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# An Empirical Analysis of the Effect of Agricultural Sector Determinants on Economic Growth in Sri Lanka

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**Abstract**

The role of agriculture has been significantly emphasized in improving the living standard of the population and the economic framework of any country. Agriculture has been an important sector in Sri Lanka which contributes 7.4% to the GDP, 25.5% of the total labor force, and 20.62% to the foreign earnings and Livelihood Avenue for 2.1 million households in Sri Lanka. The contribution of agriculture sector determinants food, forestry, fishery, and livestock: to the GDP shows a declining trend during the last four decades. Therefore, this study attempts to examine the effect of these determinants on economic growth from 1987 to 2019. Secondary data was extracted from the Central Bank of Sri Lanka. The Augmented Dickey-Fuller and Phillips-Perron unit root tests confirmed that all the variables are stationary only at I(0) and I(1) and ARDL (3,4,4,3,4) model. The findings of the Auto-Regressive Distributed Lag (ARDL) bound test show that livestock has a statistically significant impact on RGDP at a 5% significant level in the long run in Sri Lanka. The Error Correction version of the ARDL test found that a short run significantly positive effect of food production, forestry, and livestock on RGDP. Thus, the Sri Lankan government should prioritize in focusing on different subsector determinants to accelerate the economic growth

in Sri Lanka. Further, Sri Lanka should take favorable policy decisions to ensure a sustainable agricultural system to challenge the future crises and shocks in the food safety of the population.

**Keywords:** Economic Growth (RGDP), Agricultural sub-sectors, Time Series analysis, Auto Regressive Distributed Lag Model, Sri Lanka

## 1. Introduction

Major challenges facing worldwide by human beings is provision of an evenhanded normal living with satisfying of adequate and quality food, clean drinking water, shelter and energy, a healthy life and secured setting, of that the primary and most simple to human life and survival is food security. International Economic history provides us with sample proof that agricultural revolution could be an elementary pre-condition for economic process, particularly in developing countries (Woolf and Jones, 1969; Oluwasanmi, 1966; Eicher and Witt, 1964). Traditionally, agriculture has been a very important sector within the Sri Lankan economy and continues to be play as a serious sector causative to GDP, employment provision, earning foreign incomes still as resource for a the larger portion of the Country's population.

In Sri Lanka, the agriculture sector contributes regarding 7.4% to the national GDP and approximately one fourth of the total employed population which include mainly the forestry, livestock and fishery sectors. Sri Lankan agriculture is created up food crops, forestry, livestock, fishing and whereas jointly these subsectors contributes regarding 7.4% to the national GDP, the fisheries sector contributes around 1.3 percent, the livestock sector accounts for 0.9% and also the forestry contributes for 0.8 %, and also the larger portion contributes by the food sector to the food sector to the gross domestic product of the country. Sri Lanka is basically invested with natural resources like cultivable and convenience of extensive land, water and precipitation, climate condition with labour offer, etc. That's necessary for the event of agriculture.

Further, agriculture is that the mainstay Sri Lankan economy that is prime to the socio-economic development of a nation as a result of it's a serious component and factor in national development (Ahmed, 1993). Therefore, it may be thought of that agriculture still needs to play the main role within the economic development of the country through food production, forestry, livestock and fishery by the helpful tendering of plants and animals for food and financial gain. The above agricultural sub sectors have been experienced in several transformations in production practices, biological adaptation and technological innovations over the last three decades. Further, the climate changes, new policy alternative, technological modernizations and globalization of the markets inflicting many challenges in the development of agricultural sub sectors in Sri Lanka.

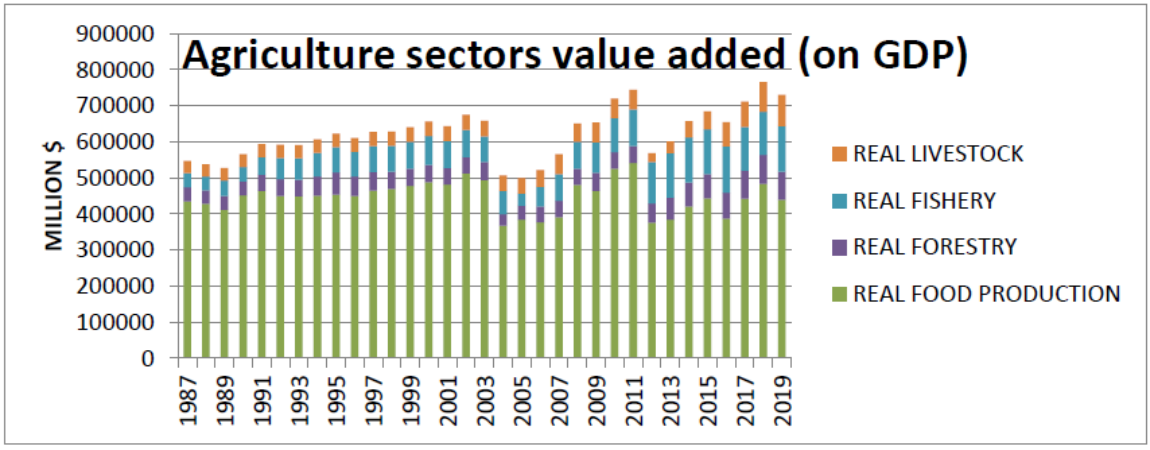


Figure 1. Agriculture sectors value added (on GDP)

Source: Authors' calculation

However, contribution of agriculture sector determinants food, forestry, fishery, and livestock: to the Economy shows a declining trend throughout the last four decades of state. Hence, the problem wasn't nevertheless statistically explored within the Sri Lankan context.

*1.1 Objective*

The main objective of this study is to empirical examining the impact of Agricultural sector determinants on economic growth in Sri Lanka, and to make some policy suggestion on however the government may improve this sector area of the economy by taking in to account of Agricultural sector determinants of Real GDP.

## 2. Literature Review

The review of previous studies also aids in gaining a broader knowledge of the research being conducted, organizing the study, identifying the research methodology, and making recommendations. Although various studies have been conducted in this regard focusing on the effect of the Agricultural sector determinants on economic growth, only a few important studies that are most relevant to our research topic are reviewed here. Chebbi et al. (2007) empirically investigates the agricultural sector's role into the economic growth and its interactions with the other sectors using time-series co-integration techniques in to Tunisia using a time series for 45 years (1961-2005) data to estimate a VAR model in the time series analysis. Findings revealed that in the long-run, all economic sectors tend to move together (co-integrate).

Izuchukwu (2011) empirically investigates the impact of agricultural sector on the Nigerian economy using panel data for the period 1986-2007 and applying the multiple regression models. The result indicated a positive relationship between GDP vis-a-vis domestic saving, government expenditure on agriculture and foreign direct investment between the above periods. Moreover, 81% of the variation in GDP could be explained by Domestic Savings, Government Expenditure, and Foreign Direct Investment. From a policy point of view, the

results recommend that to enhance the agricultural sector, government provides additional funding for agricultural universities in Nigeria to carry out researches on all areas of agricultural production this will lead to more exports and improvement in the competitiveness of Nigeria's agriculture production in international markets. Further, the Central bank of Nigeria should also come up with a stable policy for loan disbursement to farmers at a reasonable interest payback.

Olajide et al. (2012) attempted to analyze the relationship between agricultural resource and economic growth in Nigeria and the Ordinary Least Square regression method was used to analyze the data. They found a positive cause-and-impact relationship between GDP and agricultural outputs. Hussin and Yik (2012) conducted a study on China and India aimed at tracing the contribution of the agricultural sector, manufacturing sector, and services sector to economic growth using annual data from the period 1978 to 2007. And the multiple regression models were used to analyze the data. The empirical evidence of this study shows that each economic sector has a strong, positive, and significant linear relationship with economic growth in China and India.

Enu (2014) conducted a study to analyze the impact of the agricultural sector on economic process and therefore the impact of the varied sub-sectors of the agricultural sectors on economic process in Ghana by using secondary data (1996-2006) and using the regression model. Results revealed that agricultural output had a significantly positive impact (0.354515) on Ghana's growth as compared to the other sectors such are service output (0.283401) and industrial sector (0.303257).

George and Ibiok (2015) analysed sectorial contributions to Gross Domestic Product by agriculture, industry, and services sectors of the economy using a Vector Autoregressive (VAR) approach. The result showed bilateral causality between GDP and sectorial contribution to GDP by Industry. Thereafter the unrestricted VAR parameter estimate was obtained for GDP and sectorial contribution to GDP by Industry. In the conclusion, the study is recommended that the Nigerian government should come up with strategic master plan to diversify the economy using the Agriculture and services sectors since the Nigerian economy from our analysis is grossly dependent on sectorial contributions of Industry to GDP.

Using Pakistan data, Jiang et al. (2016) investigates the impact of government expenditure on agricultural sector and economic growth in Pakistan over the period 1983-2011 with time series data collected from Pakistan Statistical Year Books and Economic Survey of Pakistan using the Johansen Co-integration test, results revealed that there exists a long-run relationship among government expenditure on agriculture, agricultural output and economic growth in Pakistan. Further, the empirical results of regression analysis revealed that agricultural output, government expenditure have significant influence on economic growth of Pakistan. Moreover, he suggested that the government of Pakistan should increase its expenditure in the development of agriculture sector since it would enhance agricultural productivity and economic growth.

Using Pakistan data, Chandio et al. (2019) examine the linkage between agricultural sector foreign direct investment (FDI) and economic growth over the period from 1991 to 2013 and

employs autoregressive distributed lag (ARDL) approach. They found that in the long run FDI of agricultural sector has a positive effect on economic growth significantly. Further, in both long run and short run there is a two-way causality relationship between the FDI of agricultural sector and economic growth.

Runganga and Mhaka (2021) analyzed the relationship between the agriculture and economic growth in Zimbabwe. This study used the Autoregressive Distributed Lag (ARDL) estimation method was employed to assess the relationships by using annual data over the period of 1970 to 2018. The results suggested that a positive impact of agricultural production on economic growth in the short-term, and no impact on economic growth in the long-term. Gunawardena (2012) conducted a study for Sri Lanka aimed at providing a quantitative assessment of the likely economy-wide impacts of agricultural productivity improvements by using a static multi-sector Computable General Equilibrium technique. The research shows that when agricultural productivity increases, the economy will get more advantages. Prasannath (2015) investigated the impact of agricultural exports on economic growth in Sri Lanka and Ordinary Least Squared (OLS) method was employed using secondary data from 2005 to 2014 to determine the overall fit and the relative contribution of agricultural exports on economic growth. The results suggested agricultural export and non-agricultural exports have significant impact positively on economic growth. The result suggests that Sri Lankan government should take initiatives to promote exports especially agricultural exports.

There is vast amount of literature and several researches to signify the significance of Agricultural sector for Economic growth in any country including Sri Lanka. On the other hand various studies reveal that there are controversial issues in relationship of Agricultural sector such as food Production, forestry, livestock and fishing were not given due consideration in Economic growth focused research in many countries as well as in Sri Lanka.

## 3. Data, Variables, and Methodology

This research intends to empirical examine the impact of Agricultural sector determinants on economic process in the country, using the data from 1987 to 2019. The variables were used to estimates the effect of agricultural sectors are: Food Production[1] (FD), Forestry (FO), Fishery (FI) and Livestock (LS). Gross Domestic Product (GDP) used as a proxy for economic progress. The data of all agricultural sub sectors and GDP were collected from Annual Reports of the Central Bank of Sri Lanka (CBSL) and all the relevant variables are measured in real trend based on base year 2010.

The functional from of the theoretical model of this study is drawn as:

$$RGDP = (FD, FO, FI,\ LS) \tag{1}$$

The above functional form is specified in the following econometric model:

$$RGDP_t = \pi_0 + \pi_1\, FD_t + \pi_2\, FO_t + \pi_3\, FI_t + \pi_4\, LS_t + \varepsilon_t \tag{2}$$

[1] Food Production includes cereals, vegetables, perennial and non-perennial crops and etc.

Where, $\pi_i (i = 0, \ldots\ldots, 4)$ are the slop coefficients and $\varepsilon_t$ is the white noise error term.

In order to make the model and variables free from problems associated with time series data used Augmented Dickey – Fuller (ADF) unit root test approaches to test stationarity of the variables. Then the optimum lag which will be enclosed within the model is selected from the AIC criterion. Moreover normality of the error term, heteroscedasticity, multicollinearity, autocorrelation, omitted variables problems are tested by adopting Jarque-Bera test, Whites' test, correlation analysis, Durbin-Watson test and Ramseys' RESET respectively.

Auto Regressive Distributed Lag (ARDL) co-integration method developed by Pesaran et al. (2001) was utilized to empirically examines the equation (2). This technique is applied for several reasons. Firstly, the bounds testing approach is simple as opposed to other multivariate co-integration procedure like Johansen and Juselius (1992), it allows co-integrating relationship to be estimated by OLS once the lag order is selected. Secondly, Johanesen and Engel Granger techniques require that all the variables to be integrated in the same order. Nevertheless, ARDL method is better suited for regression of different order of integration (Pesaran and Shin, 1999) but, this procedure will smash in the existence of I(2) series. Thirdly, this test is relatively more efficient in small sample data sizes as is the case of this study. Finally, the error correction method integrates the short run dynamics with long run adjustment without losing long run information. The ARDL co-integrating bound testing procedure is shown by the Equation (3).

$$\Delta RGDP_t = \beta_0 + \beta_1 RGDP_{t-1} + \beta_2 FD_{t-1} + \beta_3 FO_{t-1} + \beta_4 FI_{t-1} + \beta_5 LS_{t-1} + \sum_{1=1}^{q1} \gamma_{1i} \Delta RGDP_{t-i} + \sum_{1=0}^{q2} \gamma_{2i} \Delta FD_{t-i} + \sum_{1=0}^{q3} \gamma_{3i} \Delta FO_{t-i} + \sum_{1=0}^{q4} \gamma_{4i} \Delta FI_{t-i} + \sum_{1=0}^{q5} \gamma_{5i} \Delta LS_{t-i} + e_t \quad (3)$$

Where $\Delta$: 1st difference operator, $\beta_0$: drift component, $e_t$: unobserved random error term, $\beta_2 \rightarrow \beta_5$: long-run slope coefficients, the remaining expressions with the summation sign $(\gamma_{1i} \rightarrow \gamma_{5i})$ denotes the short-run dynamics of the model. Bound testing procedure is used to investigate the existence of long-run relationships among the variables. The ARDL bound test is based on the F-statistic. The asymptotic distribution of the Wald-test is non-standard under the null hypothesis of no co-integration among the variables; the hypothesis can be defined as bellow:

$H_o: \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (There is no cointegration among the variables)

$H_1: \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (There is cointegration among the variables)

To check the above hypothesis, two critical values are given by Pesaran et al. (2001). The lower critical bound assumes that all the variables are I(0) which means that there is no cointegrating relationship between the examined variables. The upper critical bound assumes that each one the variables are I(1) meaning that there is co-integration among the examined variables. When the computed F-statistic is greater than the upper bound critical value, then the Null hypothesis is rejected (thus, the variables are co-integrated).

In the next step of the estimation procedure obtain the short run dynamics of parameters and long run adjustment of the model by estimating the error correction version of ARDL model

pertaining to the variables in equation (4) is as follows:

$$\Delta RGDP_t = \alpha_0 + \sum_{1=1}^{q1} \alpha_{1i} \Delta RGDP_{t-i} + \sum_{1=0}^{q2} \alpha_{2i} \Delta FD_{t-i} + \sum_{1=0}^{q3} \alpha_{3i} \Delta FO_{t-i} + \sum_{1=0}^{q4} \alpha_{4i} \Delta FI_{t-i} + \sum_{1=0}^{q5} \alpha_{5i} \Delta LS_{t-i} + \gamma ECT_{t-1} + \mu_t \quad (4)$$

Where, $\alpha$ is the speed of adjustment coefficient, and $\mu_t$ is a pure random error term. Meanwhile as this methodology considers both short-run and long-run relationships it facilitates policy making to attain expected changes of the economy through these variables.

## 4. Results and Discussions

In the first steps of the estimation procedure, have to confirm the order of integration of all the variables. The results of ADF and PP unit root tests are shown in Table 4.1.

Table 1. Results of Unit Root Test

| Variables | ADF | | PP | | Order of Integration |
|---|---|---|---|---|---|
| | Level | 1st Difference | Level | 1st Difference | |
| RGDP | 0.9922 | 0.0002*** | 0.9921 | 0.0002*** | I(1) |
| FD | 0.0151** | 0.0000*** | 0.0147** | 0.0000*** | I(0) |
| FO | 0.8821 | 0.0000*** | 0.8821 | 0.0000*** | I(1) |
| FI | 0.8473 | 0.0003*** | 0.8391 | 0.0003*** | I(1) |
| LS | 0.9991 | 0.3626 | 0.9440 | 0.0002*** | I(1) |

Note: Probability values are given in the Table. ** and *** depict the rejection of the null hypothesis at 5%, and 1% significance levels respectively.
Source: Authors' calculation

Accordingly, the results of the unit root test presented in Table 1, ADF (level and first difference), PP (level and first difference) all the variables are indicated in series stationary at the first difference of PP. Except for LS, the other four variables (RGDP, FO, FI, and LS) are stationary at the first difference at the 5% significant level at the ADF unit root test. But only FD at ADF and PP unit root test indicates stationery at the levels form. This reveals that FD is integrated into I(0) while all other series are integrated into I(1), which suggests we use ARDL Bound testing method to estimate the coefficients.

Using the unrestricted VAR model and AIC criteria, this study has chosen 4 lags as optimum lag for the model. Thereby we used these lags for the ARDL model to choose the optimum number of lags for each series that can be included in our model. The results of AIC (given below in Figure 2) advocate the use ARDL (3, 4, 4, 3, 4) model among the best 20 models to evaluate the parameters.

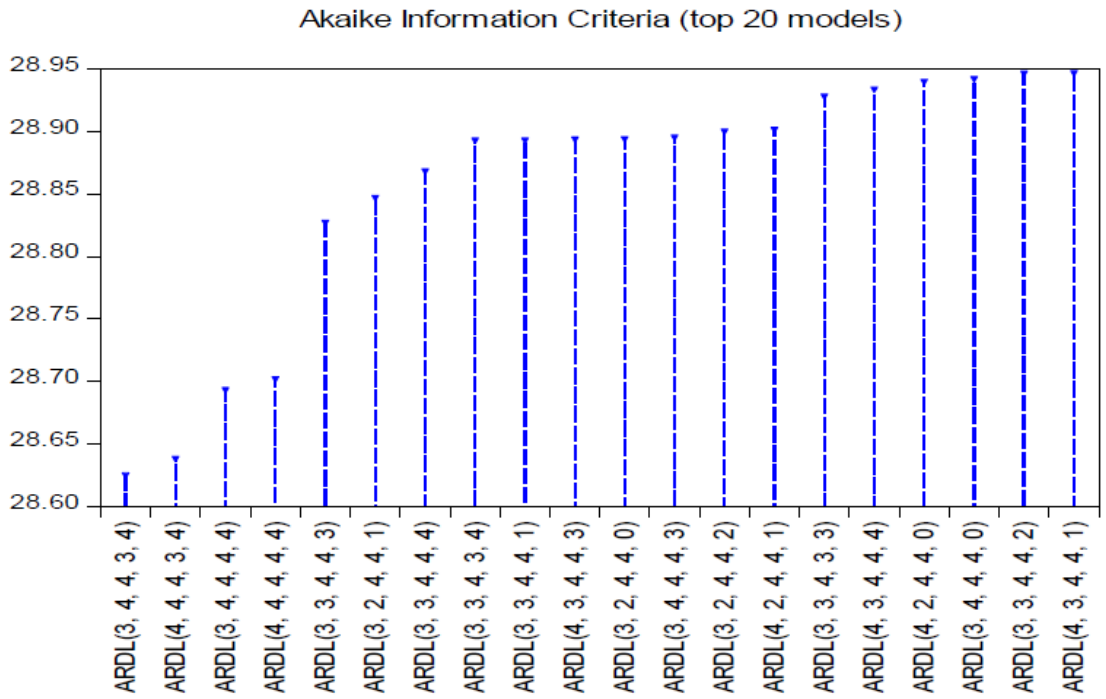


Figure 2. Results of Optimum Lag Length of Each Variable (AIC)

The selected ARDL model gone through LM test, Jarque-Bera test, BPG test, Ramsey's RESET in order to test the serial correlation, Normality, Heteroscedasticity and Omitted variable issues.

The above all tests (see Table 2 below) are Confirmed that there is no Serial Correlation, Heteroscedasticity, Omitted Variable issues at 5% significant interval. Accordingly, residuals are not serially correlated and normally distributed and represent homoscedasticity and there is no specification error in the estimated model. The model is proofed the best.

Table 2. The Results of Diagnostics Test of ARDL Model

| **Test** | **Probability value (F or Chi-square)** |
|---|---|
| Serial Correlation [LM test:$\chi^2_{(df)}$] | 0.1359 |
| Normality Test (Jarque-Bera) | 0.9421 |
| Heteroscedasticity (BPG Test) | 0.9382 |
| Omitted Variable (Ramsey's RESET) | 0.1434 |

In the study, need to confirm the cointegrating association between the variables of the selected model. ARDL Bounds test (Wald Test) method was adopted and the results (see Table 3) indicated the existence of cointegrating relationship between RGDP and explanatory variables in the model since the calculated test statistics (3.945) is exceed critical value (3.49 ) of the upper bound [I(1)] at 5% significance level.

Table 3. The Results of ARDL Bounds Test (F- Bounds Test)

| Test Statistics | Value | Significance Level | I(0) | I(1) |
|---|---|---|---|---|
| F-statistics | 3.945 | 10% | 2.2 | 3.09 |
| K | 4 | 5% | 2.56 | 3.49 |

Accordingly, it could be concluded that there is a strong evidence to support the existence of a long run association between RGDP and explanatory variables such as FD, FO, FI and LS. Hence, the estimated model confirms that there is a long run relationship between the variables under this study. The estimated results of long-run link of the model are show in the Table 4.

Table 4. The Results of Long-run Relationship

| Variable | Coefficient | Probability Value |
|---|---|---|
| Constant | 2226320 | 0.8828 |
| FD | -21.18120 | 0.5677 |
| FO | -139.9200 | 0.3002 |
| FI | 73.89960 | 0.2363 |
| LS | 267.3435** | 0.0450 |

Note: Probability values are given in the Table. ** denote the rejection of the null hypothesis at 5% level of significance.

Out of these determinants, food production, forestry have negative relationship, fishery and livestock have positive relationship with RGDP. Even though all the explanatory variables have relationship RGDP, only livestock has statistically significant impact on RGDP at 5% significant level in the long run in Sri Lanka. Hence, an increase in LS by one unit will increase the RGDP by 267.3435 units in the long run.

Because, livestock rearing in Sri Lanka remains a rural sustenance activity that utilizes inactivity labour, underutilized agricultural by product and marginal lands. At present, business and repair sectors are quickly growing, compared to the agriculture sector, thus the contribution of agriculture, forestry and fisheries sector to national GDP remains at 7.4% in 2019 (Annual Report, CBSL, 2019), whereas the contribution of livestock has been remained nearly at 1% for the recent years. The labor-intensive nature of the many placental operations is effectively controlled for rural employment creation, sustenance improvement, and financial condition alleviation in Sri Lanka.

In the long run, the key characteristic of the model parameters is their stability. Hence, the “CUSUM” test is employed to identify stability of the model parameter. The result of this test is given as Figure 3.

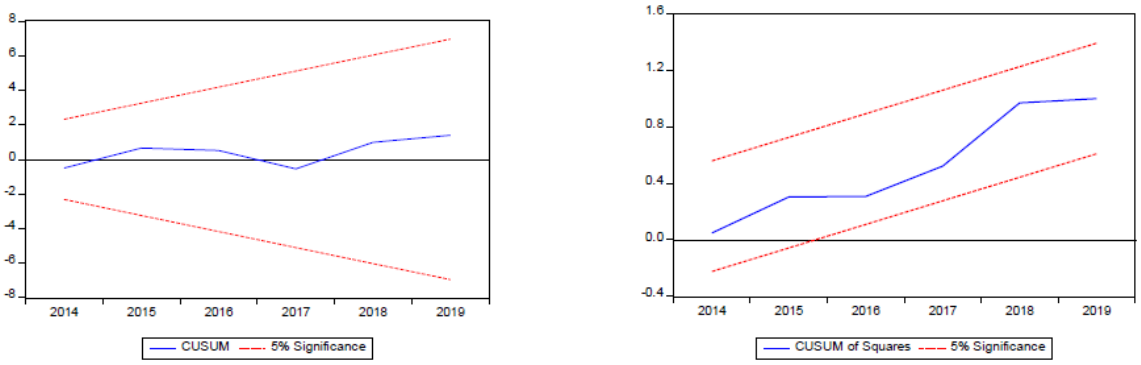


Figure 3. The Results of CUSUM Test for ARDL (3,4,4,3,4) Model

The graphs of CUSUM and CUSUM of squares confirm that the model is stable since the residual plot lies between the lower and upper critical bounds at the 5% level of significance.

Finally, we estimated the error correction version of the ARDL model to identify the short-run relationship between the variables and the long-run adjustment of the model. The results are given below.

Table 5. Results of Error Correction Representation of ARDL Model

| **Dependent Variables : ΔRGDP** | | | | |
|---|---|---|---|---|
| **Variables** | **Lag order** | | | |
| | **0** | **1** | **2** | **3** |
| ΔRGDP | - | 0.045266 (0.7288) | 1.541114 (0.0002)*** | - |
| ΔFD | 13.81695 (0.0017)*** | 10.59176 (0.0039)*** | 23.79802 (0.0001)*** | 16.83496 (0.0042)*** |
| ΔFO | 3.781081 (0.7918) | 87.21354 (0.0041)*** | 78.45870 (0.0097)*** | 86.73227 (0.0040)*** |
| ΔFI | 6.015594 (0.6312) | -79.58088 (0.0008)*** | -80.59667 (0.0021)*** | - |
| ΔLS | 95.81876 (0.0007)*** | -66.16480 (0.0090)*** | -128.9052 (0.0001)*** | -119.7738 (0.0018)*** |
| ECT (-1) | -0.357507 (0.0006)*** | - | - | - |
| $R^2$ | 0.937198 | - | - | - |
| F-Stat | 3.945371 | - | - | - |

Note: Probability values are given in the parenthesis. *** imply the rejection of the null hypothesis at 1% level of significance respectively. All other variables are not significant at least at 10 % significance level.

The short run form of ARDL results reveals that the impact of coefficients of food production, forestry, fishery and livestock are statically significant. With regard to short run relationship, two periods before the RGDP, current period of food production, past periods (-1,-2,-3) of food production, past periods (-1,-2,-3) forestry and current period livestock are have a positive and significant impact on RGDP in short-run. Past periods (-1,-2) fishery and past

periods (-1,-2,-3) livestock are have a negative and significant impact on RGDP in short-run. Meanwhile, Coefficient of error correction term ($ECT_{t-1}$) carries an expected negative sign. The absolute value of the coefficient of the error-correction term (0.3575) indicates that about 35.7% of the disequilibrium in the RGDP is offset by short-run adjustment in each year one period after the exogenous shocks. Thus, it is important to reduce the existing disequilibrium over time to maintain long-run equilibrium.

## 5. Conclusions and Policy Recommendations

This study focused on examining the effect of agricultural sector determinants on economic growth in Sri Lanka. Time-series econometric analytical procedures were adopted to find the effect of Agricultural subsectors determinants; food production, forestry, fishery, and livestock GDP were used as a proxy for economic growth from 1987 to 2019. ADF and PP tests confirmed the stationary of variables and the Wald test found a co-integrating relationship between the variables under-considered in this study. The findings show that the real value of food production and forestry have a negative relationship, and fishery and livestock have a positive relationship with GDP in the long run. Even though all the explanatory variables have a relationship with GDP in the long run except the livestock, the four sub-sectors have a significant impact on GDP in the short run at 5% significant level. The results of the above analyses reveal that the determinants of agricultural subsectors have a significant influence on the economic growth of Sri Lanka, especially in the short run which needs policy-making considerations regarding agricultural sub-sector development approaches to accelerate the economic growth of Sri Lanka.

Hence, it is highly concerned that the unfavorable results of the Covid-19 pandemic situation, unstable agricultural policies of the government and present economic mismanagement crisis lead to facing several challenges in the agricultural sector as well as related subsectors in Sri Lanka. As a result, it becomes a challenge and at risk, for nearly one-fifth of the total households of the country who mainly depend on the agricultural sector for their livelihoods, income, and employment avenues. Lack of modern agriculture practices, market information, and logistical facilities; the poor role of the government in innovative agricultural research and development; lack of adaptation of the new biological and technological innovations; unstable agricultural policies and strategies; over healed political interference in the agricultural development decision making; and lack of investment perspectives are the major challenging issues in the agricultural sub-sectors of the country. Hence, Sri Lanka needs efforts on agricultural based structural transformation by adopting new technology in mechanization and biological innovations in order to enhancing productivity, improving farm-market linkages, investing in value chains. It is necessary further action on generating off-farm employment to absorb excess labor from the agricultural sector. Also it needs to redouble its efforts to build sustainable agricultural food systems through enhancing agricultural sub sectors such are forestry, fishery, food production and livestock that are better able to withstand food safety facing crises and shocks in the future and contributing to the sustainable economic growth of the country.

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