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The role of CAP subsidies in reducing socio-economic marginalisation in Romanian rural areas

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Abstract

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Since the fall of the Iron Curtain, the rural areas of Romania have suffered from intense permanent out-emigration. Following its entry and in an effort to counter this phenomenon, the European Union has tried, through financial subsidies and decoupled payments, to lessen the socio-economic marginalisation in rural territories. The core purpose of this paper was to assess, using a quantitative methodology, whether these financial subsidies and other kinds of support disbursed through the Common Agricultural Policy have had a discernible effect in reducing the levels of poverty and permanent emigration in the regions of Romania. To this end, this research has employed two methods: Principal Component Analysis aimed at defining some clusters among the Romanian regions, and Data Envelopment Analysis, to conduct an efficiency analysis of farming activities. The prime aim of this latter methodology was to identify which socio-economic variables have been involved in the permanent emigration over the period 2007-2017 in order to be able to address those factors and so reduce the levels of socio-economic pauperisation present in Romanian rural areas. Findings have revealed that, generally speaking, the financial support and decoupled payments allocated through the European Union have had a positive and significant impact, generating many employment opportunities and greater diversification in the Romanian countryside, which in turn has had a direct impact on reducing the levels of poverty and, thus, the levels of permanent emigration in some Romanian regions.

Keywords: second pillar; Data Envelopment Analysis; cluster; rural villages; multifunctionality; diversification

Introduction

Since the fall of the Berlin wall, many Eastern European countries that were formerly behind the iron curtain have undergone vast social, political, and economic change. Focusing attention on Romania, one of the last countries to enter the European Union, socio-economic findings reveal that this country has suffered more than other former communist nations from significant changes in its socio-economic fabric following the collapse of the Soviet Bloc, with the consequence that there has been an increasing permanent out emigration from rural territories and a rise in the number of people living in conditions of severe poverty and social exclusion.

Indeed, the transition from a centralised planned economy to an open free market economy has been the main driver of a widening socio-economic divide that has acted to stimulate an intense out permanent emigration predominately affecting rural areas rather than urban centres (Galluzzo, 2018; 2015; 2013).

In the Romanian countryside, the impact of rural emigration has been overwhelmingly negative, increasing socio-economic marginalisation and the growth of a subsistence and semi-subsistence farming that are at odds with an integrated and cohesive sustainable rural development (Galluzzo, 2018; Davidova et al., 2009; Giurca, 2008; Davidova & Bailey, 2014; Davidova, 2011; Popescu, 2014). Andren and Roman in 2016 sustained that the number of emigrated

Romanians increased from 0.3 to 2.1 million between 2001-2010, which is the highest level of emigration from any European country, and that emigration to new countries was seen by the population as representing not only an opportunity to improve their general living conditions but, more, as an essential strategy for life (Sandu, 2005a; 2005b; 2007) that would be able to satisfy some specific attitudes and needs (Andren & Roman, 2016).

A deep analysis of the emigration flow from Romania following the collapse of the Communist regime has shown it to have been an autonomous phenomenon based on a significant level of self-organisation and spontaneity (Horváth & Anghel, 2009). These authors have highlighted that the phenomenon of emigration can broadly be divided in function of the time period, considering, for example, the final destination nation, which at the beginning, from 1990 to 1993, was Germany, and then, after 1993, shifted to other European countries such as France and Italy (Horváth & Anghel, 2009). According to these two authors, emigration increased again after 1997, although irregularly, particularly as a consequence of a worsening economic situation from 2002, and then from 2007 when Romania became part of the European Union and a mass wave of emigration was unleashed on such a scale that it was able to radically change the socio-economic fabric and relationships in the country.

Following the collapse of the Communist regime, Romania as a whole has seen a period of intense economic growth that has brought a reduction in the rate of unemployment, even if a long-term analysis reveals significant fluctuations in this economic pattern (Andren & Roman, 2016). As such, the real reasons underlying the phenomenon of Romanian emigration would seem to be extremely complex, and investigating and understanding them in order to reach a complete and holistic analysis is no easy task (Ambrosini et al., 2012).

It is important to underline that during the transition phase from a centralised to an open economy that came with Romania's entry to the European Union during the last phase of its enlargement, the deindustrialisation process linked to an intense labour crises in Romania also fostered an internal migration from rural to urban areas, even if the countryside retained its particular characteristic, with farming serving as a buffer sector during times of economic recession (Galluzzo, 2018; 2015; 2013; Petrick & Tyran, 2003; Petrick & Weingarten 2004; Davidova, 2011; Andren & Roman, 2016; Davis & Pearce, 2001; Haggblade et al., 2010).

The Romanian countryside is characterised by small farms that exhibit the typical features of subsistence or semi subsistence enterprises that are also found scattered throughout many Eastern European countries (Giurca, 2008, Davidova, 2011), that fuel the flow of migration abroad (Sandu, 2005a). Furthermore, as a consequence of the global economic recession and the instability brought by the country's transition towards EU membership in the 5th round of EU enlargement, the percentage of people living in poverty in Romania increased significantly, and this has had a clear impact on the level of emigration from the country (Sandu, 2005b; Panduru et al., 2009; Andrén & Roman, 2016). Furthermore, alongside an intense emigration, both Romania and Bulgaria have suffered the effects of a pronounced population ageing which has had direct consequences on socio-economic growth, particularly in rural areas where there is a much higher percentage of elderly people than in urban centres. In Romania, the research findings have revealed appreciable fluctuations between different counties over the period of study, corroborating the theoretical hypothesis according to which small farm size and low income stimulate emigration from rural territories towards the European Union (Kulcsár & Brădăţan, 2014) hence, due to the limited resources at their disposal, the rural communities in these areas need an increase in the level of the financial support allocated to them by the National authorities and the European Union, as the two previously cited authors have argued. Romania is also considered an emerging country which is increasing its own emigration, the effects of which will increase the rate of depopulation, in particular in the small villages sparsely dispersed through the rural territories, inevitably impoverishing the country as a whole (Horváth & Kiss, 2015).

Recently conducted studies into Romanian farming using a quantitative approach based on panel data that have been aimed at investigating links between financial subsidies allocated through the Common Agricultural Policy and emigration in Romanian regions have assessed that there is indeed a positive correlation between rural emigration and financial payments allocated through the first pillar of the CAP (Galluzzo, 2018). In particular, this author has corroborated the role of subsidies made to disadvantaged rural areas in partially reducing the level of permanent out-emigration. Meanwhile, other scholars have found emigration to be a complex phenomenon correlated to economic, social, and regional policies, as well as to the relative availability of natural resources, and that it is strongly influenced by population ageing and economic activities able to draw young people to large cities and also abroad, generating a constant flow both of internal and external emigration (Ianos, 1998).

In general, the factors driving emigration since the collapse of the communist regime have predominantly been socio-economic, even if some authors have argued that it is possible to find that the same typology of migrants and style of migration seen in Romania might similarly be reproduced in other countries too (Porumbescu, 2015). Furthermore, in

Romania the phenomenon of emigration has been felt more intensely in rural areas than urban ones, and this is particularly true in the north-eastern regions where there has been a strong need for emigrants to improve their living conditions in a perspective of improving life satisfaction (Sandu, 2005a; 2005b; 2007). According to Sandu, some specific patterns have emerged in the process of emigration; in fact, people from the southern regions of Romania are more inclined to a temporary emigration whereas, in contrast, in the north and north-east, the incidence of permanent emigration is more intense (Sandu, 2007). The main consequence of these disparate patterns of emigration, together with variances in the general living conditions prevalent in the different rural areas, implies the need to adopt specific measures and policies that are able to act on the underlying factors in each territory. In fact, one of the main drivers stimulating emigration is people's need to find new job opportunities and their desire to improve their living conditions hence, since the first wave of emigration in Romania in the 1990s, the labour migrations has not been linked to development differentials, but only to other external and internal factors (Stan & Erne, 2013; Roman et al., 2010).

Investigation using a quantitative approach has revealed that, in general, several macroeconomic variables, such as income and the level of poverty, influence and have a direct relationship on permanent emigration, hence it can be said that the lower the wealth and its growth over time and the higher the percentage of the population at risk of poverty, the higher the level of emigration from a given area will be. Drawing some conclusions, several scholars have argued that the economic policies that are adopted must work towards alleviating the risk of poverty and, consequently, of socio-economic exclusion among the Romanian population (Simionescu, 2016). In contrast, other qualitative studies have argued that certain internal factors correlated to social and local aspects have acted on the emigration flows, thus emphasising the relationship between emigration and particular social aspects at play in Romanian communities (Anghel, 2016).

The dichotomy between rural and urban areas in Romania implies comparing very different contexts where significant socio-economic divisions exists between counties resulting from an uneven and non-homogenous endowment of infrastructure and industries, meaning that the transition following the 1989 revolution has emphasised fundamental structural changes (Dachin, 2008). In fact, as Dachin underlines, the rural space in Romania covers more than 80% of the territory and encompasses 45% of the population, the vast majority of who are living at risk of severe poverty. This, consequently, makes rural areas less attractive than urban centres, stimulating permanent emigration and, thus, depopulation and marginalisation. To counter this, a process of rural development must be instigated in the Romanian countryside as part of a cohesive strategy of growth and the sharing of values that is able to stimulate a multifunctional and sustainable socio-economic development, financed through public initiatives, which will act to reduce regional disparities and imbalances and bring greater opportunities, notably in terms of employment, to rural areas (Dachin, 2008; Galluzzo, 2018; 2015; 2013). Consequently, the Rural Development Programme, during the last two seven-year periods, from 2007-2013 and from 2014-2020, has defined certain priorities for action, while the LEADER initiative has come to be seen as one of the most suitable means for encouraging the integrated development of rural areas at severe risk of emigration and social exclusion. This initiative is able to stimulate direct links between urban territories, local communities, and economic activities. Furthermore, the small farms in Romanian rural villages have traditionally been characterised by the significant role they play in contrasting permanent emigration, providing some employment opportunities to people in areas where non-agricultural opportunities are limited, and this feature has been an element that has distinguished and discriminated the resilient role of small farming enterprises both before and after the collapse of the Communist regime (Tudor, 2015).

Aim of the Research

The key purpose of this research was to assess, through a quantitative approach, if there are some relationships between poverty, emigration, and the financial subsidies allocated under the first and second pillars of the Common Agricultural Policy such as the payments to disadvantaged rural areas (LFA payments) and the direct support provided through the Rural Development Programme. In particular, in addition to a classical estimation through a multiple regression model on panel data from 2008 to 2017 and through Principal Component Analysis, this study has also performed an efficiency analysis estimated through a non-parametric approach defined by Data Envelopment Analysis with the aim of investigating, in depth, the role that financial subsidies have played in reducing the degree of socio-economic marginalisation in Romanian regions.

Methodology

The Principal Component Analysis (PCA) used in this research has proved very useful in estimating the main relationships between the financial subsidies allocated through the CAP, the farm net income, the land capital endowment

of farms in terms of usable agricultural areas, and the level of permanent emigration from Romanian counties in two different years, namely 2007, at the beginning of Romania's membership of the European Union, and 2017, midway through the implementation of the latest seven year period of the CAP.

PCA has the primary purpose of extracting the main information from a dataset, reducing its dimensions by an easy description of the variables involved in it through an assessment of the different structure of variables and observations and then eliminating some non-relevant items that are characterised as noise (Anderson & Gerbing, 1988; Kim, Suh, & Eves, 2010; Abdi & Williams, 2010; Brandano et al., 2018).

Principal Component Analysis is a multivariate analysis methodology able to simplify the object of study since it allows the transformation of a set of n-$_{th}$ quantitative variables into p units or, rather, into a reduced set of new unrelated variables, called main components, which are able to summarise more information in the starting model (Bolasco, 2002). The PCA methodology allows researchers to break down and reproduce the variances and co-variances of a correlation matrix, making the first component one that is able to reproduce the main share of variance and the second component a smaller share, in such a way as to treat, statistically, all the observed variables while reducing the dimension of the observation space (Di Franco, 2005). In formulas, this can be interpreted as follows:

Correlation matrix				Eigenvalues				Eigenvector		
R11	R21	R31		Λ2				C11	C21	C31
R12	R22	R31	=		Λ2		*	C12	C22	C32
R13	R23	R33				Λ3		C13	C23	C33

With the core purpose of obtaining the first eigenvalue, by solving a system of homogeneous equations summarised in matrix form and indicated in the part below, the following simplification has to be used to calculate the PCA relationships:

$$(R - \lambda 1 I)\, u_1 = 0,$$

where with I it is possible to explain the identity matrix, R is the square matrix of the correlations, and u1 is the eigenvector of the weights of the variables present in the matrix R. The condition underlying the use of this formulation is to maximise the variance. This latter is possible only if the determinant of the square matrix of the correlations between the observed variables R minus the eigenvalue and multiplied by the identity matrix is equal to zero.

All this implies choosing the largest value of the variance, i.e. the highest value of the eigenvalue λ1, and replacing it with the base value, present in the correlation matrix R, that will give the eigenvector matrix of the first main component (Di Franco, 2005). The first main component, therefore, is nothing more than a linear, zero-average combination of the starting variables, whose most important purpose is to optimise the objective function represented by the variance (Bolasco, 2002).

The main problem of Principal Component Analysis resides in choosing the number of variables to be observed for the application of multivariate analysis on the principal components, which can be solved by both using the variance plot model (Jolliffe, 1986) and by defining a minimum threshold of explained variance, which in this analysis has been placed at a threshold of 75%, which is able to consider all the variables with a variance greater than the unit value.

The first proposals to estimate efficiency using a non-parametric approach were made by Charnes, Cooper, and Rhodes in 1978 and Banker, Charnes, and Cooper in 1984. Their aim was to investigate efficiency through a method not requiring a priori specifications such as Data Envelopment Analysis (DEA), assuming that there are n DMUs which produce a quantity s of output y in such a way that the $y \in R^{s+}$ using m inputs in multiple arrangement and in combinations of $x \in R^{m+}$.

The technical efficiency of a DMU$_k$, under the assumption proposed by Charnes, Cooper, and Rhodes in 1978, can be estimated by solving a linear programming problem that minimises the level of inputs used in the production process (Coelli et al., 2005; Battese & Coelli, 1992; Galluzzo, 2013; 2015; 2018), expressed as:

$$\min \theta_k^c - \varepsilon\left(\sum_{i=1}^{s} S_i^- + \sum_{r=1}^{m} S_r^+\right)$$

$$s.t.\ \sum_{j=1}^{n} \lambda_j x_i + S_i^- = \theta_0 x_{ik}\,,\ i = 1, 2 \dots, m,$$

$$\sum_{j=1}^{n} \lambda_j x_i + S_i^- = \theta_0 x_{ik}\,, \qquad i = 1, 2 \dots, m,$$

$$\sum_{j=1}^{n} \lambda_j y_{ij} - S_r^+ = y_{rk}\,,\ r = 1, 2 \dots, s,$$

$$\theta_k^c, \lambda_j, S_i^-, S_r^+ \geq 0,$$

The aim of the DEA is to assess the value of θ, which is the optimal level of technical efficiency that should be equal to 1; ε is a non-Archimedean infinitesimal, proposed by Charnes et al. in 1978, aimed at overcoming some difficulties linked to testing multi-optimum solutions, and λ is a convex coefficient in the input x in each DMUj, producing

a level of output *y* in the farms *j* (Coelli et al., 2005; Battese & Coelli, 1992).

S_r^+ and S_r^- are non-negative output and input slacks. Thus, if θ is equal to 1 and all input and output slacks are equal to zero, the DMU is operating on the CRS frontier and, therefore, is technically efficient (Charnes et al., 1978, Banker et al., 1984; Coelli et al., 2005; Battese & Coelli, 1992; Galluzzo, 2013; 2015). If θ is not equal to 1 and all input and output slacks are different to zero, there is an inefficient use of resources as input or output in the enterprise.

A further stage of this research has investigated the increase or decrease in technical change and in technology using the Malmquist index (Färe et al., 1994; Färe & Primont, 1995). In 2004, Tone argued that the Malmquist index is a tool able to assess the change of efficiency between two different periods of time in all investigated Decision Making Units, either through an improvement of its efficiency or by an innovation that is able to move the frontier of efficiency (Coelli et al., 2008; Odeck, 2007; Madau et al., 2017; Färe & Primont, 1995).

In 1994, Färe et al. observed that the Malmquist index assessed the change in Total Factor Productivity (TFP) in terms of distance produced by a common production technology therefore, given a DMU able to produce a combination of inputs and output in a period t using a specific technology, the TFP is able to highlight the technical change in comparison to a base period (Coelli et al., 2008; Odeck, 2007; Madau et al., 2017). If the value of m_o^t is above 1 it implies a growth in technology while, conversely, a value of less than 1 corroborates a decline in technology between the time s and time t of investigation, written in this way:

$$m_o^t(q_s, x_s, q_t, x_t) = \frac{d_o^t(q_t, x_t)}{d_o^t(q_s, x_s)},$$

where *o* denotes the output orientation, $\boldsymbol{q}_t$ is the (M×1) output vector of the firm (in period *t*), and $\boldsymbol{x}_t$ is the (K×1) input vector of the firm (in period *t*):

$$m_o^s(q_s, x_s, q_t, x_t) = \frac{d_o^s(q_t, x_t)}{d_o^s(q_s, x_s)}$$

Results and Discussion

Table 1 shows that, in all investigated Romanian regions, the average value of direct payments has been below 2000 euros, while the average value of subsidies allocated under the second pillar of the CAP have been around 100 euros. Findings have revealed significant fluctuations in patterns of emigration between Romanian regions and a significant percentage of people at risk of poverty, which averages around 23%.

Estimating the correlation among variables in the Pearson matrix, the findings have underlined an inverse correlation between the variables direct payments, people working in the primary sector, and people at risk of poverty (Table 2). In contrast, a direct correlation has been found between direct payments and permanent emigration hence, the higher the number of people who have emigrated, the higher the total amount allocated by the European Union to the primary sector. A direct link has been found between the percentage of people at risk of poverty and the percentage of people working in the primary sector. As such it seems that, in general, in the rural areas where the number of people employed in agriculture is higher, the number of people at risk of severe poverty and social exclusion is also higher. Meanwhile, the correlation between emigration and poverty is ambiguous; in fact, an increase in emigration is indirectly correlated to the percentage of people at risk of poverty. Drawing some conclusions, then, it can be summarised that the higher the proportion of people at risk of poverty, the lower the level of emigrated people.

The analysis of multicollinearity among all the investigated variables has not revealed any issues, with a VIF value that is below the threshold of 4 (Figure 1).

The following stage of the investigation was addressed to estimating the variance in all the variables. The variance decomposition shows that more than 92% of the variance was between classes (inter-class) and only 7% within classes (intra-class). In fact, the cluster analysis estimated using the kmean approach grouped the data from the 8 Romanian regions over the 10 years of investigation into 5 clusters, and found that in the clusters 2 and 3 it is possible to pool 28 and

Table 1. Main descriptive statistics in all Romanian regions between 2008-2017

Variable	Unit	Observations	Minimum	Maximum	Mean	Std. deviation
Direct payment CAP	€	80	696 730	6.532 070	1.941 951	1.103 071
RDP payments	€	80	0	1.295 000	101 563	180 340
Emigrated people	n°	80	419 000	6.148 000	1.933 363	1.172 357
People at risk of poverty	%	80	2 600	37 600	22 933	9 027

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 2. Main correlations in some socio-economic variables from 2007 to 2017

Variables	Direct payment CAP	RDP payments	Emigrated people	People working in agriculture	People at risk of poverty
Direct payment CAP	1.00				
RDP payments	-0.063	1.00			
Emigrated people	0.265**	0.031	1.00		
People working in agriculture	-0.537***	-0.071	-0.258**	1.00	
People at risk of poverty	-0.547***	-0.029	-0.347***	0.685***	1.00

** At 5-1%: *** 1%

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

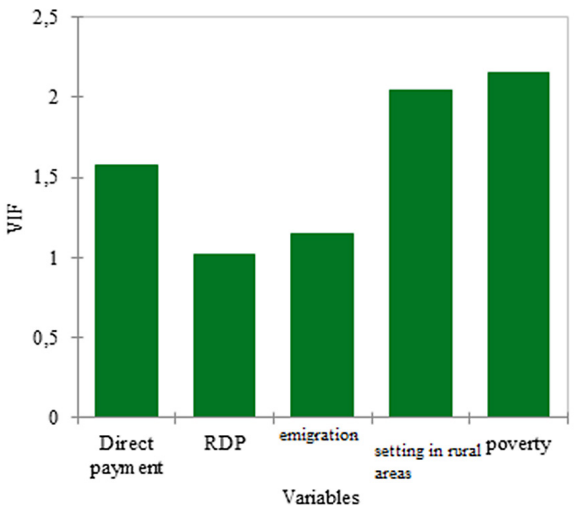

Fig. 1. Analysis of multicollinearity in all investigated variables used in the regression model

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

18 objects, respectively (Table 3). The findings have shown that the region of Bucharest-Ilfov has been part of the cluster 1 for all of the years of observation whilst, in contrast, the cluster 3 has been composed of different Romanian regions over the years of observation.

The evolution of the relationships, directions, and correlations amongst all investigated variables has been investigated in two different years, 2008 and 2017, through the Principal Component Analysis. The data have been normalised with the aim of reducing the impact of price fluctuations over the period of investigation. As such, the data assessed in 2008 has been discounted at the year 2008 hence; the data comparison in the analysis has been made at constant prices referred to the year 2017.

Findings of the PCA investigated in 2008 have revealed a direct correlation between the total amount of financial subsidies allocated by the Rural Development Programme and the land capital endowment in terms of Usable Agricultural Areas (Figure 2). The main consequence of this relationship implies that the more modest the agricultural area, the lower the RDP subsidies allocated by the CAP hence, the role of the second pillar in addressed to stimulating diversification and other actions of compensation in rural areas seems not to have been so adequate.

Together, the two axes have been able to explain more than 70% of the variance during the year 2008.

An indirect correlation has been found between the two variables, people at risk of poverty and direct payments disbursed by the first pillar of the Common Agricultural Policy. This has corroborated that allocations of decoupled payments are typically related to areas where the risk of poverty in the Romanian population is lower. Furthermore, the variables total

Table 3. Main features of the clusters investigated in all Romanian regions from 2007 to 2017 using the k-means approach

Class	1	2	3	4	5
Objects	10	28	18	12	12
Sum of weights	10	28	18	12	12
Within-class variance	9 273 814.75	4 438 285.01	2 911 472.34	10 782 342.55	3 414 700.32
Minimum distance to centroid	1 788.43	700.30	502.94	1 397.87	363.73
Average distance to centroid	2804.24	1903.83	1502.58	2738.13	1519.73
Maximum distance to centroid	3885.42	4016.00	2512.53	7177.33	3239.12

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

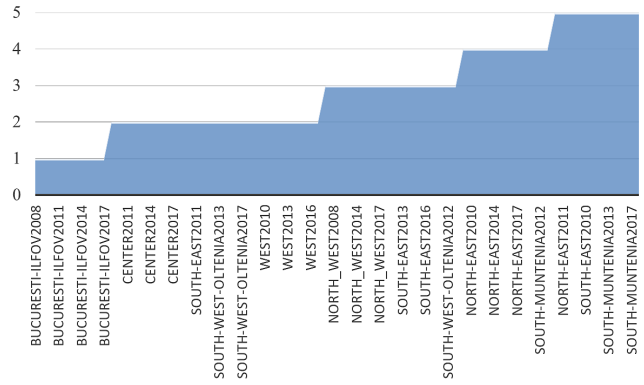

Fig. 2. Main clusters investigated in all Romanian regions

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

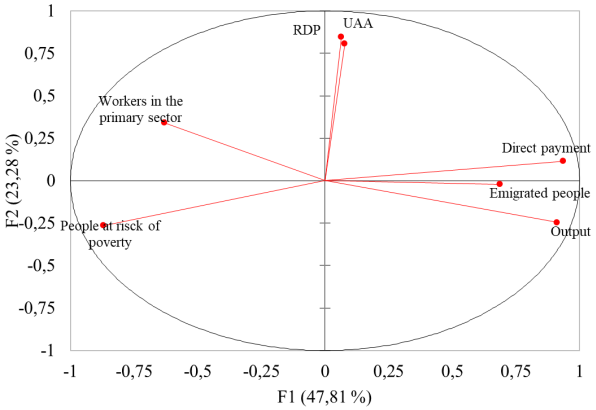

Fig. 3. Main results in the PCA analysis for 2008

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

output, permanent emigration, and direct payments are directly and strongly correlated. An increase in output is indirectly correlated to poverty; consequently, the higher the level of output per capita the lower the proportion of people at risk of poverty and social exclusion. Focusing on the role of employment in agriculture and on total output, the research findings have shown there to be an indirect correlation, hence the regions with more modest levels of output per capita are typically those with a low level of occupation in the primary sector. This partially explains the fact that in Romanian regions with a significant occupation in agriculture, the level of GDP per capita is very modest.

Turning attention to the 8 regions of Romania, the findings of the Principal Component Analysis have underlined

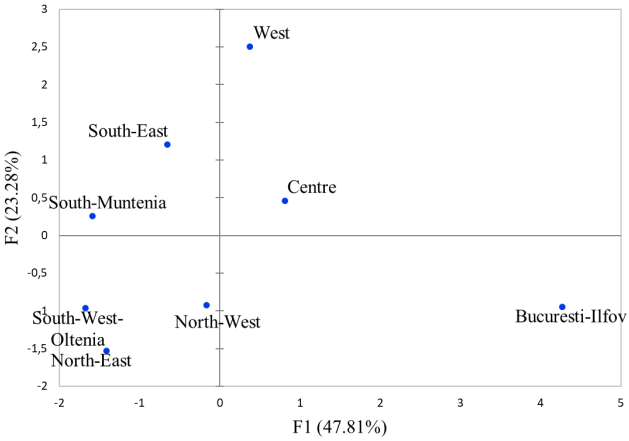

Fig. 4. Year 2008 position of all Romanian regions estimated by the PCA

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

that there are different clusters, with the region of Bucharest-Ilfov holding an autonomous outlier position by itself due its value of GDP per capita, where poverty is the variable able to act on the PCA (Figure 4). In contrast, the West region has been characterised by a higher level of usable agricultural area than other regions. Meanwhile, the South-east and South-Muntenia regions are characterised as having the highest levels of occupation in the primary sector from among all the regions of Romania.

The two-dimensional plane in 2017 in all Romanian regions has been able to explain more than 78% of the vari-

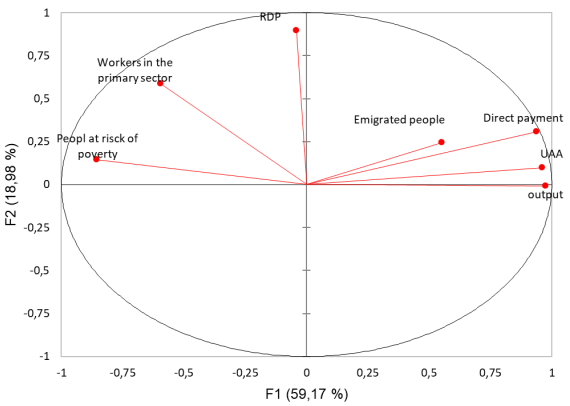

Fig. 5. Main results in the PCA analysis for 2017

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

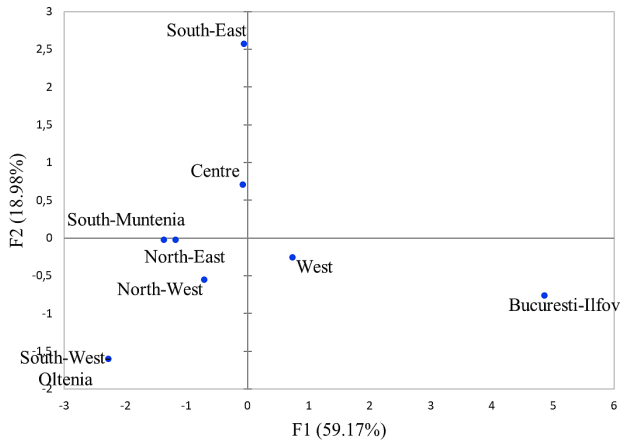

Fig. 6. Year 2017 position of all Romanian regions estimated by the PCA

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

ance, and comparing the findings for the two years of observation, 2008 and 2017, one may note a complete change (Figure 5). Between the variables GDP per capita and people at risk of poverty, there is an indirect correlation. Therefore, in poor areas where the risk of poverty is higher, the level of GDP per capita is lower.

A weak correlation has been found between the variables direct payments and financial subsidies allocated through the second pillar of the Common Agricultural Policy. It is important to underline the direct correlation between Usable Agricultural Areas, direct payments, and emigration. Summing up, a growth in Usable Agricultural Areas is directly correlated to both emigration and direct payments hence, a scarcity in land is associated to a low level of permanent emigration in Romanian regions. Comparing the findings for 2008 to those for 2017, it seems there has been an intensification of the connection between these two variables. Instead, the other correlations and links among variables for 2017 seem to have many elements in common with the research's outcomes estimated for 2008.

The findings show that the Romanian South-Eastern and Centre regions are characterised by having the highest values of poverty, occupation in the primary sector, and financial subsidies allocated under the second pillar of the CAP (Figure 6). Meanwhile, the regions of Bucharest-Ilfov and, to a lesser extent, the West, which are characterised by having the highest levels of GDP per capita, have made some autonomous clusters.

The multiple regression models on panel data estimated by the fixed effects in all Romanian regions over the period of investigation has highlighted that the dependent variable permanent emigration is directly correlated to the number of people working in the primary sector (Table 4). Therefore, in rural areas where the phenomenon of permanent emigration has been very intense, it has involved predominately those areas most at risk of severe poverty and social exclusion. The financial subsidies allocated through the second pillar of the Common Agricultural Policy in the framework of the RDP did not have a discernible impact on the level of permanent emigration. Instead, focusing on the other variables involved in the emigration process, an inverse correlation has been assessed between the independent variables employed people, GDP per capita, and financial subsidies allocated through the first pillar of the Common Agricultural Policy. Meanwhile, the level of permanent emigration has been very intense in some Romanian regions where the levels of employed people, GDP per capita, and financial subsidies allocated through the first pillar of the CAP have been low.

In this paper, we have used an input oriented model estimated by DEA on a panel data with the aim of minimising some inputs such as emigration, people at risk of poverty, and people working in the primary sector, whilst the outputs are financial subsidies allocated through the first pillar of the CAP as direct payments and RDP subsidies. The research findings have revealed that, both in constant returns to scale

Table 4. Multiple regression models in a panel data of Romanian regions during the period 2008-2017 for the dependent variable permanent emigration

Variable	Coeff.	Std. error	T value	Significance
Employed people	-708.80	276.28	-2.57	**
GDP per capita	-0.023	0.0102	-2.33	**
Direct payment first pillar CAP	-0.3528	0.1171	-3.01	***
RDP payments	0.7456	0.5001	1.49	n.s.
Employed in the primary sector	0.2650	0.0610	4.34	***
Constant	152.558	1012.64	0.15	n.s.

** At 1%; ***< 1%

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 5. Main results in the non-parametric analysis of efficiency input oriented in a panel data of Romanian regions, for which Irs means increasing returns to scale

Region	CRSTE	VRSTE	Scale	
Bucharest-Ilfov	1.00	1.00	1.00	–
Centre	1.00	1.00	1.00	–
North-East	0.379	0.562	0.674	irs
North-West	0.841	0.994	0.846	irs
South-East	1.00	1.00	1.00	–
South-Muntenia	0.763	0.912	0.837	irs
South-West	1.00	1.00	1.00	–
West	0.870	0.884	0.985	–
Mean	0.857	0.919	0.918	–

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 6. Target and gain in DEA input-oriented analysis estimated in a panel data of Romanian regions

North-East	Value	Target	Increase (%)	South-Muntenia	Value	Target	Increase (%)
Direct payments	1736	2429	39.92	Direct payments	1921	2185	13.74
RDP subsidies	12	215	1,691.67	RDP subsidies	5	158	3060.00
Emigration	4408	2477	-43.81	Emigration	2351	2143	-8.85
Setting in agriculture	35 033	18 776	-46.40	Setting in agriculture	29 459	18 928	-35.75
Poverty rate	33.4	18.77	-43.80	Poverty rate	24.9	22.69	-8.88
North-West	Value	Target	Increase (%)	West	Value	Target	Increase (%)
Direct payments	2152	2422	12.55	Direct payments	2687	2687	0.00
RDP subsidies	74	214	189.19	RDP subsidies	31	75.61	143.90
Emigration	2482	2467	-0.60	Emigration	2986	2638	-11.65
Setting in agriculture	25 004	18 780	-24.89	Setting in agriculture	20 077	16 292	-18.85
Poverty rate	19	18.87	-0.68	Poverty rate	21.4	18.9	-11.68

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

(CRSTE) and also in variable returns to scale (VRSTE), 4 Romanian regions out of 8 have been technically efficient (Table 5). In contrast, the worst results have been found in the North-East, South-Muntenia, and West regions.

Having the aim of defining which inputs and outputs must be reduced or increased, the results of the DEA assessment have underlined which of the variables in the production set have to be changed in quantity in regions found to be technically inefficient (Table 6). With the exception of the West region, the research outcomes have pointed out the need to increase some inputs, such as the direct payments and financial subsidies allocated through the second pillar of the CAP within the framework of the Rural Development Programme. In regards to inputs, the findings have underlined that it is important for Romanian farms to obtain an increase in the financial subsidies allocated under the first pillar of the Common Agricultural Policy. The results for the North-West and West regions have shown a lower need for increasing the amount of financial endowments allocated by the Common Agricultural Policy than the other technically inefficient regions.

The evaluation of technical efficiency has to be associated with another analysis such as the Malmquist index, comparing data for all the different Romanian regions and also all the years of investigation between 2008 and 2017. A value above 1 in the Malmquist index implies an improvement in technology while, conversely, a value below 1 is an indication of a worsening situation.

Focussing attention on technical change, the Malmquist index over the period of investigation has highlighted an increase during the years 2010, 2011, 2012, 2016, and 2017 with an average value above 1, which implies a very modest increase of technology over the time in all Romanian regions that is able to reduce the levels of permanent emigration and poverty (Table 7). In both the years 2014 and 2015 there was a significant decrease in technical change. In fact, the findings have revealed an increase in only 4 years out of 9, while the average value was below 1 for the period overall.

Table 7. Malmquist index summary of annual means over the years of observation in all Romanian regions

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2009	0.83	1.38	1.03	0.81	1.15
2010	1.21	1.11	1.02	1.19	1.35
2011	1.15	0.72	1.00	1.15	0.83
2012	1.11	0.94	1.00	1.01	0.96
2013	1.00	1.02	1.00	1.01	1.02
2014	0.82	1.10	0.96	0.85	0.90
2015	0.57	0.99	1.00	0.57	0.57
2016	1.96	0.79	1.03	1.90	1.54
2017	1.05	0.98	0.98	1.08	1.02
Mean	1.02	0.98	0.978	1.08	1.02

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 8. Malmquist index summary of regional means over the years of observation in all Romanian regions

Region	EFFCH	TECHCH	PECH	SECH	TFPCH
Bucharest-Ilfov	1.000	0.941	1.000	1.000	0.941
Centre	1.029	1.083	1.026	1.003	1.115
North-West	1.049	0.985	0.989	1.061	1.034
North-East	1.076	1.007	1.013	1.063	1.083
South-East	1.012	0.993	1.011	1.001	1.004
South-Muntenia	0.971	0.920	0.990	0.981	0.893
South-West	1.000	0.907	1.000	1.000	0.907
West	0.985	1.074	0.986	0.998	0.907
Mean	1.015	0.978	1.002	1.013	1.001

Source: author's own elaboration on data available at https://ec.europa.eu/agriculture/rica/database/database_en.cfm
http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Comparing all Romanian regions, the findings of the Malmquist index have underlined a modest average value of efficiency change, with two regions, South-Muntenia and West, showing a decrease in technical change and a positive although modest increase in all the other regions (Table 8). In contrast, on average there has been a decrease in technical change, since in three out of 8 Romanian regions, the research outcomes have produced values below the optimal threshold that is equal to 1.

With the aim of assessing the role and impact of the Common Agricultural Policy, both following the 5th enlargement of EU in 2007, and in 2017 during the course of the second seven-year period of the CAP, the study applied an estimation of efficiency assessed through Data Envelopment Analysis in an input-oriented approach using, as inputs permanent emigration and poverty and social exclusion.

Table 9 shows that, in 2008, three Romanian regions, namely Bucharest-Ilfov, the South-West, and West, were more efficient than the others or, rather, they were able to minimise the level of emigration and poverty exclusion in their regions, both in constant and also variable returns to scale. On average, all the regions of Romania have shown results for technical efficiency that are below optimal val-

Table 9. Main results in the non-parametric analysis of input-oriented efficiency estimated in 2008 in all Romanian regions

Region	CRTS	VRTS	Scale	
Bucharest-ilfov	1.00	1.00	1.00	–
Centre	0.93	1.00	0.93	drs
North-West	0.43	0.82	0.53	irs
North-East	0.25	0.82	0.45	irs
South-East	0.90	0.91	0.99	irs
South-Muntenia	0.99	1.00	0.99	irs
South-West	1.00	1.00	1.00	–
West	1.00	1.00	1.00	–
Mean	0.81	0.91	1.00	–

* irs = increasing returns to scale; drs = decreasing returns to scale
Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm
http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 10. Target and gains in the DEA input-oriented analysis estimated in 2008 in all Romanian regions

North-West	Value	Target	Increase (%)
CAP	1201	2230	85.68
Direct payments	1133	2133	88.26
LFA subsidies	0	0	0.00
RDP subsidies	0	0	0.00
Emigration	1137	932	-18.03
Poverty rate	20	16.39	-18.05
North-East	Value	Target	Increase (%)
CAP	827	1,872	126.36
Direct payments	785	1,782	127.01
LFA subsidies	0	0	0.00
RDP subsidies	0	0	0.00
Emigration	1412	799	-43.41
Poverty rate	33.4	18.91	-43.38
South-East	Value	Target	Increase (%)
CAP	1,903	1,962	3.10
Direct payments	0	0	0.00
LFA subsidies	0	0	0.00
RDP subsidies	0	0	0.00
Emigration	881	798	-9.42
Poverty rate	26.1	23.66	-9.35

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Table 11. Main results in the non-parametric analysis of input-oriented efficiency estimated in 2017 in all Romanian regions

Region	CRTS	VRTS	Scale	
Bucharest-Ilfov	1.00	1.00	1.00	–
Centre	1.00	1.00	1.00	–
North-West	0.85	0.99	0.85	irs
North-East	0.38	0.56	0.68	irs
South-East	1.00	1.00	1.00	–
South-Muntenia	0.77	0.91	0.84	irs
South-West	1.00	1.00	1.00	–
West	0.89	0.91	0.98	irs
Mean	0.86	0.92	0.92	–

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm
http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table
* irs = increasing returns to scale

ues, equal to 0.81 and 0.91 in constant and variable returns to scale, respectively. The Centre region reveals a decrease in returns to scale while, in contrast, the North-West, North-East, South-East, and South-Muntenia regions have shown increases in technical efficiency estimated in returns to scale.

The North-West, North-East, and South-East regions have shown the lowest levels of technical efficiency, and all 3 have corroborated that it is fundamental in a non-oriented model to increase the level of financial subsidies allocated through the first pillar of the CAP in terms of decoupled direct payments to reduce the rates of emigration and poverty (Table 10). No effects have been found for the financial subsidies allocated through the second pillar of the Common Agricultural Policy and through the LFA subsidies.

In 2017 the estimation of efficiency through the non-parametric DEA approach reveals a radically different situation (Table 11). In fact, on average, there has been a modest increase in the value of efficiency in all Romanian regions over the period of investigation, with half of the regions being efficient both in variable and also constant returns to scale, while inefficient regions have shown increasing returns to scale. As such, it can be observed that an increase in input or outputs in some Romanian regions is able to increase efficiency. The research findings have underlined the positive role that financial subsidies allocated through the second pillar of the Common Agricultural Policy, particularly those subsidies aimed at reducing the marginalisation in many disadvantaged rural areas; have played in improving the level of efficiency (Table 12). In specific terms, the results of the analysis of input-output gain have underlined that in two Romanian regions, the North-East and South-Muntenia, it is important to increase the amount of RDP subsidies, of 1,600 and 3,000 euros respectively, in order to both increase efficiency and, at the same time, reduce the levels of socio-economic poverty and emigration.

Conclusion

Since the country's entry to the European Union, Romania has been seeing a more modest level of permanent emigration compared to the huge flows seen following the collapse of the Communist regime in the early 1990s. In general, the Romanian region of Bucharest-Ilfov has formed a unique and autonomous cluster, both in terms of emigration and also in terms of the proportion of people at risk of poverty, with values of these two variables that are completely

Table 12. Target and gains in DEA input-oriented analysis estimated in 2017 in all Romanian regions

North-West	Value	Target	Increase (%)	South-Muntenia	Value	Target	Increase (%)
CAP	2274	2655	16.75	CAP	1961	2357	20.19
Direct payments	2152	2422	12.55	Direct payments	1920	2185	13.80
LFA subsidies	49	143	191.84	LFA subsidies	0	0	0.00
RDP subsidies	74	214	189.19	RDP subsidies	5	158	3060.00
Emigration	2482	2467	-0.60	Emigration	2351	2143	-8.85
Poverty rate	19	18	-5.26	Poverty rate	24.9	22.6	-9.24
North-East	Value	Target	Increase (%)	West	Value	Target	Increase (%)
CAP	1773	2664	50.25	CAP	2910	2910	0.00
Direct payments	1735	2429	40.00	Direct payments	2687	2687	0.00
LFA subsidies	0	0	0.00	LFA subsidies	0	0	0.00
RDP subsidies	12	215	1691.67	RDP subsidies	31	197	535.48
Emigration	4408	2477	-43.81	Emigration	2986	2704	-9.44
Poverty rate	33.4	18.77	-43.80	Poverty rate	21.4	19.37	-9.49

Source: author's own elaboration on data available at: https://ec.europa.eu/agriculture/rica/database/database_en.cfm
http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

at odds with the other Romanian regions, and failing to effectively take advantage of financial subsidies available for rural areas and small farming enterprises.

During the second seven-year period of financial subsidies allocated to farmers through the Common Agricultural Policy (2014-2020), the findings demonstrate the positive and very significant role that subsidies allocated to rural development and in favour of rural areas at risk of marginalisation have had in increasing efficiency and in reducing emigration and poverty.

Drawing some conclusions, this research has underlined the need for public administrations in Romania to increase the amount of financial support allocated to farmers and to rural areas in the future in order to prevent the increase of socio-economic marginalisation in rural territories as a consequence of a shrinking of financial resources allocated by the European Union to the primary sector within the framework of the first and second pillars of the Common Agricultural Policy.

Summing up, it is important to ensure the growth of land capital and the diversification of activities in farms, for example into agritourism and rural tourism, since in small farms it is possible to observe a constant even if modest emigration phenomenon and an increase in poverty and social exclusion, particularly in regions where the incidence of people employed in the primary sector is greater.

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