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FACTORS INFLUENCING THE INTENSITY OF EU WINE EXPORTS TO THE UNITED STATES

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Abstract

The standard gravity model is adapted to determine and quantify factors which influence EU wine exports to the United States. Using the trade intensity index to represent a country's relative share of the U.S. wine market, independent variables are chosen to augment the standard gravity model and identify the effects of transaction costs and productivity on the competitiveness of EU wine exports. Variables considered in the model include factors which represent a country's capacity to trade and those that represent their cost of trade. Factors that influence a country's capacity to trade include gross domestic product and relative per capita wine productivity; factors which influence cost to trade include distance between countries, import tariffs, and dummy variables related to trade agreements and whether the country is landlocked. Each of these factors is analyzed to determine how it affects the trade intensity. The positive GDP coefficient indicates the existence of intra-industry trade and suggests that the protection of Designations of Origin and Geographical Indications will help maintain EU wine exports. This analysis provides information that will enable producers and policy makers to better evaluate potential trade agreements and other strategies that influence the competitiveness of European wine in the world market.
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1. Introduction

The EU-28 is currently the world's largest wine exporter. In 2015 the EU exported 2.1 billion liters of wine valued at $11.9 billion (Bettini and Sloop, 2015). France, Italy and Spain are the top three EU wine producers (Table 1), with Germany recently surpassing Portugal to move to the fourth largest EU wine producer. Despite its large share of the world export market, the European Union has suffered from a glut of excess wine. Actions brought about through the EU's Common Agricultural Policy in recent years to correct this problem have financially remunerated EU wine producers who voluntarily ceased production. Thanks to these and similar measures, excess EU wine production is decreasing, and Europe is gradually eliminating it's so called wine lake. However, per capita wine consumption is also decreasing in traditional wine producing countries due to wide spread anti-alcohol campaigns and driving

laws which restricting alcohol consumption. All of these factors highlight the importance of exports for the EU wine industry.

Given this, it is important to evaluate the factors that impact EU wine trade to provide information to wine producers which will allow them to maintain and enhance their most important foreign markets. Table 2 shows that the United States is by far the largest importer of EU wine; in 2015 the United States accounted for over three times the imports of Switzerland, the next largest EU trading partner. Hence, it is clear that trade with the United States is vital to the EU wine industry.

Table 1. European Union Wine Production by Country, 2015

	Million liters	Value (Million US$)
France	4,650	$9,200
Italy	4,442	$6,000
Spain	4,161	$3,000
Germany	930	$1,100
Portugal	589	$818
Romania	370	$514
Greece	290	$460
Other EU-28 countries	853	$1,200
EU-28 country total	16,285	$22,292

Source: Wine Annual, 2015

Table 2. European Union Wine Exports by Destination Country, 2015

	Million liters	Value (Million US$)
United States	523	$3,518
Switzerland	167	$1,146
Japan	150	$972
Canada	171	$951
China	220	$855
Hong Kong	27	$732
Russia	279	$681
Singapore	18	$456
Norway	67	$412
Australia	28	$225

Source: Wine Annual, 2015

A variety of factors influence trade in wine or any other product. These include import policies, trade agreements, exchange rates, and other additional quality and price variables. A potential event influencing trade between the European Union and the United States had been the proposed Transatlantic Trade and Investment Partnership (TTIP). The Office of the United States Trade Representative first introduced the TTIP to the European Commission in 2013. The goal of this agreement was to liberalize trade and investment, better coordinate trade by specific regulations, boost intellectual property protection, and relax the European Union governments' impediments to trade.

Not only is it unclear how a TTIP would have affected EU wine exports to its most important trading partner, it is important to determine the impact of a variety of factors influencing EU wine exports to the United States. Although the potential for a successful TTIP

appears to have vanished due to the United States withdrawal from the negotiations, it is important to determine the impact of alternative future agreements on trade between these countries. Given this, the purpose of this analysis is to determine and quantify those factors that influence EU wine exports to the United States. To accomplish this, an augmented gravity model is adopted, using the trade intensity index (TII) as the dependent variable to capture a country's relative share of the U.S. market. As a result of our analysis, information will be available which will enable producers and policy makers to better evaluate trade agreements and other strategies that influence the competitiveness of their industry in the world market.

2. Theoretic Framework

The concept of the Gravity Model is adapted from Newton's law of gravitation. The basic gravity formula is as follows:

$$F_{ij} = G\,(M_i^{\,\beta 1} * M_j^{\,\beta 2} / D_{ij}^{\,B3}) \qquad (1)$$

where F_{ij} represents trade flow between countries i and j; M_i and M_j represent the economic mass of the country i and j, respectively; D_{ij} represents the distance between countries i and j; and G is a constant. This model is widely used in international trade analysis to assess the impact of treaties and various alliances on trade and also for the testing the efficiency of existing FTA such as NAFTA or the WTO. However, this model is quite flexible; additional variables, such as dummy variables, can be added to the model. Van Bergeijk and Brakman (2010) described the Gravity model as an interaction between economic agents. The larger the economic size of the countries, the greater the probability that they will trade; the further they are from each other, the less probable their economic interaction.

Linnemann (1966) added several important variables to the Gravity model, making it useful for international trade. These include population, economic distance, relative endowments, trade preferences, and common history and cultural background. Geraci and Prewo (1977) included common language into the measure and found that it has a positive relationship with bilateral trade. Hooper and Kolhagen (1978) found the negative impact on trade volume between countries caused by exchange rate volatility. As Grant and Lambert (2005) concluded, the Gravity model is in fact a universal and broadly applicable measure of bilateral trade flows between countries, since it has performed noticeably well in measuring the pre- and post-integration economic positions of respective states. Any factor that the researcher logically assumes as relevant variable for estimation of gravity model can be used, while regression output, particularly the p value of respective explanatory variables tells whether that variable is significant. The gravity variables can also be modified through logarithmic transformations. For example, log-linear transformation of the gravity model, proposed by Anderson (1979), allows for coefficients to be interpreted as elasticities. Koo et al. (2006) applied the gravity framework to international agricultural trade, where they consider certain variables as necessary in obtaining consistent results within agricultural sector. A group of variables was added reflecting trade creation and diversion effects resulting from the countries' common membership in an FTA. Their analysis considered cultural similarities such as language and historical linkages, exchange rates, and relative endowments of the commodity.

3. Empirical model

The objective of this analysis was to determine which variables are the most influential in bilateral wine trade between the European Union and the United States. Our analysis considers bilateral trade flows to the U.S. market; only U.S. imports are considered. Panel data was assembled, and the data was regressed using Panel Data Linear Regression in STATA Data

Analysis and Statistical Software, Release 14. The period of analysis was chosen to begin in 1989 to correspond with the collapse of Soviet Union. This event is linked to newly established political systems of several European states, new country borders, transitions to open economies and overall reassessment of new, more efficient trading partners in Europe. After the creation of time series data for the time period 1989-2015 (26 years of observations), we were able to detect the evolution of the United States' mutual engagement in trade with the main European wine producing countries, particularly France, Italy, Spain, Portugal, Greece and Germany. The inclusion of Slovakia, the only landlocked country, allows the model to determine the impact of this feature on international trade. Australia is included as a non-EU country in the model which is currently in an FTA with the United States. China was included as well, as a non-EU country which is not currently in an FTA with the United States.

The dependent variable is the Trade Intensity Index of country i exports to the United States (TII_{ij}), commonly used as an indicator of trade by the World Bank. The TII_{ij} conveys much the same information as would an export share. However, TII_{ij} allows for easy comparison across countries as it is a relative measure and is not biased by country or market size.

The explanatory variables used are the Gross Domestic Product of exporting country i (GDP_i) and that of the United States (GDP_j), distance between countries i and j ($Dist_{ij}$), real exchange rate in terms of country i currency per U.S. Dollar (RER_{ij}), an endowment variable representing the relative per capita wine productivity between countries i and j ($ENDOW_{ij}$), and U.S. tariff rate on country i exports (IT_{ij}). Dummy variables are included as follows: EU_i is 1 if country i is an EU member and 0 if not; $LLOCK_i$ is 1 if country i is a landlocked country and 0 if not; and FTA_{ij} is 1 if country i is a member of a trade agreement with the United States and 0 if not. The linear regression formula used in this analysis is as follows:

$$TII_{ij} = \beta_1 + \beta_2 GDP_i + \beta_3 GDP_j + \beta_4 Dist_{ij} + \beta_5 RER_{ij} + \beta_6 ENDOW_{ij} + \beta_7 ITij + \beta_8 EU_i + \beta_9 FTA_{ij} + \beta_{10} LLOCK_i + e. \quad (2)$$

For each of the variables, with the exception of the dummy variables, a natural logarithmic transformation was used in the analysis. Obtaining statistical data for the purpose of measuring the trade intensity, we used the World Integrated Trade Solutions (WITS) software created by the World Bank, Comtrade database. The formula of the Trade Intensity Index (TII) is as follows:

$$TII_{ij} = ((x_{ijk} / X_{ik}) / (x_{wjk} / X_{wk})) * 100 \quad (3)$$

A Trade Intensity Index coefficient of more than 100 indicates an intensive trade relationship involving country i exports to country j with respect to commodity k. Here x_{ijk} represents the amount of exports of product k from country i to country j, X_{ik} represents total exports of product k from country i, x_{wjk} represents the amount of exports of product k from the world to country j and X_{wk} denotes total world exports of product k. As an example, suppose the European Union exports 350,000 tons of wine the United States, while total EU wine exports were 700,000 tons. At the same time world wine exports to the United States were 9,000,000 tons, and total world wine exports were 18,000,000 tons. Substituting this data into the general formula of the Trade Intensity Index, we obtain the measure

$$TII_{ij} = ((350{,}000/700{,}000) / (9{,}000{,}000/18{,}000{,}000)) * 100 = 100.0 \quad (4)$$

where i represents the European Union and j represents the United States. The value of the Trade Intensity Index is 100.0. In this case the United States imported half of EU exports, but yet the U.S. share of EU exports was no more or less than the U.S. share of world exports. A trade intensity index greater than 100 indicates that country i is an intensive trading partner of

country j with respect to commodity k, while a trade intensity index of less than 100 indicates that country i exports account for a below average share of country j imports.

The exchange rate variable was problematic as our panel was applied to the period 1989-2015. The Euro was adopted as a currency in 1999 (European Central Bank, 2011). Prior to the adoption of the Euro, the EU member countries in our model used their own currencies. We calculated the real exchange rate in each year via the following formula:

$$RER_{ij} = NER_{ij} * (CPI_i / CPI_j) \tag{5}$$

Where RER_{ij} is the real exchange rate in terms of country *i* currency units per one country *j* currency unit (U.S. Dollars), NER_{ij} is the nominal exchange rate of country i currency per country j currency, CPI_i denotes the consumer price index for country *i*, and CPI_j denotes the consumer price index for country *j*.

For the period of 1989 to 1998, we adjusted each country's currency per Euro exchange rate. Subsequently, we corrected this number for inflation, and hence created a real exchange rate. We then divided the term by pegged currency in EURO terms ($PER_{i/EUR}$). By this we converted specific currency per Euro and created an artificial EUR/USD exchange rate for years 1989-1998 (Koo et al., 2006). For instance, France's currency was the Franc during the years 1989-1998. We have converted FRA/USD currency into EUR/USD using the following formula:

$$(NER_{FRA/USD} * (CPI_{FRA} / CPI_{USD})) / PER_{FRA/EUR} = RER_{FRA/USD} / PER_{FRA/EUR} = RER_{EUR/USD} \tag{6}$$

This formula was used for each country in our model that went through the transition into new currency (the exception being non-EU exporters Australia and China) to retain consistency with the Euro/Dollar exchange rate prior to 1999.

$ENDOW_{ij}$ is a measure of relative wine endowments for each exporting country. The proxy utilized is wine production per capita. As opposed to an income effect, this variable is used to find a possible Linder-type effect associated with wine production (Martinez-Zarzoso and Nowak-Lehmann, 2003). In other words, trade between countries is positively correlated to their similarity, in this case similarity in wine productivity. The variable is defined as:

$$ENDOW_{ij} = ln (PROD_i / POP_i) - ln (PROD_j / POP_j) \tag{7}$$

Given this equation, when there are similarities with respect to per capita wine productivity, the coefficient will approach zero. As the similarities among countries decrease, the variable will diverge from zero. A positive coefficient suggests an inter-industry trade structure; a negative coefficient suggests an intra-industry trade structure. Inter-industry trade is commonly attributed to comparative advantage. Since this analysis considers a single commodity, competitive rather than comparative advantage would be more appropriate. Given that this analysis only considers trade flows from an exporting country *i* to the United States, a positive coefficient for the *Endow* variable would be consistent with trade resulting from competitive advantage.

Other variables used in the model, such as the GDP of the United States and exporting countries, the distances between main ports, and dummy variables representing EU membership, landlocked nature of a country, and common membership in an FTA with the United States, were straightforward and did not require specific calculation. Data for this analysis was obtained from the International Monetary Fund, the World Bank, the European Central Bank, the United Nations Comtrade Database, World Integrated Trade Solutions (WITS), FAOSTAT, and EUROSTAT.

4. Results

The regression results from the empirical model are presented in Table 3. The overall adjusted R-squared from the pooled linear regression is 0.7677, indicating that 76.77% of the variance of the dependent variable is explained. The model was also corrected for heteroskedasticity and autocorrelation using an AR1 Autoregressive model to correct for the First-Order Serial Correlation. The model has normal distribution. Coefficient estimates as well as their standard errors and levels of significance are presented in Table 3.

Table 3. Standard Errors and Significance Levels of Coefficients. [1]

Trade Intensity Index	Coefficient	Standard Error	P>z[2]
Constant	8.3057	3.0582	0.007***
GDP_i	0.3970	0.1492	0.008***
GDP_{US}	-0.3311	0.2545	0.193
$Dist_{ij}$	-0.4517	0.2023	0.026**
RER_{ij}	0.0338	0.0103	0.001***
$ENDOW_{ij}$	0.1414	0.0491	0.004***
IT_i	-0.0428	0.0226	0.058*
EU_i (dummy)	-0.9756	0.1961	0.000***
FTA_i (dummy)	0.0434	0.2352	0.854
$LLOCK_i$ (dummy)	-2.9411	0.4121	0.000***

Note: 1) The Trade Intensity Index (TII_{ij}), GDP_i, GDP_{US}, $Dist_{ij}$, RER_{ij}, and IT_i variables were transformed into natural logarithms for this analysis. 2) Significance at $\alpha = 0.10$ (90% confidence level) is indicated by *****, significance at $\alpha = 0.05$ (95% confidence level) by ******, and significance at $\alpha = 0.01$ (99% confidence level) by *******.

The coefficient of the exporting country's GDP is 0.3970. It is positive and significant at the 99% confidence level. This indicates that countries with a higher GDP tend to export with a greater intensity to the United States. This could indicate that wealthier countries tend to have more capacity to export their wines. However, as the dependent variable is trade intensity, the coefficient relates to the impact of GDP on the intensity of trade with the United States, not overall trade. The positive sign of this coefficient could indicate the presence of intra-industry trade. On the other hand, the coefficient of the importing country's GDP was not significant. The United States is an attractive market given its large capacity for consumption. Changes in GDP from current levels will not likely change overall U.S. wine imports, nor will they impact the sourcing of those imports. Thus, U.S. GDP does not affect the Trade Intensity Index.

The coefficient of the Distance variable was consistent with our expectations. With a value of -0.4516, it is negative as anticipated and significant at the 95% confidence level. This result shows that the closer two trading partners are, the greater the trading intensity. Since the discipline of economics is different from physics (Van Bergeik & Brakman, 2010), the measure of initial distance should capture transportation costs and time, which can change with technological advancements and prices. As greater distance is associated with greater transaction costs, both with respect to money and time, we may also infer that an increase in other trade related costs, whether monetary, temporal, or bureaucratic, will decrease the trade intensity between countries. Likewise, reduction of these costs would increase trading

intensity. While distance between countries cannot be changed, increasing trading efficiency and decreasing transaction costs can serve to increase trade intensity between countries.

The coefficient of the real exchange rate has a positive value of 0.0338 and is consistent with prior expectations. It is significant at the 99% confidence level. Given that this analysis is dealing with an individual commodity, the implications of this coefficient can be considered in a partial equilibrium context. The positive sign of this coefficient indicates that a depreciation of the Euro increases the trade intensity of EU wine exports to the United States, while an appreciation of the Euro decreases its trade intensity.

The $ENDOW_{ij}$ coefficient has a positive value of 0.1413. In addition, it is a highly significant parameter, exhibiting significance at the 99% confidence level. As was indicated previously, this variable is showing a possible Linder-type effect by demonstrating that dissimilarities (in this case in terms of wine production) increase the intensity of the country i to export its product to country j, in this case the United States (Hallak, 2010). Since the sign is positive, it is indicating the presence of an inter-industry trade structure. This suggests that the competitive advantage of the exporting country is a determinant of trade.

The output coefficient for U.S. import tariffs has a value of -0.0427. This variable was significant at the 90% confidence level. It implies that a decrease in the U.S. import tariff of 1% would result in an increase in trade intensity of 0.04%, which is consistent with prior expectations.

The regression coefficient for the dummy variable representing EU membership is -0.9756. It is significant at the 99% confidence level. If the country is an EU member state, then the trade intensity with the United States decreases by 0.97%. This result may be explained when one considers membership in the European Union as trade diverting from the United States. Since the free trade area within the European Union provides internal trading opportunities with other member countries, it also results in trade diversion from exchange opportunities with non-EU countries such as the United States. Given that the U.S. proposed TTIP initiative sought to embrace the European Union free trade area and create the world's largest free trade zone, the negative significant coefficient of this EU dummy variable may provide some insight as to potential trade creation opportunities of that trade agreement.

The dummy variable that represents a country which is currently in a Trade Agreement with the United States has a positive coefficient of 0.0434. However, this coefficient is not statistically significant. The only country in our model that is currently engaged in an FTA with the United States is Australia. Trade agreements have varying degrees of trade liberalization. Membership within a trade agreement does not imply free trade, nor does it signify the same level of trade liberalization for all commodities or countries. This result highlights that it is not the act of forging a trade pact that encourages trade, but the specific details of the agreement. For the European Union, this indicates that the costs and/or benefits accruing through an agreement depend on the type and levels of concessions made.

The output coefficient of the Landlocked dummy variable is negative -2.9410 and it is significant at the 99% confidence level. Of the countries in the model, only Slovakia is landlocked. Our interpretation for this result is that not having direct access to the sea or to the ocean significantly impedes the country's ability and willingness to trade. More specifically, the trade intensity with the United States is weakened by 2.94% in the case of a landlocked country. Conversely, the trade intensity of a non-landlocked country is 2.94% greater than that of a landlocked country.

5. Summary and Conclusions

A primary reason for conducting this analysis was to determine the impact of an EU-US trade agreement on wine trade. However, given the uncertainty of trade negotiations involving the European Union and the United States and the failure of TTIP, our analysis focused on

determining and quantifying the impact of various factors influencing the intensity of EU wine exports to the United States. This information can then be used to either help formulate trade agreements or to determine their potential impacts.

The goals of the TTIP proposal included the liberalization of trade and investment as well as better coordination of trade through specific regulations. The results of this analysis provide insight into factors that impact EU export intensity; these factors can be influenced through a variety of means, including trade agreements. The two basic factors of the gravity model are mass and distance. In economic terms mass can be viewed as capacity for trade while distance is analogous with trade costs. Given this, the discussion of the analysis will be framed according to these categories.

Factors which represent a country's capacity to trade include GDP_i, GDP_j, and $ENDOW_{ij}$. The positive and significant impact of $ENDOW_{ij}$ indicates that export intensity is positively impacted by competitive advantage. As new trade agreements are forged, negotiators can seek to eliminate regulations that mask competitiveness while creating an environment that allows for commerce to be based on market signals. Such an agreement would be a vehicle to encourage market access and promote trading efficiencies through non-distorting policies.

The positive coefficient related to the Gross Domestic Product of the exporting country (GDP_i) has implications for both large and small countries. Although this analysis did not examine wine exports from the United States to the European Union, the positive GDP_i coefficient may indicate the impact of intra-industry trade. In other words, a country or region can specialize in a product that is unique to their region, thereby producing and exporting that wine while potentially importing other wines from other regions or countries.

Agreements which abolish protections for Designations of Origin and Geographical Indications would allow for the free imitating and legalized counterfeiting of wine. Moreover, there is a possible loss of the linkage of the wine brands with their historic location and traditional value (e.g., Bordeaux, Champagne, Tokaj). Allowing for the removal of these protections would potentially lessen the importance of intra-industry trade, as U.S. producers may seek to fabricate these products for domestic consumption, thus replacing imports of the traditional EU-produced wines.

The significance of the real exchange rate (RER_{ij}) in determining trade intensity also provides implications for policymakers as they negotiate trade and investment agreements such as TTIP. There have been trade agreements that have accomplished trade liberalization through the removal of trade barriers and elimination of tariffs only to find these accomplishments mitigated by exchange rate fluctuations. Individual sectors are not typically considered when formulating macroeconomic policy. However, the ramifications of these policies have implications for trade, particularly through the exchange rate.

Factors which influence a country's cost to trade include $DIST_{ij}$, IT_i, EU_i, FTA_i, $LLOCK_i$. Distance ($Dist_{ij}$) and import tariffs (IT_i) are perhaps the most obvious of these factors in determining costs of trade. Yet each contribute to transaction costs and provide implications for trade intensity. As an industry in a particular country seeks to enhance its trade intensity with the United States, these five factors should be examined in order to best frame the trading environment.

While distance between countries does not change, transportation and transaction costs can be reduced via prices, technology, and policy. Thus, each of the five factors can be manipulated to enhance a country's trade intensity, in this case with the United States. Polins (1989) and Van Bergejik (1992) allude to the impact of a positive diplomatic atmosphere between trading countries in encouraging exchange. This can take the form of trade agreements or the removal of red tape. Thus, the cost of distance can be reduced.

Policy makers can account for these cost factors as they craft a TTIP-type agreement between the European Union and the United States. Trade intensity gains can be achieved through the negotiated reduction of import tariffs. The insignificant FTA_i variable implies that

Trade Agreements, in and of themselves, do not guarantee enhanced trade; they must be accompanied by provisions to increase market access and eliminate trade barriers. In the case of land-locked countries, options to enhance transportation infrastructure must be considered to allow all countries to benefit from a freer, more open, trading environment.

Even the negative EU_i coefficient has implications for trade intensity with the United States. Lower trade intensity with the United States is likely accompanied by greater trade intensity with other EU countries. This indicates the success of the EU in achieving "a kind of United States of Europe" (Churchill, 1946). Creating an agreement that provides a greater degree of inclusion for the United States in the EU common market would increase the trading intensity of EU countries exporting to the United States. However, there would likely be cross-effects resulting in decreased trading intensities with other European countries.

This raises an issue that can be addressed in future research. Future analysis can consider the cross effects of these factors with respect to the trade intensities with other countries. For example, will a policy designed to enhance the TII of Italy exporting to the United States result in a decreased TII for Italy with Germany?

The standard gravity model utilizes GDP and population as proxies for production and consumption capacity in evaluating trade flows between counties. This analysis utilized the $ENDOW_{ij}$ variable to account for differences in production capacity and competitive advantage between countries at the commodity level. Future research should develop similar measures that account for differences in tastes and preferences between countries. Development of these types of measures will help refine the augmented gravity model and better tailor this type of commodity-level trade analysis to provide better insights for policymakers from both a production and consumption perspective.

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