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Original Research Article

Examining the Effect of Agricultural Product Insurance on Value Added in the Agricultural Sector Using Panel Data Technique in Various Provinces of Iran from 2001 to 2011

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Abstract

Nowadays, insurance is considerably important due to feasibility of multiple economic activities in addition to positive effects on magnitude and prosperity of economy, employment, managed assets, etc. Some scholars even believe that development of various economic sectors can be detected through proper performance of insurance department in those sectors. Insurance has different effects on economy among which improved economic stability and reduced concerns can be cited, which stimulate economic growth. This effect is mostly highlighted in the agricultural sector due to great influence of random factors. The present paper aimed to examine the effect of agricultural product insurance on value added in the agricultural sector using panel data technique in various provinces from 2001 to 2011. Library method and econometric (panel data technique) were used to study theoretical foundations due to nature of the study. In addition, panel data technique and E-views software were used to introduce and fit the econometric model according to topic of the study and research variables. Excel software was used to display the statistical data. The results of data analysis showed that the econometric model was estimated using random effect. The results showed that growth rate of the amount of compensation paid to agricultural sector had a significant and positive effect (0.025) on growth rate of value added in the agricultural sector. This coefficient shows that the amount of compensation paid to farmers has significantly and positively increased the growth rate of value-added agricultural products. There was also a significant and positive relationship between growth rate of gross capital formation sector and growth rate of value added in the agricultural sector (0.23). Moreover, there was a positive and significant relationship between growth rate of labor force employed in the agriculture sector and growth rate of value added in the agricultural sector(1.04). It may be argued that the impact of traditional factors of production like labor and capital (especially labor) on growth rate of value added in the agricultural sector is greater than other factors. The situation is not unexpected since Iranian agricultural sector mostly relies on labor and capital instead of technology, advanced equipment and modern production methods. In other words, Iranian agricultural sector relies on labor rather than capital, which is due to legacy of agricultural sector in Iran.

Keywords: Agricultural insurance, Growth of agricultural sector, Value added

INTRODUCTION

Agriculture isone the most important economic sectors in Iran. Agriculture-based economic growth can be put on the agenda in Iran. However, agriculture is a risk-taking process in Iran due to finite water resources and little rainfall, market turmoil of agricultural products and agricultural price fluctuations and absence of job security

for farmers. Development of insurance as a financial sector in the economy and particularly agricultural insurance can significantly reduce risk in this sector. Agricultural products can be guaranteed against a variety of accidents such as plant diseases, fires, drought, etc. through insurance services. In addition, financial damage to agricultural products can be compensated to a certain extent for insured farmers.

Due to natural and economic conditions, agricultural production is one of the most hazardous economic activities in Iran. Since an important segment of agricultural producers in Iran have limited financial means, sometimes even the slightest damage to agricultural products can be hazardous. Accordingly, agricultural product insurance is known as an important infrastructure of agricultural development. This is because this mechanism provides not only greater security for agricultural producers, but also more favorable conditions for absorbing private investment in agriculture (Research Institute of Planning and Agricultural Economics, 2012). The present paper examined the effect of agricultural product insurance on value added in agricultural sector using panel data technique in various provinces in Iran from 2001 to 2011. The results of this study can determine magnitude and type of the effect of financial intermediation toolsand particularly agricultural product insurance on value-added agricultural products and offer appropriate political recommendations for development of agricultural sector from the perspective of insurance industry.

Insurance and its role in economy

Nowadays, insurance greatly contributes to feasibility of multiple economic activities. Insurance also has positive effects on magnitude and prosperity of economy, employment, managed assets, etc. Even some scholars believe that development of different economic sectors can be detected through proper performance of insurance industry in those sectors. Skipper (2001) stated that insurance has many effect some of which are cited here:(1) improved economic stability and reduced concerns; (2) replacement of governmental support programs;(3) facilitated trade and commerce; (4) flow and transfer of savings; (5)more efficient risk management manner;(6) discount on the amount of compensation paid for damages;(7) more efficient allocation of capital

Sigma (1999), Enz (2000), and Ward and Zurbruegg (2002) described the relationship between development of insurance market and economic development as a S-shaped curve, which corresponds to an intense increase in insurance development at lower levels of economic development and a steady increase in insurance development at higher levels of economic development. Ward and Zurbruegg (2002) argued that the role of insurance on economic growth covers the following aspects as risk transfer and compensation services and intermediary services. They believed that the above terms lead to improved productivity, facilitated innovation for the aforementioned services, increased production efficiency, improved investment opportunities, reduced loss of financial resources and advantageous insurance institutional supervision on these services.

Webb *et al.* (2002) argued that such factors as financial activities of insurers should also be added to the generalized growth model according to Solow- Swan neoclassical growth model assuming Cobb-Douglas production model (which shows that growth results from labor, capital and technology) According to this analysis, it is expected that insurance activities have a positive effect on economic growth, although this effect varies in various countries.

Different theories have been proposed by economists on the relationship between financial development and economic growth. First, Schumpeter (1911) noted the importance of financial sector in support of economic growth. Schumpeter argued that financial services provided by financial intermediaries – covering flow of savings, evaluation of economic projects, risk management, supervision on performance of managers and simplified exchanges – are necessary for technical innovation and economic development.

With development of endogenous growth models, new theoretical foundations have emerged with regard to the impact of financial development on economic growth, which shows a causal relationship between financial development and economic growth. Pagano (1993)showed that financial development affects the growth rate of economic growth through changes in saving rates (the ratio of savings that is invested) and total factor productivity (TFP)based on a model. Levine and Zervos (1988) showed that the level of financial development properly predicts economic growth.

Merton (1992), Merton and Bodie (1995, 2004) and Levine (2004) in their theoretical studies showed that financial institutions contribute to economic growth through savings mobilization, resource allocation, monitoring borrowers and participatory monitoring, facilitated risk management and facilitated exchange of goods and services by capital accumulation and technological innovation.

Agricultural insurance

Risk is an inherent element of any agricultural activity, which is risk-taking due to widespread influence of climactic conditions, market structure and institutional

environment. Risks in agriculture stem from various factors, which are classified into several categories. Baquet *et al.* (1997) and Hardaker *et al.* (1997) classified risks in agriculture into following categories: production risk, price risk or market risk, financial risk, monetary risk, institutional risk (or risk due to uncertainty about government policies in the agricultural sector), legal risk and personal risk or human rights. In addition, the type and severity of the risks that farmers are facing vary with respect to farming system, climatic, structural and political conditions. Agricultural risks also depend on level of development and modernization of agricultural sector in various countries (in terms of tools and institutions), so that environmental risk and uncertainty (performance risk) is the highest priority in subsistence agriculture. Thereby, production risk or fluctuations in production influenced by climactic conditions is the most important type of risk in agricultural activities.

In general, there are three basic approaches to deal with and reduce risk in the agricultural sector. These approaches can be used in traditional and modern systems, despite some similarities and strategic principles. Nevertheless, varying degrees of effectiveness and success rates were accomplished as these approaches were used to reduce agricultural risks:

Risk Reduction: The most important strategies used in this area were as follows: multiple cropping system, diversification of production activities and using social facilities.

Risk prevention covers macro or individual measures, which prevent some predictable risks. These measures are as follows: constructing dams or levees, farm segmentation, livestock and poultry vaccination, using resistant seeds, observing rules and regulations in warehouses and buildings

Compensating damages: there are different strategies to compensate damages in traditional and modern agricultural systems. Following strategies are used in the traditional system: support of family network, borrowing, sale of assets or job migration, i.e., leaving agricultural production and engaging in other activities. However, wide insurance services are used to compensate for damages to modern systems (Zahedi and Hosseini Kazerouni, 2014).

In this context, agriculture insurance products are called a risk management operational procedure. In fact, insurance refers to the process of risk transfer and income redistribution, which differs from support policies and should be applied in order to stabilize economy (Bielza *et al.*, 2004). Insurance program alone do not increase total amount of income of the groups participating in this program. Insurance contributes to income redistribution by collecting small amounts of insurance rights from a large number of insurers and paying substantial amounts to those with fewer losses (Kianirad, 2004). In general, most agricultural economists believe that agricultural product insurance program causes production and investment security and consequently leads to stabilized income for the farmers (Amini and Ramadan, 2001).

Risk of changes in agricultural production

Manufacturing risks arise from manufacturing process. Changes in production rates are due to such factors as climactic conditions like drought, floods and damages caused by strong winds as well as damage caused by fire or pests. These risks are known. However, the effect of these risks on production of the farms in developing countries is often not accurately recorded. Specifically, Agricultural Credit Insurance responds to these risks by covering losses from natural hazards. In fact, agricultural insurance does not offer full support for possibility of changes in production rates.

Market-related Risks

Market-related risks refer to changes in supply and demand for agricultural products with no price control and failure of controlled market to react efficiently to changes in these circumstances. These risks primarily reflect changes in prices for the products supplied by farmers. Farmers increase the price of their products in order to compensate for decline in production rates. In general, agricultural insurance relies on production rates and cannot protect farmers against market risk.

Risk management

Risk management encompasses lenders to farmers. Innovation at farm level requires management capacity, which refers to information and capability and commitment to take action in this field. It seems that agricultural credit insurance has limited association with field management risk. Incorrect management decisions are not covered by insurance services. In fact, insurance does not directly protect lenders against management risk of these activities that necessarily affect farmers' income. Risk management at this level is reflected through failure to prepare innovative manufacturing inputs at deadline.

Political risk

Political risks in financing agriculture are classified into two certain categories: (1) the risk of government

intervention in rural credit operations in order to determine lenders, interest rates, guaranteed rights and allocation of loan; (2)those agricultural activities such as bribing that directly affect credit institutions without any interventionist government agent, which leads to non-optimal allocation of credit resources.

Strategic risks

Three types of strategic risks are detected in offering credit to agricultural sector. The first type of strategic risk refers to the mechanism through which lender-borrower trust is either built or destroyed. Lender-borrower trust is essential for flow of credit in private markets. The second type of strategic risk refers to credit rationing among small-scale farmers. The third type of strategic risk is associated with a variety and quality of services that lenders of credits offer to the agricultural sector.

The relationship between insurance and growth rate of value-added agricultural products

The agricultural sector is one of the most important economic sectors, especially in Iran. Prosperity of this sector has always been on the agenda of governments. Various tools such as risk management are used to increase agricultural production and boost this sector of the economy, in order to guarantee investment in this sector by offering increased security. Agricultural product insurance is an alternative and sometimes complementary to traditional methods such as co-culture, farm production diversity, guaranteed prices, etc. (Rostami *et al*., 2007).

A review of literature

The most prominent study in this contest was conducted by Levine *et al.* They showed the relationship between banking development and economic growth. Studies on the relationship between financial development and economic growth using various econometrics showed a strong relationship between these two factors. The following table 1 present a summary of the studies in Iran and other countries.

Research Conceptual Model

The present study primarily aimed to evaluate the effect of agricultural product insurance on value added in the agricultural sector from 2001 to 2011in various provinces in Iran. For this purpose, growth accounting method was used based on hypotheses cited in the second chapter. Econometric model was extracted. For this purpose, following production function is assumed for agricultural products.

Y=f(L,K,S)

where Y represents the rate of production in agricultural sector, L shows labor in the agricultural sector, K represents capital used by farmers and S refers to S index of agricultural insurance. In the present study, S indicates the amount of compensation paid to farmers by insurers.

If we differentiate the above equation and divide it by y, we have:

$$\frac{\dot{y}}{y} = \dot{E} + \frac{F_K.k}{y}\frac{\dot{k}}{k} + \frac{F_L.l}{y}\frac{\dot{l}}{l} + \frac{F_S.s}{y}\frac{\dot{s}}{s}$$

whereF_i is final production of k, L, S variables. Therefore, production extension of each variable can be defined as follows:

$$V_K = \frac{F_K.k}{y} V_L = \frac{F_L.l}{y} V_S = \frac{F_S.s}{y}$$

by substituting $V_i$in equation (2-4), the growth model based on growth accounting method will be as follows:

$$\frac{\dot{y}}{y} = \dot{E} + V_K\frac{\dot{k}}{k} + V_L\frac{\dot{l}}{l} + V_S\frac{\dot{s}}{s}$$

Assuming fixed production scale, we have:

$$V_K + V_L + V_S = 1$$

Now, we can estimate the contribution of each variable to growth rate of value added in agriculture with the help of the above variables. The model used in this study is as follows based on research objectives:

$$\mathrm{V_{it}} = \alpha_0 + \beta_1 \mathrm{S_{it}} + \beta_2 \mathrm{K_{it}} + \beta_3 \mathrm{L_{it}} + \varepsilon_{it}$$

where:

V:growth rate of value-added agricultural products

S:growth rate of the amount of compensation paid to farmers

K:growth rate of capital formation in agriculture

L:growth rate of the labor force employed in agriculture

ϵ: error

RESEARCH METHOD

This was an applied study regarding applied criteria. There was a logical relationship between research and the statistical population in this study. Accordingly, the author thought about benefiting from the results and achievements. Testing for stationarity in panel data was performed to avoid false regressions. For this purpose, Levin, Lin and Chu (LLC) test and few other tests were used.

RESULTS, DISCUSSION AND CONCLUSION

Testing for stationarity in panel data was performed to

Table 1. A review of literature

No.	Work title	Authors	Year	Method
1	Effectiveness of agricultural product insurance subsidies on value added in livestock and crop subsections	Yazdan P Anah *et al.*	2012	vector error correction model and Yuhanson-Yucelius Model
2	Evaluation of agricultural product insurance with sustainable agriculture approach in Iran	Pishro *et al.*	2011	Time-series regression
3	Effect of agricultural product insurance on technical efficiency of wheat farmers in Kermanshah Province (using modified ordinary least squares method)	Agahi *et al.*	2008	Regression
4	Determinants of continues agricultural product insurance	Karami *et al.*	2008	Theoretical-questionnaire
5	The role of insurance and agricultural products in development of agricultural sector: barriers and strategies	Hemati	2005	Theoretical
6	Barriers and challenges to agricultural insurance technology	Salami and Door Andish	2004	Theoretical
7	The role of private insurance in development of agricultural insurance	Isari	2004	Theoretical
8	Effect of agricultural product insurance on economic performance	Spori *et al.*	2012	Simultaneous equation systems
9	Supply and effect of agricultural specialized insurance	Lijen	2011	Regression
10	Development of insurance and economic growth	Lian *et al.*	2010	GMM method for dynamic panel data
11	The relationship between insurance and economic growth	Hais and Siumji	2006	Granger causality test
12	Does insurance support economic growth?	Kogler and Ofoghi	2005	Johanson and causality tests
13	Efficiency of insurance market and selection of agricultural products in Pakistan	Korosaki and Fafchamps	2002	Diminished form and structural models
14	Production effect of the policies supporting agricultural income under uncertainty	Hansi	1998	Regression

avoid false regressions. For this purpose, Levin, Lin and Chu (LLC) test and few other tests were used. The results are presented in Table 2. The results showed that all variables used in the model are static. In other words, the null hypothesis claiming a unit root is rejected.

Testing for Group effects, fixed effects and random effects

In this section, the necessity to use panel data for model estimation is checked. Next, necessary tests are performed to select the best method for model estimation using panel data.

A) Testing significance of group effects

Prior to discussion about interpretation of results and judgment on the relationship between agricultural product insurance and agricultural growth, it is necessary to check homogeneity of the studied provinces. In this test (conducted by F test), the null hypothesis claims homogeneity of the provinces. If the null hypothesis is rejected, panel data technique will be used. If the null

Table 2. Results of unit root test

Variable	Test				Degree of integration
	Levin, Lin & Chu	Im, Pesaran and Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square	
V	-10.3034 (0.000)	-4.26266 (0.000)	121.811 (0.000)	264.402 (0.000)	1 [0]
K	-17.8341 (0.000)	-7.10517 (0.000)	170.024 (0.000)	225.807 (0.000)	1 [0]
L	-6.96546 (0.000)	-3.15477 (0.008)	102.855 (0.001)	234.509 (0.0000)	1 [0]
S	9.78417 (0.000)	-3.23458 (0.006)	99.5472 (0.003)	414.956 (0.000)	1 [0]

Source: Research Calculations (numbers in parentheses indicate the probability of variables is the model)

Table 3. The results of group effects, fixed effects and random effects

Group effect test (F)	**0.0921101 (214.00)**
Hausman test (Chi-Sq. Statistic)	

Table 4. Model estimation results

Variable	Coefficient	Standard deviation	t-statistics	Probability
C	5.06386	0.346113	14.6306553	0.0000
S	0.024415	0.009422	2.59141326	0.0257
K	0.23148	0.024731	9.35991266	0.0000
L	1.041257	0.074876	13.9064186	0.0000
F-statistic	963.7423			
R^2	0.911784			
Adjusted R-squared	0.910416			
Durbin-Watson stat	1.862632			

Source: Research calculations

hypothesis was accepted, pooled least square method will be used. The results are shown in Table 3-4.The null hypothesis was rejected; therefore, panel data technique was used.

It should be noted that one model was not estimated for all studied variables and several models were estimated to ensure reliability of the proposed model. For this purpose, F test was performed with following degrees of freedom as N-1, N-K-NT (N: the number of provinces, K: the number of explanatory variables and T: the number of observations over time) to select panel data technique with aggregated least squares method. Calculated F-values were compared with F-table. F-values computed for the model are presented separately in the table. The results are shown in the first row of Table 3-4, which indicate that the null hypothesis was rejected. Thereby, panel data technique was used for all provinces in the studied period.

B) Selecting between fixed effects and random effects

At this stage, either fixed effects or random effects should be selected among two model estimation methods for panel data. It should be noted that time is not considered in estimating fixed effects and only the effects specific to each unit are considered as individual effects. However, time is considered in estimating random effects and individual effects of the units over time as explanatory variables are separately logged into the model (Green, 2000). Hausman test was used to decide on whether

fixed effects or random effects should be used. Hausman test results are shown in Table (3-4), which confirm random effects. This is because probability of Chi-Sq. Statistic was greater than 0.05%, which confirms the null hypothesis and random effects. The numbers in parentheses show probability of the statistics.

Estimating research model

Model estimation results using random effects are shown in Table (4). It should be noted that random effects indicate that random causes and factors in all provinces affect economic growth. These factors can be caused by natural disasters, drought, etc. However, this result was not unexpected given the immense impact of environmental variables such as flood, drought and rain, etc. (as random effect) on agriculture.

Growth rate of the amount of compensation paid to agricultural sector had a significant and positive effect (0.025) on value added in the agricultural sector in various provinces in Iran from 2001 to 2011. It should be noted that this coefficient was less than other classical factors of production like labor and capital. It was also found out that growth of gross capital formation in the agriculture had a significant and positive relationship (0.23) with growth rate of value added in agricultural sector. There was also a significant and positive relationship between growth rate of labor and growth rate of value added in the agricultural sector(1.04). Therefore, labor is still a major growth factor in the agricultural sector in Iran since coefficient of this variable is larger than other variables in the model.

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