

## Modelling the Determinants of the Financial Viability of Farms

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**Abstract:** One of the main objectives of agricultural policy, both on an EU level, and a national level, is the economic growth of the agricultural sector, which is pursued through various investment programmes. One of the most important programmes for the development of business structures in the agricultural sector is the financing programme for young farmers. Inclusion in the subsidy scheme of this programme is based on socio-economic criteria. The aim of the present paper is the creation of a specific model that describes the relation between farm's financial viability level and its determinants. In order to fulfill the aim of the research, data was used concerning the submitted investment plans for improvement linked to funding for the installation of young farmers. Six socio-economic parameters were used to create the model, which also constitute the criteria for the inclusion of young farmers in this particular subsidy programme. The method of Categorical Regression was applied in order to examine the effect of the socio-economic parameters on the level of financial viability. According to the results, there is a significant multiple correlation between the level of financial viability (dependent variable) and the socio-economic criteria (independent variables). The amount of labour and age have the highest effect, the type of agricultural activity and the place of permanent residence have the lowest, while the effect of gender does not seem to be statistically significant. The research conclusions can help in the formulation of agricultural policy and funding proposals and measures, with the aim of improving the financial viability level of agricultural holdings, depending on the effect of specific socio-economic parameters.

**Keywords:** financial viability, model, categorical regression, agricultural policy, financing programmes

### INTRODUCTION

Greek agriculture is presently faced with the challenge of adapting to a particularly harsh, ever-changing international environment<sup>[6,19]</sup>. The development of business structures in agriculture requires the presence of young capable farmers, armed with additional business incentives and mainly more knowledge than previous generations, who are called upon to provide products of a higher quality that will meet the new competitive standards of the marketplace. Young farmers possess more business incentives and additional technical knowledge, and are therefore able to produce products of a higher quality, which can compete on the international market. Young farmers, as the representatives of innovation, can make a dynamic contribution to the ever-changing, competitive environment of the European and global market for agricultural products<sup>[10,12]</sup>.

Through these business incentives for young farmers and various other parallel programmes, an attempt is being made to substantially develop the agricultural sector. A major part of the investments made by Greek agricultural holdings are financed by

national resources, and the structural funds of the European Union. In order to be eligible for financial aid, agricultural holdings must fulfill basic preconditions of financial viability<sup>[3,6,21]</sup>. The following parameters are primarily used to determine the financial viability of agricultural holdings<sup>[16,17]</sup>:

- Farm family income (FFI) per fully employed member of the agricultural family.
- The family labour used at the holding, measured in Human Labour Units (HLU).

Based on the above-mentioned indicators, farms are divided into the following categories<sup>[5,19]</sup>:

- *Viable farms*, that render an FFI per used family HLU higher than the reference income (the Ministry of Agricultural Development annually determines the reference income as equal to approximately 80% of the comparable income) and use at least one (1) HLU of family labour.
- *Potentially viable farms*, in which the FFI per HLU ranges between 80 and 100% of the reference income, while it is estimated that at least one (1) family HLU is used.

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- *Declining farms with signs of economic recovery*, in which the FFI per HLU is less than 80% of the reference income.
- In addition, *small farms* can also receive financial support, as long as their owners are “new farmers” and it has been less than three years since their first crop.

One of the most important programmes for the development of business structures in agriculture is the funding programme for young farmers. More specifically, the financial assistance for Young Farmers is included in Priority Axis 3 of the Operational Programme “Rural Development–Restructuring of the Countryside 2000-2006”, which involves measures for improving the age composition of the rural population. In particular, two measures of financial aid are included: a lump sum subsidy for the installation of young farmers and financial support for them to handle the expenses resulting from this installation. The implementation of this programme aims at:

- renewing the age composition of the rural population,
- installing young farmers in regions characterized by a population decline and intense demographic problems, such as mountainous, less favoured and island regions,
- improving the economic status of the farmers and their families
- improving the operation of the agricultural holdings and the living standards of the livestock while protecting the environment.

The basic preconditions for inclusion in the subsidy regime of the programme are the following:

- the permanent place of residence, where three regional categories are defined (mountainous, less favoured, standard). The level of financial aid is determined according to the population and the category of each region.
- the age of the beneficiaries, that should not exceed 40 years.
- the proprietary status of the agricultural holding. The land belonging to the agricultural holding should either be privately-owned or leased for a minimum of 10 years; the livestock must be privately-owned. It is also mentioned that the initial installation must have taken place at least 12 months prior to the inclusion in the funding programme.
- the amount of family income. The total family

income must not exceed 150% of the reference income (set at 22,500€).

- the needs of the holding calculated in human labour units (HLU, 1 HLU = 1750 hours of work per year) must be at least equal to half a HLU (0.5). The financial aid is determined according to the size of the holdings, based on the amount of labour and in combination with the regional category of the beneficiaries’ permanent place of residence.
- the improvement of the viability level of the holding, according to the EU criteria of financial viability<sup>[3,9]</sup>. A precondition for the inclusion of young farmers in the funding programme is that it will lead to an economically viable holding or at least that it will maintain the viability level of the holding, in the case of potentially viable holdings.
- the type of agricultural activity, with a particular focus on animal husbandry and mixed holdings. More specifically, the production of certified high-quality agricultural products and production based on integrated management, both constitute criteria for inclusion and determine the amount of financial assistance provided.

The purpose of this paper is to describe the effect of certain socio-economic parameters on the formulation of the viability level of holdings. Its outcome is a model that interprets the relation between the financial viability level and its determinants.

## MATERIALS AND METHODS

For the purpose of the research, investment (improvement) plans were selected that are related to the lump sum subsidy provided for the installation of young farmers, that were submitted to the Region of Central Macedonia in 2006, within the framework of the Operational Programme “Rural Development – Restructuring of the Countryside 2000- 2006”. The sampling method used to determine the sample was proportionate stratified sampling<sup>[1,4,13]</sup>. The size of the sample was set at 103 Improvement Plans, which is equal to 18.72% of the total number of improvement plans submitted to the Region of Central Macedonia.

The Categorical Regression model was applied in order to model the determinants of a farm’s financial viability and examine the effect of the socio-economic parameters on its financial viability level. Categorical Regression, also known as regression with optimal scaling, quantifies the categorical variable data by assigning numerical values to the variable categories<sup>[15,18]</sup>. The variable categories are thus

quantified so that the square of the multiple correlation coefficient between the dependent variable and the group of independent variables is the maximum one, based on the available data<sup>[11,14]</sup>. Through this quantification, it is possible to predict the values of the dependent variable for any combination of independent variables. The effect of each independent variable on the dependent one is described by the relevant regression coefficient<sup>[8]</sup>.

The resulting model provides us with a version of the relation between the factors that directly influence the formulation of the financial viability level of the agricultural holdings.

In order to construct the model, the following parameters were used, which also constitute the basic criteria for the inclusion of young farmers in funding programmes:

- the gender of the beneficiaries from the holdings,
- the age of the beneficiaries,
- their educational level,
- their permanent place of residence,
- the number of HLUs and
- the type of agricultural activity.

These parameters are also the criteria for the inclusion of young farmers in the funding programme and are linked to the fulfillment of certain financial, demographic and social standards, which are related to the exploitation of the region's social capital<sup>[2]</sup>.

The applied method is suitable for the development of the model, due to the categorical-qualitative nature of the available variables. In particular, the viability level (dependent variable) was denoted in the model as a variable on an ordinal scale, just as the independent variables concerning the "educational level", "age" and "number of HLUs". The remaining independent variables, i.e. "gender", "permanent place of residence" and "type of agricultural activity", were denoted as variables on a nominal scale.

## RESULTS AND DISCUSSIONS

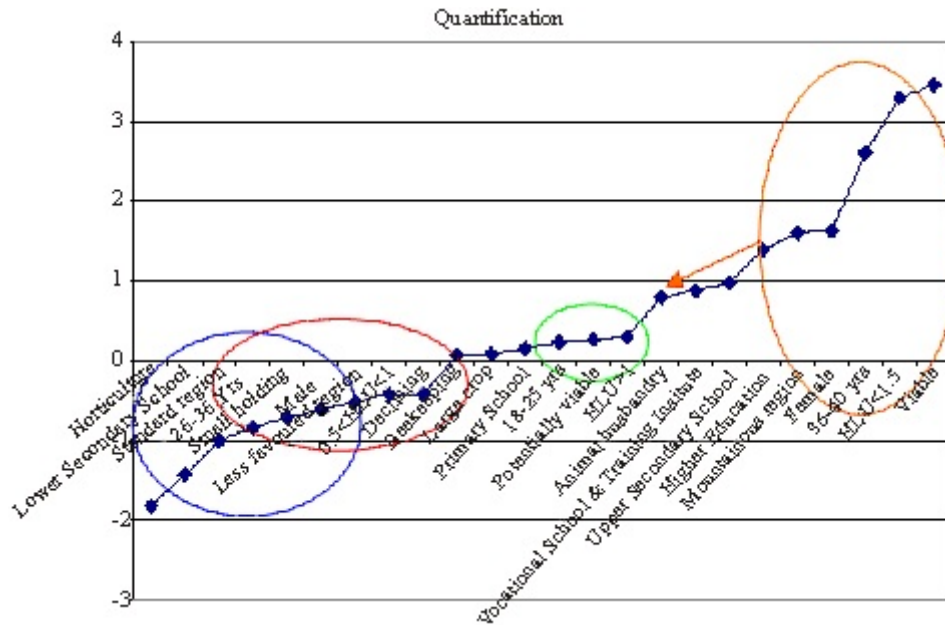
**Results:** The analysis has shown a statistically significant multiple correlation between the level of financial viability of the agricultural holdings and the independent variables. Therefore, 72.3% of the generalized variance of the financial viability level of the agricultural holdings can be explained by the combined effect of the independent variables ( $R=0.850$ ,  $p=0.000$ ,  $R^2=0.723$ ).

In Table 1 we observe that the gender of the beneficiaries does not have a statistically significant effect on the financial viability level of the agricultural holdings, in the presence of the other independent variables. For the remaining variables, the relevant Beta coefficients were found to be statistically significant at a significance level  $\alpha=0.10$ . The highest relative effect seems to be associated to the variables "no of HLUs" (Beta=0.866) and "age" (Beta=0.134). The lowest relative effect seems to be that of the variables "type of agricultural activity", (Beta=-0.089) and "permanent place of residence" (Beta=-0.155). Such a result is justified by the fact that holdings with a high intensity of labour have higher levels of viability, since the intensification of labour is related to achieving high productivity results. In addition, the age of the beneficiaries is related to increased productivity in agricultural holdings. Young producers have more knowledge and more opportunities for business growth than the previous generations, and can therefore respond to the new competitive market conditions<sup>[20]</sup>.

If we assess the relation between the independent variables and the dependent variable, based on the Pratt index of relative importance, we observe once again that the number of HLUs has the highest relative importance for predicting the level of financial viability of the agricultural holdings (importance=0.978), while the lowest relative importance is assigned to the permanent place of residence of the beneficiaries (importance=0.001).

**Table 1:** Assessment of independent variable coefficients in the model.

Coefficients	Standardized Coefficients		df	F	P	Pratt Index
	Beta	Std. Error				
Gender	-0.066	0.060	1	1.187	0.279	0.020
Age	0.134	0.057	2	5.482	0.006	0.020
Educational level	0.090	0.060	4	2.214	0.074	-0.023
Permanent place of residence	-0.155	0.058	2	7.128	0.001	0.001
No of HLUs	0.866	0.061	2	199.74	0.000	0.978
Type of agricultural activity	-0.089	0.058	3	2.369	0.076	0.004



**Graph 1:** Representation of the quantified values of all independent variables on a single axis

Based on the optimum values of the variable categories presented in Table 2 and from their representation on a single axis of values (graph 1), we observe that:

The small farms are characterized by labour demands ranging between 0.5 to 1 H.L.U., and the beneficiaries are mainly men, who have completed Lower Secondary school, are aged 26-35 yrs, live in less favoured regions, and seem to be oriented towards horticultural crops. The small holdings present a low labour intensity coefficient, are located in less favoured regions and try to improve their viability level through intensive crops (horticulture-greenhouses).

The declining farms are characterized by labour demands ranging between 0.5 to 1 H.L.U., the beneficiaries of the holdings are aged 26-35 yrs, live in less favoured regions, and are oriented towards large crops and beekeeping.

The potentially viable farms are characterized by labour demands that range between 1 and 1.5 H.L.U., the beneficiaries of the holdings are aged 18-25 yrs, and the majority have completed primary education and are oriented towards animal husbandry. The potentially viable holdings are characterized by beneficiaries with the lowest age composition, who have either completed primary education and have now taken over the family holdings, or have graduated from vocational schools and training institutes with the intention of entering the agricultural profession.

The viable farms are characterized by labour demands that exceed 1.5 H.L.U. These holdings are dominated by women beneficiaries, aged 36-40 yrs,

**Table 2:** Optimum quantification of the variable categories

Variables	Frequency	Optimum value
<b>Level of financial viability</b>		
Small	15 (14.56%)	-0.708
Declining	52 (50.48%)	-0.412
Potentially viable	29 (28.15%)	0.266
Viable	7 (6.79%)	3.476
<b>Gender</b>		
Male	75 (72.81%)	-0.611
Female	28 (27.18%)	1.637
<b>Age</b>		
18-25 yrs	48 (46.6%)	0.239
26-35 yrs	45 (43.68%)	-0.837
36-40 yrs	10 (9.7%)	2.622
<b>Educational level</b>		
Primary School	32 (31.06%)	0.151
Lower Secondary School	31 (30.09%)	-1.425
Upper Secondary School	23 (22.33%)	0.986
Vocational School & Training Institute	14 (13.59%)	0.888
Higher Education	3 (2.91%)	1.404
<b>Permanent place of residence</b>		
Standard region	14 (13.59)	-1.002
Mountainous region	28 (27.18%)	1.615
Less favoured region	61 (59.22%)	-0.511
<b>No of HLUs</b>		
0.5<HLU<1	77 (74.75%)	-0.416
1<HLU<1.5	18 (17.47%)	0.308
HLU>1.5	8 (7.76%)	3.3
<b>Type of agricultural production</b>		
Horticulture	22 (21.35%)	-1.820
Large crops	27 (26.21%)	0.088
Animal husbandry	46 (44.66%)	0.806
Beekeeping	8 (7.76%)	0.071

who are higher education graduates, live in mountainous regions, and seem to be involved in animal husbandry. The beneficiaries of the viable

holdings are relatively older women, who consciously choose to take on and exploit their mountainous holdings through animal husbandry.

**Conclusions:** In this paper, a model is developed that describes the effect of certain socio-economic parameters on the formulation of the viability level of agricultural holdings located in the region of Central Macedonia of Greece. From the model, it appears that the greatest relative effect is linked to the number of HLUs and the age of the beneficiaries, while the smallest relative effect is attributed to the type of agricultural activity and the permanent place of residence. After studying the model, the basic concluding remarks are that:

- The farms in mountainous areas reach a high level of financial viability by being involved in animal husbandry.
- Young farmers, who are beneficiaries of holdings and have a high educational level, choose to be active in dynamic holdings, particularly related to animal husbandry.
- Women with a high educational level (higher education graduates) choose to get involved in animal husbandry, and manage to reach a high viability level in their holdings.
- The farms which present low intensity as regards the labour coefficient, also present a low level of financial viability.
- The agricultural production of holdings that present a low level of financial viability is mainly oriented towards horticultural crops and beekeeping.

The formulated model is of particular importance, since it leads to a real representation of the effect of socio-economic parameters on the formulation of the farms' financial viability level. In this way, we identify groups of farms with a similar socio-economic profile and respective problems and weaknesses, which can then be addressed through the implementation of flexible agricultural or financial policy measures or actions that will enhance their relevant structures.

Therefore, different financing and policy measures can be taken for farms, depending on the profile of the model. It is recommended that the agricultural holdings that achieve a number of HLUs ranging between 0.5 and 1, should pursue more dynamic crops, where the "labour" coefficient will be more fully exploited. Such a shift towards intensive farming and animal husbandry in particular, will help to improve their viability level, and will simultaneously benefit the exploitation of agricultural land located in mountainous and less favoured regions. A precondition for this shift is the inclusion of beneficiaries in funding programmes for

new infrastructure, since it is known that animal production holdings require a large amount of invested capital. It is therefore proposed that funding be directed towards dynamic animal husbandry holdings (e.g. stabled sheep/pig farming), on favourable repayment terms, so that the major requirements for permanent capital can be met more easily.

If the above-mentioned holdings fail in their efforts to adopt more intensive farming practices and subsequently increase the number of HLUs, any funding provided to them will most probably result in a loss of resources, and will have an obvious negative impact on the agricultural and national economy in general. It is thus recommended that financial incentives be provided, that will either encourage several of the beneficiaries to withdraw from farming (e.g. through early retirement plans), or that incentives be given to small holdings, so that they may merge and create "groups of producers". Generally speaking, it is possible for these holdings to become a target of early retirement schemes for their beneficiaries, given the fact that the coefficients released through such a process (agricultural land in particular) can be used in order for potentially viable farms to be extended or modernized, a step that will consequently lead to a saving of EU capital.

The organization of training programmes for the beneficiaries of the holdings (particularly those in the youngest age group, who will also be taking over the family holdings), will help to promote the use of modern technology at all levels of production, and will also reinforce the competitiveness of the holdings in question.

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