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THE CHANGES TO RURALITY IN EUROPEAN FARMS AND THE ROLE OF CAP SUBSIDIES IN EU ENLARGEMENT

ABSTRACT

The Farm Accountancy Data Network (FADN) is an important tool for assessing the impact of the Common Agricultural Policy on EU farming. The core aim of this research was to assess through a quantitative approach the impact that a number of variables and the financial subsides allocated under the Common Agricultural Policy have had on the rurality in European countries, using data for farms included in the FADN dataset during the years 2004 and 2017. The research followed a non-parametric approach, using the Partial Least Square Structural Equation Modeling (PLS-SEM) and Principal Component Analysis (PCA). These methodologies have been applied with a view to defining the main correlations in all variables linked to the rurality, namely crop specialisation, farmer's net income, management costs, and costs of production. The findings have revealed that the financial subsidies allocated under the Common Agricultural Policy correlated to crop and livestock specialisation have influenced the rurality index over the period of investigation. Drawing conclusions, payments and decoupled subsidies disbursed by the European Union have acted directly on the level of rurality in all investigated farms included in the FADN dataset during the period of investigation. This implies that the Common Agricultural Policy decoupled payments and the subsidies provided to disadvantaged rural areas have had a prominent role in the rurality index of all farms included in the Farm Accountancy Data Network dataset.

Keywords: PLS-SEM, PCA, Less Favoured Areas subsidies, rural areas, Common Agricultural Policy.

JEL Classification: Q10, R11.

1. INTRODUCTION

Rural depopulation and socio-economic marginalisation have long been two of the most significant problems facing European rural areas, and the subsidies allocated under the Common Agricultural Policy (CAP) represent the European Union's attempts at mitigating and partially solving these issues (Galluzzo, 2018a; 2018b; Vieri, 2012). Rural territories in general, and lagging-behind farming areas in particular, are dependent on exogenous financial subsidies allocated under the Common Agricultural Policy aimed at promoting multifunctionality and greater diversification in the rural space that go towards partially solving the permanent

rural out migration (Galluzzo, 2019a; 2019b) while stimulating, also, a generational turn-over in the countryside (Galluzzo, 2018a).

Multifunctionality in rural areas is the consequence of the transition from a productivist model to a post productivist one, and a reduction in decoupled subsides allocated under the second pillar to rural areas has a detrimental effect on the promotion of multifunctionality and, by extension, the socio-economic protection in rural territories. According to various authors (Van der Ploeg *et al*., 2002; Ilbery, 1998; Galluzzo, 2019a; 2019b; 2018a; 2018b), in so far as local and European administrations are able to stimulate rural development and socio-economic growth through a new model of governance based on a cohesive and bottom-up approach, the European countryside could be an optimal driver for reducing socio-economic marginalisation as well as increasing environmental protection. As several scholars have argued, the rurality has come to play a new strategic role in the European countryside due to its sensitivity to exogenous socio-economic drivers (Woods, 2005; Galluzzo, 2019a; 2019b).

The core purpose of this research, therefore, was to assess, through a quantitative approach, an estimation of rurality in all farms belonging to the sample of the Farm Accountancy Data Network (FADN) dataset for the years 2004 and 2017 with the aim of estimating the effect of financial subsidies allocated under the CAP and of farm specialisation after the various phases of EU enlargement. Furthermore, this quantitative approach was utilised in order to evaluate whether some cause-effect relationships exist between different items and endogenous variables correlated to the rurality.

2. STATE OF KNOWLEDGE

Since the early nineteen seventies, a few authors have argued for the need to investigate the rurality through quantitative study (Kendall, 1975), so defining a precise quantitative approach to its investigation. Other scholars have followed by proposing quantitative approaches aimed at describing rurality through the measurement of Local Indicators of Spatial Association (LISAs) that measure spatial association in sub-areas of a study region and that can also be useful for identifying outliers and clusters (Woods, 2005; Halfacree, 1993; 1995; Jones, 1995; Van Dam *et al*., 2002; Woods, 2005; Halfacree, 1993; 1995; Jones, 1995; Galluzzo, 2018a; 2018b; 2019b; Heley & Jones, 2012; Galluzzo, 2018c; Li *et al*., 2015; Cloke, 1977; Kendall, 1975; Lehtonen & Tykkyläinen, 2010; Griffith, 2003). Generally speaking, it is difficult to find many studies that seek to describe the rural index through quantitative investigation. In 1977, Cloke was the first to propose a definition of the rural index, setting out a theoretical conceptualisation of rural and rurality for the first time with the specific objective of generating different strategies for development (Cloke, 1977; Banister, 1980; Harrington & O'Donoghue, 1998).

From a review of the literature, it has been very difficult to find studies that investigate the correlation between a farm's specialisation and financial subsidies allocated under the Common Agricultural Policy aimed at influencing the rurality and the index of rurality (Cloke, 1977; Cloke & Edwards, 1986; Galluzzo, 2019a; 2019b; Finco *et al*., 2005). The main purpose of an index of rurality is to define a model that is able to asses which socio-economic variables have an effect on the development patterns in rural areas. Furthermore, a quantitative index is able to suggest the optimal allocation of financial resources in a planning process of rural development, considering which socio-economic variables are involved in reducing the socio-economic marginalisation of rural areas (Galluzzo, 2018a; 2018b; 2019b).

Drawing some conclusions about different quantitative methodologies able to define and assess the rurality index, the research findings suggest that there is, in fact, no single definition of the rurality index that is able to exhaustively analyse both the impact of financial subsidies allocated under the CAP and of the other socio-economic variables correlated to the rural context (Prieto-Lara & Ocaña-Riola, 2010; Cloke, 1977; Ocaña-Riola & Sánchez-Cantalejo, 2005; Cloke & Edwards, 1986; Galluzzo, 2019a; 2019b; 2018a; 2018b; Finco *et al*., 2005).

3. MATERIAL AND METHODOLOGY

In this paper, data published by the European Union in its annual European Farm Accountancy Data Network (FADN) survey has been utilised with the core aim of evaluating the impact of the Common Agricultural Policy on a sample of European farms (Galluzzo, 2019a; 2019b). The principal purpose of this study was to assess, through a quantitative approach, the cause-effect relationships in all European farms included in the FADN dataset in the years 2004 and 2017, in all European regions.

Partial Least Square Structural Equation Modelling (PLS-SEM) is a non-parametric approach which fits well to the aim of the analysis, or rather, to the aim of estimating cause-effect relationships among different factors and endogenous and exogenous variables involved in the investigation of the index of rurality. For this study, the Smart PLS 3 software has been used (Ringle *et al*., 2015).

The PLS-SEM meets our research targets since it fits well to the specific features of the analysis and, in particular, with the scarcity of theoretical models available in the literature (Hair *et al*., 2017; 2016; Tenenhaus *et al*., 2004; Galluzzo, 2018a; 2018b; 2018c). In fact, according to these authors, the modest dimension of the sample size of investigated farms in the FADN dataset that comprises less than 3,000 units necessarily implies the use of a non-parametric approach, such as that of Partial Least Square Structural Equation Modeling.

Roughly speaking, the PLS-SEM describes the causality among latent variables through an iterative methodology aimed at estimating the internal and

external correlations and values in all investigated latent variables (Hair *et al*., 2017; 2016; Tenenhaus *et al*., 2004, Wong, 2013; Vinzi *et al*., 2010; Galluzzo, 2018a; 2018b, 2019b; Monecke & Leisch, 2012).

Furthermore, the non-parametric model PLS-SEM requires some non-restrictive assumptions to be applied compared to other approaches, such as Covariance Based Structural Equation Modeling (CB-SEM) which has a consolidated application and a theoretical framework in the literature in some other fields of study such as psychology and sociology (Hair *et al*., 2016; Galluzzo, 2018a; 2018b; 2019a; 2019b). Table 1 shows the endogenous and exogenous variables investigated in this research and the items used in the PLS-SEM. Furthermore, the Partial Least Square Structural Equation Modeling is adequate to estimate a modest sample size of investigative units where there is a not well-defined model with correlated specifications maximising the difference to the variance (Hair *et al*., 2017; 2016; Tenenhaus *et al*., 2004; Wong, 2013; Galluzzo, 2018b; 2019a; 2019b; Monecke & Leisch, 2012).

In the framework of the multivariate analysis, the most important role has been carried out by the Principal Component Analysis (PCA) that, in a dataset of variables, is able to generate a limited cluster made by new variables which describe the data in a more concise way (Bolasco, 1999).

Table 1

The main exogenous and endogenous variables and items used in the Partial Least Square Structural Equation Modelling in all European regions included in the FADN dataset

Variables	**Description**
RURALITY	Index of rurality
First Pillar	Endogenous variable assessing the impact of financial payments allocated under the first pillar of the CAP
Income	Endogenous variable aimed at estimating the level of assets and output produced by farm
Specialisation	Endogenous variable describing concentration of farm activity in cultivations or animals
Cost	Endogenous variable estimating the total costs for farm management
Farm production	Endogenous variable assessing the production yield of farms
Items	**Description**
Labour_input	Total labour in hours used in farm production
UAA	Usable Agricultural Area measured in hectares
Cereals	Hectares of UAA cultivated with cereals
Orchards	Hectares of UAA specialised in permanent fruit and flower crops
Forage_crops	Areas cultivated with permanent forage crops
Dairy_cows	Number of cows used for producing milk
Sheep_goats	Number of sheep and goats in farms
Pigs	Number of pigs in farms
Total_output	Total output produced in farms
Cereals_y	Yield of cereal in tons
Cows_milk_y	Yield of milk produced in farms
Beef_veal_y	Yield of meat produced from cows
Pigmeat_y	Yield of meat produced from pork
Sheep_goats_y	Yield of meat produced from sheep and goats

Table 1 (continued)

Seeds_plants_cost	Costs correlated to plant and seed
Feed_livestock_cost	Costs correlated to feeding livestock
FNI	Farm net income
Total_assets	Total assets in farms
Total_direct_payments	Direct payments allocated under the first pillar of the CAP
Environmental_subsidies	Payments allocated to environmental measures under the first pillar
LFA_subsidies	Payments made towards disadvantaged rural areas
RDP	Rural Development Programme payments allocated under the second pillar of the CAP
Agritourism	Subsidies aimed at promoting diversification in farms allocated within the framework of the second pillar of the CAP

In the n_j correlated variables dataset, the PCA transforms them into new variables or components which have a linear independence that is able to explain the variance of investigated data in a different way, giving the same information but using a lower number of involved variables.

4. RESULTS AND DISCUSSION

The main findings of the Principal Component Analysis for 2004 have revealed a strong and direct correlation between the variable Farm Net Income and the items Usable Agricultural Areas, Total Assets, and Total Direct Payments allocated under the first pillar of the CAP (Fig. 1). At the same time, no correlation has been found between the variables farm net income and less favoured areas payments (LFA); in contrast, a direct and strong correlation has been assessed between the variables rural development programme payments and LFA subsidies.

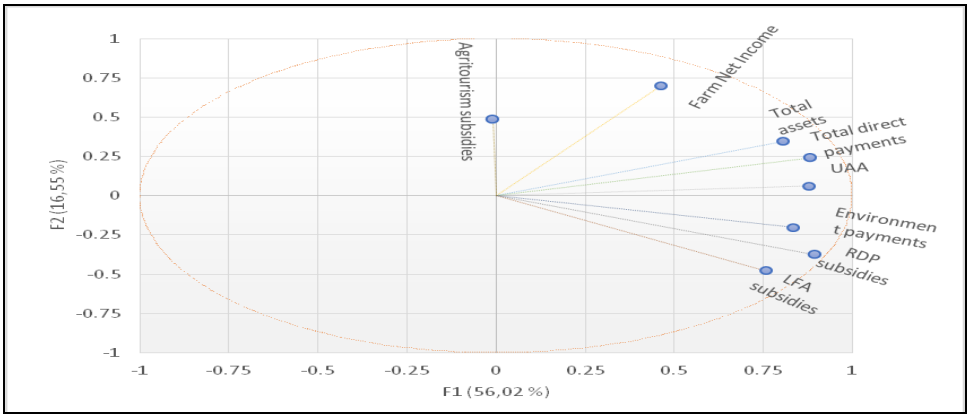

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Figure 1. Main results of the Principal Component Analysis for the year 2004 in all European regions included in the FADN dataset

The results underlined an increase of direct correlations in all investigated variables in 2017 (Fig. 2).

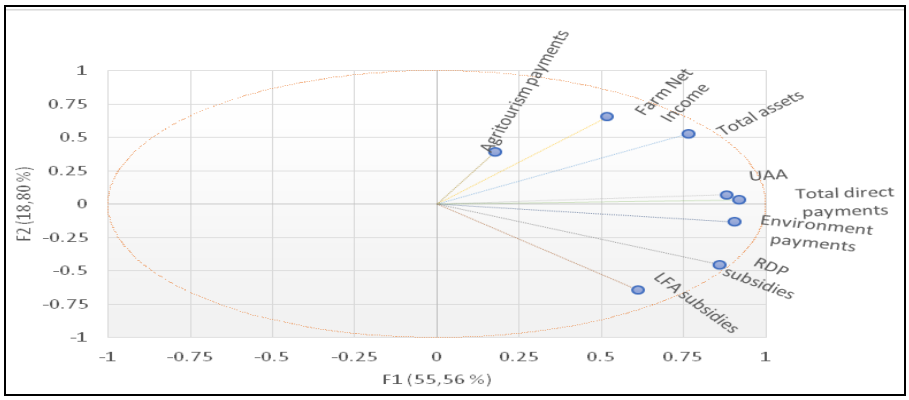

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Figure 2. Main results of the Principal Component Analysis for the year 2017 in all European regions included in the FADN dataset

A very strong and pronounced direct correlation was found between the variable Total Direct Payments and the item UAA. In contrast, an indirect correlation was found between the item LFA Subsidies and the item Agritourism that represents the financial subsidies aimed at implementing greater multifunctionality in the countryside.

Findings in the rurality index assessed for 2004 through Partial Least Square Structural Equation Modeling (PLS-SEM) in the inner model reveal that the exogenous variables First Pillar, Cost, and Specialisation are able to explain more than 50% of the variance, and in particular, the endogenous variable First Pillar explained more than 60% of the variance (Fig. 3) with a level of significance expressed in p value lower than 0.01 (Fig. 3a). Investigating the role of three items correlated to the exogenous variable Rurality in depth, the items LFA subsidies and RDP show a level of significance under 0.01, while there was no statistical significance with the item Agritourism, being the financial subsidies allocated under the second pillar of CAP aimed at stimulating diversification and multifunctionality in the countryside (Fig. 3b).

Focusing attention on the complete model, the research outcomes have corroborated that the higher the variance explained by the endogenous variable, the higher the level of statistical significance of the items involved (Fig. 4). All the items that are part of the endogenous variables First Pillar, Income, Cost, and Farm production have a level of statistical significance lower than 0.01. In contrast, in 2004 some items involved in the endogenous variable Specialisation were not statistically significant. Specifically, the area cultivated with vegetables and flowers had no effect on the endogenous variable Specialisation. On the other hand, the item Orchard did have a direct and significantly statistical effect on the endogenous variable Specialisation.

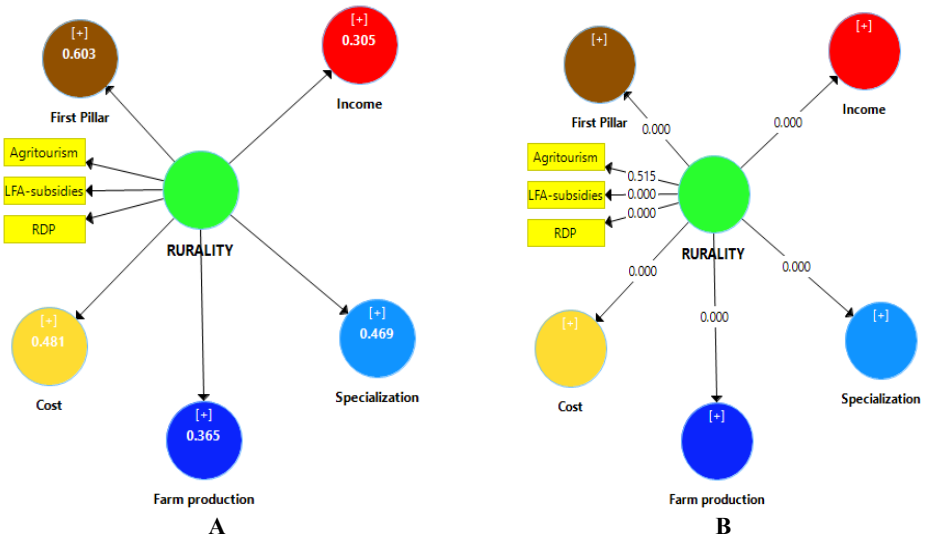

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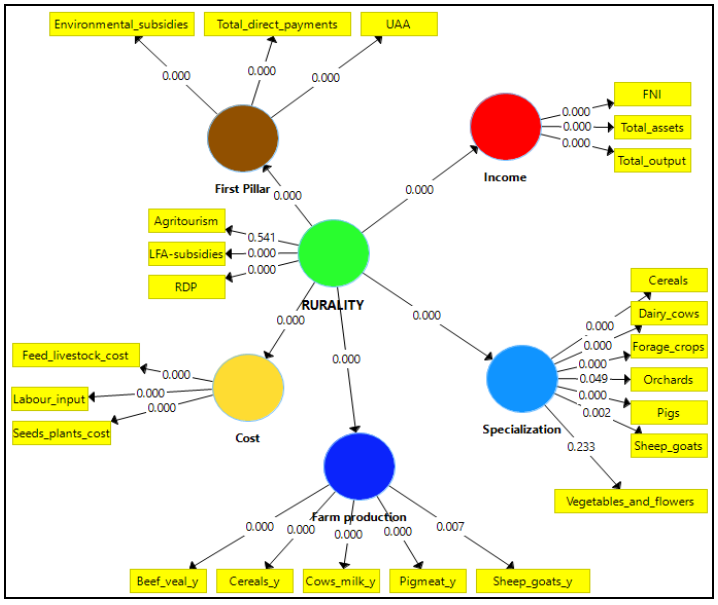
Figure 3. Main results of the variance (A) and p value (B) in the year 2004 in all European regions included in the FADN dataset using the inner model of the PLS-SEM



Source: calculations made using data from http://ec.europa.eu/agriculture/rica/database/database_en.cfm

Figure 4. Main results in the PLS-SEM for the year 2004 in all European regions included in the FADN dataset.

The findings in the PLS-SEM for 2017 have revealed in the inner model that the endogenous variables First Pillar, Cost, and Specialisation are together able to explain more than 45% of the variance, even if the endogenous variable First Pillar had the highest value of explained variance among these three (Fig. 5a). The statistically significant results for the year 2017 showed the same results in terms of correlations (Fig. 5b).

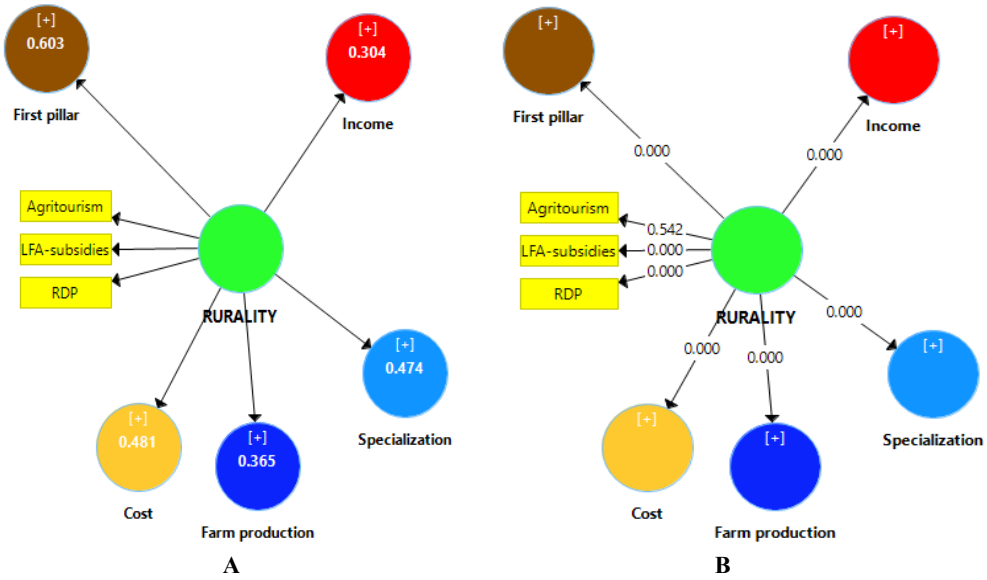


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Figure 5. Main results of the variance (A) and p value (B) in the year 2017 in all European regions included in the FADN dataset using the inner model of the PLS-SEM

On the other hand, the item Agritourism did not show any effect on the exogenous variable Rurality. Comparing the complete model for the years 2004 and 2017, the research findings showed that all the items included in the endogenous variable Rurality had a statistical significance on the endogenous variables investigated in the model (Fig. 6). Meanwhile, the items vegetables and flowers in the endogenous variable Specialisation and the item Agritourism have not had any effect on the cause-effect relationships.

Comparing the two years 2004 and 2017 in order to assess whether the enlargement of the European Union brought any changes in the PLS-SEM models, the findings do not seem to show any significant effects of the enlargement on the rurality index in the European regions included in the FADN dataset.

A reduced model of the rurality index assessed for the year 2017 shows that the exogenous variable Specialisation explained more than 70% of the variance, while the endogenous variable Net Farm Income explained 56% of the variance. Focussing the investigation on the main cause-effect relationships and the p value in the complete model, the research findings have underlined that all the involved items impacted on the endogenous variables (Fig. 7).

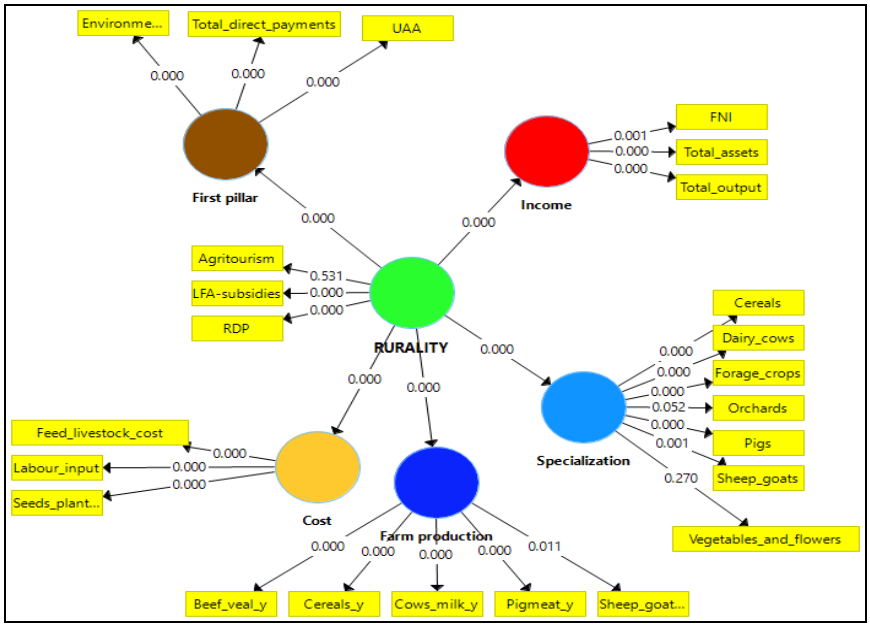

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Figure 6. Main results of the PLS-SEM for the year 2004 in all European regions included in the FADN dataset

Investigating the results in depth, it is important to observe that there in an inverse relationship between the item permanent Forage Crops and the variable Specialisation, while the items Vegetables and Flowers did not show a significant level of correlation. The endogenous variables Specialisation and Net Farm Income both had a positive impact on the Rurality, even if the former seems to have a greater impact on the Rurality than the later. Summing up, the items correlated to the second pillar of the Common Agricultural Policy such as RDP, or rather financial subsidies allocated under the second pillar of the CAP, and LFA subsidies have had an important effect on the Rurality variable. Finally, the item UAA also played a direct role in influencing the rurality index as well.

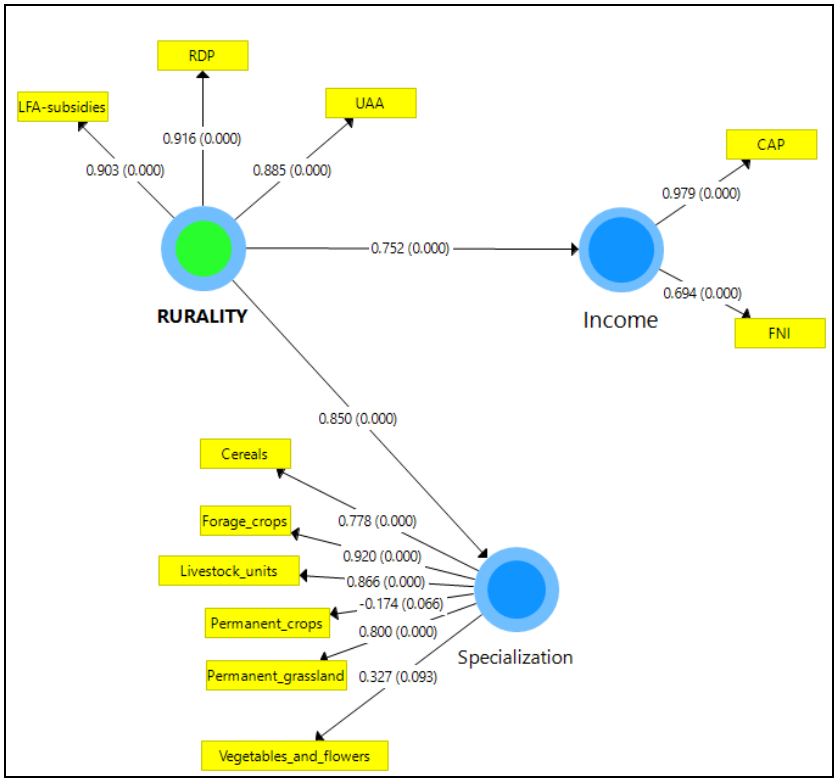

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Figure 7. Main results in the reduced PLS-SEM for the year 2017
in all European regions included in the FADN dataset

5. CONCLUSIONS

Comparing the two years 2004 and 2017, the enlargement of the European Union does not seem to have had any impact for the PLS-SEM while, in contrast, the model developed through the Principal Component Analysis has been more sensitive in emphasising the main changes over the period.

The findings have revealed that the specialisation in crops and the financial subsidies allocated under the Common Agricultural Policy, in particular through the second pillar, have had fundamental impacts on the farms included in the FADN survey. This is particularly true with regard to the LFA payments and RDP subsidies, corroborating the need for strategies addressed to farms located in disadvantaged rural areas where it is pivotal to diversify the on-farm activities in order to reduce the socio-economic pauperisation and emigration of those areas.

In respect to the next seven-year period of the Common Agricultural Policy programme, from 2021-–2027, despite the various pressures to do so, it is therefore important to note that reducing the total budget, in particular to the second pillar, may increase the socio-economic divide between rural and urban territories, with a significant effect on the environment.

In summary, these findings have implications for the stakeholders in rural areas and for policy makers aiming at a cohesive development, considering that a bottom-up approach is able to define the hierarchy of priorities for socio-economic growth.

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