarities along four different dimensions, i.e., language, geography, wealth, and

religion. In addition, Ronen and Shenkar (1985) synthesise eight studies that classify countries according to aspects such as prevalent needs, values, and work attitudes. I used clusters of countries that present similar cultural characteristics to home country by the work of Filippaios and Rama (2011).

Moreover, tariff barriers are generally included in the form of dummies for the existence of regional trade agreements (RTAs) or use of WTO membership. It should be noticed that employing gravity data brings up some problems, discussed by next section.

4.4 General problems with gravity trade data

We can face the following problems if we utilise gravity data such as measuring multilateral resistance term, heterogeneity, accounting for zero trade flows and choosing the appropriate function forms specification.

Anderson and van Wincoop's (2003) show that controlling for relative trade costs[10] is crucial for a well-specified gravity model called multilateral trade resistance. The rationale for including these so-called multilateral trade resistance (MTR) terms is that ceteris paribus, two countries surrounded by other large trading economies will trade less among themselves than if they were surrounded by oceans or by vast stretches of deserts and mountains (Bacchetta et al., 2012, p. 105). The problem with estimating multilateral resistance terms is that they are not directly observable. A number of alternative proxies for MTRs are possible. First is to use iterative methods to construct estimates of the price-raising effects of barriers to multilateral trade (Anderson and van Wincoop, 2003). However, this procedure is not commonly used since it requires a non-linear least square (NLS) estimation. An alternative often used method is to replace these remoteness variables by applying country fixed effects for importers and exporters (Rose and van Wincoop, 2001; Feenstra, 2004; Baldwin and Taglioni, 2006).

Occasionally, observations in gravity data would be heterogeneous in a variety of ways. Consequently, homoscedasticity assumption of error terms is being likely to be violated. The use of bilateral panel data has an advantage of mitigating the bias generated by

[10] Their theoretical results show that bilateral trade is determined by relative trade costs, i.e. the propensity of country j to import from country i is determined by country j's trade cost toward i relative to its overall "resistance" to imports (weighted average trade costs) and to the average "resistance" facing exporters in country i; not simply by the absolute trade costs between countries i and j (Anderson and van Wincoop, 2003, p. 105.).

heterogeneity across countries. In a panel database, the country-pair heterogeneity can be controlled for using country-pair fixed effects by including dummy variables.

Endogeneity problem often arises in gravity models when estimating the impact of trade policies e.g. using regional trade agreements (Bacchetta et al., 2012). There are many examples where those countries sign a trade agreement that already trades each other (NAFTA, EU). Since currency unions economise on transaction costs of converting exchange, they will be greater when there are more transactions when countries trade a lot with each other. Cross-section or pooled estimates are therefore not reliable. One solution would be to find an instrumental variable, though, because of the lacking plausible instrumental variables, the most promising approach is to include country-pair fixed effects (Head and Mayer, 2013).

As concerns the zero trade flows, the gravity panel data generally contain zero trade values. Zero trade reported in the data either would be really zero trade or reflects systematic rounding errors associated with very small trade flows; therefore, dropping zero trade flows out of the sample would result in a loss of useful information (Linders and de Groot, 2006). There are three alternative ways to handle zero trade flow (Bacchetta et al., 2012):

- truncating the sample by dropping the observations with zero trade;
- adding a small constant (e.g. 1 dollar) to the value of trade before taking logarithms;
- or estimating the model in levels.

Zero trade flows can be handled by estimating the model in levels employing Pseudo Poisson maximum likelihood (PPML) estimator. Santos and Tenreyro (2006) highlight that in the presence of heteroscedasticity the PPML is the best-unbiased estimator.

Furthermore, the zero trade flows would result from country's decisions not to export to a certain market. To model these decisions and correct the estimation of the volume of trade for this selection bias the Heckman approach is called for (Linders and de Groot, 2006; Herrera, 2010). Heckman two-stage estimations can solve the sample selection bias by only using results that explain a country's decisions to export.

A Heckman-based approach involves first using probit to estimate the probability that one country imports a positive amount of trade from the second country (Helpman et al., 2008). The second step estimates the gravity equation on the positive-flow observations including a selection correction (mills lambda). However, in the Heckman-based methods, it is difficult to find an exclusion restriction. Thus, one ideally would

like to use a variable in the export status probit that can be excluded from the gravity equation. Since both equations have country fixed effects, this variable needs to be binary in nature (Helpman et al., 2008).

The literature suggests several function forms in order to estimate gravity models from linear pooled OLS to non-linear PPML. The standard gravity equation and other multiplicative models can be estimated by OLS estimation after taking logs of variables. Santos and Tenreyro (2006) brought to the attention that this seemingly innocuous approach involves taking a much stronger standpoint on the functional form of the error than other estimation techniques.

Santos and Tenreyro (2006) argue that Pseudo-Poisson maximum likelihood (PPML) is a smart alternative to linear-in-logs OLS for the gravity equation. A useful feature of the PPML is that permit the inclusion of zero trade values as well.

In the present study, I employ heteroskedasticity robust panel estimation (PPML), including zero trade flows and country-time fixed effects for bilateral wine export data.

4.5 Econometric specifications

Based on the empirical evidence of gravity literature (Pinilla and Serrano, 2008; Dascal, et al. 2002; De Blasi et al., 2007; Fertő et al., 2013; Lombardi et al. 2016) in the wine industry, the following hypotheses are tested here, reflecting on the second research question (RQ2):

H2.1: Demand for wine increases by market size, therefore, larger countries export more wine.

In empirical gravity models, larger countries export more, therefore, the GDP of exporters and importers have a positive effect on trade (Bacchetta et al., 2012) that is expected to be true for wine trade. Bacchetta et al. (2012), Head and Mayer (2013) also confirm that trade costs increase with geographical distances.

H2.2: Wine trade costs increase with geographical distance.

If the trader countries are landlocked that makes the trade more expensive (Bacchetta et al., 2012) since the sea access enables the water transport that reduces transport costs.

H2.3: Wine trade costs are higher in the case of landlocked countries.

Trade costs are lower in those countries that are similar culturally because they know better each other's business culture and practise (Bacchetta et al., 2012; Pinilla and Serrano, 2008) that is probably true for wine export.

H2.4: Countries with common cultural features export more wine each other's market because trade costs are lower between culturally similar countries.

Lower trade barriers stimulate trade by reducing trade costs (Bacchetta et al., 2012, p. 106; Bianco et al., 2013b). In this model, free trade variables are included by WTO membership and regional trade agreements (RTA).

H2.5: Free trade agreements facilitate wine trade by reducing trade costs.

While the wine producer countries are mainly Latin European, Germanic, Latin American, and Anglo-Saxon countries (Annex 2). I establish the following hypothesis for language clusters (Filippaios and Rama, 2011) between countries analysed:

H2.6: Trade relations are more developed in identical language clusters (Latin European, Germanic, Latin American, and Anglo-Saxon) than between different country clusters.

Cultural-linguistic clusters (Filippaios and Rama, 2011) are investigated without and with common language variable representing the extra trade effect of language clusters.
My panel gravity model includes bilateral trade data of 32 considerable wine exporter countries and their 216 trading partners for a period of 2000–2013 (Annex 2). The dependent variable of the model comes from bilateral wine export data of World Bank World Integrated Trade Solution (WITS) database in HS-6 level, product code 2204[11], used in level and log form (World Bank, 2014a) in line with the sample investigating the revealed comparative advantage (Chapter 3).

[11] Product code 2204 includes wine of fresh grapes, including fortified wines; grape must.

The explanatory variables of the model are economic size (exporter, importer country's GDP), bilateral distances (shortest distances between capital cities) and cultural distances (common official language, colonial relationship in the past, common religion, island-landlocked dummies).

The set of bilateral covariates comes from the database of Research and Expertise Centre on the World Economy (CEPII, 2014). Information on WTO memberships can be found on the WTO website (WTO, 2014). The impact of free trade is represented by the bilateral WTO memberships. The regional trade agreement (RTA) variable models the impact of bilateral regional trade agreements between countries, comes from International Economics Data and Programs of José de Sousa (De Sousa, 2014).

A religion variable derived from data of La Porta et al. (1999). To measure the cultural distance between the home and the host country, I employed language cluster variables (see Annex 2) from the work of Ronen and Shenkar (1985) in Filippaios and Rama (2011). The description of applied variables can be found in Table 13.

I employ four different estimation methods: pooled OLS, Random Effects suggested by Baier and Bergstrand (2009), PPML by Santos and Tenreyro (2006) and Heckman two-stage approach (Heckman, 1979) to estimate the gravity equation for the wine trade. In all models, country fixed effect are included by country-pairs (D_i *exp dummies*$_i$ and D_j *imp dummies*$_j$) and time fixed effects by year dummies (D_i *time dummies*$_{ij}$). To avoid dropping zero trade values in logarithm form, I added a small value of 1 dollar to wine export variables to correct zero trade flows. I estimated the following models by OLS, Random Effect, Heckman and PPML estimators (including zero trade flows).

Model 1

$$*ln\ wine\ export_{ij} = \alpha + \beta_1 ln\ GDPexp_i + \beta_2 ln\ GDPimp_j + \beta_3\ ln\ dist_{ij} + \beta_4\ comlang\_off_{ij} + \beta_5\ comcol_{ij} + \beta_6\ colony_{ij} + \beta_7\ religion + \beta_8\ landlocked_{ij} + \beta_9\ WTO_{ij} + \beta_{10}\ RTA_{ij} + D_i\ exp\ dummies_i + D_j\ imp\ dummies_j + D_i\ time\ dummies_{ij} + u_{ij} \quad (9)$$

Model 2

$$*ln\ wine\ export_{ij} = \alpha + \beta_1 ln\ GDPexp_i + \beta_2\ ln\ GDPimp_j + \beta_3\ ln\ dist_{ij} + \beta_4\ comlang\_off_{ij} + \beta_5\ comcol_{ij} + \beta_6\ colony_{ij} + \beta_7\ religion + \beta_8\ landlocked_{ij} + \beta_9 WTO_{ij} + \beta_{10}\ RTA_{ij} + \beta_{10}\ Anglo\text{-}saxon_{ij} + \beta_{11}\ Germanic_{ij} + \beta_{12}\ LatinAm_{ij} + \beta_{13}\ LatinEU_{ij} + D_i\ exp\ dummies_i + D_j\ imp\ dummies_j + D_i\ time\ dummies_{ij} + u_{ij} \quad (10)$$

Model 3

$$*ln\ wine\ export_{ij} = \alpha + \beta_1 ln\ GDPexp_i + \beta_2\ ln\ GDPimp_j + \beta_3\ ln\ dist_{ij} + \beta_4\ comcol_{ij} + \beta_5\ colony_{ij} + \beta_6\ religion + \beta_7\ landlocked_{ij} + \beta_8\ WTO_{ij} + \beta_9\ RTA_{ij} + \beta_{10}\ Anglo\text{-}saxon_{ij} + \beta_{11}\ Germanic_{ij} + \beta_{12}\ LatinAm_{ij} + \beta_{13}\ LatinEU_{ij} + D_i\ exp\ dummies_i + D_j\ imp\ dummies_j + D_i\ time\ dummies_{ij} + u_{ij} \quad (11)$$

*Note: in PPML models wine export were used in level instead of logarithm form

Table 13. – Description of independent variables

Independent variables	Description	Data sources	Exp. sign
lnGDPexp	GDP of wine exporter (GDP in current US dollar)	World Bank WDI (2014b)	+
lnGDPimp	GDP of wine importer (GDP in current US dollar)	World Bank WDI (2014b)	+
lndist	distance: simple distance of most populated cities in km	CEPII (2014)	-
Independent dummy variables	**Description**	**Data sources**	**Exp. sign**
comlang_off	common official language: 1 if trader countries have common official primary language, 0 otherwise	CEPII (2014)	+
comcol	common colonizer: 1 for common colonizer post 1945, 0 otherwise	CEPII (2014)	+
colony	1 if traders were ever in colonial relationship, 0 otherwise	CEPII (2014)	+
landlocked	landlocked country: 1 if both traders are landlocked, 0 otherwise	CEPII (2014)	-
religion	1 if common main religion for both countries, 0 otherwise	La Porta et al. (1999)	+
RTA	1 if traders have regional trade agreements, 0 otherwise	De Sousa (2014)	+
WTO	WTO: 1 if both traders are member of WTO, 0 otherwise	WTO (2014)	+
Language classification	**Description**	**Data sources**	**Exp. sign**
Anglo-Saxon	1 if trader countries belong to Anglo-Saxon cluster, 0 otherwise	Filippaios and Rama (2011)	+
Germanic	1 if trader countries belong to Germanic cluster, 0 otherwise	Filippaios and Rama (2011)	+
Latin American	1 if trader countries belong to Latin American cluster, 0 otherwise	Filippaios and Rama (2011)	+
Latin European	1 if trader countries belong to Latin European cluster, 0 otherwise	Filippaios and Rama (2011)	+

Source: own composition

4.6 Pattern of bilateral wine export

Regarding bilateral export of major wine exporters in the world (Table 14), we can conclude that France, Italy, Spain and Australia commercialised the highest amount of wine during the analysed period by the gravity sample's data. The UK, the USA and Germany can be considered as the top destinations of wine exported however, third countries are also included in the sample such as Canada and Japan. Among these trading partners, larger countries (Australia, France, USA, Canada, and China) also can be found, predicting the hypothesis that larger countries trade more wine (H2.1).

Table 14. – The top 10 wine exporter countries and their top destinations in the gravity sample, 2000–2013, in 1000 USD

Top wine exporters	wine export (mean)	Top wine importers	wine export (mean)
France	37309.89	United Kingdom	131337.94
Italy	21321.14	USA	111749.60
Spain	11484.95	Germany	81923.07
Australia	10355.87	Canada	38214.55
Chile	6679.68	Belgium	33433.56
USA	5083.79	Netherlands	32933.73
Germany	4289.93	Japan	27975.51
Portugal	3888.89	Switzerland	27486.17
New Zealand	3692.51	France	19368.20
Argentina	3086.42	Denmark	15834.09

Source: own calculation based on Word Bank WITS database (World Bank, 2014a)

4.7 Gravity regression results

In this section, I present regression result for gravity model by four different estimation methods[12] (OLS, Random effects, PPML, Heckman). Based on the result of OLS and Random Effect estimation, the traders' GDP, common official language, colonial history, religion variables as well as RTA and WTO affect positively the wine export reducing trade costs (Table 15) in line with previous expectation.

[12] The zero trade flows, country-pairs and time fixed effects are also included in all models. As concerns the pooled OLS and Random Effect models, zero trade flows were corrected by a small value of 1 dollar in order to avoid dropping zeros by taking the logarithm of wine export variable. Otherwise, only 65 % of observation would have been used during the regression estimation.

Table 15. – Results of OLS and Random effects estimation

	(1) OLS	(2) OLS	(3) OLS	(4) Random effects	(5) Random effects	(6) Random effects
VARIABLES	lnexport_adj	lnexport_adj	lnexport_adj	lnexport_adj	lnexport_adj	lnexport_adj
lnRepGDP	0.227*	0.228*	0.228*	0.202	0.202	0.203
	(0.121)	(0.121)	(0.122)	(0.136)	(0.136)	(0.136)
lnPartGDP	1.346***	1.347***	1.349***	1.299***	1.300***	1.300***
	(0.101)	(0.101)	(0.102)	(0.122)	(0.122)	(0.122)
lndist	-1.894***	-1.856***	-1.983***	-2.040***	-2.005***	-2.140***
	(0.0358)	(0.0387)	(0.0385)	(0.0893)	(0.0969)	(0.0974)
comlang_off	1.697***	1.603***		1.731***	1.640***	
	(0.0732)	(0.0766)		(0.191)	(0.199)	
comcol	2.960***	2.965***	2.978***	3.062***	3.070***	3.090***
	(0.248)	(0.248)	(0.247)	(0.732)	(0.732)	(0.730)
colony	2.512***	2.571***	3.335***	2.515***	2.577***	3.360***
	(0.0965)	(0.0980)	(0.0910)	(0.252)	(0.256)	(0.248)
religion	1.168***	1.140***	1.264***	1.185***	1.156***	1.284***
	(0.0737)	(0.0739)	(0.0741)	(0.185)	(0.186)	(0.188)
landlocked	-0.540***	-0.565***	-0.519***	-0.481	-0.512	-0.463
	(0.145)	(0.148)	(0.149)	(0.371)	(0.373)	(0.378)
WTO	1.477***	1.529***	1.651***	1.707	1.766	1.945
	(0.457)	(0.459)	(0.480)	(1.292)	(1.303)	(1.409)
RTA	0.606***	0.615***	0.654***	-0.105	-0.103	-0.0983
	(0.0703)	(0.0704)	(0.0707)	(0.109)	(0.109)	(0.109)
AngloSaxon		0.0402	0.778***		-0.0250	0.732
		(0.153)	(0.152)		(0.462)	(0.462)
Germanic		-0.0658	-0.0116		-0.0877	-0.0323
		(0.146)	(0.148)		(0.397)	(0.406)
LatinAmerican		1.285***	2.072***		1.304***	2.113***
		(0.155)	(0.152)		(0.380)	(0.378)
LatinEuropean		-0.192	-0.185		-0.198	-0.191
		(0.120)	(0.121)		(0.286)	(0.290)
Constant	-24.56***	-24.89***	-23.91***	-19.38***	-19.71***	-17.99***
	(3.954)	(3.952)	(3.981)	(5.096)	(5.114)	(5.156)
Observations	45,421	45,421	45,421	45,421	45,421	45,421
R-squared	0.593	0.593	0.589	0.592	0.592	0.587
Number of country pairs				3,539	3,539	3,539
exporter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
importer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: to avoid dropping zero trade flows lnexport_adj was calculated by adding 1 USD to 0 trade values
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: own calculation based on Word Bank (2014a) WITS, Word Bank (2014b) World Development Indicators, CEPII (2014), De Sousa (2014), La Porta et al. (1999), Filippaios and Rama (2011) and WTO (2014) databases

The positive effect of common official language (comlang_off) as cultural factor is revealed in all models indicating the reduction of wine trade costs (H2.4). However, additional effects of language clusters[13] (model (3) and model (6)) suggest that only countries within Latin American cluster have significant trade relations. The OLS and Random Effect estimation can prove significant relationship between cost of wine trade along with its determinants and these results are accordant with the previous empirical studies in most of the variables. On the contrary, language cluster variables are only partly significant. On the other hand, in case of panel gravity data PPML and Heckman estimation provide more robust result.

As a result of PPML estimation (Table 16) – including zero trade flows and wine trade in absolute value – approximately all coefficients of the models are significant and have the same sign as empirical literature suggest (H2.1-H2.5). The elasticity of trade to distance is usually between -0.7 and -1.5 in empirical gravity models (Bacchetta et al., 2012) that is similar to the estimated distance coefficients of wine exporters (it ranges between -0.58 and -1.34 depending on models). The PPML models also confirm a positive role of language clusters and reduced trading costs between Anglo-Saxon, Germanic, Latin American and Latin European countries (H2.6). The additional effect of language clusters (PPML model 2) reveals that in case of Latin American countries, the trade effect is the highest in accordant with OLS and Random effect models.

[13] Model 2 includes both "comlang_off" and language cluster variables representing the extra trade effect of language clusters

Table 16. – PPML estimation results for wine export

VARIABLES	(1) PPML export	(2) PPML export	(3) PPML export
lnRepGDP	0.152	0.156	0.167
	(0.187)	(0.184)	(0.186)
lnPartGDP	0.948***	0.949***	0.949***
	(0.179)	(0.179)	(0.179)
lndist	-0.352***	-0.330***	-0.375***
	(0.0828)	(0.0879)	(0.0843)
comlang_off	0.763***	0.561***	
	(0.153)	(0.185)	
comcol	2.886***	2.996***	2.973***
	(0.801)	(0.830)	(0.772)
colony	0.514**	0.520**	0.672***
	(0.239)	(0.243)	(0.236)
religion	0.650**	0.573**	0.636**
	(0.261)	(0.279)	(0.259)
landlocked	-1.341**	-0.879	-0.584
	(0.547)	(0.607)	(0.628)
WTO	2.512***	2.503***	2.494***
	(0.855)	(0.882)	(0.922)
RTA	0.441**	0.425**	0.440**
	(0.202)	(0.200)	(0.194)
AngloSaxon		0.344	0.743***
		(0.269)	(0.208)
Germanic		0.626*	0.825**
		(0.372)	(0.408)
LatinAmerican		1.016***	1.170***
		(0.246)	(0.277)
LatinEuropean		0.462*	0.458*
		(0.257)	(0.263)
Constant	-11.46	-12.03*	-11.42*
	(7.047)	(6.969)	(6.907)
Observations	45,421	45,421	45,421
Pseudo R-squared	0.869	0.871	0.862
exporter fixed effects	Yes	Yes	Yes
importer fixed effects	Yes	Yes	Yes
time fixed effects	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: own calculation based on Word Bank (2014a) WITS, Word Bank (2014b) World Development Indicators, CEPII (2014), De Sousa (2014), La Porta et al. (1999), Filippaios and Rama (2011) and WTO (2014) database

Table 17 presents the Heckman two-stage estimation using sample selection variable[14] (exportdummy). As concerns the Heckman estimation, the first and the second stage estimation produce similar results as empirical literature suggest: almost all coefficients are significant and have expected sign.

[14] The "exportdummy" variable is equal to 1 if the value of export is positive and 0 otherwise.

Table 17. – Results of Heckman two-stage estimations

VARIABLES	(1) heckman lnexport_adj	export dummy	(2) heckman lnexport_adj	export dummy	(3) heckman lnexport_adj	export dummy
lnRepGDP	0.884***	0.162***	0.833***	0.164***	0.581***	0.164***
	(0.0312)	(0.00370)	(0.0255)	(0.00372)	(0.0175)	(0.00372)
lnPartGDP	0.841***	0.154***	0.772***	0.154***	0.501***	0.154***
	(0.0289)	(0.00303)	(0.0234)	(0.00306)	(0.0152)	(0.00306)
lndist	-0.366***	-0.102***	-0.243***	-0.0793***	-0.111***	-0.0793***
	(0.0369)	(0.00889)	(0.0307)	(0.00940)	(0.0226)	(0.00940)
comlang_off	2.218***	0.424***	1.628***	0.366***		0.366***
	(0.103)	(0.0216)	(0.0824)	(0.0224)		(0.0224)
comcol	1.507***	0.0105	1.711***	0.0466	1.797***	0.0466
	(0.254)	(0.0563)	(0.212)	(0.0563)	(0.178)	(0.0563)
colony	1.010***	0.265***	1.141***	0.312***	1.235***	0.312***
	(0.120)	(0.0353)	(0.103)	(0.0356)	(0.0762)	(0.0356)
religion	1.458***	0.293***	1.117***	0.247***	0.780***	0.247***
	(0.0862)	(0.0199)	(0.0680)	(0.0203)	(0.0495)	(0.0203)
landlocked	-1.890***	-0.264***	-1.779***	-0.250***	-1.409***	-0.250***
	(0.0732)	(0.0144)	(0.0611)	(0.0147)	(0.0457)	(0.0147)
WTO	1.303***	0.297***	1.086***	0.284***	0.447***	0.284***
	(0.0970)	(0.0174)	(0.0786)	(0.0175)	(0.0587)	(0.0175)
RTA	1.907***	0.411***	1.764***	0.415***	1.156***	0.415***
	(0.0951)	(0.0194)	(0.0778)	(0.0194)	(0.0551)	(0.0194)
AngloSaxon			1.413***	0.348***	2.100***	0.348***
			(0.181)	(0.0935)	(0.124)	(0.0935)
Germanic			1.153***	0.319***	0.629***	0.319***
			(0.139)	(0.0510)	(0.100)	(0.0510)
LatinAmerican			3.190***	1.277***	2.554***	1.277***
			(0.201)	(0.0951)	(0.145)	(0.0951)
LatinEuropean			0.368***	0.210***	0.0719	0.210***
			(0.115)	(0.0407)	(0.0833)	(0.0407)
smctry		0.599***		0.500***		0.500***
		(0.0788)		(0.0818)		(0.0818)
mills lambda	4.726***		3.933***		0.553***	
	(0.355)		(0.285)		(0.193)	
Constant	-40.84***	-7.157***	-38.20***	-7.404***	-23.16***	-7.404***
	(1.601)	(0.143)	(1.337)	(0.148)	(0.881)	(0.148)
Observations	45,421	45,421	45,421	45,421	45,421	45,421
Censored obs	16,379		16,379		16,379	
Uncensored obs	29,042		29,042		29,042	
exporter fixed effects	Yes		Yes		Yes	
importer fixed effects	Yes		Yes		Yes	
time fixed effects	Yes		Yes		Yes	

Note: to avoid dropping zero trade flows lnexport_adj was calculated by adding 1 USD to 0 trade values
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: own calculation based on Word Bank (2014a) WITS, Word Bank (2014b) World Development Indicators, CEPII (2014), De Sousa (2014), La Porta et al. (1999), Filippaios and Rama (2011) and WTO (2014) database

All language cluster variables suggest positive trade effect and the reduction of trade costs. On the other hand, the mills lambdas are also significant in the models suggesting selection bias of zero values. It implies that zero trade flows may represent missing values instead of the absence of trade in the sample.

The Heckman results show that in case of wine trade the larger countries export more (H2.1), the wine transport costs also increase in line with the geographical distance (H2.2) and these trade costs are higher for landlocked trading partners (H2.3). The costs of wine export could be lower if trading partners have shipping ports and if they have common cultural relations (common language, common religion, and colonial links), if both of them are members of the WTO or have RTA agreement (H2.4 and H2.5).

Language cluster variables reveal that Anglo-Saxon, Germanic, Latin American and Latin European countries trade wines predominantly with each other (H2.6). The additional effects of language clusters (PPML and Heckman model (2) and (3)) suggest that Latin American, Anglo-Saxon and Germanic clusters have positive significant extra trade effects. It indicates more developed wine trade relation within country cluster than between clusters.

In summary, these models can prove the hypothesised relationship between costs of wine trade and common cultural, historical and geographical link with the trading partners. The results also confirm the positive role of free trade and regional trade agreements. In addition, the estimations suggest that Anglo-Saxon, Latin European, Latin American and Germanic countries have significant extra trade within country cluster. In addition, cultural clusters correspond to wine trade clusters.

4.8 Conclusion and limitation

In recent decades, the wine trade accompanied by a geographical relocation of wine consumption in particular, by increasing wine consumption in North America and Asia. Currently, almost half of the global wine is consumed outside of a country of production that is often associated with an extra trade cost for trading countries.

The effect of the cultural and geographical similarity on international trade has already been proved by international trade literature in help with applying gravity equations for trade. This chapter analysed the hypothesised effects of cultural and geographical proximity on wine trade, calculating for the world major wine producer countries, employing panel gravity model for a period of 2000–2013. It investigated the role of

cultural variables and language clusters in the wine trade costs. Results suggest that the exporter and importer country's common official language, colonial history, religion variables affected the wine export positively. This evidence can contribute to the magnitude of cultural similarity in terms of wine export. The results also confirm the hypothesis that larger countries export more wine, the transport costs increase in line with the geographical distance and they are higher for landlocked trading partners. The costs of wine export could be lower if trading partners have common cultural relations or both have trade agreements. As a result of the language clusters, Anglo-Saxon, Germanic and Latin American countries export wines predominantly to each other's market. The additional effects of country clusters suggest that trade costs are the lowest within Latin American language cluster.

In sum, this new empirical evidence proves that historical and cultural background has a significant role in wine trade and culturally similar countries have remarkable trade advantage.

5 PRICE DISCRIMINATION BEHAVIOUR OF EUROPEAN WINE MARKET LEADERS

Price is a crucial factor for wine trade since exchange rates have had a relatively large impact on the competitive performance of wines (European Commission, 2014, p. 75). As concerns, the wine-importing countries whose exchange rates appreciated most (e.g. China and Japan) would be expected to import more wine, all other things being equal. Meanwhile, for those experiencing depreciation, e.g. the United Kingdom, wine imports would be expected to fall (Anderson and Wittwer, 2013 p. 136). Hence, the important relation can be observed between export prices and international exchanges rates.

Anderson and Wittwer (2013) also confirm that real exchange rates have played a dominant role in the fortunes of some countries' wine markets in recent years.

The methodology for modelling price discrimination behaviour induced by bilateral exchange rates changes called pricing to market (PTM) in the empirical literature.

In the beginning, the pricing to market models (Krugman, 1987) analysed the industrial products in US-German trade relationship. Knetter (1993) suggests that the existence and extent of PTM vary widely between industries and exporting countries. On the other hand, policy-makers have become increasingly interested in pricing behaviour in agri-food trade as well. The majority of the PTM studies in agri-food sector focus on wheat, meat (Saghaian and Reed, 2004), rice (Griffith and Mullen, 2001) and beer industry (Fedoseeva and Werner, 2014). However, the investigation of pricing strategy in several agri-food products attract significant research interest, PTM effects in the wine industry is quite understudied yet, particularly in the case of European Union's wine market leaders.

To date, mainly European traditional wine exporters dominated the world wine trade for that reason third empirical part investigates the pricing strategy of France, Spain, Italy, Portugal and Germany across their foreign wine export markets. It aims to answers the following three research questions:

Research question 3 (RQ3): Are the major European wine exporter countries able to price discriminate across their EU extra wine export destinations?

Research question 4 (RQ4): How can the market structure be characterised on EU extra wine export markets?

Research question 5 (RQ5): How the depreciation and appreciation of wine exporter's exchange rates can influence international wine prices on European wine export markets?

These research questions aim to investigate the pricing strategy and market structure of international export destination markets for the EU market leader countries.

5.1 Theoretical framework

Krugman (1987) introduced the model of price discrimination induced by changes in bilateral exchange rates called pricing to market (PTM). The perfect competition assumes that prices equal marginal cost (p=MC). On the contrary, in the case of imperfect competition prices are not always equal marginal cost (p≠MC). If the exporting country's currency depreciates, import prices do not change equivalently and thus, relative world prices can be affected. As a result, the export price implicitly contains a destination-specific mark-up over marginal cost; exporters can charge the importing countries based on their demand characteristics (Pall et al., 2013).

Pricing to market (PTM) refers to the "destination-specific adjustment of mark-ups in response to exchange-rate changes" Knetter (1993, p. 473). This implies that currency changes are not fully transmitted into export prices with divergent movements in different markets (Krugman, 1986).

The price discrimination can be considered as the optimal decision of a profit maximising exporter. A profit maximising exporter has a chance to exercise price discrimination in an import market only when the importer's residual demand elasticity is inelastic. Otherwise, in the case of elastic residual demand, price discrimination cannot occur (Goldberg and Knetter, 1997; 1999).

The PTM model has received considerable attention as it tests whether exporters can differentiate their prices between destinations markets, providing an insight into the degree to which trade is characterised by a lack of convergence in market prices across export markets (Krugman, 1986; Jin, 2008).

5.2 Pricing to market models in agricultural trade literature

A number of empirical studies have been conducted based on the PTM model. However, these models are missing in wine trade literature that is why I focus on the PTM literature of agri-food trade. Early empirical PTM studies focused on manufactured goods (Krugman, 1986; Knetter 1993) and there has been limited research on agro-food products (Pick and Park, 1991; Lavoie, 2005; Jin, 2008; Pall et al., 2014; Pall et al., 2013). However, policy-makers have become increasingly interested in analysing pricing behaviour in agri-food trade (Gafarova et. al., 2015; Varma and Issar, 2016; Pall et al., 2014). OECD notes that competition issues in the food sector are complex and require further research (OECD 2013 p. 29). Table 18 provides an overview of empirical studies on PTM in the agri-food sectors.

Table 18. – Recent PTM studies in agri-food sector

Authors	Data and industry	Methodology	Results
Pick and Park (1991)	North American wheat exports to eight destination markets, panel quarterly data for 1978–1988	PTM model	Strong evidence of price discrimination across destination markets for US wheat exports
Pick and Carter (1994)	the USA and Canadian wheat exports	PTM model	Evidence of PTM in Canadian wheat exports and significant role of exchange rate in the export pricing decisions of both Canadian and US exporters
Griffith and Mullen (2001)	monthly Japonica rice export prices, data from rice grower cooperatives	PTM model	Cooperatives was able to price discriminate and exercise market power to obtain price premium
Saghaian and Reed (2004)	Monthly value and quantity of US meat export (beef, pork and chicken)	PTM and sensitivity analysis of US export prices	International meat markets are price-integrated except beef
Lavoie (2005)	Canadian wheat exports, monthly price data, 1982–1994, four destination markets	PTM model	Canada has market power emerging from product differentiation and discriminates across destinations
Gafarova et al. (2014)	Wheat export of Kazakhstan, Russia and Ukraine, annual exports value data from UN COMTRADE, during 1996–2012	PTM fixed-effects model, panel data	KRU countries can price discriminate in importing countries, perfect competition exists in most destinations

Fedoseeva andWerner (2014)	German beer exports to sixteen non-Euro destination countries, monthly data from January 1991 to December 2012	PTM partial sum decomposition approach	Both types of nonlinearities play an important role in PTM decisions
Pall et al. (2014)	Russian wheat export	PTM, residual demand elasticity model	Russian wheat exporters can exercise market power in a few export markets, other exporters behave competitively in most of the importing countries
Varma and Isaar (2016)	Top 10 agricultural and food products exported from India. From December 2006 to October 2014, a period of 95 months.	PTM model panel corrected standard errors (PCSE) with heteroskedastic errors and errors, contemporaneously correlated across panels.	The local currency price stabilisation by the Indian exporters was more prominent than the amplification of exchange rates. This is indicating the presence of market power in those destinations.

Source: own composition

In sum, agri-food industries such as US meat sector (Saghaian and Reed, 2004), Japonica rice (Griffith and Mullen, 2001), German beer (Fedoseeva and Werner, 2014), India's agri-food export (Varma and Isaar, 2016) have already investigated by price discrimination models. By contrast, the monopolistic competition and potential market power of EU wine sector were not researched.

5.3 Methodology

To investigate the relationship between export prices and destination specific exchange rates and to determine the presence of price discrimination in the international wine trade, the PTM model will be applied in this chapter (Knetter, 1989; Krugman, 1987). The regression equation for pricing to market model can be calculated as follow (Knetter, 1993):

$$lnP_{it} = \beta_i \, lnER_{it} + \theta_t + \lambda_i + u_{it} \quad i=1,\ldots,N \; t=1,\ldots,T \qquad (12)$$

where lnP_{it} is the wine export unit value in euro to importing country i in period t in logarithm form,

$lnER_{it}$ represents the destination-specific exchange rates expressed as units of the domestic currency in euro in logarithm form,

θ_t are common time-specific effects,

λ_i are country-specific effects,

β_i are the PTM-coefficients or the elasticity of the export price with respect to exchange rate changes.

Since the model is estimated in logarithmic terms representing the elasticity of the domestic currency export price with respect to the exchange rate. The estimated parameters β_i and λ_i can be used to distinguish between different scenarios of export pricing behaviour (Knetter, 1993), see Table 19.

Table 19. – Relationship between estimated parameters and different market scenarios

λ_i	β_i	Market scenarios
Not significant	Not significant	Perfect competition, imperfect competition with common mark-up
Significant	Not significant	Constant elasticity of demand higher than constant mark-up, which can differ across countries
Significant	Significant	Varying elasticity of demand higher than varying mark-up, which can differ across countries (imperfect competition)
	• positive	Amplification of exchange-rate effects (PTM effects)
	• negative	Local-currency price stability (LCPS) higher than PTM effects

Source: Knetter (1993) in Pall et al. (2011)

If the estimated coefficients (β_i and λ_i) are statistically significant, imperfect competition and price discrimination across destination countries exist (PTM effects occur). As follows, two different cases of price discrimination can be distinguished.

The first one assumes a constant elasticity of demand with respect to the domestic currency price in each importing country leading to constant mark-up over marginal cost (β_i= 0). This mark-up can differ across destination countries, which implies $\lambda_i \neq 0$. The country effect variable (λ_i) captures the constant quality differences. Therefore, a significant estimate of the country effect ($\lambda_i \neq 0$) does not necessarily indicate imperfect competition. The other PTM behaviour is that the optimal mark-up by a price-

discriminating entity will vary across destinations ($\lambda_i \neq 0$) with changes in bilateral exchange rates ($\beta_i \neq 0$) (Pall et al., 2011).

Knetter (1993) further distinguishes the situations of a positive ($\beta_i > 0$) versus a negative sign ($\beta_i < 0$) for coefficients of exchange rates (β_i). A negative β_i coefficient implies that exporters do not pursue a constant mark-up policy, but rather stabilise prices in the buyer currency (indicating local-currency price stability, LCPS). Otherwise, a positive β_i coefficient signals that exporters intensify the effect of destination-specific exchange-rate changes through destination-specific changes in the mark-up. Both, country effects ($\lambda_i \neq 0$) and destination-specific exchange-rate changes ($\beta_i \neq 0$) are significant plus exchange rate effects are positive ($\beta_i > 0$) it signal PTM effect and show that exporter country is able to price discriminate on their export destinations.

The equation (12) could be re-specified in the following manner to test for asymmetries in the response of export prices to exchange rate changes. Interaction terms of the dummy variable with the exchange rate can be included in the model to capture the differential impact of appreciation and depreciation (Knetter, 1993; Vergil, 2011). The interaction of the dummy variable with the exchange rate is specified as follows:

$$E_t = (\beta_1 + \beta_2 D_t)E_t = \beta_1 E_t + \beta_2 D_t \times E_t \qquad (13)$$

A dummy variable assumes a value of 1 for periods of appreciation (a fall in E_t) and 0 for periods of depreciation and it is specified in the following manner:

D_t = 1 if $\Delta Et > 0$ (suggests appreciation of the exporter's currency);
D_t =0 if
$\Delta Et < 0$ (induces depreciation of the exporter's currency).

Accordingly, equation (12) can be specified as follows:

$$ln\ p_{it} = \theta_t + \lambda_i + \beta_1 (ln\ e1_t) + \beta_2 (ln\ e2_t) + u_{it} \qquad (14)$$

$$ln\ p_{it} = \theta_t + \lambda_i + \beta_1 (ln\ e1_t) + \beta_2 (ln\ e2_t \times D_t) + u_{it} \qquad (15)$$

In the equation (14) and (15), the interaction term is expressed to capture asymmetry in the exchange rate fluctuations. If its coefficient is statistically significant and has a positive sign, the effect of the appreciation of exporter's currency exchange rates on

export prices is greater than depreciation. Similarly, a negative significant coefficient implies that the effect of depreciation of exchange rates on export prices is greater than appreciation (Byrne et al., 2010).

However, employing panel data set for PTM model brings up some preliminary assumptions and methodological questions. In case of panel data such as a time series property, stationary and convergence used to be tested by panel unit root tests. To check convergences or divergence in the wine export unit values and destination specific exchange rates, I employ second generation panel unit root tests with and without time trend specifications, respectively, as a deterministic component: Maddala and Wu (1999) and Pesaran (2007). Moreover, in this analysis beside the convergence assumption, the cross-sectional dependence appears to be reasonable according to the literature, because various studies using cross-country data indicate that time series are contemporaneously correlated (Breitung and Pesaran, 2008). Therefore, the analysis also investigates the potential for cross-sectional dependence (CD) in data, applying Pesaran (2004) CD test.

5.4 Econometric specifications and hypothesis

The PTM model comprises monthly wine export data of top 5 European wine exporters for EU extra wine export destination markets, from January 2000 to December 2013 (Table 20).

Table 20. – The major European wine exporter countries in PTM model

Country names (5)
France
Italy
Spain
Germany
Portugal

Source: Own composition based on the sample

The strongly balanced panel includes a number of export destination countries and 14 years period. Wine export data for the analysis derived from EUROSTAT (2015)

international trade database in HS 6-digit level, product code 220421[15] given in euro and in kg. Exchange rates are based on the European Central Bank, Statistical Data Warehouse (European Central Bank, 2015) database (local foreign currency in euro). The description of variables can be found in Table 21.

Table 21. – Variables used in PTM model

Dependent variables	**Description**	**Data sources**	**Expected sign**
lnuvx	monthly **w**ine export unit value: wine export value in euro divided per export quantity in kg (wine export data in HS 6-level, product code 220421given in euro and in kg)	EUROSTAT (2015)	
Independents variables	**Description**	**Data sources**	**Expected sign**
lnxrate	local destination specific exchange rates, foreign currency in euro	European Central Bank (2015), Statistical Data Warehouse	+/-
λ_i	country-specific effects	EUROSTAT (2015)	+/-
ΔEt	asymmetric exchange rate effects	EUROSTAT (2015)	+/-

Source: own composition

Based on the empirical works and in order to reflect the third group of research questions (RQ3-RQ5), I estimated the following PTM equation:

$$lnxuv_{it}=\alpha_i + \beta_i\, lnxrate_{it} + \lambda_i\, country\ effects_t + \Delta_i \text{ asymmetric effects} + u_{it} \qquad (16)$$

In equation (16) wine export prices (*lnxuv)* as dependent variables are represented by wine export unit value (Euro/kg as average monthly wine export prices) and the exchange rates expressed as units of the importer's currency per unit of the exporter's currency (*lnxrate).* The country effects are included by country fix effects dummies and the asymmetric effect by interaction terms (16). Time fixed effects are included by the estimation method (PCSE). To follow the previous theoretical literature and in line with the RQ3-RQ5, the PTM model tests the following hypothesis:

[15] The wine of fresh grapes, including fortified wines, and grape must whose fermentation has been arrested by the addition of alcohol, in containers of smaller than 2 litre, excluding sparkling wine.

H3.1: The major European wine exporters are able to price discriminate across their EU extra wine export markets.

The major European wine exporters play a dominant role in global wine market (export share at 70 %) hence; they might apply price discrimination across their export destination markets. It reflects the third research question (RQ3).
If the European wine exporters dominate the world wine market, their export destinations, wine markets are characterised by imperfect competition i.e. monopolistic or oligopolistic market structure. H3.2 hypothesis corresponds to the fourth research question (RQ4).

H3.2: The main EU export destination markets (EU-27 extra export) are not competitive.

The interaction term of the dummy variable with the exchange rate capture the effect of asymmetry. If the coefficient of asymmetry is statistically significant and has a positive sign, it suggests that the effect of the appreciation of wine exporter's currency on wine export prices is greater than in depreciation. Final hypothesis tests the asymmetric effects on exporter's exchange rates and wine export prices (RQ5):

H3.3: Asymmetric effects have a significant impact on wine export prices in case of European wine exporters by appreciation or depreciation of destination specific exchange rates.

5.5 Empirical results

Regarding the EU major wine exporter countries, France, Italy, Spain, Germany and Portugal had the highest export share comparing to the EU-27 extra wine trade, between 2000 and 2013. Furthermore, the top 5 market leaders in the EU represented 91% of EU-27 total wine export targeted to the EU extra markets during the analysed period (Table 22). These countries can be considered as the largest European wine producers and exporters, especially France at 42% of export share. Ahead of France, Italy (30%) owned the place of second largest wine exporter in the EU.

Table 22. – Wine export share of major European wine exporters, 2000–2013

Wine exporter country	Export share in EU-27 extra wine export (%)
France	42%
Italy	30%
Spain	10%
Germany	5%
Portugal	4%
Total	**91%**

Source: own composition based on EUROSTAT (2015) database

Based on the sample data the United States, Canada, Switzerland, Japan, Hong Kong and China can be entitled as the largest European (EU-27) wine export destinations during the analysed period (Table 23). This group of countries represented the 87% of the EU-27 extra wine export. Table 23 illustrates that vast amount of European wine was shipped mainly to New World and Asian countries such as USA, Canada, Hong Kong and China.

Table 23. – The top 10 EU extra wine export destination of EU-27, 2000–2013

Export destinations	Export share in EU-27 extra wine export
United States	36%
Canada	11%
Switzerland	11%
Japan	11%
Hong Kong	5%
China	5%
Russia	4%
Norway	3%
Brazil	1%
Singapore	1%
Total	**87%**

Source: own composition based on EUROSTAT (2015) database

Regarding the wine export share by destination markets, trade statistics suggests that USA, Canada, Switzerland and Japan are the biggest demand market for European wines (Table 24).

Table 24. – Wine export share by export destinations, in per cent, 2000–2013

Export destination	France	Italy	Spain	Portugal	Germany
Australia	1%	1%	1%		1%
Canada	14%	14%	11%	31%	7%
Hong Kong	9%	1%	1%		
Japan	20%	7%	8%	4%	12%
Mexico	1%	1%	9%		
Norway		3%	5%	5%	14%
Russia	2%	2%	3%		11%
Singapore	2%	0%	0%		1%
Switzerland	12%	13%	22%	14%	10%
United States	37%	58%	39%	46%	45%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: own composition based on EUROSTAT (2015) database

Table 25 shows those wine export destinations that imported notable wine from top 5 European wine exporters. 43.1 % of USA, 14.2 % of Japanese, 10.8% of Canadian and 12.5% of Swiss wines were imported from the top EU wine producers.

Table 25. – The wine import of destination countries from top 5 European wine producers, in percent, 2000–2013

	France	Italy	Spain	Portugal	Germany	
Wine importers						**Total**
Australia	1.6%	0.4%	0.1%	0.0%	0.0%	**2.2%**
Canada	5.1%	3.8%	0.9%	0.6%	0.4%	**10.8%**
Hong Kong	2.4%	0.2%	0.1%	0.0%	0.1%	**2.8%**
Japan	10.5%	2.3%	0.9%	0.1%	0.4%	**14.2%**
Malaysia	0.1%	0.0%	0.0%	0.0%	0.0%	**0.2%**
Mexico	0.4%	0.2%	0.6%	0.0%	0.1%	**1.3%**
Norway	1.3%	1.1%	0.6%	0.1%	0.3%	**3.4%**
Philippines	0.0%	0.0%	0.0%	0.0%	0.0%	**0.1%**
Russia	2.1%	1.9%	1.1%	0.1%	0.4%	**5.6%**
Singapore	3.4%	0.1%	0.0%	0.0%	0.0%	**3.6%**
South Africa	0.2%	0.0%	0.0%	0.0%	0.0%	**0.2%**
Switzerland	5.6%	4.4%	1.9%	0.3%	0.4%	**12.5%**
Thailand	0.1%	0.0%	0.0%	0.0%	0.0%	**0.2%**
United States	18.6%	18.1%	3.7%	1.0%	1.7%	**43.1%**
Total	**51%**	**33%**	**10%**	**2%**	**4%**	**100%**

Source: own composition based on World Bank WITS database (2014a)

French and Italian wines are strongly present in US wine market (with import market share at 18%) and they are moderately present in Japanese and Swiss wine market. Spain has only 10 % of import market share on importer countries' markets. Finally, we can conclude that the German and Portuguese wines are less significant in these export destinations.

This result confirms the relevance of the research questions (RQ3-RQ5) and the research problem (H3.1-H3.3) to be investigated. The following section tests the stationary of panel data and seeks to investigate whether the European wine exporters can price discriminate across its export destinations (does PTM effect exist) and how the competition can be characterised in this markets (type of market structure).

5.6 Robustness test

In the case of panel models, if the data set is non-stationary (i.e. variables contains unit root) OLS estimation method between such series can be generally spurious. To control this problem I investigated whether the panel variables contain unit roots. To check for non-stationary hypothesis of panels, a number of tests have been developed. I performed second generation panel unit root tests to take into account the impacts of cross-sectional dependence (CD) employing 0-4 time lags (Maddala and Wu, 1999; Peseran, 2007).

The second generation panel unit root tests reject the hypothesis of non-stationary (Annex 3) for French data; therefore, we can conclude that French wine export prices and exchange rates do not diverge over time.

As concerns, Italy, Spain, Germany and Portugal, the wine unit values do not contain unit roots while the exchange rates do (see Annex 3). I have found strong evidence against the existence of panel unit root in export unit values in other words; the dependent variables are stationary. In this case, co-integration tests cannot be used (to run a co-integration test dependent and independent variables are required to be non-stationary).

5.7 PTM regression results

Before estimating the PTM regression, the model was pre-tested for serial correlation and cross-sectional dependence (CD). The Wooldridge (2002) tests confirm the

existence of serial correlation in the case of France and Germany. Pesaran (2004) CD test reveals cross-sectional dependence in all variables (Table 26).

Table 26. – Tests for serial correlation and cross section dependence

	France		**Italy**		**Spain**		**Germany**		**Portugal**	
	lnxuv	lnxrate	lnxuv	lnxrate	lnxuv	lnxrate	lnxuv	lnxrate	lnxuv	lnxrate
Wooldridge (2002) test	0.0040		0.1520		0.8470		0.0182		0.0611	
Pesaran (2004) CD test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: own calculations based EUROSTAT (2015) and European Central Bank (2015), Statistical Data Warehouse database

Therefore, I employed panel corrected standard error models (PCSE) – which controls for heteroscedasticity – with AR(1) type of autocorrelation for France and Germany along with PCSE without AR(1) for Spain, Italy and Portugal. In addition, the asymmetric effects of exchange rates will be also investigated by interaction dummies.
Table 27 presents the regression results analysing the exchanges rate effects on wine export prices (detailed regression table can be found in Annex 3). Based on the estimation results, France was able to apply price discrimination across Australian, Hong Kong's, Mexican and United States' wine export markets (positive significant exchange rate effects, β_i; and significant country effects, λ_i). Moreover, besides France, Italy also could control their wine export prices in Japanese, Mexican and the American markets (positive PTM effects). The other countries analysed such as Spain, Portugal and Germany could not pursue price discrimination in their EU extra wine export destinations (PTM coefficients were not positive significant). Accordingly, the H3.1 hypothesis can be partly confirmed.

Table 27. – PTM regression result for top 5 EU wine exporter

	France (AR1)			Italy			Spain			Portugal			Germany (AR1)		
Destination country	**ER effect**	**C. effect**	**AS effect**	**ER effect**	**C. effect**	**AS effect**	**ER effect**	**C. effect**	**AS effect**	**ER effect**	**C. effect**	**AS effect**	**ER effect**	**C. effect**	**AS effect**
AUSTRALIA	PTM effect	+***	dep.	-***	+	app.	-	-	-	NA	NA	NA	-***	-	+
CANADA	LCPS	+***	app.	-***	+	+	-***	-	app.	-***	-	+	-**	-	dep.
HONG KONG	PTM effect	-***	dep.	LCPS	+	-	-	-	-						
JAPAN	+	+**	+	PTM effect	-**	-	-	-	+	+	-	-	+	-	-
MALAYSIA	+***	o	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MEXICO	PTM effect	+**	+	PTM effect	-***	+	-***	-	+	NA	NA	NA	NA	NA	NA
NORWAY	NA	NA	NA	-**	o	+	-	o	+	-	o	+	-	o	+
PHILIPPINES	NA	NA	NA	+	-	-	LCPS	+***	+	NA	NA	NA	NA	NA	NA
RUSSIA	LCPS	+***	+	-	-	-	-***	+	+	NA	NA	NA	-***	+	-
SINGAPORE	+	+***	dep.	LCPS	+***	+	-*	-	app.	NA	NA	NA	-	-	-
SOUTH AFRICA	LCPS	+***	+	+*	+	-	NA	NA	NA	NA	NA	NA	NA	NA	NA
SWITZERLAND	LCPS	+***	+	-*	+	+	-***	-	-	-	-	+	+***	-	+
THAILAND	+**	-	+	+***	-	+	NA	NA	NA	NA	NA	NA	NA	NA	NA
UNITED STATES	PTM effect	+***	-	PTM effect	-**	+	-***	-	+	-***	-	+	+***	-	+

Note: Panel corrected standard error model (xtpcse) was run. In case of France Malaysia while Norway was treated as intercept in all other cases.
AR1 – autocorrelation of order one, NA – because of the lack of observations balanced panel data were not available, o – omitted variables, ER – exchange rates, C. – country, AS – asymmetric effects
If the coefficient of asymmetric effect is statistically significant and has a positive sign, the effect of appreciation of exporter's currency exchange rates on export prices is greater than in depreciation. Similarly, a significant and negative coefficient of asymmetric effect implies that the effect of depreciation of exchange rates on export prices is greater than appreciation (Byrne et al., 2010)

*** p<0.01, ** p<0.05, * p<0.1

Source: Own calculations based EUROSTAT (2015) and European Central Bank (2015) data

Concerning the estimated coefficients for Canada, Russia, South Africa, Switzerland (French wine prices), Singapore, Hong Kong (Italian wine prices) and Philippines (Spanish wine prices), they have significant country (λ_i) and a negative significant exchange rate effects (negative β_i), revealing that local-currency price stability (LCPS) was higher than PTM effects in this countries, for the entire period (Table 27).

The analysis of the asymmetric effects of exchange rates on wine export prices indicates that in relation of France and Germany, the depreciation of euro compared to Australian, Hong Kong's; Singapore's dollar had a greater impact than the appreciation relative to the euro.

Between France and Canada as well as France and Australia, the appreciation of euro to the Canadian and Australian dollar had higher effect than depreciation. Regarding Italy, the appreciation of Australian dollar in euro exceeded the effect of depreciation, respectively in relation of Canada-Germany.

A positive statistically significant asymmetric effect was estimated for France and Canada as well as between Italy and Australia, Spain, Canada together with Singapore.

Results indicate that many French and Italian wine export markets were not competitive during the period analysed, in other words, these countries were able to price discriminate across their EU extra destination markets (H3.2) suggesting monopolistic competition.

In contrast, in Canada, Russia, South Africa, Switzerland, Hong Kong, Singapore and Philippines the local currency price stability was higher than PTM effects between 2000 and 2013.

The analysis of the asymmetric effects of exchange rates on wine export prices revealed that in France, Portugal, and Germany the depreciation of euro relative to Australian, Hong Kong's; Singaporean dollar had a greater effect than the appreciation while between France-Canada, Australia-Italy, Spain-Canada, Spain-Singapore, the appreciation of euro exceeded the effect of depreciation (H3.3).

The PTM model suggests the wine markets are non-competitive rather characterised by oligopolistic market structure dominated by France and Italy.

5.8 Conclusion and discussion

Despite the empirical evidence in the agri-food sector, analysing the pricing to market behaviour in wine trade has relatively understudied yet. However, it is crucial to

investigate whether the European (World) largest wine exporter countries are able to price discriminate across their wine export destinations. This chapter investigated the price discrimination behaviour of France, Italy, Spain, Portugal and Germany applying PTM model for a period of 2000 and 2013. Moreover, the asymmetric effects on exchange rates were also investigated. The model was based on a strongly balanced panel data set including monthly wine export data for EU-27 extra wine export destination countries.

To check the robustness of the results I performed second generation panel unit root tests to take into account possibility of the non-stationary of data, employing time lags. The Maddala and Wu (1999) and Pesaran (2007) panel unit root tests rejected the hypothesis of the unit root in dependent variables. By contrast, independent variables for Italy, Spain, Portugal and Germany were nonstationary therefore cointegration tests cannot be used.

On the other hand, because of the presence of serial correlation and cross-sectional dependence I applied panel corrected standard errors (PCSE) estimation allowing autocorrelation of order one and contemporaneous correlation across panels.

In sum, my estimations suggest that France and Italy had market dominance in their export markets. In the case of other countries analysed - Spain, Portugal and Germany - the price discrimination behaviour in EU extra wine export markets could not be observed.

The local currency price stability was higher than PTM effect during the entire period in case of Canada, Russia, South Africa, Switzerland (French wine), Singapore, Hong Kong (Italian wine) and Philippines' (Spanish wine). The analysis of the asymmetric effects of exchange rates on wine export prices revealed that depreciation of the euro in France, Portugal, Germany compared to the Australian, Hong Kong's; Singaporean and Canadian dollar had a greater impact than the appreciation while appreciation of euro to Australian dollar in term of Italian wine export, as well as euro to Canadian dollar and Singaporean dollar in term of Spanish wine export exceeded the effect of depreciation.

6 SUMMARY

Since the 80s, the market share of Old Wine World was decreased significantly, in the global wine market, meanwhile, New World wine producers were increased their export and became considerable in the global market competition and trade.

The wine consumption decreased mainly in southern European countries, where changing consumption habits affected the overall demand. Furthermore, 40% of the wine is consumed outside European countries in 2013, compared to 30% in 2000. While Australia, New Zealand, Chile and USA were able to increase their demand for wine France, Italy and Spain consumed less wine for 2013. The new market changes also influenced depressingly the wine sector of minor European wine producers such as Hungary, Croatia and Slovakia. These small producers had the least benefit from the new market environment and market policy changes.

Furthermore, since the Age of Discovery, the changes on global wine market have been accompanied by geographical redistribution of wine trade due to the colonisation and migration. The coloniser countries had a period of almost complete power in world trade thus reshaped the culture and the language in their colonies and established the wine culture. Accordingly, we can conclude that besides economic reason the cost of wine trade has geographical and cultural determinants.

However, historical and cultural factors of trade have been already proved by gravitation model; this research field is scarcely investigated in wine economics, especially considering the most important market players in the world.

The growing market competition and changing regulations of agricultural policy in European wine market raise a question: how did the wine trade and competitiveness change over time and how does the competition characterise among major market players, who are the dominant market leaders in the international wine trade.

In recent decades, the analyses of world wine industry also attracted significant research attention confirmed by recent scientific associations and scientific journals appeared in wine economics.

However, to date, a comprehensive analysis of international wine trade employing representative sample of world wine producer countries, applying various models by panel econometrics has not been published yet.

The research that I presented in this dissertation analysed the international wine trade from three different aspects: it evaluated the trade competitiveness and export performance of wine trade, assessed the cultural and gravitation factors behind trade costs and the export pricing behaviour of major market players analysed by empirical trade model in the global wine market.

The first part of the empirical research explored the actual situation and trends in world wine industry. In addition, it provided insight into the export competitiveness of wine producer countries on global markets and investigated the determinants of wine trade competitiveness. Second part researched the effects of geographical proximity, cultural-linguistic similarity by language clusters along with the impact of free trade on wine trade costs. The final empirical part took into account the role of exchanges on export prices of top European wine exporters across their EU extra wine export destinations along with analysing the asymmetric effect on exchanges rates.

6.1 Novelty of the research

This research mostly contributes to existing research in the field of evaluating world wine trade and competitiveness. Firstly, it applied three trade models to world wine industry. While previous research analysed only a given country or a wine region, my research took into consideration all major wine producer countries and concentrate on the role of top market leaders.

Secondly, the research also has various contributions to the empirical trade literature. Unlike previous research, this study investigates first time the determinants of revealed comparative advantages in the wine industry by an econometric panel model employing Balassa (1965) and its transformed indices. It discovered the deterministic role of cultural and language clusters between trade relations and highlighted the positive effect of trade liberalisation on wine export. In addition, my dissertation is the first to analyse the price discrimination behaviour of major European wine exporters across their wine export destination by pricing to market (PTM) model exploring imperfect competition on wine export markets.

This research employed representative samples of world wine industry (32 countries) contained three data sets for a period of 2000–2013. It employed panel econometrics carried out at country level for a disaggregated wine product category at HS-6 classification level.

My regression estimations provide significant and consistent results in line with the previous empirical literature and draw up policy implementation for decision makers, researchers and wine economist. The robustness of results was provided by graphical analysis as well as several methods such as consistency tests, unit root tests, cross-sectional dependence and serial correlation.

6.2 Reflections on the research questions and hypotheses

The dissertation investigated five research questions and tested fifteen hypotheses on international wine trade. The summary of the applied trade models, research questions posted, the hypothesis tested and the results can be found in Table 28.

First research question (RQ1) analysed the competitiveness of wine exporters by employing Balassa (1965) comparative advantage indices. Descriptive statistics induced that besides traditional wine producers (Italy, France, Spain, Portugal, Georgia and Moldova) the New World countries (such as Argentina, Australia, Chile, New Zealand, and South Africa) also exhibited strong comparative advantage in the wine trade. However, the comparative advantage of traditional wine exporters declined compared to the beginning of the period. The declining comparative advantage of traditional wine exporters is principally caused by global and EU specific reasons. Primarily, the introduction of the EU CMO reform in 2008 reduced the wine production in many EU member states. Most of the minor EU wine producers were affected negatively by these new market changes. Secondly, the world financial and economic crisis also affected negatively the global wine consumption and trade. Finally, while EU reduced their wine sector, the New World wine producers enhanced their activity in international wine markets by extending their vineyards and production.

Consistency tests confirmed that applied trade indices perform very well in terms of binary and ordinal measures while they work less efficient as a cardinal indicator.

The panel unit root tests provided a strong support for the existence of unit root in dependent variables indicating a divergence in comparative advantage indices over time. Since the unit root tests of independent variables suggests mixed result and panel time period is relatively small, plus explanatory variables are unbalanced, hence the cointegration tests are not held for my database.

Regression estimates revealed that factor endowments are very important components of comparative advantages in wine industry suggesting that natural resources are needed

for increasing wine production and besides capital; the wine production is also a labour intensive sector (H1.1).

Moreover, the model confirmed that higher grape yields weaken the competitiveness of wine export indicating trade off between wine quality and quantity (H1.2). My result suggests that not obviously the biggest (most populated) countries are the most competitive in terms of wine trade due to the home bias i.e. the consumers usually favour domestic wine products compared to import wines (H1.3).

Higher export prices can refer to the quality of wine indicating high-quality wines have significant trade advantages (H1.4). In addition, trade policy variables confirmed the hypothesis that free trade agreements enhance wine trade competitiveness (H1.5). Finally, we can conclude that New World wine producers perform better in international trade compared to Old Wine World due to the better technical efficiency and productivity (H1.6).

Second research question (RQ2) estimated the factors behind wine trade costs suggesting that value of wine trade is increasing in line with GDP growth (H2.1). Standard gravity hypothesises were also confirmed in wine trade (H2.2-H2.3).

Estimations explored that common cultural background between trading partners (such as common official language, past colonial history, similar religion) encourage the wine export (H2.4). H2.5 indicated a positive role of free trade agreements (WTO and RTA) in accordance with *the model of comparative advantage (RQ1).*

As concerns the role of language clusters, results indicate that Anglo-Saxon, Germanic and Latin American countries transport wines predominantly to each other's market (H2.6). The additional effects of language clusters suggest that the highest positive extra trade effect exists within language cluster countries especially in Latin American countries.

Table 28. – Summary and results

Research questions	Hypothesis	Variables	Sign	Results
Part 1				
(RQ1): What determines a country's comparative advantages in world wine market?	*H1.1: Higher factor endowments increase a country's comparative advantage on world wine market.*	grape area harvested	+	confirmed
	H1.2: Higher grape productivity in the wine industry weakens the competitiveness of wine export because higher grape yields result in a lower quality of wine.	grape yields	-	confirmed
	H1.3: Larger market size negatively influences the comparative advantages of world wine trade due to home bias.	country's population	-	confirmed
	H1.4: The better the quality of wine exported is, the higher comparative advantages of wine trade are.	export unit value	+	confirmed
	H1.5: Free trade agreements can enhance the competitiveness of wine trade by reducing trade barriers and lowering trade costs.	WTO membership	+	confirmed
	H1.6: New World wine exporter countries perform better in trade on global wine market due to the higher technical efficiency.	membership of New Wine Word	+	confirmed
Part 2				
(RQ2): What factors influence costs of wine trade between wine producers and their trading partners?	*H2.1: Demand for wine increases by market size, therefore, larger countries export more wine.*	Gross Domestic Products	+	confirmed
	H2.2: Wine trade costs increase with geographical distance.	geographical distance	-	confirmed
	H2.3: Wine trade costs are higher in the case of landlocked countries.	landlocked	-	confirmed
	H2.4: Countries with common cultural features export more wine each other's market because trade costs are lower between culturally similar countries.	common language spoken, past colonial history, common religion	+	confirmed
	H2.5: Free trade agreements facilitate wine trade by reducing trade costs.	WTO membership, regional trade agreements (RTA)	+	confirmed
	H2.6: Trade relations are more developed in identical language clusters than between different country clusters.	Latin European, Germanic, Latin American, Anglo-Saxon language clusters	+	confirmed

Part 3				
(RQ3): Are the major European wine exporter countries able to price discriminate across their EU extra wine export destinations?	*H3.1: The major European wine exporters are able to price discriminate across their EU extra wine export markets.*	win export unit values, exchanges rates	+	partly confirmed
Research question 4 (RQ4): How can the market structure be characterised on EU extra wine export markets?	*H3.2: The main EU export destination markets (EU-27 extra export) are not competitive.*	if H3.1 is true		partly confirmed
Research question 5 (RQ5): How the depreciation and appreciation of wine exporter's exchanges rates can influence international wine prices on European wine export markets?	*H3.3: Asymmetric effects have a significant impact on wine export prices in case of European wine exporters by appreciation or depreciation of wine exporter's exchange rates.*	asymmetric effects dummy	+/-	confirmed

Source: own composition

The third part of the dissertation (RQ3-RQ5) researched the price discrimination behaviour of the major wine exporters across their export markets. We can conclude that only two major traditional market players: France (in Australian, Hong Kong's, Mexican and United States' export markets) and Italy (in Japanese, Mexican and the American markets) were able to apply price discrimination across their destination markets (H3.1). By contrast, Spain, Portugal and Germany could not pursue price discrimination in their export destinations. The price discrimination model reveals that *global wine markets are not competitive (RQ4)* rather can be characterised by oligopolistic competition with two dominant market players (H3.2).

Moreover, the third model indicates that in the case of Canada, Russia, South Africa, Switzerland (French wine), Singapore, Hong Kong (Italian wine) and Philippines' (Spanish wine) the local currency price stability was higher than the effect of price discrimination (PTM) between 2000 and 2013.

Finally, the *analysis of the asymmetric effects of exchange rates on wine export prices (RQ5)* revealed that in relation to France, Portugal, Germany the depreciation of wine importer's currency as well as Australian, Hong Kong's; Singaporean and Canadian dollar relative to euro had a greater impact than the appreciation. Furthermore, the appreciation of Australian, Canadian and Singaporean dollar exceeded the effect of depreciation (H3.3).

6.3 Policy implication

My result suggests that it is crucial to improve the market position of European wines on European internal and external markets by product differentiation techniques such as labelling, quality standard and brand building.

My first model calls the attention that besides factor endowments and natural resources, the wine quality and the reduction of trade barriers are the key components of export competitiveness.

The second model points out that EU wine export should target primary the culturally similar countries and wine markets e.g. within Latin European countries wine trade costs are lower than between Latin European and Germanic countries. European wines should be exported mainly to those third countries which can be considered as former colonies of European explorer since among these countries there are well-established trade relations.

The third model recommends that world dominant market players can set their wine prices to market as a consequence wine prices are driven by the market leaders in export markets. Small countries need strong marketing tools to differentiate their wine products from these dominant exporters. Finally, for wine exporters, the variation of international exchange rates has to be permanently studied because they are significant factors to rising or pushing down wine export prices.

As for the practical applicability of this research, it would be primarily interesting for wine economist, international or national statistical organisation – OIV, FAO, EC – being responsible for analysis of world wine industry.

6.4 Limitations and directions for future research

Concerning the limitations of the research, I would like to highlight the following: it is important to note that the employed wine trade data were measured at macro (country) level. In addition, the applied trade models assume that wine products across countries are homogenous. Furthermore, the employed trade indices measuring comparative advantage can also be distorted by agricultural and trade policies. Moreover, a few wine producer countries were omitted from the database to obtain balanced dependent variables (e.g. Brazil, Bosnia and Herzegovina).

It should be mentioned that in case of small time period, panel unit root tests have weak power and there is a potential risk of concluding that the whole panel is non-stationary even when there is a large proportion of stationary series in the panel. For that reason, testing unit roots in panel data may require additional techniques to obtain more consistent results.

However, the first and the second empirical trade models assume perfect competition on world wine market; by contrast, the third model revealed that wine export markets are not competitive.

Finally, my research can also be extended in the future with focusing on other important determinants of competitiveness and factors of trade costs for a more disaggregated level in the wine industry. It would be advisable if future research also concentrates on the pricing to market strategy of New World wine producers on European Union’s wine market.

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Annex 1: Descriptive statistics of revealed comparative advantage model

Table 1.1 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RCA	448	6.19	17.68	0.00	164.21
RTA	448	5.41	17.69	-4.42	162.54
ARCA	448	0.01	0.04	-0.00	0.35
NRCA	448	0.00	0.00	-0.00	0.00
lnagempl	447	1.90	1.90	-0.51	4.01
lngrapeland	448	11.06	1.75	5.76	13.99
lnPop	448	16.63	1.63	12.85	21.03
lnUVX	430	-5.96	1.00	-7.69	1.36
WTO	448	0.91	0.29	0	1
lnYield	402	11.09	0.54	9.55	12.14
NWW	448	0.22	0.41	0	1

Source: Own calculations based on the sample data

Table 1. 2 – Pearson's correlation between analysed variables

	lnagempl	lngrapeland	lnPop	lnUVX	WTO	lnYield	NWW	lnGDP
lnagempl	1.000							
lngrapeland	0.339*	1.000						
lnPop	0.014	0.552*	1.000					
lnUVX	-0.286*	-0.262*	0.022	1.000				
WTO	-0.246*	0.030	0.033	-0.047	1.000			
lnYield	-0.174*	0.483*	0.412*	0.067	0.064	1.000		
NWW	-0.162*	0.241*	0.465*	0.009	0.170*	0.566*	1.000	
lnGDP	-0.373*	0.375*	0.838*	0.238*	0.18*	0.459*	0.387*	1.000

Note: * $p<0.05$

Source: Own calculations based on the sample data

Table 1. 3 – Levin-Lin-Chu, Harris-Tzavalis and Breitung unit root test for dependent variables

	RCA		RTA		ARCA		NRCA	
Lags(1)	without trend	with trend	without trend	with trend	without trend	with trend	without trend	with trend
Levin-Lin-Chu unit-root test	0.0001	0.0000	0.0000	0.1091	0.0000	0.0000	0.0004	0.0000
Harris-Tzavalis unit-root test	0.0517	0.0000	0.0315	0.0000	0.7161	0.0000	0.9420	0.0107
Breitung unit-root test	0.9979	0.5688	0.9864	1.0000	0.8795	0.0347	0.9983	0.1354

Source: Own calculations based on the sample data

Table 1. 4 – IPS, ADF and PP unit root test for independent variables

	without trend			with trend		
	IPS	ADF	PP	IPS	ADF	PP
lnGDP	0.6225	0.6835	0.6835	1.0000	1.0000	0.6835
lngrapeland	0.6629	0.0107	0.0107	0.7194	0.0220	0.0220
lnagempl	1.0000	0.5576	0.5576	0.9990	0.7468	0.7468
lnPop	0.9993	0.0000	0.0000	0.2414	0.0000	0.0000
lnUVX	0.5203	0.6860	0.6860	0.0411	0.0001	0.0001
lnYield	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Own calculations based on the sample data

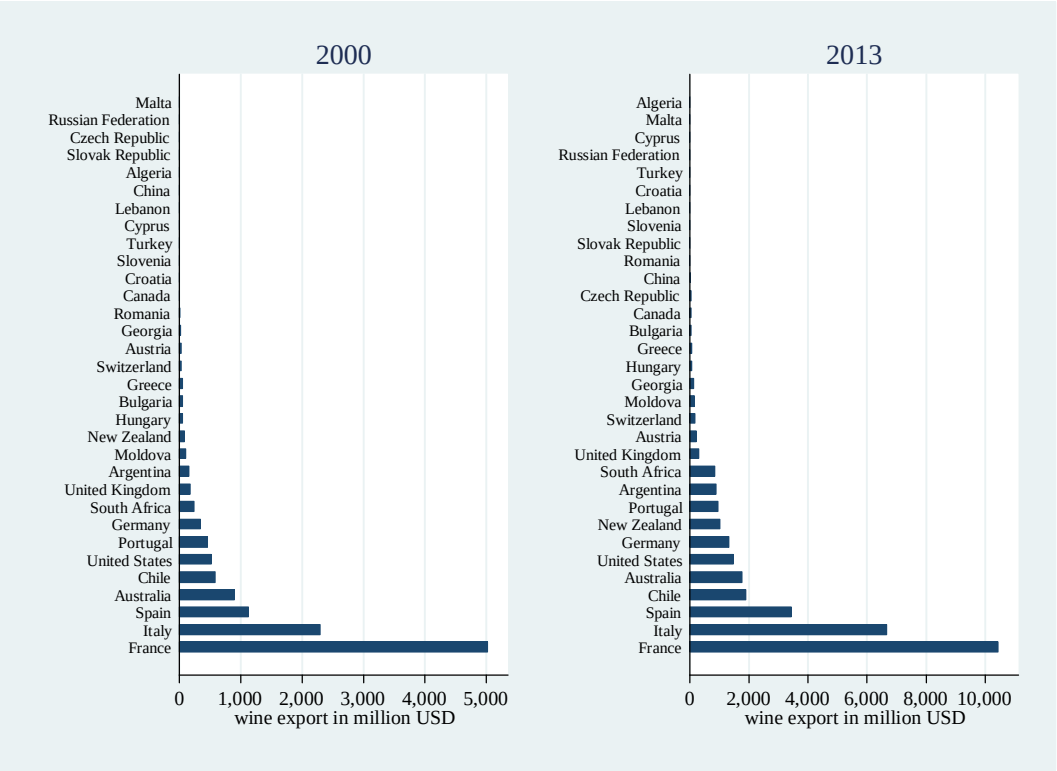
Table 1. 5 – Levin-Lin-Chu, Harris-Tzavalis and Breitung unit root test for dependent variables

	lnGDP		**lngrapeland**		**lnPop**	
Lags (1)	without trend	with trend	without trend	with trend	without trend	with trend
Levin-Lin-Chu unit-root test	0.0000	0.0000	0.0001	0.0000	1.0000	0.0000
Harris-Tzavalis unit-root test	0.9985	1.0000	0.0086	0.0000	1.0000	1.0000
Breitung unit-root test	1.0000	0.9989	0.9995	0.9228	1.0000	1.0000

Note: NA – tests are not available for lnagempl, lnUVX, lnYield because the variables are not strongly balanced

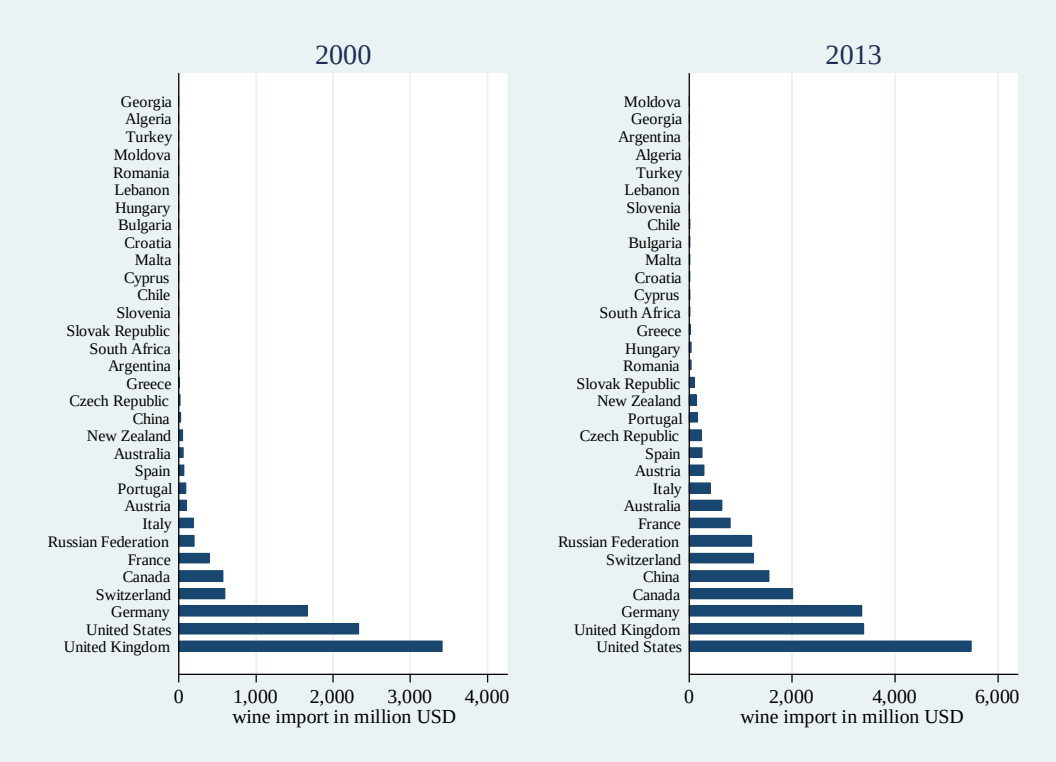
Source: Own calculations based on the sample data

Figure 1.1 – Wine export by sample countries, in million USD, 2000 and 2013



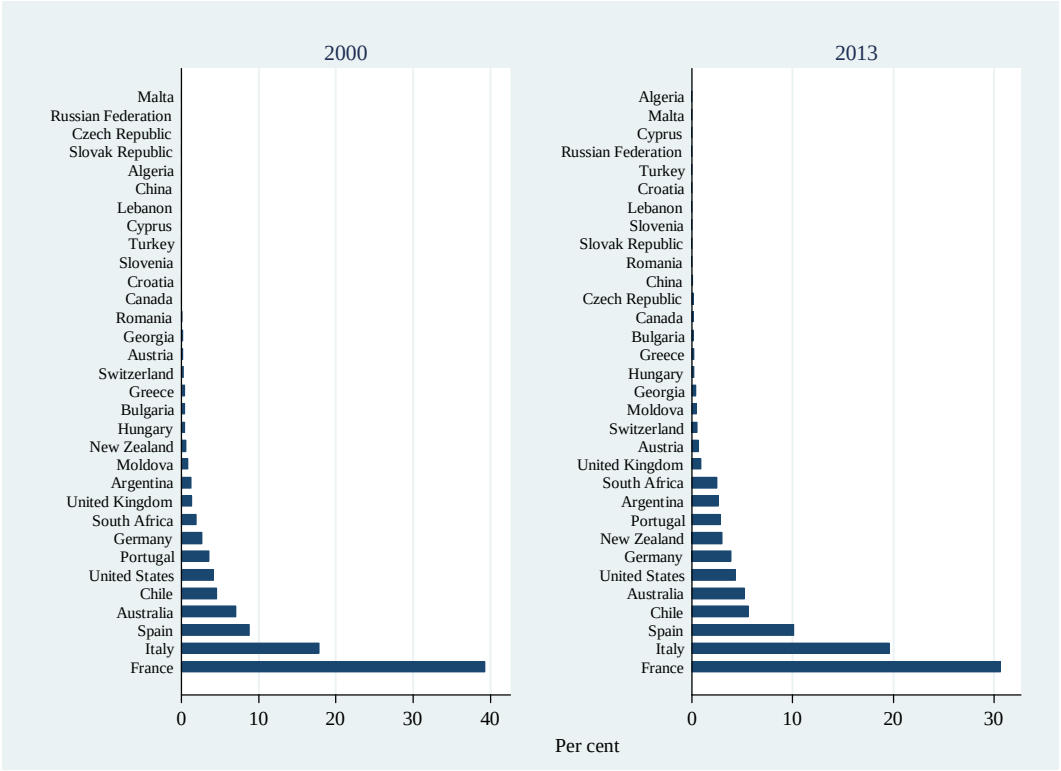
Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

Figure 1.2 – Wine import by sample countries, in million USD, 2000 and 2013



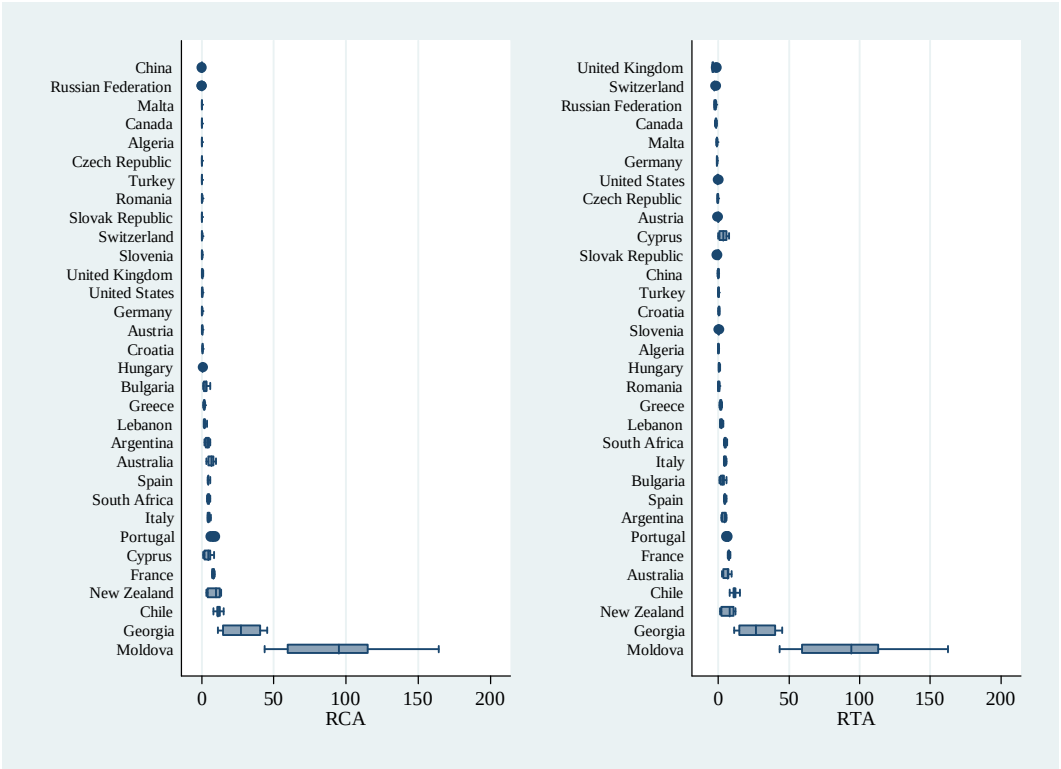
Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

Figure 1.3 – The share of sample countries in the world wine trade, 2000 and 2013



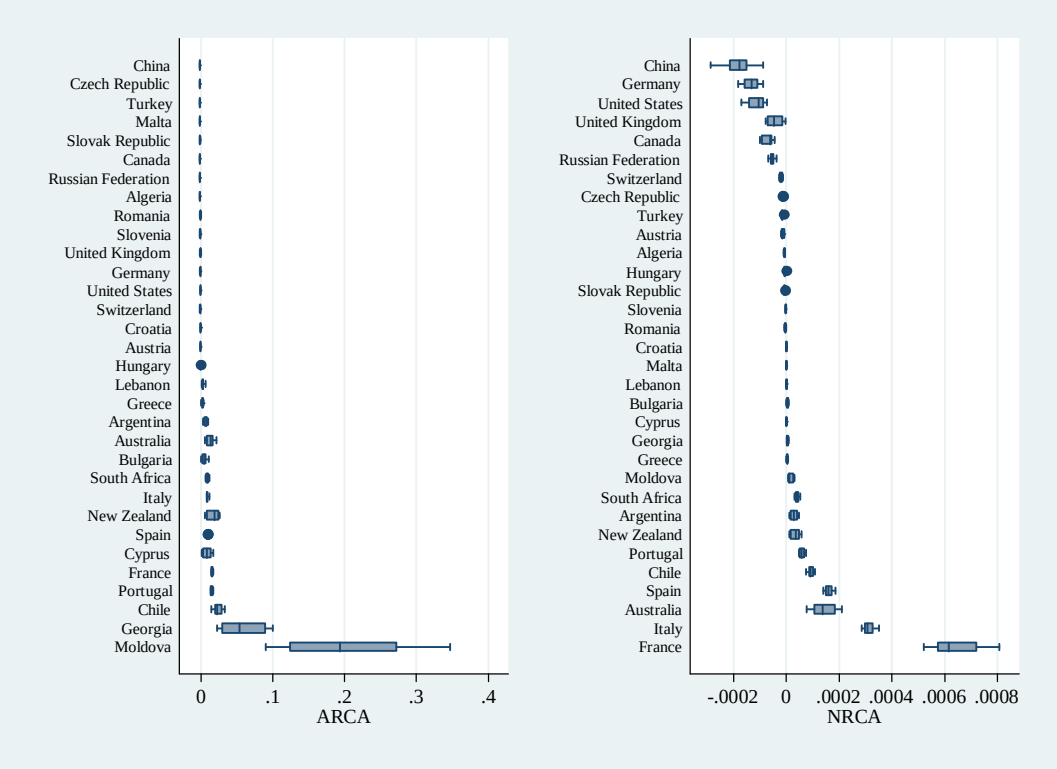
Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

Figure 1.4 – Boxplots for RCA and RTA indices, by sample countries, 2000–2013



Source: Own calculations based World Bank WITS database (World Bank, 2014a)

Figure 1.5 – Boxplots for ARCA and NRCA indices by sample countries, 2000–2013



Source: Own calculations based on World Bank WITS database (World Bank, 2014a)

Annex 2: Descriptive statistics and sample data of gravity model

Table 2.1 – Language classification

Anglo-Saxon

Australia, Canada, Hawaii (USA), Island of Man, Ireland, Netherlands Antilles, Netherlands, New Zealand, South Africa, United Kingdom, United States of America

Arabic

Algeria, Bahrain, Brunei, Egypt, Iran, Jordan, Kuwait, Lebanon, Saudi Arabia, Syria, United Arab Emirates

Far East

Bangladesh, Cambodia, China, Fiji, Guam, Hong Kong, Indonesia, Macao, Madagascar, Malawi, Malaysia, Mali, Marianas Islands, Nepal, New Caledonia, New Guinea, Papua New Guinea, Philippines, Seychelles, Singapore, Solomon Islands, South Korea, Sri Lanka, Surinam, Tahiti, Taiwan, Thailand, Vietnam

Germanic

Austria, Belarus, Bosnia, Czech Republic, Croatia, Estonia, Germany, Hungary, Latvia, Lichtenstein, Lithuania, Luxembourg, Poland, Slovakia, Switzerland, Ukraine

Independent

Israel, India, Japan, Russia

Latin American

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Equator, Guatemala, Guyana, Honduras, Virgin Island, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Santa Lucia, Salvador, Trinidad & Tobago, Uruguay, Venezuela, Bahamas, Barbados, Bermudas, Cayman Islands.

Latin European

Albania, Belgium, Bulgaria, Cyprus, France, FYROM (Former Yugoslav Republic of Macedonia), Greece, Italy, Malta, Moldova, Monaco, Portugal, Romania, Serbia, Slovenia, Spain

Near East/Africa

Angola, Armenia, Belize, Botswana, Burundi, Cameroon, Congo, Ethiopia, Gabon, Ghana, Guinea, Ivory Coast, Kazakhstan, Kenya, Lesotho, Liberia, Morocco, Maurice, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, Uzbekistan, Pakistan, Reunion, Rwanda, Senegal, Sierra Leone, Soudan, Swaziland, Tanzania, Chad, Tunisia, Turkey, Yemen, Zaire, Zambia, Zimbabwe

Nordic

Denmark, Finland, Greenland, Iceland, Norway, Sweden

Source: Ronen and Shenkar (1985) in Filippaios and Rama (2011)

Table 2.2 – Pattern of gravity database

Wine exporter countries	Frequency	Wine exporter countries	Frequency
Algeria	260	Italy	2,535
Argentina	1,885	Lebanon	1,196
Australia	2,223	Malta	481
Austria	1,781	Moldova	1,027
Bulgaria	1,456	New Zealand	1,599
Canada	1,053	Portugal	2,314
Chile	2,119	Romania	1,183
China	1,053	Russian Federation	663
Croatia	923	Slovak Republic	728
Cyprus	910	Slovenia	988
Czech Republic	1,313	South Africa	2,457
France	2,639	Spain	2,431
Georgia	988	Switzerland	1,872
Germany	2,47	Turkey	1,001
Greece	1,495	United Kingdom	2,379
Hungary	1,339	United States	2,041

Source: own composition based on sample data

Table 2.3 – Wine export destinations of major wine exporters

Export destinations (216)
Afghanistan, Albania, Algeria, Andorra, Angola, Anguilla, Antigua, and, Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, The Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, British, Virgin Islands, Brunei, Bulgaria, Burkina, Faso, Burundi, Cambodia, Cameroon, Canada, Cape, Verde, Cayman, Islands, Central, African, Republic, Chad, Chile, China, Christmas Island, Cocos (Keeling) Islands, Colombia, Comoros, Congo Dem. Rep., Congo Rep., Cook Islands, Costa, Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, East Timor, Ecuador, Egypt Arab Rep., El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia(excludes Eritrea), Faeroe Islands, Falkland Island, Fiji, Finland, Fm Sudan, Fr. So. Ant. Tr, France, French Polynesia, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Greenland, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, China, Hungary, Iceland, India, Indonesia, Iran, Islamic Rep., Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea, Dem. Rep., Korea, Rep., Kuwait, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Macao, Macedonia, FYR, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia, Fed. Sts., Moldova, Mongolia, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Niue, Norfolk Island, Northern Mariana Islands, Norway, Oman, Pakistan, Palau, Panama, Papua, New Guinea, Paraguay, Peru, Philippines, Pitcairn, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saint Helena, Saint Pierre and Miquelon, Samoa, San Marino, Sao Tome and Principe, Saudi, Arabia, Senegal, Seychelles, Sierra, Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, Somalia, South Africa, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, Vincent and the Grenadines, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tokelau, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Turks and Caicos Islands, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela,Vietnam, Wallis and Futura Islands, Yemen, Zambia, Zimbabwe

Source: own composition based on sample data

Table 2.4 – Pattern of language clusters in the sample

Language clusters by Filippaios and Rama (2011)	**Number of observation** (if variable equals to 1)	**Number of observation** (if variable equals to 0)	**Share** (%)
Anglo-Saxon	624	48178	1,30%
Arabic	104	48698	0,21%
Far East	143	48659	0,29%
Germanic	1222	47580	2,57%
Independent	26	48776	0,05%
Latin American	650	48152	1,35%
Latin European	1651	47151	3,50%
Near East/Africa	78	48724	0,16%
Nordic	0	48802	0,00%
Total	**4498**	**48802**	**9,22%**

Source: own composition based on sample data

Annex 3: Second Generation unit root test and PTM regression results

Table 3.1 – Second Generation Panel Unit Root Tests for France

		Maddala and Wu (1999) Panel Unit Root test (MW)		Pesaran (2007) Panel Unit Root test (CIPS)	
		without trend	with trend	without trend	with trend
Variable	**lags**	**p-value**		**p-value**	
lnuvx	1	0.0000	0.0000	0.0000	0.0000
lnuvx	2	0.0000	0.0000	0.0000	0.0000
lnuvx	3	0.0000	0.0000	0.0000	0.0000
lnuvx	4	0.0000	0.0000	0.0000	0.0000
lnxrate	1	0.0000	0.0000	0.0000	0.0000
lnxrate	2	0.0000	0.0000	0.0000	0.0000
lnxrate	3	0.0000	0.0000	0.0000	0.0000
lnxrate	4	0.0000	0.0000	0.0000	0.0000

Own calculations based EUROSTAT (2015) and European Central Bank (2015), Statistical Data Warehouse database

Table 3.2 – Second Generation Panel Unit Root Tests for Italy

		Maddala and Wu (1999) Panel Unit Root test (MW)		Pesaran (2007) Panel Unit Root test (CIPS)	
		without trend	with trend	without trend	with trend
Variable	**lags**	**p-value**		**p-value**	
lnuvx	1	0.000	0.000	0.000	0.000
lnuvx	2	0.000	0.000	0.000	0.000
lnuvx	3	0.000	0.000	0.000	0.000
lnuvx	4	0.000	0.000	0.000	0.000
lnxrate	1	0.000	0.000	0.006	0.000
lnxrate	2	0.272	0.822	0.834	0.091
lnxrate	3	0.580	0.981	0.953	0.401
lnxrate	4	0.757	0.989	0.960	0.361

Own calculations based EUROSTAT (2015) and European Central Bank (2015), Statistical Data Warehouse database

Table 3.3 – Second Generation Panel Unit Root Tests for Spain

		Maddala and Wu (1999) Panel Unit Root test (MW)		Pesaran (2007) Panel Unit Root test (CIPS)	
		without trend	with trend	without trend	with trend
Variable	**lags**	**p-value**		**p-value**	
lnuvx	1	0.000	0.000	0.000	0.000
lnuvx	2	0.000	0.000	0.000	0.000
lnuvx	3	0.000	0.000	0.000	0.000
lnuvx	4	0.000	0.000	0.000	0.000
lnxrate	1	0.283	0.935	0.988	0.967
lnxrate	2	0.372	0.981	0.995	0.994
lnxrate	3	0.211	0.953	0.989	0.990
lnxrate	4	0.072	0.811	0.996	0.995

Own calculations based EUROSTAT (2015) and European Central Bank (2015 database

Table 3.4 – Second Generation Panel Unit Root Tests for Portugal

		Maddala and Wu (1999) Panel Unit Root test (MW)		Pesaran (2007) Panel Unit Root test (CIPS)	
		without trend	with trend	without trend	with trend
Variable	**lags**	**p-value**		**p-value**	
lnuvx	1	0.000	0.000	0.000	0.000
lnuvx	2	0.000	0.000	0.000	0.000
lnuvx	3	0.000	0.000	0.000	0.000
lnuvx	4	0.000	0.000	0.000	0.000
lnxrate	1	0.260	0.742	0.742	0.368
lnxrate	2	0.356	0.857	0.857	0.167
lnxrate	3	0.219	0.730	0.730	0.138
lnxrate	4	0.282	0.805	0.805	0.170

Own calculations based EUROSTAT (2015) and European Central Bank (2015) database

Table 3.5 – Second Generation Panel Unit Root Tests for Germany

		Maddala and Wu (1999) Panel Unit Root test (MW)		Pesaran (2007) Panel Unit Root test (CIPS)	
		without trend	with trend	without trend	with trend
Variable	**lags**	**p-value**		**p-value**	
lnuvx	1	0.000	0.000	0.000	0.000
lnuvx	2	0.000	0.000	0.000	0.000
lnuvx	3	0.000	0.000	0.000	0.000
lnuvx	4	0.000	0.000	0.001	0.000
lnxrate	1	0.448	0.689	0.719	0.137
lnxrate	2	0.594	0.897	0.756	0.216
lnxrate	3	0.432	0.862	0.721	0.198
lnxrate	4	0.434	0.848	0.769	0.241

Own calculations based EUROSTAT (2015) and European Central Bank (2015) database

Table 3.6 – PTM regression results

Exporters	France (AR1)			Italy			Spain			Portugal			Germany (AR1)		
VARIABLES	exchange rate effect	country effect	asymmetric effect	exchange rate effect	country effect	asymmetric effect	exchange rate effect	country effect	asymmetric effect	exchange rate effect	country effect	asymmetric effect	exchange rate effect	country effect	asymmetric effect
AUSTRALIA	0.261*	1.165***	-0.172***	-1.087***	0.159	0.158*	-0.107	-0.527	-0.0263	NA	NA	NA	-0.528***	-1.480	0.0522
	(0.140)	(0.334)	(0.0602)	(0.182)	(0.204)	(0.0834)	(0.180)	(0.498)	(0.0865)				(0.170)	(1.384)	(0.0768)
CANADA	-0.642***	1.247***	0.0668*	-0.849***	0.102	-0.0212	-1.546***	-0.183	0.144**	-0.547***	-0.121	0.0343	-0.602**	-1.570	0.0939***
	(0.134)	(0.329)	(0.0392)	(0.207)	(0.200)	(0.0774)	(0.167)	(0.492)	(0.0644)	(0.177)	(0.551)	(0.0684)	(0.274)	(1.383)	(0.0360)
HONG KONG	1.107***	-1.005***	-0.0519***	-0.525***	0.374**	-0.0115	-0.224	-0.693	-0.0356	NA	NA	NA	NA	NA	NA
	(0.111)	(0.370)	(0.0118)	(0.0929)	(0.189)	(0.0458)	(0.269)	(0.783)	(0.0344)						
JAPAN	0.0304	1.014**	0.000244	0.588***	-0.941***	-0.0200	-0.0157	-1.130	0.00309	0.106	-0.876	-0.00222	0.134	-2.158	-0.00691
	(0.0560)	(0.412)	(0.00262)	(0.137)	(0.357)	(0.0195)	(0.0995)	(0.710)	(0.0062)	(0.101)	(0.741)	(0.00621)	(0.159)	(1.580)	(0.00503)
MALAYSIA	0.657***	omitted	-0.0424	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(0.237)		(0.0322)												
MEXICO	0.115*	0.772**	0.00645	0.368***	-2.049***	0.00314	-0.163***	-0.230	0.0182	NA	NA	NA	NA	NA	NA
	(0.0635)	(0.368)	(0.0107)	(0.0570)	(0.322)	(0.00347)	(0.0620)	(0.526)	(0.0112)						
NORWAY	NA	NA	NA	-0.200***	omitted	0.0197	-0.359	omitted	0.0086	-0.412	omitted	0.00191	-0.722	omitted	0.00324
				(0.0717)		(0.0144)	(0.240)		(0.0101)	(0.267)		(0.0119)	(0.661)		(0.00747)
PHILIPPINES	NA	NA	NA	-0.113	0.0239	-0.0176	-0.996***	2.331***	0.00495	NA	NA	NA	NA	NA	NA
				(0.364)	(0.773)	(0.0162)	(0.140)	(0.736)	(0.0103)						
RUSSIA	-0.556***	2.539***	0.00654	-0.0997	-0.0826	-0.00520	-0.721***	0.663	0.0206	NA	NA	NA	-1.108***	1.600	-0.000526
	(0.172)	(0.683)	(0.0113)	(0.207)	(0.858)	(0.0162)	(0.131)	(0.684)	(0.0130)				(0.138)	(1.466)	(0.00874)
SINGAPORE	0.204	1.292***	-0.122***	-0.800***	2.442***	0.0213	-0.603*	-0.178	0.199*	NA	NA	NA	-0.274	-0.959	-0.0314
	(0.172)	(0.323)	(0.0449)	(0.161)	(0.559)	(0.0148)	(0.340)	(0.560)	(0.117)				(0.395)	(1.400)	(0.130)
SOUTH AFRICA	-0.518***	1.583***	0.0154	0.354**	0.247	-0.0399	NA	NA	NA	NA	NA	NA	NA	NA	NA

	(0.120)	(0.334)	(0.0389)	(0.171)	(0.212)	(0.0584)									
SWITZERLAND	-0.518***	1.583***	0.0154	-0.664*	1.687	0.00964	-0.678***	-0.253	-0.0787	-0.00489	-0.564	0.0364	0.747***	-1.431	0.000836
	(0.120)	(0.334)	(0.0389)	(0.374)	(1.429)	(0.0196)	(0.0917)	(0.498)	(0.0499)	(0.122)	(0.548)	(0.0596)	(0.276)	(1.385)	(0.108)
THAILAND	0.589**	-1.212	0.00867	0.251***	-0.292	0.0269	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(0.297)	(1.100)	(0.0112)	(0.0458)	(0.184)	(0.0476)									
USA	0.161***	1.228***	-0.0165	0.341**	-1.143***	0.000487	-0.626***	-0.448	0.0505	-0.932***	-0.204	0.127	0.316***	-1.710	0.0493
	(0.0414)	(0.330)	(0.0400)	(0.157)	(0.387)	(0.0271)	(0.0443)	(0.501)	(0.0428)	(0.0941)	(0.553)	(0.0991)	(0.0676)	(1.381)	(0.0482)
Constant	-0.621*			1.435***			2.000***			1.854***			2.872**		
	(0.331)			(0.187)			(0.501)			(0.553)			(1.381)		
Observations	1,848			2,184			1,848			840			1,344		
Number of country	11			13			11			5			8		
R-squared	0.527			0.599			0.755			0.614			0.804		

Note: In case of France, Malaysia in all other cases Norway was treated as intercept.
NA – because of the lack of observations balanced panel data were not available.
If the coefficient of asymmetric effect is statistically significant and has a positive sign, the effect of appreciation of exporter's currency exchange rates on export prices is greater than in depreciation. Similarly, a significant and negative coefficient of asymmetric effect implies that the effect of depreciation of exchange rates on export prices is greater than appreciation (Byrne et al., 2010).

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Source: Own calculations based EUROSTAT (2015) and European Central Bank (2015), Statistical Data Warehouse database

Annex 4: Relevant publications of the author

List of publications in Hungarian

Academic volumes, chapters in academic volumes:

Balogh Jeremiás (2006): Az európai uniós tagság következményei a magyar szőlő- és borszektorban In: Tamás Csaba Gergely (szerk.) Magyarország és az Európai Unió: Díjnyertes pályaművek, 2005-2006. Budapest: Országgyűlés Hivatala, 2006. pp. 17–67.

Participation at conferences with publication of the full paper submitted:

Balogh Jeremiás Máté (2016): Minőségirányítási rendszerek a borágazatban. *Taylor: gazdálkodás- és szervezéstudományi folyóirat.* Virtuális Intézet Közép-Európa Kutatására Közleményei (8/2):23, pp. 79–86. ISSN 2064-4361 *Available:* http://vikek.hu/wp-content/uploads/2016/05/Taylor2016.2.számNo23.pdf

Balogh Jeremiás (2014): Mi befolyásolja a tradicionális és az újvilági bortermelő országokban a nemzetközi borkereskedelmi versenyképességet? LVI. Georgikon Napok. 1-2 October 2014, Pannon Egyetem Georgikon Kar, Keszthely, pp. 35–47. ISBN 978-963-9639-60-7

*Available:*http://napok.georgikon.hu/cikkadatbazis/cikkek-2012/cat_view/3-cikkadatbazis/24-2014/27-ix-szekcio-szoleszet-boraszat

Peer-reviewed journals:

Balogh Jeremiás Máté (2016): A földrajzi távolság, a kulturális hasonlóság és a szabadkereskedelem hatása a borkereskedelemre. *Közgazdasági Szemle* 63:(7-8), pp. 858–881.

Balogh Jeremiás Máté (2016): A versenyképesség meghatározó tényezői a borágazatban. *Statisztikai Szemle* 94:(3), pp. 279–299.

Balogh Jeremiás Máté (2015): A borkereskedelem versenyképességének elemzése a hagyományos és az újvilági bortermelő országokban. *Gazdálkodás* 59:(5), pp. 475–487.

Balogh Jeremiás (2006): A magyar szőlő- és borágazat versenyképessége. *Gazdaság és Statisztika* 18:(5), pp. 55–73.

List of publications in English

Participation in conferences with publication of the full paper submitted:

Balogh Jeremiás Máté, Jámbor Attila (2016) On the Duration of Comparative Advantages of Top European Wine Producers XXIII Enometrics Conference, Colmar, France May 25-28, 2016, Colmar, France. *Available:* http://www.vdqs.net/2016Colmar/documents/publications/text/BALOGH_JAMBOR.pdf

Jeremiás Balogh, Imre Fertő (2015): Drivers of Export Competitiveness in Wine Sector. 29th ICAE Conference, August 9-14, 2015, Milan, Italy *Available:* http://ageconsearch.umn.edu/handle/211197

Academic volumes, chapters in academic volumes:

Jeremiás Balogh What role geographical distances and cultural proximity play in bilateral wine trade of Hungary? In: Erzsébet Hetesi, Zsófia Vas (szerk.) New Ideas in a Changing World of Business Managament and Marketing. University of Szeged, Doctoral School of Economic, Szeged, Hungary, 19-20 March 2015,

pp. 35-45. ISBN 978-963-306-385-9 *Available:* http://www.eco.u-szeged.hu/download.php?docID=46191

Peer-reviewed journals:

Balogh Jeremiás, Jámbor Attila (2016): Determinants of revealed comparative advantages: the case of European cheese trade. *Acta Alimentaria*, Akadémia Kiadó Paper on-line.

Attila Jambor, Jeremias Balogh, Peter Kucsera (2016): Country and industry specific determinants of intra-industry agri-food trade in the Baltic Countries. *Agricultural Economics Czech* 62:(6), pp. 280–291. (2016)

Imre Fertő, Szilárd Podruzsik, Jeremiás Balogh (2016) Intra-industry trade in the wine sector in the enlarged European Union. *Review of Agricultural, Food and Environmental Studies* 2016: pp. 1–14.

Balogh Jeremiás Máté (2015): Investigating the effect of geographical distances and cultural proximity on the Hungarian wine trade. *Society and Economy* 37(4), pp. 513–529

Balogh Jeremiás (2014): The evaluation of competitiveness of the Hungarian wine sector. *Tér–Gazdaság–Ember*, 2(4), pp. 33–46. *Available:* http://kgk.sze.hu/images/dokumentumok/folyoirat/TGE_II_evf04.pdf

Research Studies:

Imre Fertő, Jeremiás Máté Balogh (2016): Are the major European wine exporters able to price discriminate across their EU extra wine export destinations? MTA Discussion papers MT-DP–2016/24 *Available:* http://www.econ.core.hu/file/download/mtdp/MTDP1624.pdf