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## **DETERMINANTS OF DEMAND FOR LIFE INSURANCE: THE EXAMPLE OF FARMERS FROM NORTH-WEST POLAND**

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## **DETERMINANTY POPYTU NA UBEZPIECZENIE NA ŻYCIE: PRZYKŁAD ROLNIKÓW Z REGIONU PÓŁNOCNO-ZACHODNIEJ POLSKI**

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**Summary:** Life insurance is a voluntary and additional element of protection and financial security for the future of insured and financially dependent persons. This safeguard should be of particular importance in the agricultural sector, which is characterized by a high number of accidents at work causing loss of health and death. The decision to buy life insurance depends largely on the economic and social factors characterizing the farm. The purpose of the article is to identify and evaluate the factors determining the purchase of life insurance by persons conducting agricultural activity. Data was collected in the north-west region of Poland using a survey questionnaire. Identification of the factors affecting the purchase of life insurance was made by means of a two-dimensional relationship analysis and logit regression model. The basis of the model was a set of obtained independent variables, based on a survey conducted in 2018 among randomly selected farm owners or managers. The analysis showed that the decision to buy life insurance depended on the sex of the farm owner or manager, the number of people in the farmer's household, and possession of production insurance. The presented research results indicate that the probability of buying life insurance decreased when the owner or manager of the farm was a man. On the other hand, when the number of people in the farmer's household increased and agricultural production was insured, the probability of buying life insurance increased. Research results suggest that having life insurance is associated with high awareness of the threats arising from farming activities and is an expression of ensuring financial security for the farmer's family members in the future.

**Keywords:** life insurance demand, farms, agricultural activity, financial security, logit model.

**Streszczenie:** Ubezpieczenie na życie jest dobrowolnym i dodatkowym elementem ochrony i zabezpieczenia finansowej przyszłości ubezpieczonego oraz osób od niego zależnych finansowo. Zabezpieczenie to powinno mieć szczególne znaczenie w sektorze rolnym, który charakteryzuje się dużą liczbą wypadków przy pracy, powodujących utratę zdrowia, a nawet życia. Decyzja o zakupie ubezpieczenia na życie zależy od czynników ekonomicznych i społecznych charakteryzujących gospodarstwo rolne. Celem artykułu jest identyfikacja i ocena czynników determinujących zakup ubezpieczenia na życie przez osoby prowadzące działalność rolniczą. Dane zebrano w regionie północno-zachodniej Polski za pomocą kwestionariusza ankiety. Identyfikacji czynników wpływających na zakup ubezpieczenia na życie dokonano za pomocą analizy zależności w ujęciu dwuwymiarowym oraz modelu regresji logitowej. Podstawą modelu był zestaw uzyskanych zmiennych niezależnych, bazujący na badaniu przeprowadzonym w 2018 r. wśród wylosowanych właścicieli lub zarządców gospodarstwa rolnego. Analiza wykazała, że decyzja o zakupie ubezpieczenia na życie zależała od płci właściciela lub zarządzającego gospodarstwem rolnym, liczby osób w gospodarstwie domowym rolnika oraz posiadania ubezpieczenia produkcji. Wyniki wskazują, że prawdopodobieństwo zakupu ubezpieczenia na życie malało, gdy właścicielem lub zarządzającym gospodarstwem rolnym był mężczyzna. Z kolei gdy liczba osób w gospodarstwie domowym rolnika wzrastała oraz produkcja rolna była ubezpieczona, prawdopodobieństwo zakupu ubezpieczenia na życie wzrastało. Rezultaty badań sugerują, że posiadanie ubezpieczenia na życie wiąże się z dużą świadomością zagrożeń wynikających z prowadzenia działalności rolnej oraz jest wyrazem dbałości o zabezpieczenie finansowe członków rodziny rolnika w przyszłości.

**Keywords:** popyt na ubezpieczenie na życie, gospodarstwa rolne, działalność rolnicza, bezpieczeństwo finansowe, model logitowy.

## 1. Introduction

Agriculture is the most vulnerable section of the economy. This is due to the diversity of factors, the work carried out and the machines, devices and tools used. The work related to animal husbandry and changing weather conditions is also relevant. These are risk factors not found in other professions (Ministerstwo Rolnictwa i Rozwoju Wsi, 2008). The degree of threat to health and life in agriculture is high. According to data from the Agricultural Social Insurance Fund in 2018, there were 15,295 accidents reported in Poland, and 14,998 of them were considered accidents at work in agriculture. Most of these events caused significant damage to health. In the same period, 81 fatalities were reported. In Poland, persons running a farm are subject to compulsory social insurance for farmers. There are two types of insurance with different financial principles, i.e. pension and accident, sickness and maternity insurance (Ustawa z dnia 20 grudnia 1990 r. ...).

Life insurance is a voluntary and additional element of protection and financial security for the future of the insured farmer and his/her financially dependent persons. A farm is both a household and an enterprise at the same time. Sometimes it is the basis for the farmer's household. If the risk of health loss or death is realized, the lack of adequate insurance protection may significantly affect the financial risk

associated with the business and the financial stability of the farmer's family. This may have negative consequences as to the further operation of the farm. So the question arises, what factors determine farmers' decisions regarding the purchase of life insurance and to what extent do these factors increase the likelihood of buying this instrument?

The purpose of the article is to identify and evaluate the factors determining the purchase of life insurance by persons conducting agricultural activity. The study focused on identifying the socio-economic factors that may affect the purchase of life insurance by farmers. The study was conducted in order to broaden knowledge, fill the research gap and create the basis for wider research on the demand of farmers for life insurance in Poland. There are very few studies that would indicate what factors determine the demand for life insurance, taking into account the specific professional group of farmers.

## 2. Factors determining the demand for life insurance

Life insurance is an instrument ensuring income as a result of the unexpected death, illness or accident of an insured person. In general, life insurance policies can be seen as protection against the effects of financial losses or their equivalent that would arise if the insured person dies (Freeman, Abdul Latif, & Paul, 2015) or his/her professional activity as a result of an accident or illness is limited and he/she would require expensive treatment or rehabilitation. Life insurance often helps in fulfilling family responsibilities, such as children's education, paying off loans or other debts (Parrish, 2014). In addition to the protective function, most life insurance also has a saving function. In these insurance policies, the benefit is paid not only in the event of the death of the insured, but also when he or she lives to the age specified in the contract (usually the age close to retirement age). In the event of ceasing to continue with life insurance, it is also possible to recover some of the funds previously paid (Sułkowska, 2000).

The issue of life insurance is one of the frequently undertaken studies in the field of economics and finance. As a result, much is known about the determinants of life insurance demand. Literature in this area focuses on one hand on the analysis of the macroeconomic factors indicating that income per capita, social security system, level of development of the financial system, level of economic development of the country, interest rate and inflation are the main factors affecting the demand for life insurance (Beck & Webb, 2002, 2003; Hwang & Greenford, 2005; Li & Grace, 2007; Outreville, 2011; Bednarczyk, 2011; Śliwinski, Michalski, & Roszkiewicz, 2013; Chang & Lee 2012; Fier & Carson, 2015; Dragos, Codruta, Dragota, Dragos, & Muresan, 2017; Šatrović 2018). On the other hand, individual data of households are analyzed indicating that the demand for life insurance is determined by socio-demographic factors such as: age, sex, education, occupation, employment, marital status, size of the household, number of children in the household, better perception

about insurance, risk aversion and health (Hammond, Houston, & Melander 1967; Burnett & Palmer, 1984; Showers & Shotick, 1994; Cameron & McCollum, 1995; Yusof, Gbadamosi, & Hamadu, 2009; Ćurak, Dzaja, & Pepur, 2013; Sarkodie & Yusif, 2015; Tsendsuren, Li, Peng, & Wong, 2018; Abdul-Fatawu, Logubayom, & Abonongo, 2019; Ward & Zurbruegg, 2002; Li, Moshirian, Nguyen, & Wee, 2007; Narradda Gamage, Lin, & Haq, 2016; Dragos, et al., 2017; Zietz, 2003; Wicka & Leśniewska, 2017) as well as economic factors among which income, net worth, level of savings, and price of the policy most often stand out (Hammond et al., 1967; Burnett & Palmer, 1984; Celik & Kayali, 2009; Beck & Webb, 2003). Among the determinants of life insurance there are institutional factors such as distribution networks (both traditional and modern), conditions of use insurance and easy access to claim when due (Czerwiński, 2015; Dragos et al., 2017; Beck & Webb, 2003; Hwang & Greenford, 2005). Considering the factors determining the demand for life insurance, it is noted that the findings of researchers in this area are not consistent. The demand for life insurance varies in different countries or groups of countries (Śliwiński, 2016).

### 3. Data and methodology

The study was conducted in the north-west region of Poland, which is a typically agricultural region. This region has a more favourable than average agrarian structure. The average utilized agricultural area per farm is almost twice as large as the national average. About 70% of arable land is concentrated on farms over 10 hectares. This region is characterized by a high share of commercial agriculture and relatively the lowest employment in agriculture compared to other regions of Poland.

Farm owners or managers were analyzed. The survey was conducted in 2018 using a questionnaire. Answers were obtained on the basis of acceptance of participation in the study. After logical and substantive verification of the collected material, 215 farms qualified for the research. In order to determine the factors influencing the life insurance of persons running a farm, selected methods of multivariate comparative analysis were used, such as determining the relationship between features and the logit model<sup>1</sup>. The logit model made it possible to describe the relationship between the dichotomous qualitative variable ‘having life insurance’ ( $Y$ ) and a set of independent variables ( $X_1, \dots, X_k$ ).

In linear regression models, a linear relationship is assumed between the explained variable ( $Y$ ) and the explanatory variable ( $X$ ). The dependent variable is of a continuous type. However, in the case of logistic regression, it is assumed that the dependent variable is dichotomous or binary, i.e.  $Y_i = 0$  or  $1$  for all  $i = 1, \dots, n$ . The regression model using the logistic function has the form:

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<sup>1</sup> A detailed description of logit modeling together with an assessment of its quality can be found e.g. in the works of Kurdyś-Kujawska and Sompolska-Rzechuła (2018) and Sompolska-Rzechuła (2018).

$$p_i = \frac{\exp(\beta_0 + \beta_1 X_i)}{1 + \exp(\beta_0 + \beta_1 X_i)},$$

where:  $\beta_0$  i  $\beta_1$  are model parameters,  $X_i$  independent variables that can be both qualitative and quantitative,  $p_i$  is the probability that  $Y_i = 1$ . After linearization of the equation, we obtain (Frątczak, 2018):

$$\frac{p_i}{1 - p_i} = \exp(\beta_0 + \beta_1 X_i).$$

In this case  $\frac{p_i}{1 - p_i}$  is called odds, and the log odds function is called logit. The form

of the logit-based model is as follows:

$$p_i' = \ln\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 X_i.$$

Odds are defined as the ratio of the likelihood of occurring of an event and the probability of an event not occurring. Due to the fact that the logistic function is nonlinear, the direction coefficient  $\beta_i$  represents the change in logic caused by the change of  $X$  by one unit. In the context of odds, the interpretation of the directional coefficient is as follows: for  $X$  variable having a continuous value  $\exp(\beta_i)$  is an increase in odds  $Y = 1$  for each unit of growth of  $X$  variable; for  $X$  variable having the dichotomic value  $\exp(\beta_i)$  is an increase in the odds that  $Y = 1$ , when  $X = 1$  in relation to the situation when  $X = 0$ .

The variables adopted in the model were quantitative and qualitative. The selection of variables was based on the available database and analysis of existing research in the use of life insurance and on the analysis of correlations between variables. The model uses a set of explanatory variables in which the life variable (yes, no) is assumed to be the explanatory variable  $Y$ . The explanatory variables formed a set of the following diagnostic features:  $X_1$  – arable land area (ha),  $X_2$  – the main source of income from agricultural activity (yes, no),  $X_3$  – the main source of income from paid employment outside the farm (yes, no),  $X_4$  – main source of income from non-agricultural business activity (yes, no),  $X_5$  – main source of income from non-profit sources (pensions, disability pensions) (yes, no),  $X_6$  – age (years),  $X_7$  – gender (male, female),  $X_8$  – education (secondary and higher, vocational and basic),  $X_9$  – number of people in the household,  $X_{10}$  – number of children (adult children being members of a farmer's family),  $X_{11}$  – period of running a farm (years),  $X_{12}$  – income from agricultural activity (PLN thousand),  $X_{13}$  – having savings (yes, no),  $X_{14}$  – having a successor (yes, no),  $X_{15}$  – occurrence of natural disasters in the past (yes, no),  $X_{16}$  – having production insurance (yes, no).

#### 4. Main results and discussion

Among the surveyed population, 54% (116) had life insurance. 72% of the respondents were men (155), and the average age of the person running a farm was almost 50, the youngest was 24 years old, the oldest – 80 years old; 60% of people running a farm had secondary or higher education. In 24% of farms there were four family members, in 32% there were no children, and 42% of farms were characterized by having two or three children. The most common period of running a farm was 20 years, the shortest is a two-year period, and the longest, 50 years. Income from manufacturing activities is characterized by a strongly asymmetrical distribution with an asymmetry factor of 2.29. The median income was 57 thousand PLN, which means that in 50% of farms at most this value of income was achieved. Savings were declared in 74% of farms. In 56% of farms there is no successor, so farm succession is not possible. Fewer than half of the surveyed population has suffered damage in the past caused by natural disasters. Production was insured in over half of the farms (62%). Some respondents indicated more than one source of income. In 54% of farms it was declared that the main source of income is agricultural activity.

Analysis of the relationship, in two-dimensional terms, between the feature relating to life insurance and every other feature, showed the existence of significant relationships between having life insurance and: sex ( $p = 0.000008$ ), number of persons in the household ( $p = 0.010808$ ), having a successor ( $p = 0.016241$ ) and having production insurance ( $p = 0.004586$ ). The odds ratios for the indicated pairs of features were 0.22192, 2.09596, 1.95918 and 2.26990, respectively. The odds ratio of 0.22192 means that the probability of having life insurance is 78% lower on male-led farms. On the other hand, the value of the odds ratio 2.26990 indicates that the probability of having life insurance is 127% higher in farms which have production insurance.

The logit model was used to determine the factors affecting having life insurance in a multidimensional approach. In order to find the best combination of features significantly affecting having life insurance, the formal selection of features was made using step forward regression and the following set of variables was obtained:  $X_7$  – sex,  $X_9$  – number of persons in the household and  $X_{16}$  – possession of production insurance. Regarding feature  $X_9$ , categorization was made and two categories were created (relative to the median): less than three members and at least three members of the household. Evaluations of the logit model parameters taking into account the adopted set of features are presented in Table 1.

In the model, variables  $X_9$  and  $X_{16}$  have a positive, statistically significant impact on the dependent variable. This means that the greater the number of dependents in a farmer's household, the higher the probability of having life insurance. Similar research results were pointed out by Abdul-Fatawu et al. (2019), Ward and Zurbruegg (2002) and Li et al. (2007) who state that the number of people in a family is positively related to the demand for life insurance. This may be due to the fact that the insured

**Table 1.** Evaluation of logit model parameters

Variable	Variable name	Parameter evaluation	<i>p</i> -value	Odds ratio
	constant	0.1120	0.7947	–
$X_7$	sex	–1.5393	0.00003	0.2145
$X_9$	number of people in the household	0.8586	0.0068	2.3597
$X_{16}$	possession of production insurance	1.0695	0.0008	2.9139

Source: own calculations.

with a large family (in particular more children) are more aware of the risk, buying an insurance policy to provide other family members with financial security in the event of their sudden death. When the farmer had production (crop/ livestock) insurance, the probability of buying life insurance was also higher. This factor was the most important indicator of the probability of purchasing life insurance by the surveyed farmers. This may be due to high risk aversion and the high awareness of threats resulting from agricultural activity. Earlier studies conducted by Kurdys-Kujawska and Sompolska-Rzechuła (2018) show that farmers insuring production had previous experience of loss or reduction of assets and even health as a result of adverse weather conditions. It can be assumed that they are more aware of the risks and benefits of having life insurance. Research by Fier and Carson (2015) suggests that following disasters, life insurance purchase decisions are taken together with property insurance decisions. Chang and Berdiev (2013) provide evidence that the cases of natural and unanimous disasters lead to increased demand for insurance, including the purchase of life insurance and the consumption of non-life insurance.

However, variable ‘gender’ has a significant negative impact on the probability tested. If the farm is managed by a man, the likelihood of having life insurance is reduced. Narradda Gamage et al. (2016) came to similar conclusions indicating that if the head of the household is a man, the probability of buying life insurance decreases. On the contrary, Sarkodie and Yusif (2015) according to their research results claimed that if a man is the head of the household, the probability of buying a life insurance policy is greater than when a woman runs it.

By interpreting the odds ratios for the *i*-th variable (assuming that the remaining variables included in the model are unchanged), the following information is obtained:

- when the household is managed by a man, the probability of having life insurance decreases by 79% compared to households run by women,
- when the number of people in the household exceeds three, the probability of having life insurance will increase by 136%,
- when the farm has production insurance, the probability of having life insurance will increase by 191%.

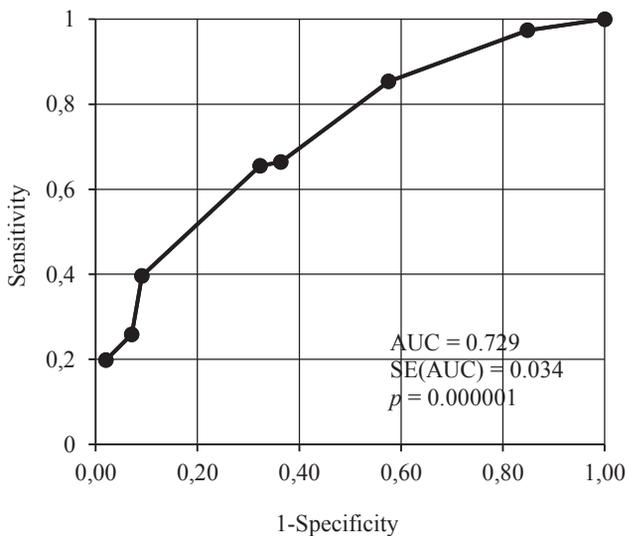
In the next step, the correctness of the estimated model was assessed by counting the accuracy of farm classification (Table 2).

**Table 2.** Accuracy of logit model classification

Classification of holdings based on the logit model	Actual classification		Overall accuracy of the classification (%)
	$y_i = 1$	$y_i = 0$	
$\hat{y}_i = 1$	77	36	65.12
$\hat{y}_i = 0$	39	63	
Sensitivity, specificity (%)	66.12	63.64	

Source: own calculations.

Classification accuracy was assessed using the coefficient  $R_{calc}^2$  Hosmer-Lemeshow test and ROC curve and its components. The value of the coefficient  $R_{calc}^2$  was 65.12%, the results of the Hosmer-Lemeshow test indicate no significant differences between the empirical and theoretical numbers that result from the estimated logistic regression models ( $\chi^2 = 8.41$ ;  $p = 0.0776$ ). The area under the ROC curve was 0.7287 (Figure 1).



**Fig. 1.** The ROC curve for model  
Source: own calculations.

Therefore it can be concluded that the logit model is characterized by a fairly good fit to empirical data, where 66.12% of persons running a farm and having life insurance obtained a positive diagnostic test, which is logistic regression. On the other hand, among persons running a farm and without life insurance 63.64% obtained a negative test result. Thus the model has a similar degree of recognition (66.12%) and non-recognition (63.64%) of the distinguished feature, i.e. having life insurance by persons running a farm.

## 5. Conclusions

The study presents the results of research on the identification and assessment of the factors determining the purchase of life insurance by farmers. The explanatory variables were selected based on literature studies and the availability of data. The study included sixteen variables related to the economic and social characteristics of farms. It was found that two variables have a significant positive impact on the probability of buying life insurance. These are the number of people in the farmer's household and the possession of production insurance. The presented research results suggest that the probability of purchasing life insurance by farmers from the north-west region of Poland rises with the increase in the number of people in the farmer's household, and the probability of buying life insurance is almost twice as high in farms with production insurance. In turn, gender has a significant negative impact on the purchase of life insurance. The probability for the life insurance being purchased by farm owners in north-west Poland decreases by 79% if the farm is managed by a man. Research results suggest that having life insurance is associated with high awareness of the threats arising from farming activities and is an expression of ensuring financial security for the farmer's family members in the future.

The obtained research results are of a cognitive and application nature. They help to deepen the knowledge of the socio-economic factors determining the decision to purchase life insurance in households of a specific professional group, in this case farmers. They can also be a reference point for future activities of insurance companies in the area of the creation and distribution of new life insurance products, taking into account the specifics of farm operations. The uncertainty of agricultural income and progressive climate change mean that farmers have a lower sense of security. This is reflected in the decisions to provide security for one self and one's family. Chieffe and Rakes (1999) noted that life insurance is often used by households as an intergenerational wealth transfer or estate planning tool. Rather than focus primarily on selling life insurance as a tool for income replacement, financial advisers may also want to promote life insurance as an instrument to hedge against future losses of household wealth. This would effectively change the life insurance argument away from income towards wealth protection. Insurance advisers should promote life insurance when selling property insurance. Farmers who insure their property can be an important group of potential life insurance clients. It is noteworthy that the results of the study indicate that having production insurance was the most important indicator of the probability of purchasing life insurance on farms in the north-west of Poland. It is also necessary to take measures to raise awareness about life insurance products. An insurance education process is necessary to make the farmers and their family members well informed about insurance products as well as the risks and protection, so that they can make the right choices. It is necessary to educate young farmers – the generation of successors fulfilling the management mission and make them aware that life insurance along with property insurance is an important element of the farm safety network.

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