International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 46 No. 1 August 2024, pp. 255-263

Understanding The Key Determinants Of Cattle Business Insurance Adoption In Gowa Regency, Indonesia

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Abstract – Cattle Business Insurance (CBI) is very important for mitigating risks such as death, disease outbreaks, natural disasters, and theft, which often harm farmers. This study aims to understand the key determinants influencing CBI adoption. Using a survey method with a sample of 100 farmers, consisting of 50 adopters and 50 non-adopters, the variables measured include age, experience, cattle ownership, family labor, and interaction with extension workers. Data were analyzed using logistic regression. The results show that age, experience, and interaction with extension workers have positive and significant effects on CBI adoption, with odds ratios of 1.022, 3.191, and 5.012, respectively. This means each unit increase in age, experience, and interaction raises the likelihood of adoption by 1.022, 3.191, and 5.012 times, respectively. These variables are categorized as key determinants. Conversely, cattle ownership and family labor are not significant and are therefore considered non-determinants, as they are perceived by farmers as irrelevant to the risks faced. The study concludes that CBI adoption is related to age, experience, and extension worker interaction, as well as farmers' understanding and perception of risk. Future research should identify and analyze farmers' risk perceptions in relation to CBI adoption.

Key Word – Adoption, Cattle Insurance, Determinan.

I. INTRODUCTION

Cattle Business Insurance (CBI) is very important for farmers to mitigate the risks that farmers often face. These risks include livestock mortality, disease outbreaks, natural disasters, and theft, which have a significant impact on farmers' livelihoods [1][2]. In this context, CBI not only serves as a production and financial risk protection mechanism but also has an impact on improving the economic stability of farmers and supporting the sustainable development of the livestock sector [3][4].

Although the benefits of insurance are clear, farmers' participation in the program has not been as expected. So far, the government has motivated farmers to become CBI participants by providing premium subsidies of 80% per head [5][6]. However, several researchers have reported that CBI adoption in some parts of Indonesia still remains low [7][8][9]. This phenomenon raises the question of what factors influence and determine the decision of farmers to adopt cattle business insurance.

Previous research has highlighted various factors affecting the adoption of agricultural and livestock insurance in other countries [9] and Indonesia[9]. It was reported that the low adoption of CBI is due to farmers' lack of understanding of the benefits of insurance and distrust of the services offered [10][8][11]. Other studies have also reported factors such as age, farming experience, number of livestock holdings, number of family laborers, and interaction with agricultural extension workers, have been identified as important variables in CBI adoption in Indonesia (Ardiansyah, 2023; Arsih et al., 2021; Simamora & Matoneng, 2024).

However, previous studies tend to focus on livestock insurance in general and pay less attention to the specific context of cattle business insurance locally [12][13][14][15]. In addition, previous studies have limitations in examining the interaction between age, experience, ownership and family labor with institutional factors in the local context. Therefore, this study seeks to fill this gap by focusing on the specific (key) determinants of CBI adoption in Gowa District.

International Journal of Progressive Sciences and Technologies (IJPSAT)
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This research aims to identify the key determinants that influence and interact with each other in influencing the decision to adopt CBI in Kabupaten Gowa. Theoretically, this study is expected to contribute to the literature on CBI adoption specifically and in the local context in Indonesia. Practically, it is also expected to assist policy makers and practitioners in the insurance field in formulating more effective strategies to encourage the adoption of CBI in their respective regions.

II. METHOD

2.1. Population and Sample

The study was conducted in Gowa Regency, South Sulawesi Province, which has the second largest population in South Sulawesi, from August 2023 to February 2024. Using the survey method with population criteria; all farmers who have at least 3 cattle. There were 1137 farmers identified as the population, then set the sample using the Slovin formula [16][17] as follows.

$$n = \frac{N}{1+N(e)^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Description: n = Number of samples / respondents N = Population size (e) = Percentage of sampling error tolerated 10%; e = 0.1.

Based on this, the current sample size used was 92 or rounded up to 100 which was grouped into two, namely 50 for adopters and 50 non-adopters. Sampling was done purposively based on the number of ownership and affordability of respondents.

2.2. Variables

The variables measured in this study refer to the set of variables that have been stated by previous researchers. These variables are age, farming experience, number of livestock holdings, number of family labor, and interaction with extension officers. Based on previous studies, these five variables are theoretically and empirically reported to influence the adoption of CBI [4][18][11][19]. Thus the five variables can be identified as key-determinants. Furthermore, the description and data type of the five variables are presented in Table 1 below.

Tabel 1. Research Variable and Data Type

Variable	Symbol	Description	Type Data
1. Adoption	Y	1 if farmers adopt CBI, and 0 otherwise	Nominal
2. Age	X1	Age of the farmer in years	Rasio
3. Breeding Experience	X2	1 if ≥ 10 years, and 0 otherwise	Nominal
4. Number of Livestock	X3	Number of livestock owned (head)	Rasio
5. Number of Family Labor	X4	Number of household laborers involved (people)	Rasio
6. Extension worker interaction	X5	1 if interaction ≥ 4 times, and 0 otherwise	Nominal

2.3. Analysis Model

The regression model used is logistic regression because the dependent variable (CBI adoption) is in the binear form of adopting and not adopting. Logit regression can describe the relationship between binary categorical (nonmetric) dependent

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ISSN: 2509-0119.

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variables and metric and non-metric independent variables. In this study, the logistic regression model used is a model that has been transformed into natural logs as follows [16][17].

$$Y = \text{Ln}\left(\frac{\text{Pi}}{1-\text{Pi}}\right) = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + u \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Description

Y = Chance of CBI adoption (1 if the farmer adopts CBI, and 0 otherwise)

β0 = Intercept

β1-β5 = Logit regression coefficients of dependent variables

X1 = Age of the farmer in years (ratio)

X2 = Farming experience, 1 if ≥ 10 years, and 0 otherwise (nominal)

X3 = Number of livestock owned, heads (ratio)

X4 = Number of household labor involved, people (ratio)

X5 = interaction with extension officers, 1 if interaction ≥ 4 times, and 0 otherwise (nominal)

u = error terms.

2.4. Model Testing

To determine the feasibility and accuracy of the regression model used, the test is carried out as shown in Table 2 below [16], [17].

Table 2: Model Fit And Accuracy Test

Test	Objective	Criteria
1. 1. -2likelihood (Overall Model Fit Test)	Assess overall model feasibility (simultaneous) by comparing the -2LL (minus two log likelihood) value of the initial block (number = 0) with the -2LL value of the subsequent block (number = 1).	If there is a decrease in the -2LL value in the subsequent block (number = 1), it indicates that the regression model used has simultaneous feasibility.
2. Goodness of Fit Test (Hosmer and Lemeshow)	Assess model accuracy.	If the significance value (Sig) ≥ 0.05, it means the model has good predictive accuracy (Goodness of Fit Test).
3. Nagelkerke R Square (Determinant Test)	Assessing the ability of the independent variable to explain the dependent variable	If a value of ≥50% is obtained, it is considered good; the independent variable is able to explain its relationship with the dependent variable by 50%.

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III. RESULTS AND DISCUSSION

3.1. Respondent Characteristics

Table 3. Summary Statistics

Karakteristik	Symbol	Adopter		Non_Adopter	
		Average	Std Dev	Average	Std Dev
Age	X1	57.923	3.268	42.713	4.175
Breeding Experience	X2	0.749	0.733	0.482	0.361
Number of Livestock	X3	3.172	1.448	4.266	2.937
Number of Family Labor	X4	2.811	0.972	3.647	1.026
Extension worker interaction	X5	0.651	0.231	0.487	0.393

Summary statistics (Table 3) illustrate that age, experience, and extension worker interaction in the adopter group had greater values than the non-adopter group. The mean values of livestock ownership and family labor were greater in the non-adopter group. Smaller standard deviation values illustrate that the variation in observed values is close to the mean, while large standard deviations indicate that the variation in data is greater than the mean.

3.2. Model Fit and Accuracy Test

Table 4. Model Fit and Accuracy Test

Test	Decision	Value and Criteria
1. -2likelihood (Overall Model FitTest)	Likelihood statistic 37,837 signifikansi 0,000 (<0,05),	It is feasible and appropriate if the independent variables together or at least one independent variable has a significant effect on the decision of farmers to become participants in the CBI program..
2. Good of Fit Test (Hosmer and Lemeshow)	Chi square 57.019 (Sig ≥ 0.05)	Feasible and appropriate if there is no significant difference between the model and its observation value, in other words, this model has accuracy (Goodness of Fit Test) as a predictor.
3. Nagelkerke R Square (Uji Detrminant)	R Square 0,618	It is appropriate if all independent variables explain the dependent variable by 61.80%, while the remaining 38.20% is explained by variables outside the unknown system..

In the overall model fit test, the LR statistic value is 37.837 with a significance of 0.000 (<0.05), so it can be concluded that the independent variables together or at least one independent variable has a significant effect on the decision of farmers to become CBI program participants. The Hosmer Lemeshow Test shows a chi-square value of 3.558 with a significance of 0.683 (>0.05). It can be interpreted that there is no significant difference between the model and its observation value, or in other words, this model has accuracy (Goodness of Fit Test) as a predictor. Furthermore, the Nagelkerke R Square test provides a value of 0.618, explaining

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

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that all independent variables are able to explain the dependent variable by 61.80%, while the remaining 38.20% is explained by variables outside the unknown system. Based on the feasibility test in Table 4 above, it is concluded that the logistic regression model used in this study is considered appropriate and feasible [16][17] to explain the key-determinants of CBI adoption in Gowa Regency.

Table 5. Partial Test of Regression Coefficient

Variables	Symbol	B	SE	Sig	Odd Rasio (OR)
Intercept	βo	2.741	2,790	0.061	
Age	X1	1,594	0.863	0.011*	1.202
Breeding Experience	X2	2.771	0.428	0.031*	3.191
Number of Livestock	X3	1.216	1.013	0.201	0.612
Number of Family Labor	X4	1.017	2.924	0.062	1.018
Extension worker interaction	X5	0.819	1.077	0.001**	5.012
-2likelihood is 49,501; chi square 57,019**; Nagelkerke R Square 0,698; Number of observation : 77					

3.3. Key-Determinant of CBI Adoption

Table 5 shows an intercept value of 2.741 and not-significant (sig ≥ 0.05), which can be interpreted as the value contributed by the current 5 analyzed independent variables to CBI adoption. Furthermore, of the five independent variables analyzed, there are 3 independent variables that are statistically significant, namely age, farming experience, and interaction with extension workers. Interpretation of the effect of the independent variables on the dependent variable in the logit regression is shown by the Odd Ratio (OR) value in Table 5. The variables age (X1), experience (X2), and interaction with extension officers (X5) have positive coefficient values of 1.594; 2.771; and 0.819 respectively and have a significant effect (sig < 0.05). The number of livestock ownership (X3) and the number of family labor (X4) gave positive values of 1.216 and 1.017 but were not significant (sig≥0.05). Interpretation of the effect or contribution of independent variables to the dependent variable in this logit regression is done using the Odd Ratio (OR) value in Table 5.

3.3.1. Age of Farmers

Age has a positive and significant influence on farmers' decision to adopt CBI with an OR value of 1.022. This means that every unit increase in age will increase the chance of farmers becoming CBI participants by 1.022 times. The average age of farmers participating in CBI is 57.923±3.268 while the age of non-adopter farmers is 42.713±4.175. This finding supports previous research which reported that farmers with older age tend to be more risk conscious [4][19]. This may be due to accumulated experience and hence higher awareness in adopting CBI. In life cycle theory, it is explained that individual preferences and decisions, including CBI adoption may vary based on age, where older age tends to be more adopter. In summary, life cycle theory has shown that there is an increased awareness of risk at older ages [20][21]. This finding is quite important for policy-making institutions or program implementers to prioritize the older age of farmers as targets for CBI participants.

3.3.2. Farming Experience

Farming experience has a positive and significant influence in adopting CBI with an OR value of 3.191. This means that every unit increase in the length of farming experience will increase the chance of farmers becoming CBI participants by 3.191 times. The average farming duration of CBI participant farmers is 15.411±5.933 while non-adopter farmers are 7.812±4.361. This finding supports previous studies which reported that farming experience has a significant effect on CBI adoption [4][18].

It is explained that a higher level of farming experience over time provides a deeper knowledge of the various risks encountered in farming. Experienced farmers may have seen the impact of unexpected events such as livestock diseases or natural disasters, thus understanding the importance of having insurance to protect their investment. Much earlier Learning Theory and Behavioral Theory have explained that the more experience a person has in a field, the more likely they are to adopt new innovations as they are better able to assess the associated risks and benefits.

Behavioral theory, focuses on how past experiences influence a person's behavior. Experienced farmers, who have a richer history of agricultural engagement and challenges, may be more adept at recognizing the potential value of insurance and new technologies as tools to manage risk and improve efficiency [22][23][24]. This finding is quite important for policy-making institutions or program implementers, to prioritize more experienced farmers as targets for CBI participants.

3.3.3. Interaction with Extension Officers

Interaction with extension workers has a positive and significant influence on the decision of farmers to become CBI participants with an OR value of 5.012. This means that every unit increase in the frequency of interaction between farmers and extension workers will increase the chance of farmers becoming CBI participants by 5.012 times. The average interaction between farmers and extension workers who are CBI participants is 0.514±0.231 while the non-participants are 0.487±0.393.

This finding is in line with the study of [25] which reported that agricultural extension workers have a significant role in the adoption of innovations. It is known that agricultural extension workers play an important role in providing information and education on the benefits of CBI. A high frequency of interaction with extension workers allows farmers to gain better knowledge about insurance products and their benefits, and increases their trust in the program.

Communication and diffusion of innovations theory has explained the influence of interaction on innovation adoption [26][27]. According to this theory, effective communication and direct interaction with service providers can influence perceptions of risks and benefits, thereby increasing the likelihood of innovation adoption[28][29]. This finding is quite important for agricultural extension institutions to improve their role in communicating the CBI program in the study area.

3.3.4. Variable Non-Determinan

In addition to the determinant variables, this study also found non-determinant variables, namely the number of livestock ownership and the number of family workers. These two variables did not give significant influence, so they can be categorized as non-determinant variables for the implementation of CBI in the research area [16][30].
The number of livestock ownership does not affect the adoption of CBI, and this may be due to farmers' perception that the number of livestock owned is not related to the risks that will be faced. This is also the case with the amount of family labor available, which is understood by farmers as something that is not related to CBI, so that these two variables (number of livestock and labor) become non-determinants. In this context, the adoption of CBI is more influenced by factors directly related to farmers' understanding and knowledge of risk management such as age, experience and interaction with extension officers, as explained earlier. Not by the number of livestock holdings and family labor capacity. This finding is important enough to not over-prioritize the number of holdings and family labour in the implementation of the CBI program.

3.3.5. Implications

This study has theoretical implications that CBI adoption is not only related to age, experience, and interaction with extension officers, but also related to farmers' understanding and perception of the risks to be faced. The emergence of the number of livestock holdings and family labor as non-determinant variables is because these two variables are perceived by farmers as variables that are less relevant to the risks faced. This finding also has practical implications for extension officers and local agricultural institutions as policy makers, that to succeed the CBI program in rural areas, in addition to the consideration of older farmers' age (≥ 50 years), and farming experience (≥ 15 years), and interaction with extension officers, it is also necessary for farmers' perceptions of the risks faced.

IV. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

This study concluded that the key determinants that influence farmers' decision to adopt CBI are age, experience, and interaction with extension officers. Older age and higher experience, as well as intense interaction with extension officers have made farmers aware of the risks faced while motivating them to adopt CBI. The non-determinant variable of this study is that the number of livestock holdings and the amount of family labor available do not influence the adoption of CBI. This may be due to farmers' perception that these two variables are not relevant to the risks faced. In this case, the adoption of CBI is more influenced by factors directly related to risk and knowledge of risk management, rather than the number of livestock holdings and the amount of family labor.

4.2. Recommendation

To complement these findings, the current study recommends that future research should identify and analyze the types and risk perceptions of farmers that are relevant to the adoption of CBI.

Acknowledgment

The author would like to express gratitude to the livestock authorities of Gowa Regency for their assistance in providing the data and information that supported this manuscript.

Author's Declaration

1. There are no conflicts of interest from the execution of this study to the publication of this manuscript.
2. This study was conducted without financial support from the government or third parties.
3. This manuscript has not been previously published and is not under consideration for publication in any other journal.

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