



Management

AN EMPIRICAL EVIDENCE OF THE EFFECT OF PREMIUM AND PREMIUM SUBSIDY ON FARMERS COVERAGE UNDER CROP INSURANCE

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Abstract

Agriculture sector is the prime mover of state economy of Odisha. It drives the state economy towards the inclusive and sustainable development. Odisha is one of the states in which risk in crop production is very high due to variability in rain fall, low resources base of farmer, frequency occurrence of natural calamities etc. In such a risky environment of the state there is a greater need for crop insurance in the event of crop failure, the insured farmer will receive indemnity to cover their loss. This article examines the effect of premium and premium subsidy on farmers' coverage in crop insurance in Odisha by using Log linear model to measure the effect of premium and premium subsidy on the farmers coverage. We have analysed the data with the help of eview and do the residual test and found that the model is suitable for the study. Our empirical results shows that there is significant effect of premium and premium subsidy on farmers coverage under crop insurance both kharif and rabi season.

Keywords: Crop Insurance; Risk; Elasticity; Premium Subsidy; Premium; Farmers Coverage.

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1. Introduction

Agriculture in India is the largest private sector enterprise in the world comprising more than 55% of the total population of the country and contributing more than 16% to GDP of the economy. Agriculture can be considered as a key driver for economic as well as human development. The government of India has been trying to develop the sector with numerous

schemes since independence. Some of them though successful, many of them failed miserably. The production has increased manifold and India has become self-sufficient in food grain production. In spite of these the fate of Indian farmers has not improved much specially in case of small and marginal farmers who constitutes more than 70% of the total population. Agriculture has become a risky business in developing countries like India where the farmers are dealt with series of risk related to the production, market, weather etc.

There has been continuous human cry about the farmers distress and suicides in India for the last twenty years. Agriculture production and farmers income in India are frequently affected by natural disasters such as floods, droughts, landslides, storm, earthquake and cyclone. Besides the natural disasters, there are several manmade factors such as fire, sale of bad quality of seed by the government, non-availability of fertilizer, pesticides and price crashes also affect farmer's income as well as agricultural production. Now the question is how to protect the farmers by minimizing the losses. In order to stabilize the income of farmer, the government provides Minimum Support Price (MSP). But many of the states yet to be implement MSP. Now a day's future trading has been introduced in which helps in manage adverse price fluctuation. But the farmers are not aware of this concept. The above adverse events are the major factors leading to farmer's distress and suicide. So the agriculture insurance is considered as an important means to effectively address the production risk and income resulting from natural and manmade activities.

Crop insurance as the concept for risk management in agriculture has emerged in India since twentieth century. It has evolved occasionally but continuously throughout the century and is still evolving in terms of scope, methodology, and practices. Government of India introduced crop insurance scheme in order to help the farmer at least to face the distress caused due to natural calamities and adverse climatic conditions destroying the crops .The scheme has been modified over the period of time and has now named as Pradhan Mantri Fasal Bima Yojana (PMFBY) with substantial modifications.

2. Previous Work

Many theoretical and empirical studies pointed out that in the developing countries where agriculture is the main sources of living and to give protection to small, medium, marginal and large farmers from risk the area yield insurance is logically better than the other scheme (Dandekar 1976, 1985, Ahsan et al. 1982, Miranda 1991, Mahul and Kalvakoonda 2005). Many studies also found that demand for crop insurance was not affected by the level of crop insurance premium or premium rates (Gardner and Karmer 1986, Goodwin 1993 Coble. et al 1996, Shaik. et al 2008). There are several studies Rao (2010, Nair 2010, Cappiello et al. 2012) that evaluate National Agriculture Insurance Scheme (NAIS) and purpose whether insurance as more effective alternative for small holder farmers.

It is found that under the NAIS the participation rate is low but claim to premium ratio is high. The NAIS has covered only about 10 percent of gross cropped area and the claims to premium ratio were about 4.17 in Kharif crop till 2002(Sinha 2004). As regards to the perception awareness towards crop insurance as a tool for risk management using Tobit and Probit models ,It was found that 65 percent of the farmers were aware of risk mitigation measures

(Kumar2011). The main difference between the NAIS and Weather Based Crop insurance (WBCI) scheme is that weather index insurance need relatively high start-up cost (I.e. weather station) Nair (2010, Raju & Chand 2008). Some studies also found that, the yield insurance (NAIS) does not face a high initial investment, but faces a high administrative and transaction cost through the provision of insurance (, Rao 2010, Raju & Chand 2008).

Normally in USA, Crop insurance premium subsidies encourage farmers to insure more crop acreage or to increase crop coverage level and it is indicated that 19% increase in subsidy per Liability increase planted acreage about 1.3% from its average (Yu 2015). As far as the relationship between chemical input use and crop insurance purchase decision for dry land wheat farmers in USA, it was found that the dry land wheat producer who purchase crop insurance use fewer agriculture chemical inputs. The result of the study also indicates farmers who use agriculture chemicals inputs more intensively are less likely to purchase crop insurance (Vincent et al2017).

Research Gap- perhaps many studies on crop insurance had been conducted in India but few studies had been conducted on crop insurance with special reference to Odisha. This paper will determine the elasticity of non loanee farmers insured in relation to total farmers insured under National Agriculture Insurance Scheme (NAIS): a case study of odisha will add some values in the existing literature.

3. Historical Development of Crop Insurance in the World

The first agriculture insurance emerges over 200 years ago against the risk of live stock mortality and climate risk. The oldest type of insurance is hail insurance has existed in Germany since 1700. This insurance scheme covers against single identifiable risk. The livestock insurance started in Germany in the 1830 and Switzerland by 1900. These insurance schemes were provided by small mutual companies offering coverage on single identifiable risk. Thus the multi peril crop insurance started first time in United States in 1930. Federal crop insurance was first authorised in title V of the agriculture adjustment act 1938. This scheme was launched in pilot basis and covers only wheat. In 1980 federal crop insurance act was passed. To increase the participation of farmer's premium were subsidised up to 30% of the premium cost. Prior to 1980 agriculture producer paid the full premium on the risk of loss. Japan started the multi peril crop insurance scheme in 1939 that provides nationwide coverage of rice and wheat. Canada implements the multi peril crop insurance scheme in 1959. Italy Spain, France implements the scheme in 1970, 1980 and 2005 respectively. However china started the crop insurance scheme in 1982.

4. Historical Development of Crop Insurance in India

4.1. Pre-Independence

As far back as 1915 in the pre independence era Shri J.S Chakravarthi of Mysore state had purposed a rain insurance scheme based on area approach for the farmers with a view to ensuring them against drought. In 1920 Shri Chakravarthi published a book titled, agriculture insurance

scheme: practices scheme suited to Indian conditions. Although chakravarthi plan was never implemented, it still serves as the basis of crop insurance in India today.

4.2. Post-Independence

In 1947 the need for crop insurance was recognised by the government and a committee was appointed in 1948 to study the problems and to operationalise the crop and cattle insurance schemes in experimental basis in few selected areas. A crop insurance bill was introduced in the parliament in 1965. The draft bill was prepared and referred in March 1970 to an expert committee chaired by one on crop insurance for fully examination of economic, administrative, finance and actuary implications under the chairmanship of Dharam Narain. The committee came to the conclusion that it was not advisable to introduce crop insurance in near future on pilot or experimental basis.

The general insurance department of life insurance corporations introduced a crop insurance scheme on H4 cotton in Gujarat during 1972. Later on in 1972 general insurance corporation business was nationalised by an act of parliament and the General Insurance Corporation was set up. The new corporation took over the experimental scheme in H-4 cotton in Gujarat. This scheme was based on individual approach and continued till 1978-79.

4.3. Pilot Crop Insurance Scheme 1979

With the experience of the experimental scheme for crop insurance a study was conducted by GIC under chairmanship of agricultural economist Prof.V.N.Dandekar. The committee looked into issues and revise the Dharam Narain committee view. Based on the recommendation of Prof.V.M.Dandekar a pilot crop insurance scheme was introduced by GIC in 1979 the important features was that the scheme was based on area approach, and Participation of state government was voluntary, The risk was shared by GIC and respective state govt in the ratio of 2:1. This scheme continued till 1984-1985 with participation of 13 states.

4.4. Comprehensive Crop Insurance Scheme (CCIS) 1985

The CCI scheme was launched in 1st April 1985 to protect major crop by the government of India with the participation of state government. This scheme used homogeneous area approach. CCI was an instrumental of risk management in agriculture. This scheme provides relief to the farmers whose crops were damaged due to natural calamities.

4.5. Experimental Crop Insurance Scheme (ECIS) 1997

This scheme was introduced in Rabi session 1997 with the substantial modification of CCIS. This scheme covered initially 14 districts of 5 states to cover non loanee small and marginal farmers giving them 100% subsidy premium. The Premium subsidy and Claims were shared by the Central and respective State Governments in 4: 1 ratio. Due to administrative and financial difficulty this scheme was lasted for one season.

4.6. National Agricultural Insurance Scheme (NAIS) 1999

This scheme replaced the CCIS from the Rabi session 1999-2000. This scheme was introduced to address the operational problems that arose during the CCI implementation. The main objectives of this scheme were

- 1) To encourage farmers to adopt progressive farming practices, high value input and high technology in agriculture.
- 2) To help stabilise farm income, particularly in disaster area.
- 3) To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases.

4.7. First Weather Index Insurance 2003

The first weather insurance product was introduced in India in 2003 by ICICI-Lombard in Andhra Pradesh as pilot basis was launched more broadly in 2005.

4.8. Weather Based Crop Insurance Scheme (WBCI) 2007

This scheme was introduced from kharif 2007 season in selected area on pilot basis. The main objective of this scheme is to bring more farmers under crop insurance programme. WBCIS is intended to provide insurance protection to the farmers against adverse weather incidence, such as deficit and excess in rainfall, high or low temperature, humidity etc, which are deemed to adversely affected crop production. The advantage of this scheme is to settle the claim within shortest possible time.

4.9. Modified National Agriculture Insurance Scheme (MNAIS) 2010

In 2004 the joint working group and World Bank purposed modification of NAIS to overcome its drawbacks. MNAIS was implemented on pilot basis in 50 districts from Rabi 2010-11 seasons with improved over NAIS. Under this scheme unit area is reduced to village Panchayat level for major crops.

4.10. National Crop Insurance Programme (NCIP) 2013-14

To make the crop insurance scheme more farmers friendly a new restructured central sector scheme was introduced in the rabi 2013-14 season namely National Crop Insurance Programme. NCIP was approved by merging the existing pilot scheme of Modified National Agricultural Insurance Scheme (MNAIS), Weather Based Crop Insurance Scheme (WBCIS) and Coconut Palm Insurance Scheme (CPIS) with some improvement. NCIP replaces the existing NAIS from rabi 2013-14. However on the request of some state NAIS was allowed in few states during rabi 2013-14 and 2014-15 and at the option of the state for the year 2015 16.

4.11. Pradhan Mantri Fasal Bima Yojana (PMFBY) 2016 (YIELD BASED)

Taking the problems faced by the earlier scheme the Government of India has recently introduced a new scheme called PMFBY by replacing existing NAIS/MNAIS from kharif 2016.

PMFBY will provide a comprehensive insurance cover against failure of the crops thus helping in stabilising the income of the farmers and encourage them for adoption of innovative practices. The scheme is compulsory for loanee farmers obtaining crop loan for notified crops. However, this scheme was voluntary for other /non-loanee farmers who have insurable interest in the insured crops.

4.12. Objectives of the Study

- 1) To find out the relationship among the farmers insured, premium and premium subsidy in the kharif and rabi season in Odisha under NAIS.
- 2) To determine the effect of premium paid by the farmers and premium subsidy on farmers coverage under crop insurance in kharif season.
- 3) To study the effect of premium paid by the farmers and premium subsidy on farmers coverage under crop insurance in Rabi season.

5. Methodology

The broad aim is to find out the effect of premium and premium subsidy on farmers covered under crop insurance. The study is entirely based on the secondary data. The data were collected from the Agriculture Insurance Company of India limited. The Study period was 13 years starts from 1999 rabi season to 2013 kharif season. To study the effect of premium and premium subsidy on farmers' coverage under crop insurance we have used log linear model. We have analysed the data with the help of E-views software.

5.1. Specification of Variables

The following are the specifications of the variables which are included in our model. Among all the variables some of the variables are explained variables and others are explanatory variables.

- 1) **Premium**- The premium means total premium paid by the farmers. This variable was treated as an Independent variable in the construction of the model.
- 2) **Premium subsidy**- Premium subsidy means the amount of subsidy allowed to small and marginal farmers to be shared equally by the government of India and state government in the kharif and rabi season. This variable is the explanatory variable.
- 3) **Farmers coverage in crop insurance**- Farmers coverage means all farmers including share cropper, tenant farmer growing the notified crop in the notified area are eligible for coverage. This variable is taken as the explained variable for constructing the model.

5.2. Specification of Hypothesis

The hypothesis that is to be tested in light of data collected secondary sources.

Hypothesis 1 – There is no significant effect of premium and premium subsidy on farmers' coverage in crop insurance in the kharif season.

Hypothesis 2 - There is no significant effect of premium and premium subsidy on farmers' coverage in crop insurance in the rabi season.

5.3. Log Linear Model

To study the effect of premium and premium subsidy on farmer’s coverage under crop insurance log linear model has been used. This model is also known as exponential regression model.

$$Y_i = \beta_1 X_{2i}^{\beta_2} X_{3i}^{\beta_3} e^{u_i} \text{Eq.....1}$$

Where Y = farmers coverage under crop insurance, X₂ =premium paid by the farmers,
 X₃ = premium subsidy.

From Eq. (1) it is clear that the relationship between employment generation and two independent variables is nonlinear. However if we log transform this model, we obtain

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + u_i \text{Eq.....2}$$

This can be expressed as

$$\text{Log (Farmers coverage)} = \alpha + \beta_2 \text{Log (Premium paid)} + \beta_3 \text{Log (premium subsidy)} + u_i \text{Eq... 3}$$

Where $\alpha = \ln \beta_1$, this model is linear in the Parameters α , β_2 , and β_3 and is therefore linear regression model. Though it is nonlinear in the variables Y and X but Linear in the Logs of these variables. This Equation can be estimated by multiple regressions because of this linearity, such models are called log-log, double-log, or log linear models.

Where β_2 is the (partial) elasticity of farmers coverage with respect to the premium paid by the farmer, that is, it measure the percentage change in farmers coverage for 1 percentage change in premium rate keeping the premium subsidy constant.

6. Result and Discussion

Table 1: Coefficient Correlations

Analysis of association of variables: ordinary; sample 2000- 2013; Observation: 14				
Correlation	Farmers Insured	Premium	Subsidy	TFB
farmers insured	1			
premium	0.9089*	1		
subsidy	0.7688*	0.7009*	1	
TFB	0.7652*	0.6042*	0.9065*	1

Source- Authors own computation based on secondary data collected from Agriculture Insurance Company of India limited.

* stand for significant correlation among the variables as the P-Value is extremely small.

TBT stands for Total farmers benefited from in Kharif season.

The table No-1 shows the coefficient correlation among the Farmers insured, premium, subsidy, premium paid by the farmers and total farmers benefited under National Agriculture Insurance Scheme in odisha from 2000 kharif season to 2013 kharif season. The above correlation matrix

clearly depicts that there is very high degree of positive correlation between farmers insured and premium paid by the farmers. In other word when one variable increases others follows it and vice-versa. There is a very high degree of positive correlation between the farmers insured and premium subsidy. In order to avoid multicollinearity problems in our model, the farmers benefit have not been take. There is positive correlation among farmers insured, premium paid by the farmers and premium subsidy.

6.1. Log Linear Model

Table 2: Regression results of the effect of Premium and Premium subsidy on Farmers coverage

Method: least Squares; Sample: 2000-2013 ; Observation:14							
Dept. var	Explanatory Var	Coefficient	S.E	t-stat.	F- stat	R Squ (Adj R-Sq)	DW stat.
Log (Farmers coverage)	Constant	4.2768*	0.9922	4.31	51.39 (.000003)	0.903 (0.885)	1.96
	Log (Subsidy)	0.1613**	0.0626	2.57			
	Log (Premium)	0.3417*	0.0498	6.85			

Source- Authors own computation based on secondary data collected from Agriculture Insurance Company of India limited.

Estimates marked with* stand for significant at 1% level,** indicates for significant at 5 % level. Dept. Var. = Dependent Variable; E.V = Explanatory variable; S.E = Standard Error; t-stat = t statistics; DW stat = Durbin – Watson statistics; Log (subsidy) = Logarithm of Subsidy given to farmers; Log (Premium) = logarithm of Premium paid by the farmers; the bracket of F. statistics indicates corresponding P.vale.

The above table reveals the regression result of the effect of premium and premium subsidy on farmers insured in odisha in kharif season from 2000 to 2013. We found that the premium paid by the farmers to the insurer play an important role in farmers insured in the kharif season in the state. As the model is log linear, thus 0.3417 coefficient of premium is less elastic that is a ratio of farmers coverage to premium paid by the farmers. The result indicates that as the premium rate changes by 1 percentage, farmer’s insurance coverage changes by .3417 percentages holding subsidy as constant. It is noteworthy that premium plays an important role in farmer’s coverage under crop insurance scheme. It also depicts that premium subsidy paid by the central and state government play a vital role in farmer’s coverage under crop insurance. Further the result indicates that 1 percentages change in premium subsidy paid by the government to the insurer it impacts on farmers coverage under crop insurance in the kharif season is 0.1613 percentage, holding premium paid by the farmers as constant. We have found that the effect premium paid by the farmers and subsidy on farmers coverage is significant as the p value is less than 05% hence we reject our null hypothesis.

From the statistical view point the estimated regression line fits the data quite well. The R square value of 0.903 means that about 90 percent of the variation in the (log of) farmers covers under crop insurance in the kharif season is explained by the (logs of) premium paid by the farmers and subsidy. The estimation of the equation is done with the help of evIEWS and do the residual

test and found that the model should not have heteroscedasticity, the residuals are normally distributed and there is no serial correlation in the model.

Table 3: Coefficient Correlations in rabi season

Analysis of association of variables: ordinary; sample 1999- 2012; Observation: 14				
Correlation	Farmers Insured	Premium	Subsidy	
farmers insured	1			
premium	-0.3159	1		
subsidy	0.6073*	-0.1537	1	

Source- Authors own computation based on secondary data collected from Agriculture Insurance Company of India Limited.

* stand for significant correlation among the variables as the P-Value is extremely small.

The table No-3 shows the coefficient correlation among the Farmers covered under crop insurance, premium paid by the farmers and premium subsidy, under National Agriculture Insurance Scheme in odisha from 1999 rabi season to 2012 rabi season. The table indicates that there is a significant positive correlation between farmers insured and premium subsidy. There is negative correlation between the farmers insured and premium paid by the farmers meaning that if the premium rate or premium paid by the farmer’s decreases farmers insured increases in the rabi season. The relationship between subsidy and premium paid by the farmers is negative but insignificant as the P-value is extremely high.

Table -4 Regression results of the effect of Premium and Premium subsidy on Farmers coverage in Rabi season

Method: least Squares; Sample: 1999-2012 ; observation:14							
Dept. var	Explanatory Var	Coefficient	S.E	t-stat.	F- stat	R Squ (Adj R-Sq)	DW stat.
Log (Farmers coverage)	Constant	-11.292*	6.223	-1.81	10.98 (.0029)	0.68 (0.62)	1.31
	Log (Subsidy)	0.519***	0.2497	2.08			
	Log (Premium)	0.9217*	0.1967	4.68			

Source- Authors own computation based on secondary data collected from Agriculture Insurance Company of India limited.

Estimates marked with* stand for significant at 1% level,** indicates for significant at 5 % level, *** indicates significant at 10% level.

Dept. Var. = Dependent Variable; E.V = Explanatory variable; S.E = Standard Error; t-stat = t statistics; DW stat = Durbin – Watson statistics; Log (subsidy) = Logarithm of Subsidy given to farmers; Log (Premium) = logarithm of Premium paid by the farmers; the bracket of F. statistics indicates corresponding P.vale.

The above table reveals the regression result of the effect of premium and premium subsidy on farmers coverage under crop insurance in odisha rabi season 2000 to 2013. We found that the premium paid by the farmers to the insurer play an important role in farmers insured in the rabi season in the state also. The coefficient of premium is .9217 is less elastic. The result indicates that as the premium rate changes by 1 percentage, farmer's insurance coverage changes by .9217 percentages holding subsidy as constant. It also depicts that premium subsidy paid by the central and state government play a vital role in farmer's coverage under crop insurance. Further the result indicates that 1 percentages change in premium subsidy paid by the government results in .519 percentage changes in farmers insurance coverage in the rabi season. We have found that the effect premium paid by the farmers and subsidy on farmer's coverage is significant; hence we reject our null hypothesis.

The R square value of 0.68 means that about 68 percentage of the variation in the (log of) farmers covers under crop insurance in the rabi season is explained by the (logs of) premium paid by the farmers and subsidy. The estimation of the equation is done with the help of eviews and do the residual test and found that our model is homoscedasticity, stationary, normally distributed and there is no serial correlation.

7. Conclusion

In this study we have analysed the effect of premium and premium subsidy on farmers coverage under crop insurance during the period Rabi 1999 to Kharif 2013 under National Agriculture Insurance Scheme. Here the log linear model is considered for empirical analysis and is estimated by ordinary least square techniques. We have found that the relationship among the variables is positive in the kharif season but in the rabi season there is negative relationship between farmers insured and premium rate and premium rate and subsidy. The empirical results indicate that 1 percentage change in premium and premium subsidy results in .16 and .34 percentage change in farmers coverage under crop insurance in the kharif season meaning that the premium and premium subsidy has significant positive effect on farmers insured. The results also found that 1 percentage change in premium and premium subsidy in the Rabi season results in .92 and .52 percentages change in farmer's coverage under crop insurance in Odisha.

Appendix 1

Kharif	Farmers insured kharif season	Subsidy	Total premium paid by farmer	Rabi	Farmers insured in odisha in rabi season	Total premium	Premium subsidy
2,000	681010	5,00,00,000	112392562	1999	232836	22844642	97,60,000
2,001	627568	3,00,00,000	102218803	2000	123964	18561159	79,70,000
2,002	1204849	7,00,00,000	298560962	2001	212162	33184437	1,00,00,000
2,003	638303	2,00,00,000	138160518	2002	142871	25437945	64,70,000
2,004	872551	2,00,00,000	254954481	2003	202699	33678681	57,60,000
2,005	900022	2,00,00,000	263334143	2004	200853	49858874	42,40,000
2,006	880330	2,00,00,000	275039791	2005	230039	57848051	47,40,000

2,007	840727	2,00,00,000	282415471	2006	199886	52583352	42,30,000
2,008	611447	2,00,00,000	217694400	2007	132418	38119451	29,40,000
2,009	1068687	3,00,00,000	396960881	2008	161720	49783305	40,00,000
2,010	1107710	4,00,00,000	470714428	2009	134672	46502950	37,00,000
2,011	1428590	5,99,00,000	729027524	2010	34676	15003612	11,00,000
2,012	1445986	6,92,00,000	795514834	2011	69150	42429399	29,00,000
2,013	1309088	7,15,00,000	855721642	2012	76983	574727771	40,00,000

Source- collected from AIC India limited

References

- [1] Agricultural Finance Corporation Ltd (2012), A Study on National Agricultural Insurance Scheme (NAIS) at http://www.afcindia.org.in/PDF/research_reports/NAISFinal%20Report-17.01.12/NAIS-Final%20Report-170112.pdf [consulted on March 4, 2014].
- [2] Agriculture Insurance Company of India limited.
- [3] Ahsan, S. M., A. Ali, and N. J. Kurian, (1982), "Toward a Theory of Agricultural Insurance" *American Journal of Agricultural Economics* 64, 520-529.
- [4] Dandekar, V.M (1976), "Crop Insurance in India", *Economic and Political Weekly*, A-61 to A-80.
- [5] Dandekar, V.M (1985), "Crop Insurance in India A Review, 1976-77 to 1984-85", *Economic and Political Weekly*, 20(25&26): A-46 to A-59.
- [6] Department of Agriculture (2016) "Operational Guidelines Pradhan Mantri Fasal Bima Yohana" *Ministry of Agriculture and Farmers Welfare*, Krishi Bhawan, New Delhi.
- [7] Economic Survey (2015-16, 14-15): Department of planning and convergence, Government of odisha.
- [8] Goodwin B.K. (1993), "An Empirical Analysis of the Demand for Multiple Peril Crop Insurance", *American Journal of Agricultural Economics*, 75, 425-34.
- [9] Government of India (2004), "Report of the Joint Group on Crop insurance", Ministry of Agriculture.
- [10] Government of India (GOI, 2014), "Report of the Joint Group on Crop Insurance", Ministry of Agriculture.
- [11] Gujarati, D and Sangeetha (2011), "Basic Econometric", Tata Mc Hill New Delhi.
- [12] <http://www.eviews.com>.
- [13] Kumar, D.S., Barah, B.C., Ranganathan, C.R., Ranganathan, R., Gurunathan, S. And Thirumorthy, S. (2011), "An Analysis of Farmers' Perception and Awareness towards Crop Insurance as a Tool for Risk Management in Tamil Nadu", *Agricultural Economics Research Review*, 24, 37-46.
- [14] Miranda, M. J. (1991), "Area yield crop insurance reconsidered", *American Journal of Agricultural Economics*, 73, 223-242.
- [15] Nair, R. (2010), "Crop Insurance in India: Changes and Challenges", *Economic and Political weekly*, 6(6).
- [16] Planning Commission (2007), Report of working Group on "Risk Management of Agriculture" XI five year plan.
- [17] Raju, S S and Ramesh Chand (2007), "Progress and Problems in Agricultural Insurance in India", *Economic and Political Weekly*, May 26, pp.1905-1908.
- [18] Rao, K N (2010), "Index based Crop Insurance", *Agriculture and Agricultural Science Procedia*, 1, 193-203.
- [19] Shaik, S. K.H.Coble, T.O. Knight, A.E. Baquet, G.F. Patrick. (2008), "Crop Revenue and Yield Insurance Demand: A Subjective Probability Approach", *Journal of Agricultural and Applied Economics*, 40, 3:757-766.

- [20] Sinha, Sidharth. (2004), "Agricultural Insurance in India: Scope for Participation by Private Insurers", *Economic and Political Weekly*, vol 39, No 25 pp 2605-12.
- [21] Thirumoorthy, S. (2011), "An Analysis of Farmers' Perception and Awareness towards Crop Insurance as a Tool for Risk Management in Tamil Nadu", *Agricultural Economics Research Review*, 24:37-46.
- [22] Vincent H, smith and Barry K. Goodwin (2017), "Crop insurance, moral Hazard and Agriculture Chemical use", *American Journal of Agriculture Economic*, Feb PP 189-201.
- [23] Yu, jisang (2015) "The Acreage effects of Premium Subsidies in US crop insurance", *job market paper working Draft- preliminary and incomplete of US*, Nov 3, 2015.

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