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RESEARCH ARTICLE

AGRICULTURAL INSURANCE AND AGRICULTURAL PERFORMANCE: AN APPLICATION OF THE VAR MODEL IN CHINA

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ABSTRACT

In developed as in developing countries, the study of the impact of the development of the agricultural insurance on the agricultural performance is of a big utility as far as this study allows to pull measures of economic policies which allow to promote the agricultural insurance and the strategies allowing the country to pull the profits of the development of the agricultural insurance. We show the existence or not of the causality between the agricultural performance and the development of the agricultural insurance and this by resorting to an econometric approach which defines itself as follows: by proceeding by a study of the stationarity of the series to determine their order integration. In the second stage, we test the existence of a relation of cointegration between the used variables. Afterward by specifying the parameters of the model, we make the tests of causality, decomposition of the variance and the tests of the distribution of residues. The VAR model was then used to make the various tests in China over the period 2000-2012. We found interesting results in this connection which reflect the state of the agricultural insurance and the implications of its use to allow the preservation of the agricultural performance. Besides, we showed in term of causality the implications of the application of the agricultural modalities of risk management on the agricultural performance. By applying all of the tests, we show the existence of a causality between the agricultural performance and the development of the agricultural insurance which is measured by the penetration in the agricultural insurance. And this unidirectional causality is valid for the China between 2000-2012. A causality which remains true in the short and long term, so the model can be adopted for estimating projected effects. In this result is added a causality which puts in relation the action of the State by direct helps granted to the insurants in the form of subsidies of the premiums of agricultural insurance and their effects on the agricultural performance. In these causalities, are added other relations appropriate to a country.

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INTRODUCTION

The relation between insurance development and economic performance has been the subject of considerable academic research. Several other authors tried to show the importance of the insurance in the process of the economic development in particular in developing countries in spite of the difficulty seizing and including the degree of contribution of the insurance in the economic activity. 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 XIXth of Century and that the insurance seems to be motivated by the rhythm of the growth of the economy. It was shown by the World Bank via empirical works of Erik's and Rodney. L (2011) 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, (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 a effective way. The insurance allows insuring the risk management to reduce or master the losses. Craig and Fotis (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

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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 demand of the insurance.

Yesuf (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 and Silviu (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. Various studies have focused on different countries, time periods, modeling techniques and different proxy variables which have been used for insurance activity such us rate of penetration on insurance. The development of the insurance as an economic activity comes from the necessity of facing risks for a behavior of solidarity between the individuals. It is in this spirit that establishes themselves the institutions of insurance which have for principle to insure a solidarity between the various individuals in case of risks. The role of insurance companies is to insure a behavior of mutual insurance between the various individuals to face the risks.

And it is the World Bank through studies made for the years eighty that incited so that insurance companies play a role in the reduction of the risks by sharing the risks between the various individuals especially in case of grave risks. We suppose that the quantitative evaluation of the impact of the insurance in the economic activity is of a big importance to be able to encircle the factors which could contribute to the development of the activity of insurance and as a consequence which could impact on the economic activity. Our work joins from this perspective; it is supposed that the management of agricultural risks by the agricultural insurance could have a significant impact on the growth of the agricultural production and on the agricultural productivity. We shall move forward empirical models which allow estimating the effects of the development of the penetration at the agricultural insurance on the growth of the agricultural production on one hand and on the agricultural productivity on the other hand.

From the existing studies, we can use the VAR model to study the causality between agricultural insurance development and agricultural performance. The objective of this study is to show the causality between agricultural insurance and the agricultural productivity on one hand and the causality between the development of the agricultural insurance and the real growth of the agricultural production on the other hand. In other words, we shall test the causality between agricultural insurance and agricultural performance. To be made, we use the technique of VAR model. The study is made on China, a country where the agricultural insurance is strongly developed between 2000-2012.China will be the representative country on which is made our VAR model. The choice of this country was made on the basis of the penetration rate in the agricultural insurance the highest among the countries of the sample in Asian countries.

We use the following variables: the rate of real growth of the agricultural production, the agricultural productivity, the subsidies of the premiums of agricultural insurance, the premiums of agricultural insurance, the agricultural spending and the penetration in the agricultural insurance. The study which we lead use the theory of the co integration of Engels and Granger to analyze the relation between the development of the agricultural insurance and the growth of the agricultural production on one hand and the agricultural productivity on the other hand in China between 2000-2012.It allows to pull the observations and the teachings and to deduct the implications on the causal relations between the aforesaid variables. In this article we present in section 2 briefly reviews the related literature, followed by section 3 that present the econometric modeling approach and describe the data used, section 4 depicts the empirical findings and the final section, section 5, holds the concluding annotations and presents some policy implications.

Literature Review

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, the Marshall Island 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. It was during 1960s when the economy of insurance knew its peak with the works of Borsh (1962) and Arrow (1970) which showed that it is the theory of insurance that allows the economic analysis of the risk and the uncertainty. Laguerre (1990) supposed that "No society can prosper without mechanisms of risk coverage". According to Grace 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. According to Beck and Webb (2003), as financial service, the insurance is

considered as a particular service which affects the economic growth. Chun-Ping (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 insuring the compensation of the insurant what could contribute to the economic growth by allowing managing 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 enters the period 1992-2007.Olubiyo. And Ajfand (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 integrate 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 input what lead 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 more power and a net profit by reducing their current level of the use of the resources compared with the uninsured farmers. Most of the empirical studies which targeted the evaluation of the interaction between the activity of insurance and the economic growth were based on descriptive analyses to analyze the development of the activity of insurance and its effect on the economic activity. On the other hand, concerning the agricultural activity, the activity strongly subjected to the risks that are natural risk or risk of production which is of for the variability of the agricultural yields, the empirical studies were rare. Our work tries to show empirically if there is causality between the development of the agricultural insurance and the agricultural performance for one of the Asian countries, namely China during period 2000-2012.

We target to show the causality between agricultural insurance and the agricultural productivity on one hand and the causality between the development of the agricultural insurance and the real growth of the agricultural production on the other hand. In other words, we shall test the causality between agricultural insurance and agricultural performance. To be made, we use the technique of VAR model for the Asian countries; it is China which will undergo this test. The choice of this country was made on the basis of the penetration rate in the agricultural insurance the highest among the countries of the sample in this continent. We use the following variables: the rate of real growth of the agricultural production, the agricultural productivity, the subsidies of the premiums of agricultural insurance, the premiums of agricultural insurance, the agricultural spending and the penetration in the agricultural insurance. The study which we lead uses the theory of the co integration of Engels and Granger to analyze the relation between the development of the agricultural insurance and the growth of the agricultural production on one hand and the agricultural productivity on the other hand in China between 2000-2012.It allows to pull the observations and the teachings and to deduct the implications on the causal relations between the aforesaid variables.

Econometric analysis and specification of the model

We specify the model, the sources of the data and our methodological approach and we analyze the stationarity of the series to be able to determine the level of integration of variables. It is a question of identifying the explained variable and the explanatory variables of the model, the signs of the parameters and the equation of the model. Our analysis joins in the theoretical frame of the approach of the institutional adaptation developed by Wilhelms (1998) and who finds his origin in the school of the integration. This approach supposes that the agricultural performance depends on institutional variables and on adopted policies of regulation; in fact, the approach of the institutional adaptation grants an important role to the State in its regulation besides the role of the market. The agricultural performance is estimated by the rate of real growth of the agricultural production (according to the FAO) and by the global agricultural productivity of factors.

The variables of the model were specified in the methodology of analysis and both estimated models will be of type:

$$VPA = \beta_0 + \beta_1\ penetration + \beta_2\ AgrinsurSubsidi + \beta_3 \Pr im + \beta_4 \text{Agricultural spending} + \varepsilon_t \quad (1)$$

$$PGFA = \beta_0 + \beta_1\ penetration + \beta_2\ Agr\ insuSubsidi + \beta_3 \Pr im + \beta_4\ agricuspending + \varepsilon_t \quad (2)$$

With VPA: the rate of real growth of the agricultural production.

And PGFA: the global agricultural productivity of factors

Variable VPA and PGFA measure the agricultural performance of the country. Penetration: the penetration rate in the agricultural insurance (SER); Agri insur subsidi: subsidies of the premiums of agricultural insurance (SAA); Prim: the premiums of agricultural insurance (Prim) and agricultural Spending: the agricultural spending other than the subsidies of production prices (DPA)

β_0 is a constant

$\beta_1, \beta_2, \beta_3\ and\ \beta_4$ are he coefficients relative to every variable

and ε_t is the term of error.

Sources of the data and the methodology of analysis

The data cover the period 2000-2012 and result from the FAO and the publications of the French statistics of the Asian Ministry of Agriculture. The software used for the estimation is Eviews 8. Variables are taken in real terms. This study on the impact of the agricultural insurance on the agricultural performance in France has for objective to analyze the impact of development of the agricultural insurance on the growth of the agricultural production and on the agricultural productivity in China, to determine the measures of agricultural risk management policies susceptible to minimize the agricultural risks allowing China and farmers assured to maintain stable their agricultural production and their returned. So the Econometric methodology that we adopt comes true in four stages. The first stage consists of the study of the stationarity of the series to determine their orders of integration. We test in the second stage the existence of a relation of cointegration between variables. We identify the parameters of the model and we make the various tests in the fourth stage to be known, the test of causality, the decomposition of the variance and the hard test residues. These various tests will be made seen retaining two dependent variables, the first test is by retaining the rate of real growth of the agricultural production and the second test is by considering the global agricultural productivity of factors.

The stationarity of the series and their orders of integration

By the appeal to both tests of Dickey Fuller (ADF) and test of Philips-Perron (PP), we can specify the stationary character of the model. The results of the test of stationarity for China are recapitulated in the following Table 1.

Table 1. Results of the tests of stationarity and integration of variables

		Test of stationarity (at the threshold of 5 %)						
	Stationarity		Dickey-Fuller (ADF)		Philips-Perron		Stationarity	
Variables	Yes/ No	Order of integration	Value of the statistics	Critical value	Value of the statistics	Critica l value	Yes/ No	Order of integration
VPA	Yes	I(1)	-4.697	-3.175	-7.695	-3.175	Yes	I(1)
PGFA	Yes	I(1)	-7.016	-3.212	-12.707	-3.175	Yes	I(1)
SAA	Yes	I(1)	-2.895	-1.977	-2.892	-1.977	Yes	I(1)
PRIM	Yes	I(2)	-3.380	-1.982	-4.749	-1.982	Yes	I(2)
PENET	Yes	I(2)	-3.240	-1.988	-3.879	-1.982	Yes	I(2)
DPA	Yes	I(1)	-2.709	-1.977	-2.709	-1.977	Yes	I(1)

Source: the Author from the data of the model

The second stage tests the existence of a relation of cointegration between the used variables. The third stage is interested in the estimation of the parameters of the model and the last and fourth stage allows making the test of causality. The endogenous variable is the rate of real growth of the annual agricultural production of the country or the agricultural productivity of the country in the period 2000-2012.

The explanatory variables are the subsidies of the premiums of agricultural insurance, the premiums of agricultural insurance, the agricultural spending and the penetration in the agricultural insurance. The VAR model allows making the various tests: stationarity and causality. by making these tests, the results relative to the Asian Economy obtained about the interaction between agricultural insurance and agricultural performance are interesting. The test of stationarity revealed that all the variables are stationary in first difference and they are quite significant. The model is globally significant and can be used for the forecast.

The causality agricultural insurance, agricultural performance: application of the VAR model in Chinato test the existence or not of a causality agricultural insurance and agricultural performance in China. A country which is characterized by the development of the industry of agricultural insurance to face the climatic risks even if this development is low compared with the other countries. Methodically, the followed approach contains four stages. We make in a first stage the study of the stationarity of the series to determine their orders of

The results of the test of Unitarian root of Dickey-Fuller Augmented (ADF) and that of Philips-Perron show that variables rate of real growth of the agricultural production (VPA), the global agricultural productivity (PGFA), the subsidies of the premiums of agricultural insurance (SAA) and the agricultural spending (DPA) are stationary in first difference. Other variables, namely the penetration (SER) and the premium (Prim) are not integrated by the same order; they cannot be cointegreted in the sense of Granger according to the econometric theory. What returns us to use an Autoregressive Vectorial model (VAR).

The contribution of the autoregressive or vectorial method with correction of errors is that she allows us to study the causality in short or long-term of Granger between agricultural insurance and the agricultural performance. It also allows seeing in which proportion variables self-determine and this by a decomposition of the variance. The calculation of the impulsive functions of a the model means analyzing how the variation in the date t of the innovation of a variable of interest is going to affect all the variables for periods t, t+1, t+2 …The VAR model allows to analyze the effects of the economic policies on the shocks. We use it besides, to make the tests of residues (autocorrelation, homoscedasticity, heteroscedasticity)

Subsidies of the premiums of agricultural insurance, growth of the agricultural production and the VAR model

The statistics of Fisher is superior to that obtained in the picture of Fisher tabulate (1.96), what confirms that the model is

globally significant. Besides, all the used variables are significant.

For our case, residues are homoscedatic because the probability is equal 0.2959 > 5 %. As a consequence, the estimations are optimal.

Table 2. Estimations the VAR model

Vector Autoregression Estimates					
ample (adjusted): 2001 2012					
Included observations: 12 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
		DPA	PRIM	SAA	SER01
VPA(-1)	1.023804	1.597510	6.379260	3.858482	0.628359
	(0.31433)	(1.08983)	(3.74212)	(0.42218)	(0.51082)
	[3.25713]	[1.46583]	[1.70472]	[9.13950]	[1.23011]
DPA(-1)	0.065422	-0.284768	-2.013655	-0.129133	-0.299947
	(0.09476)	(0.32855)	(1.12813)	(0.12727)	(0.15400)
	[0.69040]	[-0.86674]	[-1.78495]	[-1.01461]	[-1.94777]
PRIM(-1)	-0.042755	0.538080	-0.013741	-2.627432	0.148455
	(0.16349)	(0.56684)	(1.94632)	(0.21958)	(0.26568)
	[-0.26152]	[0.94927]	[-0.00706]	[-11.9657]	[0.55877]
SAA(-1)	-0.006506	-0.112401	-0.234305	-0.009142	-0.032864
	(0.02603)	(0.09025)	(0.30989)	(0.03496)	(0.04230)
	[-0.24994]	[-1.24545]	[-0.75610]	[-0.26150]	[-0.77692]
SER01(-1)	0.038550	-1.161776	6.123289	18.06995	0.292880
	(1.00121)	(3.47137)	(11.9195)	(1.34473)	(1.62707)
	[0.03850]	[-0.33467]	[0.51372]	[13.4376]	[0.18000]
C	0.271240	-36.03721	-100.6132	-14.25725	-13.73166
	(3.50220)	(12.1428)	(41.6943)	(4.70384)	(5.69147)
	[0.07745]	[-2.96779]	[-2.41312]	[-3.03098]	[-2.41268]
R-squared	0.992989	0.985319	0.961311	0.998806	0.967151
Adj. R-squared	0.987146	0.973085	0.929071	0.997811	0.939777
Sum sq. resids	0.001275	0.015326	0.180695	0.002300	0.003367
S.E. equation	0.014577	0.050541	0.173539	0.019578	0.023689
F-statistic	169.9561	80.54031	29.81683	1003.840	35.33103
Log likelihood	37.87150	22.95138	8.147833	34.33163	32.04458
Akaike AIC	-5.311916	-2.825230	-0.357972	-4.721939	-4.340763
Schwarz SC	-5.069463	-2.582777	-0.115519	-4.479485	-4.098309
Mean dependent	19.97782	2.597945	18.09921	17.84489	0.175000
S.D. dependent	0.128572	0.308068	0.651606	0.418461	0.096531
Determinant resid covariance (dof adj.)		0.000000			
Determinant resid covariance		0.000000			

Source: the Author from the data of the model

Tests on residues

We make the tests of normality, of heteroscedasticity and of autocorrelation of the errors.

Test of normality

Statistically, it is the test of Jarque-Bera that allows us to deduct if the variables of the model follow or not a normal law. The results of our test show that residues are normal.

Table 3. Test of heteroscedasticity

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Sample: 2000
2012
Included observations: 12
Joint test:
Chi-sq df Prob.

Test of heteroscedasticity of the residues

By the appeal to the test White, we can show that the errors are homoscedastic or not. The series have to be homoscedastic to have good results.

Test of autocorrelation of the errors

We verify by this test if the errors are not correlated. It is by the test of Durbin who allows verifying the autocorrelation of the errors if the endogenous variable is moved.

Table 4. Test of autocorrelation of the errors

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 2000 2012
Included observations: 12

Lags	LM-Stat	Prob
1	75.37585	0.8540
2	78.51263	0.4283
3	80.92345	0.4554
4	77.05486	0.9973
5	77.99451	0.7074

Probs from chi-square with 25 df.

In our case, there is absence of autocorrelation because the associated probability is superior to 5 %.

As a matter of fact, the model can be used for econometric

projected purposes, as far as there is absence of autocorrelation and homoscedasticity of the errors and the distribution is normal.

Test of causality

The analysis of the causality by retaining the variable subsidies of insurance premiums agricultural as dependent variable shows that the subsidies of the premiums of agricultural insurance allow a better forecast of the growth of the agricultural production.

The application of the test in these taken variables two - two for an optimal delay of period, indicates that the subsidies of the premiums of agricultural insurance cause the growth of the agricultural production, the subsidies of insurance premiums have an impact on the volumes of the premiums of agricultural insurance and that the subsidies of insurance premiums cause the penetration in the agricultural insurance.

By analyzing the existing relation between the subsidies of the premiums of agricultural insurance and the growth of the production, we can deduct the following estimated model:

$$SAA_t = 3.858 VPA_{t-1} - 0.129\, DPA_{t-1} - 2.627 \Pr im_{t-1} - 0.009 SAA_{t-1} + 18.06\, Penetr + \varepsilon_t \quad (3)$$

It is a unidirectional causality which is between the subsidies of the premiums of agricultural insurance and the growth of the agricultural production. A relation which is the true in China and which reflects that it is by the management of agricultural risks by subsidizing the premiums of agricultural inssurance that improves the agricultural production;

Table 5. Granger Test

VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 2000 2012
Included observations: 12

Dependent variable: SAA

Excluded	Chi-sq	df	Prob.
VPA	83.53046	1	0.0000
DPA	1.029439	1	0.3103
PRIM	143.1790	1	0.0000
SER01	180.5687	1	0.0000
All	1150.040	4	0.0000

The statistics of Fisher is superior to that obtained in the picture of Fisher table (1.96), what confirms that the model is globally significant. And the used variables are significant.

By analyzing the relation between the agricultural insurance (measured by the penetration in the agricultural insurance) and the global agricultural productivity of factors (measured by the PGFA), the estimated model can be written as follows:

$$PGFA = -0.889\, PGFA_{t-1} - 0.945 DPA_{t-1} + 0.918 \Pr im_{t-1} - 0.042 SAA_{t-1} - 4.311\, Penetr_{t-1} + \varepsilon_t \quad (4)$$

Causality between agricultural productivity and penetration in the agricultural insurance by applying the VAR model

Table 6. Estimations the VAR

Vector Autoregression Estimates
Sample (adjusted): 2001 2012
Included observations: 12 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	PGFA	DPA	PRIM	SAA	SER01
PGFA(-1)	-0.889502	-0.022976	-0.751870	-0.137735	-0.098054
	(0.26122)	(0.14302)	(0.41292)	(0.17524)	(0.05059)
	[-3.40522]	[-0.16065]	[-1.82084]	[-0.78597]	[-1.93840]
DPA(-1)	-0.945602	0.123826	-0.494551	0.843732	-0.154405
	(0.36286)	(0.19867)	(0.57359)	(0.24343)	(0.07027)
	[-2.60599]	[0.62326]	[-0.86220]	[3.46604]	[-2.19738]
PRIM(-1)	0.918409	1.311193	3.135495	-0.752400	0.460910
	(0.44960)	(0.24617)	(0.71072)	(0.30162)	(0.08707)
	[2.04271]	[5.32638]	[4.41172]	[-2.49451]	[5.29379]
SAA(-1)	-0.042908	-0.074108	-0.259336	0.061178	-0.041798
	(0.19376)	(0.10609)	(0.30630)	(0.12999)	(0.03752)
	[-0.22145]	[-0.69854]	[-0.84668]	[0.47064]	[-1.11394]
SER01(-1)	-4.311312	-5.909287	-12.44806	6.651406	-1.522350
	(2.60670)	(1.42724)	(4.12059)	(1.74874)	(0.50479)
	[-1.65394]	[-4.14037]	[-3.02094]	[3.80354]	[-3.01581]
C	-7.396496	-18.96644	-28.31843	27.48809	-6.460597
	(8.13942)	(4.45655)	(12.8666)	(5.46045)	(1.57621)
	[-0.90873]	[-4.25586]	[-2.20093]	[5.03404]	[-4.09882]
R-squared	0.809286	0.980147	0.963012	0.983847	0.974707
Adj. R-squared	0.650357	0.963604	0.932188	0.970386	0.953629
Sum sq. resids	0.069134	0.020725	0.172754	0.031114	0.002593
S.E. equation	0.107342	0.058773	0.169683	0.072012	0.020787
F-statistic	5.092135	59.24564	31.24258	73.08882	46.24305
Log likelihood	13.91244	21.14056	8.417483	18.70270	33.61278
Akaike AIC	-1.318739	-2.523427	-0.402914	-2.117116	-4.602130
Schwarz SC	-1.076286	-2.280974	-0.160461	-1.874663	-4.359677
Mean dependent	2.775000	2.597945	18.09921	17.84489	0.175000
S.D. dependent	0.181534	0.308068	0.651606	0.418461	0.096531

Determinant resid covariance (dof adj.)	3.22E-17
Determinant resid covariance	1.01E-18
Log likelihood	163.5029
Akaike information criterion	-22.25049
Schwarz criterion	-21.03822

Tests on residues

In the same way, we make the tests of normality, of heteroscedasticity and of autocorrelation of the errors.

Test of normality

The test of Jarque-Bera allows showing us that residues are normal.

Test of heteroscedasticity of the residues

For our estimation, residues are homoscedatic because the probability is equal 0.2825 > 5 %. As a consequence, the estimations are optimal.

Table 7. Test of heteroscedasticty

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Sample: 2000 2012
Included observations: 12

Joint test:

Chi-sq	df	Prob.
86.80064	80	0.2825

Test of autocorrelation of the errors

We verify by this test if the errors are not correlated. With the test of Durbin who allows to verify the autocorrelation of the errors if the endogenous variable is moved.

In our case, there is absence of autocorrelation because the associated probability is superior to 5 %.

The model which tries to explain the causality between the agricultural productivity and the penetration to the agricultural insurance could be used for predictive effects because there is absence of autocorrelation and homoscedasticity of the errors and the distribution is normal.

Test of causality

From the Granger causality test, we were able to release a unidirectional causality between the agricultural productivity and the penetration in the agricultural insurance in China between 2000-2012.

Besides, other unidirectional causalities can be clear released, that is a relation between the agricultural productivity and the agricultural spending and a unidirectional causality between the agricultural productivity and the volume of the premiums of agricultural insurance. According to the results of the table, we release that short-term and long-term the agricultural productivity is the cause of the penetration in the agricultural insurance because the p value is lower than 10 %; that is the previous information on the agricultural productivity allows a better forecast of the penetration the agricultural insurance in China.

Table 8. Test of autocorrelation of the errors

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 2000 2012
Included observations: 12

Lags	LM-Stat	Prob
1	75.37585	0.8540
2	78.51263	0.4283
3	80.92345	0.4554
4	77.05486	0.9973
5	77.99451	0.7074

Probs from chi-square with 25 df.

Table 9. Granger causality

VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 2000 2012
Included observations: 12

Dependent variable: PGFA

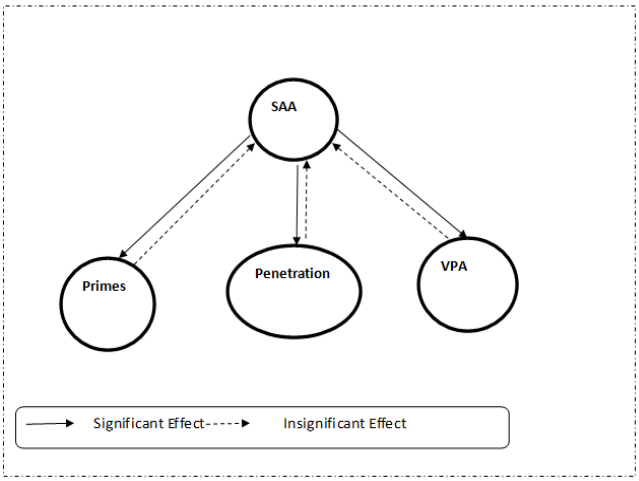
Excluded	Chi-sq	df	Prob.
DPA	6.791189	1	0.0092
PRIM	4.172674	1	0.0411
SAA	0.049038	1	0.8247
SER01	2.735505	1	0.0981
All	19.20192	4	0.0007

Interpretation of the results of the estimation

This study targeted to demonstrate the existence or not of a causality between the agricultural insurance and the agricultural performance in China during period 2000-2012. The led analysis allowed us to demonstrate the existence furthermore that a unidirectional causality. By leading the analysis by retaining the dependent variable, the subsidies of the premiums of agricultural insurance, the unidirectional causalities significant are the following ones (schematized in Figure 1):

- The subsidies of the premiums of agricultural insurance cause the growth of the agricultural production. The subsidies of the premiums of agricultural insurance have an impact on the volumes of the premiums of agricultural insurance.
- And the subsidies of insurance premiums cause the penetration in the agricultural insurance.
- Relations released having shown the stationarity of the series and their degree of integration and having shown that the model is globally significant, residues are of normal

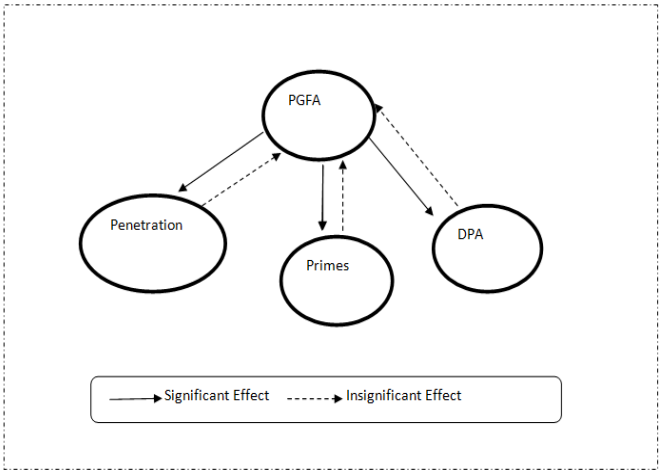
distributionand the errors are not autocorreleted and homoscedastic. Thus, the model is acceptable to be used for the forecast.



Source: the Author from the data of the model

Figure 1. The causalities by retaining the subsidies of the premiums of agricultural insurance

VPA :the real growth of the agricultural production
Penetration : The rate of penetration on the agricultural insurance
Subsidies: Subsidies of the agricultural premiums
Primes : Agricultural insurance premiums



Source: the Author from the data of the model

Figure 2. The causalities by retaining the global agricultural productivity of factors

Penetration : The rate of penetration on the agricultural insurance
PGFA :The global agricultural productivity of factors
DPA : Agricultural Subsidies
Primes : Agricultural insurance premiums

In fact, the growth of the agricultural production depends on the risk management policy agricultural adoptee in the country. In China and during the period of study, the State opts for direct aids supplied to the insurants to face the agricultural risks, in particular in case of disasters climatic as those were observed in China between2009-2010.Our study can be improved by the addition of the other variables which affect the growth of the agricultural production, the relative variables of the agricultural development and the variables relative to the agricultural risks …

Besides, by retaining the agricultural productivity as dependant variable, we found unidirectional causalities significant among which (schematized in Figure 2):

- Causality between the agricultural productivity and the penetration in the agricultural insurance.
- A unidirectional causality between the agricultural productivity and the agricultural spending.
- And a unidirectional causality between the agricultural productivity and the volume of the premiums of agricultural insurance.

These relations of causalities were demonstrated having made all the necessary tests of specification of the model, the stationarity of the series and their order of integration. The estimated model presents a predictive aspect as far as the previous agricultural productivity presents a significant effect on the global agricultural productivity at the moment t. which productivity engenders the development of the agricultural insurance in China. The agricultural productivity depends on the volume of the premiums of agricultural insurance and on the agricultural spending supplied by the State other than the subsidies of the prices or the insurance premiums.

A result which reflects correctly the state of the developing economies which target to promote the agricultural activity especially if its contribution to the Agricultural Internal Product is not insignificant as it is the case of China.

Conclusions and policy implications

Throughout our study, we targeted for main objective to study the impact of the development of the agricultural insurance, measured in term of penetration in the agricultural insurance on the agricultural performance in one representative country of the Asian continents, namely China during period 2000-2012.

To do it, we used the model the VAR to make the various tests: of stationarity, causality, decomposition of the variance and the residues. By these tests, we were able to make important profits and which reflect the reality of the agricultural activity in China. In China all the variables are not stationary in level and were differentiated to be stationary. Three models used to estimate the impact of the agricultural insurance on the growth of the agricultural production and to estimate the impact of the penetration at the insurance on the agricultural productivity or the one who is used to study the impact of the subsidies of the premiums of agricultural insurance on the growth of the agricultural production are globally significant. These modelsare not autocorreleted, homoscedastic and follow a normal distribution so it can be used for the forecast.

First causality supposes that the growth of the agricultural production in an influence on the development of the agricultural insurance and the agricultural productivity causes the penetration in the agricultural insurance in three countries. As a consequence, the analysis of the causality supplies us with

previous information on the level of growth of the agricultural production and this for a forecast of the development of the agricultural insurance. Besides, the previous information on the agricultural productivity in three countries allows preventing better the penetration in the agricultural insurance. We also release a second unidirectional causality verified in China to know the causality enter the penetration the insurance and the subsidies of the premiums of agricultural insurance. A causality which supposes that the development of the agricultural insurance is dependent on the agricultural modality of risk management applied in countries to face the agricultural risks.

In this country, States supply the direct aids to the farmers insured to minimize the agricultural risks between 2000-2012.
The third Causality is the relation between the agricultural productivity and the premiums of agricultural insurance: a unidirectional causality which supposes that the agricultural productivity depends on volumes of the available agricultural insurance premiums in the economy. We note besides these important results, other unidirectional causalities which are verified. In China, the causality is rather between the agricultural productivity and the agricultural spending. The analysis of the causality by retaining the subsidies of the premiums of agricultural insurance allowed us to release the following unidirectional causalities: the subsidies of the premiums of agricultural insurance affect the growth of the agricultural production; the volume of the premiums of agricultural insurance engenders the penetration in the agricultural insurance.

These causalities confirm that in China the risk management policy agricultural impacts on the growth of the agricultural production and the development of the agricultural insurance. Our analysis in terms of causality can be improved by integrating other data relative to the agricultural development, to the risk management policy agricultural and in the development of the activity of insurance.

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