

A PANEL ANALYSIS OF THE INTERACTION BETWEEN THE DEVELOPMENT OF THE AGRICULTURAL INSURANCE AND THE GROWTH OF THE AGRICULTURAL PRODUCTION IN PRESENCE OF RISK YIELDS

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Abstract

In this paper, we try to evaluate the impact of the systems of insurance on the growth economy and this by an empirical estimation in static panel of the interaction which exists between the degree of the development of the market of the agricultural insurance and the development of the real growth of the agricultural production in three American, European and Asian continents during period (2000-2012) in presence of risk of variability of the agricultural yields. Our study covers 24 countries selected on the basis of data availability they include : (a) the European countries, consisting of 7 countries, namely : Austria, Russia, France, Greece, Portugal, Italy and Spain ; (b) the Amercian countries, consisting of 15 countries, namely : Brazil, Canada, Mexico, Panama, Chile, Dominique République, Argentina, Costa Rica, Paraguay, Australia, the USA, Colombia, Peru, Uruguay and Venezuela ; and (c) the Asian countries, consisting of 2 countries, namely: India and China. The hypothesis which is discussed stipulates that the application of the agricultural insurance could have a positive impact on the growth of the agricultural production in presence of risk of variability of the agricultural yields. The results obtained from our estimation suppose that several factors influence positively the development of the industry of agricultural insurance to insure an improvement of the agricultural growth production. These factors are: the penetration rate in the agricultural insurance, the agricultural investments, the agricultural spending and the subsidies of agricultural price production.

Keywords: Agricultural insurance, agriculture growth production, risk of variability of the agricultural yields, panel analysis

INTRODUCTION

Empirical research has not yielded a consensus on the interaction between the development of systems of insurance and the economic growth. More recently, the subject has garnered attention due to rising of risks which led to costs with the desire to reduce risks. Various studies have focused on different countries, time periods, modeling techniques and different proxy variables have been used for insurance activity and economic growth nexus.

The evaluation of the significant impact of the systems of insurance on the economy was not enough developed. In particular, this evaluation was not explored for an economic activity strongly submitted to risks, namely the agriculture. The empirical results of these studies are mixed and have not reached a consensus. The results differ even on the effect of the insurance on economic growth.

We are interested in our work on the evaluation of the implications of the development of agricultural insurance on agricultural growth production in countries confronted to agricultural risks. The policy implications of these relationships can be significant depending upon what kind of causal links exists.

In fact, it is the theories of the insurances and the risks, the information theories and knowledge, theories of the economy of transaction costs and the theory of the organization that analyze the effect of the application of the systems of insurance on the development of the economic process. As a consequence, several factors relative to the financial and economic system determine the evolution and the rigor of the systems of insurance and contribute to the realization of the objectives fixed during the application of a system of insurance.

Our work calls on to two disciplines to know the economy and the finance because we try to understand the effect of the application of a method of management of risk of knowing the insurance about the economy. More exactly, we chose to see these impacts for the agricultural activity.

We suppose that the development of the agricultural growth production constitutes an essential determiner to insure the well-being of the farmers and to maintain stable their income and this could come true by having a system of insurance which meets the expectations of insurants and which insures the regulating effect in case of risks. We support in our article the hypothesis which stipulates that the application of the agricultural insurance and as a consequence the development of the penetration in the agricultural insurance could have a positive impact on the agricultural growth production in presence of risk of variability of the agricultural yields.

Our objective is to answer the following question:

The development of the penetration to the market of agricultural insurance of a country could - it improve the growth rate of the agricultural production in presence of risk of variability of the agricultural yields ?

Our article will be organised as follows, after the introduction which is presented in section 1, in section 2, we move forward the importance and the objectives of our analysis, we give a review of the literature onto the foundations of the insurance in an economy to know the concepts of uncertainty and risk and we present the functions of the insurance in the economy. Then in section 3, we present a theoretical review which consists in presenting the models which put in relation the development of the systems of insurance and the economic activity and we identify the main canals of transmission between insurance and economic activity by making a reference to the agricultural activity.

We distinguish the various empirical works which analyzed the relation enter agricultural growth production in presence of risk of variability of the agricultural yields and insurance to make the main empirical profits on this matter in section 4. The concluding remarks are given in the fifth section.

LITERATURE REVIEW

The interaction between the insurance and the economic activity

Historically, the importance of the activity of insurance is not new because some references to the activity of insurance were mentioned in the works of Adam Smith, Marshall and in that of Knight. However, these works did not specify its contribution to the economic activity and did not really study its role and its modalities of management of risk.

A review of the empirical literature on the relation between insurance and economic growth led to explain the interaction between the activity of the market of the insurance and the economic growth were diverse. Simply, the explanation of this relation enters an exceptional sectorial activity of point of view that it is submitted to diverse risks and which demands an effective management of these risks by the appeal to the market of the agricultural insurance and to the activity so vital as is in developed countries or in development regarding its contribution to the agricultural growth production was not enough developed.

The evaluation of the link between the activity of the market of the agricultural insurance and the growth of the agricultural production was not widely Studied. Probably it is of for the not availability of the data which explain this relation. From this limit, we direct our research work to explain the interaction between the development of the activity of insurance and the real growth of the agricultural production.

In what follows we shall present a review on the empirical literature of the main works which handled this relation.

It was during 1960s when the economy of insurance knew its peak with the works of Borsh (1962) and Arrow K (1970) which showed that it is the theory of insurance that allows the economic analysis of the risk and the uncertainty. The idea developed by the economists is that the insurance contract allows a monetary exchange in case of unforeseen specific events what allows to insure an additional debt which allocates the economic activity.

In the modern financial theory and in the model Arrow Debreu, the insurance contract is a financial asset in an economy of uncertainty. It is a question according to this analysis a shape of conditional debt.

In the process of the trade and the development, the insurance knew its development. In fact, since 1964, and during the United Nations Conference on Trade and Development (UNCTAD), the market of the insurance and the reinsurance were considered as an essential component of the economic growth. And the insurance as a financial service took its quantitative importance while trying to follow the evolution of the financial situation of institutions.

According to Grace (Favor) and Rebello, (1993), the activity of the insurance can contribute on the activity of the banking sector. The development of the activity of insurance could encourage the bank loan by increasing the demand of financial services.

The evaluation of the relation between the potential activity of the market of the insurance and the economic growth was presented by Ward and Zurbruegg (2000), Webb and al. (2002) Kugler and Ofoghi (2006), and Adams, Andersson, Andersson, and Lindmark (2006) for the countries of the OECD, it was Ward and Zurbruegg (2000) which tried to explain the potential relation between the growth of the insurance sector and the economic growth.

These authors used the tests of cointegration of Johansen to explain the models of test and correction of errors to explain the relation of causality between the economic growth and the insurance.

They examined the relation of potential causality between the economic growth and the activity of the market of the insurance for the countries of the Organization of the Trade and the Economic development for period 1961-1996 and this by using the annual Real Gross domestic product as measure of the economic growth and the annual premiums as the measure of the insurance.

Adam and al. (2005) examined empirically the relation between the banking activity, the insurance and the economic growth in Sweden for period 1830-1998 by using the tests of causality of Granger.

The results showed that the banking development and not of the insurance (by the total insurance premiums) led to the economic growth in Sweden in XIX ème of Century and that the insurance seems to be motivated by the rhythm of the growth of the economy.

Chun-Ping. C (2005) explained the relation between the development of the market of the insurance (via the penetration and the density) and the economic growth. The variables which are used are relative to the demography, to the financial level in the economic profit and in the regional conditions.

Kugler and Ofoghi (2006) showed proofs of long-term causality of the insurance in the growth of the Gross domestic product for eight categories of insurance in the United Kingdom.

Marco. In (2006) showed that in the developed countries or in the developing countries, the activity of insurance is considered as a financial intermediary and a supplier of transfer of risk. Such an activity allows to insure the compensation of the insurants what could contribute to the economic growth by allowing to manage the risks in an effective way. Arena (2008) found proofs of a link of causality enter the development of the insurance on the economic growth a wide panel of 56 countries and of 28 years (1976-2004).

Curak, Loncar and Poposki (2009) examined the relation between the development of the agricultural insurance sector and the economic growth in 10 countries member states of the EU between the period 1992-2007.

Besides, Olubiyo. And Ajfand. O (2009) tried to make a comparison between the practices of production between the insured and uninsured farmers by using an econometric analysis and this by referring to functions of which integrates the option agricultural insurance. The results showed that the insured farmers are directed to the choice of the combination of the factors of production such as inputs what led to an increase of the production.

One of the underlying hypotheses of the agricultural insurance, it is because its introduction allows to encourage the farmers to change positively the agricultural practices what allows to increase the production further to an effective use of the agricultural inputs. The analysis suggests that the insured farmer would generate a net profit by reducing their current level of the use of the resources compared with the uninsured farmers.

According to the World Bank via Erik's empirical works (Rodney. L 2011), it was shown That there is a link of causality between the development of the insurance sector and the economic growth, although the results turn out sometimes ambiguous. Piece. G (2012) showed that the development of the industry of the insurance assurance can contribute to the economic growth as a financial intermediary and a supplier of transfer of risks and compensation to manage the risks in an effective way.

The insurance allows to insure the risk management to reduce or master the losses. Craig. M and Fotis. P (2013) were able to estimate the impact of the use of the insurance on the economic performance of farms by making an analysis of the determiners of the demand of the agricultural insurance, saw that the demand of the agricultural insurance could affect The agricultural performance and this by using a model in two simultaneous equations. The first equation describes the impact of the explanatory variables, including the use of the insurance, on the performance of the agricultural activity.

And the second equation describes the impact of the explanatory variables, including the agricultural performance at request of the insurance. Yesuf. M (2014) identified the insurance collect as an effective institutional mechanism to face the risks of production. It is estimated the impact of the insurance collects on the risks of production. Once used the insurance collects, it will affect the yields on the farmers.

Mirela. C and Silviu. C (2014) tried to analyze the correlation between the insurance and the economic growth by showing the existence of a direct link of causality between both, such as the level of development of the insurance sector depends on the degree of economic development of the country.

ECONOMETRIC ISSUES

Our estimation aims at seeing the sense of the relation agricultural insurance and growth of the agricultural production in the presence of the risk of agricultural production, a risk which has for cause a variability of Agricultural yields.

The variability of the production and the yield on the cultures is due to unpredictable weather conditions. We target to introduce the variable which measures the risk of agricultural production which is the measure of the risk of variability of the agricultural yields because these risks are systematic and rare and cause very important damage.

Hypothesis of the work

By the present estimation, we show if in the presence of risk of variability of the agricultural yields, the development of the agricultural insurance could lead to an improvement of the agricultural production. We use the same sample of American, European and Asian countries between 2000-2012.

In what follows we move forward the results of the empirical estimations. The dependent variable is the real growth rate of the agricultural production.

The explanatory variables are the following ones:

The penetration rate to the market of the agricultural insurance (penetration)

The agricultural investments (idea)

The quality of farmlands (ta)

The subsidies of production prices agricultural (esp)

The agricultural spending in percentage of the PIBA (depa)

Indicator of the average losses of the agricultural yields with compared with the mobile average, by taking into account last five years except the maximum and the minimum (ipm3)

$$I_{p5-2} = \frac{\sum_{i=1}^n \max(\bar{y}_{5-2i} - y_i, 0)}{n}$$

With

N: Number of years,

Yi: value of the variable analyzed in the year i: Mobile average of the last five years except the maximum and the minimum.

N: Number of years,

Yi: value of the variable analyzed in the year i

Ti: value of the trend in the year

Model specification

The equation of panel is defined as follows:

$$Y_{it} = \alpha X_{it} + \beta Z_{it} + \varepsilon_{it} \quad (1)$$

With Y_{it} : the real growth of the annual agricultural production

And, X represent the penetration rate to the agricultural insurance of a country

Z is all the variables of control in the model which reflect the economic and financial conditions which could impact at the same time on the activity of agricultural insurance and the agricultural production.

For the estimation, the variables of control are the agricultural spending in percentage of the Agricultural Gross domestic product, the subsidies of the prices the agricultural production, the agricultural investments, the farmlands and two variables which measure risk of variability of the agricultural yields.

The term of error is ε_{it}

The indications $i = 1 \dots N$ and $t = 1 \dots T$ represent respectively the individuals and the time.

In the model predefined the terms of interaction are used to know the effect of the development of the agricultural insurance on the growth of the agricultural production. That is if the development of the market of the agricultural insurance could exercise a positive impact on the growth of the agricultural production.

In the model, we integrate variables which can explained the economic and financial conditions and which are defined in the vector according to whom group $F = (\text{Economy, finance})$ **(2)**

These variables are tested to see if they will have an impact on the relation between the development of the penetration to the market of the agricultural insurance and the growth of the agricultural production. The economic consequences can be spread as follows:

If $\alpha > 0$ et $\beta > 0$, it confirms the hypothesis which the development of the penetration to the market of the agricultural insurance has a positive impact on the growth of the agricultural production and in this case the variables of control which are introduced into the model affect positively the relation.

All the used variables and which reflect the economic and financial conditions F has a positive impact on the growth of the agricultural production.

If $\alpha > 0$ et $\beta < 0$, it supposes the hypothesis which the development of the penetration to the market of the agricultural insurance has a positive impact on the growth of the agricultural production through the conditional variables which have negative impact on the estimated relation.

These hypotheses will be clearly explored to estimate how the development of the penetration to the market of the insurance affects the growth of the agricultural production by using conditional variables which express the economic and financial conditions.

$$\frac{\partial (VPAB)_{i,t}}{\partial X_{i,t}} = \alpha \quad (3)$$

$$\frac{\partial (VPAB)_{i,t}}{\partial X_{i,t}} = \alpha + \beta \cdot M_{i,t} \quad (4)$$

The equations (3 and 4) express the marginal effects of the model. In the model, the sign of α is positive or negative and α indicates the direct effect, while $\alpha + \beta \cdot M_{i,t}$ indicates the indirect effect and represent the total effect.

In fact, the total effect of the agricultural insurance on the growth of the agricultural production affected by the conditional variables is measured by the total effect $\alpha + \beta.M_{i,t}$.

In the model, the marginal effect of the insurance on the growth of the agricultural production depends on coefficients α, β and M (one of the conditional variables). En consequence, the marginal effects of the model can be ambiguous.

Through this estimation, we target to show if the development of the penetration in the agricultural insurance contributes to the growth of the agricultural production. We examine if the relation between the development of the penetration to the market of the agricultural insurance and the growth of the agricultural production could be affected by different conditions.

The model aims at adding certain conditions and terms of interaction between the variables of agricultural insurance and the conditional variables.

ANALYTICAL TESTS

Test of Fisher

The consideration of the variability of the risk of the agricultural yields in the estimation which expresses the relation between the development of the agricultural insurance and the growth of the agricultural production is justified by the test of Fisher.

The model is judged as globally significant as far as sound $R^2 = 74.51 \%$ and the probability of calculated Fisher is lower than 5 %.

Explanations are thus possible between:

- The development of the penetration in the agricultural insurance and the real growth of the agricultural production.
- The relation between the relative variables at the risk of agricultural production and the agricultural production.
- The links between the variables which reflect the economic conditions (as the agricultural foreign direct investments, the agricultural spending in percentage of the PIBA, the agricultural quality of farmlands and subsidies of production prices and the real growth of the production).

By analyzing the significativity of the explanatory variables for it t of student, we have:

- The penetration rate in the agricultural insurance is a significant variable in 1 %.
- The agricultural foreign direct investments is a significant variable in 1 %.
- The quality of farmlands is an explanatory variable in 1 %.
- The variable which measures the risk of variability of the agricultural yields is a significant variable in 1 %.
- The variable subsidies of production prices agricultural is a significant variable in 5 %.

Test of normality of residues

The data used in our estimation follow a normal law, this report is confirmed by the test of normality of residues as far as the probability of the test is $Pr = 0.1747 > 0.05$. We thus accept the hypothesis H_0 according to which residues follow a normal law.

Test of multicollinearity

According to the test of multicollinearity through the calculation of the VIF, we can keep all the variables used in the estimation.

Test of Hausman

Our model can be estimated by the data of panel. We proceed by a test of Hausman for an identification of the type of the model if the specific effects are fixed effects or random effects.

For our estimation, it is the model with random effects that will be the model the most appropriate and which will answer the hypotheses inverted by the test following to know for our model:

H_0 : there is a systematic difference between the coefficients

H_1 : there is no systematic difference between the coefficients

Thus, the predefined model is a model with random effects with $\text{Chi}^2 (7) = 375.91 > 0$

And $\text{Prob} > \text{Chi}^2 0.0000$.

Test of heteroscedasticity of the residues

Once, identified the type of model we test the existence or not problems of heteroscedasticity of the residues. In the second estimation, there is a problem of heteroscedasticity of the errors which we corrected.

In the presence of the problem of heteroscedasticity of the residues, we proceed by the correction because the probability associated with the test is lower than 5 %.

The contemporary correlation between individuals: the test of Breush-Pagan

By the test of Breush-Pagan, we found a probability of the test is lower than 5 %, what allows us to say that the random effects are globally significant And, the errors are not correlated in a contemporary way.

The test of auto correlation of the errors (Breush-Godfrey)

For our estimation, the test of autocorrelation of the errors confirms the absence of the problem of autocorrelation of the errors because the probability of the test is superior to 5 % ($Pr = 0.162$) The estimated model is a model with random effects corrected by the problem of heteroscedasticity. By correcting the problem of heteroscedasticity the errors, the explanatory variables are the following ones:

- The penetration rate to the market of the agricultural insurance is a significant variable in 1 %.
- The agricultural foreign direct investments is a significant variable 1 %.
- The quality of lands is a significant variable in 1 %.
- And the variable risks of variability of the yields is a significant variable in 1 %.

The test of endogeneity

There is no endogeneity between the explanatory variables and the dependent variable seen that the probability of the test of endogeneity is $Prob > Chi2 = 0.0688$.

ANALYSIS AND RESULTS DISCUSSION

Statistical analysis of the results of the estimation

The model with random effects corrected is the following one (5):

$$VPA = 15.79 + 0.647 \textit{penetration} + 0.529 \textit{idea0} + 0.591 \textit{ta0} - 0.035 \textit{depa0} - 0.524 \textit{ipm3} + 0.136 \textit{ipmt 20} + 0.201 \textit{esp0}$$

$$(25.41)^{***} \quad (6.42)^{***} \quad (7.09)^{***} \quad (5.88)^{***} \quad (-0.26)^{***} \quad (-8.19)^{***} \quad (0.51) \quad (1.48)$$

$$R^2 = 88.50\%$$

$$WaldChi2(7) = (547.80)^{***}$$

The relation enters the development of the penetration to the market of the agricultural insurance and the growth of the agricultural production is always valid in the presence of the risk of variability of the agricultural yields.

The statistical results of our estimation show that:

- The hypothesis which stipulates that the development of the penetration to the market of agricultural insurance could have an effect on the growth of the agricultural production is based as far as the model is globally significant for the various countries of the sample during period 2000-2012.

- There is more than an explanatory variable which is significant according to the value of the test of Student.
- Residues follow a normal law.
- Absence of the problem of multicollinearity between the variables which permit us to kept all the variables in the estimation.
- It is the model with random effects corrected of the problem of heteroscedasticity of the errors that is the model the most suited for our estimation.
- The tests of Breush-Pagan and Breush-Godfrey show respectively that the random effects are globally significant and the absence of the problem of autocorrelation of the errors.
- And the test of endogeneity confirms the absence of the problem of endogeneity between variables.
- In the presence of the risk of agricultural production expressed in terms of risk of variability of the agricultural yields, the variable penetration in the agricultural insurance is correlated positively and significantly in the real growth of the agricultural production.
- In our estimation, the variable which measures the risk of variability Agricultural yields (imp3) is a variable significant and correlated negatively in the value of the agricultural production. It supposes that in the countries of the sample, more the risk of variability of the agricultural yields felt is grave more deteriorates the agricultural production.
- The agricultural investments are correlated positively and significantly in the growth of the agricultural production.
- And, a significant and positive correlation between the quality of farmlands and the value of the agricultural production.

Economic analysis of the results of the estimation

By analyzing the signs expected from the explanatory variables which are used in our regression, we can move forward the following results:

.The sign concerning the variable of the penetration to the market of agricultural insurance is positive and waited because the countries of the sample resort to the insurance agricultural as one management tool of the risks what has impacts on the growth of the agricultural production. The positive sign enters the penetration rate to the market of agricultural insurance and the growth of the agricultural production explains well that in the American, European and Asian countries there is a strong trend to the development of the industry of agricultural insurance what contributes to the improvement of the agricultural performance.

.The variable risks of variability of the agricultural yields (ipm3) present a negative sign, an expected sign because further to climatic hazards the agricultural production is subjected to risks of losses, these losses are estimated by indicators such as the indicator of the average losses of the agricultural yields compared with the mobile or olympic average, by taking into account last five years except the maximum and the minimum which means that more the losses owed at the risk of production are more brought up the agricultural production falls.

.The agricultural investments always present an expected positive sign as far as the agricultural investments make only increase the agricultural production capacity. Necessary investments to help the insurant to face the risks of production.

.The quality of farmlands is a significant variable correlated positively in the agricultural production. An expected sign as far as the lands is an essential factor in the potential development of the agricultural production.

Interpretations of the results of the estimation

The risk of agricultural production which undergo the American, European and Asian insured farmers, makes incite to the development of the agricultural insurance in particular for the insurance yield to manage this risk.

By our estimation, we confirm the positive relation between the development of the insurance in the presence of risk of variability of the agricultural yields and the growth of the agricultural production.

We were able to demonstrate also that the risk of agricultural production expressed in term of risk of variability of the agricultural yields affects negatively the growth of the agricultural production.

We also proved that the development of the agricultural insurance is dependent on factors other than financial to be known about economic factors among which the development of the agricultural investments and the quality of farmlands.

On the other hand, the subsidies of production prices agricultural supplied by States present a positive but not significant sign what supposes that in case of risk of losses due to the variability of the agricultural yields, the measure of direct helps supplied to the producers is not suited to improve the growth of the agricultural production.

So, the improvement of the agricultural production in case of risk of production will depend on the penetration rate to the market of the agricultural insurance and a development of the industry of the agricultural insurance demand a transfer of risk and justifies the state intervention.

CONCLUSION

The agricultural insurance is the activity of financing which demands the solidarity for the property to be insured individuals.

In fact, it is the solidarity of the individuals that makes reduce the risks until their control. More the number of individuals to manage the risks is important more the risks are mastered. So, the insurance is once applied will be verified the law of large numbers.

We examined, the empirical relation between the development of the market of the agricultural insurance and the real growth of the agricultural production of other one by holding the economic and financial conditions and this for a panel of 25 countries for the period 2000-2012.

In the model, the relation between the positive impact of the development of the market of the agricultural insurance and the real growth of the agricultural production is demonstrated in this estimation by specifying the type of risk us agricultural risk due to the variability of risk yields.

In fact, the relation between the development of the agricultural insurance and the growth of the agricultural production can become ambigüe seen the specificities of the agricultural activity in every country and because the behavior of farms distinguishes itself from a country in another one.

As a matter of fact, one of the political recommendations which we can pulled it is that States owe insurants a successful financial system which contributes to maintain the positive

effects of the development of the market of the agricultural insurance on the growth of the agricultural production.

In defect and if the decision-makers do not take into account the conditions which affect the relation, the growth of the agricultural production can be maintained with the development of the industry of agricultural insurance .

From their part, the insurers have to hold in consideration the conditions relative to the development of the agricultural production.

Among the financial factors which were used as potential factors which contribute to the development of the agricultural insurance, a penetration rate in the importing agricultural insurance, in other words the important agricultural volumes of insurance premiums allow the development of the industry of agricultural insurance.

Besides, the development of the industry of insurance depends on the number of covered risks and on their importance in a country.

Concerning the economic factors which act positively at the same time on the growth of the agricultural insurance and on the growth the agricultural production, we showed that it is the agricultural investments, the agricultural spending in the form of the helps other than subsidies on the prices and the quality of the farmlands which are the potential economic factors.

In conclusion, to allow the promotion of the industry of agricultural insurance, it is enough to develop data which have a direct or indirect impact on the agricultural insurance and which allow to analyze the relation agricultural insurance versus the agricultural performance.

In particular, the structure of the market, the culture of the country as well as the institutional, environmental, statutory and legal frame of the country.

The impact of the insurance on the economic activity cannot be only explained by these elements, there are other factors who can explained such an effect and even to spread it to the social side.

The insurance acts effectively on the agricultural performance provided that from macroeconomic point of view, the contribution of the agricultural insurance to the Agricultural Gross domestic product is important and from microeconomic point of view, if the State plays the role of a regulator to reassureur which insures the division of the risk.

Of this result, we can pull that the development of the agricultural insurance is dependent on the risk management policy agricultural applied to face the agricultural risks.

The evaluation of the significant impact of the systems of insurance on the economy was not enough developed. In particular, this evaluation was not explored for an economic activity strongly submitted to risks, namely the agriculture.

One of the major limits of this work is the availability of the long series of data which would have allowed us to lead an analysis in dynamic panel to estimate the type of interaction between the development of the agricultural insurance and the agricultural productivity in the presence of risk of agricultural production.

To estimate clearly the impact of the agricultural insurance on the agricultural performance, it is enough to develop data which have a direct or indirect impact on the agricultural insurance and which allow to analyze the relation agricultural insurance versus the agricultural growth production.

In particular, the structure of the market, the culture of the country as well as the institutional, environmental, statutory and legal executive of the country.

We suppose that the insurance could act effectively on the growth of the agricultural production provided that from microeconomic point of view, the State plays the role of a regulator to reassureur which insures the sharing of the risk.

Of this result, we can suppose that the development of the agricultural insurance is dependent on the risk management policy agricultural applied to face the agricultural risks.

So, the data which measure the degree of supports of States to the insured farmers are of a big utility to be able to estimate the effect of the programs of insurance on the agricultural growth production in presence of agricultural risk yields.

Model:

Risk of variability of the agricultural yields and the interaction between the development of the agricultural insurance and the growth of the agricultural production (includes penetration, esp, idea, Ta, depa, ipm3, ipmt2)

*, **, *** indicate the level of meaning to 10 %, 5 % and 1 % respectively.

The values in brackets are t of student.

With :

MEF: model with fixed effects, MEA: model with random effects and MEAC: model with corrected random effects.

| Variables | MEF | MEA | MEAC |
|-----------------------------|---------------------|----------------------|----------------------|
| Penetration | 0.079 (1.03) | 0.745 (5.74)*** | 0.647 (6.42)*** |
| esp0 | -0.004 (-0.08) | 0.309 (2.31)*** | 0.201 (1.48) |
| Idea0 | 0.153 (3.9)*** | 0.583 (7.19)*** | 0.52 (7.09)*** |
| Ta0 | -0.076 (-0.26) | 0.537 (4.49)*** | 0.591 (5.88)*** |
| depa0 | 0.104 (1.03) | -0.01 (-0.01) | -0.035 (-0.26) |
| lpm30 | -0.117 (-0.97) | -0.599 (-6.41)*** | -0.524 (-8.19)*** |
| ipmt2 | 0.276 (0.94) | 0.349 (1.17) | 0.136 (0.51) |
| Constante | 16.58 (27.02)*** | 15.14 (23.63)*** | 15.79 (25.41)*** |
| R² | 18.61% | 88.50% | 88.50% |
| N/Nbre d'obs | 9/107 | 9/107 | 9/107 |
| F Statistique | (2.97)*** | | |
| Wald Chi 2 | | (289.43)*** | (547.80)*** |
| Test de Hausman | | (375.91) | |
| Test de Breush-Pegan | | (243.07)*** | |
| Test de Breush-Godf | | (2.373) | |

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