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CICLO: XXXIV

TRADE COMPETITIVENESS OF AGRO-FORESTRY PRODUCTS: ENTREPRENEURIAL AND SOCIAL DRIVERS

Liam Pippinato

Docenti guida:
Prof. Filippo Brun
Prof.ssa Teresina Mancuso

Coordinatori del Ciclo:
Prof.ssa Eleonora Bonifacio
Prof. Domenico Bosco

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1. General Introduction

1.1. Agro-forestry products trade relevance

Agro-forestry products play a very important role in international trade in goods: forestry products trade accounts for more than 300 billion dollars in 2020 worldwide (United Nations, 2021; UNECE, 2021) while agricultural trade reached about 1,800 billion dollars in 2020, showing a relatively steady increase over the last ten years (WTO, 2021). Moreover, it showed to be quite resilient to the Covid-19 pandemic that occurred in 2020, compared to other traded goods (Arita, 2022), increasing the export value by about 1% (WTO, 2021). To 2020, agri-food trade accounts for almost 10% of the total trade worldwide (World Bank, 2021).

Considering the significant market share of the primary sector, for both developed and developing countries, it becomes clear that there is interest in evaluating and measuring trade-related issues and performances, both by institutions and researchers (Martin, 2018).

1.2. Economic instruments to evaluate trade flows

Due to the economic relevance and topicality of the theme, two main aspects arise to be explored by the scientific community: the competitiveness of regions and nations in trade exports and which factors might influence trade dynamics (Martin, 2018) since, through the years there can be relevant changes in the directions of

trade flows, magnitude, and the trade performances and determinants (Ataman et al., 2010).

1.2.1. Trade competitiveness assessment

Competitiveness represents one of the main issues in trade as it can be analysed from a macro or firm-level perspective (Mizik, 2021).

Its analysis at regional or national level is a well-known tool to assess the state of the art of the trade situation or to evaluate the trend of competitiveness after a certain event, such as trade shocks (Carraresi & Banterle, 2015; Chen et al., 2020).

It is a very versatile tool, as it can be used to analyse the performance and specialization (Laursen, 2015) of a certain region (Mizik et al., 2020), a country (Zdráhal et al., 2021) or a specific commodity (Naseer et al., 2018).

From a methodological point of view, several studies have adopted the indices derived from the research of Balassa (1965), who proposed the Revealed Comparative Advantage Index, in the field of agricultural economics.

A more recent literature has tried to solve the inherent issues of the Balassa index, mainly its asymmetric distribution (between 0 and +∞) (Yu et al., 2009), by adopting other derived indices, such as the Revealed Comparative Export Advantage Index, which ranges between -1 and +1, and is more suitable for regression analysis (Vollrath, 1991; Danna-Buitrago & Stellian, 2021).

Following Mizik (2021), competitiveness is influenced by several determinants, such as production performance, product value added and the export orientation of the country. According to the authors, this is the first step towards more in-depth studies of the phenomena influencing trade competitiveness. This statement paves the way for more structured analyses that seek to estimate which factors affect export performance, and their magnitude.

1.2.2. Evaluation of factors affecting trade performances

Adopting the theoretical framework of the gravity model, proposed by Tinbergen (1962), one of the most widely adopted econometric tools for estimating the determinants of trade (Yotov et al., 2016), we assume that trade is a function of several factors. The main ones are trade-related costs and the economic dimension of trading partners followed, in the augmented form of the model (Anderson and Van Wincoop, 2003) by production (Dal Bianco et al., 2016), consumption (Morland et al., 2020), cultural peculiarities (Linders et al., 2005) and, of course, Tariff and Non-Tariff Measures (TM/NTM), which include private standards (Ehrich & Mangelsdorf 2018).

The effects of trade agreements (Curzi & Huysmans 2022) and their market distortions (Hirsch & Oberhofer 2020) are also a subject of current interest, as multilateral negotiations seem to be losing interest in the eyes of the international community.

In recent years, NTMs and policy actions became relevant to researchers, as tariffs barriers have been replaced by NTMs in recent decades (Johnson, 2014; Fiankor et al., 2021).

According to Santeramo & Lamonaca (2019), non-tariff measures could include Sanitary and Phytosanitary Measures (SPS), Technical Barriers to Trade (TBT) and Maximum Residue Limit (MRL), but also control measures for quality and traceability, as well as private and voluntary standards.

Among the different determinants highlighted in the literature, two are of particular interest to the authors, which are I) the role of socio-cultural identity in determining trade flows, and II) the effect of the adoption of private standards by entrepreneurs.

I. Concerning cultural aspects, they are often included in the econometric estimation of trade flows as dummy variables referring to common language, religion, border contiguity, using the database provided by the Centre d'Études Prospectives et d'Informations Internationales (CEPII, 2021). Nevertheless, this type of data does not allow for the testing of specific hypotheses, leading to less attention by researchers to explore the cultural dimension (Gani & Scrimgeour, 2019).

   Many studies have highlighted the positive role of cultural covariates (Linders et al., 2005), while studies focusing on the concept of cultural diversity, such as the one proposed by Hofstede (2001), show variable effects. In some cases, cultural diversity enhances trade flows (Lankhuizen et al., 2011), while in others (Kristjánsdóttir et al., 2020) it shows negative market effects. A possible explanation is provided by Lankhuizen et al. (2014), who suggest a non-linear relationship between cultural diversity and trade flows. It becomes interesting for the authors

to explore how cultural diversity behaves on agricultural products trade flows.

II. Following Fiorini et al. (2018), private standards are characterised by three main features: they are not mandatory (so their adoption is likely to be a business strategy), they are mainly focused on social and environmental sustainability and there is an organization or institution that manages their activity.
In the case agri-food sector, issues related to the trade of public and private standards have been widely explored (Beghin et al., 2015), highlighting the positive spillovers on export performances for some agri-food products, as in the case of GlobalGAP certification (Fiankor et al., 2020) and International Featured Standard (Ehrich & Mangelsdorf 2018). Despite so, the ongoing debate about “standards as catalysts VS barriers to trade” (Santeramo e Lamonaca, 2019) remains topical, due to the different highlighted impacts of these standards, for example considering the economic size of firms or the development of countries (Fontagné et al., 2015).
Moreover, it has been clearly shown that private standards act, in some cases, as quasi-mandatory regulations, “forcing” firms to adopt those standards to maintain their access to high-income markets, with repercussions particularly for developing countries (Henson & Humphrey, 2010).
While the agri-food sector presents some detailed analysis and reviews that explore the market impact of adopting voluntary standards, this is not the case for forest products, where few

studies have been conducted, showing some disagreement between their findings (see Chapter 4).

1.3. Aim of the thesis and framework

Considering the aforementioned issues related to the assessment of international trade in agro-forestry products, the research aim underlying this doctoral thesis is to explore the concept of trade competitiveness and comparative advantage, firstly by providing a general approach to the analysis of market performance, characterising a product market that is quietly unexplored from this point of view. The second objective is to provide a more in-depth exploration of the drivers influencing trade performance, focusing on those predictors related to I) social characteristics of trading partners and on the II) entrepreneurial strategies, as the former is currently rather underestimated (Gani & Scrimgeour, 2019), adopting a relatively under-researched (in commercial terms) niche market such as honey, with a strong relationship to cultural identity (Eteraf-Oskouei & Najafi 2013). Regarding the second, when discussing the adoption of voluntary certification schemes, some disagreement emerges on the results of the literature, which needs a clearer summary of the economic evidence on the topic, particularly for the forest products sector, whose effects are still debated.

The selection of the research targets came down to the forest ecosystem which, compared to the more widely discussed products of the agri-food sector, has production chains with high added-value

that have not been treated in the same way in economic terms. Moreover, their produces show common economic, social and environmental implications.

In the product basket of the forest ecosystem, parallel to the timber production for several uses, there are also the so-called non timber forest products (NTFP) (Jacobs, 1984), among which honey stands out (Zocchi et al., 2020).

The characterisation of timber and NTFPs markets, such as honey, is relevant at global level, but particularly for Asian, South American and African countries (Vedeld et al., 2007; Mugido & Shackleton, 2019) where many communities are linked to such productions through both economic and cultural aspects (Vandebroek et al., 2011).

Moreover, both production activities have significant repercussions in terms of providing ecosystem services. Indeed, beekeeping plays a key role in crop pollination (Klein et al., 2007; Sillman et al., 2021), as well as in the maintenance of plant biodiversity (Vrabcová & Hájek, 2020), but also on a societal level (Fedoriak et al., 2021).

At the same time, forests hold multiple important ecosystem services (Jenkins & Schaap, 2018), such as maintaining biodiversity (Taye et al., 2021), carbon sequestration (Kangas & Ollikainen, 2022) and above all, the protection from natural disasters (Bianchi et al., 2018): all of these services are preserved through a correct management practices, with relevant economic spillovers.

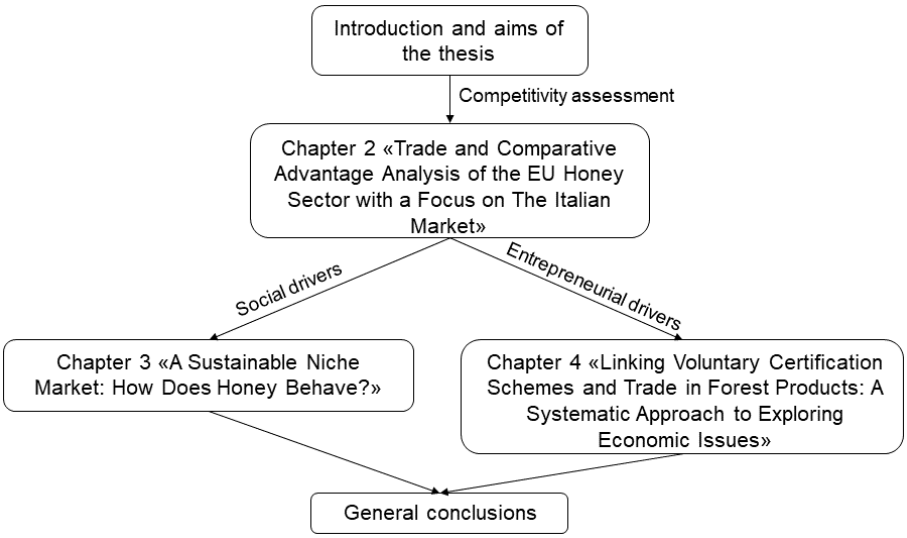
In economic terms, the demand for both products is increasing in recent years (United Nations, 2021), as well as the worrying phenomenon of food fraud about international honey exportations (Ferrier, 2021) and of illegal logging of forest products (Thompson & Magrath, 2021), which consistently afflict trade of these two agro-forestry products.

Hence, by focusing on the forest ecosystem, two products that are of great interest at an economic and consumer level emerge, with positive and common environmental and social repercussions in terms of the ecosystem services they provide, and which also share the growing need to characterise their trade flows, to better define their export quality standards and to explore the aspects that determine their competitiveness on the market.

Following the conceptual framework reported in Figure 1, the PhD thesis is organized as follows:

Chapter 2 reports the study “Trade and Comparative Advantage Analysis of the EU Honey Sector with a Focus on The Italian Market”, where the authors explored the European honey market thorough the adoption of the main indexes of competitiveness and comparative advantage. The aim of this research was to investigate a relatively unexplored product market, from the point of view of international trade, such as honey, which is a niche product on the international scene, if compared to other commodities in the sector. This was done in order to fill the knowledge gap on the subject and highlight those markets and national producers with the highest comparative advantage performances.

Figure 1. Workflow diagram of the PhD thesis



Following the previous characterisation of the European Union honey market, the next objective was to adopt a global perspective on honey trade flows, analysing whether the socio-cultural aspects of a trading partner can affect its export capacity. An econometric method, namely the gravity model of trade, has been applied in the study entitled “A sustainable niche market: how does honey behave?” (Chapter 3), comparing a series of approaches to select the best performing one. Thus again, the honey market was selected since there are no other studies exploring this product with an international perspective.

After the more detailed exploration of the social drivers’ effect on the international trade of an agricultural product, Chapter 4 explores a different field of the primary sector, namely the market of forest products. The study reported, titled “Linking Voluntary Certification

Schemes and Trade in Forest Products: A Systematic Approach to Exploring Economic Issues" focuses on entrepreneurial strategies and their effect on export performance. In particular, the trade effect of the adoption of voluntary forest certification schemes about sustainability and traceability has been investigated thorough a systematic bibliometric review to find out whether there is scientific interest in the market repercussions of this kind of firm strategies and what are the main effects highlighted in the literature.

Finally, Chapter 5 summarises the main findings of the research, highlighting the scientific impact on the field, while also evidencing its implications on the international scene for stakeholders and policy-makers.

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2. Trade and Comparative Advantage Analysis of the EU Honey Sector with a Focus on The Italian Market

Liam Pippinato[1*], Giuseppe Di Vita[1] and Filippo Brun[1]

[1]Department of Agricultural, Forest and Food Sciences (DISAFA), University of Turin, 10095 Grugliasco, Italy.
[*]Correspondence: liam.pippinato@unito.it

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Abstract

On the international scene, the study of commercial competitiveness is an excellent tool in order to gain an understanding of the market behaviour of a given product. This methodology can be implemented on goods with a significant influence on total exports, in addition to others having a lower impact, such as honey, which has interesting production characteristics. This paper aims to study the behaviour of the main competitiveness indices (RXA, RMA and RTA) relating to the European Union honey market, as the UE acts as an important trade hub for primary sector products, with a separate focus on the Italian performance. The results show that the EU is not very competitive in relation to honey exports and is strongly oriented towards imports. The analysis of the disaggregated data, on the other hand, has revealed that the eastern regions of the EU,

currently important producers of honey, are the areas with the highest performance and degree of specialisation in honey exports. Italy's behaviour is similar to the rest of the EU, showing a substantial comparative disadvantage in the trade of this product when compared to countries such as Romania or Spain, which produce greater quantities, or Germany, which is highly specialised in trade.

Keywords
Honey; competitiveness; export; Relative Trade Advantage.

2.1. Introduction

In recent years, the existing literature on agro-food trading has mainly focused on gaining an understanding of market mechanisms by analysing food consumption and its trade determinants (Lanfranchi et al., 2014; Blanc et al., 2018). In particular, a relevant number of studies have been addressed to better understanding the behaviour of foreign countries involved in the agro-food production, through the analysis of competitive performances in international agro-food markets (Bellia & Pilato, 2014; Cardoso et al., 2016; Scuderi et al., 2018; Mancuso et al., 2019). So, farm competitiveness assumes a relevant importance both for EU agricultural economy and policy. Additionally, farming competitiveness has acquired a prominent importance for both the EU agricultural economy and policy.

The issue of competitiveness has been viewed through several dimensions, due to its complexity, and the empirical approaches adopted by current literature are heterogeneous (Bojnec & Ferto,

2009; Zecca & Capocchi, 2012; Coppola et al., 2018; Timpanaro et al., 2018). Concerning the methodological approaches to competitiveness, several studies are based on the analysis of economic indices; among them, the Revealed Comparative Advantage Index (RCA), also known as the “Balassa index” (Balassa, 1965), represents one of the most widespread indices in international economics (Pappalardo et al., 2013; Zarbà et al. 2013). It enables the comparison of multiple subjects in relation to their specialization, by calculating the relative advantage or disadvantage of a certain country, in international trade, for particular classes of goods. The RCA technique is currently used for commodities both in high and limited demand: Banterle (2005) highlighted the competitive performance of the EU countries within the European agro-food market, while other studies were carried out on primary sector products such as wine (Carrion & Albaladejo, 2013), meats and cereals (Sarker & Ratnasena, 2014), citrus fruits (Naseer et al., 2018) and forest products (Rossato et al., 2018). This approach has also been adopted several times in the analysis of the honey sector, yielding interesting results on the competitiveness of emerging markets, and comparing trade performances of multiple countries (Zhang & Li, 2012; Song & Jensen, 2014; Yu et al., 2014; Ignjatijevic et al, 2015; Paula et al., 2016; Magana et al., 2017; Terin et al., 2018).

Despite the rather limited role of Italian honey production, when compared to the production of other nations, the wide array of production typologies and the high quantities re-exported, make Italy an interesting case study in order to understand the performance of a good that is increasingly successful on the market.

Recent studies also pointed out that beekeeping is economically and environmentally sustainable (Blanc et al. 2018), at all the examined dimensional scales. Honey is one of the most sustainable products of the agro-food sector; its processing system undoubtedly places it in a condition of endogenous sustainability, connected to the specificity of the whole production process that can be certainly considered as environmentally sustainable. For these reasons, it is worthwhile to perform an in-depth analysis of the current trade scenario of this production by identifying the most efficient and competitive models of specialization in the honey sector, in addition to comparing Italian trade performances and competitiveness to the other producers in EU member states. Therefore, the aim of this study is to understand how the economic performances of the sector have evolved, and more specifically to identify the main competitors of Italian producers, by determining their comparative economic advantage, and the relative competitive positioning of Italy within the EU countries.

The paper is organized in three different sections, as follows: the first part presents the methodological approach that reports data sources and explains the methodology developed according to the Balassa theory, the second section reports the main results of the analysis based on competitiveness indexes, while the discussion concludes the paper.

2.2. Current overview of the honey sector

Over the last two decades, beekeeping has experienced a significant increase in production at international level, with an average annual growth of 35,000 tons from 2000 onwards; in 2016,

total production of honey consisted of 1.8 million tonnes (FAO, 2018). The global growth of beekeeping activities is certainly due to the enhancement of the technical production process and the parallel increase in consumption at international level, more markedly in the most developed countries (FAO, 2018; UN Comtrade, 2018). This trend has led to an increase of the honey market, whose exports in 2016 reached a total value of approximately 2.2 billion dollars (UN Comtrade, 2018).

With regards to production flow by nation, China, the EU, Turkey, Iran and the United States are the main producers: these countries represent approximately 80% of global honey production. The EU is the world's second largest honey producer after China, with over 260,000 tonnes, thanks to the large contribution mainly from Romania, Spain and Hungary (EU, 2016). Within this scenario, in 2016 Italy ranked in 36th position for production, whose total amount was approximately 9,000 tonnes. While Italian exports amount to much less significant quantities (around 21,000 tonnes), mainly directed to Switzerland, Saudi Arabia, Japan and the United States, for a total of around 130 million Euros (EUROSTAT, 2018). Similar to other agro-food products, the EU is unable to satisfy the domestic demand for honey, consequently it is a net importer: in 2017, imports exceeded 200,000 tonnes, mainly from China, Ukraine and Argentina, for a total of over 450 million € (EUROSTAT, 2018). On the contrary, exports represent much less significant quantities, with just over 21,000 tonnes sold, mainly to Switzerland, Saudi Arabia, Japan and the United States, for a total of approximately 130 million euros (EUROSTAT, 2018).

With regard to exports of honey, in 2016, China, Argentina, India and Mexico were the world leading countries; Italy ranks 17th in exported volumes, with approximately 7,400 tonnes (UN Comtrade, 2018). Although limited, the export of Italian honey was mainly addressed to other European countries, such as Germany and France (EUROSTAT, 2018), with an increasing trend, between 2003 and 2017, towards Asian and American markets.

The Italian honey market is driven by a small number of big enterprises that control more than half of the entire national market (SSN, 2018). At the same time, a relatively large number of small and very small enterprises occupy a growing niche-market. Currently, the Italian beekeeping sector is made up of over 49,000 honey producers, 29,000 of whom are mainly self-consuming and around 20,000 are mainly market-oriented (SSN, 2018).

According to the National Beekeeping Registry, in Italy there are over 1.3 million hives and in 2017 the turnover of the honey industry exceeded 2 billion Euros (SSN, 2018). Domestic consumption of honey has seen constant growth (+5% in 2017), while production is subject to strong fluctuations due to climate change and pollution, which negatively affect the health of bees.

2.3. Method

2.3.1. Data sources

The sector specialisation analysis was carried out on the 28 EU member states by analysing their trade performance, and then comparing Italian honey trading. In order to better understand the dynamics of the trade flows in EU economies, the balance of export and import flows of the last 15 years, ranging from 2003 to 2017,

was studied. Export and import data, expressed in monetary terms (current US $), were obtained from the United Nations Comtrade Database (UN Comtrade, 2018). To this aim, the data were changed to constant terms, using the consumer price index for the United States, as reported by the World Bank (WB, 2018). Data referred to the year 2010. The data on honey imports and exports were extracted on the base of the type of product, according to the Harmonized System Code (HS) selection, which classifies honey under the heading honey, with the following natural code HS4:040900. Conversely, the total values of imports and exports were selected by using the expression "total of HS commodities".

2.3.2. Competitiveness analysis of the honey trade sector

The international competitiveness of a country was analysed by means of the Revealed Comparative Advantage Index (RCA), also known as the Balassa Index (Balassa, 1965), which is one of the most widely used and popular instruments for this kind of analysis (Laursen, 2015; Yeats, 1985) and is calculated as follows (Eq. 1):

$$RXA_{ij} = \frac{\left(\frac{X_{ij}}{\sum_t X_i}\right)}{\left(\frac{\sum_n X_j}{\sum_n \sum_t X_i}\right)} \quad (1)$$

Where:

- Xij corresponds to the monetary value of exports for product j of country i;
- ∑t Xi are the exports of all t products from the country i;

- ∑n Xj are the exports of n countries worldwide for product j;
- ∑n∑t Xi is the total export value for all n world states.

This index was introduced for the first time in 1965, in order to evaluate the comparative economic advantage of a given product, providing an estimate of the degree of specialization at international level for a nation, or a group of countries, in addition to verifying their degree of competitiveness in that sector (Laursen, 2015).

This performance indicator is widely used in the international trade debate, with recent and interesting applications, by analysing products of the primary sector tout-court (Ferto & Hubbard, 2003; Herciu, 2013; Zarbà et al., 2013; Bojnec & Ferto, 2015) or also focusing on specific production sectors.

The RCA Index has a distribution range between 0 and +∞, where the values included between 0 and +1 indicate the absence of a comparative advantage and a low degree of specialization, values close to +1 indicate a certain neutrality, while indices above +1 show a real advantage and good levels of specialization for a specific country.

The RCA Index has been modified to address its main problems (Laursen, 2015), including the asymmetric distribution, which translates into a different weight in the regression analysis for index values below or above 1 (Vollrath, 1991; Dalum et al, 1998; Bojnec & Ferto, 2009; R. Yu et al., 2009; Laursen, 2015) and the double counting of export values of the sector in the equation (Vollrath, 1991).

In order to partially solve these problems, the index was replaced by Revealed Comparative Export Advantage Index (RXA) (Vollrath, 1991). The index is then redefined as follows (Eq. 2):

$$RXA_{ij} = \frac{\left(\frac{X_{ij}}{\sum_{t,t\neq j} X_{it}}\right)}{\left(\frac{\sum_{n,n\neq i} X_{nj}}{\sum_{n,n\neq i}\sum_{t,t\neq j} X_{it}}\right)} \qquad (2)$$

To avoid double counting of product j and state i exports, these are excluded from the summations in the equation (Vollrath, 1991; Bojnec & Ferto, 2009).

In the same way, the calculation (Eq. 3) of the so-called Revealed Comparative Import Advantage (RMA) can be carried out as follows (Latruffe, 2010; Vollrath, 1991; Bojnec & Ferto, 2009):

$$RMA_{ij} = \frac{\left(\frac{M_{ij}}{\sum_{t,t\neq j} M_{it}}\right)}{\left(\frac{\sum_{n,n\neq i} M_{nj}}{\sum_{n,n\neq i}\sum_{t,t\neq j} M_{it}}\right)} \qquad (3)$$

In this equation, the terms and summations express the same values as the previous one; however, the export values are replaced by the import values (M). Each value reported is always expressed in monetary terms (US $).

Finally, to integrate the concepts of both export and import performance, the values of RXA and RMA obtained are related (Eq. 4). For this purpose, the index called the Relative Trade Advantage

(RTA) (Vollrath, 1991) can be obtained according to the following relationship:

$$\mathrm{RTA_{ij}} = \mathrm{RXA_{ij}} - \mathrm{RMA_{ij}} \quad (4)$$

The resulting index is interpreted in a symmetrical way: RTA values below 0 indicate the absence of a concrete trade advantage, while higher values indicate a certain degree of specialisation and a positive comparative advantage regarding the product being analysed. In this formulation, moreover, the assessment of the competitiveness of the sector is expressed in an overall manner, including the terms relating to both import and export trade flows (Vollrath, 1991; Bojnec & Ferto, 2009; Latruffe, 2010; Rossato et al., 2018).

2.4. Results

The first result on the performance of the EU honey trade flows is graphically presented in Figure 1. It is possible to note that the EU competitiveness in exports index (RXA) is constantly below the comparative advantage threshold (+1), with an average index for the period 2003-2017 equal to 0.37. The corresponding index of specialisation in imports (RMA) is above the value of +1. Europe, like in some other commercial sectors (Bojnec & Ferto, 2015), has a honey import-oriented market, with a high degree of specialisation for honey. Consequently, the RTA confirms this result and shows that the EU market does not have a comparative advantage in this trade sector.

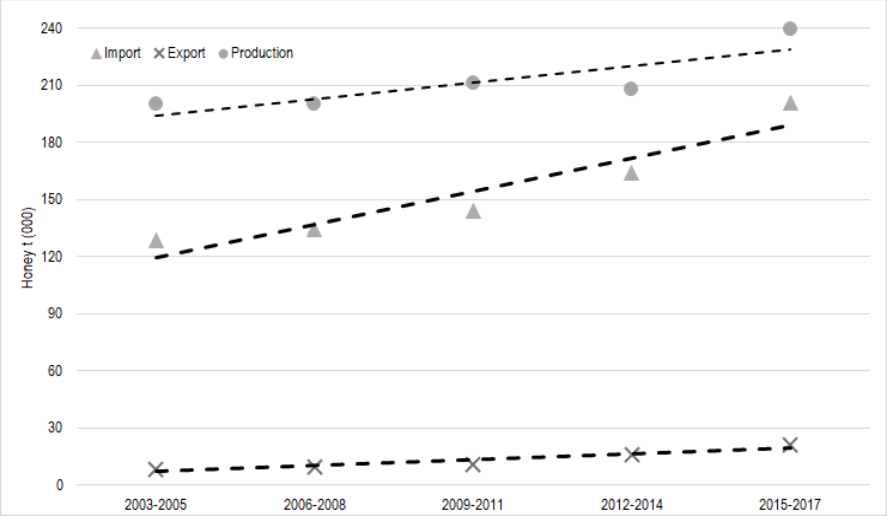
However, the trend of the three indicators shows a slight improvement: the RMA has a gradually decreasing trend, testifying a decrease in the specialisation in honey imports, while the trend of the RXA index is substantially constant.

Figure 1. EU-28 honey RXA, RMA and RTA trends for the period 2003-2017

The different trends of these indices can be partly explained by relating them with marketed quantities and relative prices, represented respectively in Figure 2 and Figure 3. As can be seen, with increasing quantities of imports, there is a parallel increase in production. (FAO, 2018), which has improved self-support and internal trade. On the other hand, the evolution of average export and import prices can be explained as follows: while for exports there has been a significant increase in average prices per kg (+20% average growth between 2003-2005 and 2015-2017), import

prices have remained substantially unaltered (-5% average), reducing the impact of the value of imports on the total. As a consequence, the trend of the RTA index shows a positive movement, even though its values are still far from reaching a comparative advantage for the EU honey sector. In addition, it is interesting to note that, in the period 2009-2011, the RTA shows a decrease in average value. In fact, the values for 2009 and 2010 were below -2.0 and this could be due, at least in part, to the occurrence of the economic crisis of the last decade (Crescimanno et al., 2014).

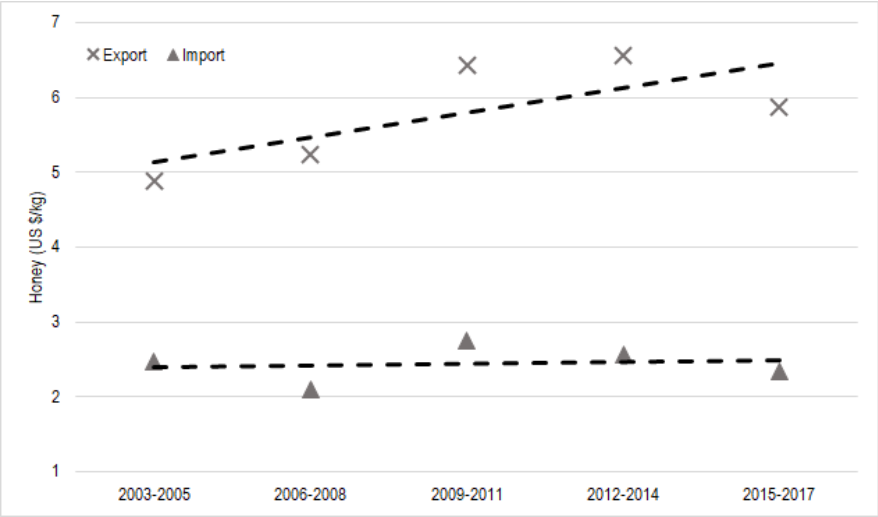
Figure 2. EU-28 honey export and import quantities in t (000)



Proceeding further in the analysis, thanks to the disaggregation of data at national level, as shown in Table 1, it is possible to observe that Bulgaria is the country with the highest competitive performance in the honey market, throughout the entire fifteen-year

period considered. This is followed by Hungary and Romania, which show fairly similar performances.

Figure 3. EU-28 honey export and import prices (US $/kg) for the period 2003-2017



Among western European regions, only Spain and Portugal have positive average RTA values.

In the European trade panorama, only Belgium, Germany, Spain, Greece, Lithuania, Latvia and Portugal have improved their competitive performance, some even achieving positive RTA values, as in the case of Lithuania and Portugal. On the other hand, for the rest of the member countries, the general trend is negative; in fact, a decrease in the comparative advantage can be observed for Bulgaria, Hungary and Romania, which nevertheless continue to lead the ranking. In other cases, such as for Austria, France, Italy and Sweden, the analysis revealed that their disadvantage had worsened even further.

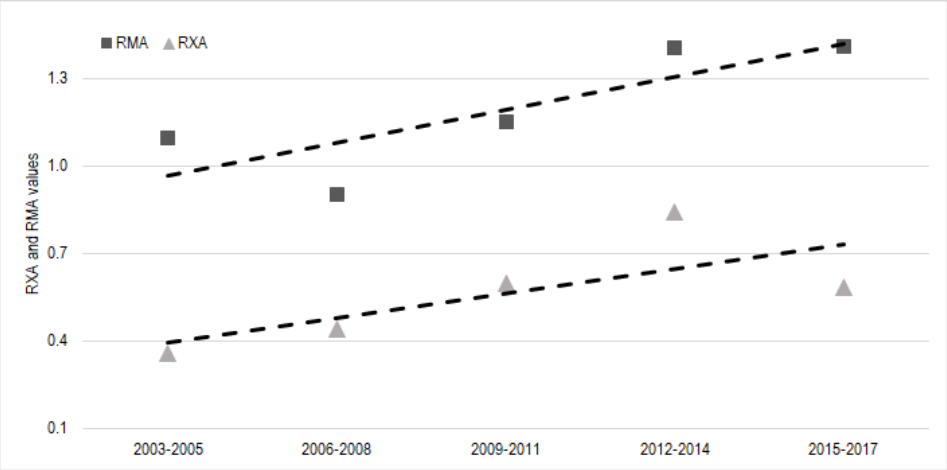
Table 1. Honey RTA values for the EU members

	2003-2005	2006-2008	2009-2011	2012-2014	2015-2017	Mean
Austria	-1.29	-0.73	-1.45	-1.92	-1.88	-1.45
Belgium	-0.33	-0.36	-0.13	-0.06	-0.24	-0.23
Bulgaria	**13.41**	7.64	**12.38**	**12.08**	**9.39**	**10.98**
Croatia	2.29	3.43	2.98	0.53	-0.1	1.83
Cyprus	-0.04	-0.86	-1.43	-1.83	-2.14	-1.26
Czech Republic	0.61	0.31	-0.04	-0.07	-0.19	0.13
Denmark	-0.45	-0.48	-0.47	-0.55	-0.64	-0.52
Estonia	-0.48	-0.36	-0.69	-0.41	-0.49	-0.49
Finland	-0.72	-0.61	-0.89	-0.95	-1.15	-0.86
France	-0.83	-0.99	-1.15	-1.18	-1.21	-1.07
Germany	-2.77	-2.05	-2.05	-1.83	-1.37	-2.01
Greece	0.89	0.40	0.70	0.86	1.27	0.82
Hungary	9.60	**9.32**	6.61	7.10	5.48	7.63
Ireland	-0.66	-0.85	-1.19	-1.8	-1.2	-1.14
Italy	-0.74	-0.46	-0.55	-0.57	-0.83	-0.63
Latvia	-0.6	-0.14	-0.28	-0.09	-0.07	-0.23
Lithuania	-0.15	0.13	-0.13	0.09	0.38	0.06
Malta	-0.03	-0.64	-0.77	-0.66	-0.8	-0.58
Netherlands	-0.77	-0.75	-0.77	-0.79	-0.87	-0.79
Poland	-0.52	-0.73	-1.13	-0.54	-0.63	-0.71
Portugal	-0.11	0.33	0.47	0.37	0.33	0.28
Romania	9.45	7.11	8.41	6.61	4.34	7.18
Slovakia	1.4	0.7	-0.44	-0.58	-0.53	0.11
Slovenia	0.01	-0.52	-0.82	-1.25	-0.98	-0.71
Spain	0.98	1.38	1.84	1.47	0.99	1.33
Sweden	-0.96	-0.93	-1.22	-1.09	-1.09	-1.06
United Kingdom	-1.41	-1.75	-1.66	-1.33	-1.13	-1.46

More specifically for Italy, there is a situation of general disadvantage and lack of specialisation for the honey sector, which is mainly due to the uncertain trend in production and the effect of the great climatic variability (Pappalardo & Naldi, 2018). The disaggregated indices RMA and RXA (Figure 4), both show increasing values but that the decline recorded in the period 2015-

2017 is a key element that dampens the trend. This is probably a reaction to the decrease in production in the same years, which led to a consequent decline in exports in order to meet domestic demand.

Figure 4. Honey RXA and RMA values for Italy between 2003 and 2017.



2.5. Conclusion

The analysis of the trade performance of honey producers shows that the EU is not particularly competitive and specialized in the exports of this product. On the contrary, it is evident that EU is a net importer, as reported by FAO (2018).

However, although the EU and Italy undoubtedly play a limited role in the context of global honey production, during the fifteen years examined, the EU countries show a strong heterogeneity in trade performances of honey. While the eastern regions, with the leading role played by Romania (Popescu, 2017), reveal positive performances, the central and western regions, especially France

and Germany, show a negative exchange rate, that detrimentally affects their international competitiveness.

Nevertheless, we observed a slight upward trend in the RTA index. This means that the EU is gradually improving in terms of competitiveness on the international stage, whereas other countries, such as Turkey, Argentina and China, currently show more positive performances, as indeed shown in similar studies conducted in other markets (Song & Jensen, 2014; Terin et al., 2018). A possible explanation could be linked to the constantly growing demand of honey by internal consumers. In fact, from 2007 to 2019, EU countries showed a constant growth in honey consumption (IndexBox, 2022), negatively affecting market exportation due to the requirement of the internal demand. More in detail, among the reasons that led this increase in honey consumption there are the growing attention attached to the nutritional and functional properties of the product (Brščić et al., 2017; Zanchini et al., 2022), and to the ecological role of beekeeping which in recent years has been threatened by the growing phenomenon of colony losses (Tamburini et al., 2019).

When compared to the more competitive players, Italy reveals a profile of comparative disadvantage, which does not allow the classification of Italian beekeeping as particularly competitive in the international scenario, as on the contrary occurs in other primary commercial sectors, such as vegetables and fruit. The fluctuations and the shortage of production (Pappalardo & Naldi, 2018) negatively influences the export performance. However, two considerations must be made: firstly, that the gap in competitiveness of Italian honey in the international arena has been

partially reduced; secondly, the increase in terms of the price of the exported product, we observed, would seem to reinforce the placement of Italian honey production in the international market.

These two dual contingencies open up interesting economic perspectives for Italian producers, both for hobbyist and professional beekeepers (Blanc et al., 2018), in addition to the large-scale companies involved in the trade, packaging and distribution of imported honey.

As a consequence, the results seem to provide an encouraging scenario for small scale producers, in terms of the opportunities correlated to the growing interest of consumers. In fact, given the growing domestic demand for honey (Cosmina et al., 2016) and due to the fact that honey is increasingly consumed in the domestic market, future positive economic effects for small Italian beekeepers are expected (Blanc et al., 2018).

Current trends might have important implications for the enhancement and increment of local production that would undoubtedly have positive impacts in terms of the multifunctionality of agricultural activities and environmental sustainability.

Finally, by observing import data and trade performance of some EU countries, like Italy, France and Germany, we noted a well-structured phenomenon of re-exportation. Although these countries represent the leading honey importers, they also play an important role as trade nodes for international re-exportation. In this regard, the decisive role of Italy should be stressed since it represents an important trade-hub for honey international re-exports as reported by the CBI (2016). A more relevant role on the international scene allows these countries to increase the value-added honey exports,

since worldwide consumption, particularly in developed countries, showed growing interest in honey with high standards of quality or even linked to specific areas (Zanchini et al., 2022).

Moreover, in a perspective of market development scenarios, linked to openings of new markets and global partnership (Di Vita et al., 2015; Zarbà et al., 2015; Dal Vecchio et al., 2018), our results suggest the consolidation of commercial relations and trade agreements with honey-producing countries, such as Ukraine and Turkey. Although these countries present high competitiveness indices, they offer products with a lower level of differentiation and as such, they could be the object of commercial interest from large distribution groups (large-scale retail) and major honey enterprises.

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3. A Sustainable Niche Market: How Does Honey Behave?

Liam Pippinato[1*], Simone Blanc[1], Teresina Mancuso[1] and Filippo Brun[1]

[1]Department of Agricultural, Forest and Food Sciences (DISAFA), University of Turin, 10095 Grugliasco, Italy.
[*]Correspondence: liam.pippinato@unito.it

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Abstract

The global honey market has witnessed constant growth over recent decades, especially in Asian regions. In recent years, the increase in export flows of this product throughout the world has raised the issue of the lack of international import standards and regulations, making trade susceptible to variables that are not only economic, but also social or political. The objective of this study is therefore to explore, using the econometric methodology of gravity models, what the determinants of the international honey trade are, both economic and socio-cultural, and to verify whether a niche market, such as the one being examined, is influenced by these covariates, in a similar manner to the main commodities of the agri-food sector, or if honey displays a unique behaviour.

The results show that honey market behaviour is not statistically different from that of the main agri-food products already studied and that the cultural distance, introduced as a covariate, does not have a significant influence.

Keywords

Honey; international trade; niche market; gravity model; econometrics.

3.1. Introduction

Over the last twenty years, both technical and scientific progress and the growth of beekeeping have led to a significant increase in honey production, with an average annual growth of 35,000 tonnes since 2000, amounting to a total of 1.8 Mt of honey produced in 2016 (Faostat, 2019) worldwide.

Despite the partial reliability of the production data available, there is a positive trend in international honey production, mainly driven by Asia, and more specifically by China and India, which in recent years have established their production leadership, recording average honey production increases in excess of 10,000 tonnes per year. In contrast, other regions of the world, such as Europe and the Americas, have shown more limited increases in production, of less than 2000 tonnes per year (Blanc et al., 2019a; Faostat, 2019).

Economically, the honey sector can be defined as a niche market in the global agro-food exports' context, mainly driven by commodities with much higher volumes and values. By 2017, honey exports accounted for 0.17% of total world agri-food exports; comparing the different national economies, the honey sector never

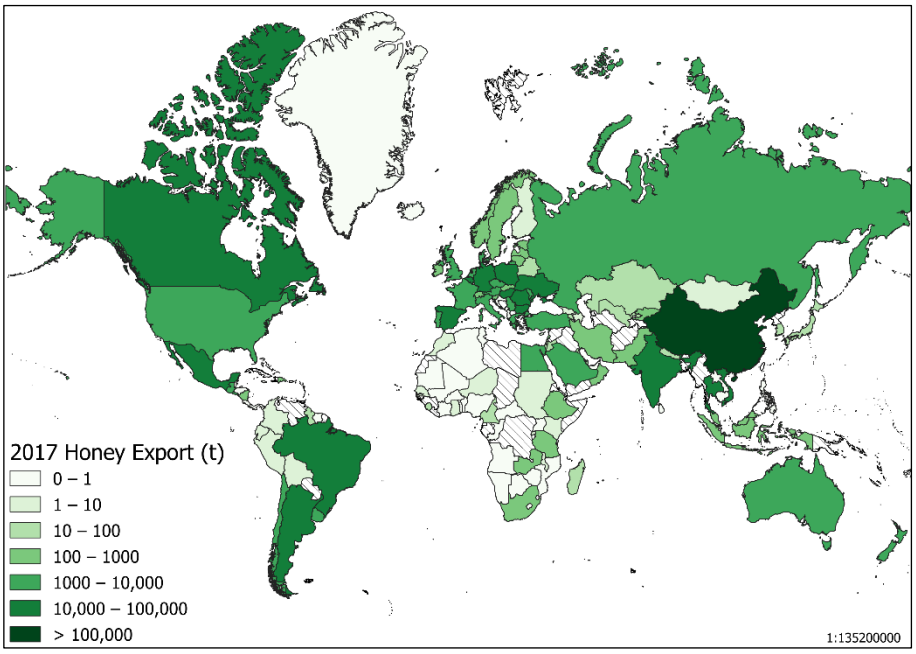
accounts for more than 1% of total exports, even where this production is more widespread (Blanc et al., 2019a; UN Comtrade, 2019). The impact of this economy is therefore very little marked in fact. Although the volumes exported are increasing, it is not possible to define honey as an agri-food commodity.

In parallel to this trend, there has been an increase in apparent consumption of this niche agro-food product, especially in high-income countries (Faostat, 2019; UN Comtrade, 2019).

Increasing production and consumption have, consequently, provided a strong impulse to the world honey trade: notably, since 2009, the total quantity of honey exported has increased by about 50%, from 400,000 tons per year to over 600,000 tons (Faostat, 2019), with an estimated value for 2016 of over 2.2 billion US dollars (UN Comtrade, 2019). It should also be noted that the export capacity of Asian countries has evolved in a similar way to the volumes produced, whereas in other regions, particularly Europe, the competitive capacity of honey exports has been rather limited (Pippinato et al., 2019), showing instead a growing attention to the quality aspects and ecosystem services provided by beekeeping (Blanc et al., 2019b).

Focusing on trade flows, there was a significant increase in quantities traded worldwide, from around 300,000 tonnes in 1995 to over 650,000 tonnes in 2016, with a value of exports of over 2 billion dollars, according to the UN Comtrade database (UN Comtrade, 2019), which also demonstrates the market liberalization process, particularly for Asian countries, with an estimated average annual increase of around 9000 tonnes of honey exported (Blanc et al., 2019a) (Figure 1).

Figure 1. 2017 Honey exporting country in tonnes (Source UN Comtrade).



The leadership in honey exports is held by China, which exported almost 130,000 tonnes of honey in 2017, followed by Argentina and Ukraine. Many countries, particularly Asian ones, have met the growing international demand for honey by placing a high quantity of the product on the international scene at a more competitive price than other markets of origin (García, 2018): according to UN Comtrade (2019), for example, the average price per kg of Chinese honey in 2017 was just over $2, whereas honey from Germany or Spain was over $4.5·kg^{-1}.

Imports therefore followed the same trend, with the USA, Germany, and the UK leading the most important honey importing countries (UN Comtrade, 2019). Moreover, some nations, such as Germany, report large quantities of imported and exported honey, showing

that some countries mainly play a role as a commercial hub for re-exports (García, 2018; Blanc et al., 2019a). In this context, the EU is one of the world's major honey importing partners (Figure 2).

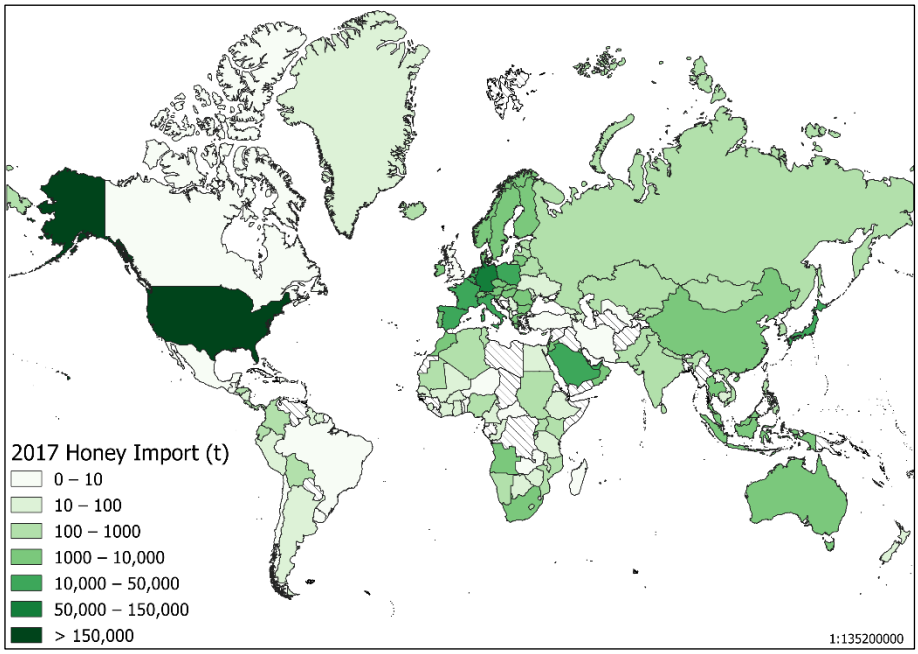
From a legislative point of view, the honey trade is currently regulated by a small number of international standards, and import and export of this product are currently mainly based on the parameters set out in the Codex Alimentarius (FAO, 1981), as revised in 2001. This has led to a wide variability in the parameters adopted to define the product and its quality standards, making the international honey trade susceptible to factors that are not strictly linked to quality aspects, but also economic and political. For example, among the custom barriers linked to economic issues, there are the anti-dumping measures, in force since 2001, implemented on the Chinese honey entering in the U.S. market, to mainly preserve internal production in the domestic market (US Department of Commerce, 2018).

Therefore, there is no unique or recognized legislation at international level, so a number of different national regulations are applied, making it even more difficult to meet the varying criteria imposed and hindering trade (Thrasyvoulou et al., 2018).

By using the Codex Alimentarius as a voluntary regulation mainly related to botanical and geographical origin and to the criteria of chemical composition and physical characteristics of the product (FAO, 1981), already in 2001 the European Union had adopted the requirements for honey trade (EU Council, 2001; EU Commission, 2005), subsequently implementing further regulations that

integrated the quality parameters for imports from third countries (EU Commission, 2010; EU Parliament, 2011, 2014).

Figure 2. 2017 Honey importing country in tonnes (Source UN Comtrade).



In addition to this limited and heterogeneous regulation, there is also the phenomenon of food fraud, in which honey is considered as one of the marketed products most subject to adulteration: according to the study by Moore et al. (2012), honey is third in the world in terms of number of cases of reported fraud. In particular, many fraud cases in the sector have been traced back to the product from Asian countries (García, 2016, 2018). This has also led to important commercial consequences, such as the limitation of Chinese honey flowing into the US market after 2010 (García, 2016) and also the European Commission's monitoring plan in

2015, which highlighted at least 15% of the samples analyzed as not meeting the standards imposed by the European single market (García, 2018).

Honey is a sustainable product by definition. It has environmentally friendly characteristics, including the conservation of biodiversity and pollination as an ecosystem service (Wratten et al., 2012). These aspects can be recognized, for example, by the organic label for honey, by incorporating low-impact production criteria and management of adversities through biotechniques (Mancuso et al., 2020; Vercelli et al., 2020), instead of conventional techniques, as in the case of the Varroa mite (Traynor et al., 2020).

With the use of biotechniques, organic honey production has an undoubtedly positive impact from a socio-economic and environmental point of view and can help organic beekeepers to gain a better recognition of their product. As highlighted by de Oliveira et al. (2019), most of the indicators used to explore the economic and environmental impact positively describe the conversion and organic production of beekeepers.

Moreover, the role of bees and beekeepers in maintaining biodiversity has already been emphasized in the literature, confirming the fundamental activity of beekeeping from an ecological point of view (Blanc et al., 2019b) and highlighting the pollination service activity as a positive economic externality (Allsopp et al., 2008). Many authors have observed the consumers' opinion of honey, which is perceived as healthy, safe, and environmentally friendly. A more sustainable product often means that the consumer is willing to pay a higher price, which has

important implications for producers (Sama et al., 2019; Vapa-Tankosic et al., 2020).

Consumers attach great importance to these aspects, which are well-represented by the organic label (Jensen et al., 2013). Equally important is the concept of local production, closely linked to the territory. This is taken into account in a positive way by consumers, who not only associate positive environmental effects but also the preservation of local activities (Khaoula et al., 2019; Ribeiro et al., 2019; Vapa-Tankosic et al., 2020). So, honey identifiable as a local or mountain product (Brun et al., 2020), or even with Geographical Indication schemes like the Product Designation of Origin (PDO), can be considered sustainable and recognizable on the market by a label, and all of these characteristics can contribute to building the image of a more sustainable product in the consumer's mind (Arvanitoyannis & Krystallis, 2006), thus potentially influencing trade flows.

Despite the limited economic impact of the honey trade in the global context, when compared to the main agro-food commodities, it is interesting to analyze the dynamics and determinants that influence export flows, in order to identify the main trade drivers at international level, also in consideration of the fact that there are no specific studies in literature focusing on the international honey trade, whereas the last decade has seen an increase in scientific publications focusing on food fraud, where honey is one of the main products subject to food adulteration (Moore et al., 2012; Djekic et al., 2018; Jones Ritten et al., 2019).

Trade flow analysis draws mainly on gravity models, econometric tools theorized and developed in the 1960s (Tinbergen, 1962) and

still widely applied today in many sectors, including migration flows, for which many applications have been developed (Belot & Ederveen, 2012; Beine et al., 2016).

The great versatility of gravity models has also made them useful for applications in the field of agricultural economics, ranging from the study of the meat trade, in which the impacts of specific trade restrictions have been studied (Belot & Ederveen, 2012; Ghazalian et al., 2012; Thompson, 2018; Webb et al., 2018; Shahriar et al., 2019), of fish products (Chen et al., 2018; Kuo & Vincent, 2018; Wang et al., 2019), and of wines (Agostino & Trivieri, 2014; Castillo et al., 2016; Dal Bianco et al., 2017). Other recent applications include fruit and vegetables (Fiankor et al., 2019; Irandu, 2019), olive oil (Kavallari et al., 2011; Kashiwagi et al., 2020) or, more generally, the impacts of tariff and non-tariff barriers or trade agreements on many primary sector products (Winchester et al., 2012; Crivelli & Gröschl, 2016; Santeramo & Lamonaca, 2019).

With regard to honey, the only econometric application related to this product examines the Chinese market (Wei et al., 2012). Thus, the application of the structural gravity model methodology with an international outlook represents the main innovation of this study since there are no studies currently being conducted on honey following this approach.

The aim of this study is to analyze the determinants influencing global honey exports and to verify whether these determinants are similar to those of other agri-food products which have a greater economic impact or if there is evidence of original behavior. This study is carried out using the main variables used in literature, such as distance, apparent consumption, gross domestic production, and

the presence of trade treaties or free trade agreements. The analysis will also include some socio-cultural variables, in order to assess whether these covariates also have an influence on honey trade dynamics, as recently reported (Kristjánsdóttir et al., 2020). This represents another innovative feature of this study of socio-cultural variables: in fact, this is a long-established relationship, which is still of current interest but rarely applied to niche products.

3.2. Materials and Methods

3.2.1. Theoretical Framework

The gravity models are inspired, albeit with due distinction, by Newton's law of universal gravitation. The basic principle is that the trade flow from one country to another is directly proportional to the economic dimension of the two countries involved, identified by the Gross Domestic Product (GDP), and inversely proportional to the distance between the two trading partners (Tinbergen, 1962), used as a proxy for transport costs (Anderson & Van Wincoop, 2003).
In its original formulation the log-linear model is structured as follows (1):

$$\ln Trade_{ij}^{k} = \ln \alpha GDP_i + \ln \beta GDP_j + \ln \gamma Dist_{ij} + \varepsilon_{ij} \qquad (1)$$

where *Trade* is the monetary value of annual exports of product k from state *i* to state *j*, in millions of USD (nominal value). Exports were accessed from the UN Comtrade database (2019), which uses the *Harmonized System Code HS:6* classification system, thus identifying honey by the code *HS6:040900*.

GDP is the economic dimension of both states *i* and *j*, in billions of USD (nominal values), obtained from the World Bank database (2019), while *Distij* is the linear distance in km between the capitals of the two countries, retrieved from the database developed by the Centre d'Études Prospectives et d'Informations Internationales (CEPII) (2019).

Regarding distance, a negative impact on the dependent variable is expected. Finally, ***ε*** is the residual error term.

Based on the approach proposed by Anderson & Van Wincoop (2003), the model is estimated in its augmented form using the Ordinary Least Square Method (OLS), including some additional variables and presented as follows (2):

$$lnTrade_{ij}^{k} = \mu^{*} + \ln \alpha(GDP_{i,t-1}) + \ln \beta(GDP_{J,t-1}) + \ln \gamma(Food_{j}) + \ln \delta(Prod_{j}) + \ln \partial(Dist_{ij}) + \varepsilon_{ij} \quad (2)$$

where $GDP_{i,\,t-1}$ and $GDP_{j,\,t-1}$ are, respectively, the gross domestic product of state *i* and state *j*, lagged to the previous year: lag-1 allows the endogeneity of the model (Johnston et al., 2015) to be controlled and the effect of an economic cycle on the trade dynamics to be considered, referring to the following year.

$Food_j$ represents the apparent honey consumption of the importing country, in tons, and was obtained from the trade data of the UN Comtrade database (2019) and the production data of the FAOSTAT database (2019). This covariate has already been used, for example, in the study of determinants of seafood international trade and normally has a positive effect on the import flows (Natale et al., 2015) and also in the study of the forests product trade at

international level, with similar positive effects on import flows (Morland et al., 2020), without generating, in both of the cases, endogeneity problems.

Finally, $Prod_j$ represents honey supply at the time t of the importing country, expressed in tons and obtained from the FAOSTAT database (Faostat, 2019): this variable usually has a negative impact on trade flows, generating a “home bias effect” (Anderson & Van Wincoop, 2003), since it causes a trade resistance to the purchase of foreign products when domestic production increases, as already highlighted for the international wine market (Dal Bianco et al., 2016).

The proposed log-linear form includes some error components that generate biased coefficient estimates and do not allow effective control of the heteroscedasticity of the data (Baldwin & Taglioni, 2006; Santos Silva & Tenreyro, 2006; Yotov et al., 2016).

The first of these components is the presence of “Multilateral Resistance Terms”, not directly observable components (Yotov et al., 2016) which, as a result of increasing resistance to trade of a nation towards other countries, lead it to trade only with some specific partners (Anderson & Van Wincoop, 2003), causing what Baldwin & Taglioni (2006) define as one of the main errors in the estimation of gravity models (Gold Medal Mistake).

To partially counteract the error, fixed effects for the exporter and for time have been included in the model.

Another issue concerns the observations equal to 0 of the “*Trade*” dependent variable: in the log-linear form, these observations are normally omitted as “missing” data, limiting the estimation of the parameters. To avoid this, different estimation procedures have

been proposed (Winchester et al., 2012; Gómez-Herrera, 2013; Yotov et al, 2016) including the Heckman selection model (Heckman, 1977) and the Poisson-Pseudo Maximum Likelihood (PPML) estimation (Santos-Silva & Tenreyro, 2006).

More specifically, for the Heckman selection model a two-step procedure is performed, with the initial application of a Probit model followed by an OLS, based on the results of the previous procedure (Helpman et al., 2007). However, the most widely used model is the Poisson Pseudo-Maximum Likelihood (PPML), proposed in 2006, which is consistent even in the presence of fixed effects and is also able to effectively include null observations, since its formulation does not require a logarithmic transformation of the dependent variable (Santos-Silva & Tenreyro, 2006; Fally, 2015; Santos Silva & Tenreyro, 2011).

To compensate for the loss of information and observations resulting from the lack of treatment of the records equal to 0, a constant can then be added to the *Trade* value (1 + Trade), as has been performed in the present study, although in this way inconsistent estimates of parameter coefficients may result (Krisztin & Fischer, 2015).

The final source of error to be taken into account is the heteroscedasticity of the data (Krisztin & Fischer, 2015; Yotov et al., 2016), which with log-linear models is not effectively contained and can again lead to an inconsistent estimation of the coefficients, which is avoided by using the Poisson Pseudo Maximum Likelihood (PPML) estimation (Gómez-Herrera, 2013).

3.2.2. Estimation Procedure

As anticipated, gravity models can be enriched by including more explanatory variables of the commercial flow, as proposed in the following equation (3):

$$lnTrade_{ij}^{k} = \mu^{*} + \ln\alpha(GDP_{i,t-1}) + \ln\beta(GDP_{j,t-1}) + \\ + \ln\gamma(Food_{j}) + \ln\delta(Prod_{j}) + \ln\epsilon(Dist_{ij}) + \\ + \rho(EU_{ij}) + \lambda(GATT_{ij}) + \theta(FTA_{ij}) + \tau(Comlang_{ij}) + \\ + \ln\eta(Cultdist_{ij}) + \varepsilon_{ij} \quad (3)$$

In the augmented model, the main variables used are combined with others, to better explain the determinants of trade. For example, dummy variables representing common trade characteristics can be inserted, as in the case of the EU_{ij}, $GATT_{ij}$, and FTA_{ij} variables, which indicate respectively the common membership to the European Union, to the General Agreement on Tariffs and Trade (GATT), or the World Trade Organization (WTO), and finally the common signature of bilateral or multilateral free trade agreements (FTA). Data were obtained from the CEPII database for the years 2001–2015 (2019) and from the WTO database (2019) for the most recent years. As they represent trade agreements or organizations, the sign of their coefficients is generally positive.

Among the socio-cultural variables, widely used in both economic studies (Disdier & Head, 2008) and in sociological studies (Belot & Ederveen, 2012), there are the common official language ($Comlang_{ij}$) and the so-called "cultural distance" ($Cultdist_{ij}$) variables. The first is a dummy variable, derived from the study

conducted by Head (2010) and generally has a positive influence on the development of a commercial relationship between two countries. The second variable concerns the cultural dimensions proposed by Hofstede (2001). The cultural sphere is considered a key element for the economic growth of a nation (Weber, 1947; Zaheer & Zaheer, 1997; Brown & Ulijn, 2004). Hofstede (1991, 2001) has identified different cultural dimensions that contribute to determining national culture.

All of the dimensions used to build the cultural distance index derive from a repeated series of global surveys, starting from 1968. The most recent, and thus the one adopted for the present study are the scores reported in Hofstede et al. (2010). Deriving from sociological studies, a series of questions for each variable have been created, using ordinal scales for the answers. Thus, the questionnaires were administered to a large sample from different countries. During the first round of survey, over 80,000 people were interviewed, controlling the differences due to the different employment or social condition: at now, over 74 countries have been surveyed.

The use of ordinal scales allowed the authors to develop a factorial model, obtaining four different dimensions linked to the cultural differences among countries.

The four dimensions used and recognized are: I) “Power distance”, an indicator of unfairness in relationships and in the justice system, linked for example to the degree of acceptance of the unequal distribution of power by the less powerful members in an institution, or even in the family. II) “Individualism”, which describes the adoption of an individualistic system or collectivist behavior (Kristjánsdóttir et al., 2017). The concepts of individualism and

collectivism are not intended in political, but in social terms: in fact, this factor explores the issues of cohesion in groups, loyalty between members, or individual and egoistic behaviors.

III) “Masculinity”, which includes aspects of competitiveness and success related to gender, where the questionnaire asks about these using items linked to the job sphere like “challenging work”, “advancement in the career”, “cooperation”, or “employment security”. IV) “Uncertainty and avoidance” is the fourth factor, and expresses the preference for situations of certainty and stability (Hofstede et al., 1991). It is linked to three items concerning job stress and nervousness, rule orientation and the intention to stay in the same company to pursue a career.

The index that can be derived from these different cultural dimensions can be used to define a “Cultural distance” coefficient between two different nations. Among the different estimation methods, the most widely used (Kaasa et al., 2016) is the approach proposed by Kogut-Singh (1988) (4):

$$CD_{ij} = \sum_{i=1}^{n} \frac{\left[(I_{ij} - I_{ix})^2 / V_i\right]}{n} \quad (4)$$

where CD_{ij} is the cultural distance index between the two countries i and j, I_i is the i^{th} cultural dimension for the two states, V_i is the variance of the data sample of the cultural dimension considered, and n is the number of cultural dimensions used in the estimation (Kogut & Singh, 1988), equal to 4 in the formulation used for the present study. For example, this methodology has been used for the study of the effect of cultural distance on UK exports

(Kristjánsdóttir et al., 2020) or more generally to establish the relationship between trade and cultural distance (Lankhuizen & de Groot, 2016). The results identify a negative influence on international trade.

The coefficients obtained for continuous covariates are interpreted directly in terms of elasticity, whereas for the dummy variables, the coefficient is interpreted according to the formulation: $(e^{(\beta\ dummy)} - 1) \times 100$ (Baier & Bergstrand, 2007).

The main statistics of the variables employed in the present research are reported in Table 1.

Table 1. Descriptive statistics of the variables used in the study.

Variable	Type	u.m.	Obs	Median	Mean	St. Dev.	Min	Max
$Trade_{ij}$	Contin.	Mn USD	8280	0.0	1.4	6.9	0	142.0
$GDP_{j,\ t-1}$	Contin.	Bn USD	8280	826.5	1915.9	3219.9	7.9	18,707.2
$Dist_{ij}$	Contin.	km	8280	6800.1	6602.3	4220.3	196.9	19,447.4
$Food_j$	Contin.	t	8119	32,131.7	53,289.6	69,706.4	1004.7	440,577.4
$Prod_j$	Contin.	t	8280	32,336.0	52,469.3	81,944.2	471	562,875
$Cultdist_{ij}$	Contin.	-	6297	1.3	1.6	1.1	0.1	5.2
$Comlang_{ij}$	Dummy	-	8280	0	0.1	0.3	0	1
$GATT_{ij}$	Dummy	-	8280	1	0.8	0.4	0	1
EU_{ij}	Dummy	-	8280	0	0.1	0.3	0	1
FTA_{ij}	Dummy	-	8280	0	0.3	0.4	0	1

Econometric analysis was carried out using the statistical processing software STATA (Stata, 2017), version 15.1, adding the "*ppml*" tool to perform the PPML estimation (Santos Silva & Tenreyro, 2006). In order to compare and identify the best performing and statistically consistent methodology, the three

econometric models previously illustrated (OLS, PPML and Heckman) were used.

To verify the adequacy of the econometric models, the heteroscedasticity-robust “Ramsey RESET test” (Ramsey, 1969) was performed by adding an additional regressor, to verify the hypothesis of misspecification (possible non-linearity) and the possible omission of variables in the model.

3.2.3. Data Sample

In order to estimate a realistic model of the international honey trade, the main commercial partners were selected, similar to other econometric studies (Dal Bianco et al., 2016). The selection covered 24 countries: Argentina, Belgium, Brazil, Canada, China, Ethiopia, France, Germany, Hungary, India, Iran, Japan, South Korea, Mexico, Poland, Romania, Russia, Slovenia, Spain, the United Kingdom, Tanzania, Turkey, Ukraine, and the United States (Faostat, 2019; UN Comtrade, 2019) representing over 80% of total exports and approximately 80% of global honey imports and production.

The dataset is in a panel form, with observations that cover a period of 15 years, from 2003 to 2017, for a total of 8280 records. However, for two of the covariates used, i.e., apparent consumption (Food) and cultural distance (CultDist), there are fewer observations, due to the lack of data available in the official databases consulted. The variable $Trade_{ij}$ has a large rate of zero values in the dataset used (5021 of 8280 total observations).

3.3. Results and Discussion

For all models, 6,177 of the 8,280 observations were used, because the combined partial lack of observations for two covariates (apparent consumption and cultural distance) led to the selection of only those records whose explanatory variables were all present.

The comparison of the results obtained by the three models showed significant differences between the estimated coefficients (Table 2). However, the Ramsey RESET test led to the rejection of the OLS and Heckman models, as the alternative hypothesis of model misspecification must be accepted (p-values much lower than 1%). Only the PPML proved to be robust, as it did not reject the null hypothesis, and therefore we will only refer to the latter model in the analysis of the results obtained. The variable $GDP_{i,\,t-1}$ (lagged GDP for the exporter) has been omitted due to the collinearity with the other covariates, so it will not be reported in the table of results. The lagged GDP helped the model to account for heteroscedasticity.

The interpretation of the coefficient obtained for the importing country is significant ($p < 0.01$) and shows the expected positive sign: an elasticity equal to 0.62 means that a 1% increase in GDP (accumulated wealth of the previous year) corresponds to a 0.62% increase in the trade flow. Although the GDP coefficient is generally reported to be close to or higher than 1 (Santos Silva & Tenreyro, 2006), often the effect of a nation's economic dimension may have a smaller influence when analyzing trade of single products, as in the case of specific categories of fish products, which obtained coefficients comparable to those obtained for honey (Natale et al., 2015). Comparable effects have also been obtained by Serrano et al. (2015) for several categories of agro-food products and commodities, in addition to Johnston et al. (2015), who analyzed

trade relations between China and Africa. GDP effects of the same entity have also been highlighted at a disaggregated level with regard to grains and vegetables, as reported by Jayasinghe and Sarker (2008) for the NAFTA market. Moreover, similar values of impact on exports by the economic dimension of trading partners were also highlighted at an aggregate product level, as reported by Balogh and Leitão (2019) for the EU market. Considering this, the influence of the economic dimension of the importers on the honey trade fully reflects the behavior of other raw and processed agro-food products.

The distance between the two partners was statistically significant (elasticity equal to 0.401), despite a lower level of significance ($p < 0.1$): a 1% increase in distance, therefore, leads to a 0.4% decrease in trade flow, similar to what emerged from other studies on different products (Crescimanno et al., 2013; Dal Bianco et al., 2016; Thuong, 2018). The distance between the two partners, used as a proxy for transport costs, therefore has a negative effect on honey trade flows, although this effect is less pronounced than reported in literature (Disdier & Head, 2008), perhaps in relation to the niche characteristics of the honey sector. Moreover, the long shelf-life characteristics of the product (more than 12 months) (Fallico et al., 2009), combined with the lower price that large quantities of honey can achieve on the market, especially for industrial use, may affect the reduced impact of the distance between trading partners in trade flows.

The apparent consumption of the importer has a significant and positive effect on the honey trade: it is one of the strongest effects among those analyzed, with an elasticity of 0.980. This parameter

has an intermediate magnitude compared to other studies, such as for seafood products (Natale et al., 2015), where it has a lower value, or as in the case of distillates in the United States, where consumption has a much greater effect (De Matteis et al., 2019). Honey consumption is characterized by its multiplicity of uses, both in the food and non-food sectors, in many cases established at a traditional level (Miguel et al., 2017; Šedík et al., 2019) which extend the market segments to which this product has access.

Honey consumption is one of the main drivers of honey trade flows and shows an increasing trend at international level, mainly due to population growth and to the growing demand for natural food (García, 1981), especially in Europe and the United States in the last decade, for example (Blanc et al., 2019a; Shahbandeh, 2019).

The importer's domestic supply, as expected, was significant with a negative effect on the volume of imports: the negative elasticity found (−0.603) means that an increase of 1% in domestic production is followed by a decrease of 0.6% in imports, confirming the presence of the so-called "home bias effect" (Dal Bianco et al., 2016; Lombardi et al., 2016).

This phenomenon has been highlighted several times with regard to both agricultural and food products, where differentiation and processing are greater (Ghazalian, 2011), influencing the perception of consumers and companies, or even influencing the application of agricultural policies to protect and promote local production and consumption (Eriksson, 2011).

The impact of the "home bias effect" on food products has also been highlighted by analyzing markets and imports in the USA for such processed food products, as milk, vegetables, or alcoholic

beverages (Lopez et al., 2006; Olper & Raimondi, 2008). Even in the case of wine, a much-studied product from this point of view, it has already been demonstrated how local production can be recognized as an element of competitiveness on the national market in terms of quality and price (Ayuda et al., 2020). Therefore, for honey as well, similar elements that stimulate the consumption of locally produced honey can be gathered.

Regarding the trade variables, the only ones that were found to be significant were the common membership of the EU and participation in GATT or WTO, whereas the presence of free trade agreements or bilateral agreements does not appear to significantly affect trade in honey. The common membership of the European Union and, therefore, of the European single market, has a positive effect, with a coefficient higher than 1.9. The result obtained is in line with the study by Serrano (2015), which showed a fair heterogeneity between the values of this parameter, in relation to the type of product considered. The highlighted positive effect can be easily understood considering that the members of the European single market have homogeneous import regulations and trade standards and that the removal of tariff and non-tariff barriers within the same market strongly encourages intra-EU trade flows (in't Veld, 2019).

Finally, membership of the GATT shows a coefficient higher than 2.7, as also highlighted by the study of (Castillo et al., 2016) and similar to the results of Balogh and Jámbor (2018). Following the same logic, membership of the WTO, or signing of the GATT agreements, has also led to positive and statistically significant

effects on trade flows (Chang & Lee, 2011; Larch et al., 2019), including those of honey at world level.

Concerning the socio-cultural variables, both have the expected sign, but only the common official language shows a statistically significant effect and a coefficient equal to 0.75, which corresponds to an increase of more than 110% of trade. The result is in line with expectations and in accordance with other studies on socio-cultural variables affecting international trade (Castillo et al., 2016; Balogh & Jámbor, 2018).

Finally, the cultural distance investigated by the Kogut-Singh Index (Kogut & Singh, 1988) and considering the four main cultural dimensions developed by Hofstede (2001) does not show any statistically significant effect, contrary to the results of a recent study which identified a significant effect, although a small negative impact (Kristjánsdóttir et al., 2020). However, cultural distance effect may not follow a linear relationship, as suggested by Lankhuizen & de Groot (2016), which in fact reports how the relationship can be non-linear and have a significant effect only when the distance becomes high: the threshold value of this index, in order to observe a significant effect, has been identified as 4.9. This value is present only in 90 observations in the database subject of this study. It should also be considered that for some countries the values of the different cultural dimensions are not available, generating a lack of observations that may lead to a less reliable estimate of this parameter.

Table 2. Estimated gravity models for international honey exports from 2003 to 2017.

	OLS (ln 1 + Trade)	**Heckman (lnTrade)**	**PPML (Trade)**
ln$GDP_{j,\ t-1}$	0.25 ***	0.62 ***	0.62 ***
ln$Dist_{ij}$	−0.14 **	−0.48 ***	−0.41 **
ln$Food_j$	0.01	0.18 ***	0.97 ***
ln$Prod_j$	−0.10 ***	−0.30 ***	−0.59 ***
$Comlang_{ij}$	0.17	0.67 ***	0.79 *
$Cultdist_{ij}$	0.01	0.53 ***	−0.10
$GATT_{ij}$	0.01 ***	0.58 ***	2.74 ***
EU_{ij}	0.43 ***	1.43 ***	1.94 ***
FTA_{ij}	0.10	−0.16	0.33
N. of obs.	6177	6177	6177
Ramsey RESET Test	0.000 ***	0.000 ***	0.67

Levels of statistical significance: * p < 0.1; ** p < 0.05; *** p < 0.01.

3.4. Conclusions

The growing honey production and trade on the world stage has generated interest in studying this phenomenon. The purpose of this paper was to verify the economic and cultural determinants influencing the global trade in honey, using an econometric methodology widely established in the field. To this aim, a panel dataset of observations covering the period from 2003 to 2017 for the world's major honey trading partners was considered, comprising over 80% of the volume of international trade and production.

The main innovation of this study is represented by the sector in which this methodology has been applied: in fact, there are no studies conducted on honey with the structural gravity model methodology and with an international outlook. Furthermore, the

focus on honey has only recently started to intensify again, as a consequence of the renewed interest in quality certifications and food safety standards applicable to it. Despite this, most of the studies focus on consumer and health aspects of the product, thus leaving wide potential for further in-depth study on trade-related aspects. Additionally, media influence together with concerns about the negative health effects of food fraud of this product have raised awareness, firstly of consumers and, secondly, of researchers. Another innovative factor is the study of socio-cultural variables in relation to trade: although this is a long-established relationship, it is still of current interest and rarely applied to niche products. Moreover, similar studies to this study often do not include complex cultural variables, such as those related to cultural dimensions in Hofstede's approach (1991). Despite the non-significance of the variable of cultural influence given by cultural dimensions, the obtained results provide a useful application key to other economic studies for the inclusion of complex cultural variables. The results obtained show that the factors influencing the honey trade do not differ significantly from those obtained for other agro-food products, but the absence of consistent literature on international trade related to this product makes it difficult to establish clearer relationships and make more robust comparisons between different economic and trade scenarios.

This work also has limitations related to the use of only partial data on international trade: although the study analyzed the main honey trading nations, it only represents a starting point for researchers, since it does not represent the whole of existing trade flows. Further studies could extend the data baseline in order to provide an even

more complete overview of global trade flows, including not only the main global honey traders, but also the smaller trading partners on the international scene.

In addition, the lack of data on tariff and non-tariff measures related to honey reduces the considerations that can be made about the trade of this product. With a desirable increased availability of data in the future, particularly for technical barriers to trade (TBT) and sanitary and phytosanitary measures (SPS), which are still extremely heterogeneous across countries, useful measures can be made by policy makers.

Further econometric studies could also be focused, with greater data availability, more specifically on the organic honey market and trade, which has shown a greater aptitude for environmental sustainability in particular, and which is gaining interest for consumers.

This research therefore provides a useful starting point for further in-depth studies in the honey trade sector, also highlighting how niche products, with moderate economic relevance in a country's agri-food basket, fully reflect the market behavior of the major commodities in the agri-food sector.

Moreover, the analysis of these trade flows can act as a useful basis for international organizations monitoring and orienting the market (e.g., the WTO at a global level for goods and services and the International Honey Commission specifically for the honey trade). Further specific applications on the issues that most characterize this trade, such as honey fraud issues or the harmonization of quality standards, will be useful. In order to draft internationally recognized regulations that can contribute to the establishment of

trade flows of products with high quality and traceability standards, other studies will be useful for policy makers. In fact, the lack of consistent literature and regulations on honey quality and trade standards is another potential field of study, in which this type of econometric approach could successfully be applied in the future.

3.5. References

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4. Linking Voluntary Certification Schemes and Trade in Forest Products: A Systematic Approach to Exploring Economic Issues

Liam Pippinato[1*], Teresina Mancuso[1] and Filippo Brun[1]

[1]Department of Agricultural, Forest and Food Sciences (DISAFA), University of Turin, 10095 Grugliasco, Italy.
[*]Correspondence: liam.pippinato@unito.it

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Abstract

Global forest products trade accounts for a significant quota of export flows of the primary sector. Among the various issues related to it, there are the Voluntary Forest Certification Schemes. Despite the fact that their environmental, social and microeconomic effects have been widely studied, the effects on international trade flows remain unclear. Our aim is to conduct a bibliometric and systematic review, highlighting whether there is still research interest in it and which effects have been reported. The findings show there is still a growing interest in the topic, highlighting a general trade barrier effect on flows of certified product, due to the different market behaviour of developed and developing countries and to the high costs of certification, and to the often-absent premium price. Researchers and policy makers could concentrate their future

efforts on solving these issues, perhaps by focusing on the recognition of multi-corporate certification or implementing incentive policies.

Keywords

Bibliometric analysis, forest certifications, forest product, international trade, systematic review, voluntary certifications.

4.1. Introduction

4.1.1. Assessing the trade flows of forest product

On the international scene, forest products play a significant role in trade flows. By focusing on the main reference of wood products (*Harmonized System code* 44, 47 and 48) in the United Nations Comtrade Database, their export rate has been growing steadily since early 2000 (Yin et al., 2020), reaching 344 thousand million of United States (U.S.) dollars in 2019 (United Nations, 2021).

Parallel to the increasing demand of forest products worldwide, two main closely related issues have emerged. Deforestation is one of the main problems occurring, and it seems that the growing deforestation process is also due to export, particularly to countries in Europe which show an increase in sustainable forest management and forest cover surface (Nathan et al., 2018; Pendrill et al., 2019; Serra & Burns, 2020). As a consequence, illegal logging, appears to be the second − and largest − problem worldwide: as reported by the World Bank, the estimated value for 2019 (estimated since it is very difficult to measure) of illegal logging ranged between 30 and 160 thousand millions U.S. $, mainly from

low-income countries (Miranda Montero et al., 2019) located in the Asian region or in the tropical zone (Thompson & Magrath, 2021).
These issues have not gone unnoticed over the years; as a consequence, pressure from stakeholders and businesses has led to the promotion of a range of institutional and private tools accounting for more transparent and sustainable forest management and trade.

4.1.2. Government and legislative actions on forest products trade

Starting with governmental actions, the best known and most effective are those promoted by market-leading countries, such as the United States and the European Union.
Since illegal logging issues have still been significant in recent decades, many regulations have appeared, such as the amendment of the Lacey Act of 1900 during 2008, that now includes a complete list of wood species considered illegal to import (Lacey Act Amendments, 2008). Another relevant regulation is the one promoted by the European Union Forest Law Enforcement, Governance and Trade (FLEGT) initiative (Council Regulation (EC) No 2173/2005, 2005a), which acts as a starter for a series of international initiatives such as the Voluntary Partnership Agreements (VPA) (Council Regulation (EC) No 2173/2005, 2005b) and, after a couple of years, for the structured regulation of forest trade, the EU Regulation N 995/2010, called EU Timber Regulation (EUTR) (Regulation (EU) No 995/2010, 2010).
Focusing on these two well-known legislations, economic analysis has shown a certain lack of effectiveness in reducing illegal logging and promoting traceable trade flows, both on behalf of the US

legislation (Gan et al., 2013; Prestemon, 2015) and for the EUTR (McDermott & Sotirov, 2018), in fact, for the latter, some shortcomings have been highlighted that may affect its effectiveness (Levashova, 2011).

In parallel with these institutional actions to promote a more sustainable pattern on forest trade flows, there has been the emergence of private standards promoted by third-party certification organizations.

4.1.3. The role of Voluntary Forest Certification Schemes

The failed Rio Earth Summit in 1992 served as a starter to the growth of non-governmental actions to prevent illegal logging, and it was the first objective of the Forest Stewardship Council (FSC), which was established in 1993 (FSC Principles and Criteria for Forest Stewardship, 2015). It declared ten principles about laws, management activity, workers' rights, and environmental impact, setting management and trade standards for companies.

After the implementation of FSC scheme and its warm welcome on behalf of key stakeholders, other international schemes emerged, and among them, the Programme for the Endorsement of Forest Certification (PEFC) in 1999 quickly became the second most important certification worldwide (van der Ven & Cashore, 2018). To assess firms' compliance with the scheme's standards, forest products will be tracked through Chain of Custody (CoC) licences.

Voluntary certification memberships have constantly increased over the years and, currently, more than 320 million hectares, particularly in Europe, are certified with PEFC, with more than 12,000 CoCs in force (PEFC, 2020), while FSC represents more than 199 million

certified hectares and over 37,000 CoCs (FSC, 2019). Research highlighted that Northern Hemisphere countries (Kraxner et al., 2017) − particularly market leaders such as U.S. and EU − have widely adopted VFCS, despite developing and tropical countries showing some efficiency issues in adopting them (Serra & Burns, 2020).

The multiple roles of VFCSs are still a current research field, where the social impact on people is widely studied, especially for developing countries (Kalonga & Kulindwa, 2017), exploring the relationships between small and larger companies and trying to explore the benefits for local communities (Tricallotis et al., 2018) and possible medium to long-term spill overs (Lemeilleur et al., 2017).

Other effects of voluntary certifications, on the other hand, remain unclear, such as the effective reduction of the deforestation process (Blackman et al., 2018; van der Ven & Cashore, 2018).

Finally, issues related to social pressure, communication and company image are emerging; the wide adoption of certification requirements, mainly on behalf buyers in developed countries, could turn these voluntary actions into quasi-mandatory ones (Meidinger, 2006; van der Ven & Cashore, 2018).

All these issues related to the effect of VFCSs have given rise to a very active field of research, with relevant economic and social repercussions that will be highlighted in the coming years.

4.1.4. Objective and research questions

Published economic and econometric studies on the international market for certified forest product (CFP) have mainly focused on

characterising its dynamics and determinants (Buongiorno et al., 2017; Lovrić et al., 2018; Yin et al., 2020), or on defining relevant trading partners on the export scene, such as China (Nasrullah et al., 2020), the United States (Sun & Zhang, 2018) or the European Union (Buongiorno, 2015). Moreover, considering the actual role of trade agreements on trade flows (Foster et al., 2011), there is interest in exploring their impact on forest trade performance and dynamics (Buongiorno & Zhu, 2017; Borsky et al., 2018; Mukhopadhyay & Thomassin, 2018).

Noting that VFCSs have been widely explored mainly in terms of their environmental, welfare and management impacts on forests areas, businesses and stakeholders; however, there seems to be some disagreement in the literature on their macroeconomic issues. Hence, there is a need to gather information on this subject, to extrapolate far-reaching considerations and to understand the current challenges for the trade in certified forest products.

Therefore, our objective is to conduct a systematic review of voluntary certification of forest products on trade flows, focusing on an international view and highlighting the main findings from both quantitative and qualitative studies.

In particular, this investigation aims to: I) analyse the studies centred on this trade topic from a bibliometric perspective, thorough bibliometric indices and occurrence network analysis; II) discuss the main findings of the systematically reviewed papers on this topic, extracting useful insights. This systematic approach could answer the following research questions:

1. Is there interest on behalf of the scientific community in the effects and commercial repercussions of Voluntary Forest Certification Schemes?
2. What are the roles and the effects of VFCS on international trade in forest products highlighted in the literature?

This document is structured as follows: I) the methodology section explains the review workflow and bibliometric analysis; II) the results and discuss section provides the bibliometric results of the Scopus-indexed papers, and subsequently illustrate the main characteristics of the reviewed documents and their main findings, discussing them from an international perspective; III) the conclusion sections provide some suggestions and insights for policy makers, trade organisations, stakeholders, Non-Governmental Organizations (NGO) and third-party certification activities, as well as some input for further research on the topic.

4.2. Methodology

4.2.1. Bibliometric and Citation network analysis

To explore the scientific literature on the topic of international trade in forest products and to answer the first research question, a bibliometric analysis was carried out, followed by a citation network analysis.

For this purpose, keywords were identified to construct the search string. The same selection was then used for the systematic literature review.

A series of synonyms were included in the strings, using the appropriate Boolean operators, to avoid the loss of useful papers during database analysis. The selected keywords, classified by research topic into “Trade”, “Forest product” and “Forest certification”, have been reported in Table 1.

Table 1. List of keywords adopted by research topic.

Topic	Keywords
Trade	Trade
	International trade
	Trade flow*
	Export
Forest product	Forest product*
	Timber
	Wood
	Wood product*
Forest certifications	Certification*
	Voluntary certification*
	Forest certification*
	Certification scheme*

A query string was used only on the Scopus database records, similar to the query implemented for the systematic review analysis, but not including the topic of voluntary certification, as follows (1):

(TITLE-ABS-KEY (trade OR "international trade" OR "trade flow*" OR "export") AND TITLE-ABS-KEY ("timber" OR "forest product*" OR "wood product*" OR wood)) (1)

Such analysis, following a similar procedure to that of Poratelli et al. (2020) and Priovashini & Mallick (2022), aims to highlight the publication trend on this topic (and subsequently the research interest in this field of study) and the contribution of different countries.

Subsequently, Co-occurrence Analysis was implemented, following similar systematic review studies (Kamdem et al., 2019; Martinez et al., 2019; Goyal & Kumar, 2021). To obtain the graphical results and bibliometric indices useful to evaluate the research status of these topics, the freely available software named VOSviewer, was used (van Eck & Waltman, 2010). It allows for the visualisation of the network and its strength between different items.

In particular, the decision was made to apply co-occurrence analysis focusing on the network of countries and indexed keywords that emerged from the literature search. Following the structure of the bibliometric analysis carried out by Martinez et al. (2019), the main bibliometric indices used were:

Occurrence value (how many times the keyword is counted).

Total link strength: a measure of link strength: a higher value indicates a strong connection between the two items (van Eck & Waltman, 2017).

Average citations (per country or per keyword): a measure of influence in this research area, since high scientific output is not always linked to relevant influence on the literature (Jin et al., 2018).

Average normalized citations (by country or by keyword): obtained by dividing the total citations by the average citations per year (Jin et al., 2019). This provides a measure of the importance of the item in the research topic.

To avoid unreadable graphic results, we chose to select only countries with a minimum of 5 research papers published on Scopus and keywords appearing at least 10 times in the collected database.

4.2.2. Literature review's systematic approach

We followed a systematic approach to analyse the scientific literature, choosing *a priori* the exclusion criteria that will be applied to the highlighted records.

To make the most accurate, comprehensive, and replicable review, we followed the guidelines proposed by Moher et al. (2009), which are the "Preferred Reporting Items for Systematics Reviews and Meta-Analyses" (PRISMA).

The PRISMA workflow, proposed in 2009 and now updated by the PRISMA 2020 statement (Page et al., 2021), follows a systematic approach consisting of four main phases: I) Identification of the records that will be analysed; II) Screening of papers through the exclusion criteria selected prior to analysis; III) Eligible analysis, through full text reading; IV) An Inclusion phase, where studies that meet the research objectives will be used for critical review analysis.

Identification

We chose the databases and repositories used to explore the literature: Scopus and Web of Science. Moreover, we decided to include time restrictions: the time range goes from 1976, where the number of publications on this topic were at least 10, to December 2020, to include all available studies. The survey was conducted in March 2021.

The keywords used to build the query string were the same as for the bibliometric analysis but, since the systematic review allows the second research question to be answered, another topic was added, which included the keywords of the Forest certifications, as can be seen in Table 1.

Finally, the query string was built as follows (2):

(TITLE-ABS-KEY (trade OR "international trade" OR "trade flow*" OR export) AND TITLE-ABS-KEY (timber OR "forest product*" OR "wood product*" OR wood) AND TITLE-ABS-KEY ("certification*" OR "voluntary certification*" OR "forest certification*" OR "certification scheme*")) (2)

Screening

Following the PRISMA statement, the exclusion criteria were selected before the identification phase, and included:

- Removal of duplicates, due to the double selection of the same record on different repositories.
- Removal of papers written not in English, to avoid publication bias (Morrison et al., 2012; Siddaway et al., 2019).
- Removal of unrelated records after reading the title and the abstract.

Eligibility phase

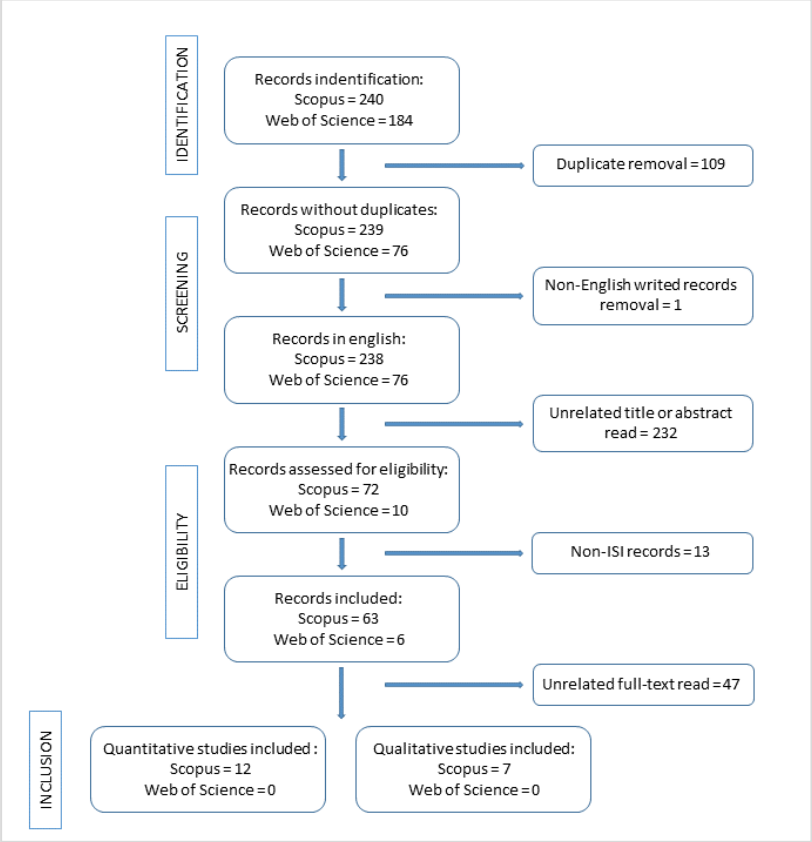
During this phase, the removal of all non-indexed works (books, chapters, proceedings, reports) led to a pool of articles eligible for inclusion in the critical analysis.

Inclusion phase

This is the last stage, all eligible full-text articles were read to highlight whether there was any research that did not meet the objectives and did not answer the research questions.

The resulting workflow diagram is proposed in Figure 1, following the suggested structure of Page et al. (2021).

Figure 1. Workflow diagram structured for the systematic review.



The final pool of papers included for the systematic review was then thoroughly read.

Since this field of studies also includes qualitative studies − which do not present statistical analyses or econometric models but mainly policy considerations or direct surveys with interesting results − we decided to include this kind of research as well, to obtain the most comprehensive overview of the effect of voluntary certification schemes on international trade in the forest products.

Moreover, adapting the scheme proposed by Tranfield et al. (2003) and Michel-Villarreal et al. (2019) to our workflow, the analysis of results was divided in two sections. The first explores quantitative studies that use a statistical methodology to highlight the effect of certifications on trade flows. The second one provides an overview of the main results obtained from qualitative studies (such as questionnaire surveys), exploring the issues emerging from the critical analyses and direct investigations reported. This dual classification is based on the conceptual work of Cleland (2015), who investigated the different characteristics of quantitative and qualitative research. Indeed, the former is more objective, requiring in most of cases experimental designs to test hypotheses by measuring phenomena. On the other hand, qualitative research is more subjective and often based on people's perception of reality and situations, but at the same time allowing a depth of analysis possible in purely numerical studies.

4.3. Results and discussions

4.3.1. Bibliometric and Co-occurrence Analysis

4.3.1.1. Bibliometric results

As first evidence, no other reviews focusing on the same topic were found, so all studies were included in the workflow of the systematic review.

Starting with the first query string on international trade in forest products, a total of 7581 documents, ranging from 1976 to 2020, were found in the Scopus repository. As can be seen in Figure 2, there is a positive trend in the scientific production on this topic, starting with about 10 studies in 1976 and reaching over 400 publications during 2020. A significant increase in scientific production − and therefore in the research interest − is shown after 1996. It is probably due to the establishment of one of the world's leading voluntary forest certifications, the FSC, in 1993. Moreover, after the introduction of PEFC in 1999 the publication trend reached more than 200 studies and increased steadily over the last two decades.

Regarding the country distribution of total publications (Figure 3), it becomes clear that North America has the greatest number of studies on the topic, followed by the European Union and then by Asia.

Figure 2. Publication trend of the topic “Trade in forest products” on Scopus (1976-2020, number of documents).

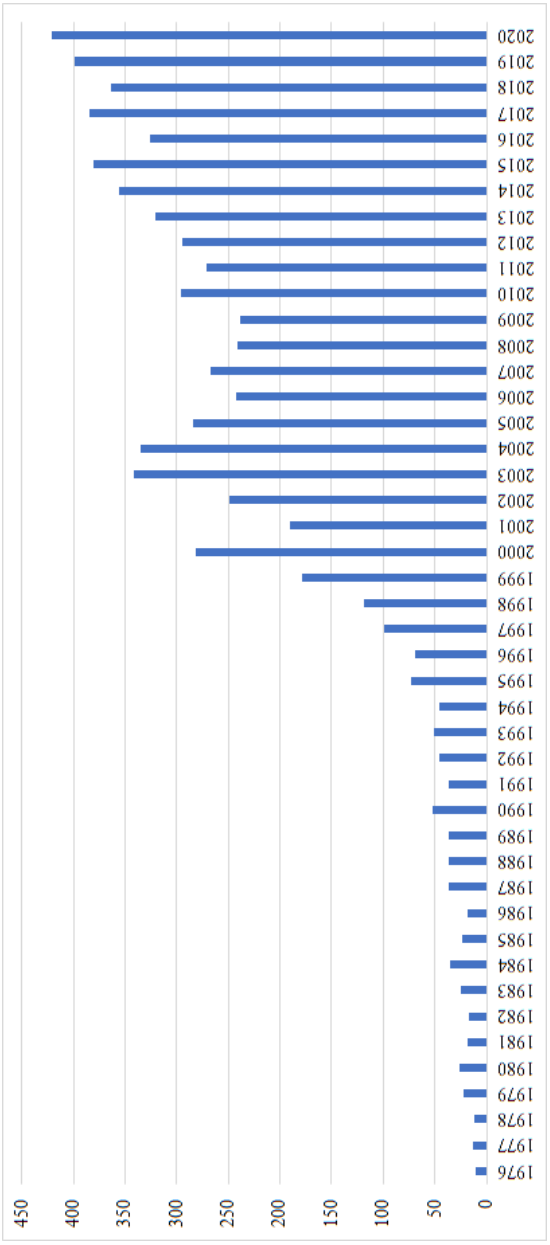
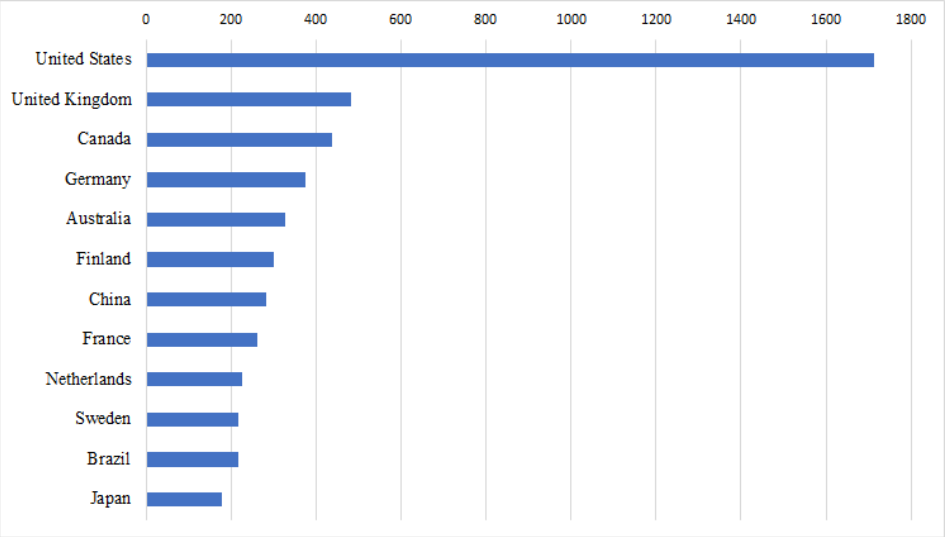


Figure 3. Total publications (by country of origin) for the topic "Trade in forest products", number of documents.



A similar trend can be identified using the second query string, focusing on VFCSs (Figure 4), where 240 results were found on Scopus, ranging from 1995 to 2020. Again, North American countries have the highest number of publications on this trend, but the quota from Asian countries is comparable to the sum of EU countries publishing the most. In terms of research trends and policy implications, Asian timber trade and certification schemes are a strongly connected topic since, as can be seen in the following systematic review, illegal logging and trade are two of the main issues affecting forest production and markets in Asian countries (Curtin, 2007). Intuitively, countries most interested in exploring these research issues in depth are often those that show some of the highest numbers of Chain of Custody in force or hectares of certified forests, for both FSC and PEFC schemes (FSC, 2020; PEFC, 2021); in most cases, these are also the same countries with

the highest income from timber exports (e.g., China, Canada, Germany, or United States) (United Nations, 2021).

The analysis was performed on the results obtained from the second query string, which focused on the topic of international timber trade related to the issue of voluntary certifications and was divided into a country network analysis and a co-occurrence keyword analysis.

4.3.1.2. Co-occurrence Analysis results

The analysis of countries network allows us to observe the connections, in terms of mutual citations, between countries (Figure 5). The larger the connection, the stronger the link between items (Martinez et al., 2019).

Based on the figure, we can assume that the main research contributions come from Europe, North America, and Asia. Moreover, the strongest connections are between Germany and the U.S.A., the United Kingdom and the U.S.A., China and the U.S.A., Indonesia and the U.S.A., and Germany and Indonesia. The key role for the U.S.A. as a network node is beyond doubt, as is the strong research connection between European countries. From this viewpoint, countries like Indonesia and China act as further research nodes.

Figure 4. Total publications (by country of origin) for the topic "Trade in certified forest products", (number of documents).

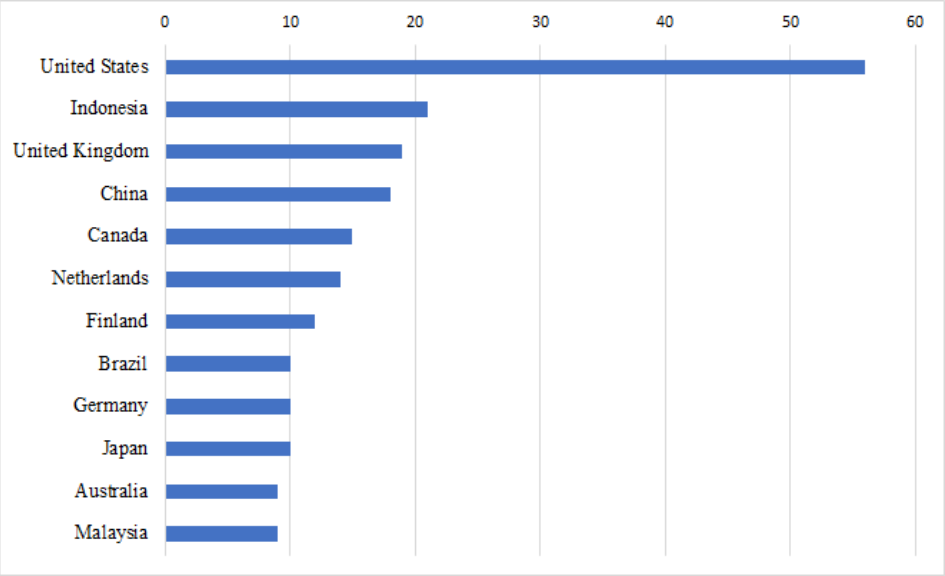
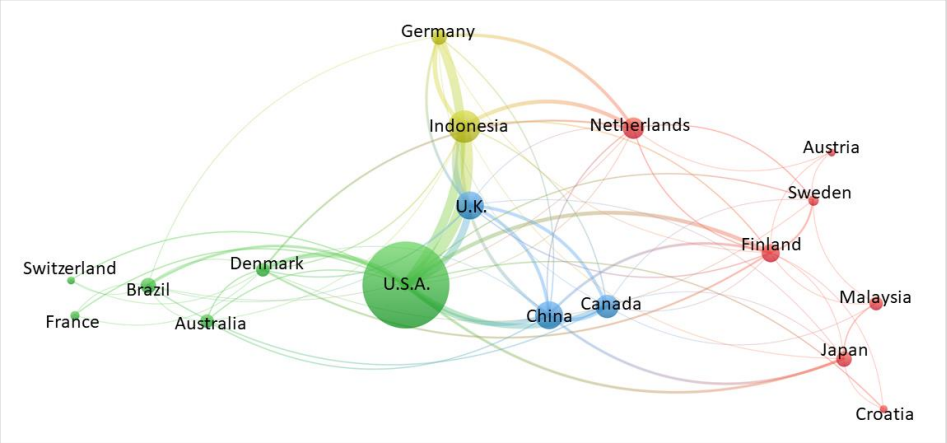


Figure 5. Network of linked countries for the topic "Trade in forest products and voluntary certification"



Considering the bibliometric indices (Annex 1), the U.S.A., Indonesia, China, and the United Kingdom are the countries that

publish the most, even when considering the total strength of the links. However, the high number of publications does not correlate with an equally higher research influence, as shown by the average citation and the average normalized citations indexes. These two values show that other countries, mainly European nations, have the highest scores, and thus have more influence and relevance on the topic of interest.

Focusing on the co-occurrence analysis of the keywords, Figure 6 shows the connections between the search topics highlighted during the literature search. A kind of clustering of keywords by topics can be seen from the image. The VOSViewer results of the cluster distribution are shown in Annex 2, as well as the bibliometric indexes obtained.

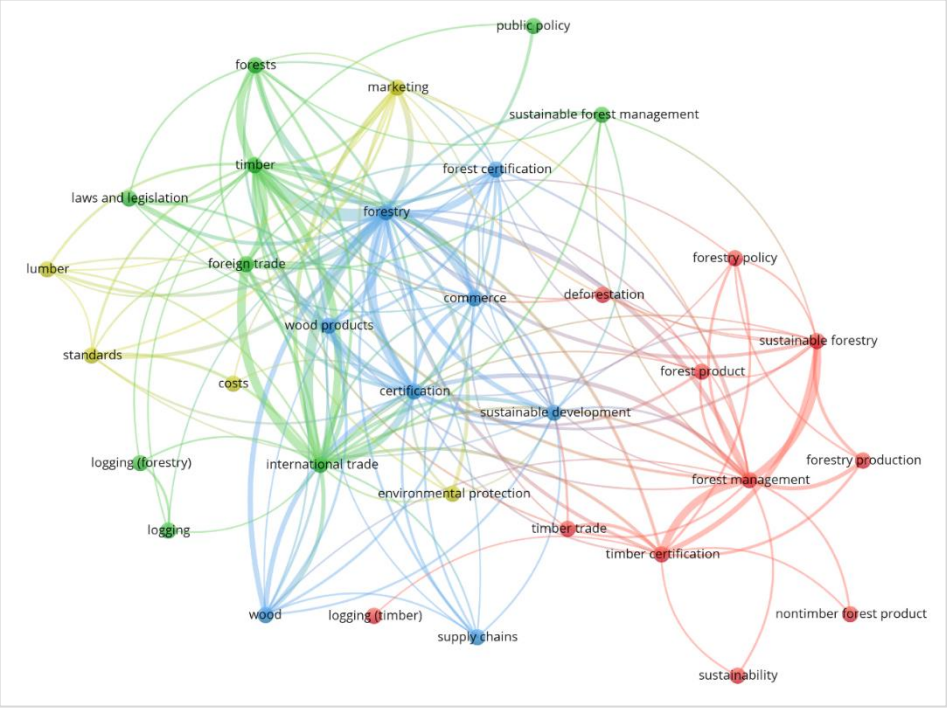
The nodal roles are resolved by the keywords “Forestry”, “Timber”, “International trade” and “Certification”, which also show the highest total link strength value and act as a connection between the four clusters formed. Thus, the four keywords above are the most frequently used in the literature reviewed. By exploring the various keywords, some synonyms emerged from the network: in particular, *lumber* and *timber*, following the Cambridge dictionary definitions, describe both wood ore trees used as a building material. The noun *wood*, on the other hand, is often used as another synonym, but is a more general term that includes, beside the building use, also fuel and “making things” purposes (McIntosh, 2013).

Nevertheless, the average normalized citation index shows that the most relevant keywords in the research field are “Sustainability”, “Forest production”, “Forest management”, “Forest product” and

“Timber trade”, which is also confirmed by the average citation score.

Finally, analysing the four clusters formed (shown in Figure 6 by different colours and categorised in Annex 2), the first group (red colour) includes the largest number of keywords and topics, ranging from the concept of sustainability to more specific topics, such as deforestation or timber trade. The second cluster (green) is more focused on international trade, mainly related to policy and legislation themes.

Figure 6. Network of keywords related to the topic “Trade in forest products and voluntary certification”.



The third group (blue) is more focused on certification issues related to the various aspects of the forest supply chain, from production to marketing. Finally, the fourth cluster (yellow) is more economically oriented, focusing on marketing aspects, as well as market standards and production costs.

The bibliometric approach adopted allows us to answer the first research question. There is currently research interest in the effect of the VFCSs on trade flows of forest products and, after a decade of moderate stability, it is still growing. Its topics range from economic and market aspects, such as costs and price premium, to legislation, illegality, and sustainability issues, with growing interest worldwide, particularly from tropical and Asian countries.

4.3.2. Systematic review results

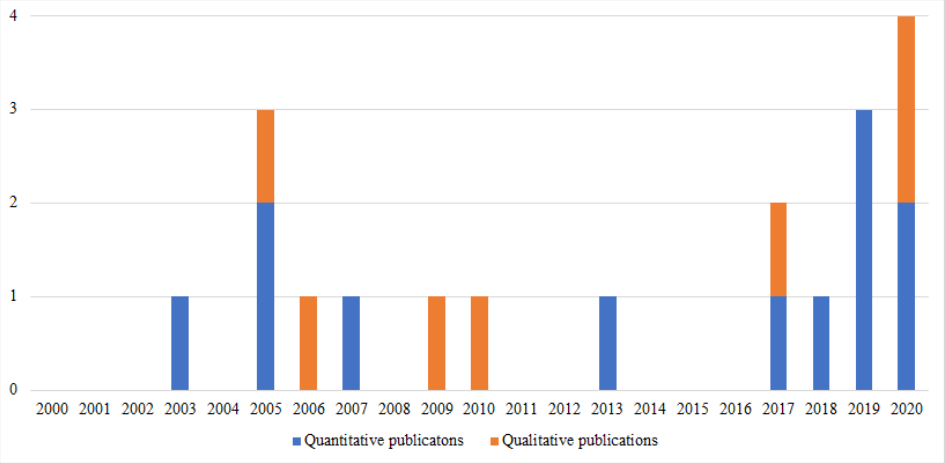
Thorough the systematic collection of research in the Scopus and Web of Science repositories, a total of 424 articles were selected, ranging from 1995 to 2020. Following the *a priori*-constructed PRISMA systematic procedure (Figure 1), the selection and eligibility analysis was conducted on a total of 19 indexed papers: 12 of them were classified as quantitative studies, as they involved statistical or experimental approaches. The other 7 were classified as qualitative, since they were critical or discursive studies, or in some cases involved a stakeholder questionnaire survey. The full references of the selected studies are available in Annex 3 at the end of this document.

By analysing the publication trend of the included research, as can be seen in Figure 7, it is possible to see an increase in scientific production between 2005 and 2007; after that, few studies were

published until 2017, when there was yet another positive trend, which continues today.

An explanation for the 2005-2007 spike in the research trend could be that, during those years, major changes in international market dynamics took place. The EU, which is one of the largest global importer of wood products, adopted the FLEGT Action Plan (Council Regulation (EC) No 2173/2005, 2005a; Moral-Pajares et al., 2020), followed within a couple of years by the authorisation to enable VPAs with non-EU countries (Council Regulation (EC) No 2173/2005, 2005b; Commission Regulation (EC) No 1024/2008, 2008) and the EU Timber Regulation (Regulation (EU) No 995/2010, 2010).

Figure 7. Publication trend of selected studies from the systematic review regarding the topic “Trade in forest product and voluntary certification”



This has led to substantial changes in trade dynamics; consequently, researchers have focused on these and the interaction effect with Voluntary Certification Schemes.

Research after 2017 has been more quantitative, analysing the various effects of VFCSs with empirical approaches.

4.3.3. Quantitative studies overview

The overview of the quantitative studies (Table 2) highlighted that most of them attempted their statistical analysis with an international breadth, selecting countries that account for the majority of forest products trade flows [1], [2], [4] or accounting for countries with a relevant role in international trade, as in the case of EU members [6], [8], the U.S.A. or Canada [12] (Sun & Zhang, 2018; United Nations, 2021). Other studies have followed a sample grouping approach, analysing aggregated groups of countries, as in the case of the Global Trade Analysis Project (GTAP) [10] (Hertel, 2000) or, more simply, grouping by continents [7].

Table 2. Different methodologies applied to evaluate VFCS's effect on forest products trade.

Range	Gravity Model	Partial/ General Equilibrium Model	Generalized Linear Model	Stochastic Actor-Oriented Model	Inferential stat.	Logistic regress.
International	[1], [2], [4]	[3], [7], [8], [10]		[6]		[12]
National		[3]	[5]		[9], [11]	

When focusing on country studies, it becomes clear that all are oriented towards the analysis of exports from Asian countries, such as China [3] and Malaysia [5], [9] or from other developing countries (United Nations, 2020) like Bolivia [11].

In this case, the results are interesting for several reasons: firstly, the timber trade from Asian or developing countries is the most susceptible to the effect of agreements, regulations or certifications (Chen et al., 2020); secondly, a significant share of timber comes from these regions, and does certified timber; lastly, the major issues pertaining to the implementation of VFCSs occur in developing countries or where illegal logging covers a significant quota of the total traded.

Focusing on the methodological approach, the analysed studies adopted a variety of statistical tools to explore the topic of interest (Table 2).

Works [1], [2] and [4] adopted the widely known gravity model of trade. First proposed in the 1960s (Tinbergen, 1963), and referring to the Ricardian model (WTO, 2012), this model has been upgraded, implementing new approaches, like those proposed by Anderson & Van Wincoop (2003), and using different data distributions to account for the main issues of this tool, like heteroskedasticity (Baldwin & Taglioni, 2006). In general terms, the gravity model allows to highlight the main determinants of trade flows and their effect size in terms of elasticity, through the use of the logarithmic form (WTO, 2012). It is a model used for many economic and social topics, ranging from agricultural products

(Pippinato et al., 2020) and their trade standards (Fiankor et al., 2020), to migration analysis (Karemera et al., 2000).

With regard to [3], [7], [8] and [10], these refer to the linear regression approach, following direct approaches using Ordinary Least Square (OLS) regression or, in most cases, exploring the topic using a partial or general equilibrium model. In particular, the latter is interesting, as it includes a global perspective and incorporates other markets and economic sectors in the analysis (Gilbert et al., 2018; Li & Whalley, 2021), starting from the principle that they have repercussions on the analysed market (Levin, 2006). With similar purposes, the Generalized Linear Model allows for the implementation of different distributions, like the Poisson or the binomial distribution (McCullagh & Nelder, 2019), as in the case of the reviewed study [5].

An innovative approach was then proposed by [6], using the Stochastic Actor-Oriented Model (Snijders et al., 2010) and analysing the trade flows of forest products as a network analysis and highlighting their structure and development (de Andrade & Rêgo, 2018).

Paper [9] and [11] address the topic using inferential statistic and group comparison, using two-way Analysis of Variance (ANOVA) or the F-test for significance.

Finally, [12] explores forest products trade and VFCS using logistic regression due to the original objective that will be discussed in the next section, highlighting, through this method, the probability that a particular situation may occurs.

Concerning the focus of the quantitative studies explored, as reported in Table 3, most of them with an international breadth focused on the general effect of VFCS implementation on trade flows, highlighting trade promotion, restrictions, or ambiguities [7]. On the other hand, most national studies have focused on the more specific topic of price premium and the issue of VFCS costs linked to trade promotion or disincentive.

In particular, [1], [2], [4] and [10] are the most generalist on the topic, highlighting whether the various CoCs in force promote or discourage forest exports. Paper [6] explores global trade flows and has included the estimation of the effect of Voluntary certifications on the forest trade network. [7] seeks to explore issues related to the implementation of Green Public Procurement (GPP) at the global level by evaluating whether certified exports and international trade market have been enhanced.

Only one study explored the topic from a completely different perspective: [12] analysed how export market destinations of certified wood products aim to further promote or discourage the adoption of certification by companies.

Among the national studies, the most researched topic is the price premium and the effect of VFCS costs on the promotion or disincentive of forest products exports; in particular, [3] focuses on the price premium of Chinese exports, while [9] and [11] provide insights into the price performance of Malaysian and Bolivian forest product exports, respectively.

Finally, [5] is the only study that represents the general perspective of the effect of CoCs, in this case, Malaysian timber exports.

Table 3. Specific topic of analysis of selected quantitative and qualitative studies on certified forest product trade.

Range of investigation	Trade promotion/trade barrier effect	Price premium and VFCS' costs	Firms' VFCS adoption
Quantitative studies			
International	[1], [2], [4], [6], [7], [8], [10]	[3], [10]	[12]
National	[5]	[3], [9], [11]	
Qualitative studies			
International	[14], [18]	[15]	
National	[13], [16], [17], 19]	[13], [19]	

As the studies were conducted on different scales, on different research topics and with diverse econometric or statistical approaches, the values obtained are not comparable with one another; therefore, the discussion, while referring to the empirical results, will focus mainly on the effect size and significance of the results. The effect size of each quantitative paper is reported in the Table 4 below.

It should be noted that, although the methodological approach is correct, the parameter estimates in [5] on the effect of CoC certificates on Malaysian forest exports have a negative sign, despite having a value close to 0, so the relationship between the two terms is negative.

Similarly, most studies report a negative effect of VFCS on trade flows of forest products, while only three records report a trade promotion effect.

In particular, it should be mentioned that [4] and [6] focus on a very general and comprehensive view of trade flows, without aiming at particular economies or geographical regions. [6] also provides interesting insight into the two different certifications analysed, where FSC promotes the establishment of export partnerships and PEFC, on the other hand, promotes import relations.

The study [2] shows a general positive impact on global trade flows of the VFCS; however, when focusing on trade flows between different combinations of trading partners using the economic classification of Developed and Developing countries provided by the United Nations (United Nations, 2020), there are many differences. More specifically, the study found that export competitiveness is improved by the number of certified hectares in the exporting countries; however, when considering an increase in certification in importing countries, there is a trade barrier effect that enhances intra-national market instead of international flows. This is particularly significant when this happens to the exporting developing countries.

This trade decline is still confirmed by [7], which showed that in a global scenario where certified forest products are more required for Green Public Procurement, CoCs promote internal production, enhancing domestic competitiveness and thus strongly reducing international exports, mainly from developing or poorer countries. In addition, [8] − with its price elasticity analysis − showed the substitution effect of imported certified wood with domestic wood (in this case related to ambiguity issues). Paper [10], which clearly links trade promotion and price issues, points out that despite the increase in market price due to the implementation of certifications,

tropical and Asian trade balances in particular have deteriorated, favouring, intra-national or intra-Union trade in forest products; this is due to the high cost of certifications not being fully compensated by price premiums.

Linking the issue of trade promotion/barrier and the second research topic, there is disagreement on the price premium and related cost of VFCS and their effect on exports. When analysed in more detail, the two studies that clearly showed a positive effect on export performance are [9] and [11], instead of [3] and [10], which reported costs issues and too low-perceived premium prices. In any case, the latter two studies follow an international perspective, and their methodologies give a more robust result, whereas [9] and [11] uses inferential statistics (with less accurate and robust results) on export price data from a national perspective, in this case Malaysian and Bolivian. Following the objective of our review process, the most reliable effects are those provided by [3] and [10]. Therefore, the most likely effect is the negative one.

Finally, the effect on the adoption of VFCSs on behalf of companies due to an increase in certified exports was only analysed for the U.S.A., Canadian and German markets. The effect size highlighted by the study [12] is positive; however, considering that the study is quite old and that it counts only developed and leading forest markets, it is clear that the trade of certified forest products follows different dynamics worldwide.

Table 4. Main effect highlighted by the quantitative and qualitative studies' analysis*

Effect	*Quantitative studies*												*Qualitative studies*						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Trade promotion/ barrier	ns	+ / –		+	–	+	–	–		–			+			–	–	–	+
Price premium and VFCS' costs			–						+	–	+		–		–				–
Firms' VFCS adoption												+							

*ns = not significant; + means a positive effect highlighted from the study, whereas – means that a negative effect has been identified.

4.3.4. Qualitative studies overview

Our work allows us to say that it is more difficult to obtain wide-ranging results from qualitative studies.

In fact, there is a tendency to conduct these studies from a national perspective (Table 3). Most qualitative papers focus on Asian or tropical countries, for example [15], which follows an international view but concentrates mainly on Asia. In addition, most of the national focused articles are on Asian market, particularly Indonesian [13] and Malaysian [16], [17]. Only one country-level study focuses on a developed country and market leader, which is the United States [19].

Confirming the findings on quantitative studies, our topic seems to be relevant especially for developing countries, in particular for those in Southeast Asia.

Furthermore, there are two studies that do not explore specific trade flows, but are more generalist, providing some research trends on the topic [14] or, as in the case of [18], a general overview of the market situation for Certified Forest Products. Considering this, and despite the fact that the critical review approved these two studies, they do not provide further insight on the topic, so they will not be discussed further.

Qualitative studies were conducted through different approaches, ranging from questionnaires to stakeholders [13] or postal surveys to producers [15], [19], and state-of-the-art analysis of trade performance [16], [17]. No statistical analysis was applied, so the results may lead to general considerations on the topic, but not to empirical parameter estimates (Table 4).

From the main considerations analysed, there is a negative perception on the effect of VFCS on trade, particularly focusing on the issue of price premium and costs. Across these studies, most of the respondents declared no price premium or too high costs to certify their production [13], [15], [16], leading to a reduction of competitiveness or, in some cases, forcing the market to certify [17] despite the unprofitable situation. This is a very clear result that makes us reflect on the deep meaning of certification which, as a market tool, is based on the increase of demand for differentiated products by conscious consumers; therefore, the system works only if a premium price is established within a WIN-WIN perspective. Evidently, this result is far from being fully achieved on an international scale and the consequences are reflected in trade.

Once again, in the only study focusing on a developed and market-leading country (once again, the U.S.A.), the survey found that these certifications promote trade, but only to other leading or developed countries, as in the case of the U.K., Germany or Japan. Despite this apparent market-enhancing advantage, producers declared some difficulties in dealing with the inconsistent price premiums received.

4.3.5. Main evidence about VFCS and forest products trade flows

Analysing what was obtained from the systematic review, it is clear that there is a kind of dichotomous behaviour and perception about VFCS.

While trade tariffs around the world are gradually decreasing due to trade liberalisation (Cipollina & Salvatici, 2020), although they still play a significant role, Non-Tariffs Measures (NTMs) are replacing

them (Guan & Ip Ping Sheong, 2019; Grübler & Reiter, 2021). NTMs include trade standards, and there is evidence of a policy substitution effect between tariff measures and standards, at least when the cost to implement the standard is low (Beverelli et al., 2014). This is not the case of voluntary forest certifications, since evidence suggests that despite being voluntary, market demand, mainly from developed countries, has led them to be a quasi-mandatory (Stringer, 2006; Islam & Siwar, 2010) market tool. Participating in forest certification implies an increase in costs (Schwarzbauer & Rametsteiner, 2001; Guan & Ip Ping Sheong, 2019), and evidence suggests that these costs are, almost at present, too high to be compensated by the premium price (Brusselaers et al., 2017; Astana et al., 2020).

In this regard, it appears that Developed countries (United Nations, 2020) could improve their demand for and production of certified wood, under a voluntary certification scheme, but the increasing price for this product tends to create a strong trade barrier to other countries that does not take into account these high costs (Brusselaers et al., 2017), favouring intra-national trade (Gan, 2005). This phenomenon is consistent particularly for developing countries and, by extension, for ones in the Southern Hemisphere (Carlson & Palmer, 2016).

Despite the intent of forest certifications to prevent illegal logging (Thompson & Magrath, 2021) and improving sustainable management (van der Ven & Cashore, 2018), aiming to lead commercial competitiveness, the trade barrier effect is too consistent (Chen et al., 2020), particularly for small scale producers

(Midgley et al., 2017), favouring home market and trade diversion (Giurca et al., 2013).

Of particular interest is also the phenomenon highlighted by Giurca et al. (2013), who reported that ambiguity in the understanding of these multiple certifications could lead to two different consequences: trade substitution with surrogates and, more interestingly, trade diversion. In other words, as already highlighted for agricultural standards (Baylis et al., 2011), the trade reflection of the product may lead exporting countries to seek destination markets with less stringent regulations (Giurca et al., 2013), thus creating multiple isolate markets.

4.4. Conclusions

The market of forest products plays a major role on the international scene, especially for developing countries. In this context, many countries have had to deal with the growing phenomenon of illegal logging and trading in recent years. Their main actions are the result of the promotion of specific regulations on management, quality, and traceability standards for forest products, such as the Lacey Act, or the relatively recent EUTR. Parallel to this, voluntary certifications for forest products have increased in recent decades. Over time, certified forest products have grown from an initial niche market to a significant share of the international scene. FSC and PEFC, in particular, have become the best known and most adopted standards. Moreover, many countries have used their principles and criteria to build their own forest legislation.

Despite their role to improve sustainable management and more transparent production processes, and their undoubted role in reducing illegal logging, we can state that the effectiveness of voluntary certifications from an international trade perspective remained unclear.

This systematic review sought to explore the varied evidence in scientific literature on their role in the context of trade flow, highlighting: 1) whether there is still scientific interest on the topic, despite the fact that voluntary certifications have been well studied for almost two decades; 2) what the roles and the magnitude of the effects provided by voluntary certifications on trade flows of forest products are.

Our results suggest that, at present, scientific interest in the topic is steadily growing, particularly focusing on the worrying role of the quasi-trade barrier resolved by voluntary certifications.

Moreover, many studies come from developing countries, and in particular from the Asian region. This area accounts for a significant share of the total forest products traded, and the role of certification is gradually increasing in these countries.

Regarding the second research question, the systematic review highlighted some economic issues: although the adoption of certifications tends to improve export competitiveness, the high cost required to certify and manage forest surfaces and products and the too low premium price granted by buyers lead to a deterioration of the export capacity of many countries. Moreover, in most studies, there is evidence of a decrease in the trade effectiveness of forest certification, instead of the growing intra-national trade, related to the home-effect. Another relevant issue is the ambiguity of

companies in fully understanding certification requirements: this has also led to trade diversion effects, particularly, again, for developing countries that prefer to trade with countries with less stringent requirements for forest standards.

In our opinion, there are clear signs that VFCS tend to promote two different trade behaviours worldwide: developed countries promote and require certified wood to account for the sustainability and social issues, while developing countries find it difficult to profitably implement these standards.

Two main suggestions emerge from our findings, which may be useful for policy makers, government, and third-party certification organisations but also helpful in building further scientific studies about the topic:

I. the growing confusion about the world of voluntary certification schemes and parallel mandatory regulation systems can be resolved by establishing mutual recognition actions between them. One example of this process could be the endorsement from the PEFC scheme to the Malaysian Timber Certification Scheme in 2009. Indeed, academicians may also be interested in exploring and developing international systems or regulations that bring together forest certification and timber legality systems.

II. Difficulties in accounting for forest export requirements, including VFCS, such as insufficient price premium, problems in accessing the certified market competitively, and the high costs of administering and maintaining forest certification requirements, tend to isolate and perhaps eliminate developing countries from the international market

for certified forest products. New government policies or subsidies could help solve the cost issue and co-operative initiatives could help reduce costs particularly for small producers, who are the most prone to these difficulties.

Connecting to the second suggestion, in addition to national legislations that could help developing countries' businesses, international organizations and NGOs could act in this sense, helping to communicate instances from developing countries about certification issues to market leading countries, promoting international co-operation and, moreover, trying to help companies front the costs.

Research trends are also shifting towards this topic, trying to highlight and measure how these actions could improve, or restrain, the international trade of certified forest products.

4.5. Annex

Annex 1. Co-occurrence analysis of countries doing research in the topic “Trade in forest products and voluntary certification” (by total citations).

Country	Publications (n)	Total citations	Total link strenght	Avg. citations	Avg. norm. citations
U.S.A.	56	1479	89	26	1,64
Netherlands	14	446	24	32	2,11
Australia	9	377	8	42	2,17
Austria	5	346	3	69	3,31
Finland	12	340	28	28	1,61
Denmark	9	313	24	35	1,71
United Kingdom	18	301	41	17	1,89
Indonesia	21	283	52	13	1,26
Sweden	7	276	11	39	2,42
Germany	10	231	35	23	1,87
Canada	15	212	28	14	1,12
France	6	175	4	29	2,00
China	18	152	38	8	0,76
Switzerland	5	137	4	27	1,77
Japan	10	127	15	13	1,07
Brazil	10	117	13	12	0,60
Malaysia	9	88	5	10	0,45
Croatia	5	26	4	5	0,46

Annex 2. Co-occurrence analysis of the keywords related to the topic "Trade in forest product and voluntary certification" (by Occurrence).

Keyword	Total strength link	Occurrence	Avg. citations	Avg. norm. citations	Cluster
Forestry	412	80	14	0,78	3
International trade	296	60	13	1,05	2
Timber	292	55	9	0,80	2
Certification	277	53	19	1,21	3
Forest management	220	48	22	1,27	1
Timber certification	183	48	18	1,12	1
Wood	139	32	13	0,82	3
Commerce	155	30	13	1,09	3
Wood products	157	30	8	0,83	3
Sustainable forestry	148	29	16	1,03	1
Foreign trade	179	29	7	0,65	2
Marketing	139	29	12	0,77	4
Forests	155	27	8	0,73	2
Forest certification	153	25	11	0,68	3
Sustainable development	138	25	11	0,93	3
Timber trade	90	19	22	1,21	1
Forest product	85	17	22	1,23	1
Forest production	67	17	16	1,27	1
Environmental protection	83	17	21	1,13	4
Sustainability	41	16	38	2,31	1
Laws and legislation	92	16	24	1,07	2
Standards	97	15	10	0,71	4
Deforestation	60	14	16	1,42	1
Lumber	73	14	7	0,42	4
Forest policy	78	13	23	1,41	1
Supply chains	78	13	11	1,28	3
Logging (forestry)	61	11	8	0,80	2
Sust. forest management	88	11	16	0,77	2
Logging (timber)	49	10	15	0,89	1
Nontimber forest product	33	10	19	1,53	1
Logging	58	10	13	0,79	2
Public policy	67	10	9	0,30	2
Costs	61	10	7	1,08	4

Annex 3. Full reference and corresponding ID of the studies compliant with the review criteria

ID	Full reference
	Quantitative studies
[1]	Moral-Pajares, E., Martínez-Alcalá, C., Gallego-Valero, L., Caviedes-Conde, Á. A. (2020). Transparency Index of the Supplying Countries' Institutions and Tree Cover Loss: Determining Factors of EU Timber Imports? *Forests*, 11(9), 1009.
[2]	Chen, J., Wang, L., Li, L., Magalhães, J., Song, W., Lu, W., Xiong, L., Chang, W.Y., Sun, Y. (2020). Effect of Forest Certification on International Trade in Forest Products. *Forests*, 11(12), 1270.
[3]	Guan, Z., Ip Ping Sheong, J. K. F. (2019A). The restricting effects of forest certification on the international trade of wood products. *Journal of Sustainable Forestry*, 38(8), 809-826.
[4]	Guan, Z., Xu, Y., Sheong, J. I. P. (2019B). The impact of application of FSC Chain of Custody certification on global wood products trade. *European Journal of Wood and Wood Products*, 77(4), 633-643.
[5]	Saadun, N., Khamurudin, M. N., Azhar, B., Omar, H., Hariz, M. H. (2019). Export Performance of Tropical Timber Products Certified by The Malaysian Timber Certification Scheme. *Journal Of Sustainability Science And Management*, 14(5), 115-127.
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[7]	Brusselaers, J., Van Huylenbroeck, G., Buysse, J. (2017). Green public procurement of certified wood: spatial leverage effect and welfare implications. *Ecological Economics*, 135, 91-102.
[8]	Giurca, A., Jonsson, R., Rinaldi, F., Priyadi, H. (2013). Ambiguity in timber trade regarding efforts to combat illegal logging: potential impacts on trade between South-East Asia and Europe. *Forests*, 4(4), 730-750.
[9]	Kollert, W., Lagan, P. (2007). Do certified tropical logs fetch a market premium? A comparative price analysis from Sabah, Malaysia. *Forest Policy and Economics*, 9(7), 862-868.
[10]	Gan, J. (2005). Forest certification costs and global forest product markets and trade: a general equilibrium analysis. *Canadian Journal of Forest Research*, 35(7), 1731-1743.
[11]	Nebel, G., Quevedo, L., Jacobsen, J. B., Helles, F. (2005). Development and economic significance of forest certification: the case of FSC in Bolivia. *Forest policy and Economics*, 7(2), 175-186.

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Qualitative studies

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5. General Conclusions

Agro-forestry sector plays a non-negligible role on the international trade scene, with over 2,100 billion dollars globally (UNECE, 2021; WTO, 2021). As its market share is constantly increasing, academicians and institutions pay attention to the topic, particularly in the case of developing countries, which are steadily growing in their high-value exports and, thereby, their export performance (Smith & Glauber, 2020).

Two main aspects of the trade are currently being studied in the literature: I) trade competitiveness at the macroeconomic level, exploring the *tout-court* export performance of a certain country or product, and II) the analysis of the drivers influencing the capacity of trade flows, with a more in-depth view, and adopting econometric tools able to highlight the effect of single determinants on trade.

That said, the aim of this PhD thesis was to explore the trade related aspects linked to the concept of competitiveness and comparative advantage, thorough the application of competitive indices on a quietly unexplored product: honey.

Secondly, it was decided to explore in more detail which determinants influence trade competitiveness, using the conceptual framework of the augmented gravity model of trade (Tinbergen, 1962; Anderson & Van Wincoop, 2003) and focusing the research effort on two drivers currently debated by the scientific community:

I) the relationships between the social and cultural peculiarities of trading partners and export flows, in particular by focusing on a

relatively unexplored and interesting covariate, namely the “cultural distance” (Hofstede, 2001).
II) the impact of the adoption of private standards by entrepreneurs, focusing on a relevant commodity of the primary sector that has not been deeply investigated about this issue: forest products.

Starting on the main results obtained on the trade characterisation of the honey market, both from a competitive (Chapter 2) and econometric point of view (Chapter 3) several useful considerations for businesses and policy makers arise.

Focusing on the study reported in Chapter 2, the authors pointed out that the EU market does not seem to be so competitive in exports, with direct repercussions on their specialisation and on the sector’s income. In spite of the general disadvantage, the eastern regions of the EU show positive performances for honey exports, due to a multiplicity of factors.
Being a niche market implies a more selective and narrower consumer base (Parrish et al., 2004); moreover, frequent fluctuations in the quantities produced put export competitiveness at risk (Pappalardo & Naldi, 2018). The main findings of the paper, despite the limit of being focused on European level and not with an international breath, could be helpful mainly in terms of export and market strategies improvement.
In authors opinion, from an economic and marketing point of view, a first step to strengthen export comparative advantage on the international scene is to adopt solutions to differentiate and characterise the product with quality labels or, even, private

standards, in order to increase the price premium perceived by companies.

Considering the not always positive effect of private standards, their adoption may be of interest to large manufacturers and may be considered by small and medium-sized enterprises (SMEs), if their economic margin is still positive.

Opening up to the adoption of voluntary certification schemes on honey production could certainly increase the added value of honey exports, while also providing a set of an internationally recognised regulations, as the honey sector suffers from a lack of homogeneous legislation.

When focusing on the specific determinants influencing international trade in honey, it becomes clear that, despite its niche market characteristics, it behaves similarly to major commodity trade flows around the world.

Two main outcomes rise from the study in Chapter 3: until now, econometric applications such as the gravity model have not been applied on a global scale, giving, for the first time, useful data mainly for international organizations and government institution.

Econometric analyses carried out in the present study could be useful to explore the current issues of honey export: quality requirements, traceability of the product and food fraud, very topical in recent years. More attention was given to assess the effectiveness of existing international honey trade regulations and the need to introduce new sets of standards.

Secondly, this is one of the first studies in the field of agricultural economics to implement complex cultural covariates such as

cultural distance, highlighting its negative effect (despite not statistically significant). In this way, additional effort has been made to give more attention by the scientific community to the complex cultural determinants of trade, contributing to the scientific debate that has emerged around the positive or negative repercussions of cultural dissimilarity on trade relations. This was done in order to promote the idea of including cultural criteria in trade negotiations.
The study reported in Chapter 3 suffers of a series of limitations, mainly due to the partial availability of data, in terms of international trade flows value and quantity, in particular from developing countries, but also in terms of custom barriers to honey exportations, which are, to date, very heterogeneous and, in some cases, outdated. Data availability is a common constrain of the analysis of niche markets: overcoming this issue paves the way for more in-depth research linked to niche markets, relatively unstudied in literature instead of the main agro-forestry commodity flows, focusing on the implementation of new quality certifications and regulations. In this direction, the presented work acts as a first example of econometric characterisation of these high value-added markets.

Moving to a different and more economically relevant market such as forest products, (Chapter 4), the authors explored another current field of research in international trade: private standards, trying to answer the “standard as catalyst or barrier of trade” in the forest products sector, which has not been as widely explored as agri-food products.

The survey revealed two distinct economic impacts of the adoption of voluntary certification schemes on trade: there is a real increase in the competitiveness of export worldwide, but the price premium perceived by companies does not always compensate for the cost increase due to the certification adoption, and this is particularly relevant for developing countries.

In some cases, the quasi-mandatory nature of these standards forces small companies out of the market, if they are not competitive enough (Greenaway et al., 2008), diminishing the commercial effectiveness of certifications. Even in this area, the results on private standards remain questionable.

On the other hand, the growing interest of academicians and policy makers on the topic could solve these issues, by developing and estimating new policy regulations that mitigate the cost effectiveness of certifications. International organisations and national governments could also try to implement cooperation initiatives and support policies for SMEs, making the adoption of standards more economically attractive.

The main limit emerged from this study is linked to the availability of studies with a global perspective and not only focused on small groups of exporters or single countries.

In this way, the authors are currently trying to capitalize on the findings and the limits emerged from the literature review: at now, an econometric study involving the application of the gravity model is in progress.

It is attempting to include all trade partners of certified forestry products, and to add data and information about the certified forest surfaces and number of Chain of Custody of the two main voluntary

forest certifications worldwide: the Programme for the Endorsement of Forest Certification (PEFC) and the Forest Stewardship Council (FSC). The goal is to highlight the overall effect of PEFC and FSC at global scale focusing on groups of exporters, classified on the basis of their economic and development characteristics.

5.1. References

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