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Investigating the Varying Effect of Attitudes, Behavior and Socioeconomic Characersitics on the Investment Behavior of Arable Crop and Tree Farmers

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ABSTRACT

The present paper examines the attitudes and investment behavior of arable crop farmers in a comparative context with farmers that specialize in tree farming (fruit and nuts). The paper reveals that there exist significant differences on the investment behavior of the two groups. It also shows that various attitudes such as the pro-environmental stance, acceptance of EU identity and farming motive as well as farmers behavior regarding research and information engagement have a different impact on the investment behavior of the two groups as this is revealed by a series of correlation analyses. The results of the paper are expected to be very useful for guiding policy makers in drawing effective policies for mobilizing the two groups of farmers toward the improvement and modernization of their farms.

Keywords: investment behavior, farmers, arable crops, orchards, correlation analysis, Greece

1. Introduction

Global agricultural sustainability requires the enhancement of farmers productivity as well as the adoption of more environmentally friendly agricultural practices. The transition to a more sustainable agriculture is backed by international organizations and initiatives such as the United Nations, Food and Agriculture Organization and the Common Agricultural Policy of the European Union (Niavis & Vlontzos, 2019). The importance of these initiatives is unquestionable as they steer substantial amount of funds toward the structural transformation of the agricultural sector. Nevertheless, the achievement of the sustainability targets remains subject to the willingness of the farmers to incorporate the guidelines of the policy initiatives in their everyday farming practices and the implementation of the proper investments that would render their holdings more efficient and environmentally friendly (Lefebvre et al. 2014). Therefore, in order for the policies to be effective, the general stance of farmers against their guidelines as well as the personal and other socioeconomic characteristics that shape their decision making should be examined.

International literature is rich in studies examining the farmers' attitudes and the factors that affect their investment decisions regarding various types of on-farm technological improvements (Konrad et al., 2019). Personal attitudes and characteristics, farm type, business and situational factors seem to be the most important drivers of investment decisions (Brotherton, 1989; Wilson & Hart, 2000; Wynn et al. 2001; Garforth & Rehman, 2006). Moreover, particular attention is given to knowledge as a means for improving the decision

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making of farmers (Chantre & Cantrona, 2014). Defrancesco et al. (2008), in their research on the participation of farmers in agri-environmental measures promoted by the CAP have elaborated some key studies of factors' classification and identified the following five factors

- Farm structural factors. These factors have to do with the size and the type of the farm as well as its labor characteristics.
- Farmers' characteristics. This category includes all the personal characteristics of the farmers, such as their age, gender, education etc.
- Business factors. These factors concern among others the tenure types, the income mix of the households
- Situational factors. This category mostly captures the effect of various situational factors mainly residing on the policy environment of the farmer. These factors have to do with the effectiveness of policy makers to correctly inform the farmers regarding the various policy frameworks that they could be interested in and the efficiency of advisors in guiding the entry of farms in various policy measures. The category may also include the knowledge factor and all the channels through which farmers gather their information.
- Individual behavior and perceptions. This category includes all the personal perceptions and motivations that could drive the investment decision-making of farmers.

This five-factors scheme summarizes well the relevant literature, although there still are many other studies that build on different factors schemes. Despite the richness of studies in explaining farmers' decision making for investments there are still a gap in explaining how decision making is affected by the type of crops cultivated in different farms and especially when the differences between arable and tree crops are concerned. In a recent study of Lefebvre et al. (2014) regarding the investment intentions of farmers in six European countries, it was found that the investment intentions vary heavily depending on the specialization of the farms. More precisely, arable crops farmers presented the largest intentions to invest compared to farmers of livestock, perennial crops and mixed farms. Therefore, studies that seek to reveal the factors affecting investment decisions have to take into account this heterogeneity in order to draw safer conclusions.

The present paper builds on factors classification scheme of Defrancesco et al. 2008 in order to develop and test an explanatory framework for the investment decisions of Greek farmers. Moreover, attention is also given in the ways that farmers acquire the necessary information for realizing these investments. Furthermore, analysis puts a weight on the role of research projects in knowledge gaining and facilitation of the realization of investments by the farmers. What's different on the present framework is the fact that investment decisions and the factors behind them are examined over two distinct group of farmers namely arable crops and tree farmers. In general, the paper seeks to provide answers to the following three research questions

1) Are there any differences on the number of realized investments between arable crops and tree farmers?

2) Are there any differences in the ways that arable crops and tree farmers acquire the necessary information for realizing their investments?

3) Are there any difference on the effect of various factors on the decision of farmers to realize investments between arable crops and tree farmers?

2) The methodological framework of the study.

The methodological framework of the study is adjusted on the three research questions. The realized investments and the information sources were identified by the following two questions.

1) In the last five years have you realized any investment for improving?

- Plowing - Tillage
- Irrigation
- Lubrication
- Harvest
- Environmental protection
- Monitoring
- Management support

2) In the last five years have you been engaged in any of the following activities?

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- Attended a training seminar
- Attended a workshop
- Attended a cooperative meeting
- Attended an online seminar
- Attended a meeting with other colleagues
- Participated in a research project
- Formed an inquiry to an agricultural consultant.
- Formed an inquiry to university

As can be seen, the farmers were offered seven alternatives of investments and eight alternatives for activities regarding the gathering of information to support their farm management and investment decisions. In order to test for possible differences between the two types of farmers regarding their investments and information collection, a series of Chi-square tests (Sheskin, 2003) are conducted for each type of investment and information collection activity. This round of tests is executed in order to check which type of investments and activities are preferred from each farmers' group. In addition, the total investments and the total information activities are summed up for each farmer in order to form two variables, namely Total Investments (TI) and Total Information Activities (TIA). The TI values range between 0 and 7 and these of TIA between 0 and 8. Then, these variables are used in order to run a Mann Whitney test in order to check if there are any differences between the general tendency of the two groups for investments and information activities (Norusis, 2004).

As for the third research question, the factors considered as drivers for decision making of the farmers are presented in Table 1. Initially, the farm structural factor includes one variable which quantifies the size of the farm. The farmers' characteristics factor is composed by two variables quantifying the age and the education level of the farmer. Business factors category includes two variables. The first quantifies the income of the farmer presented in four ordinal categories and the fourth quantifies the years that each farmer runs the farm measured also in four ordinal categories. The situational factors consist of five variables. The first two focus on the role of research programmes and how the farmers get familiar with them. The first variable of this group denotes if the farmer knows some research programmes implemented in the nearby area and the second if the farmer has received any information regarding the benefits of such projects. The third variable is more general and describes the mediums that farmers use in order to acquire the essential information for their decision making. The variable is the same as the one used in the first two research questions. The last two variables incorporate the policy factor into analysis describing how farmers perceive the role of state and the usefulness of the legislation on agricultural issues.

Table 1 The explanatory factors of investment behavior and the respective variables

Type of factor	Variable/Question	Type of variable / Values
Farm structural factors	Area / Please indicate the total hectares of your farm.	Discrete Variable / Number of hectares
Farmers' characteristics	Age / Please indicate your age	Discrete Variable / Years
	Education (Educ) / Please indicate the highest level of education you have achieved 1) Primary school 2) Secondary school 3) High school 4) University	Ordinal / 1-4
Business factors	Income / Please indicate in which of the following categories your annual income lies in 1) 0-5000 € 2) 5001-10000 € 3) 10.001-20000 € 4) 20.000 €	Ordinal / 1-4
	Years - Please indicate for how many years do you operate the farm? 1) 0-5 2) 6 – 10	Ordinal / 1-4

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	3) 11 - 15 4) >15	
Situational factors	Information 1 (Inf1) / I have a good knowledge of some research projects that have been implemented in my area.	Ordinal / 1-5 Likert scale
	Information 2 (Inf 2) / I know some colleagues whose farms' prospects have been improved by their participation in a research program.	Ordinal / 1-5 Likert scale
	Total information activities (TIA)	Ordinal / 0 - 8
	State 1 (Stat1) / The state is very supportive to farmers.	Ordinal / 1-5 Likert scale
	State 2 (Stat2) / The legislation on agricultural issues is simple.	Ordinal / 1-5 Likert scale
Individual behavior and perceptions	Driver 1 (Driv1) / The driver of my agricultural business is profit maximization.	Ordinal / 1-5 Likert scale
	Driver 2 (Driv2) / Farm activities make me feel very happy.	Ordinal / 1-5 Likert scale
	Driver 3 (Driv3) / I would shift from agriculture if I could find another type of job with the same income.	Ordinal / 1-5 Likert scale
	Pro-environmental 1 (Proenv1) / It is catastrophic for farmers to make unwise use of chemicals	Ordinal / 1-5 Likert scale
	Pro-environmental 2 (Proenv2) / I feel that I have the right to use as much water as possible so that my production is not compromised.	Ordinal / 1-5 Likert scale
	Pro-environmental 3 (Proenv3) / It's hard to change a crop type just to improve my environmental footprint.	Ordinal / 1-5 Likert scale
	Research stance 1 (Res1) / I understand the feasibility of research programs to improve the agricultural sector.	Ordinal / 1-5 Likert scale
	Research stance 2 (Res2) / In terms of practice / day-to-day life I think I know best what is good for my farm	Ordinal / 1-5 Likert scale
	Research stance 3 (Res3) / My participation in a research program would increase the prestige of my business.	Ordinal / 1-5 Likert scale
	Research stance 4 (Res4) / It is worth investing some money to participate in a research project	Ordinal / 1-5 Likert scale
	Europe stance 1 (Eu1) / I feel like a European Union citizen.	Ordinal / 1-5 Likert scale
	Europe stance 2 (Eu2) / The European Union is actively supporting Greek agriculture.	Ordinal / 1-5 Likert scale

Finally, the factor of individual behavior and perceptions is composed by 12 variables which form four sub-factors. The first sub-factor includes three variables and it is used in order to capture the drivers of the respondents for engaging in farming. The second factor captures the pro-environmental stance of the respondents through three respective variables. The third factor includes four variables and captures the perceptions of respondents regarding the applicability and value of research programmes. Finally, the last factor quantifies the overall stance of farmers against EU through two questions.

All variables are incorporated into a correlation analysis with the TI variable in order to check for any significant relationships between the factors and the investment behavior of the farmers. Since not all variables are normally distributed the Spearman correlation analysis is preferred. It should be noted that many studies in the field have relied on more sophisticated statistical models, such as regression analysis and Structural Equation Modelling in order to extract relationships of factors and farmers' behavior (Wang et al., 2020). Nevertheless, for the present study the correlation analysis is preferred due to two main reasons. The first has to do with the quite early stage of survey results' elaboration which does not allow for any multivariate model to be selected among all the alternatives. The second has to do with the very scope of analysis which is not only to test the relationship of factors and investment behavior but also to check for differences of this relationship between arable crops farmers and tree farmers. It should be stressed here that correlation analysis has also been proved to be quite effective as an explanatory tool for the adoption of conservation practices by farmers in the very influential paper of Greiner et al (2009). The difference of the

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present with the paper of Greiner et al (2009) lies on the meta-analysis of the correlation coefficients extracted for the two groups of farmers. More precisely, in order to test if the rho coefficient scores for two variables vary across two independent samples, the correlations should firstly be transformed to Fisher Z scores. Then the ratio of the difference of rhos to their standard errors are used in order to check for statistical significance. The formula for transforming correlations to Fisher Z scores is provided by Sheskin (2003) and the statistical significance of the differences between the two groups was extracted using a relevant SPSS code (IBM, 2018).

3. Results and Discussion

The survey of the farmers was implemented during October 2020 in the region of Thessaly which lies at the central part of Greece. In total, 780 questionnaires were filled up by arable crops and tree (fruit and nuts) farmers, resulting in 762 valid responses based on whether respondents replied to all of questions and provided information regarding their personal characteristics. From the total number of responses, 453 came out from arable crops farmers and 309 from tree farmers. In Table 2 the results of the Chi-square test regarding the responses of the two type of farmers in the two first questions are presented. As can be seen, remarkable differences are mainly observed in the investment behavior of farmers and in a lesser extent in the information activities. More precisely, for all questions regarding the realized investments the Chi-square test has returned statistically significant results. For six out of seven types of investments the tree farmers seem to prevail over the arable crop ones. The latter show only a higher investment rate in plowing and tillage which was rather expected considering the non-permanent character of these crops. In addition, the engagement in information gathering activities does not present remarkable differences between the two groups of farmers, because statistically significant differences were only found for two activities. More precisely, tree farmers attend more online seminars than the arable crop farmers do, whilst the opposite holds true for meetings among colleagues.

Table 2. The Chi-square test results for the type of investments and information activities realized by arable crop and tree farmers

Question	Statistical Significance of Chi-Square Test	Prevailing Type	Question	Statistical Significance of Chi-Square Test	Prevailing Type
In the last five years have you realized any investment for improving			In the last five years have you been engaged in any of the following activities?		
Plowing - Tillage	0.015	Arable crops	Attended a training seminar	0.43	-
Irrigation	0.041	Tree	Attended a workshop	0.71	-
Lubrication	0.071	Tree	Attended a cooperative meeting	0.145	-
Harvest	0.010	Tree	Attended an online seminar	0.032	Tree
Environmental protection	0.010	Tree	Attended a meeting with other colleagues	0.001	Arable crops
Monitoring	0.040	Tree	Participated in a research project	0.199	-
Management support	0.023	Tree	Formed an inquiry to an agricultural consultant.	0.92	-
			Formed an inquiry to university	0.543	-

In addition, the results of the Mann-Whitney tests for the two variables, Total Investment and Total Information Activities are presented in Table 3. As can be seen from the results, the z statistic, was found statistically significant at the <0.01 level only for the first variable. Taking into account that the mean rank of tree farmers is higher than this of arable crop ones, it is concluded that on average more investments are realized on tree farms than arable crop ones. This finding somehow differs from the results of the study of Lefebvre et al. (2014) who have found that arable crop farmers were more prone to invest than those with perennial farms. Nevertheless, it should be noted that the study of Lefebvre et al. (2014) was based on the

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future intentions of farmers regarding investment whilst the present builds on their already realized investments. In addition, the lack of any statistical significance for the test of the Total Information Activities variable denotes that no group could be regarded as more active in collecting information.

Table 3. The results of the Mann-Whitney test for the Total Investment and Total Information Activities variables

Variable	Type of Farm	N	Mean Rank	Z	Asymp. Sig. (2-tailed)
Total Investment	Arable Crop	453	363.06	-2.834	0.005
	Tree	309	408.54		
Total Information Activities	Arable Crop	453	377.97	-.546	0.585
	Tree	309	386.68		

Finally, the results of the analysis under the third research question are presented in Table 4. Based on the statistical significance of the estimated rho coefficients it is extracted that more variables present a significant relationship with the investment behavior in the arable crops group (14) than in the tree group (11). The farm structural variable, land, seems to be positively correlated with the level of investment, but only in the arable crops' domain. This finding implies that size pushes arable farmers to invest more on their farms but this is not the case with the tree farmers for which the size of their farms doesn't affect their investment rate. At the farmers' characteristics, age seems to be negatively correlated with the investment rate, but the correlation was found as statistically insignificant for the both type of farmers. In addition, education seems to enhance investment in both type of farms as higher education levels seem to result in more realized investments.

Table 4. The results of the Spearman Correlation Analysis for the explanatory factors of investments

Variables	Area	Age	Educ	Income	Years	Inf1	Inf1	TIA
rho Arable	0.153***	-0.107	0.298***	0.235***	-0.097**	0.283***	0.308***	0.416***
rho Trees	0.051	-0.079	0.144**	0.105	-0.116**	0.367***	0.362***	0.527***
Variables	Stat1	Stat2	Driv1	Driv2	Driv3	Proenv1	Proenv2	
rho Arable	-0.046	0.010	-0.103**	0.249***	-0.112**	-0.025	0.059	
rho Trees	0.007	-0.071	-0.005	0.069	0.021	-0.073	-0.138**	
Variables	Proenv3	Res1	Res2	Res3	Res4	Eu1	Eu2	
rho Arable	-0.057	0.126***	-0.057	0.169***	0.195***	0.253***	0.082	
rho Trees	0.178***	0.148***	-0.096	0.386***	0.273***	0.073	-0.028	

*** Statistical significance (two-tailed) at the 0.01 level
** Statistical significance (two-tailed) at the 0.05 level
* Statistical significance (two-tailed) at the 0.10 level

As for the business factors, the income level seems to affect positively the investments in the arable crops' farms but not in the tree farms. In addition, the years of operation of a farm have a negative effect on the investment activities of farmers at both type of farms. This is a very important finding, especially when it is considered on par with the effect of age on farmers' investment behavior. This is because, the two results convey that it might not be the old age of a farmer that is negatively impacting the investment tendency but the long time that he is involved with farming. For the situational factors, all information variables are positively correlated with the investment rate in both types of farms. What's more, the high correlation between investment and realized information activities (TIA) is a finding that portrays the significance of initiatives such as training, research programs and workshops in promoting the structural transformation of

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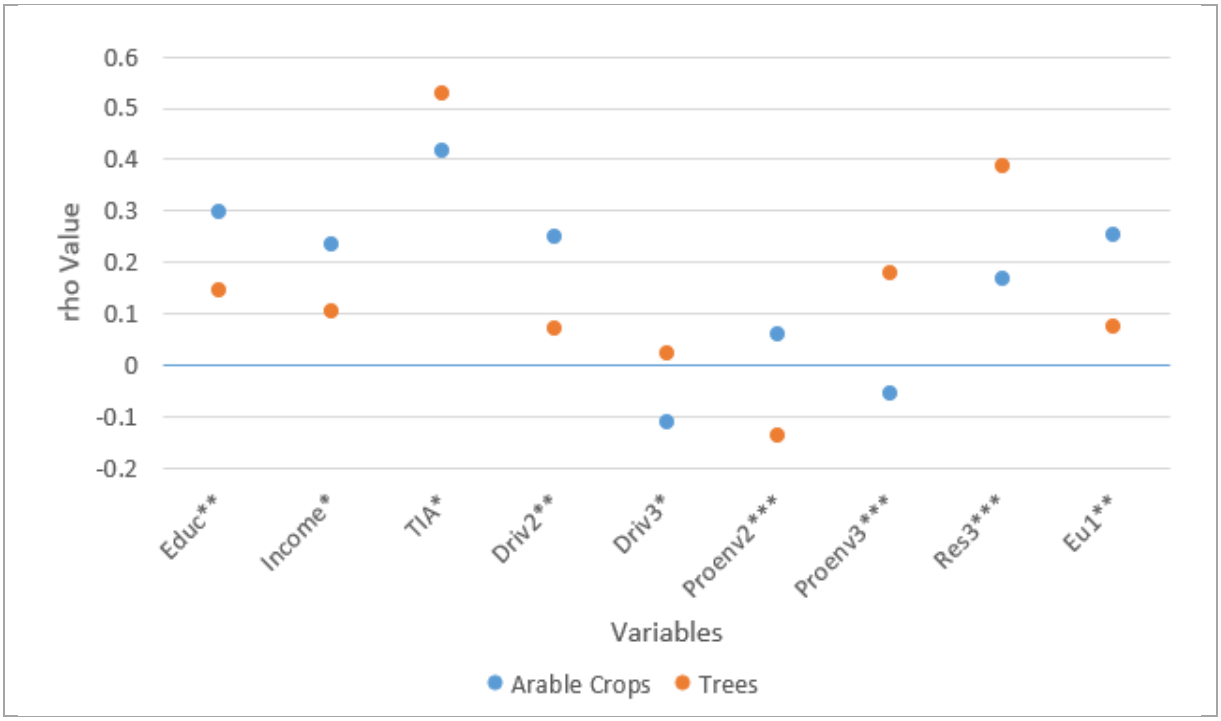
the agricultural sector. On the other hand, the perceptions of farmers on state support and the simplicity of the agricultural policy do not seem to promote investments at the farm level.

As for the factor of individual behavior and perceptions, farming drivers seem to affect more the investment decisions of arable crops farmers than those of trees. Taking into account the formation of the three first driver questions, it is concluded that farmers that enjoy engaging in agricultural life are more prone to invest in their farms than those that see farming just as a way to earn their income. This is testified from the negative coefficients of the 1st and 3rd driver question and the positive coefficient of the 2nd driver question. Conversely, pro-environmental stance affects only the investment behavior of tree farmers as no statistically significant coefficient was found for the arable crops group. As for the tree farmers, the negative correlation coefficient that was found for the Proenv2 variable denotes that more environmental sensitive farmers are more open to invest in improving their farm conditions. On the other hand, the positive coefficient of the Proenv3 variable must be interpreted with caution as it doesn't necessarily mean that less environmental caution leads to more investments considering that farmers might have taken into account the extremely high costs for changing the type of a tree farm.

The research stance variables present positive and statistically significant coefficients for both types of farms, apart from the one for the Res2 variable, for which no statistically significant estimation was extracted. This result signifies that research programmes have an outstanding role in enhancing farms modernization, as farmers that are more aware of research programmes' benefits and more eager to participate in similar activities are investing more than those who present less familiarity with research activities. Finally, from the two questions regarding the stance of farmers against EU only the first one seems to have a relationship with their investment behavior and only for the arable crop farmers. More precisely, it seems that farmers who perceive their selves as citizens of Europe are more likely to realize some investment in their farm.

As the analysis of the correlation results have shown, there are commonalities but also some differences regarding the effect of the various factors on the investment decisions between arable crop and tree farmers. In Figure 1 the most striking differences, as these were extracted by the test on Fisher z scores, are presented. The differences with the highest statistical significance are the Proenv2, Proenv3 and Res3. For all the three variables their relationship with the investment behavior is stronger for the tree farmers. In addition, striking but in a lesser degree than the former ones, are the differences between the two groups regarding the relationship of the variables Educ, Driv2 and EU1 with the farmers' investment tendency. Nevertheless, contrary to previous results, the correlation of the two variables with investment behavior is larger for the arable crop farmers. Finally, differences between the two groups but only at the <0.10 significance level are found for the variables of income and total information activities. For all other variables that are nor presented in Figure 1, no statistically significant difference between the two groups of farmers was found.



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*** Statistical significance (two-tailed) at the 0.01 level
** Statistical significance (two-tailed) at the 0.05 level
* Statistical significance (two-tailed) at the 0.10 level

Figure 1. The variables with statistically significant correlation coefficients

4. Conclusions

The present paper focused on the drivers of the investment behavior of Greek farmers. Analysis has followed the logic of past explanatory frameworks on farmers decision-making, and considered five general factors as drivers of investment behavior. The major contribution of the present analysis is that this was performed in two distinct groups of farmers, one that specializes in arable crops and one in trees. The results of the analysis signify that this disaggregated approach has a reasonable basis. This is because the analysis of the first two research questions has shown that there already exists a difference in the investment behavior between the two group of farmers and therefore any model on investment drivers that doesn't take into account this heterogeneity may produce misleading results. The need for considering the type of farms in the explanatory analyses on farmers behavior is furtherly testified by the results of the analysis under the third research question. More precisely, as the estimated correlation coefficients and their further comparisons through the Fisher z scores have revealed the substantial differences that exist in the way that the explanatory factors affect the investment decisions of the two groups of farmers. It is evident that a statistically significant difference between the estimated correlation coefficients was found for nine out of the 22 variables under consideration.

Apart from its methodological contribution, the paper analysis comes along with some interesting policy implications. The most obvious one, is the further investigation of the investment deficit of the arable crop farmers which was found for the most type of investments considered in the survey. Toward this challenge and for any subsequent policy intervention for its reduction, the results of the correlation analysis could be very useful in driving policy making. More precisely, emphasis should be given to the participation of farmers in information activities as the analysis validates that farmers that collect information from a large number of sources are more likely to realize investments toward the modernization of their farms.

Moreover, the research programmes seem to also acquire a significant role in the enhancement of investments as farmers who participate in programmes or are just aware of their benefits present a higher willingness for investment. In addition, efforts should be given to alter farmers' stance against a number of issues which were found as affecting investment behavior. The issues on which policy makers and academia should concentrate depend heavily on the type of farms. For instance, improving the perception of arable crop farmers for EU, could lead to more investments as a strong relationship between the two figures were found. Moreover, policies that improve the overall life standards of farmers are expected to result in more investments, especially for arable crop farmers, for which a strong relationship between perceived joy from the farming occupation and investment rate was found. On the other hand, making more farmers aware about the environmental externalities of agriculture is expected to result in investment increasement in the tree domain as these farmers were found to be more environmentally concerned than the arable crops ones.

Finally, despite the quite interesting results of the present, it should be noted that these are mainly extracted from simple statistical tests. Therefore, the incorporation of more advanced statistical models into the analysis is a future research challenge as it is expected to result in more accurate results regarding the drivers of investment in the Greek agricultural sector. In addition, the disaggregation of the considered types of farms into more detailed categories might shed more light on the internal and external drivers of investments.

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