

The Role of Agricultural Insurance in Enhancing Agricultural Production and its Contribution to Food Security in Algeria -Standard Study-

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Abstract: The main objective of this study is to determine the role of agricultural insurance in enhancing agricultural production and its contribution to food security in Algeria during the period 2014-2022. The SPSS software was utilised to apply a multiple linear regression model to analyse the relationship between agricultural insurance and farming production. This study concluded that agricultural insurance demonstrates a significant statistical influence on agricultural production in Algeria, in turn it contributes indirectly in the achievement of food security.

Keywords: Agricultural insurance; Agricultural production; Food security.

1. Introduction

The agrarian sector encompasses an extensive variety of farming and rural activities. Despite its essential role in achieving nutritional security and economic stability, it is exposed to various risks that threaten productivity and resource stability.

Consequently, agricultural insurance has been identified as a tool to cover and mitigate the risks faced by the agricultural sector and farmers. It provides financial protection to farmers in event of damage or loss caused by natural disasters or climatic fluctuations. This fosters innovation in farming methodologies and improves production efficiency.

The importance of agricultural insurance goes beyond financial compensation for farmers, it enhances the agricultural sector's ability to adapt climatic and economic challenges, ensures the stability of agricultural production and reduces market fluctuations, and in turn, improves food security.

1.1. Research Problematic

What is the role of agricultural insurance in enhancing agricultural production and its contribution to food security in Algeria?

1.2. Research Hypotheses

To answer to the research problem, the following hypotheses have been developed:

- Crop insurance has a positive and significant statistical effect on the agricultural production.
- Livestock insurance and multi-risk insurance has a negative effect on the agricultural production.

1.3. Research objectives

This study is focused on achieving the following objectives:

- Analysing the relationship between agricultural insurance and agricultural production in Algeria.
- Determining the role of agricultural insurance in achieving food security.

2. Theoretical Frame Work

2.1. Agricultural insurance

2.1.1. Definition of Agricultural Risk

Risk is the probability of incurring loss or damage, or its absence, without any prospect of financial gain (Financial Institute, 2016, p. 11).

The agricultural risk involves damage to agribusiness assets and their yields from natural phenomena and epidemic afflictions affecting agricultural crops and farm animals (Al-Amin, 2015, p. 6).

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2.1.2. Agricultural Risk Classifications

Agricultural risks can be classified into the following types (Komarek, Pinto, & Smith, 2019, p. 3):

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- **Production Risks** refer to uncertainties in farming production. These risks are influenced by climatic factors, such as fluctuations in temperature and rainfall, as well as threats from pests or diseases.
- **Market Risks** involve the uncertainty of prices and costs, and market access (market accessibility). These risks can be attributed to various factors, such as weather events, market inefficiency, and international trade policies that govern the sale of products.
- **Institutional Risks** relate to unexpected changes in policies and regulations by governmental and non-governmental institutions, which affect agriculture.
- **Human Risks** cover health dangers like accidents at work, injuries or death of employees, which lead to reduced productivity due to significant losses and an increase in costs (Taheri, 2011, p. 373).
- **Financial Risk** occur when farmers face difficulties in managing specific financial responsibilities, such as loan interest payments, employee salaries, and covering the leasing charges of agricultural machinery and equipment (Fatima, 2023, p. 247).

2.1.3. Definition of Agricultural insurance

Agricultural insurance is employed as a protective instrument, which reduces risks faced by farmers. Farmers can obtain protection against pre-defined risks by signing contracts with insurance companies, on the condition of paying the required premiums.

Internationally, harvest insurance represents the vast majority of agricultural insurance premiums, and farmers also choose insurance coverage against personal risks. (Ribeiro, 2021, p. 26).

- **Crop insurance products:** This type of contract provides protection from specific risks like cold, frost, or floods. Compensation claims for damages are calculated as follows (Ribeiro, 2021, p. 27):

$$\text{Compensations} = \text{Crop Losses (\%)} \times \text{Production Costs}$$

- **Livestock Insurance Products:** These types of contracts provide protection against accident or mortality of animals, and they include protection against some diseases that cannot be prevented. They may require some preventive measures such as vaccination and livestock control of insured animals (Ribeiro, 2021, pp. 27-28).

2.2. The Concept of Food Security and the Role of Agricultural Insurance

2.2.1. Definition of Food Security

According to the FAO, food security is defined as follows: « Food security can be realised when there is a consistent supply of food and healthy options for the entire population, which satisfies their dietary needs and personal preferences for a healthy and active lifestyle»(Bermont, 2021, p. 17).

As defined, food security is ensured when everyone can access to safe and nutritious food consistently. From this definition, we can identify four dimensions of food security(The world Bank) :

- **Availability:** the provisioning aspect of food security is determined by output production, goods in stock, and net trade.
- **Access:** Providing sufficient levels of food at the national and international scale does not ensure food security on household level. To attain this, it is necessary to focus on income, spending, markets and costs.
- **Utilisation:** Food utilisation refers to the way the body extracts nutritional value from food.
- **Stability:** It is necessary to consider atmospheric conditions, political instability, or economic factors because we are still deemed food insecure if we fail to obtain food on a regular basis.

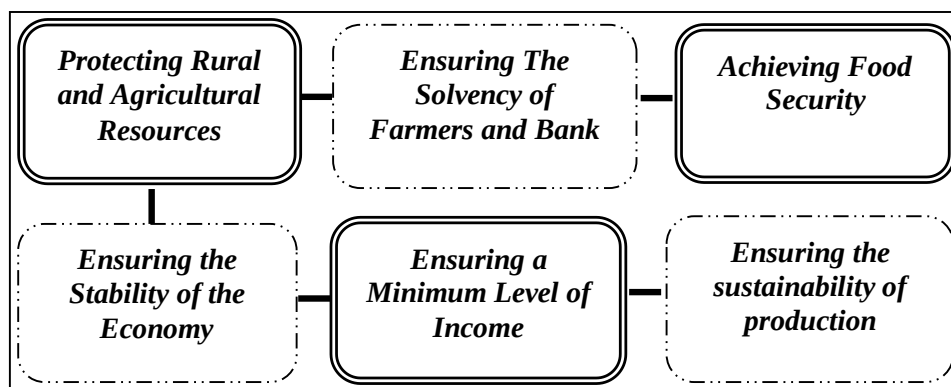
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2.2.2. The Role of Agricultural Insurance in the Achievement of Food Security

Agricultural insurance is widely recognised as a key tool for supporting and protecting the agricultural sector from risks. It effectively contributes to reducing the risks associated with agricultural production and ensuring its stability. The figure below illustrates how agricultural insurance contributes to the achievement of food security (Amel & Bouabbana, 2018, p. 281):

Fig.1. The Role of Agricultural Insurance



Source: prepared by the reasercher based on (Amel & Bouabbana, 2018, p. 281)

3. Statistical Study

3.1. Previous studies

Fiache Amel, Bouabbana Fethia’s study (2018), titled “*The Reality of The Agricultural Insurance in Algeria and its Role in the Stability of Agricultural Production (A Standard Study for the Period 2006-2016)*”, focused on analysing the reality of the agricultural insurance and evaluating its effect on the stability of agricultural yields by applying the simple linear regression model. This study demonstrated that agricultural insurance exerts a notable effect on agricultural production, and for each unit rise in agricultural insurance turnover, the agricultural output increases by 425.358 million Algerian Dinars.

Lamdjed Bouzidi’s study (2019), titled “*Analysing the interplay between variations in Agricultural Insurance and Changes in Agricultural Insurance Output in Algeria for the Period 1990-2018*”, aimed to determine the relationship between the growth of agricultural insurance turnover and the variations in annual agricultural production by applying the VAR model. The study’s findings indicate that the growth in the agricultural insurance turnover is significantly affected by the variations in annual agricultural production.

➤ Similarity and difference with previous studies

This study aligns with the previous studies in examining the influence of agricultural insurance on agricultural production. However, it differs from prior research in its study period (2014-2022) and its use of SPSS software and the multiple linear regression model. This approach provides a detailed evaluation of the implications of each type of agricultural insurance on agricultural output and offers significant insights into the contribution of agricultural loss insurance in the attainment of food security in Algeria.

3.2. Data and Methodology

In order to examine the influence of agricultural insurance on agricultural production, we will utilise SPSS software and apply the multiple linear regression model. This model enables the assessment of the combined effects of several independent variables on a dependent variable, thus facilitating the identification of the specific impact of each variable.

Our data were obtained from the economic reports of “the National Insurance Council” and the statistical reports provided by “the Food and Agriculture Organisation of the United Nations”.

In our study, the variables were defined as the following manner:

- **Dependent variable:** Agricultural Production (Y)
- **Independent variables:**
 - Crop insurance (X1)
 - Livestock insurance (X2)
 - Multi-risk insurance for agricultural machinery and equipment (X3)

Table .1. The Evolution of Agricultural Production and the Turnover of Different Products

Source: prepared by the researcher based on (National Insurance Council, Economic Notes (2014-2022)) and *(Food and Agriculture Organisation of the United Nations)

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From the previous table, we can clearly observe that there is fluctuation in agricultural

Years	Agricultural Production* (Tonnes)	Agricultural Crops Insurance	Multi-Risk Insurance	Livestock Production Insurance
2014	31830307.7	585901	1186776	1049091
2015	32875985.8	651407	1270786	1306432
2016	33459834.7	643745	1006220	1209898
2017	33384040.3	599353	716602	736022
2018	36174705.1	629292	677862	609373
2019	37255766.7	822527	705812	781524
2020	36230134.5	564787	553312	763293
2021	33225651.3	523411	571878	706226
2022	35922217.2	568096	569401	856911

production, even in the turnover of these specific sub sectors.

We can see that production increased from 31830307.7 tonnes in 2014 to reach 37255766.7 tonnes in 2019, then declined to 33225651.3 tonnes 2021, while it rose again in 2022.

The variation in the different agricultural products and agricultural production sector can be attributed to the following factors(National Insurance Council, Economic Notes (2014-2022)):

- The increase in 2015 was due to the positive effect of the agricultural and rural renewal plan, which focused on the diversification of production and the rise in added value of agricultural products(Yamina, 2023, p. 49).
- Farmers participating in the ANSEG and CNAC programs did not renew their insurance contracts, which led to a decline in the production value and turnover of the sub-sectors in 2016 and 2017.
- While, the decline in 2018 is linked to the discontinuation of renewing cattle insurance agreements.
- In 2019, numerous agreements were signed by farmers related to multi-risk insurance for cattle and goats, as well as greenhouse operations, which resulting in an increase in turnover.
- The origin of the downturn in agricultural yields and the turnover of crop, livestock, and multi-risk insurance in 2020 and 2021 can be attributed to:
 - The delay in the commencement of the ploughing season;
 - Covid-19 pandemic and the fires recorded in 2020;

- The conditions imposed by the Bank of Agriculture and Rural Development concerning Rafiq loan;
 - Some dairy farmers sold their cattle and disengaged from the agricultural sector due to the inflated cost of feed, which led to a failure in subscribing to insurance coverage.
- The growth in agricultural production and the turnover of “crop insurance, livestock insurance and multi risk-insurance” in 2022 can essentially be attributed to the new cattle importation programme established by the state and the organisation of a number of awareness campaigns targeted at farmers.
 - In addition to the above factors, there are other factors that affect the productivity of these two sectors, it can be summarized in the following points:
 - There is a deficiency in competitive vigor among insurance companies. In addition, certain risks are not covered by insurance companies, such as drought, and certain entities do not provide agricultural insurance;
 - The progressive rise in the cost of agricultural production inputs, such as seeds, fertilisers, and animal feed, has caused an increase in food prices, leading to higher costs for consumers upon purchase; This result can be explained by the fact that the growing food inflation rates affect productivity negatively, leading to a reduction in the number of agricultural insurance contracts. This is considered as one of the foremost challenges facing food security;
 - Climatic changes have a significant influence on agricultural output; they reduce productivity, which in turn leads to a decline in farmers purchasing capability and their ability to pay their insurance obligations;
 - The agricultural advisory services in Algeria suffer from inefficiency which is principally due to the insufficient presence of agricultural advisors. Convincing illiterate farmers of the importance and advantages of agricultural insurance presents a major challenge.

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3.3. The influence of agricultural insurance on agricultural production

3.3.1 Test Execution

Table .2. Model Summary

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.892 ^a	0.795	0.672	1.09308E6

a. Predictors: (Constant), Multi-risk Insurance, Crop Insurance, Livestock Insurance

b. Dependent Variable: Agricultural Production

Source: Based on SPSS Output

➤ Interpretation of results

From the previous table we can note that the value of correlation equation is equal to 0.892, which indicates a strong and positive correlation between variables. This signifies that there is a relationship between variables estimated at 89.2%.

While the value of the coefficient of determinations (R^2) was 0.795, which indicates that 79.5% of variability in agricultural production is explained by changes in agricultural crops insurance, livestock production insurance and multi-risk insurance, and other 20.5% was a result of other independent variables that are not included in the model. This shows that the model possesses a very high explanatory capacity.

3.3.2. Statistical Significance of the Model

▪ Overall Significance of the Model

Table .3. Analysis of Variance (ANOVA^b)

ANOVA ^b					
Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.315E13	3	7.716E12	6.458	0.036 ^a
Residual	5.974E12	5	1.195E12		
Total	2.912E13	8			

a. Predictors: (Constant), Multi-risk Insurance, Crop Insurance, Livestock Insurance

b. Dependent Variable: Agricultural Production

Source: Based on SPSS Output

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From the table, we can observe that the statistical significance of the model is shown by a sig value of 0.036 which is more lower than alpha level of 0.05, this confirms the strength of the model, and indicates at least there is one independent variables that has a significant statistical impact.

▪ Partial Significance of the Model

Table .4. Regression Coefficients

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.020E7	3110432.984		9.709	0.000
CropInsurance	0.013	0.005	0.589	2.866	0.035
LivestockInsurance	0.001	0.003	0.154	0.381	0.719
MultiriskInsurance	-0.006	0.003	-0.907	-2.225	0.077

a. Dependent Variable: Agricultural Production

Source: Based on SPSS Output

▪ Regression Equation

$$Y = 3.02 + 0.013 X_1 + 0.001 X_2 - 0.006 X_3 + \varepsilon$$

➤ Interpretation of the Results

From the previous table and the regression equation, the results can be explained as follows:

- For every one-unit increase in crop insurance, agricultural production increases by 0.013 units. Similarly, for every one-unit increase in livestock insurance, agricultural production increases by 0.001 units;
- Conversely, for every one-unit increase in multi-risk insurance, agricultural production decreases by 0.006 units;
- The test is based on the following statistical hypotheses:
H₀: The absence of statistical significance
H₁: The existence of statistical significance

- **The significance of the intercept:** to test the significance of the intercept, we will examine the previous hypotheses H₀ and H₁.

From the table of coefficients, we observe that the significance value of the intercept (b₀) is 0.00, which is less than alpha value (α=0.05). This indicates that the intercept is statistically significant, supporting the rejection of H₀, and confirming its inclusion in the model.

- **The significance of crop insurance:** from the table of coefficient we notice a coefficient of 0.013 for crop insurance, with a sig value (sig_{b1}) of 0.035, which is lower than alpha level of 5%. This indicates a positive correlation between crop insurance and agricultural production. Therefore, agricultural crop insurance has a significant statistical influence on agricultural production, leading us to reject H₀.

This result underscores the positive effect of crop insurance on agricultural production, and it also contributes indirectly in the achievement of food security, by raising the productivity it improves the accessibility of food, thereby aiding in price stability and ensuring a consistent availability of food.

- **The significance of livestock insurance:** we note from the table that the coefficient value for livestock insurance is 0.001, with a sig value (sig_{b2}) of 0.719. This reflects a negligible effect on agricultural production, consequently we accept H₀. This result may be attributed to the farmers' disengagement from the agricultural sector, leading to the discontinuation of renewing contracts.

- **The significance of multi-risk insurance:** the coefficient value for multi-risk insurance is -0.006, accompanied by a sig value (sig_{b3}) of 0.077, indicating a negative correlation between multi-risk insurance and agricultural production. This necessitates the acceptance of H₀, implying that multi-risk insurance lacks statistical significance.

4. Conclusion

This research paper examined the role of agricultural insurance in promoting agricultural yields in Algeria by studying the agricultural insurance turnover during the period from 2014 to 2022. It highlights the importance of agricultural insurance as an effective tool for covering losses and reinvesting in the agricultural sector to sustain productivity.

4.1. Findings

Through this research, we reached the following findings:

- There is a strong and positive correlation between agricultural insurance and agricultural production, meaning that agricultural insurance has a positive and statistically significant impact on the agricultural production;
- There is a positive correlation between crop insurance and agricultural production, indicating that crop insurance positively impacts agricultural production .This supports the validity of the first hypothesis;
- Livestock insurance has a negligible effect on agricultural production, this due to the disengagement of farmers from the agricultural sector, which led to the discontinuation of renewing the livestock insurance contracts;
- Agricultural insurance can help in managing agricultural risks, and it can promote reinvestment in agricultural sector in the event of losses;
- The achievement of food security is linked to various factors, not only agricultural production.
- There are various factors that affect the production outcomes, such as costs of agricultural production inputs and the climatic changes. Therefore, agricultural insurance is considered as an effective tool that can protect agricultural producers from these risks;
- Crop insurance indirectly contributes to the achievement of food security by helping to reduce risk exposure and encouraging investments in the agricultural sector, which raises the productivity and ensures the efficiency of production.

4.2. Recommendations

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- Spreading awareness about insurance and informing agricultural producers of the necessity of agricultural insurance and its role in protecting their agribusiness assets;
- Reducing premium rates and increasing indemnities for farmers effectively attracts a larger number of farmers and improves the efficiency of agricultural insurance;
- Providing government support to smallholder farmers to cover their insurance premiums and encourage their engagement in agricultural insurance.

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