

Preliminary findings in Italian farms part of FADN dataset by the PLS-SEM

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Abstract

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In Italy there has been a significant decrease of farms with the consequence to marginalize rural areas. By some financial subsidies allocated throughout the Common Agricultural Policy there has been a partial reduction of socio-economic marginalization in Italian rural territories. The purpose of this research was to assess by a quantitative approach which variables have acted on the rurality, management of farms and features of different unit of production since 2005 to 2015 using the dataset published in the Farm Accountancy Data Network. Findings have pointed out the positive role of the specialization of farms in terms of cultivated areas and financial subsidies allocated by the European Union throughout the Common Agricultural Policy and the Rural Development Plan. The Partial Least Square Structural Equation Modeling (PLS-SEM) has been useful in assessing the cause-effect relationships in different constructs or rather among all investigated variables and indicators. PLS-SEM has not been widely used in investigating some index of rurality and relationships among indicators and variables corroborating the pivotal role of this quantitative approach in estimating cause-effect relationships in a small sample of farms.

Keywords: Common Agricultural Policy; rural development; rural areas; financial subsidies; LFA payments; structural equation model

Introduction

Comparing findings of the Agricultural Census in 2010 and in 2000 there has been a significant drop of farms whose reasons have been investigated by few authors (Sotte, 2006). This author has argued as an hysteresis in the data is tightly correlated to an ambiguity in the definition of the unit of investigation. Although this theoretical aspect a crucial common and significant element in the depletion of Italian agricultural context is a haemorrhage of people from small rural villages with a consequently growth of the socio-economic marginalization in the countryside. The main consequence of this contraction of farms has been directly and indirectly correlated to the emigration from the countryside and to the economic crises in 2008-2009 which involved other European states (Kasimis, 2010; Gosnell and Abrams, 2011; Galluzzo, 2016a) with negative impacts on the environment in marginal land (MacDonald et al., 2000).

In general, crops specialization and the level of financial subsidies allocated by the Common Agricultural Policy (CAP) have acted on the level of efficiency halting partially the out-emigration from rural areas as investigated in lots of European countries (Latruffe et al., 2005; Marongiu and Cesaro, 2010; Galluzzo, 2015; Galluzzo, 2016b; Galluzzo, 2017a; Galluzzo, 2017b). In the same time other scholars have pointed out as positive has been the impact of financial subsidies disbursed in order to stimulate the diversification in on-farm activities in rural areas due to an enhanced in the generational turnover process and also in a radical shift of the farm management not fewer than the level of education of farmers (Gorton and Davidova, 2004; Latruffe et al., 2005).

In order to investigate the impact of the CAP to farmers the European Union has arranged an annual survey called Farm Accountancy Data Network (FADN) as described in the website and in the legislative sources of the European

Commission. According to the European Union the FADN is a survey carried out on a sample of farms and it is a complete source of economic data fundamental in investigating in depth the impact of the CAP towards European farmers.

Harsh is the theoretical concept of a univocal definition of rurality because of lots of variables are involved in it (Cloke, 2006; Woods, 2010). A quantitative index able to assess the rurality and the cause-effect relationships is pivotal in estimating the impact of financial measures and socio-political strategies in favour of rural territories in order to reduce their marginalization over the time. Lots of researchers have investigated in depth by a quantitative approach the rurality and a specific index directly correlated to it (Kendall, 1975; Cloke, 1977; Cloke and Edwards, 1986; Ocaña-Riola and Sánchez-Cantalejo, 2005; Prieto-Lara and Ocaña-Riola, 2010). According to these authors the index of rurality has been set up using some quantitative socio-economic variables able to define in several European countries which variables have acted on the rural areas and in their own features and development.

As argued by several authors one of the weakness of these studies aimed at estimating the index of rurality by a quantitative approach is tightly linked to their own target (Kendall, 1975; Cloke, 1977; Cloke and Edwards, 1986; Ocaña-Riola and Sánchez-Cantalejo, 2005; Prieto-Lara and Ocaña-Riola, 2010); in fact, these above mentioned models are able to underline the direct or indirect correlations among variables but they cannot assess and explain cause-effect relationships.

Aim of the research

The purpose of this research was to assess by a quantitative approach the role of productive specialization in terms of cultivated areas, economic variables, management aspects and financial subsidies allocated by the CAP on Italian farms belonging to the FADN dataset since 2005 to 2015. A further stage of this research has defined preliminary an index of rurality by a quantitative approach aimed at assessing the direct and indirect cause-effect relationships among investigated variables and other items.

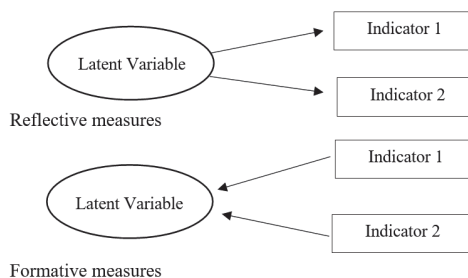


Fig. 1. Formative and reflective measures in the SEM
Source: author's elaboration on Wong, 2013; Hair et al., 2016

Methodology

In order to estimate cause-effect relationships in a small sample of dataset and considering the lack of a parametric approach due to a scarcity in using a structural equation modelling in literature review in this research it has employed a non-parametric approach.

The assessment of the cause-effect model in a pattern of investigation of the rural development growth and socio-economic marginalization needs of a Structural Equation Modelling (SEM) which has to be modified in line to the specification proposed in the Partial Least Square Structural Equation Modelling approach (PLS-SEM) which fits well to the features of the analysis and to the theoretical framework proposed by different authors (Tenenhaus et al., 2005; Hair et al., 2016; Hair et al., 2017).

In fact, the non-parametric model PLS-SEM needs of not restrictive underlying assumptions compared to the SEM where are well defined in literature the application and the basic assumptions (Hair et al., 2016); furthermore the Partial Least Square Structural Equation Modelling is also adequate to estimate a modest sample size of investigation units because of there are not well defined and *a priori* model specifications in the model (Wong, 2013; Awang et al., 2015; Hair et al., 2016; Hair et al., 2017).

Due to both few socio-economic variables investigated in a small simple of data made by different heterogeneous indicators or items and also because of the lack of previous investigation and models the Partial Least Square Structural Equation Modelling fits well to the predictive purpose in this research (Hair et al., 2016). In this study it has used as software Smart-PLS version 3.2.7 student licence.

General speaking, the Structural Equation Modelling describes the causality among latent variables by an iterative methodology aims at estimating the internal and external correlations and values in all investigated latent variables (Tenenhaus et al., 2005; Vinzi et al., 2010; Wong, 2013; Hair

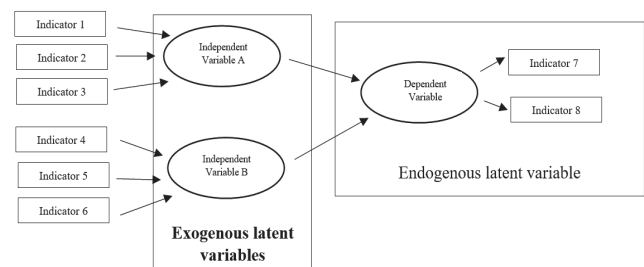


Fig. 2. Exogenous and endogenous latent variables in the PLS-SEM

Source: author's elaboration on Hair et al., 2016; Wong, 2013

et al., 2016). According to these authors the partial estimation has a different set of socio-economic and technical variables stratified in several blocks of variables which alternate simple and multiple regressions.

In function of the direction of the arrows in the latent variable in the SEM and in the PLS-SEM as well it is possible to estimate a formative or reflective measurement model (Hair et al., 2016). In the formative model each indicator is the dimension of the latent variable and it builds the latent variable (Fig. 1). By contrast in the reflective model the indicators are representative of the latent variable.

In the Partial Least Square Structural Equation Model which is based on the same approach and theoretical framework described and used in the SEM it is compulsory to estimate two different sub models defined as the inner one made by the interactions between the dependent and independent variables and the outer model which is based on some main relationships between latent variables and their factors or indicators (Wong, 2013; Hair et al., 2016). As described in the Structural Equation Model showed in Fig. 2, variables have been splitted in two groups and stratified in exogenous variables with path arrows pointing outwards which do not receive any other arrows and endogenous variables with one or more arrows leading to it (Vinzi et al., 2010; Wong, 2013; Awang et al., 2015; Hair et al., 2016; Hair et al., 2017).

Results and Discussion

In the first stage of the study it has used a PLS-SEM made by one exogenous variable such as the economic unit of production and two endogenous variables such as crops specialization and economic management of the farm (Fig. 3). Findings have pointed out as economic size is a very pivotal indicator able to act to the economic unit of production made by all Italian farms part of the FADN dataset.

The endogenous variable specialization of farm has acted directly on the level of endogenous variable management made by economic and asset indicators. Focusing the analysis on the indicators constituting the endogenous variable specialization surface cultivated with vegetables, livestock in terms of total animals in farm (sheep, cows, pigs and goats), olive crops, forage and cereals have acted significantly on the level of specialization. Farm net income, total assets, total specific costs and total farming overheads cost have had a direct impact on the management endogenous variable. Summing up, the economic unit of production has had a direct impact on the level of specialization of Italian farm but an indirect link to the management endogenous variable and it has also had a direct link to the cause effect correlation between the variables specialization and the management variable.

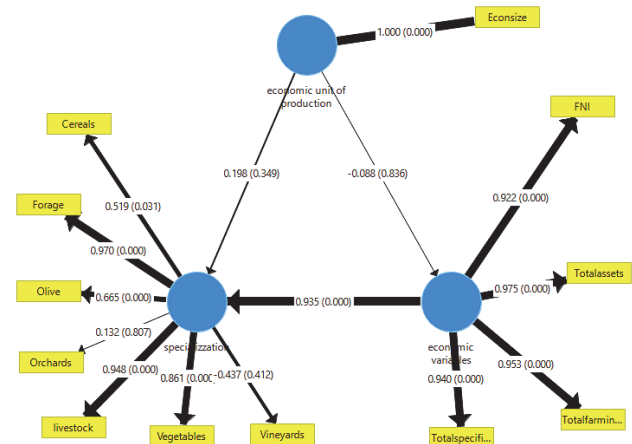


Fig. 3. Research model main results in the first PLS-SEM in Italian farms part of the FADN dataset

Source: author’s elaboration on data published on http://ec.europa.eu/agriculture/rica/database/database_en.cfm

The values of alfa rho have been above 0.85 with the highest value assessed in the exogenous variable economic unit of production; the values of composite reliability (CR) has been above the threshold of 0.70 and the average variance extracted (AVE) has been above of the minimum value equal to 0.50. To sum up in all exogenous and endogenous variables the value of AVE was equal respectively to 0.95 for the endogenous variable economic unit of production and

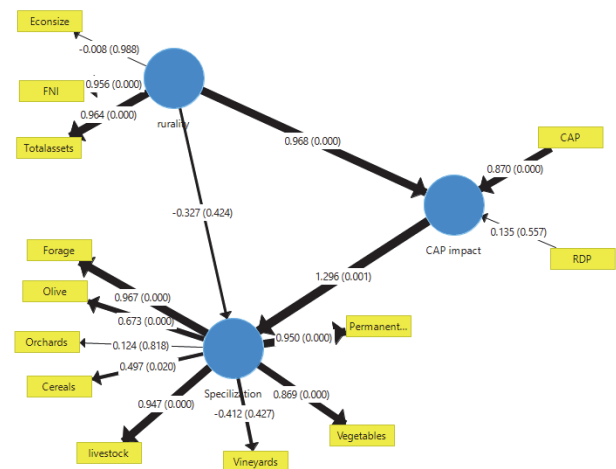


Fig. 4. Main results in the first PLS-SEM research model in Italian farms part of the FADN dataset aimed at assessing the index of rurality

Source: author’s elaboration on data published on http://ec.europa.eu/agriculture/rica/database/database_en.cfm

0.80 and 0.50 for the endogenous variables economic and farms specialization. The average variance extracted close to the threshold 0.50 due to a small consistent sample of Italian farms in the FADN dataset can be considered significant hence, the convergent validity is confirmed (Fornell and Larcker, 1981; Gye-Soo, 2016).

In the second phase of this research has been assessed which variables have influenced the rurality in Italian farms part of the FADN dataset (Fig. 4). The exogenous variable is made by the rurality and the endogenous variables have been properly set up by the level of specialization and the CAP impact in terms of financial subsidies allocated by the National Rural Development Program.

The first endogenous variable is made by indicators correlated to the farms specialization in terms of cultivated areas or breeding animals instead the CAP impact endogenous variable has been made by two reflective indicators made by the indicators financial subsidies allocated by the CAP and also by the aids and supports disbursed by the second pillar (RDP) of the Common Agricultural Policy. The indicators Farm Net Income (FNI) and total assets have had a direct and highly significant impact on the exogenous variable rurality; no impact has had the item economic size on the rurality. A direct link and cause effect relationship has been found between the exogenous variable rurality and the endogenous variable CAP impact and no effect has been found between the exogenous variable rurality and the endogenous variable level of specialization in Italian farms.

In the same time findings have underlined a direct and significant cause-effect relationships between the endogenous variable CAP impact and specialization expressed as cultivated surface hence, the exogenous variable rurality is mediated by the CAP impact on the variable specialization. Focusing the attention on the variable specialization research outcomes have pointed out as some cultivated areas such as permanent crops, vegetables and fruits, olive and livestock have had a positive and direct relationship to the endogenous variable specialization. The values of R^2 in the constructs as specialization and CAP impact have been equal to 0.93 and 0.96 which implies as more than 90% of the variance has been explained by the model furthermore, the alfa rho value has been above the threshold of 0.70. Focusing the attention on the average variance extracted (AVE) findings have been in the variable specialization and rurality equal to 0.54 and 0.61 and the composite reliability (CR) has been above the threshold of 0.70 and equal respectively to 0.85 and 0.76.

In the third simulation the exogenous variable has been the management of Italian farms part of the FADN dataset and the endogenous variables have been made by financial subsidies allocated by the European Union to the rural de-

velopment and by the CAP, the management aspects and the level of specialization in Italian farms part of Farm Accountancy Data Network dataset (Fig. 5).

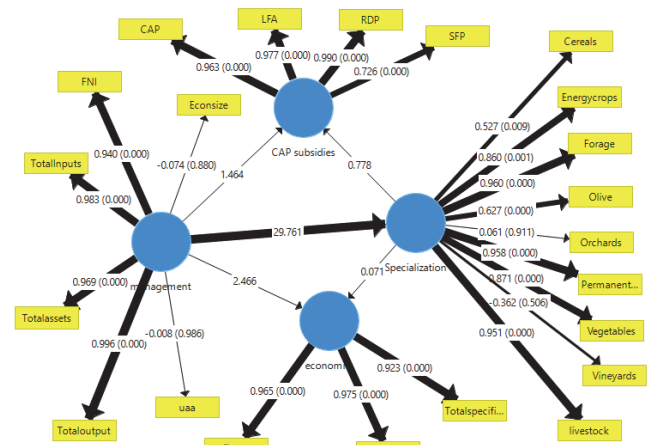


Fig. 5. Main results in the research model PLS-SEM in Italian farms part of the FADN dataset aimed at assessing the main relationships among all investigated variables

Source: author's elaboration on data published on http://ec.europa.eu/agriculture/rica/database/database_en.cfm

Results have pointed out as the indicators of total output, total assets, total input and farm net income (FNI) have directly acted on the exogenous variable farm management. Research findings have underlined as the constructs economic aspect, European funds and specially the specialization of farms have acted in a significantly way to the exogenous variable farm management. No relationships have been found between the variable farm specialization and economic aspects. Addressing the analysis towards the constructs made by variables economic aspects and financial subsidies outcomes have pointed out as the indicators taxes and specific cost have had a positive and direct cause effect impact and also indicators single farm payment scheme (SFP), total financial subsidies allocated by the CAP, payments in favour of the rural development and direct financial support towards less favored areas have had a direct correlation to the endogenous variable European funds.

The value of R^2 and adjusted R^2 have been above the 0.90 in the exogenous variables CAP subsidies, specialization and economic; this implies as the model fits well because it is able to explain more than 90% of the variance. The Cronbach alfa has been above 0.70 in all endogenous and exogenous variables. The values of alfa rho have been above the threshold of 0.70 and between in all investigated

constructs 0.85-0.95. Addressing the attention on the average variance extracted (AVE) findings have been above the threshold of 0.50 and the lowest value has been assessed in the construct specialization and the highest in the variables economic and CAP subsidies. The values of composite reliability (CR) have been above the minimum threshold equal to 0.70 with the highest level in the variables economic and CAP subsidies close to 0.95 and the lowest has been found in the variable management.

Summing up, it is important also to underline the role of financial subsidies allocated towards stayed behind rural areas on the one hand by the second pillar (LFA payments) and on the other by the single area payment scheme able to protect the rural environment and reducing the marginalization in disadvantaged rural areas.

Conclusions

The third simulation considering more indicators and exogenous and endogenous variables in the constructs has been optimal in investigating and in assessing the role of the farm's management as pivotal variable in the Italian farms with a direct link to the construct specialization in terms of cultivated surface. With reference to the exogenous variable the farm's area cultivated with forage and the livestock in farms, even if not stratified in function of their own species, have pointed out their prominent role in influencing the specialization of farm and with a direct link to the exogenous variable management.

The use of PLS-SEM in some simulations has corroborated the positive role of the financial subsidies allocated by the Common Agricultural Policy even if in the rurality index the role of subsidies allocated in stimulating the multifunctionality in farms has been less intense than the financial subsidies allocated by the first pillar of the CAP. In conclusion, findings have strengthened the positive role of CAP subsidies to the management of Italian farms part of FADN dataset; hence, in the next seven-year time of planning of the rural development the national authorities should implement financial resources in order to stimulate the diversification in the Italian countryside by on-farm activities able to reduce socio-economic marginalization and mostly the out emigration from rural space.

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