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The Impact of Crop Insurance on the Economic Performance of Hungarian Cropping Farms

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Abstract

Crop insurance products can improve and stabilize economic performance. However, due to insurance market imperfections, the use of insurance products often requires governmental support. This paper analyses the actual impact of insurance products on the economic performance of cropping farms by linking the economic performance model with the insurance demand model. For this analysis, a simultaneous equation system is solved. Our estimations show a negative impact of insurance on the economic performance indicators farm profit, labour productivity and land productivity. The analysis of the insurance demand side confirms financial limitations of many farms.

Keywords: Hungary, Crop Insurance, 2SCML, Impact evaluation

JEL classification: Q12, Q14, G22

1. INTRODUCTION

A stable long-term economic performance of a farm is the foundation for its stable and sustainable development. Governmental support is often needed to control the volatility of economic performance and ensure agricultural production. But to minimize the impact of such governmental support on the agricultural commodity markets, decoupled modes of supportive payments are in discussion. A possible strategy is to enhance and support agricultural insurance use. Agricultural insurance schemes are a potential tool to cope with income losses trough indemnity payments and therefore stabilize income and economic performance of farms. The support of insurance use would be possible through direct subsidies for insurance premiums, through providing reinsurance, or through more indirect support by enhancing research and development of insurance products and providing an institutional framework for the agricultural insurance market (Iturrioz 2009). Under certain conditions, the support of insurance can be regarded as a Green Box measure within the WTO agreements (OECD 2009).

However, governmental agricultural support involves the redistribution of public funds, and from the social planner's perspective, it has to be ensured that these public funds are allocated efficiently. In other words, the impact of insurance use on farm economic performance should be positive. This paper analyses the impact of crop insurance (crop disaster insurance) on the economic performance of Hungarian cropping farms during the period of 2001-2009.

To assess the impact of insurance use on the economic performance of farms, an analysis of the demand side has to be included as well, since the demand side might be influenced by the

* These are very early preliminary results, please do not use for citations

farm economic performance (Mishra and Goodwin 2003, van Asseldonk et al. 2002, Ogurtsov et al. 2009 and Enjolras and Sentis 2008) thus there could be endogeneity problems. A reciprocal causation between insurance use and economic performance can be assumed. In the context of the Hungarian agriculture, the reciprocal causation is formed by financial restrictions due to low economic performance, which leads to a low demand for insurance products (Bielza Diaz-Caneja et al. 2008: Annex 11). To solve this reciprocal causation system, a simultaneous model with two coupled equations is used in this study. The first equation describes the impact of various explanatory variables, including insurance use, on the economic performance. The second equation describes the impact of various explanatory variables, including economic performance, on insurance demand.

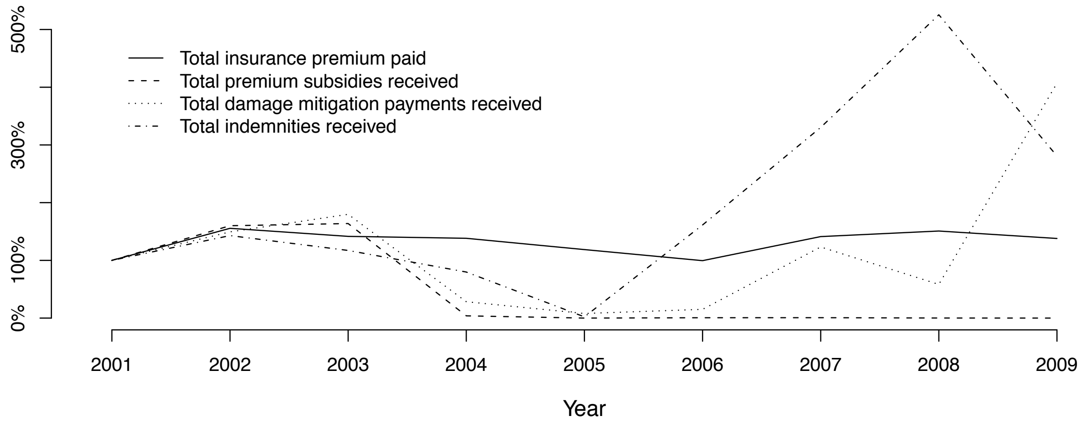
This paper is structured as follows: The next section describes the peculiarities of Hungarian agricultural insurance systems to show either similarities or inequalities to other agricultural production systems. In the following section, the conceptual framework for the econometric model is described. The data used in this study are described in section 4 and methods used to solve the simultaneous equation system are explained in section 5. The last two sections are dedicated to results, discussion and conclusions.

2. EMPIRICAL BACKGROUND

The Hungarian agricultural production is affected by many sources of risk, including natural hazards. The most important natural hazard is drought (accounting for 42% of all losses), followed by hail (21%), flooding (18%), frost (16%) and other (Gábor et al. 2011). Since for important hazards like drought and spring frost, there are no insurance products, ad hoc disaster aid (until 2007) and a National Damage Mitigation System (DMS) (from 2007) substituted the insurance system. The DMS consists of a damage mitigation fund composed of 50% of fees paid by farmers and 50% of state money. Figure 1 shows the development of the sum of total insurance premium paid and the sum of total subsidies, damage mitigation payments and indemnities received by the Hungarian farms. Since the mid-nineties, the Hungarian state supported agricultural insurance use by subsidies up to 30% of the premium cost (Bielza Diaz-Caneja et al. 2008: Annex 11). However, this support has been abandoned in 2004. This resulted in a slight decrease of insurance use. The indemnities received give a picture of natural hazards that have occurred in Hungary. 2005 was a particularly good year, however 2007 and 2008 were years with many reported losses. Damage mitigation payments often only cover about 10 to 20% of all losses due to a low stock in the damage mitigation fund. Thus, these payments do not show the same peaks as the indemnities. This changed in 2009, when the DMS became compulsory for small and medium sized farms (HCA 2012).

The current low level of insurance use reflects to some extend demand and supply mechanisms on the agricultural insurance market. Even if the estimated impact of insurance use on economic performance would be positive, the low participation level is evidence for limited demand and/or not sufficiently elaborated and adapted insurance products.

Figure 1: Development of total insurance premium paid and total subsidies, damage mitigation payments and indemnities received by the Hungarian farms.



Data: Hungarian national FADN data.

Crop insurance demand is particularly low in Hungary. Only 40% of all farms that are specialized in cropping consider insurance as a risk mitigation measure. The main reason for that is the income situation of many farms. The supplied insurance products on the market are not affordable, and insurance is mostly purchased because financial institutes or other stakeholders require it (Gábor et al. 2011).

However, the farm manager's willingness to pay is additionally reduced by lack of trust into the insurance system, lack of experience with "true" insurance systems (in opposite to insurance systems during times of the plan economy) and wrong signals imposed by the governmental ad hoc payments (Gábor et al. 2011). Therefore, premium subsidies alone cannot increase insurance use among farm managers. Better communication, education and information flows are needed as well.

In addition, there is a discrepancy between existing insurance products and the actual risk exposure of farms. For main risks as drought and spring frost, no insurance products are supplied. In a survey conducted by the Hungarian Research Institute of Agricultural Economics (AKI) in 2011, 30% of farmers reported that they would consider buying crop insurance if it insures losses due to drought. Thus, better-adapted insurance products may further increase demand.

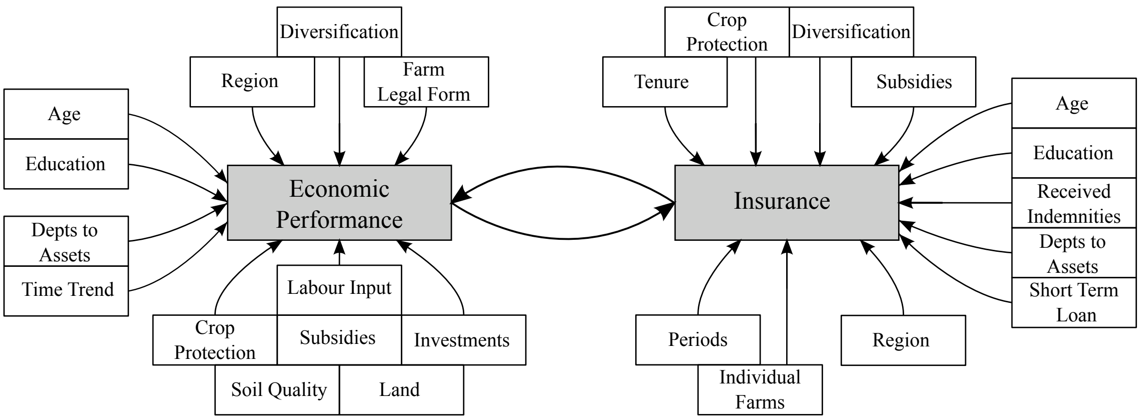
3. Conceptual Framework

Our hypothesis is that insurance has a positive impact on the long-term economic performance of farms. This, because insurance has a stabilizing effect on income through indemnity payments on insured losses. A stable income often is a condition to receive financial loans and to be able to invest. Farm investments are necessary for farm growth or to adapt the farm to changes in its environment. In addition, some production activities are too risky without insurance (Meuwissen et al. 2001), or on-farm risk reduction measures are not possible or not efficient. When having insurance, farm managers are able to readjust their production strategies and thus improve the economic performance when measures of risk avoidance or risk reduction are less efficient.

However, previous studies about the determinants of insurance demand suggest that financial and economic performance indicators such as farm output (Mishra and Goodwin 2003), farm income (van Asseldonk et al. 2002, Ogurtsov et al. 2009) or return on equity (Enjolras and Sentis 2008) can have an impact on the insurance purchase decisions of farmers. To obtain a consistent estimate of the insurance impact on economic performance, we have to consider the demand side as well. Insurance thus is an endogenous variable, and a reciprocal causation between insurance and economic performance can be assumed. This is especially true within the Hungarian system, where financial constraints often do not allow farmers to purchase insurance (Bielza Diaz-Caneja et al. 2008: Annex 11).

Figure 1 shows a schematic illustration of the two econometric models needed to describe above stated reciprocal causation hypothesis. The left hand side of the illustration shows the impact of explanatory variables on the economic performance of farms. Explanatory variables are, next to insurance, farm management characteristics, production-related characteristics and farm characteristics. This model is connected to the second model on the right hand side, which describes the impact of explanatory variables on the insurance demand of farms. The explanatory variables here are, next to economic performance, characteristics of the farm manager's behaviour and risk attitude, indicators the farm risk exposure, and risk management substitutes.

Figure 2: Schematic illustration of the assumed causal connection in the econometric model.



Source: Own drawing

The economic performance of farms can be expressed in many different ways. Simple measures like farm income and return per unit input or asset (El-Osta and Johnson 1998, Mishra et al. 1999) or output (Bezlepkina and Lansink 2003) are often used to compare farms within more or less homogeneous groups. More elaborated measures put the economic performance indicator in relation to the performance of other farms (El-Osta et al. 2007, Aggelopoulos et al.

2007). Long-term economic performance indicators may measure the stability of the performance (e.g. Purdi et al. 1997, using variance of return on equity) or farm survival and growth (e.g. Rizov and Mathijs 2003, using land expansion of farms). Many studies use the technical efficiency (or inefficiency) of farms as an economic performance indicator (e.g, Bakucs et al. 2010, Bojnec and Latruffe 2009, Bakucs et al. 2011). Such inefficiency effects are obtained by a preceding stochastic frontier or data envelopment analysis of the assumed production function. Finally, total factor productivity is suggested to be an economic performance indicator as well (Diewert 2005).

The economic performance indicator must be a measure that allows comparison between different farms within the analysed group. In this paper, profit, labour productivity and land productivity will be used. These are rather simple measures of economic performance, but may provide a good first insight into the topic.

3.1. The economic performance model

The economic performance of farms is assumed to be influenced by explanatory variables such as farm management characteristics, production-related characteristics and farm characteristics. The expected sign of impact of these variables often depends on the economic performance indicator.

Production-related characteristics are variables like labour input, crop protection, subsidies, investments, soil quality or land. We expect a positive return on crop protection and investments. Subsidies improve liquidity of farms and their competitiveness in markets. However, some studies have observed a negative impact of subsidies if technical efficiency is used as an economic performance indicator (Bakucs et al. 2010).

Farm management characteristics are variables describing experience and skills of the farm manager through proxies like age, education. These variables show the ability of the farmer to allocate his inputs. All variables therefore are assumed to be positive, and estimation results in previous studies confirm this assumption (e.g. Rizov and Mathijs 2003, Gloy et al. 2002, El-Osta et al. 2007).

Farm characteristics are variables that describe the farm's environment and its adaption to this environment. Next to regional dummies, variables like diversification and farm legal form are used. The sign of the impact of these variables however cannot be predicted. Its estimated sign will rather give a picture of the analysed environment.

Other variables here are the debts to assets ratio, for higher indebtedness can restrict activities on farm, and time, because positive technical trends may be expected.

3.2. Demand Model

The choice of insurance purchase is assumed to be influenced by explanatory variables such as indicators of farm manager's behaviour and risk attitude, indicators of farm risk exposure, and risk management substitutes.

Farm manager's behaviour and risk attitude is approximated by the experience and skill variables age and education. The reasoning behind it is that experienced and skilled farmers perceive risk more adequately and choose a more appropriate risk management measure. However, the sign of the impact of these variables on insurance choice is unclear, since insurance does not always have to be the most appropriate risk management measure. Thus, other studies show similar heterogeneous results for the estimated impact of age and education (e.g. positive impact of age has been estimated by Sherrick et al. 2004 or Mishra and Goodwin 2003, negative impact by Ogurtsov et al. 2009 or Enjolras and Sentis 2008). Another variable expressing the farm manager's risk attitude would be the level of debt. If we assume that the farmer has some control over his debt, then its level shows how much risk the farmer is willing to accept. Here, however, we can assume a positive impact of the variable on insurance use, since insurance has an income stabilizing effect and therefore helps to assure regularly paid interests. For Hungarian farmers, having insurance is often a condition to receive loans (Gábor et al. 2011). Indemnities received in previous years might also have a positive impact on the farmer's attitude towards insurance products, thus a positive impact of this variable can be assumed.

Farm risk exposure can, to a certain extent, be expressed by regional characteristics. The variable region may contain information about the variability of weather and other production conditions, since such kind of variables are not part of farm accountancy data.

Risk management substitutes: Crop protection and crop diversification are important substitutes for insurance. They are expected to have a negative impact on insurance, since they aim for the same effect as insurance. Other variables that act as risk management substitutes are subsidies and land tenure. These variables give a picture of the financial stability of a farm, since they indicate wealth (land tenure) and income (subsidies) that is independent of the on-field production. Thus, land tenure has an expected positive impact on insurance demand, whereas subsidies have an expected negative impact.

Other variables describe different periods to account for policy changes as described in chapter 2. In addition, the grouping into individual farms and corporate farms is important, since in the dual agricultural system of Hungary, these two farm types should not be compared directly (AKI 2009).

4. DATA

We use Hungarian EU farm accountancy data (FADN data) of farms specialized in cropping between 2001 and 2009, complemented with Hungarian national FADN data, for this analysis. In addition to the EU FADN data, the Hungarian national data contains important information about farm manager characteristics such as age and education, about farm structural characteristics such as soil quality and farm legal form, and most important, detailed records about paid insurance premiums for crop insurance.

A description of all variables used for the analysis is given in Table 1. Profit, labour productivity and land productivity are the variables used to describe economic performance.

The variable insurance is a dichotomous variable containing 1 if a farm uses crop insurance and 0 if not.

Since corporate farms report the educational level of the farm manager only since 2009, the missing values have been filled up according to data of 2009 and 2010 if equal farm identification numbers were found in other years. In doing so, we assume no major personnel changes in farm management. However, since the composition of the sample for the FADN data changes quite frequently, not all missing values can be replaced. Thus, some systematic data deletion in early years must be accepted, and corporate farms will be slightly underrepresented in those years.

Table 1: Variables used in the analysis, with their description and statistics.

Variable	**Description**	**Mean**	**%**	**St. Dev.**
Profit	Total output – total input	-10851.10		91075.24
Labour Productivity	Total output / total labour input	36400.80		179859.06
Land Productivity	Total output / Total land	480.86		649.96
Insurance Use	1 if crop insurance is used, 0 if not		40 %	
Education	Levels of (agricultural) competence of farm manager: 1=none, 2=vocational studies under way, 3=skilled worker or technician, 4=farm engineer, 5=agricultural engineer	2.84		1.42
Age	Age in years	50.49		10.53
Soil Quality	Average golden crown value	20.82		7.29
Labour Input	Annual work units, full-time person equivalents	4.63		14.00
Land	Total utilized agricultural area	245.24		509.72
Debts to Assets	Total liabilities / total assets	0.37		0.53
Crop Protection	Total cost of crop protection	7050.84		18058.81
Investments	Total investments of previous year	13996.77		47403.53
Subsidies	Total subsidies	25356.51		65208.77
Land Tenure	Rented utilized agricultural are / total utilized agricultural area	0.51		0.38
Central Hungary	1 if farm is in Central or Northern Hungary, 0 if not.		19 %	
Great Plain	1 if farm is in Northern or Southern Great Plain, 0 if not		45 %	
Transdanubia	1 if farm is in Western, Central or Southern Transdanubia, 0 if not		36 %	
Individual Farm	1 if farm is either primary producer, agricultural entrepreneur, family farm or merged farm, 0 if not		82 %	
Diversification	1/ sum of squared shares of output of cereals, energy crops and industrial crops (this results in 1 if farm is not diversified, and values above 1 if farm is diversified)	1.01		0.09
Short term loan	Loans contracted for less than one year and outstanding cash payments	41032.53		206570.12
Indemnities received	Total indemnities received in previous year	1405.85		11206.52
Period1	1 if 2001-2004, 0 if not			
Period2	1 if 2004-2007, 0 if not			
Period3	1 if 2007-2009, 0 if not			
Year 2009	1 if 2009, 0 if not			
Year	Continuous variable of years			

Source: Hungarian National and EU FADN data

Regional dummies were created to take regional peculiarities in agriculture and risk distribution into account. The Great Plain, consisting of Southern and Northern Great Plain, describes the region with high soil quality and high density of cropping farms. It is also the region with the highest risk for drought, frost and inland inundation (Gábor et al. 2011). Transdanubia, on the other hand, is dominated by animal husbandry. The predominant risk here is hail. The remaining area consists of Northern Hungary and Central Hungary, where mostly horticulture can be found.

Another dummy was created for individual farm, to account for the dual agricultural system that can be found in Hungary (AKI 2009). The individual farms and corporate farms have structures that cannot be compared to each other directly, which makes this separation necessary.

Period dummies account for the different political changes that the insurance system had to undergo. The first change we observe in 2004, when premium subsidies were abolished. The second change might be observed in 2007, when the DMS was introduced. Other changes can be expected in 2009, when the DMS became compulsory for small and medium sized farms.

Since the FADN data does not describe a balanced panel, the data was treated as cross-sectional data. The creation of one-period lag variables for investments and received indemnities leads to the deletion of year 2001 for the analysis. In addition, missing values for age and education and reported zeros for Land or total assets led to the rejection of additional data. Thus, the set of data was reduced from 9703 to 5398 farms for the analysis.

Many continuous variables show a high deviation of their values, as shown by the high standard deviations reported in Table 1. Therefore, in order to get more consistent estimators, all continuous variables have been normalized by their geometric means for the analysis.

5. METHODOLGY

The conceptual model demands a simultaneous equation system with two equations as an econometric model. In the first equation, the impact of explanatory variables (X_{1i}) and insurance (y_{2i}^*) on an economic performance indicator (y_{1i}^*) is estimated. In the second equation, the impact of explanatory variables (X_{2i}) and the economic performance indicator (y_{1i}) on insurance (y_{2i}) is estimated. The simultaneous equation system can be denoted by:

$$\left| \begin{aligned} y_{1i} &= \gamma_1 y_{2i}^* + \beta_{1j} X_{1i} + u_{1i} \\ y_{2i}^* &= \gamma_2 y_{1i} + \beta_{2j} X_{2i} + u_{2i} \end{aligned} \right| \quad \begin{aligned} (1) \\ (2) \end{aligned}$$

Here, $i = 1, \dots, n$ is the index of the different farmers, and $j = 1, \dots, m$ the index of different explanatory variables. The indices i and j will be dropped from now on to improve legibility. The coefficients γ_1, γ_2, β_1 and β_2 are parameters to be estimated. The coefficients $\gamma_1 \neq 0$ and $\gamma_2 \neq 0$ are expected to be non-zero, which would confirm the hypothesis of reciprocal causation. The economic performance indicator y_1^* can be observed continuously, thus $y_1 = y_1^*$, as already replaced in equations (1) and (2). However, the decision whether to buy insurance or not can only be observed as a dichotomous variable: $y_2 = 1$ if $y_2^* > 0$, say if the farm manager bought insurance, and $y_2 = 0$ otherwise. A continuous observation of the farm manager's decision process to buy insurance is not possible. The variables u_1 and u_2 are the error terms of the two equations, and $E(u_1) = 0$, $E(u_2) = 0$, i.e. their expected values are zero.

For the estimation of a model with a dichotomous dependent variable (such as equation (2)), ordinary least squares (OLS) estimations are not able to give efficient estimates (Maddala 1983). Therefore, two-stage least squares (2SLS) methods commonly used for simultaneous equation systems cannot be used here. For this analysis, the two-stage conditional maximum likelihood (2SCML) method developed by Vuong 1984 and Rivers and Vuong 1988 is used as follows:

The first stage consists of estimating reduced forms of the two equations (1) and (2).

$$y_1 = \Pi_1 X + v_1 \tag{3}$$

$$y_2^* = \Pi_2 X + v_2 \tag{4}$$

Here, X consists of all the exogenous variables in x_1 and x_2. In the reduced model, the coefficients are denoted by Π_1 and Π_2 and the error terms by v_1 and v_2. The two equations are estimated separately: equation (3) by OLS, equation (4) by maximum likelihood (ML).

The second stage includes the estimation of the following equations:

$$y_1 = \gamma_1 \hat{y}_2 + \beta_1 x_1 + u_1 \tag{5}$$

$$y_2^* = \gamma_2 \hat{y}_1 + \beta_2 x_2 + \lambda \hat{v}_1 + u_2 \tag{6}$$

Equation (5) is estimated using the predicted values $\hat{y}_2 = \hat{\Pi}_2 X$ from the reduced model estimation. Equation (6) uses observed values for y_1, but includes the estimated error term $\hat{v}_1$ from the reduced equation (3). This procedure leads to efficient estimates for the coefficients γ_1, γ_2, β_1 and β_2 (Rivers and Vuong 1988). No standard error correction for the coefficients of equation (6) is necessary. In addition, the coefficient λ can be used as a test for endogeneity (Rivers and Vuong 1988). If this coefficient is significant, we have evidence for endogeneity of economic performance y_1. The standard errors of the coefficients of equation (5) are corrected by multiplying them with the square root of the variance of the residuals of equation (5), i.e. $\sqrt{Var\,(\hat{u}_1)}$ (Achen 1986).

6. Results and Discussion

In Table 2, the results of the 2SCML estimations can be found according to the three economic performance indicators profit, labour productivity and land productivity. For all three indicators, the impact of insurance use is significant, but negative. This result does not confirm our hypothesis, but can be explained by the following: High labour and land productivity can be achieved on farms that possess high quality in management, labour and land. This high quality can be employed to minimize risk on farm. High land quality is also an indicator for lower exposure and higher resistance to natural hazards. In the Hungarian context, it can also be expected that even if farmers use insurance products, they do not readjust their production decisions due to lack of knowledge and trust into insurance products. In this case, the impact of insurance that remains is cost alone, leading to a lower economic performance.

Table 2: 2SCML estimation results of the economic performance model and the insurance demand model, according to the economic performance

	Profit		**Labour Productivity**		**Land Productivity**	
	Estimate	Pr(>|t|)	Estimate	Pr(>|t|)	Estimate	Pr(>|t|)
Economic Performance Model						
Insurance Use	-1.7389	0.0000	-8792.3787	0.0096	-218.9315	0.0000
Intercept	-227.5553	0.0002	-1677487.3123	0.0073	-55712.5317	0.0000
Farm management characteristics						
Education	0.1993	0.0003	1578.2729	0.0048	15.9751	0.0001
Age	0.0032	0.3162	64.8173	0.1875	-1.8022	0.0004
Production-related characteristics						
Soil Quality	0.0417	0.0000	1085.5545	0.0000	6.9101	0.0000
Labour Input	0.2804	0.0006			40.0951	0.0000
Land	0.8598	0.0000	1893.5952	0.0254		
Crop Protection	0.1908	0.0011	595.1553	0.0421	7.3844	0.0001
Investments	0.0029	0.0018	7.8512	0.1564	0.1889	0.0004
Subsidies	0.1437	0.0041	-191.2982	0.2745	-9.7095	0.0002
Farm characteristics						
Great Plain	0.9101	0.0002	7977.7043	0.0000	118.4297	0.0000
Transdanubia	0.6035	0.0124	6999.5669	0.0028	108.7189	0.0000
Individual Farm	-0.2712	0.3754	13105.6611	0.0077	-71.7289	0.0150
Diversification	-0.6490	0.2612	-22008.0930	0.0165	-153.5259	0.0086
Other						
Depts to Assets	1.3299	0.0000	9737.2730	0.0009	89.2391	0.0000
Year	0.1125	0.0002	836.3155	0.0136	27.9378	0.0000
Insurance Demand Model						
Economic Performance	0.0990	0.0499	0.0000	0.0000	0.0016	0.0001
Intercept	-0.1025	0.8711	-1.1434	0.0009	-1.6142	0.0003
Farm manager's behaviour and risk attitude						
Education	0.0324	0.0752	0.0264	0.0472	0.0004	0.2836
Age	0.0100	0.0000	0.0070	0.0001	0.0131	0.0000
Short Term Loan	-0.0064	0.0084	-0.0031	0.0000	-0.0044	0.0000
Depts to Assets	0.5017	0.0000	0.2968	0.0000	0.3841	0.0000
Indemnities received	0.0001	0.3002	0.0000	0.3535	0.0000	0.7847
Farm risk exposure						
Great Plain	0.2968	0.0001	0.0276	0.6210	0.0105	0.8740
Transdanubia	0.4213	0.0000	0.0433	0.4481	0.0162	0.8024
Risk management subsitutes						
Diversification	-0.5609	0.1918	-0.1985	0.4514	-0.4656	0.0737
Crop Protection	0.0446	0.0502	0.0089	0.4427	0.0120	0.3221
Land Tenure	0.1832	0.0295	0.3926	0.0000	0.5065	0.0000
Subsidies	0.0449	0.0548	0.0811	0.0000	0.1057	0.0000
Other						
Period2	-0.2810	0.0001	-0.2389	0.0000	-0.3316	0.0000
Period3	-0.3204	0.0000	-0.3176	0.0000	-0.4682	0.0000
Year 2009	0.4657	0.0000	0.5833	0.0000	0.5787	0.0000
Individual Farm	-0.9088	0.0339	-0.2994	0.0520	0.0245	0.8790

On the other hand, the impact of the economic performance indicators on insurance demand is significant and positive, but evanescent for labour and land productivity. Profit, however, has some impact on insurance demand. This result confirms to some extend that many Hungarian farmers do not purchase insurance for the simple fact that they cannot afford it.

Education has the expected sign on economic performance and is significant for all indicators. Age, however, has no significant impact on profit and labour productivity. The impact on land productivity is even negative. However, in the Hungarian context experiences, especially those of older farmers, may not correspond to better ability of increasing on farm productivity, since incentives for increasing farm productivity exist only since transformation from plan to market economy.

The sign of most production-related characteristics is positive. The exception is subsidies, having a negative impact on both marginal productivity measures. However, subsidies can only be counted as an input use indicator if the received subsidies are actually used for investments. If, on the other hand, subsidies are used as an additional income, farmers may be tempted to reduce their effort to increase productivity.

Cropping farms of both Great Plain and Transdanubia show higher economic performance than farms of Central and Northern Hungary (in the intercept), with Transdanubia having the best performing farms. This is confirmed by the actual density of cropping farms within these regions. The economic performance of individual farms is lower than of corporate farms (in the intercept). The positive coefficient of individual farms on labour productivity can be explained by the simple fact that individual farms in general do not report labour input of the farm manager and other family members. Finally, diversification has a negative impact on economic performance, which again is confirmed by the observed low diversification level of Hungarian cropping farms (see Table 1).

The explanatory variables in the demand model also mostly confirm hypotheses from the conceptual model. Both age and education have positive, but low impacts on insurance demand, suggesting that knowledge and experience do play a role. The negative sign of short term loan again shows the financial limitation of many Hungarian farmers, and suggest that if liquidity of farmers can be improved, insurance use might improve as well. The positive impact of the debts to assets ratio confirms the statement of many farmers that insurance is purchased because it was dictated by financial institutes to ensure regular interest payments. Indemnities received in previous years, however, have no significant impact.

In regions of both Great Plain and Transdanubia, insurance demand is higher than in Central and Northern Hungary (in the intercept). But the demand in Transdanubia is higher, even though the Great Plain regions face higher risks. However, losses due to drought, frost and inland inundation, the main risks in the Great Plain regions, cannot be insured under the current system anyway. On the other hand, losses due to hail, which is the main risk in Transdanubian regions, can be insured.

Diversification as a risk management substitute has the expected negative sign on insurance demand, but the impact is mostly insignificant. Crop protection, on the other hand, has a positive sign and is significant if profit is chosen as the economic performance indicator.

Thus, the level of crop protection might simply reflect a more intensive production in general and thus correlate highly with insurance use. Land tenure has the expected positive sign, suggesting that farmers having less security in own assets are looking for more security in insurance. The positive sign of subsidies, however, suggest that this additional income is not seen as additional security, but serves as the necessary liquidity needed to be able to purchase insurance products.

In both periods 2 and 3, insurance demand was lower than in period 1 (in the intercept), which was to be expected since these are the periods after premium subsidies were abandoned in 2004. In the year 2009, however, we expected a further decrease of insurance use due to compulsory participation in the DMS. The results show that farmers seem to make their insurance purchase decisions independent of governmental acts. High indemnity payments and low damage mitigation payments in 2008 (as shown in Figure 1) rather suggest that farm manager who did not purchase insurance products in 2008 had to bear high losses and therefore were tempted to buy insurance in the next period.

7. CONCLUSION

Our study findings confirm some general considerations of the relation between economic performance and insurance use, while others are clearly specific for Hungarian cropping farms. The estimated impact of education and most input variables is as expected, and might be observed similarly in other agricultural systems. The impact of the regional dummies, diversification levels and farm legal forms correspond with the specifics of the Hungarian agriculture.

In the insurance demand model, we observed the negative impact of most risk management substitutes, thus confirm that insurance products can be replaced by alternatives to some extend. The positive impact of subsidies, but also the negative impact of short-term loan confirms the financial limitation of many Hungarian farms (Bielza Diaz-Caneja et al. 2008: Annex 11). On the other hand, the impact of indemnities received in previous years was not significant, confirming for some part the lack of trust and knowledge of some farm managers into insurance products (Gábor et al. 2011), since good experience does not change their behaviour.

Thus, premium subsidies alone might not be a conclusive strategy to support insurance use and improve its impact on economic performance of farms. Strategies to enhance knowledge and trust are needed to ensure that farm managers are able to utilize insurance products for readjusting their production decisions and improving their performance. If such development can be accomplished, premium subsidies may even only be necessary as a temporal strategy to resolve some of the insurance market imperfections.

However, the results of this analysis are subject to some limitations and may be improved by choosing some more appropriate long-term economic performance indicators, by separate estimations of different subgroups of farms within the quite heterogeneous Hungarian agriculture, and by considering additional variables. Different results might be found for different subgroups of farms, and when considering long-term economic performance indicators, the impact of insurance on the economic performance might even be found to be positive.

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