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THE EVALUATION OF THE IMPACT OF SUPPORT ON LITHUANIAN FARMS INVESTMENTS

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The paper aims to evaluate the impact of support on Lithuanian farms investments. Logistic regression, also called a logit model, was used to determine the probability of investing. The regression was estimated on cross-sectional data set of Lithuanian family farms participating in the Farm Accountancy Data Network. It was specified for investments in machinery and equipment. The research showed that support encourages investments in machinery and equipment. However, scenario analysis revealed that the impact of different support scenarios on the probability of investing is relatively small. It was also confirmed the importance of farm characteristics in making investments.

Key words: investment, logistic regression, support.
JEL Codes: C50, G11, Q12.

1. Introduction

The Common Agricultural Policy (CAP) allocates great sums to the European agricultural sector every year. There is an ongoing debate among scientific community and policy makers about the beneficiaries of the CAP support. Although farmers are the primary recipients of the CAP support, various factors may lead to a situation where also other agricultural market participants partly or fully capture the CAP subsidies. Another important question related to the support is the extent to which support actually stimulates private investments.

The evaluation of the impact of support on farms investments has received significant attention in recent years in the scientific literature. Nonetheless, most researches are too fragmentary and there is some ambiguity on the effects of support.

It is recognized that direct payments foster investment through income support, however, several studies (Gallerani, 2008; Sckokai, 2009; Viaggi, 2010) highlighted that prices significantly affect farm investments, whereas direct payments have smaller impact.

However, it is widely assumed that investment support promotes investments. M. C. Ahearn et al. (2005) and S. Kirchweger et al. (2011) found that investment support has a positive, but heterogeneous, impact on farm growth. T. Ratinger et al. (2013) identified that the deadweight loss of investment support in Czech Republic is rather low on average, but it is high in large farms.

J. Michalek et al. (2013) found that there is a strong deadweight loss of the investment support policy among dairy farms in Schleswig-Holstein (Germany). M. Wigier et al. (2014) demonstrated that investment support in Hungary and Poland is not characterized by efficiency and effectiveness. The main conclusion is that farms investing without support are characterized by more stable levels of investments.

S. Buchta and T. Buchta (2009), T. Medonos et al. (2012), T. Travnikar and L. Juvančič (2013), and J. Mezera and J. Špička (2013) found that investment support helps to increase income of the beneficiaries and improve labour productivity. Also, the support significantly contributes to the mitigation of the decline in employment and helps to preserve the employment in agriculture. K. Ališauskas et al. (2012) pointed out that investment support not only increase economic indicators of farms, but also has positive effect on technological, social, and ecological changes.

The present paper aims to evaluate the impact of support on Lithuanian farms investments. The following tasks are therefore set: 1) to review relevant literature and set out empirical approach; 2) to build a logistic regression model; 3) to evaluate the impact of different support scenarios on farms investments.

The paper is structured as follows. Section 2 describes support for the development of Lithuania's agricultural sector. Section 3 presents data used for the analysis and method. Section 4 brings the results. Section 5 provides conclusive remarks.

2. Support for the development of Lithuania's agricultural sector

After Lithuania's accession to the EU on 1 May 2004, Lithuanian producers and processors of agricultural products have used the advantages of the EU support under the CAP. Lithuanian farmers started receiving support through direct payments and measures of rural development programmes.

Direct payments is the main tool of CAP support, intended for maintenance of the level of farmers' income, generated from agricultural activities. Since 2004 direct payments in Lithuania are paid for the owned utilized agricultural area, animals and quota milk under a scheme of single direct payments. Direct payments are paid from the European Agricultural Guarantee Fund and from the national budget by paying complementary national direct payments.

Since 2007 investment and compensatory support to farmers has been granted under the 2007–2013 Rural Development Programme (RDP) of Lithuania. The main goal of this programme is to contribute to the enhancing of the competitiveness of the agricultural sector, improving the environment and the countryside, ameliorating the quality of life in rural areas and promoting the diversification of the rural economy, and mobilizing local participation in the design and implementation of innovative programmes for the development of local rural areas.

According to the National Paying Agency data, measures for strengthening the competitiveness of the agricultural sector were the most popular. For implementation of the measures under RDP Axis 1 "Improving the Competitiveness of the Agricultural, Food and Forestry Sectors", the most substantial support was granted.

Investments which can receive investment support can be classified into five groups: structural investments, investments that improve the environment, investments that improve animal welfare, investments that enhance diversification, investments that occur during take-over of farms.

Structural investments concern buildings, equipment and machinery. Environmental investments consist of investments that reduce environmental risks such as emission reduction techniques, energy reduction techniques, etc. Investments that improve animal welfare concern alternative animal housing systems or conditions. Diversification investments consist of investments that result in a farm income of non-agricultural activities such as solar energy investments, investments in education, etc.

3. Methodology

Logistic regression, also called a logit model, was used to assess the impact of support on farms investments. The advantage of logit model is that it transforms information about the binary dependent variable an unbounded continuous variable and estimates a regular multivariate model. P. Komarek and A. Moore (2005) demonstrated that the model is sufficiently accurate and fast for classification of binary outcomes in large real-world datasets. M. Maalouf (2011) highlighted that logit model is one of the most important and one of the most widely used data mining techniques.

Logit model was estimated on cross-sectional data set of Lithuanian family farms participating in the Farm Accountancy Data Network (FADN). A set of data covers all districts, natural zones and reflects different farming conditions. The model was specified for investments in machinery and equipment.

In order to improve the accuracy of the model, the following variables were selected:

- age of the farm head. it is hypothesized that younger farmers are more willing to invest than older farmers;
- gross profit. it is hypothesized that farmers who have higher gross margins are more likely to be willing to invest;
- labour input. it is hypothesized a higher labour input tends to increase the probability of investing;
- rented land. it is hypothesized that farmers who have a larger proportion of owned land are more willing to invest than farmers who rent the majority of their land;
- support (including direct payments and structural support). It is hypothesized that farmers who receive more support are more likely to be willing to invest.

After selecting variables, next task was to look for intercorellations among them (multicollinearity). Note that in the presence of high multicollinarity, it is impossible to

obtain a unique estimate of regression coefficients with all the independent variables in the model. Table 1 presents the correlation matrix of independent variables.

Table 1. The correlation matrix of independent variables

	Age of the farm head	Rented land	Support	Gross profit	Labour input
Age of the farm head	1.00				
Rented land	– 0.07	1.00			
Support	– 0.01	– 0.06	1.00		
Gross profit	0.03	– 0.04	– 0.69	1.00	
Labour input	0.15	0.06	0.13	0.03	1.00

From the data in Table 1, it can be seen that there was no multicollinearity among the independent variables. After performing mentioned analysis, logit model was built:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum_{j=1}^{m} \beta_i X_{ij}, \qquad (1)$$

where the following notations are used: P – the probability that the dependent variable will have the desirable property, X – the independent variables, β – the regression coefficients.

Finally, the model was used to evaluate the impact of different support scenarios on farms investments. The scenarios tested concerned the following changes in support: status quo, increase of 50%, and increase of 100%. The second and the third scenarios correspond to support in Poland and Denmark, respectively.

4. Results

From the data in Table 2, it can be seen that impact of support on investments in machinery and equipment is positive and statistically significant at 0.1 level. This can be explained by the fact that support reduces risk that the income stream will decrease and relaxes credit constraints in the presence of imperfect capital markets, and thus increase farmers' willingness to invest.

Table 2. Logistic regression results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	– 0.9124	0.3071	– 2.9706	0.0030***
Age of the farm head	– 0.0010	0.0052	– 0.1891	0.8500
Rented land	0.0089	0.0022	3.9992	0.0001***
Support	0.0002	0.0001	1.7283	0.0839*
Gross profit	0.0000	0.0000	0.0410	0.9673
Labour input	0.4529	0.0562	– 8.0593	0.0000***

* and *** Indicates significance at the 0.1 and 0.01 levels, respectively.

The research also confirmed the importance of farm characteristics, beyond just gross profit, in making investments. It was found that farmers with a higher share

of rented land are more willing to invest. Furthermore, it was observed that a higher labour input encourages investments in machinery and equipment.

The research also shown that the age of the farm head is not important to decision to invest in machinery and equipment. The hypothesis that younger farmers are more willing to invest than older farmers was denied. This can be explained by the fact that younger farmers are relatively inexperienced and financially constrained.

The final logit model has the following form:

$$\ln\left(\frac{P_i}{1-P_i}\right) = -0.9558 + 0.0089_{RL} + 0.0002_{S} + 0.4515_{LI}, \qquad (2)$$

where the following notations are used: P – the probability of investing in machinery and equipment, RL – rented land, S – support, LI – labour input.

As can be seen, in the case of stable support, the probability of investing in machinery and equipment is equal to 76%. If the support increase by 50% and 100% compared to 2013, the probability will increase by 2 and 4 percentage points, respectively. This can be explained by the fact that during the period of Lithuania's membership in the European Union number of investments undertaken by farmers got increased. Farmers having invested recently may therefore not need to invest in new assets. These results can also be explained by the increased purchase prices of agricultural products.

The research contributes to the general understanding of the impact of support on farms investments. The novelty of this research is threefold. First, the research concentrates on investments in machinery and equipment, while most studies focus on all on-farm investments. Second, the research relies on FADN and involves family farms covering all districts, natural zones and reflecting different farming conditions, while most studies concentrates on one farm specialization. Third, the research also explores the role of farms characteristics as determinants of investments.

According to LIAE researchers, Lithuanian farmers rarely buy modern tractors, combine harvesters and farm implements. This suggests that the link between investments and innovations should be more clearly addressed in the new programming period 2014–2020 of the CAP. This would enable Lithuanian farmers to be competitive in the international markets. Moreover, particular attention should be paid to the more effective distribution of support.

This research leaves room for further investigation into this field. Further research should investigate farms investments according to different farm sizes, as well as different farm specializations. This would enable to compare the role of support in fostering farms investments and provide recommendations on the design of policy measures in the field of farm investments.

5. Conclusions

1. A review of the scientific literature revealed that there is some ambiguity on the impact of support on farms investments. Although it is widely recognized that investment support foster investment, several studies highlighted that the impact of direct payments is relatively small.

2. It was found that support encourages investments in machinery and equipment. However, scenario analysis revealed that the impact of different support scenarios on the probability of investing is relatively small.

3. The research also confirmed the importance of farm characteristics in making investments. It was found that both labour input and rented land increase the probability of investing in machinery and equipment.

4. Further research should examine farms investments according to different farm sizes, as well as different specializations. This would enable to compare the role of support in fostering farms investments and provide recommendations on the design of policy measures in the field of farm investments.

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PARAMOS POVEIKIO LIETUVOS ŪKIŲ INVESTICIJOMS VERTINIMAS

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Santrauka

Straipsnio tikslas – įvertinti paramos poveikį Lietuvos ūkių investicijoms. Tyrimo metu buvo sudarytas *logit* modelis, įgalinantis nustatyti ūkininkų tikimybę investuoti. Tyrimui buvo naudoti 2013 metų Lietuvos ūkininkų, įtrauktų į Ūkių apskaitos duomenų tinklą (ŪADT), duomenys. Vertintos investicijos į žemės ūkio mašinas ir įrenginius. Remiantis tyrimu nustatyta, kad parama skatina ūkių investicijas, tačiau scenarijų analizės metu nustatyta, kad jos pokyčiai tikimybę investuoti veikia nedaug. Taip pat tyrimu atskleista, kad ūkių investicijoms daug įtakos turi ūkio charakteristikos.

Raktiniai žodžiai: investicijos, logistinė regresija, parama.
JEL kodai: C50, G11, Q12.