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Improving Net Revenue of Farming in Indonesia through Agriculture Extension and Risk Aversion: A Time series Analysis

Yusro Hakimah[a*], Mala Ganatri[b], Sulbahri Madjir[c], Sutardi[d], Eka Nopi Aktiva[e], [a,e]Faculty of Engineering, Universitas Tridinanti Palembang, Indonesia, [b]Faculty of Economics, STIE International Golden Institute, Jakarta, Indonesia, [c]Faculty of Economics, Universitas Tridinanti Palembang, Indonesia, [d]Faculty of Economics, STIE Bisnis, Indonesia,
***Corresponding Author Email** : [a*]yusrohakimah@yahoo.co.id

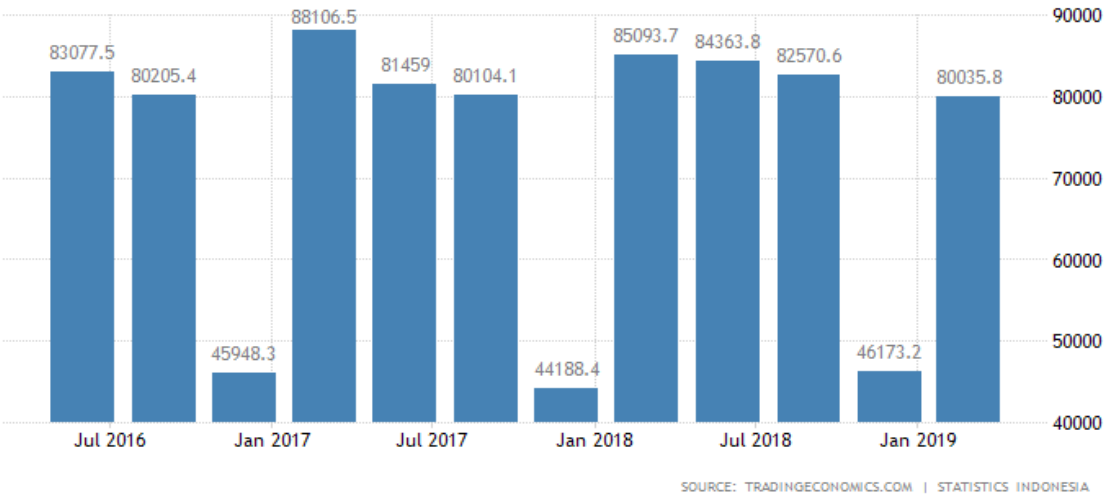
The purpose of this study was to analyze the impact of risk aversion and "agricultural extension services" (AES) on the "revenue of farming" (ROF). For this purpose, this research was conducted in Indonesia where the data was collected regarding the current variables and time series approach was adopted to check the relationships. The time series approach enabled the researcher to identify the lags at which some relationship were significant. The data collected through secondary sources was subjected to analysis in which descriptive, co-integration, unit root and heteroscedasticity tests were applied on the data. The regression equation was applied to check the relationships. The results of regression revealed that the AES has significant positive influence on the revenue of farming at first lag in Indonesia however, the impact of risk aversion on ROF was not proved to be significant and therefore, it is found that risk aversion is not a significant predictor of ROF in Indonesia. However, the AES is a significant predictor of net revenue of farming in Indonesia. The results of "long-run equation" and "short run equation" proved that AES and risk aversion have no significant long-term impact on ROF however, they both have significant and positive short-term impacts on ROF. The current study has important implications in theory and practice because it reveals the role of AES and risk aversion in the net revenue of farming in Indonesia.

Key words: Net Revenue of Farming, Agriculture Extension service, Risk Aversion, Indonesia.

Introduction

Agriculture is the crucial segment for the economy of Indonesia. Even though the agricultural sector's input in national GDP has meaningfully deteriorated since three decades ago (Nugraha & Osman, 2017), it still continues to be a revenue source for mainstream Indonesian families (Yanuarti, Aji, & Rondhi, 2019). The prominence of agriculture in the frugality of Indonesia, as well as other republics, is gauged as the worth added to the national GDP due to farming (Negoro et al., 2018). The agriculture sector involves fishing, hunting, forestry, in addition to the farming of crops as well the production of livestock With the massive and plentiful fertile loams, Indonesia remains a chief world-wide producer of an extensive range of agrarian tropical crops, where it continues to provide nutrients and revenue for the majority of the rural population. Below, in Figure 1, the statistics of net revenue of farming in Indonesia over the last four years (Sivaraman, Krishnan, & Radhakrishnan, 2019) are presented.

Figure 1. Net Revenue of Farming in Indonesia



Agriculture extension services have been altering the agricultural sector of Indonesia in recent years. Before the era of the 1970's, the Indonesian economy was founded on outdated agricultural practices (Ton, Vellema, Desiere, Weituschat, & D'Haese, 2016). However, since 1970, the nation has restructured its agricultural innovation through the institution of modern and up-to-date agricultural involvement and services. These modern technological and managerial skills and expertise were delivered to the farmers and peasants by the strategic use of agricultural extension services (Negoro et al., 2018).

However, many social scientists currently report that poor agriculturists prefer to use those agricultural practices and crop permutations that maintain their current living standard instead of adopting substitutive economic approaches that are possibly more cost-effective but involve greater risks(Slamet, Nakayasu, & Ichikawa, 2017). Risk aversion is the concept where peasant

farmers avoid implementing innovations in farming such as the employment of new seeds or fertilizers and favor subsistence crops instead of cash crops, or pursue non-agricultural employment. Throughout the 1950s and 1960s, the majority of programs designed for rural peasants involved mostly risk aversive or showed conservative behaviors for the adoption of novel agricultural techniques. However currently, an innovation focus is putting pressure on diminishing risk related to the adoption of novel practices in order to increase the net income of the nation (Mariyono, 2017).

Nations which are up-to-date with innovative advancements through agricultural extensions and who are not adverse to risk are economically stable and also have greater net revenue in the agricultural sector. Dissemination of knowledge is important so that agriculturists do not become risk aversive and are highly motivated for implementing innovations in their practice (Negoro et al., 2018). Mostly, Indonesian farmers lag behind in agricultural innovations, which is at the root cause of poverty and the scarcity of food for larger population. Net revenue for farming needs to increase for the entire progress in economic stability and to increase the country's GDP. The issue is prevalent domestically in Indonesia, as well as internationally in republics such as Pakistan, India, Nebraska, Philippines, South Africa, Utopia, etc. which are mostly considered under-developed countries in terms of their net income (Yanuarti, Aji, & Rondhi, 2019). Therefore, to increase the net revenue of farming in Indonesia, it is imperative that adequate agricultural extension services are provided along with decreasing the risk of aversive behaviours.

From a review of the literature, it is evident that improving the net revenue of farming in Indonesia has been researched widely. However, risk aversion has not been researched thoroughly. This is coupled with agricultural extension services for improving net revenue of farming in Indonesia (Ton, Vellema, Desiere, Weituschat, & D'Haese, 2016). Particularly, risk aversion behaviors of farmers has been researched, however its impact on net revenue is not observed in previous studies (Mariyono, 2017). For that reason, thorough research is required in this domain and the current research will focus on evaluating the impact of risk aversion and extension services in improving the net income of farming in Indonesia. The research questions formulated for the current study are given below:

1. To analyze the role of agricultural extension services in improving the net revenue of farming in Indonesia.
2. To evaluate how risk aversion impacts the net revenue of farming in Indonesia.

Net revenue generated from farming helps to increase trade, which can provide a source of offshore currency and makes a state renowned internationally (Altieri, 2018). As Indonesia is the fifth largest agriculturist nation, it makes demands on its farmers to stay up to date with modern agricultural skills and technology which is only possible through the strategic employment of extension services (Etriya, Scholten, Wubben, Kemp, & Omta, 2018).

Moreover, various economic strategies for snowballing the agricultural efficiency and domestic revenues of developing republics comprise of programs proposed to boost agriculturalists to approve novel agricultural practices as well as cash crops. This aims to reduce framers' risk aversive behaviors and motivate them to expend their horizons for the final outcome of maximum net revenue through their innovative farming techniques (Djanibekov & Villamor, 2017).

Literature Review

Impact of agriculture extension on net revenue of farming

It is known that extension services provide necessary knowledge about latest technology and modern practices of agriculture in order to give smallholder farmers higher returns on farming (Irungu, Mbugua, & Muia, 2015). In addition to latest technology, these services also provide better management and marketing skills to farmers which are as much necessary as technology to gain higher profits. The purpose of extension services is to spread this information about technology and marketing to fellow farmers so that they can also benefit from them and enhance their living standards. These services also probe the problems of farmers and make efforts to solve them in the best possible manner (Ng'ombe, Kalinda, & Tembo, 2017). Sometimes extension services don't give required results due to a number of factions such as reluctant behavior of farmers or non-cooperation from the extension services staff.

Studies from Sub Saharan Africa (SSA) show that the main source of income for most of the rural people is agriculture. However, there are certain problems faced by the farmers in SSA such as climate fluctuations, land degradation and soil fertility depletion (Nyuor et al., 2016). To overcome these problems, their government has started development programs to promote water and land conservation processes which have resulted in better resource management and high productivity and profits. Zambia is also using the same processes in order to overcome its rainfall and extreme weather problems (Carroll, Carter, Goodhue, & Lawell, 2017).

One of these processes is conservation farming (CF). This process aim for less soil depletion, better crops and nitrogen fixing crops etc. The FC program has been a big hit and many non-government agencies and development programs were attracted to FC and joined it. With the passage of time, FC became the national agriculture policy used by all farmers in Zambia. FC was focused on the adoption rate of farmers and its impact on them but still adoption rates were very low in smallholder farmers. This low adoption rate was studied extensively and the results showed that this adoption rate is not consistent (Dalhaus, Musshoff, & Finger, 2018). Some studies revealed that FC activities result in welfare gains but these studies had very contradictory results. Some of them inferred that there is no significant impact of FC practices on net revenue of farmers; some said that there is slight impact and some said that there is a heavy impact on net revenues of farmers (Donovan, 2016). Based on all these conflicting

results, this study concludes that FC practices do have impact on net revenue of farmers but under certain circumstances which need to be further studied to determine their impact. Adoption can be determined by studying combination of FC activities and their impact on net revenue of farmers (Emerick, de Janvry, Sadoulet, & Dar, 2016).

It is generally considered that rural areas and agriculture are only for the people who cannot do anything else but this concept should be changed. Traditionally, youth find no attraction in agriculture because according to them, it requires more time and resources and its output is slow, risky and it gives less net revenue as the net revenue depends upon weather conditions and harvesting time (Gong, Baylis, Kozak, & Bull, 2016). Lack of innovation adoption has resulted in traditional farming practices which ultimately results in lower net revenue. Inactiveness of extension services has resulted in limited or no awareness of modern technology and agricultural practices in today's youth. The information about such modern technology and latest farming methods must be communicated on web based platforms because extension services members do no effectively reach to smallholder farmers in rural areas (Gwary, Muhammad, & Mustapha, 2015). Youth can be incorporated in agriculture for generating and processing this information by creating employment opportunities for them. It will be very difficult to attract the youth to get in to agriculture because at present, youth are highly unattached towards agriculture because of potential low net revenue, high inputs and time etc.

Youth is important to agriculture because they are usually well educated and can adopt and handle new things very well (Hanemann, Sayre, & Dale, 2016). They can contribute to bring certain practices and methods of farm management and technology in order to increase t productivity and gain higher net revenues. They can use internet services and mobile phones effectively in order to get information about latest farming practices and use them in agriculture. They can access social media and thus can contact with the relevant costumers and relevant market in a technologically appropriate way. Even digital trade can be effected through internet easily at less cost and minimal time consumption (Huong, Bo, & Fahad, 2018). They can also take control of the accounts and efficiently deal with all monetary matters. In this way, youth can compensate the gap created by unavailability of extension services officers and can perform tasks which were supposed to be completed by extension services. This will ultimately lead to adoption of innovation and technology and provide high net revenues to smallholder farmers. It can be concluded from the above discussions that extension services have very significant effect on the improvement of net revenues earned by farmers (Jensen & Barrett, 2017).

H1: AES has significant impact on Net revenue of farming.

Impact of risk aversion on net revenue of farming

Risk aversion can be defined as the behavior of an investor in which the value of certain lower output is greater than the value of uncertain higher output. In other words, if an investor invests in something with less risk as compared to something having more risk, then that investor is said to be risk averse. This phenomenon is called risk aversion (Emerick et al., 2016). Studies in Sub Saharan Africa SSA revealed that the climate fluctuations have increased the temperatures, frequency and severity of droughts and depletion of soil. In some regions such as South Africa, it may get drier in winter while other regions may enjoy new opportunities of farming at high temperatures (Monjardino, McBeath, Ouzman, Llewellyn, & Jones, 2015).

Some crops give fewer yields with high temperatures while some crops are heat resistant and remain unaffected. In summary, the productivity and net revenue have declined markedly and will decrease further gradually. In this situation, government and private agricultural development centres are focusing on the development of climate smart agriculture in which smallholder farmers are told about the ways by which crops are least affected by climate fluctuation (Jin, Wang, & Wang, 2016). At the same time, some farmers fail to increase productivity and higher income because they fail to use modern technology and latest farming techniques such as the use of fertilizers. This may be due to such reasons as unavailability of credit, no awareness about new technology and higher costs etc.

Studies have made it very clear that innovation of technology adoption has decreased the downside risk as a result of improved crops productivity. An experiment was carried out in Odisha in which an innovative rice type was distributed randomly in 128 villages (Karimi, Karami, & Keshavarz, 2018). This type of seed results in high yield and has high flood tolerance. Other villages of that region were not given any seeds. It was found as a result of that experiment, that modern technology compelled the farmers to adopt innovation in response to the fact that they got very high yield. The experimental results can be divided into four sets. The first result showed that the farmer used the modern technology for agricultural purposes instead of traditional methods and the land used for faming also increased. This led to a concept in farmers that modern technology practices are risk averse and they can provide higher net revenues (Liu, Langemeier, Small, Joseph, & Fry, 2017). Secondly, the results showed that farmers used more fertilizers for crop production during that time to avoid risk of crop loss due to floods. The third result suggested that the use of innovative techniques led to the borrowing of credit by farmers to avoid risk of lack of financial resources. This credit was fully used in the production of higher yields of crops. All these results showed that innovation adoption by farmers lead to risk aversion and results in higher productivity and higher profits (Mishra, Sahu, & Sahoo, 2016).

As studies clearly suggested that farming is full of risks such as drought, floods etc., and that it is very important to study the attitudes of farmers in relation to risk preference. Risk aversion impacts are very difficult to understand but some researchers have used three modules to study in this regard. The most important module suggests that farmers have fixed risk preferences through which researchers find out the utility function of farmer and thus assess risk aversion (Monjardino et al., 2015). Mostly experiments and researches are done in this module of risk aversion assessment. Another module suggests that risk aversion can be determined indirectly by assessing the farmer's investments activities. In this situation, experiments and researches can give different results in real life situations, which may result in misleading results. An alternate of these experiments and researches to measure risk aversion is to conduct opinion polls in which individuals are asked to assess themselves on the criteria of risk aversion based on a scale of 11 (Ng'ombe et al., 2017).

Studies have revealed that opinion polls have almost similar outcomes as that of experiments and researches. So opinion polls are most commonly used for such research purposes as described above. However some studies show inconsistent results and found no correlation between opinion polls and other methods of doing research. In the case where a farmer is risk averse, he will not look forward for higher profits and instead he will be satisfied with fewer variations in profits and productivity. The most commonly accepted concept of risk aversion is decreasing absolute risk aversion which means that the risk adverse attitude of farmers decreases with the increase in wealth and profits (Petsakos & Rozakis, 2015). Some other studies in this regard give ambiguous results i.e. risk aversion may increase, decrease or remain constant. Risk attitudes of farmers are very much important to determine the behavior of a farmer and his management decisions. Nonetheless, many studies related to risk preferences and risk aversion do not give any information about risk management in farmers, which is a very important factor in the improvement of net revenues of farming (Sajesh & Suresh, 2016).
H2: Risk aversion has significant impact on Net revenue of farming.

Methodology

Data Collection and Methods

The current study analyzes the role of agricultural extension services (AES) and risk aversion in the revenue of farming (ROF). For this purpose, the current study has adopted the time series approach through which thirty years' data of respective macroeconomic indicators of Indonesia was taken and analyzed. The population of the current study consists of time series data of AES, risk aversion and ROF for Indonesia from which the sample of 30 years was selected because the sample size seems appropriate for the current study. The data was collected from the archival and database of "World Bank Group"

Variables Definition and Measurements

Following are the variables that are included in the current model:
Dependent Variable: The dependent variable of the current study is "revenue of farming" (ROF) which has been measured through Output of agriculture and taking the percentage of "agricultural forestry and fishing value added".

Independent Variable: The independent variables of the current study included two key variables that are "risk aversion" and "Agricultural extension services" (AES). AES has been measured as a dummy variable which can be assigned value of 1 or 2 only. The risk aversion has been measured as the percentage of R&D expenditure to reduce the risk.

Control Variables: Five control variables were added in this model for maintenance of results. These control variables are named as "carrier yield, economic growth, central government debt, arable land and inflation". Economic growth was measured with GDP rate and arable land was measured with percentage of total arable land in total land while the data about all other variables was available on the database of "World Bank Group".

Modelling and Methodological Framework

The present research adopted the ARDL time series analysis to see the short-run and long-run impacts of AES and risk aversion (RA) on the "revenue of farming" (ROF). The time series analysis was very helpful in identifying the lags at which the AES and risk aversion significantly influenced the ROF in Indonesia. The following regression equation was tested in the current study:

$$\mathrm{ROF}_t = \beta_0 + \beta_0 AES_{t-1} + \beta_3 \mathrm{RA}_{t-1} + \beta_3 \mathrm{CY}_{t-1} + \beta_4 \mathrm{DP}_{t-1} + \beta_5 \mathrm{CDC}_{t-1} + \beta_6 \mathrm{ARL}_{t-1} + \beta_7 \mathrm{INF}_{t-1} + u_{it} \quad (1)$$

Unit Root Test

The "unit root test" was used in the current study to assess the stationery of the data. This test is very important particularly in study, which involves the macroeconomic data or financial data. Therefore, the current study applied this test to assess the stationery of the current macroeconomic data. Through this test, the independence of error terms was ensured. In this study, the "unit root test" including the "ADF Fisher Chi-square (ADF Fisher) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS)" was applied to assess stationery of data. The "unit root test" can be presented through the following mathematical equation:

$$\Delta Y_1 = \beta_1 + \beta_2 \mathrm{t} + \alpha Y_{t-l} + \sum_{t=1}^{r} \rho_i \, \Delta Y_{t-i} + \mu_t \quad (2)$$

Where "ΔY_{t-i}" is the "lag difference", the "β_1" is the "constant term" and "t" is the "time trend". In "unit root test", the "error term" is independent by including the enough "lag difference terms". In "unit root test", Following hypotheses were tested.

$$H_o: \boldsymbol{\alpha = 0}$$
$$H_1: \boldsymbol{\alpha \neq 0}$$

Results

The current study analyzed the impact of AES and risk aversion on the ROF along with the control variables of CY, ARL, GDP, Inflation, and CDC. There was the need to assess the "descriptive statistics, stationery, heteroscedasticity, and co-integration" of the data to analyze the normality and appropriateness of the data before running ARDL model.

Descriptive Statistics

The descriptive statistics found through Eviews revealed that the current data has acceptable normality and adequacy. For this purpose, the values of "skewness, kurtosis, mean value and std. deviation" were considered and interpreted mainly and are presented in Table 1 below

.

Table 1: Descriptive Statistics

	ROF	AES	RA	ARL	CY	CGD	GDP	IN
Mean	6.52722	1.40000	1.13298	13.0892	4508.304	34.2350	7.09131	9.60182
Median	5.96578	1.00000	1.13945	13.0770	4365.800	31.3661	6.91097	6.40656
Maximum	11.2427	2.00000	1.44315	13.2758	5306.600	72.4853	11.9438	58.4510
Minimum	4.43786	1.00000	0.65625	12.9722	3816.900	23.9231	3.05878	3.19835
Std. Dev.	1.84682	0.50000	0.25825	0.10584	519.9653	10.5590	2.43108	10.8853
Skewness	0.84376	0.40825	-0.29906	0.29672	0.150860	0.27321	0.15096	0.83533
Kurtosis	2.82228	1.16667	1.74015	1.69685	1.481168	2.34108	2.19317	1.67261
Jarque-Bera	2.99927	4.19560	2.02601	2.13582	2.497796	51.2469	0.77305	285.546
Probability	0.22321	0.12273	0.36313	0.34373	0.286821	0.53455	0.67941	0.45654

The mean value of ROF, AES, risk aversion, CY, ARL, GDP, Inflation and CDC show that there is no outlier in the data because they fall within the range from minimum to maximum value. Similarly, the value of skewness for all these variables is ranging from -1 to +1 and the value of kurtosis for all of them is ranging from 1 to 3. The probability of Jarque-Bera which is >0.05 for all variables is also confirming that the current data is normal and adequate for further analysis. It can be seen that both ADF and KPSS are giving same results in which it is indicated that all current variables have "unit root" at level. This means that series ROF, AES,

RA, ARL, CY, CGD and IN are I(1) so, the estimation of "cointegrating vector" for current series is allowed by ARDL.

Unit Root Test

The "unit root test" was used in the current study to confirm that data is stationery. For this purpose, the "unit root test" including the "ADF Fisher Chi-square (ADF Fisher) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS)" was applied. Table 2 and Table 3 below present the results of "unit root test" for all variables at level and at first differences.

Table 2: Unit Root Test at the levels of the variables

Variables	ADF (null: variables has a unit root)		KPSS (null: variable is stationery)	
	Test Statistic	Critical value at .05 level	Test Statistic	Critical value at .05 level
ROF	-0.14	-3.01*	0.71	0.79**
AES	0.39		0.89	
RA	1.11		0.81	
ARL	1.17		0.79	
CY	1.18		0.42	
CGD	1.31		0.31	
GDP	1.07		0.39	
IN	1.12		0.46	

Table 3: Unit root test at first differences of variables

Variables	ADF (null: variables has a unit root)		KPSS (null: variable is stationery)	
	Test Statistic	Critical value at .05 level	Test Statistic	Critical value at .05 level
ROF	-6.28	-3.01	0.08	0.79
AES	-7.09		0.21	
RA	-6.09		0.09	
ARL	-6.35		0.19	
CY	-5.29		0.15	
CGD	-6.18		0.08	
GDP	-6.10		0.07	
IN	-5.18		0.04	

Co-integration test

This test was applied to see the co-integration in the data in the data because results of the unit root test suggested that there must be co-integration in the data. The co-integration test was applied on the data with key indicators of "Akaike information criteria (AIC) and Schwarz information criteria (SIC)". The minimum AIC and SIC were checked to determine the optimal m. For rejection of null hypothesis, "F-statistics" must be greater than the "upper bound critical value". The null hypothesis suggests for no co-integration while the alternative hypothesis suggests for existence of co-integration. Table 4 below provides results of co-integration analysis.

Table 4: Cointegration Test

Lag	Intercept			Intercept and trend		
	AIC	SIC	F	AIC	SIC	F
1	-2.210	-1.499	3.47	-2.201	-1.478	3.11
2	-2.165	-1.310	4.02	-2.156	-1.301	3.95
3	-2.110	-1.306	2.46	-2.101	-1.302	2.19
4	-2.112	-1.203	3.57	-2.103	-1.199	3.43
5	-2.119	-1.399	3.26	-2.112	-1.378	3.17
6	**-3.071**	**-1.751**	**5.87***	**-3.052**	**-1.769**	**5.78****
7	-2.795	-1.399	0.95	-2.722	-1.386	0.79

It can be seen in Table 4 that the minimum AIS and SIC and F-statistics against them are revealing that the null hypothesis is rejected because the "F-statistics" is more than "upper critical value". Therefore, it is concluded from the co-integration test that there is co-integration in the data. Furthermore, the minimum SIC and AIC at lag 6 are depicting the optimal m. After proving the co-integration, the "long run equation" and "short-run equation" have been estimated according to the following ARDL models.

$$ROF_t = \beta_0 + \sum_{i=0}^{p}\beta_{1i}AES_{t-i} + \sum_{i=0}^{q}\beta_{2i}RA_{t-i} + \sum_{i=0}^{r}\beta_{3i}CY_{t-i} + \sum_{i=0}^{s}\beta_{4i}GDP_{t-i} + \sum_{i=0}^{t}\beta_{5i}CDC_{t-i} + \sum_{i=0}^{v}\beta_{6i}ARL_{t-i} + \sum_{i=0}^{m}\beta_{7i}INF_{t-i} + \epsilon_t \quad (3)$$

Equation 3 is the long-run equation of current ARDL model.

$$ROF_t = \delta_0 + \sum_{i=0}^{p}\delta_{1i}\Delta AES_{t-i} + \sum_{i=0}^{q}\delta_{2i}\Delta RA_{t-i} + \sum_{i=0}^{r}\delta_{3i}\Delta CY_{t-i} + \sum_{i=0}^{s}\delta_{4i}\Delta GDP_{t-i} + \sum_{i=0}^{t}\delta_{5i}\Delta CDC_{t-i} + \sum_{i=0}^{v}\delta_{6i}\Delta ARL_{t-i} + \sum_{i=0}^{m}\delta_{7i}\Delta INF_{t-i} + \lambda ECM_{t-1} + \pi_t \quad (4)$$

Equation 4 is the "short-run equation" for the current ARDL model in which the ECM is "coefficient of error correction term".

ARDL model

The impact of risk aversion and AES was assessed on farm revenue through time series analysis and regression analysis was run to check their relationships as depicted in Table 5 below.

Table 5: ARDL Model (Dependent Variable: ROF)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AES	0.408654	0.215498	1.896322	0.0822
AES(-1)	0.742036	0.205780	3.605958	0.0036
RA	-1.547153	2.398606	-0.645022	0.5311
ARL	6.647827	7.262542	0.915358	0.3780
CY	0.001239	0.001534	0.807759	0.4349
CGD	-0.005434	0.012142	-0.447508	0.6625
GDP	-0.251193	0.079096	-3.175806	0.0080
GDP(-1)	0.269140	0.067665	3.977535	0.0018
IN	0.082180	0.013552	6.064098	0.0001
IN(-1)	0.046289	0.011085	4.176000	0.0013
C	-90.07576	99.93886	-0.901309	0.3852
R-squared	0.971440	Mean dependent var		6.427673
Adjusted R-squared	0.945261	S.D. dependent var		1.816736
S.E. of regression	0.425051	Akaike info criterion		1.433637
Sum squared resid	2.168018	Schwarz criterion		2.022663
Log likelihood	-5.203639	Hannan-Quinn criter.		1.589906
F-statistic	37.10680	Durbin-Watson stat		1.725815
Prob (F-statistic)	0.000000			

The results of regression show that impact of AES on ROF is significant at first lag and this effect is positive as the one unit increase in AES enhances the ROF by 74 percent. However, the impact of risk aversion on the ROF was insignificant. The control variables i.e. arable land, carrier yield and CGD have insignificant effects on ROF however, the impact of GDP and inflation on the ROF was significant. Hence, the results showed that the AES has significant positive impact on ROF while risk aversion does not have significant effect on ROF. The overall model is good because the adjusted R-sqaure indicated that 94 percent variation in ROF has been explained by the control variables and independent variables of this model.

Table 6: Estimation of Long run and short run equations (Dependent Variable: ROF)

Variable	Long Run Equation			
	Coefficient	Std. Error	t-Statistic	Prob.*
AES	0.021154	1.421553	1.087787	0.6532
RA	0.0231`1	1.964334	1.853215	0.0654
ARL	4.213434	1.423223	2.742223	0.0210
CY	1.423214	1.942111	3.953233	0.0000
CGD	0.312`34	0.976543	3.967544	0.0000
GDP	0.453223	1.643223	1.990777	0.0422
IN	0.031122	2.875443	0.965435	0.7543
Variable	Short Run Equation			
	Coefficient	Std. Error	t-Statistic	Prob.*
COINTEQ01	0.231121	1.043221	2.756433	0.0122
D(AES)	0.213477	0.326668	5.277278	0.0000
D(RA)	0.266161	1.900377	2.174671	0.0134
D(ARL)	3.164666	1.377781	1.994661	0.0012
D(CY)	0.377711	1.377377	1.986621	0.0442
D(CGD)	2.054661	2.177477	1.356277	0.6543
D(GDP)	0.351512	1.377173	2.038871	0.0137
D(IN)	1.046644	1.366663	1.355512	0.4555
C	1.365553	1.035551	1.883838	.07774
ECM	-0.80134	0.96991	2.08998	0.002

The results of "long-run equation" and "short run equation" indicate that AES and risk aversion have no significant long-term impact on ROF however, they both have significant and positive short-term impacts on ROF.

Heteroscedasticity

The heteroscedasticity of the data was checked to ensure that there is no heteroscedasticity issue in the data. For this purpose, the "Breusch-Pagan-Godfrey" test was applied. Table 7 below presents the results of this test. The results of heteroscedasticity test indicated that there is no issue of heteroscedasticity in the data because p-values against Chi-square and F-statistics are more than 0.05 therefore, the null hypothesis is accepted. Hence, the errors in the current data are constant and they do not vary with variation in the data.

Table 7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.004239	Prob. F(7,17)	0.4618
Obs*R-squared	7.313534	Prob. Chi-Square(7)	0.3970
Scaled explained SS	7.221302	Prob. Chi-Square(7)	0.4062

Discussion

The purpose of this study was to know the impact of Agriculture Extension Services (AES) on Revenue of Farming (RF). The aim was also to know the impact of Risk Aversion on RF. Another objective of this research was to determine the affiliation between Arable Land (AL) and RF, between Central Government Debt (CGD) and ROF and between GDP and ROF (Ulimwengu & Sanyal, 2011). The purpose of this study was also to find the impact of Inflation Rate (IR) on RF. This study conducted a test and suggested the following hypotheses. The first hypothesis suggested that the impact of AES on ROF is significant and positive. This hypothesis was accepted. Danso-Abbeam, Armed & Baidoo (2014) suggested that AES helped in economic gains for the farmers. Farmer's revenue is currently mostly dependent on AES. The second hypothesis suggested that RA has an insignificant impact on ROF and this hypothesis was rejected. “HAO AIMIN” proposed in that study, that due to uncertainty, most of the farmers go with RA and this mostly resulted in decreased production and lower earning for the farmer. The study investigated the impact of CY on RF (Mitchell, Rejesus, Coble, & Knight, 2012).

According to many Chinese researchers, the CY also showed a decreasing trend when there are less innovative techniques adopted by the farmers. So, this impact is insignificant and negative. This study also looked at the impact of AL on RF which, according to “ROBERT WEIGEL,” AL’s study, is a vital factor for raising a better crop and for better performance, the relationship between AL and ROF is significant. This study also took interest and looked at the impact of CGD on RF. According to the “THOMAS KOELLNER” study, CGD resulted in a huge amount of taxes and fines for the farmers so the impact of CGD on ROF is negative and insignificant. The study also administered the impact of GDP on RF. “PATRIK POPPENBORG” suggested that improved GDP is a symbol of developed countries and this also caused better revue for the farmers. In this way, the impact is positive between these two variables. This study also focused on the impact of IR on RF. “CHRISTIANA BOGNER” proposed the IR in Indonesia is less, especially for the agriculture sector, so the impact is positive of IR on RF (Dismukes, Coble, Miller, & O'Donoghue, 2013).

Conclusion

The main objective of this study was to have a deep insight into the bond between AES and ROF, RA and RF, Cy and RF. The goal was to have knowledge about CGD and RF. The objective was also to know about the impact of GDP on ROF and IR on ROF. This study was conducted in Indonesia. The data was gathered with the help of the internet. Already published data was used in this research. The data of the past 30 years were composed and studied. The results showed positive and negative impacts (both) between discussed variables.

Implications of the study

This study has contributed to the literature perspective significantly such that the available material in this field has been enhanced through this research. It has provided helpful data about the farming revenue and the factors that influence this topic. This study has made a contribution to future government policymaking also in that the agriculture sector of Indonesia can benefit and formulate different policies regarding the issue. The study findings can be implemented important practically. Farmers can use these suggestions when they confront crisis situations. They can get information about the IR impacts on RF.

Limitations and future research implications

Available data was used in this research. In the future, research should use primary data for more accurate answers and suggestions. The data was collected through the internet. Future researchers could collect data through the use of different research tools. They could use different and advanced research methodologies. This study has used the data available from the previous thirty years. Future investigators could use the latest from the previous ten to fifteen years of the agriculture sector. They could also use mediating variables rather than using the control variables. Finally, the reasons for the rejected hypotheses were not clearly stated in this study.

REFERENCES

Altieri, M. A. (2018). *Agroecology: the science of sustainable agriculture*. CRC Press.

Carroll, C. L., Carter, C. A., Goodhue, R. E., & Lawell, C.-Y. (2017). Crop disease and agricultural productivity: National Bureau of Economic Research.

Dalhaus, T., Musshoff, O., & Finger, R. (2018). Phenology information contributes to reduce temporal basis risk in agricultural weather index insurance. *Scientific reports, 8*(1), 46.

Danso-Abbeam, G., Armed, M., & Baidoo, F. (2014). Determinants of consumer preference for local rice in Tamale Metropolis, Ghana. International Journal of Education and Sosial Science, 1(2), 114-122.

Dismukes, R., Coble, K. H., Miller, C., & O'Donoghue, E. J. (2013). The effects of area-based revenue protection on producers' choices of farm-level revenue insurance. The Agricultural and Applied Economics Association 2013 Annual Meeting, Washington, DC. August 4-6, 2013.

Djanibekov, U., & Villamor, G. B. (2017). Market-based instruments for risk-averse farmers: rubber agroforest conservation in Jambi Province, Indonesia. *Environment and Development Economics*, *22*(2), 133-155.

Donovan, K. (2016). Agricultural risk, intermediate inputs, and cross-country productivity differences. *Unpublished Working Paper, University of Notre Dame*.

Emerick, K., de Janvry, A., Sadoulet, E., & Dar, M. H. (2016). Technological innovations, downside risk, and the modernization of agriculture. *American Economic Review, 106*(6), 1537-1561.

Etriya, E., Scholten, V. E., Wubben, E. F., Kemp, R. G., & Omta, S. W. F. (2018). The importance of innovation adoption and generation in linking entrepreneurial orientation with product innovation and farm revenues: the case of vegetable farmers in West Java, Indonesia. *International Food and Agribusiness Management Review*, *21*(7), 969-988.

Gong, Y., Baylis, K., Kozak, R., & Bull, G. (2016). Farmers' risk preferences and pesticide use decisions: evidence from field experiments in China. *Agricultural Economics, 47*(4), 411-421.

Gwary, M. M., Muhammad, F. A., & Mustapha, S. B. (2015). Review of farmer field schools approach to extension service delivery: Utilization and impact in Nigeria. *World Journal of Agricultural Sciences, 11*(4), 229-238.

Hanemann, M., Sayre, S. S., & Dale, L. (2016). The downside risk of climate change in California's Central Valley agricultural sector. *Climatic change, 137*(1-2), 15-27.

Huong, N. T. L., Bo, Y. S., & Fahad, S. (2018). Economic impact of climate change on agriculture using Ricardian approach: A case of northwest Vietnam. *Journal of the Saudi Society of Agricultural Sciences*.

Irungu, K., Mbugua, D., & Muia, J. (2015). Information and Communication Technologies (ICTs) attract youth into profitable agriculture in Kenya. *East African Agricultural and Forestry Journal, 81*(1), 24-33.

Jensen, N., & Barrett, C. (2017). Agricultural index insurance for development. *Applied Economic Perspectives and Policy, 39*(2), 199-219.

Jin, J., Wang, W., & Wang, X. (2016). Farmers' risk preferences and agricultural weather index insurance uptake in rural China. *International Journal of Disaster Risk Science, 7*(4), 366-373.

Karimi, V., Karami, E., & Keshavarz, M. (2018). Climate change and agriculture: Impacts and adaptive responses in Iran. *Journal of Integrative Agriculture, 17*(1), 1-15.

Liu, Y., Langemeier, M. R., Small, I. M., Joseph, L., & Fry, W. E. (2017). Risk management strategies using precision agriculture technology to manage potato late blight. *Agronomy Journal, 109*(2), 562-575.

Mariyono, J. (2017). Moving to commercial production: a case of intensive chili farming in Indonesia. *Development in Practice*, *27*(8), 1103-1113.

Mishra, D., Sahu, N. C., & Sahoo, D. (2016). Impact of climate change on agricultural production of Odisha (India): a Ricardian analysis. *Regional environmental change, 16*(2), 575-584.

Mitchell, P. D., Rejesus, R. M., Coble, K. H., & Knight, T. O. (2012). Analyzing farmer participation intentions and county enrollment rates for the average crop revenue election program. *Applied Economic Perspectives and Policy, 34*(4), 615-636.

Monjardino, M., McBeath, T., Ouzman, J., Llewellyn, R., & Jones, B. (2015). Farmer risk-aversion limits closure of yield and profit gaps: A study of nitrogen management in the southern Australian wheatbelt. *Agricultural Systems, 137*, 108-118.

Negoro, A. A., Kuntariningsih, A., Dewi, H. A., Daroini, P. B., Latifah, E., Zambani, M. A., & Setyoko, H. (2018, September). The usage of information and communication technology in improving bio-business performance: a case of vegetable farming in

Indonesia. In *International Conference on Green Agroindustry and Bioeconomy, held in Universitas Brawijaya, on* (pp. 18-20).

Ng'ombe, J. N., Kalinda, T. H., & Tembo, G. (2017). Does adoption of conservation farming practices result in increased crop revenue? Evidence from Zambia. *Agrekon, 56*(2), 205-221.

Nugraha, A. T., & Osman, N. H. (2017). The energy-economic Growth Nexus in Indonesia. *Journal of Business Management and Accounting*, *7*(2), 61–76.

Nyuor, A. B., Donkor, E., Aidoo, R., Saaka Buah, S., Naab, J. B., Nutsugah, S. K., Bayala, J., Zougmoré, R. (2016). Economic impacts of climate change on cereal production: implications for sustainable agriculture in Northern Ghana. *Sustainability, 8*(8), 724.

Petsakos, A., & Rozakis, S. (2015). Calibration of agricultural risk programming models. *European Journal of Operational Research, 242*(2), 536-545.

Sajesh, V., & Suresh, A. (2016). Public-sector agricultural extension in India: A note. *Review of Agrarian Studies, 6*(1), 116-131.

Sivaraman, I., Krishnan, M., & Radhakrishnan, K. (2019). Better Management Practices for sustainable small-scale shrimp farming. *Journal of cleaner production*, *214*, 559-572.

Slamet, A., Nakayasu, A., & Ichikawa, M. (2017). Small-scale vegetable farmers' participation in modern retail market channels in Indonesia: the determinants of and effects on their income. *Agriculture*, *7*(2), 11.

Ton, G., Vellema, W., Desiere, S., Weituschat, S., & D'Haese, M. (2016). *Effectiveness of contract farming for improving income of smallholder farmers-Preliminary results of a systematic review* (No. 717-2016-48699).

Ulimwengu, J., & Sanyal, P. (2011). Joint estimation of farmers' stated willingness to pay for agricultural services. *International Food Policy Research Institute Discussion Paper, 1070*.

Yanuarti, R., Aji, J. M. M., & Rondhi, M. (2019). Risk Aversion Level Influence on Farmer's Decision to Participate in Crop Insurance. A review. *Agricultural Economics.*