AgBioForum, 23(2): 113-122. ©2021 **AgBioForum**

A Time Series Analysis to Enhancing Net Revenue of Farming in Malaysia through Agriculture Extension and Risk Aversion

Sobhia Saifan
AL-Ahliyya Amman University,
Hourani Center for Applied Scientific Research
Email: s.saifan@ammanu.edu.jo

Rida Shibli
AL-Ahliyya Amman University,
Hourani Center for Applied Scientific Research
Email: r.shibli@ammanu.edu.jo

Mohd Shukri Ab Yajid
Management and Science University
Email: shukri@msu.edu.my
https://orcid.org/0000-0001-5688-4392

Junainah Abd Hamid
Management and Science University
Email: junainah@msu.edu.my
https://orcid.org/0000-0003-3078-6123

S.M. Ferdous Azam
Management and Science University
Email: drferdous@msu.edu.my
https://orcid.org/0000-0002-0001-3595

Farming and agricultural industry is prone to risk due to factors that are beyond the control of farmers like weather, and this can lead to adversely affecting the farm income. Because the farmers are found to be risk-averse, it is essential to focus on the impact that it can create on the net income of the farm. Another, facet of the agricultural industry and revenue is the exposure and access to extension services. Extension services assist the farmers through educational processes and work through the improvement in the farming procedures and practices. These services and practices can lead to substantiating the net revenue of the farms through adoption of profitable practices. Thus, the focus of the present study is on evaluating the impact of risk aversion and agricultural extension on the net revenue of farms in Malaysia. The study adopts a time series approach and adapts the dynamic time series model for studying the associations among the variables in the long and short run. The study found evidence of cointegration and lack of stochastic issues in the data. The results from the estimation indicated that agricultural extension leads to improved net revenue for the farms. However, risk aversion pertains detrimental effects to the profitability and revenue of the farming households. The study has important implications and policy recommendations.

Keywords: agricultural extension, risk, risk aversion, credit access, educational services, technical services, agricultural and farming industry.

1. Introduction

Rural household farms when do business, industry is formed, known as farming (Ali, 2019). Many types of research, in the present time, highlight the numerous problems that Malaysian farmers are facing. Farming community in Malaysia, specifically the rice farmer, is confronting serious issues due to the increase in the outmigration of youth of the country. The crisis is making the farming sector lose its productivity and face stagnant net revenue figures. It seems that the worsening condition of the farming sector maybe because the youth of the country are benefitting in terms of education, age, and productivity. The situation makes the risk for farmers high as the negative factors show their impact (Ali, 2019). Farmers are that part of society, which can uplift the whole nation if they are happy, and their financial condition is quite well. The problem of poverty gains even more strength when farmers' wellbeing deteriorate, thus making it difficult for the state to reduce the surging level of poverty as the level of effectiveness of the government efforts reduce and cost increases (Fahmi, Samah, & Abdullah, 2013). Negative impacts can be observed on Malaysian rice trade liberalization due to participation and inclusion of Malaysian government in different trade agreements like ASEAN Free Trade Agreement (AFTA) and World Trade Organization (WTO). When Malaysia became a part of AFTA establishment, the government had to eliminate non-tariff barriers and do a reduction in import duties. The effects of such agreements are not limited to import and export but automatically the change is also reflected in local market situation. Commodities produced at an exceptionally low price are offered to local market customers that increase the price competition in the market. Consequently the local producers had to bear losses (Fahmi et al., 2013). Due to trade liberalization and globalization Malaysia is expected to face increasing poverty rate in agrarian sector since it a developing nation.

Growth in the agriculture sector is determinant for the declining poverty and boosting economic development, especially when discussed in context of developing nations (Lee, An, & Kim, 2020). Wik*, Aragie Kebede, Bergland, and Holden (2004) noted that in worse and unfavorable economic conditions and other environmental factors only those farmers survive in the industry that can determine the strategy to improve their farming skills and abilities. Here a concept of risk aversion was introduced, which do not let farmers to choose strategies regarding the prevailing conditions. Roumasset (1976) explained that a high degree of uncertainty is present relating to the process of production and the global economic environment. Many researchers worked on risk aversion in farming, Dillon and Scandizzo (1978), Moscardi and De Janvry (1977) and Binswanger and Sillers (1983) found out that risk aversion is present in poor farmers of Malaysia .

Ali (2019) concluded that about 86.22% of the farmers show behaviors that are risk aversive. The farmers are afraid of the uncertainties that can happen at any time. Being risk aversive can help farmers to save costs. The

cost spent on seeds, fertilizers, water, and workforce can be cut down to increase profits and revenues. For example, more fertilizers and DTS are used when the distance of the input market and fertilizer quantity are linked. Similarly, if farmers would rely heavily on the credits issued to them by the bank. Farmers need to maintain a balance between risk aversion and agricultural extension to craft a better future for farming in Malaysia.

The goal of the paper is not only to understand the variables risk aversion and agricultural extension but also to know their relationship with net revenue and how these variables affect net revenue generation in farming sector of Malaysia. Shaw (1996) states that income, similarly revenue, and risk aversion are positively correlated. But contrary to that when farmers are more risk aversive, they are fearful to make investments and thus they will get reduced amount of revenue. Whenever the total number of resources or total available resources are not allocated to use, the productivity would reduce.

De Janvry, Fafchamps, and Sadoulet (1991) Farmers are likely to become risk aversive when they do not have complete information. Due to lack of information uncertainty increases and so do fear. Uncertainty can only be reduced when awareness and education is made available to farmers easily. Risk aversive workers are likely to look for better opportunities with less ambiguities for example contract specific jobs. While farming is like being a worker and an owner both facing uncertainties and risks with steadfastness and sheer intellect.

To impart knowledge agriculture extension concept is often discussed. The process of improving the rate of production of food and making farmers understand the use of new farming techniques is known as agricultural extension (Poverty, 2001). The goal of agricultural extension is to reduce the uncertainty regarding the information available to farmers. Information asymmetry leads to making wrong decisions that will result in drop of net revenue figure (Zwane, 2012). Awareness regarding but the opportunities and utilization of better farming techniques can help reduce cost. Since workers with better knowledge can innovate the sector (Anaeto, Asiabaka, Nnadi, Ajaero et al., 2012). In many countries of the world the challenge is to make the farmers participate in the process of extension, as usually due to lack of awareness farmers are not concerned with extension (David & Samuel, 2014). The main objectives of the research paper are to know risk aversion helps in improving the net revenue in farming given full access to bank financing. The second objective is to know how agricultural extension helps in increasing net revenue in farming given access to bank financing. The third objective of the research is to know how risk aversion and agriculture extension helps in improving net revenue in farming sector of Malaysia with complete access to bank financing. Previous researchers reported that risk aversion have a slightly more negative impact when the workers are less educated. Given in view the theories suggest that risk aversion decreases return on investment. Similar to this research conducted on agricultural extension in South Africa states that this phenomenon significantly influence deep productivity earnings and profits (Lee et al., 2020).

2. Literature review

2.1 Risk aversion and expected utility theory

The decision-making processes are especially important for the success of any field. Even in the agricultural field, such processes are given very importance. However, while making decisions, the risks that could be faced are also pointed out. Decision making processes help in achieving the desired goals or objectives (Al Wakil, 2018). Here the risk aversion kicks in. according to many economists, the concavity of the utility functions captures the risk aversion. According to "expected utility theory," the "risk averse individuals" are the ones who do not prefer to opt a "fair gamble" in which the net profit is observed to be zero. Such individuals are more likely to show "concave growth" whereas, the individuals who are more likely to seek risks, show "convex growth" and the last neutral individuals show "linear growth" (Bodnar, Okhrin, Vitlinskyy, & Zabolotskyy, 2018). The uncertainty in payoff brings the attention of the decision-makers towards the "expected utility hypothesis." This theory helps the individuals in making effective decisions by determining rational options that should be considered in a complex case. Both "risk appetite" as well as "preferences" are considered for this purpose.

Many farmers especially of the rural areas around the globe are "risk-averse" individuals as they already have a lot to put on stake in obtaining the expected utility. Even though they obtain the required output they expected but they are not able to gain more than that due to their risk aversion behavior. According to the "expected utility theory", the risk averter are the ones who "always prefer the expectation E(X) to the random variable X-are characterizable by concave utilities" (Khaw, Li, & Woodford, 2021). According to many studies it has been observed that the farmers with higher incomes, are more likely to take risks as compared to the farmers with lower incomes. This encourages such farmers to make more investments to gain more effective outcomes. Whereas the poorer farmers are less likely to take any risk and are mostly risk averters. In order to improve this condition, many scholars have depicted the importance of technologies (O'Donoghue & Somerville, 2018). They have promoted the implementation of modern technologies in the agricultural field to improve the risk management of the farmers for having more effective outcomes. For this purpose, the extension services are also found to play an important role as they help in improving the technical efficiencies of the farmers (Thoma, 2019).

Many scholars have encouraged the educational programs for the rural farmers so that they can become more professionals in making their decisions as well as risk management that could help them to work more efficiently to increase the net revenue. This promotes the risk-taking ability of the farmers as well. Many researches have showed that the wealth should be

promoted in the rural areas for the farmers before tempting them to take on "risky ventures" (Stewart, Canic, & Mullett, 2019). This would help them in improving their views towards such "risky ventures." For this purpose, the agricultural extension services should also be promoted as well as instilled in every rural area to boost the rural farmers to opt for "fair gambles" to obtain profitable revenues.

2.2 Risk aversion and net revenue of farming

Risk is a common factor i.e., observed in the agricultural sector. As different internal as well external factors are considered to have an impact on the crop productivity. Such factors might include environmental changes, climate changes, diseases, political issues, and many others. This leads to fluctuations in the prices as well as outputs for this sector. Different "farming practices" are undertaken by different farmers for this purpose (Adnan, Ying, Ayoub, Sarker et al., 2020). However, the "Agricultural risk management" is influenced by different dimensions such as the attitude of the farmers towards the risk, already implemented risk management instruments, different techniques of farming, risk aversion of the farmers and many others. However, it has been observed by many researchers that no proper financial aid is provided to the agricultural sectors especially in the developing countries (Ali, 2019). This leads to prevention of promotion of modern technologies for this purpose. Whereas, to minimize the risks, most of the farmers go for "crop diversification." This helps in limiting the losses that could be observed because of the related risks.

According to Qasim (2012), the rural farmers opt "self-protection" to meet their needs. For this purpose, the farming is the important source of income for the households of the rural farmers. Some of the uncertain conditions such as climate change and others natural disasters might cause lowering of the income of such farmers (Asravor, 2019). So, they take essential measures to decrease the no. of uncertainties observed to improve the farming revenue. The risk aversion behavior of the farmers plays a key role for this process. For this purpose, both "Production and consumption" theories as well as "risk aversion theory," are considered by different academia for improving the households of the rural farmers, especially in the developing countries. According to Haim and Moshe (2009), the "safety model" is taken into consideration to opt for modern technologies while considering the different issues related to poverty, insecurity of food and many other related problems.

However, without any "formal insurance," the decision-making methods of the farmers are more significant and how the risk management promoted by such farmers is also considered to be important for obtaining better outcomes. In order to understand such conditions, the farmers should be more able to understand proper technologies for improving the crop productivity and this could only be possible if less losses are observed from the related risks (K. K. Haile, Nillesen, & Tirivayi, 2020). The "risk management" is thus considered to be very essential as well as implacable for the improvement of the households of the rural farmers, especially in the developing countries. One of the most important decisions made by the farmers to reduce the risks is to "allocate the land" for the selected crops. However, the "allocation of land" might also become a difficult decision for many farmers when they have to face any type of uncertainty (Khor, Ufer, Nielsen, & Zeller, 2018). Before making any type of decision, proper data as well as the farmers should gain information to reduce the level of uncertainties to have a smooth "risk management" process that could lead to an effective outcome in terms of better net revenue. Such discussion leads to the development of following hypothesis for this research study:

H1: Risk aversion has a substantial impact on the net revenue of farming

2.3 Agricultural extension services and net revenue of farming

For a better "agricultural development," different "support services" are important for the farmers of the rural areas, especially in the developing countries. Such services include: training in education, providing human capital, developing important infrastructures and the implementing agricultural extension services (Mohan, 2020). The "Agricultural Extension services" help in providing the required knowledge as well as awareness to the farmers of small level to improve their technologies for increasing the "agricultural productivity" more effectively. Such services also provide better information for the farmers to make better decisions by keeping in mind all the type of risks, they must face. This helps in improving the overall crop productivity (Molla, Beuving, & Ruben, 2020). The choices of technologies by the farmers are also improved by applying such services as they help in improving the overall procedure of decision-making methods leading to a progressive household of such rural farmers due to an increase in the net revenue.

However, many studies have shown that the educated farmers are more likely to earn more profit as compared to the uneducated farmers. Because the educated farmers are provided with the required knowledge as well as awareness about a specific situation more deeply and they can make their decisions accordingly which help them to obtain the required revenue for a better living. Different extension services are provided by NGOs as well as many private sectors especially in the developing countries' agricultural sectors to improve the overall "food security" as well as "crop productivity" (Sulewski, Wąs, Kobus, Pogodzińska et al., 2020). The improved technical efficiencies of the farmers lead to an increase in net profit of the "agricultural production." Even though some uncertainties are still observed but such services help the farmers in lowering the rate of uncertainty to experience less no. of losses as compared to before. This helps in increasing the profits of the crop production by making proper "risk management" decisions.

The extension services provide better facilitation for choosing the technologies by the farmers in order to obtain better incomes as well as to have a better knowledge as well as awareness about the expected risks

so, that initial measures could be taken in order to prevent any long-term issues related to different no. of risks (Yanuarti, Aji, & Rondhi, 2019). Many developing countries have promoted the trainings as well as educational programs for their rural farmers to make them aware of the current circumstances and to determine their own values to improve the agriculture system for the sustainable development as well as also for the economic growth of the country. New technologies are also being introduced in such rural areas of the developing countries so that proper steps could be taken initially before any hazardous incident might take place (Yu, Chen, Niu, Gao et al., 2021). The farmers are the essence of the agricultural system of any country. Different policies are also being developed by different governments of the countries to promote the role of farmers in sustainable development. This discussion leads to the formulation of following hypothesis for this research study:

H2: The agricultural extension services has a significant impact on the net profit revenue of farming

2.4 Model

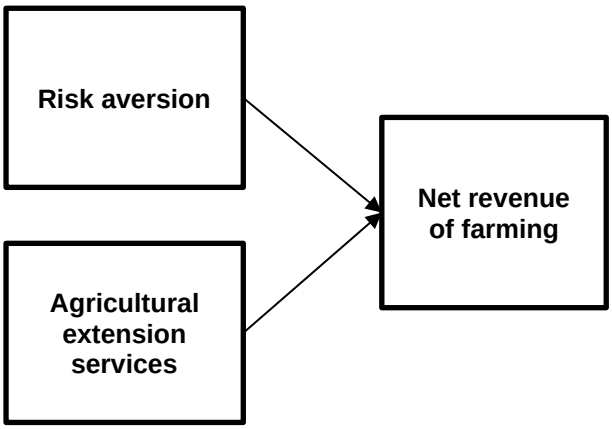

Figure 1: Research Model

3. Method and Data

The present research is aimed at empirically investigating the impact of risk aversion and agricultural extension services to on the net revenue from farming. The analysis was performed on time series data using the novel ARDL model. The impact of risk aversion and extension services has been studied and focused upon in the extant literature but has not been associated with the net revenue of the farms. Thus, the primary objective of the present study is to evaluate the trend and impact of the risk aversion and agricultural extension on the net farm revenue in the context of Malaysia. Malaysian agricultural industry is developing, and the scope of development can sometimes be limited due to the constraints like risk aversion and lack of access to education and extension services. The data was collected from Malaysia, as the study is focused on the Malaysian agricultural industry. The data was collected from various agricultural associations, banks, and official database of World Bank. The dependent variable in the present study was net farm revenue, which was measured through the aggregate farm production. This information was accessed through the district registers of yearly agricultural production. Whereas the access to extension services was evaluated through the formal and farm related education of farm households. The risk aversion was measured through the propensity of the farmers to take risks and incorporate new products and the degree to which they adopted technological resources for their production. This information was accessed through the local farming registers of different Malaysian rural districts. The dynamic ARDL model was used for the estimation of the variable dependencies. The method was used for the evaluation of the real-time change taking place in the dependent variable due to the regressors (Jordan & Philips, 2018). Unit root tests were used for the evaluation of the order of integration and stationarity of the research variables. All factors were integrated at I (0) and I (1), which established the suitability of the simulated model. The ADF (Augmented Dickey-Fuller) and KPSS (Kwiatkowski Phillips-Schmidt-Shin, Phillips-Person) (Dickey & Fuller, 1979; Phillips & Perron, 1988) were also used for evaluation of the stationarity properties of the model before using the ARDL dynamic simulations model. The following equation was used for evaluating the relationships among the variables:

$$NRM_t = \beta_0 + \beta_1 RA_t + \beta_2 AES_t + \beta_3 AC_t + \varepsilon_t$$

In the above equation, the factor ε_t represents the error term, the constant is depicted by β_0 and the terms β_1 to β_3 in the equation represent the coefficients for the independent variables.

3.2. Unit root Test

The unit root test evaluates the stochastic properties of data and integration order of the variables can also be found out by using these tests. As author has applied the KPSS, PP and ADF unit root test for evaluating the stochastic properties of the data. The equation for this test can be written as follows:

$$\Delta y_{i,t} = a_i + \rho y_{i,t} - 1 + \sum_{J=1}^{pi} a_J \Delta y_{i,t-J} + \varepsilon_{i,t}$$

Here $\Delta y_{i,t}$ is the difference that $\Delta y_{i,t}$shows for ith country for the specific period of t

3.3. ARDL Bounds Test

The ARDL bounds test was applied to evaluate the cointegration among the variables to study their long-run relationships. The following model was applied.

$$\Delta NRM_t = \varphi_0 + \varphi_1 NRM_{t-1} + \varphi_2 RA_{t-1} + \varphi_2 AES_{t-1} + \varphi_3 AC_{t-1} + \sum_{i=1}^{q} \beta_1 NRM_{t-1} + \sum_{i=1}^{q} \beta_2 RA_{t-1} + \sum_{i=1}^{q} \beta_3 AES_{t-1} + \sum_{i=1}^{q} \beta_4 AC_{t-1} + \varepsilon_t$$

In the expression defined above, the Δ signifies the first difference and the t-1 is representation of the lag selection which is selected based on the Akaike information criterion. The terms "φ" and "β" are used for the evaluation of the long-run relationships of the variables. The null hypothesis of the ARDL bounds test posits absence of cointegration and the alternate hypothesis posits the presence of long-run relationship among the variables. The F statistics are used for rejecting or accepting the null hypothesis. The long-run relationships are present among the variables of the study when the values of the F-statistics are higher than the value of the

upper bounds and absent when these are lower than the upper bound values (Pesaran, Shin, & Smith, 2001). However, the decision is irresolute when the value lies between the upper and lower bound values.

3.3 ARDL model

The ARDL model has specific advantages as compared to the other time series models (Pesaran et al., 2001). The classical ARDL method can also be used for a considerable small sample or period. The ARDL model is applicable when the variables are stationary and integrated at either I (0) or I (1). Different lags were applied for the independent and dependent variables during the statistical analysis. In accordance with the results presented in the next section, evidence of cointegration and thus long-run was found among the variables. Thus, the following ARDL model was used for estimation of the parameters.

$$\Delta NRM_t = \alpha_0 + \sum_{i=1}^{p} \sigma_1 NRM_{t-i} + \sum_{i=1}^{q} \sigma_2 RA_{t-i} + \sum_{i=1}^{q} \sigma_3 AES_{t-i} + \sum_{i=1}^{q} \sigma_4 AC_{t-i} + \varepsilon_t$$

In the above equation, the long run variations of the variables are depicted by σ. The Akaike information criterions were applied for the selection of the optimal lag for the study. The following error correction model was used to choose the optimal lag for the individual variables of the study. The following error correction model was used for studying the short-run dynamics of the model.

$$\Delta NRM_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta NRM_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta RA_{t-i} + \sum_{i=1}^{q} \beta_3 \Delta AES_{t-i} + \sum_{i=1}^{q} \beta_4 \Delta AC_{t-i} + \varphi ECT_{t-I} + \varepsilon_t$$

The short-run changes are indicated by β in the equation. The ECT is indicative of the short-run variation in the model which provides an overall estimate for the volatility existent in the model. The range for the ECT is -1 to 0. The variation and volatility can be adjusted at the equilibrium when the error correction term becomes negative and significant. The stability of the model was evaluated through the application of the CUSUM and CUSUMSQ.

3.4. Dynamic ARDL model

In accordance with Khan, Teng, and Khan (2019) and Sarkodie, Strezov, Weldekidan, Asamoah et al. (2019) the dynamic simulated approach for the ARDL is capable of simulating, estimating and plotting the forecast of the alterations in the regressors while evaluating change in one and holding others constant. The following equation represents the dynamic ARDL model.

$$\Delta NRM_t = \alpha_0 + \theta_0 NRM_{t-1} + \beta_1 RA_t + \theta_1 RA_{t-1} + \beta_2 AES_t + \theta_2 AES_{t-1} + \beta_3 AC_t + \theta_3 AC_{t-1} + \gamma_I ECT_{t-I} + \varepsilon_t$$

4. Results

4.1. Descriptive analysis

Descriptive statistics are used for the presentation of the quantitative descriptions in a manageable form and help a researcher to simplify large amounts of data (Fisher & Marshall, 2009; George & Mallery, 2016). Table 4.1 below is presenting the summary of the research variables in the form of descriptive analysis. The value variation in mean and median is low according to the results. Moreover, the standard deviation is also low, so it indicates that there are no large variations in the data. Furthermore, the values of skewness and kurtosis within the defined threshold of -1+1 and -3+3, respectively. Jarque-Bera estimates are also normal, as indicated by the p-values.

	RA	AES	NRM	AC
Mean	2.534250	3.766964	4.483944	3.758423
Median	2.005000	3.724237	4.511298	3.696639
Maximum	1	5.587992	6.490016	5.873582
Minimum	0	2.546075	2.621766	1.235471
Std. Dev.	1.975603	0.728931	0.934020	1.025521
Skewness	0.629945	0.356873	-0.128578	-0.141163
Kurtosis	2.772598	2.825837	2.324853	2.549941
Jarque-Bera	30.52363	0.896446	0.869922	0.470434
Probability	0.230078	0.649182	0.647290	0.790399
Sum	101.3700	150.6885	179.7574	150.3369

4.2. Unit root test

Three different unit root tests were used in this study and Table 2 presents the results of these tests, i.e., Augmented Dickey-Fuller (ADF), Kwiatkowski-Philips-Schmidt-Shin (KPSS), and Phillip-Perron (PP). The test results of the unit root tests inform whether the variance and mean are constant over time and if any trending behavior is present. In the case of all three-unit root tests, the variables are found to be stationary by applying the first difference. This shows that these variables are all integrated at the order one.

Table 2: Unit Root Tests

Variable	ADF		PP		KPSS	
	Level	1st difference	Level	1st difference	Level	1st difference
NRM	-4.2993**	-7.1281**	-4.5340**	-7.1203**	8.1129**	-1.7009**
AES	-6.2597**	-9.9234**	-6.3411**	-16.6035**	33.1385**	0.1343**
RA	-3.5103*	-7.6140**	-3.4801*	-25.1008*	30.4290**	0.2878**
AC	-2.5444	-7.6583**	-2.3480	-11.9176**	23.1788**	0.3404*

4.3. Lag selection

After performing the preliminary tests, the researcher needs to make an appropriate model selection. In the present study, the VAR lag selection technique is used for selecting an appropriate model and lag value. Several lag tests are performed including the Log L, LR, FPE, HQ,

SC, and AIC lag tests. In the current study, the researcher performed the analysis using annual data, hence the lag test process was begun with three lags, reducing it later on to one and zero (Altintas & Taban, 2011). Table 3 below presents the results of the lag tests. According to the results of the lag length selection criterion, the values are lowest for lag one, hence, lag one will be selected for application in the model.

Table 3: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-252.0821	NA	0.746029	13.89633	14.11402	13.97308
1	-195.365295.03917*		0.136280*	12.18190*	13.48805*	12.64238*
2	-179.6920	22.02718	0.243952	12.68605	15.08066	13.53026
3	-165.6707	15.91609	0.545874	13.27949	16.76256	14.50744

4.5. Bounds test for Cointegration Evaluation

Bounds test is used to evaluate the cointegration of the variables in this study. The research variables can only be stated to cointegrate if they have similar stochastic trends, leading them to cancel out the effects of each other (Hendry & Juselius, 2000). Hence, cointegration analysis is important for avoiding false results in the regression model steps (Hendry & Clements, 2003; Hendry & Juselius, 2001). The null hypothesis for the test is of no cointegration and it can be rejected as per the results of this study. The table values indicate that the F-statistic is greater than the critical higher and lower bound values as the value of F-statistic is 3.908447 and upper and lower bounds are 2.2-3.09. This shows that there is a stable long-term association between the risk aversion (RA), agricultural extension services (AES), and net revenue of farming dependent (NRM).

Table 4: Bounds test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I (0)	I (1)
F-statistic	3.908447	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

4.6. Long run and short run relationships

Table 6 is indicative of the novel ARDL results. The novel ARDL model can estimate, stimulate, and plot the different graphs of the positive and negative changes incurring in the variables along with their long-run and short-run relationships. The results in table 5 present the indications for the acceptance and rejection of the hypotheses formulated in this study. The relations between the risk aversion (RA), agricultural extension services (AES), and net revenue of farming dependent (NRM) can be explored based on this table.

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It can be seen that agricultural extension services has a significant and direct impact on the net revenue of farming. The relationship is positive, thus showing that if the agricultural extension services increase the net revenue of farming will also increase. Similarly, a decrease in the agricultural extension services will reduce the net revenue of farming for Malaysia's farming and agriculture sector. Thus, the hypothesis is accepted. The second relationship being tested is between the risk aversion behavior and the net revenue of farming Malaysia's farming and for agriculture sector. A high-risk aversion implies an increased financial strength and development of a sector. The values in the table indicate that there is presence of a negative relationship between these two factors. However, the results are insignificant and thus, the hypothesis will be rejected. There is a significant and positive relationship prevalent between the access to credit and net revenue of farming. A unit increase in the access to credit will increase the net revenue of farming by 18 percent, however, the lagged version of the factor demonstrates presence of a negative relationship.

The error correction term is negative with a coefficient of 0.286321 and is significant. This indicates that a short-run equilibrium is present in the model. The R-square for the model is 0.818669. This value shows that the independent variables contribute over 82.8 percent of the variation in the dependent variable. The adjusted R squared value is also 76.86 percent. These high values of R-squared and adjusted R-squared lead to indicating that the model is a good fit.

Table 5: ARDL results

Dependent Variable: NRM
Method: ARDL
Selected Model: ARDL (2, 0, 0, 2, 0)

Variable	Coefficient	Std. Error	t-Statistic
NRM (-1)	0.489681	0.185858	2.634701
NRM-2)	0.247076	0.147706	1.672761
AES	0.460422	0.183865	3.425607
RA	-0.056075	0.192780	-0.290875
CA	0.188290	0.161503	2.165861
AES (-1)	0.013033	0.217691	0.059867
RA (-1)	-0.279866	0.149618	-2.870544
C	1.489566	0.955198	1.559431
ECT (-1)	-0.286321	0.386282	2.379766
R-squared		0.828669	
Adjusted R-squared		0.768646	
F-statistic		16.36603	
Prob(F-statistic)		0.000000	
Simulations		5000	

4.7. Diagnostics

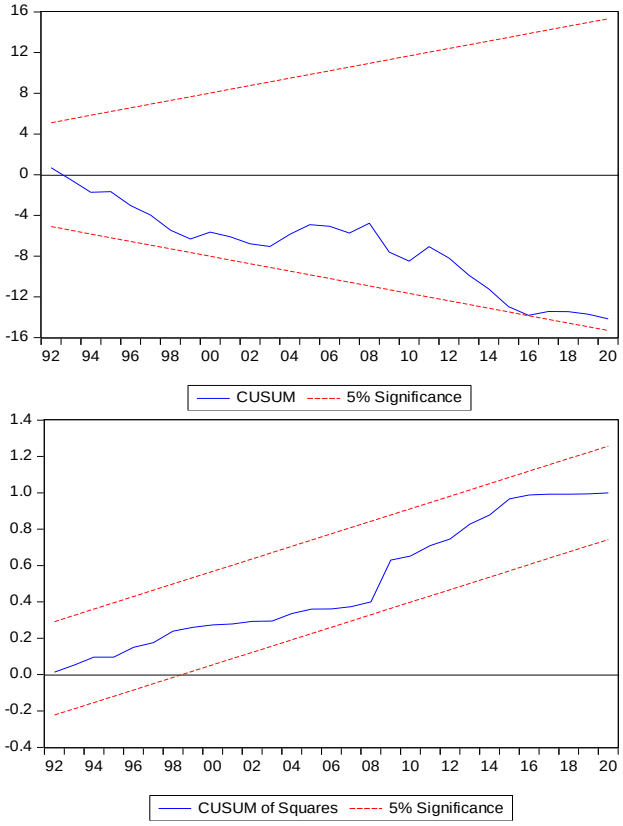
Several different diagnostics and robustness tests were applied on the model to confirm the robustness and precision of the estimates. Researcher has used five diverse types of diagnostic statistics to evaluate for issues like correlation, heteroscedasticity, model specification, normality, etc. The results of the robustness tests have been presented in the table below. Breusch Godfrey LM,

Breusch-Pagan-Godfrey, ARCH test, Ramsey RESET test and Jarque-Bera Test have been reported in the table 6. All five tests have shown that the model is robust and there is no issue of any kind in the data or the model.

Table 6: Diagnostic Tests

Diagnostic statistics tests	P values	Decision
Breusch Godfrey LM	0.453	No Issue
Breusch-Pagan-Godfrey	0.562	No Issue
ARCH test	0.273	No Issue
Ramsey RESET test	0.648	Model is Correct
Jarque-Bera Test	0.482	Model is Normal

The above table showed reports of tests for robustness of the model whereas the stability has also been evaluated and depicted in the graphs below by use of the cumulative sum of the recursive residuals (CUSUM) and cumulative sum of the recursive residuals squared (CUSUMSQ). the results indicate normality and stability of the overall model



5. Discussion and Conclusion

5.1 Discussion

The significance of sustainable development has improved the agricultural sectors in different countries around the world. Different research studies have been conducted in the past to determine the impact of different variables on the net income of farming as the economic growth is also important along with the sustainable development. For this research study, a time-series sample was obtained in context of Malaysia to determine the impact of different variables including "risk aversion" as well as "agricultural extension services" on the net revenue of farming. The current study helped in devising two important results that could be beneficial for the future studies.

First, the findings obtained from this research study showed that the risk aversion has an insignificant relationship with the net revenue of farming. However, in the present study, it has shown a positive impact on the net revenue of farming. The risk aversion behavior of the farmers is found to have an important impact on the risk-taking behaviors of the farmers. According to previous studies, the farmers of the rural areas are less likely to take risks as they try to play safe without putting their investments at stake. However, according to Aryal, Jat, Sapkota, Khatri-Chhetri et al. (2018), if proper wealth is provided to such rural farmers, their behavior changes towards such situations and they opt for more risks resulting in a "convex economic growth". However, the access to credit is considered to be an essential variable in this regard (Dagunga, Sedem Ehiakpor, Kwabena Parry, & Danso-Abbeam, 2018). It helps in promoting the risk management system in the rural areas of the developing countries. The decision-making processes of the farmers are considered to play a vital role in this regard. It provides awareness as well as knowledge to the farmers in making right decisions for having effective and increase net revenue of farming (Balana, Bizimana, Richardson, Lefore et al., 2020). For this purpose, even many organizations as well as banks are providing the needed investments and credits to the farmers. However, the risk aversion is not found to have an overall positive impact on the net revenue of farming if no proper investment is made.

Second, the results obtained from the current study showed a significant relationship between the agricultural extension services and the net revenue of farming. Many past studies conducted showed the positive relationship also. According to Mohan (2020), the "Agricultural Extension services" help in providing the required knowledge as well as awareness to the farmers of small level to improve their technologies to increase the net revenue of farming. However, the improved technical efficiencies of the farmers also help in improving the net revenue of the farming. For this purpose, different public as well as private sectors play an important role by holding different educational as well as training sessions (M. G. Haile, Wossen, & Kalkuhl, 2019). Proper system should be maintained to obtain the desired goals. This helps in improving the overall production by the rural farmers leading to better incomes of the farmers. The farmers are the essence of the agricultural system of any country. Different policies are also being developed by different governments of the countries to promote the role of farmers in sustainable development. This promotes the risk taking behavior of the farmers for improved net revenue of farming (Ndem & Osondu, 2018).

5.2 Conclusion

The risk-taking behavior of the rural farmers is highly impacted by numerous factors. Some of these are internal and some are external. Most of the rural farmers are responsible for feeding their families especially in the developing countries so they do not risk their investments in trying to get more revenue. This leads to the risk aversion behavior of the rural farmers leading to the

"concave economic growth" as no more revenue is obtained then the expected revenue (Rahman, Jianchao, Adnan, Islam et al., 2020). Many past studies have been conducted to determine the impact of different variables on the net revenue of farming. However, the focus of this research study was to determine the impact of "risk aversion" as well as "agricultural extension services" on the net revenue of farming was determined. The results obtained from this research study showed that the risk aversion behavior of the farmers has no significant relationship with the net revenue of farming. However, for this research study, the risk aversion of the rural farmers was found to have a positive effect on the net revenue of farming. The reason for this is that the rural farmers must make decisions by keeping themselves safe from the losses due to the expected risks. This improved the overall decision-making processes of the rural farmers as well as their decisions regarding the needed revenue. However, the credit or the capital investment provided to the farmers play an incredibly significant role in improving the risk-taking behavior of the farmers for a better revenue. The agricultural extension services are also considered to be effective in this case as they help in providing the needed information as well as awareness to the rural farmers for making better decisions and for better risk management.

5.3 Limitations and research indications

Limited research studies were conducted in the past to understand the need of increasing net revenue of farming. This research study will help in providing the basic understanding of sustainable development and the importance of improved net revenue of farming especially for the betterment of the rural farmers. The time-series data is obtained for the current research study. However, this leads to the encouragement of using cross-sectional data in the future studies to fill the gap. This will help in improving the agricultural conditions as well as implications of the rural farmers in the developing countries as they will be enlightened from the reformations made by the developed countries to improve their agricultural sectors. Limited number of variables were considered for this research study. However, other important variables such as politic influence, climate changes etc. should also be considered for the future studies to have a detailed knowledge about the factors required for improving the net revenue of farming and the significant changes could also be made by the rural farmers in this case.

5.4 Implications

This research study helped in improving the extension services provided to the rural farmers for improving their technical efficiencies. This is considered to play an especially key role in this regard. Different educational programs were introduced for improving the knowledge of the farmers regarding the updated measurements taken for improving the crop productivity. This also helped in improving the decision-making processes of the rural farmers regarding the important cases. Different organizations as well as banks in Malaysia have introduced different loans for the rural farmers. The promotion of wealth has showed a positive impact on the risk-taking behavior of the rural farmers. The government in Malaysia has developed new policies for encouraging the capital investments for the rural farmers as this will help in improving the overall economic growth of the country. However, the "self-protection" of rural farmers also helped them in preventing from any type of uncertainty leading to positive outcomes. Different communication measures were also introduced for encouraging the farmers to adopt the risk-taking behavior and to go for the "fair gamble" to obtain the desired results in the form of an increase in the net revenue of farming.

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