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THE DESIGN OF THE ROMANIAN WINE IMPORTS AND EXPORTS USING THE GRAVITY MODEL APPROACH

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Abstract:

Purpose-the aim of this paper is to assess the design of the Romanian wines imports and exports using the gravity model.
Design/Methodology/Approach-the regression was used, namely Panel EGLS (Estimated Generalized Least Squares), with cross-section weights option, which allows the control of heteroscedasticity and of the auto-correlation as well. The independent variables used in the gravity model are GDP per capita, distance, Unit price, exchange rates, wine production.
Findings-the GDP per capita and the common membership of two countries influence positively the wine trade flows. The Unit price, the distance, the isolation and the dominant religion influence negatively the wine trade flows. The wine production and the exchange rates have low influence and they are not statistically significant.
Practical implications-the article is useful for importers and exporters because it highlights which variables of a country could influence the wine trade flows.
Originality/Value-the application of the gravity model on Romanian wine trade flows.

Keywords:

gravity model, wine trade flows

JEL Classification: F14

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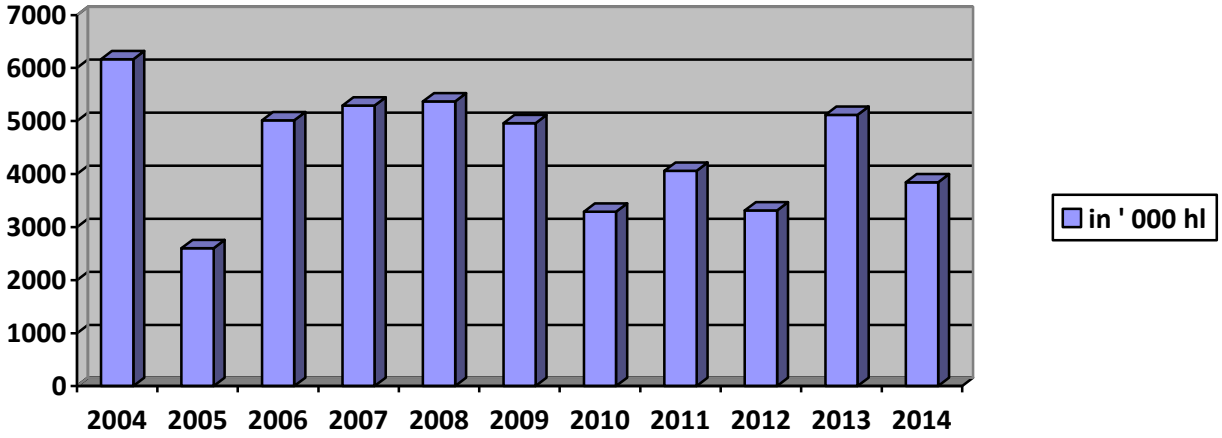
1. Romanian wine market

In ancient times, more than 4000 years ago, when Romania was Thrace to Greeks and Dacia to Romans, the god of wine was born in Thrace according to legend (Sechrist, 2017). Therefore in Romania there is a long tradition in wine growing, with great periods, as in XX century when noble wines from France (Pinot Noir, Cabernet Sauvignon, Merlot, Chardonnay, Sauvignon Blanc) were introduced in Romania wineries, or dark times, as in Communism when the focus was on quantity disrespectful to quality.

Figure 1: Production of Romanian wines during 2004 - 2014



Source: Author's chart based on INSSE statistics

The production of Romanian wines is on average 4455 million hectoliters, with a minimum of 2602 million hectoliters on 2005 and a peak of 6166 million hectoliters on 2004.

According to data from www.wineromania.com, Romania produce 402 varieties of wine, of which 11 varieties are table wines, 42 varieties are high-quality wines-PGI (Protected Geographical Indication of the wines) and 349 varieties of extra high-quality wines PDO (Protected Designation of Origin of the wines).

Table 1: Wine varieties produced in Romania

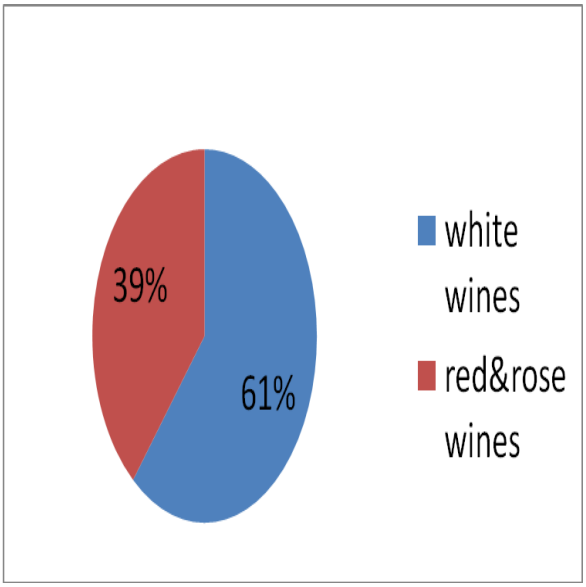
	White wines	**Red wines**	**Rose wines**	**Aromatic wines**
International wine varieties	Chardonnay	Pinot Noir	Merlot Rosé	
	Sauvignon blanc	Merlot	Burgund Rosé	
	Muscat Ottonel	Cabernet	Traminer Rosé	

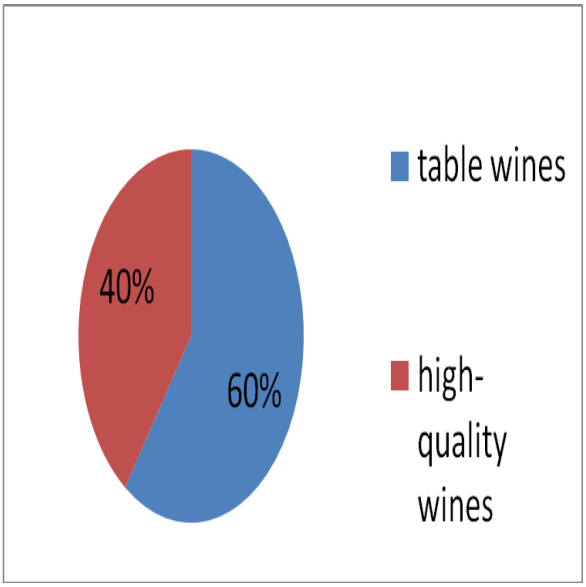
		Sauvignon		
	Pinot gris	Dornfelder		
	Aligoté	Syrah		
	Traminer	Burgund		
Romanian wine varieties	Fetească Regală	Fetească Neagră		Tămâioasă Românească
	Fetească Albă	Băbească		Busuioacă de Bohotin
	Galbenă de Odobeşti	Mustoasă de Maderat		
	Zghihară de Huşi	Negru de Drăgăşani		

Source: Author's table according to APEV 2016 data

Figure 2: Comparisons between the white wines and the red wines production in Romania (left)

Figure 3: Comparisons between the table wines and the high-quality wines production in Romania (right)

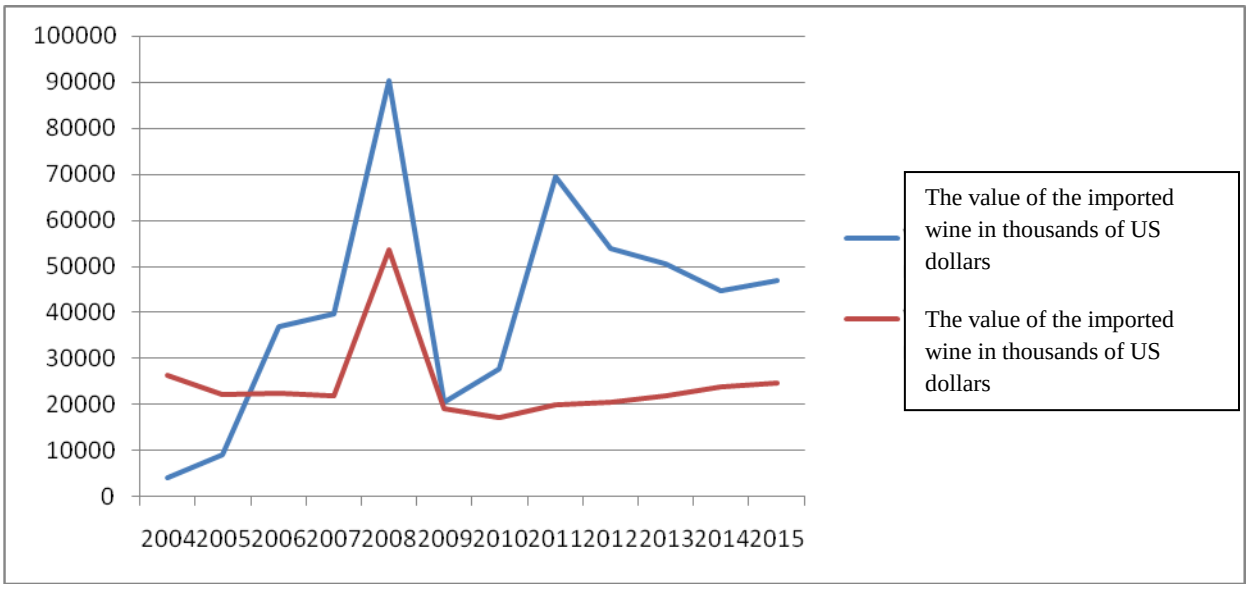




Source: Author's charts based on APEV 2016 statistics

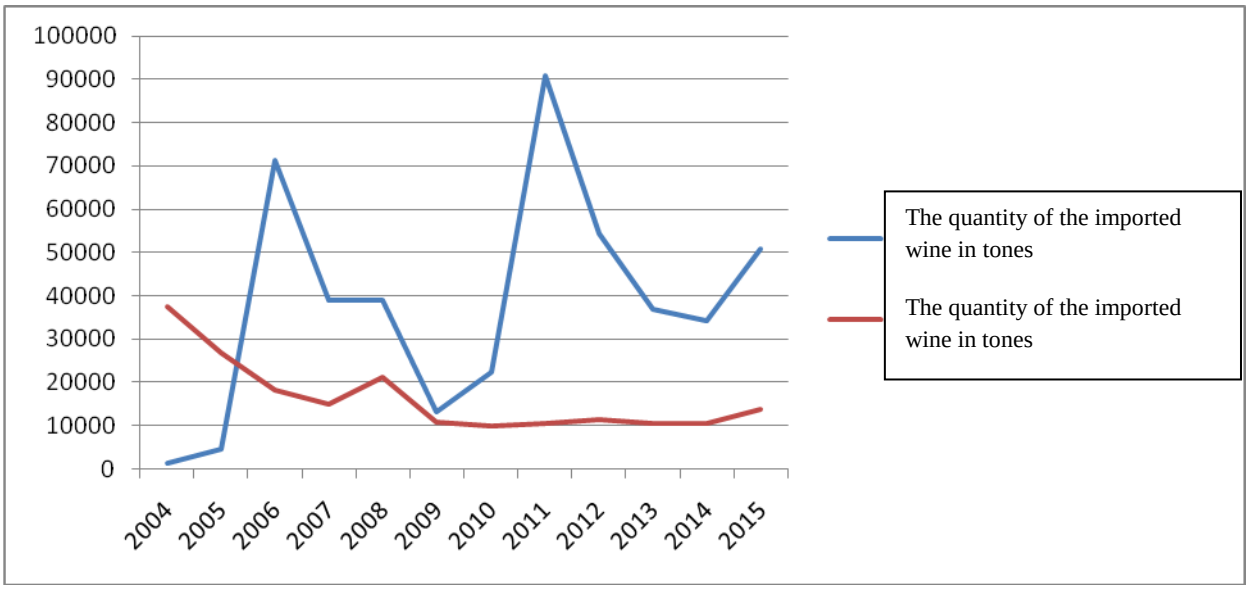
In 2016, Romania got the fifth place regarding wine production in EU (behind Italy, France, Spain, Portugal and Germany) and was in top 15 countries in the world, more precisely was no. 13 according OIV Report 2015 (http://www.oiv.int).

Figure 4: The evolution of the value of the Romanian exports and imports of wine from 2004 to 2015



Source: Author's figure based on INSSE data

Figure 5: The evolution of the Romanian exports and imports of wine (in tones) from 2004 to 2015



Source: Author's figure based on INSSE data

Analyzing figure 4 and figure 5 referring to the quantity and the value of the exports and imports of the Romanian wines, we can conclude that Romania was a net importer starting 2005, except for the year 2009, when there was a relative balanced trade. The peak was in 2008 and in the post crisis period only the imports were increasing, while the exports were increasing starting 2013.

Table 2: Top 10 countries where the Romanian wines were exported to (left)
Table 3: Top 10 countries where the Romanian wines were imported from (right)

Country	%
UK	27
China	17
Germany	11
Netherlands	10
Italy	9
Spain	8
USA	7
Estonia	5
Canada	4
Russia	2

Country	%
France	22
Spain	21
Italy	19
Moldavia Rep.	11
Germany	10
Hungary	7
Bulgaria	4
Macedonia	3
Czech Rep.	2
Serbia	1

Source: Author's tables based on APEV 2016 statistics

Three of the countries, namely Spain, Italy and Germany are in top 10 exporters as well as in top 10 importers, 3 out of 10 countries from the export top are from outside Europe(China, Canada, USA), while 3 out of 10 countries from the import top are from outside EU, yet in Europe (Moldavia, Serbia, Macedonia).

2. The gravity model

The gravity model is widely used to study the trade flows since 1962 when it was introduced by economist Jan Tinbergen. The gravity model is adapted from the well known Newton's universal gravity law, in the original model the two particles from universal gravity law are two countries, the force with which are attracted one to each other is considered the size of the reciprocal trade flows, the weights of the particles are the size of the economies of the two countries and the distance between the two particles is the distance between the capitals of the two countries (Tinbergen, 1962). The seminal model of Tinbergen was developed and improved by many other researchers.

Tabel 4: Main contributions and criticisms to gravity model

Contributions	Author(s) and year	Criticisms
Published a similar and independent with the seminal gravity model	Pöyhönen 1963	
	Linnemann 1967	Measuring the distance between countries with more than one major commercial center
The commercial effects generated by the membership of some states to EEC or EFTA	Aitken 1973	
Set up the theoretical foundation	Anderson, 1979	
	Heckman 1979	The zero flows and the controversies of the gravity model
The commercial arrangements influence significantly the trade flows.	Sapir 1981	
Correlation with the market structure	Helpman and Krugman 1985	
Introducing the exchange rates variation as a variable	Thursby & Thursby 1987	
Developed the microeconomic foundation of the gravity equation	Bergstrand 1989	
Adding the national political borders to the usually border variable	McCallum 1995	
Using gravity model to predict trade flows	Deardorff 1998	
The influence of the migration flows on the trade flows	Dunlevy & Hutchinson 1999	
Independent variables: the GDP product, the GDP per capita product and the two countries areas product	Rose 2000	
Estimating the values of the coefficients between 0.7 and 1.1	Feenstra 2002	
Introduced two new independent	Egger	

variables, lnSimilar and lnRFLAC	2002	
Emphasizing the importance of the distance and the associated risks	Head 2003	
The effect of the international political conflicts on the trade flows	Reuveny & Kang 2003	
	Rose and Spiegel 2004	The threat of zero flows in the gravity model
Empirical study on gravity model for intermediate goods	Egger and Pfaffermayr 2004	
The liberalization effect is more significant in the case of services	Kimura and Lee 2004	
	Baldwin and DiNino 2006	The zeroes flows in the gravity model
	Santos Silva and Tenreyro 2006	Problems with the homoskadasticity hypothesis using OLS
	Santos Silva and Tenreyro 2006	Nonlinear estimators, especially PPML, should be preffered to OLS
Applicability of the gravity equation on the trade with intermediate goods	Baldwin and Taglioni 2007	
	Helpman, Melitz and Rubinstein 2008	Treating the zeroes in the trade flows
80 −90% of the variation in the trade flows is captured by the gravity model	Anderson, 2011	
	Santos Silva, Joao and Tenreyro 2011	Problems with the homoskadasticity hypothesis using OLS and how to fix it
Using of the nonlinear estimators	Gomez-Herrera	

	2013	
	Martinez-Zarzoso 2013	Proved that OLS is more performant than PPLM.

Source: Author's table based on research on significant literature review

3. Modelling the Romanian trade flows for wines using the gravity model

Research hypothesis :

H1: GDP per capita of the partner countries have a positive influence on the trade flows of Romanian wines;

H2: The distance between Romania and a partner country or the isolation of a partner country have a negative influence on the trade flows of Romanian wines;

H3: The wine production and the unit price of the wine have a positive influence on the trade flows of Romanian wines;

H4: Membership at a commercial agreement have a positive influence on the trade flows of Romanian wines;

H5: A dominant religion which bans wine or other alcooholic drinks have a negative influence on the trade flows of Romanian wines.

The main reason for using the panel data in this study are:

- Panel data are strongly recommended mainly for highly volatile products, such as wine (Koo et al., 1994);
- The estimations obtained using the panel data are more robust comparing to the ones using OLS (Koutsoyiannis, 1977);
- The efficiency of the estimations obtained using panel data is better due to the reductions of the colinearity issues (Hsiao, 1986).

The equations used in the model are:

$$\ln E_t = a_{0t} + a_{1t} \cdot \ln GDPPC_t + a_{2t} \cdot \ln D_t + a_{3t} \cdot \ln Exrates_t + a_{4t} \cdot \ln UnitprE_t + a_{5t} \cdot \ln Prod_t + a_{6t} \cdot EU + a_{7t} \cdot Schengen + a_{8t} \cdot Rel\_dummy + e_t$$

and

$$\ln I_t = a_{0t} + a_{1t} \cdot \ln GDPPC_t + a_{2t} \cdot \ln D_t + a_{3t} \cdot \ln Exrates_t + a_{4t} \cdot \ln UnitprE_t + a_{5t} \cdot \ln Prod_t + a_{6t} \cdot EU + a_{7t} \cdot Schengen + a_{8t} \cdot Rel\_dummy + e_t$$

where

- E_t is either EXT_t=real export or $EXPORT_t$= the export corrected using the Tobit estimator
- I_t same as above but for import
- D_t is either Dist (distance) or Distcom (isolation)
- e_t captures the error
- t is the year, from 2004 to 2015
- GDP was used as a measure for the size of an economy by many authors : Brada & Mendez (1985), McCallum (1995), Bergstrand (1989), because for the exporter countries GDP represents the production potential, while for the importer countries

represents the purchasing power. GDP has a positive influence on trade flows, because a greater production potential leads to many products available for export and a greater purchase power leads to many opportunities for imports (Koo et al., 1994). Another measure for economic size namely GDP per capita was used in 1999 by Cheng and by Wall. The greater the GDP per capita is the more intense trade flows between countries will occur, therefore the GDP per capita has a positive influence on the trade flows. In this study the GDP per capita was used as an independent variable (GDPPC).

- The distance between two countries appears in most studies using gravity model, although there are authors who don't recommend using the distance in gravity models, arguing there are major differences between transport cost by air or using water or land transport (Cheng, 1999; Wall, 1999). Other authors like Dascal, Mattas şi Tzouvelekas (2002) recommend replacing the traditional distance with the ratio from distance and GDP of a country as a percent of the sum of GDPs of all the studied countries. In this study there are two models, one using the classical distance (Dist) and the other one using isolation as variable (Distcom). While distance usually has a negative effect, the effect of isolation could be either positive or negative.
- Unit price for export or for import were used as independent variables by Koo, Karemera and Taylor (1994), therefore the unit price for export should have a positive effect on trade flows and a negative one for imports. UnitprE was the name of the variable used for export and Unitpr the one for import.
- Exchange rates influence the trade flows, strenght of the national curency could reduce exports and stimulate imports (Koo, Karemera şi Taylor, 1994). Exrates was used for exchange rates variable.
- Prod, the wine production of partner countries was used in the study according to Dascal, Mattas & Tzouveleka (2002).
- As dummy variables, EU and Schengen were used, these dichotomous variables have the value 1 if the partner country is a EU or Schengen member and 0 otherwise. These two variables are used in many studies and have a positive influence on trade flows.

- Other dummy variable used was Rel_dummy, which have the value 1 if the dominant religion of a country bans the wine and 0 otherwise.

The regression was used, namely Panel EGLS (Estimated Generalized Least Squares), with cross-section weights option, which allows the control of heteroscedasticity and of the auto-correlation as well. The results are in Table 5.

Table 5: The results for regression panel EGLS for wines

	Model 1	**Model 2**	**Model 3**	**Model 4**
Dependent variable	LNEXPORT	LNEXP	LNIMPORT	LNIMP

C	16.81874 *** [1.070515]	16.44160*** [1.070515]	11.91371*** [0.643419]	12.05135*** [0.681693]
SCHENGEN	-0.925488 *** [0.211439]	-0.899697*** [0.204800]	-	-
EU	1.133722*** [0.250514]	1.144171*** [0.245219]	-	-
REL_DUMMY	0.177248 [0.162448]	0.141955 [0.161928]	-1.504221*** [0.127793]	-1.567388*** [0.135149]
LnGDPPC	-0.555427*** [0.089353]	-0.533108*** [0.087744]	-0.129811** [0.060887]	-0.147475** [0.064676]
LNPROD	0.012392 [0.026288]	0.021393** [0.009885]	-	-
LnunitprE	-0.160725*** [0.053412]	-0.179473** [0.054141]	-0.293546*** [0.045258]	-0.290862*** [0.046620]
LNEXRATES	-0.017715 [0.031469]	-	0.015921 [0.021250]	0.021300 [0.022401]
LNDISTCOM	-0.635820*** [0.026272]	-0.612605*** [0.026674]		
Lndist			-0.445305*** [0.051098]	-0.450119*** [0.053325]
R-squared	0.815229	0.806460	0.762356	0.739692
Adjusted R-squared	0.803212	0.795534	0.752926	0.729362
F-statistic	67.83623	73.81342	80.84091	71.60826
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000
No cross-sections	11	11	11	11
No periods	12	12	12	12
Jarque Bera value	0.768811	0.792024	3.652777	3.424561
prob	0.680855	0.672999	0.160994	0.180454

Source: Author's table based on EViews outputs

Notes:

The standard errors are in brakets,

*** significant at 1%,

** significant at 5%,

* significant at 10%

Results and conclusions

The dummy variable Schengen has a negative coefficient and the dummy variable EU has a positive coefficient, both variables are statistically significant in both export models.
The variable Rel_dummy is statistically significant only in import models, where it has negative coefficients, although in export models, this variable has positive coefficients. These values might be explained as follows :

- The fact that Romania is a EU country has a positive effect on increasing the wine exports to other EU countries.
- The fact that Romania is not a Schengen member influences negatively the wine exports to some Schengen countries.

These results sustain the findings in the previous studies, namely the common membership of two countries have a positive effect on the trade flows of the two countries.
If the dominant religion of a country bans the wine consumption, the effect on the wine trade flows is negative.
Unlike the findings in the previous studies, the coeffiecients of the GDP per capita are negative and significant in all models. This might be explained as follows, an increase of the GDP per capita leads to a refinement of the prefferences for wine, mainly for premium wines and in the same time to better opportunies to buy premium wines.
The coefficient of the Unit price both for import and for export is negative and significant in all models, therefore an increase of the Unit price would have a negative effect on bilateral trade flows.
The coefficient of the Exchange rates is negative for exports and positive for imports, yet they are not statisticaly significant.
The wine production has a positive influence, although low and it is significant in just one of the export models.
Isolation has negative and statistically significant coefficients in the export models, while the coefficients for distance are also negative and significant for import models. This means that a greater distance between the partner countries would decrease the wine trade flows, although at a lower degree for wines comparing to other goods.
Between 72% and 80% of the variation of the variables was explained by the models and the values of the F-statistics show that the models used in the study are statistically significant.

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