

## **ANALYSIS OF AGRICULTURAL EMIGRATION FROM ROMANIAN RURAL AREAS USING A QUANTITATIVE APPROACH**

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### **Abstract**

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Romania is characterized by lots of small farms with a poor usable agricultural surface which is fewer than 3.5 hectares. The main consequence of this shortage of agrarian capital has been a growth of out emigration from the countryside, aging of entrepreneurs, rural poverty and marginalization of rural space. The purpose of this paper was to investigate, after the breakdown of Berlin's wall, as a consequence of the entry of Romania into the European Union, the evolution of the rural out emigration using a quantitative approach such as multiple regression model and Self-Organizing Maps. Findings have pointed out as in small villages scattered in rural areas, with a poor agrarian surface size and a significant incidence of agricultural activity in their economic fabric, the diversification of rural activities could have positive effects in terms of farm net income growth reducing partially rural emigration.

*Key words:* Common Agricultural Policy, Self-Organizing Maps, rural development, multiple regression model

### **Introduction**

After the collapse of the communist regime in Romania in the early 1990s, there has been a significant permanent out-emigration, predominantly rural emigration, from the countryside and in the same time there has been a significant exodus of farmers, also in terms of inner emigration towards urban areas, which have been considered able to offer new job opportunities with negative socio-economic impacts. The transition from a centralized and planned economy to an open competition and globalized market has been harsh for Romanian farmers due to an endemic poverty in several Romanian counties, a poor level of infrastructures endowment and a shortage of non-diversified business activities (Turnock, 2005). According to this author, all above mentioned negative aspects have strengthened the dichotomy among towns and small rural villages. Furthermore, this author has argued about the positive role that exogenous financial subsidies and micro-credit initiatives as well have had in implementing the diversification in the countryside with the

purpose of reducing socio-economic marginalization, rural emigration, ageing of farmers and unemployment, allowing, in the same time, a restructuration of small farms by new business opportunities and job creation initiatives.

Economic performances and features in the Romanian primary sector have pointed out as rural villages and farms have same issues and peculiarities investigated in depth in lots of other European countries in the early 1960s (Otiman, 2009). In Italy, in the 1960s, many farmers and unemployed people moved from the south to the north-west where a newly industrialization was taking root and significant was the demand of a not qualified workforce. In stayed behind poor rural areas, reasons of this time lag socio-economic growth are tightly connected to a not efficient use of financial subsidies allocated by the European Union in previous pre-accession assistance time in new comers states of the European Union (Otiman, 2008a; 2008b; 2009). This author has argued as a poor level of invested capitals and new technologies have acted on the technical efficiency in farms which

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is a fundamental pillar in reducing the social desertification in Romanian countryside and in particular in less favoured rural areas, where are located semi-subsistence farms.

In general, as a consequence of the enlargement of the European Union in 2007, and nevertheless before 2004 through-out specific actions of support the transition process by the SAPARD project, in many Romanian rural villages findings have corroborated the theoretical framework, according to which, there is a nexus between financial subsidies managed and disbursed by public authorities and efficiency performance in farm; hence, capital and investments in technology correlate directly to the farm efficiency growth and farmer net income improvement, highlighting as financial subsidies disbursed by the Common Agricultural Policy in favour of farmers have positive and direct effects on the technical and economic efficiency by also a stimulation in farm diversification throughout the rural tourism and agritourism (Galluzzo, 2014, 2015, 2016).

Romanian countryside is characterized by lots of small rural villages, at risk of socio-economic marginalization, due to out emigration issues which are a negative prerogative typical of many other European rural areas such Italy as well (Galluzzo, 2015) with the consequence to foster rural desertification, land abandonment and fragmentation over the time. In general, the European size unit (ESU), stated by the European Union in its Commission Decision 377 published in 1985, defines the level of subsistence of farms. Farms classified above 1 ESU are considered subsistence farms with severe problems to survive in a long term economic perspective being these latter farms focused on their own self production and absolutely not arranged and addressed for a globalized market. In Romania, considering the Eurostat dataset, more than 70% of farms has an agricultural surface close to 1 hectare hence, the majority of Romanian farms, as a consequence also of the collapse of its previous centralized economy, which did not allow to possess private property, can be set in this subsistence cluster (Giurca, 2008) and more of them are managed by old farmers. According to this author Romanian government has planned its National Rural Development Plan by specific measures tailored in function of small family traditional farms in order to implement the level of economic and technical efficiency in almost 3 million of subsistence farms throughout an increase of financial supports disbursed by the CAP. In particular, national and local authorities have increased those funds allocated by the second pillar of the Common Agricultural Policy, tailoring specific measures of rural development able to stimulate diversification and pluriactivity in the countryside. The main consequence of this shortage of agrarian capital in the Romanian countryside, due to small dimension of farms, has been a growth of out emigration and an expansion of rural poverty with the consequence to foster the socio-economic marginalization of rural space.

Comparing Italian and Romanian farms, because both nations have an usable agricultural surface lower than the European average value close to 10 hectares, findings have pointed out a similarity between these two countries in terms of farm size and agrarian capital; in fact, in both countries, farms with small utilized agricultural area are predominately scattered in the rural space with small villages at risks of rural out emigration (Festuccia, 2013; Eurostat, 2015).

In 1990s Romanian farmers such as other new comers belonging to western countries did not receive after the transition from a centralised economic system to an open economic model any financial supports which have implied a free competition and liberalization in their economic structures (Irina and Maria, 2012) with negative direct impacts in restructuring and modernization of farms with an inadequate level of agricultural capital investments and land capital.

In Romania more than 90% of people lives in the countryside which represents a rural area with a poor endowment in public infrastructures; hence, National Rural Development Plan is a good chance but not the unique one to solve a socio-economic dichotomy between rural and urban areas (Mursa and Parashiv, 2009). Recently, Romanian rural areas have pinpointed a significant growth of diversification in farmer's activities such as agritourism and rural tourism (Calina and Calina, 2015) which are two typologies of green tourism hospitality able to protect the environment and also the rural space in a perspective of multifunctionality.

## **Aim of the Research**

The purpose of this paper was to investigate which variables have acted on the rural out emigration in three years: one after 10 years after the breakdown of Communist regime (2000), one when Romania became a member of the European Union (2007), and finally in 2013 when the adhesion to the European Union has been consolidated and also Romanian primary sector has benefited in a completely way of financial subsidies allocated by the CAP and the transition period for new comers states of the EU was over.

Furthermore, another step in the quantitative analysis has been to assess the impact of European financial subsidies and rural diversification activities have acted on the level of farm income in Romanian countryside, reducing out emigration of working force.

## **Methodology**

In order to investigate and to assess the main relationships among the dependent variable permanent emigration

from the Romanian countryside and the independent variables such as usable agricultural areas, rural population, departure from rural areas in terms of internal emigration and regional gross domestic product in every Romanian counties during three years (2000, 2007 and 2014), it has used a multiple regression model, estimating parameters by the Ordinary Least Square. The estimation of regressors has used the open source software GRETL 1.8.6 and in its algebraic form of matrix, the multiple regression models can be so expressed (Verbeek, 2006):

$$y = X\beta + \varepsilon, \quad (1)$$

where  $y$  is a dependent variable,  $\beta$  are parameters in the model and  $\varepsilon$  is the statistical error but both are vectors with  $n$ -dimensions;  $X$  is an independent variable which has dimension  $n \times k$ .

In analytical terms, the model of multiple regression in its general formulation can be written in this way (Asteriou and Hall, 2011; Baltagi, 2011):

$$y = \alpha_0 + \alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 + \varepsilon_i, \quad (2)$$

where  $y$  is the permanent emigration from all Romanian regions,  $\alpha_0$  constant term,  $x_1, x_2, x_3, x_4$  independent variables,  $\alpha, \beta, \gamma, \delta$  estimated parameters of the model,  $\varepsilon_i$  term of statistic error.

Basis assumptions, to use a multiple regression model, are (Asteriou and Hall, 2011; Baltagi, 2011): statistic error  $\varepsilon_i$  has conditional average zero that is  $E(\varepsilon_i | X_i) = 0$ ;  $(X_i, Y_i)$ ,  $i = 1 \dots n$  are extracted as distributed independently and identically from their combined distribution;  $X_i$  and error term  $\varepsilon_i$  have no fourth moment equal to zero. There is not correlation among regressors and random noise so that the value between  $\beta$  expected and  $\beta$  estimated is the same. To analyze if in the model of regression there is heteroschedasticity on standard errors, it has used White's Test on the error terms (Verbeek, 2006).

The second phase of the quantitative approach in this paper has used the Self Organizing Maps (SOM) proposed by Kohonen utilizing the open source software Orange Canvas 2.7. In a theoretical framework SOMs are similar to the Principal Component Analysis, or rather they are able to assess by an unique winner neuron (black hexagon) some main relationships among all analysed variables in turn (Kohonen, 2001). According to this author, the Self Organizing Maps reduce, in the same identical way such as the Principal Component Analysis method, the complexity in a dataset by visualizing in a unique map the best neuron or unique winner neuron, which in the map is depicted by a black hexagon, and the main relations among variables (Mehmood et al., 2011).

The Kohonen's maps have been more sensitive to highlight the effect of financial subsidies disbursed by Common Agricultural Policy in Romania and the growth of agritourisms, proxy variable of the diversification activities to farms pivotal in slackening socio-economic marginalization, and out emigration. General speaking, the black and grayish hexagons in the maps are zones where there is the highest level of clustering close to the winner neuron, instead the white ones are the opposite or rather white hexagons describe neurons far away from the winner neuron (Kohonen, 2001; Kasky and Kohonen, 1996; Mehmood et al., 2011). The main advantage of SOMs is to obtain a pattern able to classify homogenous clusters preserving their dissimilarities (Kohonen, 1984). The Kohonen's maps are based, in this paper, on a method of unsupervised learning process in a limited sized space provided that the topological properties of an input space or stimulus come from the outside (Kohonen, 2001). The SOM is a neural network where each artificial output neuron is arranged in grids based on a lower dimension in connection to all neurons of input (Haykin, 1994; Haykin and Lippmann, 1994). Each input or stimulus is connected to other neurons of the output by a weight vector assessed in order to define the position of a centroid in the space (Lucchini, 2007). Weights assigned to the neurons are initialized either as random numbers or as small values, which have been sampled uniformly from a subspace crossed by two wider eigenvectors main components hence, initial weights are a good approximation of the weights in the SOM (Kasky and Kohonen, 1996).

The network in the SOM is characterized by a pattern in two layers; one layer is made up by input and the other layer, commonly called Kohonen's layer, is constituted by output (Kohonen, 2001). The neurons of the two layers are completely connected to each other, while neurons of the output layer are linked to different output neurons (Kohonen, 1984). In the layer of output neurons there is a unique winner neuron which takes all. As a consequence of a system of interactions of lateral inhibitions and excitations in function of the distance from the winner neuron, some neurons near to the winner are excited and other neurons, more distant from the winner neuron, are inhibited generating a function similar to a Mexican hat (Kohonen, 1984). In this simplified competitive network the winner neuron has a value equal to 1 if input neurons are close enough to the Best Matching Unit (BMU) and 0 otherwise. The magnitude and the level of excitation or inhibition of different weights in neurons are a function of their geometrical distance between neurons on the lattice or map generating a typical function like a Mexican hat whose values are included in a range from 0 to 1 (Kohonen, 1984; Kasky and Kohonen, 1996). The intensity of the approach process decreases over time and it is in function of the distance of neurons from the BMU (Kohonen, 2001).

## Results and Discussion

Comparing the permanent out emigration from Romanian counties, findings in 2014 have pointed out as the level of income, in terms of Regional Gross Domestic Products, correlates directly to the out emigration phenomenon; hence, in poor counties people prefer to stay *in loco* because fewer are opportunities and poor is the personal income to move definitely or alternatively because in these counties other activities tightly linked to less favoured rural areas have lessened the out emigration from the countryside (Table 1). Nevertheless, many poor Romanian counties have suffered after the collapse of communist regime in 1990 a severe permanent out emigration from the rural space, so it is common in 2014 not to find a correlation between the variables out emigration and rural population. After the enlargement of the European Union in 2007, Romanian counties have highlighted as the out emigration correlates directly to the internal movement of people within Romania and the level of regional gross domestic products. In general, counties with a not meaningful level of rural population have been characterized by the highest level of out emigration. This has been corroborated analysing findings in 2000, according to them, higher is the level of rural population lower is the emigration; hence, in 2000 lots of people moved definitely from the populated urban centres to other European nations or in extra European territories.

During three years of investigation the value of  $R^2$  and adjusted  $R^2$  have pointed out values above 0.80 with the absence of heteroscedasticity and error terms with a normal distribution; statistical test and the value of  $R^2$  have corroborated as the multiple regression model fits well to the data.

Relations over three different years of investigation using

the Self-Organizing Maps, considering correlations among the variable growth of agritourism (hexagons) and other variables such as permanent emigration from the countryside, regional gross domestic products and rural population in all Romanian counties have pointed out as counties with the highest value of development of agritourist enterprises are linked to the lowest permanent emigration flow from the countryside, even if this phenomenon is shrunk in 2007 but it is arisen in 2014 compared to previous seven year time (Figure 1). In general, Romanian counties have highlighted as Romanian agritourism increased in poor rural areas characterized by the lowest level of Regional Gross Domestic Products, corroborating the hypothesis, according to which, agritourism is a good opportunity to implement the level of farmer's income and employment chances in rural areas at risk of marginalization.

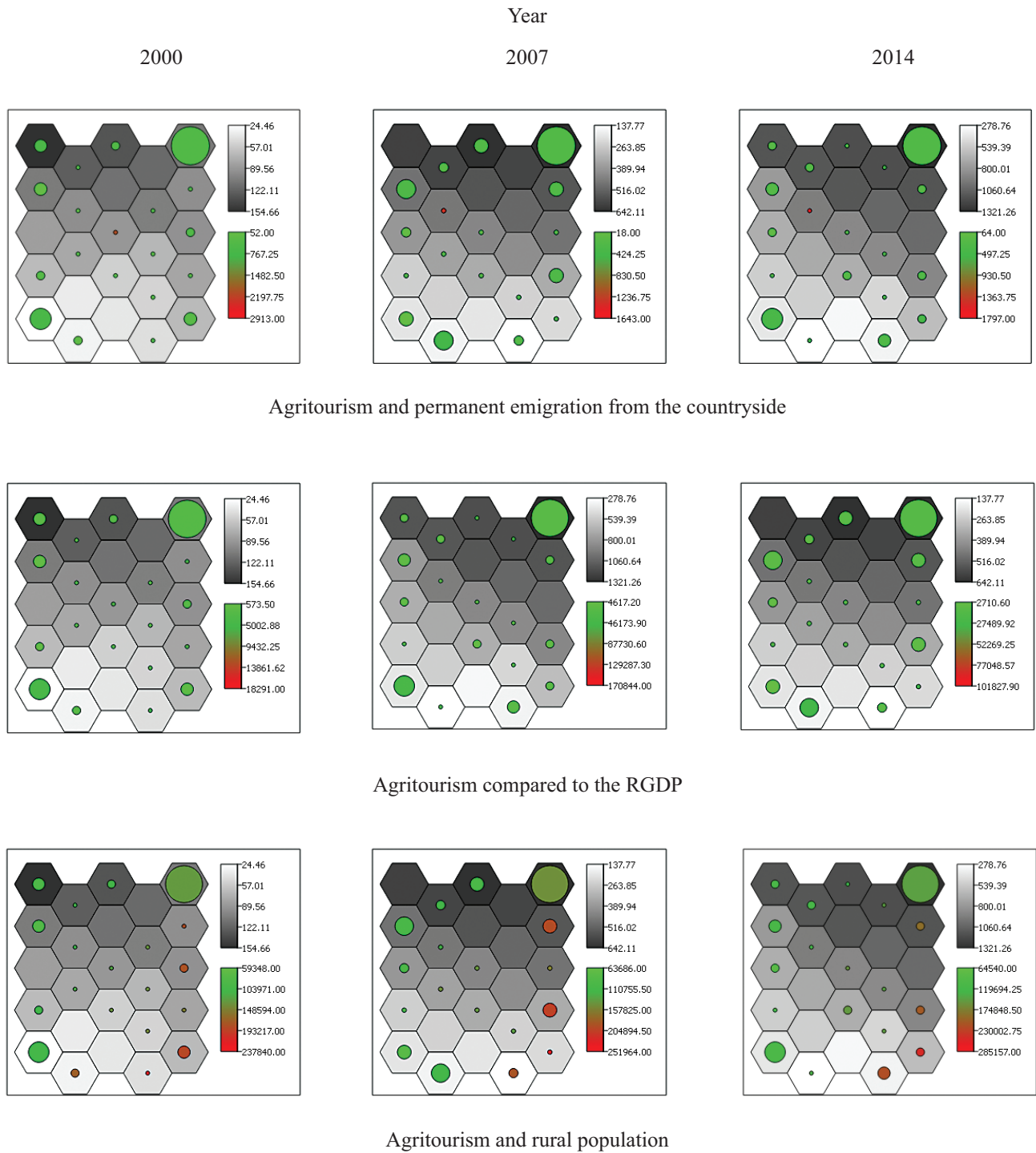
Findings in SOMs have pointed out as the growth of agritourism in Romanian counties has involved rural areas characterized by an intermediate presence of rural population even if, both in 2007 and also in 2014, Kohonen's maps have highlighted the lowest level of farm holidays farms development in rural areas marked by the highest level of rural population. This has implied as few farmers in Romanian rural space have decided to turn radically their enterprise specialization hence, in general, agritourism is rooted in few rural areas where significant is the development of tourist activities.

The Kohonen's maps have pointed out as there has been a growth of emigration from the Romanian countryside tightly linked to development of agritourism (Figure 2). Findings in 2007 have highlighted as agritourism was not a typical kind of tourist accommodation located in rural areas marked out by

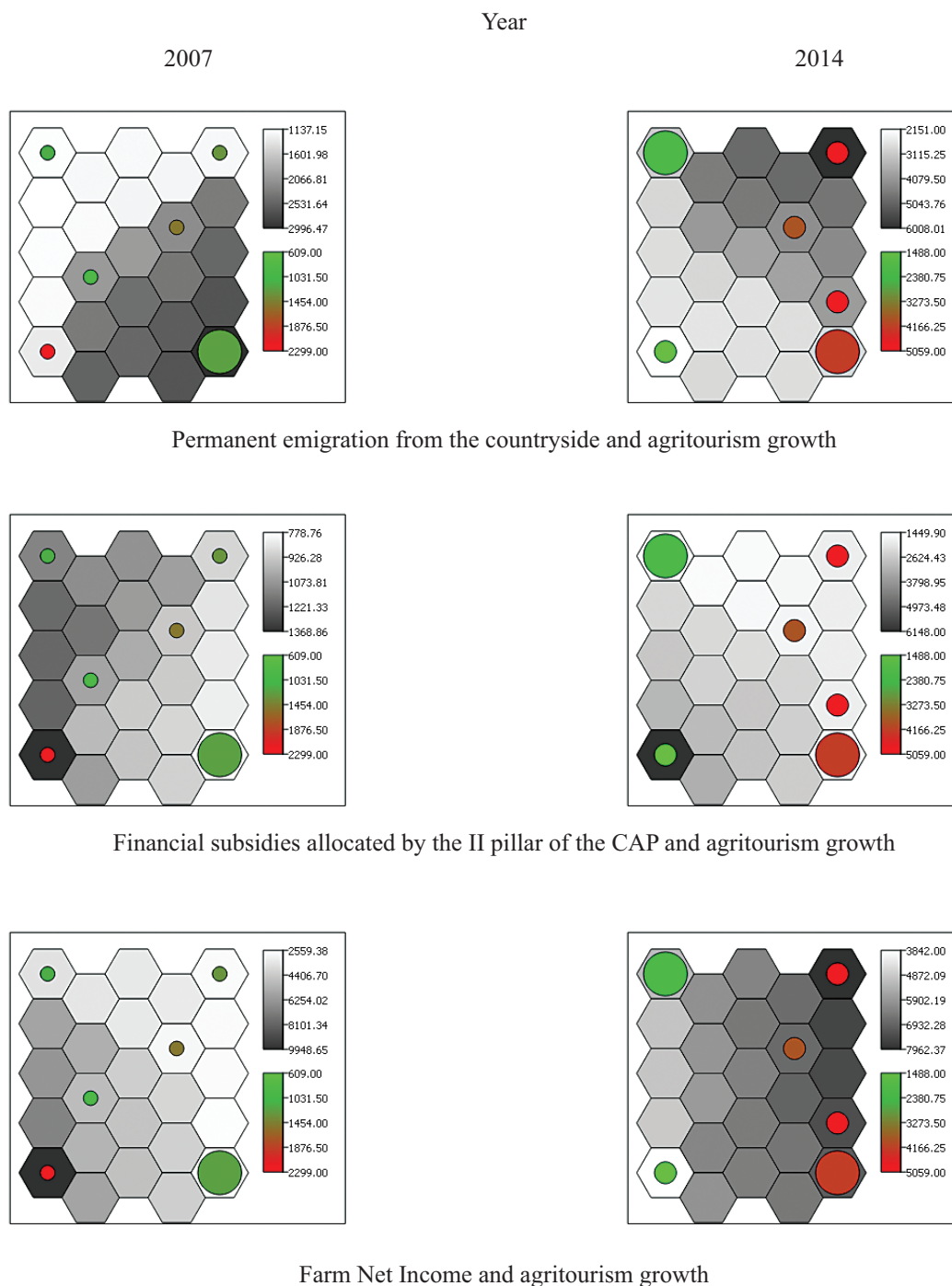
**Table 1**  
Main results in three different years of investigation in the multiple regression model. Dependent variable is permanent out-emigration in Romanian counties (Source: our elaboration on data TEMPO on line time series <http://statistici.insse.ro/shop/?lang=en>)

Variable	Year		
	2014	2007	2000
	Coefficient (Std. error)	Coefficient (Std. error)	Coefficient (Std. error)
Usable agricultural area	7.24 e-5 (0.00010)	-8.87 e-5 (0.00012)	6.34 e-5 (0.00015)
Rural population	-0.0016 (0.0014)	-0.0012 * (0.00068)	-0.0041 *** (0.0012)
Departure from the countryside	0.167 (0.113)	0.1413 ** (0.0576)	0.134 *** (0.043)
Regional Gross Domestic Products	0.0105 *** (0.00081)	0.0158 *** (0.00117)	0.172 *** (0.016)
$R^2$	0.82	0.82	0.85
Adjusted $R^2$	0.81	0.81	0.84

Level of significance \*\*\* 1%; \*\* 5%; \* 10%



**Fig. 1.** Relationships over three different years in Self-Organizing Maps considering growth of agritourism (hexagons) and other variables as emigration, Regional Gross Domestic Products (RGDP) and rural population in all Romanian counties as coloured dots (Source: our elaboration on data TEMPO on line time series <http://statistici.insse.ro/shop/?lang=en>)



**Fig. 2. Relationships over two different years in Self-Organizing Maps considering the growth of agritourism in coloured scale and hexagons are variables as permanent emigration from the countryside, financial subsidies allocated by the II pillar of the CAP and Farm Net Income (Source: our elaboration on data TEMPO on line time series <http://statistici.insse.ro/shop/?lang=en> and Farm Accountancy Data Network in [http://ec.europa.eu/agriculture/rica/database/database\\_en.cfm](http://ec.europa.eu/agriculture/rica/database/database_en.cfm) )**

higher level of out emigration. In 2014 SOMs have pointed out as there has been a direct correlation between these two variables, then the higher is the growth of agritourisms more significant has been the level of emigration from the countryside.

In 2007 the highest level of financial subsidies allocated by the second pillar of the Common Agricultural Policy has been linked to the highest level of agritourism in Romanian regions; on the contrary, findings in 2014 have highlighted an indirect correlation between these two variables.

In 2014 the highest level of financial subsidies allocated by the II pillar of the CAP did not imply a significant growth of agritourisms. Comparing the variables Farm Net Income and agritourism in activity both in 2007 and also in 2014, results have pointed out as the highest level of Farm Net Income is directly correlated to the highest growth of agritourism in Romanian rural space; then, agritourism has corroborated the hypothesis, according to which, agritourist enterprises are able to produce an adequate level of income; then, agritourism is a good change for agrarian enterprises to implement their economic sustainability.

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