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## **Intra-Industry Trade in a Rapidly Globalizing Industry: The Case of Wine**

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# Intra-Industry Trade in a Rapidly Globalizing Industry:

## The Case of Wine<sup>1</sup>

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**Abstract:** This paper overviews the current structure and dynamics of international trade in wine with an emphasis on its intra-industry features. Using network analytic methods, we illustrate developments in the world's wine markets since the mid-1960s around a relatively stable core of countries. Those developments include both evolving demands for wine and, on the supply side, a rapidly emerging group of countries entering the core without displacing the original members. Not surprisingly, given that the analysis is based on bilateral trade in a single product, the developing patterns of intra-industry trade are quite consistent with the patterns revealed in the network analysis.

**JEL classifications:** F1, L7

**Key words:** International intra-industry trade, wine trade, network methods

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<sup>1</sup> We dedicate this paper to David Greenaway: scholar of intra-industry trade, lover of wine. Forthcoming in the *Review of International Economics* Vol. 24, 2016.

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# **Intra-Industry Trade in a Rapidly Globalizing Industry: The Case of Wine**

## **1. Introduction**

Wine is one of the oldest products to be traded over long distances (Johnson, 1989, Lukacs, 2012, Pellechia, 2006, Simpson, 2011, Unwin, 1991). Indeed, there is evidence of Bronze Age trade not only in wine but also in the paraphernalia needed to store, process, and drink wine (Piggott, 1959). At the same time, wine is an archetypal differentiated product. In addition to red, white, rosé, various fortifieds and sparkling, there is differentiation by grape variety, terroir, technology, and, of course, by quality. While the data do not exist to tap these dimensions of differentiation over a significant time period, it would be surprising if there were not extensive trade between wine-producing countries. As with Staffan Linder's (1961) classic account of intra-industry trade, which provided inspiration for theoretical work rooted in monopolistic competition models (Helpman and Krugman, 1985) and systematic empirical work on intra-industry trade (Grubel and Lloyd, 1975, Greenaway and Milner, 1986), we expect wine varieties to reflect local preferences and production conditions. As consumers in other countries develop more-sophisticated palates, we expect to see the development of a preference for variety in wine which, in turn, produces intra-industry trade. With newer wine-producing countries, we might expect to observe the development of this pattern directly in the data. Thus, in this paper, we use some basic network topological measures, along with standard intra-industry trade measures, to characterize the evolution of trade in wine—the “world wine web”.

The viability of this study is underwritten to some extent by the dramatic growth in wine trade in the post-War period on both the intensive and extensive margins. We are able to take advantage of data collection efforts that provide relatively long series of data on trade, production and consumption (e.g., Anderson and Nelgen, 2011). In this paper we characterize and explore a number of facts about the growth of the global wine industry, leaving theoretical development for later work. We begin with

a narrative of recent developments in the world's wine markets. In subsequent sections we apply basic network measures to characterize the structure and dynamics of the product's international trade before providing a more-detailed analysis of intra-industry trade in wine. Finally, we conclude with some projection analysis of future trends in global wine trade.

## 2. Recent trends in the world's wine markets

The past two decades have seen globalization of the world's wine markets proceed like never before, in both speed and breadth. There was a degree of trade expansion in the five decades to World War I, but that was mostly in response to the outbreak of Phylloxera that destroyed the majority of vines in Europe and saw French wineries invest in huge plantings in North Africa (Meloni and Swinnen, 2014). Until the late 20<sup>th</sup> century, interactions between continents involved little more than the exporting of vine cuttings and of traditional production expertise. Indeed prior to 1990, most wine was consumed in the country of production (if one considers the French-owned vineyards in nearby French colonies of North Africa as part of France),<sup>3</sup> and those countries were mostly on or near the Mediterranean Sea.

The fall in transport and communication costs since the 1980s is largely responsible for the recent globalization of the industry. On the demand side, as incomes grew and access to television and the internet spread, so tastes broadened and an ever-greater variety of products has been sought by consumers, including for beverages.

On the supply side, the fall in travel and communication costs has made it more affordable for producers to consider exporting, for flying viticulturalists and winemakers to spread new technologies rapidly, and for some large wineries to also engage in cross-border mergers or acquisitions. Falling international trade costs plus de-regulation of liquor retailing from the 1980s also allowed large supermarket chains

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<sup>3</sup> If Algeria etc. are treated as separate countries, then France switched from being a net exporter of wine up to 1880 to being a net importer for the next 100 years, with a considerable degree of intra-industry trade during that period (Anderson and Pinilla 2016), importing low-quality wine from North Africa and to a lesser extent southern European countries, and exporting mainly high-quality wines from Champagne, Bordeaux and Burgundy.

to become the major buyers not only of branded bottled or bag-in-box wines but also of bulk wine for building their own house brands.

Retailing through such chain stores requires large quantities of homogenous wine year after year to justify national advertising campaigns. Producers in the New World were more adept at initially responding to that new demand, creating a huge new category of robust, fruity 'commercial premium' wines that fall between expensive fine wines and cheap non-premium (or 'table') wines.

The share of global wine production exported, which had always been below 15 percent and mostly Mediterranean or intra-European, grew dramatically from the late 1980s. By 2012 it exceeded 40 per cent. The New World was the main contributor, with its share of global wine exports rising from 3 per cent in the late 1980s to 25 percent (if sparkling wine is excluded) by 2004 (Anderson et al., 2003).

Recognizing their relatively poor performance, Europe's wine producers during the past decade have been adapting their practices to compete. The three leading European wine-exporting countries as a group now export almost half their production, up from just one-fifth a generation ago.

Simultaneously, New World producers are seeking to expand their exports of more-expensive wines to complement their lower-end products. The next phase of wine's globalization therefore may involve a convergence whereby both groups produce terroir-driven super-premium wines alongside more-affordable 'commercial premium' branded wines. Meanwhile, cheap basic non-premium wines are continuing their demise in both Europe and the New World.

Technological developments are rapidly altering the means of exporting commercial premium wines. In the past decade or so the share of wine that is exported from the New World in bulk shipping containers has risen from less than 15 to more than 40 percent (and to 57 percent for Australia by 2014). Bottling in the country of destination is sometimes cheaper, and it lowers the cost and carbon footprint of shipping. By shipping in 24,000-litre bladders to fit 20-foot containers, this new shipping technology offers greater opportunities for buyers to blend wines from any region of the world as relative prices alter – and to meet changing retail demands in the destination country more rapidly.

Greater openness to trade means winemakers and hence grape growers are far more exposed now than pre-1990 to exchange rate volatility, and also to greater import competition in their domestic market as consumers are better able to choose

from an ever-broader range of wines (Anderson and Wittwer, 2013). The share of imports in domestic consumption in Australia, for example, rose from an average of 3 percent in 2000-04 to 15 percent by 2013 in volume terms, and around 20 percent in value terms (Anderson and Aryal, 2015). Wide fluctuations in exchange rates since the global financial crisis began in 2008 have substantially altered national rankings of New World wine-exporting countries (Figure 1).

--Figure 1 about here--

Increased openness and international travel have also altered tastes and preferences not only on both sides of the North Atlantic but also in Asia. Nowhere has this been more obvious in the case of wine than in China. Chinese wine imports grew more than 50 percent per year during 2006-12. With the number of middle class in China currently around 250 million and growing at around 10 million per year, and with grape wine accounting for less than 5 percent of alcohol consumption, further large increases in wine consumption are expected. How much of that Chinese demand will be supplied by domestic producers is difficult to guess. While import growth is likely to continue for the foreseeable future (Anderson and Wittwer, 2015), some exports also might begin to emerge from China in the future if there turns out to be a miss-match between the qualities of the wines produced and demanded domestically.

### **3. Structure of the world wine web**

In this section, we apply tools of network analysis to data on global wine trade. We focus specifically on two interesting facts about the structure of the global wine economy: the overall growth in the breadth and depth of those markets, and the stability of the core of that economy.

Table 1 shows the evolution of total trade from 1964 through 2009. It is clear that the global wine economy expanded dramatically over this period. Even though the number of wine-trading countries increased by 50 percent (much of this being new countries, formed in a variety of ways, but some being new importing or exporting countries), the number of links between countries increased by 450 percent and the volume of trade increased more than 45 fold! This suggests that not only are more countries involved in importing and/or exporting wine, but these countries are trading

with more partners and the links themselves involve more trade on average. Direct evidence of this is in the next several rows in Table 1.<sup>4</sup>

--Table 1 about here--

In network analysis, degree is simply the number of links between a given node (i.e., a national economy in our case) and other nodes. Because we consider both exports and imports as links, each node is potentially linked to every other node via exports and imports, thus we show both “out degree” (economies to which a given economy is linked by exports) and “in degree” (economies to which a given economy is linked by imports). The country that exported to the largest number of countries in 1964 (France) exported to 141 countries. In fact, France was the country with the maximum out degree in every year in our data, and by 2009 it was exporting to 190 countries.

Because we are also interested in the value of exports or imports of wine between a pair of countries, we represent the structure of trade by considering the links between a pair of nodes as weighted by the value of exports or imports. France was also the country with the highest total value of exports (weighted out degree) in every year except 1964 (when Algeria was the country with the highest weighted out degree, though 97 percent of its exports went to France).

The mean number of links rises strongly over this 45-year period, from 8 to 22, while the mean weighted degree increases by a factor of 49.<sup>5</sup> As we shall see, this growth is primarily a function of increasingly intensive trade among the core members of the world’s wine economy, but it should be noted that the median country, which was not an exporter in 1964, was exporting to six countries in 2009.<sup>6</sup>

Table 1 shows similar growth in both the size and extent of importing in the world wine web. The largest importer in 1964 was sourcing wines from 34 supplier countries, and by 2009 this had more than doubled to 86 supplier countries. Similarly, the volume imported by the largest importer had increased by a factor of 23. Unlike the case of exports, where France dominated the entire period, the identity

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<sup>4</sup> All of the statistics presented in Tables 1 and 2 were calculated in UCINET (Borgatti et al., 2013). This source is a handy overview of network empirics as well as basic applications using UCINET. The appendix to De Benedictis and Tajoli (2011) is a compact presentation of most of the definitions relevant to this paper.

<sup>5</sup> The mean degree and mean weighted degree are equal for in and out since, in either case, this is just total links divided by number of countries or total world trade in wine divided by number of countries.

<sup>6</sup> Note that the median country will vary from year to year. The point here is simply that the number of wine-exporting countries clearly increases, and increases substantially.



of the largest importer has changed over time. Over this period Great Britain, the US and Germany were the largest importers by value, with Great Britain often the largest by a substantial margin.<sup>7</sup> Over the first half of the period, Great Britain usually has the largest number of suppliers, while in the latter half of our sample period this is usually the US. As with exports, we again find substantial growth in both the number of suppliers to and the imports of the median economy.

The previous two paragraphs suggest that the world wine web should have been growing progressively denser. The standard network-theoretic definition/measure of density is simply the number of (unweighted) links observed in the data as a proportion of the number of possible links. With  $n$  countries, the number of possible links in a directed network (i.e., a network in which import links and export links are both possible) is just  $[n(n - 1)]$ . Thus, density is the number in the second row of table 1 divided by the number of possible links.<sup>8</sup> So, from 1964 to 2009, density doubles, even though the number of nodes (i.e. countries) increases by just 50 percent. That is, not only do countries have more trading partners on average, but also the world wine economy is more intensely interconnected. By way of comparison, the density of the entire world trade web, as reported by De Benedictis and Tajoli (2011), also doubles over this period; however, density of total trade for approximately comparable years ranges from 0.27 in 1970 to 0.40 in 2000.<sup>9</sup> One would expect the network for a single commodity to be far less dense than the network for all commodities; in this case the latter is around five times as dense as the wine trade network over the whole period.

While the world wine web extends quite broadly across the countries of the world, it is also the case that there is a small core of countries that accounts for most of this trade. One approach to identifying a core looks for a single country that dominates trade. Freeman's (1979) centralization measures seek to characterize the extent to which a network is dominated by a single node (importer or exporter). That is, centralization is a measure of compactness in the sense that a star network is

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<sup>7</sup> An exception to this statement is that in the first two periods in our data (1964 and 1969), France is by far the largest importer. However in both of these years three quarters of its imports were from Algeria. As these imports shrank over time, France remained a sizable importer, but never one of the largest importers of wine.

<sup>8</sup> In 1964, with 152 countries, the denominator is 22952, so density in 1964 is 1147/22952 or 0.050, as reported in the final row of Table 1.

<sup>9</sup> De Benedictis and Tajoli (2011) report values at 10-year intervals, starting in 1960 and ending in 2000.

maximally centralized (in a star network, every node except the center has degree one, while the center has degree  $n - 1$ ). The centralization measures the extent to which the world wine web deviates from the star network. Thus, UCINET calculates the sum of the differences between the degree of the most central node and all other nodes, as a fraction of the maximum possible sum of differences in a network with  $n$  nodes. While the world wine web extends quite broadly across the countries of the world, it is also the case that there is a small core of countries that accounts for most of this trade. On the one hand, unsurprisingly given what we have just seen in Table 1, the level of concentration is quite low. However, we observe an interesting pattern of increasing concentration up to around 1979 and then a decline, which is especially pronounced for exports. This reflects the dominance early in our data period of traditional exporters (especially France), and then the rise of new exporters.

The low centralization reflects the existence of a number of sizable exporters and importers. Thus, we might be interested in the importance of a core set of countries. We can construct the core in a rough-and-ready way by considering the top dozen wine producers, exporters and importers in 2009.<sup>10</sup> Table 2 shows data illustrating the evolution of this core from 1964. The first thing to notice is that trade within this core rises from about half of world trade to nearly 90 percent before falling back to 80 percent.<sup>11</sup> As with the world wine web as a whole, the density of trade in the core nearly doubles over the period covered by our data. However, trade in the core is ten times as dense as in the global wine economy as a whole. Centralization of this core is on the order of 10 to 20 times greater than that of the world economy as a whole, but still shows the same pattern of rising, then declining centralization.

--Table 2 about here--

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<sup>10</sup> The top 12 producers in 2009 were: Italy, France, Spain, the US, Argentina, Chile, China, Australia, South Africa, Germany and Portugal. The top 12 exporters were: France, Italy, Spain, Australia, Chile, Germany the USA, Portugal, South Africa, New Zealand, Argentina, and Great Britain. The top 12 importers were: Great Britain, the US, Germany, Canada, Belgium-Luxembourg, Netherlands, Japan, Switzerland, Sweden, Denmark, France, and Russia. The union of these three lists gives a 21-country core as of 2009: France, Italy, Spain, the USA, Argentina, Australia, South Africa, Germany, Chile, China, Portugal, Great Britain, Canada, Belgium-Luxembourg, Netherlands, Japan, Switzerland, Sweden, Denmark, Russia, and New Zealand. It should be noted that Russia does not enter our data until 1994, and that for consistency we work with Russia combined with other former Soviet republics.

<sup>11</sup> The 12 top exporters as of 2009 account for well over 90 percent of world trade in wine in every year in our sample, even though a number of these countries exported no wine, or very little wine, in the early years of our sample period. In fact, France, Italy, Spain, and Portugal account for around 90 percent of world trade in wine in 1964 and 1969. Germany plays an increasing role, especially from 1979, and from 1999 Australia becomes a major world exporter of wine.

#### 4. Intra-Industry Trade in Wine

We now turn to analysis of the pattern of trade in wine based on the Grubel and Lloyd index of intra-industry trade. What we mean by intra-industry trade is the case where partners both import to and export from each other (*aka* two-way trade) (Greenaway and Milner, 1986, Grubel and Lloyd, 1975). Two-way trade in wine can reflect, for example, consumer interest in final wine varieties that differ by country of origin, such as trade in different wine varieties for final consumption between France and Spain. However, a great deal of wine is traded in bulk and then mixed with domestic wine, or with wine imported from other countries, before packaging for final consumers (COGEA.S.r.l., 2014). In this sense, two-way trade in wine reflects demand at both the final and intermediate product levels.

On a bilateral basis, we define the intra-industry trade index (in this case for wine)  $IIT_{i,j}$  between countries  $i$  and  $j$  as a function of imports by country  $j$  from  $i$  ( $M_{i,j}$ ) and imports by country  $i$  from country  $j$  ( $M_{j,i}$ ) as follows:

$$(1) \quad IIT_{i,j} = 1 - \left[ \frac{|M_{i,j} - M_{j,i}|}{M_{i,j} + M_{j,i}} \right]$$

In equation (1), the main term in square brackets represents the share of bilateral trade that is classified as net trade, or as reflecting inter-industry trade. The remaining share is then the share of trade that is intra-industry or two-way, meaning it reflects trade that is balanced in both directions (where country  $i$  imports from country  $j$  and country  $j$  imports from country  $i$  to the same extent). Note there is symmetry with the definition in (1), where  $IIT_{i,j} = IIT_{j,i}$ .

Starting from equation (1) we can also define an intra-industry trade index for country  $j$  trade with the world as a whole (where we take all trading partners of  $j$  collectively). In formal terms, we define this aggregate index  $IIT_{j,world}$  as follows:

$$(2) \quad IIT_{j,world} = 1 - \sum_i \left[ \frac{|M_{i,j} - M_{j,i}|}{\sum_k M_{k,j} + M_{j,k}} \right]$$

We will work with both bilateral and aggregate IIT indexes as defined in equations (1) and (2). These are all calculated on the basis of trade data (bilateral imports) from the UN COMTRADE database.

Table 3 below presents the values of index  $IIT_{j,world}$  for the 21 countries that account collectively for between 90 and 95 percent of global trade in wine over the period 1969-2009.<sup>12</sup> There are some significant changes over the 40 years in the table. For example, we see that for Argentina, Australia and South Africa there is a discernable drop in the IIT share of trade with the world. In the case of these countries, and as will become clearer when we turn to bilateral flows below, this reflects their rise over those four decades as net exporters to the rest of the world. In contrast, the IIT share of trade also fell dramatically for China, but in this case it is because of China's rise as a wine importer.

--Table 3 about here--

Globally, changes in net positions as exporters or importers are reflected in changes in the aggregate IIT indexes in Table 3. To better understand these changes, in Figure 2 we provide bilateral IIT indexes as defined in equation (1).<sup>13</sup> In comparing the pattern in 2009 with 1969, we see an increase in pair-wise relationships defined by a high share of IIT trade in total pair-wise trade, for example between Belgium-Luxemburg and Switzerland, South Africa and Argentina, and South Africa and France.

-- Figure 2 about here--

However, while we see more pairs engaged in IIT trade defined in trade share terms, much of this IIT takes place in the context of relatively low levels of total trade on a volume basis. For this reason, in Figure 3, we present the level of intra-industry trade for each of the dyads in the figures. In formal terms, we can define the level of intra-industry trade  $LIIT_{i,j}$  as follows:

$$(3) \quad LIIT_{i,j} = \left(1 - \left[ \frac{|M_{i,j} - M_{j,i}|}{M_{i,j} + M_{j,i}} \right] \right) (M_{i,j} + M_{j,i})$$

In Figure 3, cells are scaled by the maximum value of  $LIIT_{i,j}$  for the corresponding year relating to each Figure. On a level instead of a share basis, in 1969 the great bulk of two-way trade in wine was between France and Italy, with a smaller flow

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<sup>12</sup> Formally, we have taken the union of the set of the top 11 exporters and the top 15 importers for 2009. The combined share of these countries over time remains consistently between 90 and 95 percent on a value basis over the period 1969 to 2009. See note 8.

<sup>13</sup> The full set of figures for intervening decades are available as part of the on-line annex.

(approximately 25 percent of the France-Italy trade) between Germany and the Netherlands. What we see by 2009 is a spread of two-way trade. France and Italy still show the greatest level of intra-industry trade, reflecting bulk trade and well established blending patterns (COGEA, 2014). However, we also now have relatively high volumes of intra-industry trade between France and Spain, Germany and the United States, and Italy and the United States.

--Figure 3 about here--

As a further step in decomposition, in Figure 4 we present net export positions by country pair. Again with reference to equation (1) we are now working with the value of the term  $|M_{i,j} - M_{j,i}|$  entering into the right hand side of equation (1). These figures provide a different perspective from the value of intra-industry trade in Figure 3. For example, while we have some growth in the value of two-way trade between France in the United States (Figure 3), there is also growth in net exports from France to the US (Figure 4). In contrast, while we have had substantial growth in the level of intra-industry trade between France and Italy (Figure 3), there is little change in the pattern of net trade (Figure 4). This illustrates the growth of trade in wine primarily for final consumption in one case (the US and France) versus trade for both final and intermediate consumption in the other case (France and Italy).

--Figure 4 about here--

Another change evident from Figure 4 is the emergence of New World suppliers of wine, especially Australia (exporting to the United States and Great Britain), but to a lesser extent South Africa (to Germany, Great Britain and Sweden) and Chile (to the United States and Great Britain). This pattern of change is especially evident when we examine the pattern of British wine trade. Figure 5 presents the evolution of Great Britain's IIT trade, and net import patterns, from 1969 through to 2009. In 1969, most trade was imports from France and Spain (left panel). We see high two-way trade indexes for Argentina, Belgium-Luxemburg, the Netherlands, and Sweden (centre panel). However, on a value basis, we see in the right panel of Figure 5 that this is primarily trade with the Netherlands (reflecting the role of both Britain and the Netherlands as re-export points). We have a substantial change in this pattern by 2009.

--Figure 5 about here--

At the end of the period covered by Figure 5, Britain has a more diversified pattern of import suppliers, with Australia, Chile, Italy, and South Africa all taking on more important positions, although still secondary vis-à-vis France; and while Italy has steadily picked up market share in Britain, Spain has dropped off over the same period (left panel). In addition, when we compare IIT indexes with IIT values, we see a shift away from the Netherlands: on an index basis, Canada now shows the greatest two-way trade intensity (centre panel), although this is clearly at low actual values of intra-industry trade (right panel). The most important partner on a value basis in terms of Britain's two-way trade is now France (right panel), even though on a relative or share basis this trade relationship remains one of net imports (left and centre panels). We also see a growing pattern of two-way trade in wine with Denmark, both in share and value terms (centre and right panels).

## 5. What next?

How might total and intra-industry trade in wine change in the coming years? Recent global wine modeling studies by Anderson and Wittwer (2013, 2015) show that the outcome is likely to depend very much on changes in real bilateral exchange rates and the propensity of China to import versus producing more of its own wine. Since those variables are notoriously difficult to predict, Anderson and Wittwer offer several scenarios. A summary of the bilateral trade consequences from their most-likely scenario is provided in Table 4. It suggests the US\$ value (in 2009 dollars) of global wine trade will rise by 19 percent between 2011 and 2018. But more than half of that rise is accounted for by imports of China and other Asian countries. The United States is the only other country shown in Table 4 whose imports rise by (slightly) more than the global average of 19 percent. US exports grow by only 12 percent though. By contrast, Australian and New Zealand wine exports are projected to grow by more than 50 percent over the same 8-year period (mostly destined for China), while their imports grow by only two-thirds the global average, thanks to their real exchange rates depreciating from their historically high 2011 rates in the scenario modeled.

--Table 4 about here--

## 6. Conclusions

This paper illustrates the benefits of network methods to the study of trade in a sector characterized by dynamic evolution of both production and consumption of a differentiated product. The takeaway message from this analysis is that the global wine industry is growing rapidly around a rather stable core of countries that are both sizable exporters and sizable importers. This trade reflects both trade in intermediate inputs (bulk wine for blending) and trade at the final product level. The growing demand for wine is increasingly being served by new wine exporters, without displacing the historical core of the wine producers. If new Chinese producers are able to move up market, they could become major participants in this core.

While our trade data do not permit us to distinguish quality at the dyadic level over the entire period, it is clear from the aggregate data on production and consumption that countries differ substantially in patterns of consumption, and production, by quality. By focusing on a single product, especially one characterized by extensive differentiation, future work should be able to provide more extensive analysis of the foundations of intra-industry trade and its evolution. In particular, the co-evolution of production and consumption has long been recognized as a phenomenon that is characteristic of sophisticated differentiated products.<sup>14</sup> Network methods provide an effective body of tools for characterizing and measuring precisely this sort of phenomenon. We have only scratched the surface of what is possible using these methods.

In addition, the close link between network methods and gravity modeling of trade provides a bridge between the sort of analysis presented in this paper and the most common approach to empirical research on international trade in current trade research (Ward et al., 2013, Fagiolo, 2010, Duenas and Fagiolo, 2013). By matching production, consumption and trade data over time (Anderson and Nelgen, 2011, Anderson and Pinilla 2016), there is ample scope to examine in future work the causal relationships between these factors.

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<sup>14</sup> In addition to Linder's (1961) work, mentioned in the introduction, this has long been part of the product life cycle analysis of the evolution of trade relations (Vernon, 1966, Hufbauer, 1966).

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Table 1: Network Statistics on World Wine Web, all countries, 1964 to 2009

	1964	1969	1974	1979	1984	1989	1994	1999	2004	2009
<i>n</i> of countries	152	157	196	193	191	195	216	213	225	230
<i>n</i> of links	1147	1423	2029	2131	2015	2283	2997	3615	4660	5156
Total trade	587858	704647	1829924	4118851	3873040	6888756	8853214	14299819	21076262	26721601
Max out degree	141	148	169	173	168	165	183	181	195	190
Max weighted out	166155	234936	635669	1654576	1716800	3631749	4054235	6079691	6915577	8199769
Median out degree	0	0	1	1	1	1	1	2	4	6
Median weighted out	0	0	1	1	1	5	10	19	28	88
Out centralization	0.7	1.8	2.9	2.9	2.1	2.5	2.3	2.3	2.2	2.1
Mean degree	8	9	10	11	11	12	14	17	21	22
Mean weighted deg.	3867	4488	9336	21341	20278	35327	40987	67135	93672	116181
Max in degree	34	36	56	51	58	65	60	75	80	86
Max weighted in	219070	105796	293596	692263	1064519	1352308	1718869	2979401	5275938	5040290
Median in degree	6	7	8	9	8	9	11	13	15	18
Median weighted in	116	211	282	596	454	951	1225	1796	2201	3689
In centralization	0.9	0.8	1.3	1.2	1.3	0.9	1.0	1.1	1.6	1.4
Density	0.050	0.058	0.053	0.058	0.056	0.060	0.065	0.080	0.092	0.098

Source: Authors' calculations, based on UN COMTRADE data

Table 2: Network Statistics on Core of World Wine Web (top 21 wine-trading countries), 1964 to 2009

	1964	1969	1974	1979	1984	1989	1994	1999	2004	2009
<i>n</i> of countries	20	20	20	20	20	20	21	21	21	21
<i>n</i> of links	204	230	273	282	285	317	370	368	391	391
Total trade	290538	427870	1380868	3394735	3352158	6035842	7549519	12292198	17487763	21154106
Global proportion	0.49	0.61	0.75	0.82	0.87	0.88	0.85	0.86	0.83	0.79
Mean degree	10.2	11.5	13.7	14.1	14.3	15.9	17.6	17.5	18.6	18.6
Mean weighted degree	14527	21394	69043	169737	167608	301792	359501	585343	832751	1007338
Normalized degree	2.0	2.4	3.2	3.0	2.1	2.1	2.2	2.4	3.0	3.3
Density	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9
Out centralization	19.2	22.3	24.6	24.9	18.5	23.0	21.6	21.5	20.0	20.9
In centralization	9.2	8.6	9.9	9.5	11.3	7.6	8.1	9.7	15.7	12.9

Source: Authors' calculations, based on UN COMTRADE data

Table 3: IIT indexes,<sup>a</sup> top 21 wine-trading countries with the world, 1969 to 2009

	1969	1979	1989	1999	2009
Argentina (ARG)	0.354	0.428	0.056	0.288	0.029
Australia (AUS)	0.821	0.319	0.687	0.145	0.129
Belgium-Luxemburg (BLX)	0.180	0.069	0.132	0.127	0.137
Canada (CAN)	0.011	0.007	0.005	0.014	0.018
Switzerland (CHE)	0.033	0.081	0.030	0.084	0.054
Chile (CHL)	0.049	0.070	0.018	0.020	0.004
China (CHN)	0.978	0.597	0.256	0.192	0.023
Germany (DEU)	0.411	0.680	0.553	0.339	0.443
Denmark (DNK)	0.038	0.004	0.033	0.016	0.168
Spain (ESP)	0.024	0.011	0.094	0.164	0.171
France (FRA)	0.122	0.388	0.162	0.149	0.149
United Kingdom (GBR)	0.030	0.056	0.016	0.055	0.112
Hong Kong (HKG)	0.010	0.003	0.035	0.027	0.003
Italy (ITA)	0.328	0.156	0.250	0.160	0.142
Japan (JPN)	0.676	0.008	0.003	0.004	0.010
Netherlands (NLD)	0.419	0.078	0.061	0.121	0.117
Portugal (PRT)	0.005	0.088	0.337	0.465	0.298
Former Soviet Union (SVU) <sup>b</sup>	0.406	0.456	0.200	0.465	0.033
Sweden (SWE)	0.004	0.006	0.008	0.012	0.038
United States (USA)	0.017	0.030	0.161	0.376	0.367
South Africa (ZAF)	0.320	0.542	0.562	0.109	0.039

<sup>a</sup> The index of intra-industry trade is defined in equation (1) of the text.

<sup>b</sup> For the former Soviet Union (SVU) we focus on trade between the Soviet Union, or countries that were part of the Soviet Union pre-1991, and the rest of the world.

Source: Authors' calculations, based on UN COMTRADE data

Table 4: Projected changes in values of wine trade, 2011 to 2018 (US\$ million)

	FRA	BLX	DEU	GBR	OWEM <sup>a</sup>	RUS	OECA <sup>a</sup>	USA	CAN	CHN	JPN	OASIA <sup>a</sup>	AUS	NZL	RofWM <sup>a</sup>	<b>World</b>	%change
FRA	0	202	35	121	363	32	24	337	119	683	176	382	3	3	151	<b>2630</b>	<b>28</b>
ITA	11	7	-52	0	95	23	12	161	51	148	19	26	2	1	24	<b>528</b>	<b>9</b>
PRT	41	16	-1	2	24	0	1	16	14	22	2	7	0	0	61	<b>205</b>	<b>22</b>
ESP	-17	-3	-47	-15	-23	0	2	28	4	94	3	7	0	0	13	<b>46</b>	<b>2</b>
DEU	0	0	0	-6	-4	1	3	13	1	63	1	5	0	0	3	<b>80</b>	<b>7</b>
USA	-2	-2	-10	-27	-11	-2	-1	0	-9	191	-4	16	0	0	-14	<b>125</b>	<b>12</b>
AUS	1	3	0	42	24	0	1	115	33	649	3	50	0	9	3	<b>933</b>	<b>52</b>
ARG	0	0	-1	-1	-6	-4	0	11	-3	33	-1	1	0	0	6	<b>36</b>	<b>6</b>
CHL	-1	-1	-5	-4	-7	-1	2	21	5	252	2	13	0	0	28	<b>303</b>	<b>24</b>
NZL	2	2	1	45	33	0	1	128	41	35	7	36	47	0	3	<b>380</b>	<b>66</b>
ZAF	0	2	2	20	13	1	1	7	5	35	1	3	1	1	18	<b>109</b>	<b>18</b>
RofWX <sup>a</sup>	-6	-4	-16	-3	-38	-28	-39	4	-4	100	21	11	11	-3	-60	<b>-54</b>	<b>-3</b>
<b>World</b>	<b>27</b>	<b>221</b>	<b>-94</b>	<b>174</b>	<b>463</b>	<b>22</b>	<b>7</b>	<b>841</b>	<b>256</b>	<b>2305</b>	<b>231</b>	<b>557</b>	<b>63</b>	<b>11</b>	<b>236</b>	<b>5321</b>	<b>19</b>
%change	<b>4</b>	<b>15</b>	<b>-3</b>	<b>4</b>	<b>8</b>	<b>2</b>	<b>1</b>	<b>20</b>	<b>16</b>	<b>309</b>	<b>18</b>	<b>38</b>	<b>13</b>	<b>11</b>	<b>13</b>	<b>19</b>	

<sup>a</sup> OWEM = other Western European wine importers (excl. France, Belgium/Luxembourg, Germany and Great Britain),

OECA = other Eastern Europe and former Soviet Union (excl. Russia),

OASIA = other Asia (excl. China and Japan),

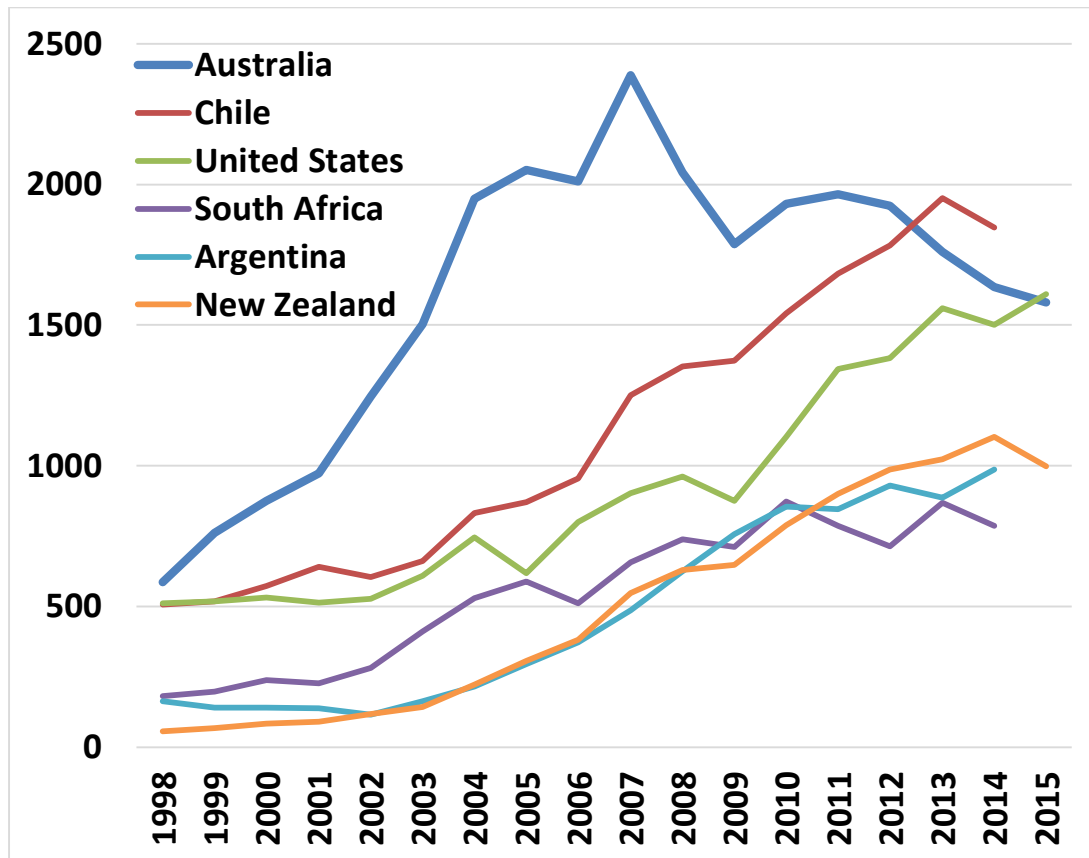
RofWM = other wine importers not shown here, and

RofWX = other wine exporters not shown here.

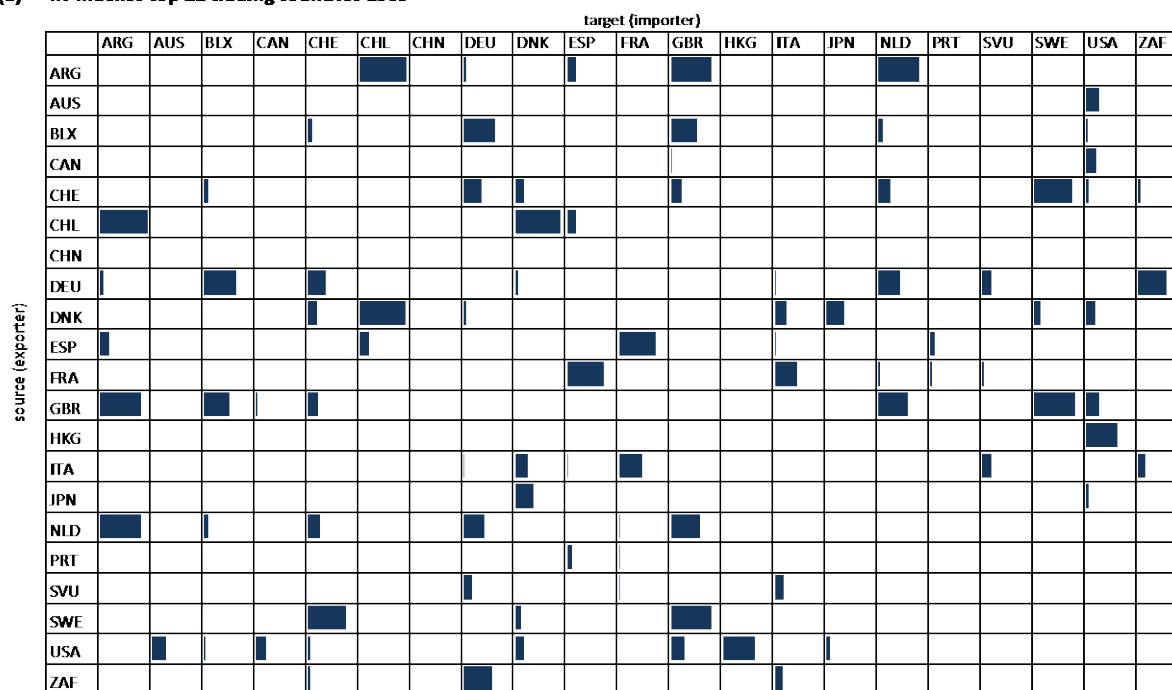
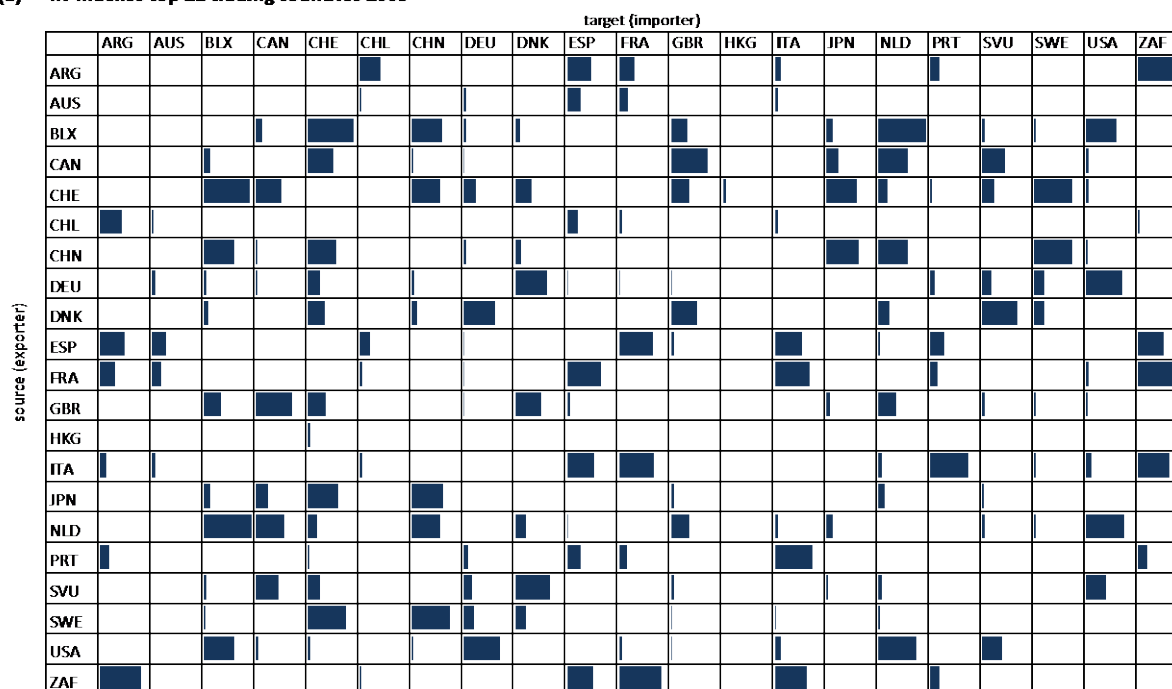
Other countries' acronyms are identified by the standard UN iso3 codes shown in Table 3.

Source: From modelling results summarized in Anderson and Wittwer (2013)

Figure 1: Value of wine exports, New World countries, 1995 to 2015 (US\$ million)



Source: Updated from Anderson (2015).

Figure 2: IIT indexes, top wine-trading countries,<sup>a</sup> 1969 and 2009**(a) IIT Indexes top 21 trading countries 1969****(b) IIT Indexes top 21 trading countries 2009**

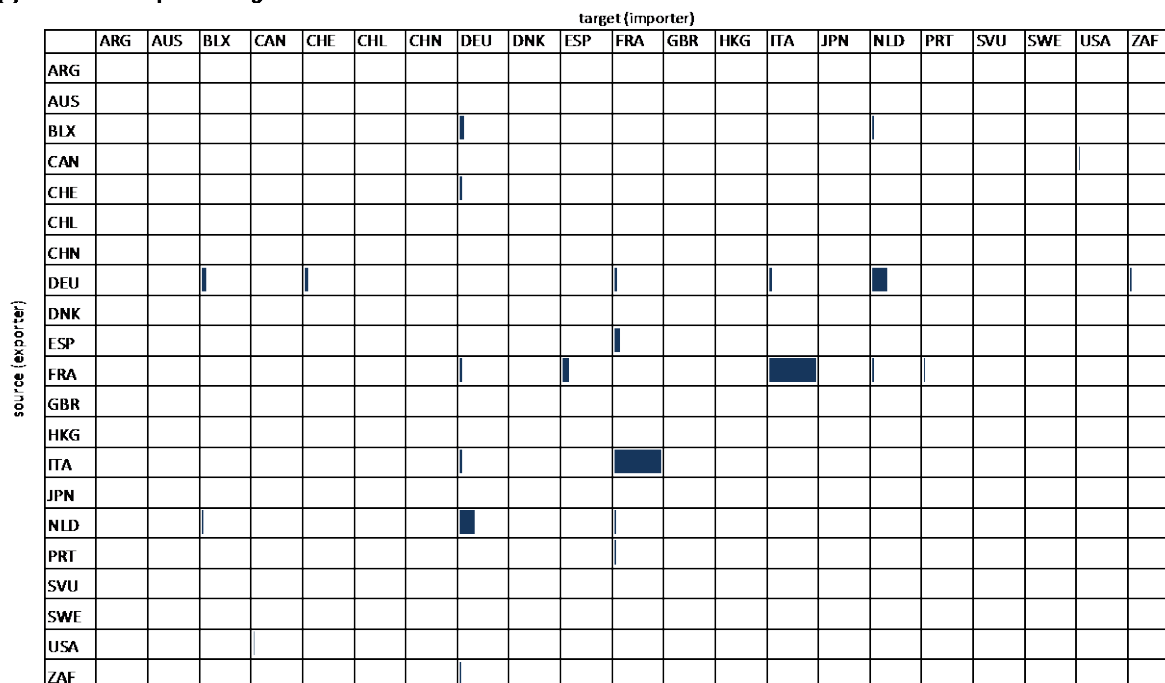
<sup>a</sup> Cells are scaled by the maximum value for the IIT index.

Source: Authors' calculations based on UN COMTRADE data and equation (1) in text.

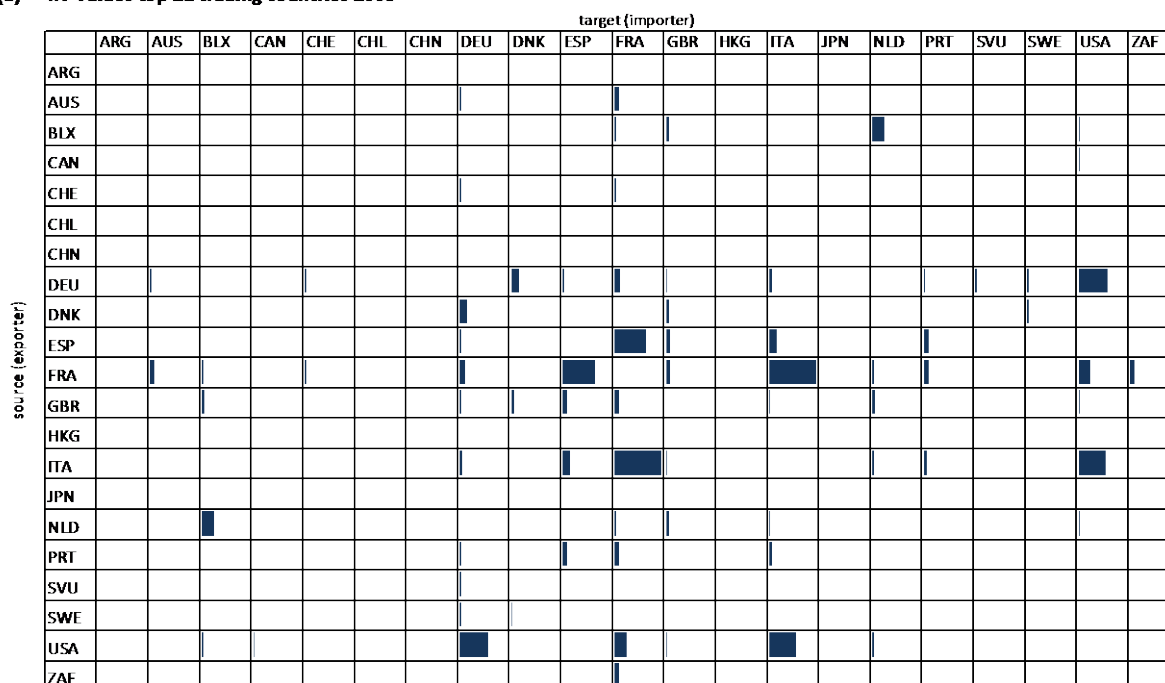
Note: countries are identified by the standard UN iso3 codes shown in Table 3.

Figure 3: Level of IIT (values), top 21 wine-trading countries,<sup>a</sup> 1969 and 2009

(a) IIT Values top 21 trading countries 1969



(b) IIT Values top 21 trading countries 2009



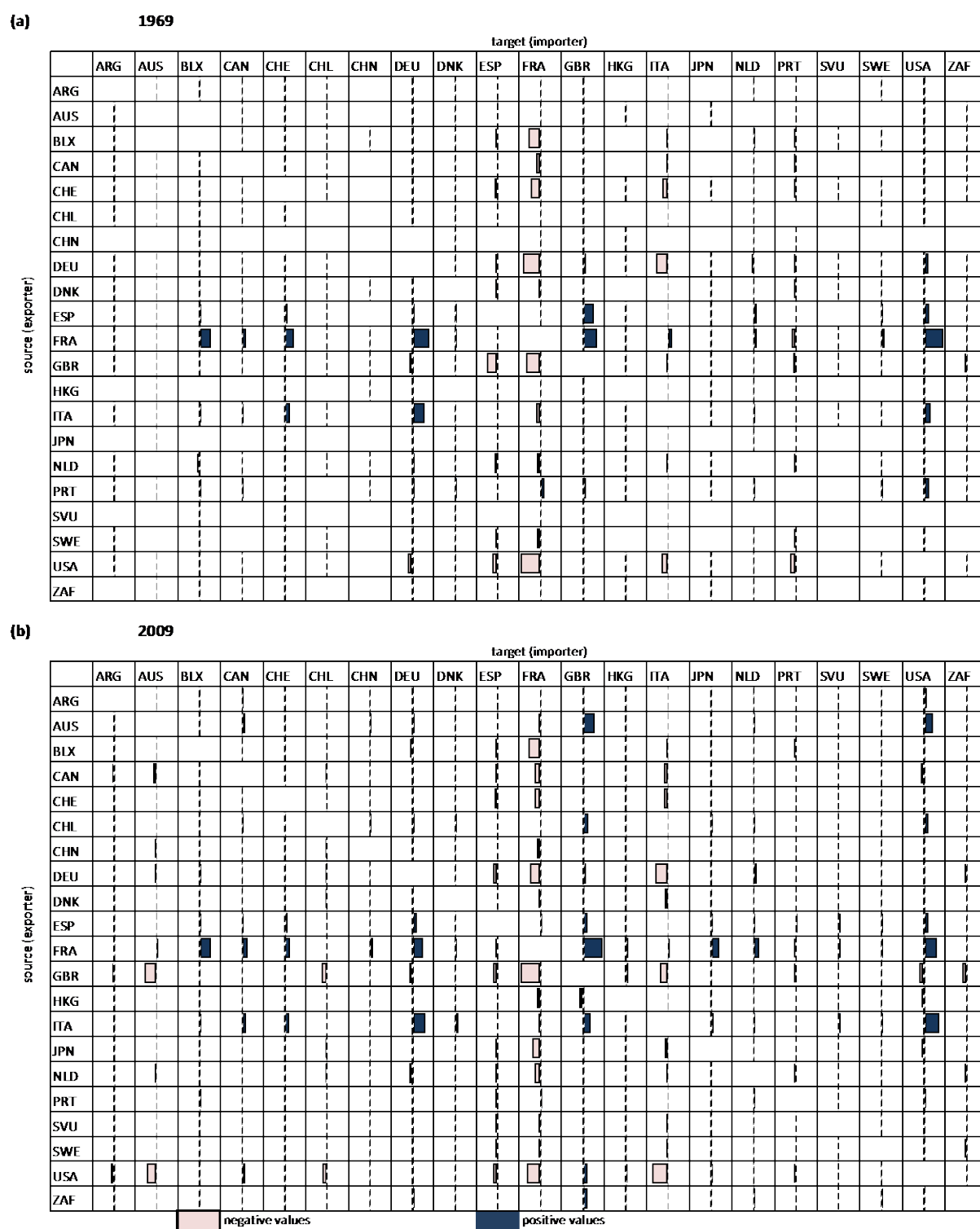
<sup>a</sup> Cells are scaled by the maximum value for inter-industry trade flows in the table.

Source: Authors' calculations based, on UN COMTRADE data

Note: countries are identified by the standard UN iso3 codes shown in Table 3.



Figure 4: Net export positions by dyad, top 21 wine-trading countries, 1969 and 2009

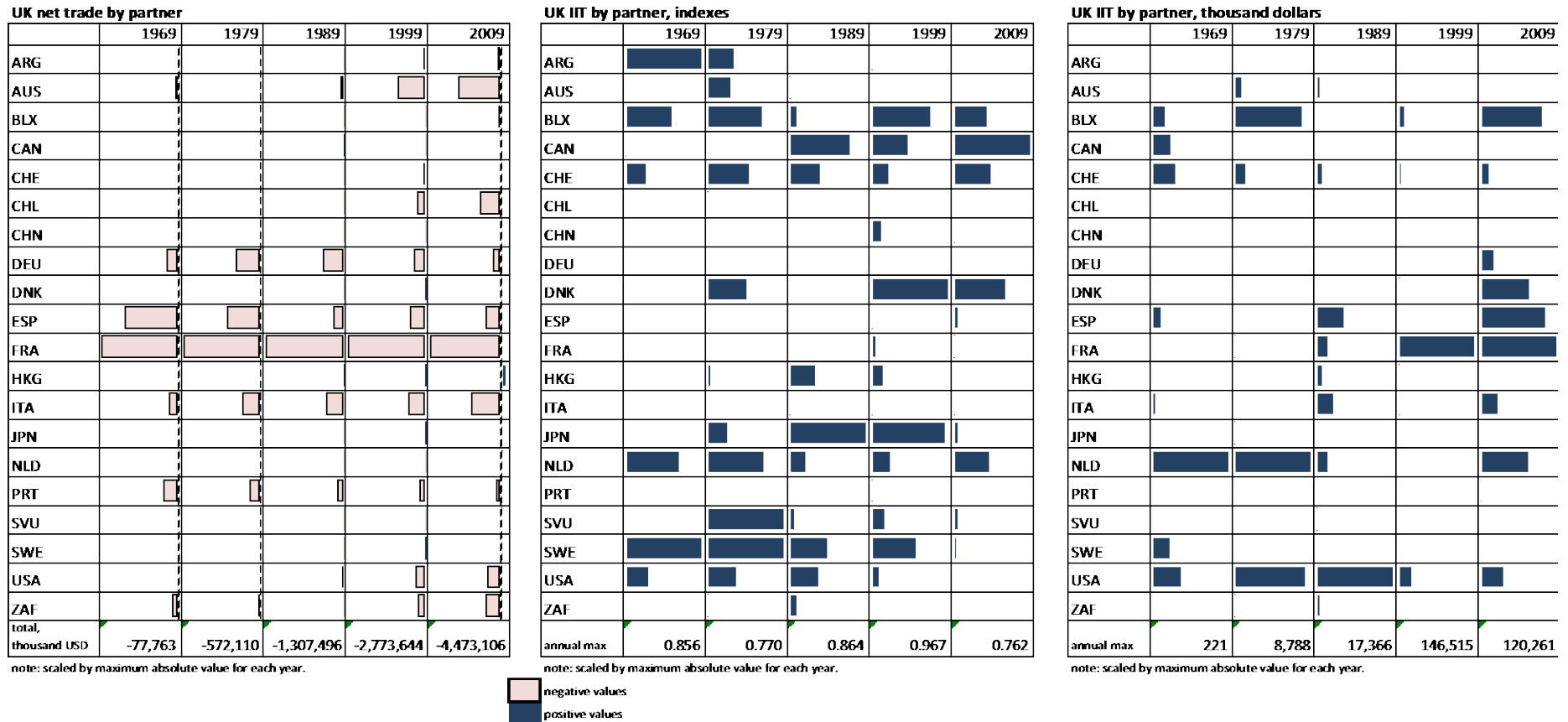


<sup>a</sup> Cells are scaled by the maximum value for net exports.

Source: Authors' calculations based, on UN COMTRADE data

Note: countries are identified by the standard UN iso3 codes shown in Table 3.

Figure 5: Evolution of UK trade composition in wine, 1969 through 2009



<sup>a</sup> Cells are scaled by maximum value for each year.

Source: Authors' calculations based, on UN COMTRADE data

Note: countries are identified by the standard UN iso3 codes shown in Table 3.