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ANALYSIS OF SUBSIDIES ALLOCATED BY THE COMMON AGRICULTURAL POLICY AND CROPPING SPECIALIZATION IN ROMANIAN FARMS USING FADN DATASET

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Abstract

Romania is one of the European countries such as Italy characterized by the highest percentage incidence of small family farms with a rural population scattered predominately in less favoured areas. The objective of this paper was to assess throughout a quantitative method, impacts of funds allocated by the second pillar of the Common Agricultural Policy on cropping specialization in order to solve out migration from Romanian countryside. We used the data published by the European Union in the Farm Accountancy Data Network (FADN) dataset from 2007 to 2012. Romanian farms have pointed out a not significant impact of financial aids paid to less favoured areas in order to reduce the rural marginalization and depopulation and, by contrast, a direct correlation between Single Area Payment Scheme and farm net income.

Key words**:** *less favoured rural areas, Rural Development Plan, second pillar, Self-Organizing Maps, Single Area Payment Scheme*

INTRODUCTION

In 2007 Romania become part of the European Union pursuing its aim of joining the EU started straight the fall of Berlin's wall. This country is characterized by the highest percentage incidence of rural population and small family farms than other European nations, scattered predominately in less favoured areas [4]. Farmers in Romanian disadvantaged areas are carrying out an irreplaceable role in environmental protection by a diversification of their activities aimed at implementing multifunctionality in primary sector.

Generational turn-over in Romanian farms needs financial subsides in order to better and implement level of investments and land capital aimed at increasing the level both of technical and also of economic efficiency [5, 20]. A reshaping and shifting of traditional productive agrarian model towards new diversified activities and crops put into action in small Romanian farms managed by a newly generation of young farmers is able to implement level of investments and efficiency using both financial supports disbursed by the Common Agricultural Policy (CAP) and also by an expansion of scale of production in terms of land capital [1, 7, 17, 21].

Aftermath the collapse of communist regime in the early 1990s, there has been a significant transition from a central planned agrarian productivist model to a post communist one, which has influenced family Romanian farmers, their productive processes and policy makers strategies, fundamental to face with radical socio-economic transformation in Romanian productive fabric [14]. This transition was particularly severe in some rural areas, far away from the traditional urbanized areas, as a consequence of aging of farmers and also of a low level of investments in innovation, such as agrarian capital, new technologies and a poor level of technical efficiency with negative impacts on Romanian farms [9].

Comparing different measures in supporting rural development and rural space before the European Union enlargement in 2007, Romania seems to have put into action few measures in order to incentivate and protect stayed behind rural areas by an allocation of specific financial supports [2]. In fact,

analysing the level of financial subsidies disbursed by the European Union, such as direct payments per hectare, in some new comers member states of the EU it is possible to observe as financial payments in Romania are lower intensive than the average European value [22].

Previous studies have argued as before the MacSharry reform of the CAP, there has been a greater impact of direct payments paid by the first pillar on income distribution towards European farmers [11]. Direct payments have been more efficient than other typologies of financial aids provided by the CAP even if the amount of supports has had an unequal distribution due to the small size of farms [23].

In contrast, other scholars have underlined a direct correlation between financial subsides allocated by the second pillar of the Common Agricultural Policy, particularly towards less favoured rural areas or throughout agri-environment measures, and reduction of income inequality [18, 24].

Small farms located in disadvantages rural areas in Romania marked out by poor level of income have benefited more of agri-environmental payments than large farms reducing socio-economic marginalization and environment degradation in the countryside [8]. The direct consequence was an increase of technical efficiency in farms even if aging seems to be the bottleneck of investments in Romanian countryside and in other European rural areas as well.

The purpose of this paper was to investigate, throughout a quantitative approach, effects and relationships among funds allocated by the second pillar of the Common Agricultural Policy on cropping specialization and farm net income in Romanian farms. Some authors argued that the more specialised are farmers and regions in agricultural productions the richer are premiums and financial subsides allocated with positive effects on territorial and productive specialization in European rural territories [19]. In the same time financial supports allocated by the EU in specific agricultural and rural policies, such as payments to less favoured rural areas (LFA) have had a positive role in contrasting marginalization and out migration [2].

The European Union in 1965 by the Council Regulation number 79 established an annual analysis on a sample of farmers through the Farm Accountancy Data Network (FADN) aimed at assessing the impact of Common Agricultural Policy decisions to European farmers. FADN is an annual survey which covers approximately 80,000 European farms and a population of about 5,000,000 farmers located in all European countries able to represent more than 90% of utilized agricultural area [3].

In this quantitative analysis we have used the data published by the European Union in the Farm Accountancy Data Network (FADN) since 2007 to 2012. This paper has compared main relationships among eight different type of farming, such as fieldcrops, horticulture, wine, other permanent crops, milk, other grazing livestock, granivores, mixed, classified according the European Regulation 369 published in 2003 by the European Commission.

The main question of the research has been addresses to assess which relationships there are between subsidies allocated by National Rural Development Plan and specifically by the Single Area Payment Schemes (SAPS) and cropping specialization in Romanian farms. Furthermore, another aim of this analysis was to assess in Romanian farms the positive role of financial aid paid towards disadvantaged areas in terms of cropping specialization.

The Single Area Payment Scheme, according to the European Commission definition, is a transitional, simplified support of farmer's income, tailored specifically for the new comer states of the European Union, such as Romania, refinanced by the CAP for the next seven year time 2014-2020 as well, aimed at implementing the level of direct payments to farmers dividing annual financial envelope for the hectares of utilized agricultural area.

MATERIALS AND METHODS

In this paper we have used a quantitative approach using the Self Organizing Maps (SOM) proposed by Kohonen utilizing the

software Orange Canvas 2.7. The SOM is a methodology similar to the Principal Component Analysis. In fact, in a theoretical framework it is able to single out an unique winner neuron which underlines main relationships among all analysed variables, visualizing also in an unique map the best neuron and the main relations among variables [12].

1. The Kohonen's maps are sensitive to highlight main analyzed effects throughout an unique winner neuron, which in the map is represented by a black hexagon. General speaking, in the SOMs there are black and grayish hexagons; each of these hexagons is a zone where there is the highest level of clustering close to the winner neuron (black hexagon) and, by contrast, white ones are the opposite or rather they are neurons far away from the winner neuron [12].

In general, Self-Organizing Maps are particularly useful to estimate the structure and the evolution of detected variables obtaining an unique parameter summarizing different aspects and visualizing different clusters of interactions and similarities in investigated variables [10, 16]. One of the main positive aspects of Kohonen's maps is to obtain an homogenous classification in some clusters able to preserve their dissimilarities in investigated variables [12].

In our analysis the Self-Organizing Maps are an unsupervised learning process where in a limited sized space with topological properties inputs or stimulus come from the outside [12]. 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 [6]. Each input 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 [15]. Weights assigned to neurons are initialized either as random numbers or as small values sampled uniformly from a subspace crossed by two wider eigenvectors main components hence, initial weights are a good approximation of weights in the SOM [10].

In our analysis the training in SOMs has used a competitive learning process. In this case when in the training sample one puts an input to the network, the model calculates its Euclidean distance from all weight vectors [12]. The neuron with the weight vector is the closest to the entrance or stimulus which is called Best Matching Unit (BMU). The weights of the neurons in the BMU and near SOM in this lattice are bought nearer to the input vector [12]. The intensity of the adjustment decreases over the time and in function of the distance of neurons from the BMU.

The updating of weights in each neuron (Wv) in mathematical formula is [12, 13, 25]:

$$Wv(t + 1) = Wv(t) + \Theta(v, t)\alpha(t)(D(t) - Wv(t))$$

where $\alpha(t)$ is a decreasing monotonic learning coefficient and D(t) is the doorway o stimulus vector. The function for the neighborhood or distance $\Theta(v, t)$ depends on the distance in the lattice between the BMU and the neuron v [13, 25. In the simplified form or in terms of competitive network the above mentioned function is 1 for all neurons close to the BMU and 0 otherwise, even if the most common choice uses a Gaussian function which, regardless of the function choice, decreases over time [12, 13, 25].

The network in the SOM is characterized by a pattern in two layers, one layer is made up by input and the another called Kohonen's layer is constituted by output [12]. According to this author neurons in these two layers are completely connected to each other, while neurons of the output layer are linked to different output neurons. In the layer of output neurons there is an unique winner neuron which takes all; hence, as a consequence of a system of interactions of lateral inhibitions and excitations in function of the distance from the winner neuron some neurons close to the winner are exited and other neurons, more distant from the winner neuron, are inhibited generating a function similar to a Mexican hat function of their geometrical distance between neurons on the lattice [10, 12].

RESULTS AND DISCUSSIONS

Comparing findings of the Romanian National Agricultural Census and the main results of

Eurostat database, it is possible to observe a sharply decrease of the average value of utilized agricultural areas from 2000 to 2010, which shifts from 3.5 hectare to 3.4 with more than 2.5 million of farmers out of 3.8 million having an own utilized agricultural surface under the 2 hectares.

Main results in FADN Romanian dataset have pointed out an average value of utilized agricultural area equal to 10.45 hectares even if fluctuations in minimum and maximum value are between 1.93 to 43.8 hectares (Tab.1). In general, cereal areas are predominant than permanent crops and in the same time sheep and pigs are the most diffused livestock in Romanian farms part of the FADN dataset.

Table 1. Main results in descriptive statistics in Romania farms part of FADN dataset

Variable	Mean	Standard Deviation	Min	Max
Farms (n°)	140,597.3	173,478.4	7,640	520,768
Adult Worker Unit (n°)	1.96	0.515	1.41	2.98
Utilized Agricultural Areas (ha)	10.45	13.80	1.935	43.82
Cereals area (ha)	4.83	9.76	0.41	28.89
Permanent crops (ha)	0.64	1.65	0.008	4.74
Dairy cows (n°)	0.91	1.57	0.016	4.56
Other cows (n°)	0.43	0.59	0.006	1.51
Sheep (n°)	1.38	3.41	0.007	9.81
Pigs (n°)	2.00	5.02	0.013	14.42
Farm net income (€)	6,396.41	3,098.38	2,425	11,567
Total subsidies (€)	2,737.95	2,685.36	653.5	7,414
Environmental subsidies (€)	59.31	126.02	0.67	369
Less Favoured Areas (€)	22.60	41.62	1	124.5
Single Area Payment Scheme (€)	887.38	1,239.95	143.5	3,894
Rural Development Plan subsidies (€)	156.04	190.55	41	468.66

Source: Own calculation on the basis of data from http://ec.europa.eu/agriculture/rica/

Farm net income is in average close to 6,500 euros even if it has significantly fluctuated from 11,600 to 2,400 euros over six year time of investigation. Funds allocated by the Common Agricultural Policy to Rural development measures, able to strength the multifunctionality in the primary sector or in order to protect disadvantaged rural areas at risk of marginalization (Less Favoured Areas), have had less impact than Single Area Payment Scheme.

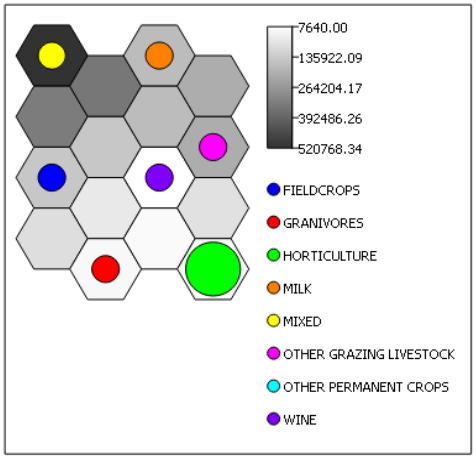

Fig. 1. Number of farms in self-organizing maps part of Romanian FADN dataset over six year time of investigation

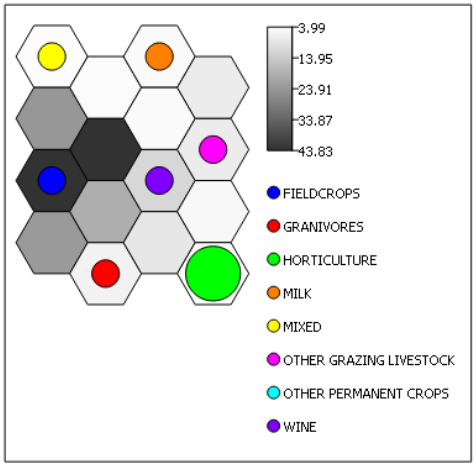

Fig. 2. Evolution of Utilized Agricultural Areas in Romanian farms investigated using Kohonen's maps

Focusing the analysis and comparing the main relationships between the most important typologies of farming in Romanian FADN dataset and the number of farms, figure 1 points out as the highest concentration of farms (black hexagon) is associated to the mixed farming system of production; in contrast, horticultural specialized productions are scattered in few Romanian farms and not so consolidated in national agricultural fabric.

Focusing the attention on relationships between typology of farming and farm net income, findings have pointed out as the highest level of income is typical of fieldcrop farms, wine, granivores, milk and horticulture enterprises (Fig. 3).

Farms specialized and ranked in fieldcrop and granivores type of production have received

the highest amount of subsidies allocated by the first pillar of the Common Agricultural Policy (Fig. 4).

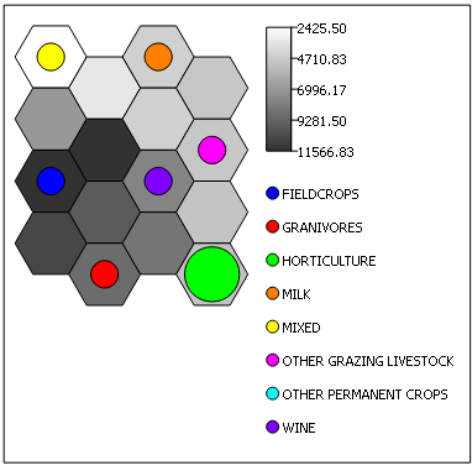

Fig.3. Relationships between farm net income and productive specialization type using Kohonen's maps

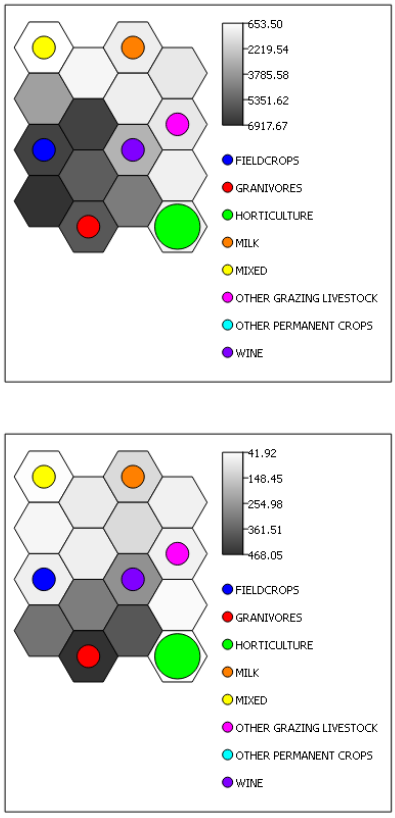

Fig. 4. Kohonen's maps comparing financial subsides allocated by the CAP in the first pillar (above) and by the second pillar of the CAP in Rural Development Plan (below).

By contrast, the total amount of financial subsidies allocated by the Rural Development Plan (second pillar of the CAP) has been lower than financial subsidies paid by the European Union to livestock and crops. Nevertheless, granivores and wine enterprises have received the highest level of aids disbursed by the Rural Development Plan, which is approximately twelve times lower than financial subsidies allocated by the first pillar of the CAP. Findings have pointed out as in Romanian fieldcrop farms subsidies on crops and livestock are more important and predominant in terms of total amount than financial subsidies allocated by the Rural Development Plan (II pillar).

Romanian farmers have benefited poorly of financial subsides allocated both in favour of disadvantaged rural areas and also towards farmers bound in putting into practice agri-environmental measures (Fig. 5).

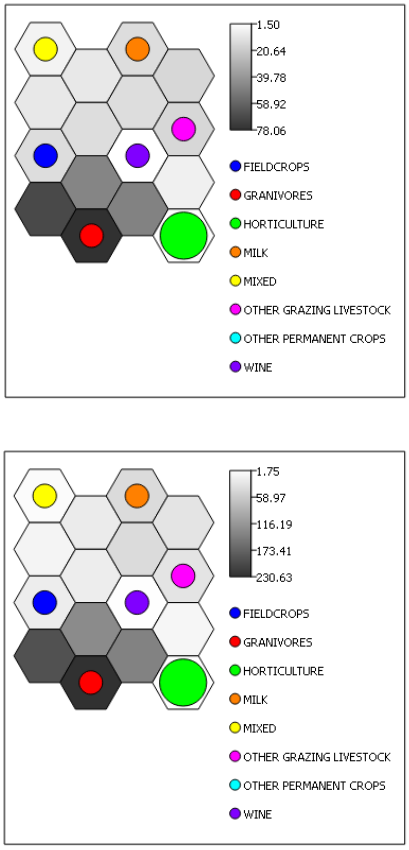

Fig. 5. Kohonen's maps comparing financial subsides allocated to less favoured Romanian rural areas (above) and as agri-environment payments (below).

Farms classified in function of type of farming as granivores have received the most significant level of financial subsidies in terms of less favoured supports and agri-environment aids.

Findings comparing farm net income and payments allocated by the SAPS have pointed out a direct correlation between these two variables (Fig. 6).

Hence, large utilized agricultural areas implying significant level of farm net income have strengthened the level of financial direct payment paid by Romanian authorities towards farmers. The Spearman's coefficients of correlation have highlighted, with a level of significance at 5%, a value of 0.74 correlating utilized agricultural areas and farm net income and 0.80 considering only variables Single Area Payment Scheme and farm net income.

Farms with a granivores productive specialization type farm net income correlates directly to SAPS even if the level of payments has been the poorest compared to other productive specialization enterprises (Fig. 7).

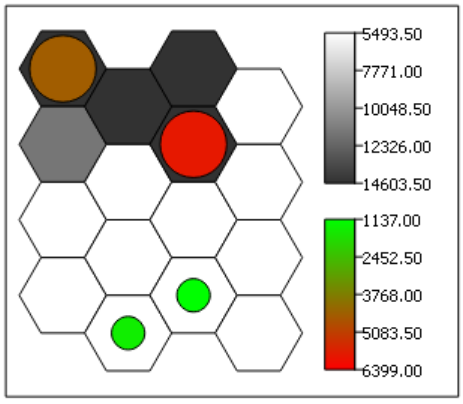

Fig. 6. Kohonen's maps comparing farm net income (grey scale) and Single Area Payment Scheme (colored scale).

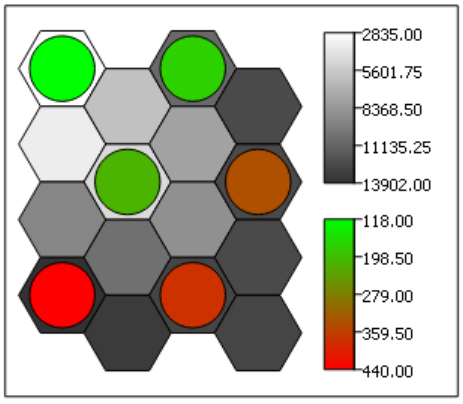

Fig. 7. Kohonen's maps comparing farm net income (grey scale) and Single Area Payment Scheme (colored scale) in farms with granivores productive specialization type.

In dairy Romanian farms findings have pointed out the highest level of Single Area Payment Scheme paid by the European Union correlated to level of farm net income which is lower than 5,000 euro (Fig. 8).

Mixed farms have underlined a direct correlation also between farm net income and SAPS, even if roughly speaking these latter enterprises have been characterized by the highest level of farm net income; by contrast, the most percentage of mixed productive farms are characterized by poor level of farm net income lower to 2,000 euros (Fig. 9).

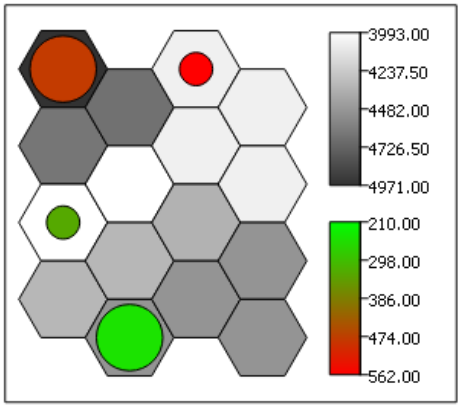

Fig. 8. Kohonen's maps comparing farm net income (grey scale) and Single Area Payment Scheme (colored scale) in farms with dairy enterprises.

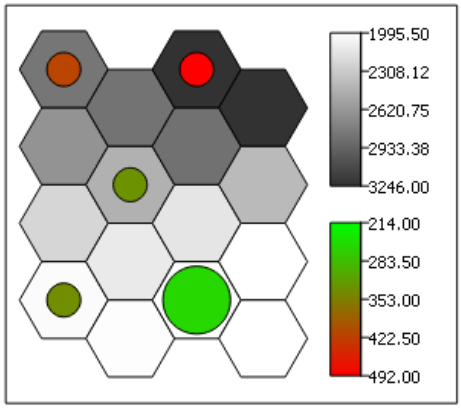

Fig. 9. Kohonen's maps comparing farm net income (grey scale) and Single Area Payment Scheme (colored scale) in dairy farms.

Summing up, field crops and granivores specialization types have been enterprises able to obtain the most significant level of farm net income correlated to the highest level of Single Area Payment Scheme, corroborating the theoretical framework of the path dependence between size of farms, level of

income and financial subsidies allocated directly by local authorities.

CONCLUSIONS

Despite lots of Romanian farms have pointed out a poor agricultural surface not using financial supports in favour of disadvantaged rural areas, findings have pinpointed a positive but differentiated role of subsidies and other financial supports disbursed by the European Union in order to solve territorial inequalities and in promoting a different territorial agricultural specialization of this country.

For the future, financial measures promoted by the National Rural Development Plan should intervene to implement land capital level in terms of size of utilized agricultural area, which is the pivotal factor in reducing and lessening rural disparities. Nevertheless, results have underlined a limited allocation of financial subsidies disbursed by the Rural Development Plan in order to stimulate rural diversification in Romanian countryside and the generational turn over throughout a younger generation of farmers, many of whom are emerging and imposing their selves in implementing technical efficiency in agrarian enterprises.

To sum up, a direct correlation has been detected between the Single Area Payments Schemes and crop specialization even if farms specialized in field crops and livestock, taking advantage from large agrarian areas have benefited of significant level of Single Area Payments. In the next seven year time 2014-2020 of National Rural Development Plan there has been a shrinking of SAPS funds hence, one of the most priority should be to address financial resources in stimulating significantly direct payments in favour of disadvantaged rural territories by LFA subsidies. These latter actions should be weighed in function of different peculiarities of Romanian farms. In fact, Romanian farms located in the north-west and in the center of the country, having the poorest level of farm net income and single area payments, are at severe risk of rural out migration.

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