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Original Research Article

Assessment of Government Agriculture and Rural Development Expenditure Impact on the Malaysia's Agriculture Production

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Abstract: This study is focused on determination of the important factors that have affected the agriculture production in Malaysia. The data on interest rate (IR) and government agriculture expenditure (GE) were collected from Bank Negara Malaysia (BNM) monthly bulletin statistic. Besides that, the number of labor use in agriculture sector (LA) was collected from the World Development Indicator (WDI). All data collected were based on the time series (annually) from 1983 to 2016. In this study, the Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests are used to determine the stationary of the time series data and the overall findings showed that the time series data are stationary at order one or I(1). In this study, the result of Engle Granger (EG) co-integration test was used and stated that all the factors were co-integrated with the agriculture productivity. However, the GE^2 and interest rate (IR) are the only factors that showed a negative relationship. In the long run, all the factors are significantly affecting agricultural productivity, while the interest rate is insignificant to determine the agriculture production. Furthermore, the Error Correction Mechanism (ECM) model showed that all the factors are significantly influencing the agricultural production in Malaysia except the interest rate. In the nutshell, this study suggests that the policy maker should take the precautions in the budget spending in agriculture sector, which should not exceed the threshold spending of RM3,057 million.

Keywords: Agriculture; government expenditure; agriculture production; innovation; nonlinear

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1. Introduction

Since Malaysia's independence in 1957, agricultural sector has played a role as engine of growth in developing economic sector and in meeting the sufficient and stable supply-demand in Malaysia. In order to reduce imported food from other countries for food consumption in Malaysia, the nation needs to increase agriculture productivity to overcome the increment of population in the country. As the result of the expenditure during this period, the visible trend shows significant relationship between government and rural development and agriculture GDP. Figure 1 shows that the growth rate for government expenditure in agriculture and rural development decreased significantly in 9th and 10th Malaysia Plan. However, the agriculture production increased gradually after 2009. Since 2010, Malaysia's government has reduced the budget support in this sector from RM 5,508 million to RM 2,920 million at year 2011 and further decreased to RM 1,128 million at year 2012 (BNM, 2017). In supply theory, the decrease of government budget support should reduce the production output. However, the budget support allocated for the Malaysia's agriculture sector significantly declined, but the agricultural GDP steadily increase until 2016 (refer to Table 1).

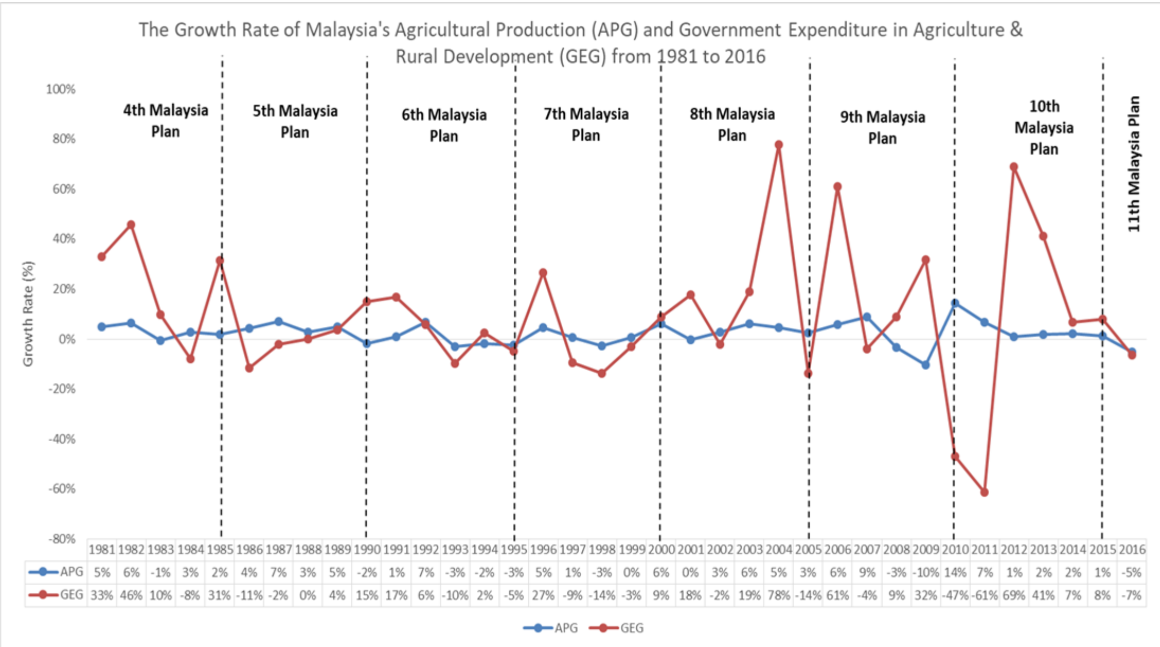

Figure 1. The Growth Rate of Malaysia's Agricultural Production and Government Expenditure in Agriculture and Rural Development from 1981 to 2016.

Source: BNM, (2017)

Table 1. Malaysia's Agricultural Production and Government Expenditure in Agriculture and Rural Development from 1981 to 2016

Year	Agricultural Production (VA) (million)	Government Expenditure (GE) (million)	Growth Rate		Remarks
			VA (%)	**GE (%)**	
1981	43.53736	523	4.9%	33.1%	Fourth Malaysian Plan
1982	46.35319	763	6.5%	45.9%	
1983	46.05571	838	-0.6%	9.8%	
1984	47.36379	771	2.8%	-8.0%	
1985	48.30512	1013	2.0%	31.4%	
1986	50.31817	897	4.2%	-11.5%	Fifth Malaysian Plan
1987	53.85528	878	7.0%	-2.1%	
1988	55.31604	877	2.7%	-0.1%	
1989	57.94808	909	4.8%	3.6%	
1990	56.94651	1044	-1.7%	14.9%	
1991	57.5388	1219	1.0%	16.8%	Sixth Malaysian Plan
1992	61.48519	1291	6.9%	5.9%	
1993	59.55525	1166	-3.1%	-9.7%	
1994	58.42723	1194	-1.9%	2.4%	
1995	56.94651	1135	-2.5%	-4.9%	
1996	59.52863	1436	4.5%	26.5%	Seventh Malaysian Plan
1997	59.92793	1300	0.7%	-9.5%	
1998	58.27084	1121	-2.8%	-13.8%	
1999	58.55035	1088	0.5%	-2.9%	
2000	62.09745	1183	6.1%	8.7%	
2001	61.99006	1394	-0.2%	17.8%	Eight Malaysian Plan
2002	63.76705	1364	2.9%	-2.2%	
2003	67.61281	1620	6.0%	18.8%	
2004	70.7737	2881	4.7%	77.8%	
2005	72.60946	2482	2.6%	-13.8%	
2006	76.84684	3999	5.8%	61.1%	Ninth Malaysian Plan
2007	83.62995	3842	8.8%	-3.9%	
2008	80.74941	4184	-3.4%	8.9%	
2009	72.45175	5508	-10.3%	31.6%	
2010	82.882	2920	14.4%	-47.0%	
2011	88.555	1128	6.8%	-61.4%	
2012	89.406	1906	1.0%	69.0%	

2013	91.181	2692	2.0%	41.2%	Tenth Malaysia Plan
2014	93.048	2875	2.0%	6.8%	
2015	94.249	3105	1.3%	8.0%	
2016	89.465	2902	-5.1%	-6.5%	

Source: BNM (2017)

Yet, the increase of agriculture production in Malaysia shows that other positive factors may have contributed despite the negative impact of the decreasing government budget spending on agriculture sector. Hence, this study aims to examine the important factors which are affecting the Malaysia's agricultural production apart from government financial support.

2. Literature Review

The behavior of the agriculture production pattern has been investigated in many studies in the context of itself or its industry in the producing countries. However, most of these studies including Elias (1985), Mogues *et al*. (2015), Oyinbo *et al*. (2013), Iganiga and Unemhilin (2011), Ebere and Osundina (2014), Saungweme and Matandare (2014), El-Enababy *et al*. (2016), Selvaraj (1993) and Mohsen *et al*. (2016) have tested the effect of the government expenditure on agriculture sector especially on the agriculture output. These studies have proven that the government expenditure has significant positive impact toward the agriculture production. However, Martins (2014) found that there is a quadratic effect of government spending on the agriculture sector and Oyinbo *et al*. (2013) found that that budg*et al*location is positively related to agriculture GDP in the long-term, but not significant in - short-term.

In the past literatures, there are three main approaches to explain the relationship between government size and economic growth. The first approach is based on the traditional interpretation from Wagner's Law, the government size and economic growth is a positive relationship because the government expenditures can increase the market's efficiency, consequently, increase the national output (Grossman, 1988). Besides that, the Keynesian economic growth theory also has suggested that the implementation of expansionary fiscal policy has improved the economic growth. However, Chen and Lee (2005) explain that the increasing public spending has led to the budget deficits arise, increase of taxation becomes one of the options and further placing an additional burden on the production growth. This second approach further explained by Aydin (2016), the government spending could be negatively related to the production growth which was subjected to the law of diminishing returns and grow out of the idea that the additional government spending gradually reduces economic growth based on the crowding-out effect on private investment.

The third approach that combine the explanation from the previous two approaches to interpret the nature of non-linear relationship between economic growth and government expenditures. This non-linear quadratic approach or Armey curve was proposed by Armey (1995). The Armey curve explained that the optimal government size and expenditures were questioned and associated with the level of economic growth. The Armey curve reflects that there was a positive relation between government expenditure and economic growth to a certain optimum point, after which the correlation becomes inversely related (Vedder and Gallaway, 1998). The negative correlation after the optimum government spending reflected that the influence of the law of diminishing returns leads to a situation in which increasing the share of government spending any further will reduce the economic growth (Altunc and Aydin, 2013).

The results from the Johensan Vector Error Correction Model used by Oyindo, Zakari and Rekwot (2013), has shown that the interest rate is also one of the significant factors that has affected the agriculture production. The interest rate is found negatively related to the dependent variable which is the agriculture output and this variable only significant in long-run, but insignificant in short-run. Selvaraj (1993) had conducted a research to analyze the impact of government expenditure on agriculture and performance of agricultural sector in India. The analysis was conducted using Ordinary Least Square (OLS) which has included factor of labor used in agriculture sector for analysis. The result has shown the labor used in agriculture sector is positively related to the agriculture production. This result also supported by the research done by Badar *et al*. (2007). This study fills the gap in the literature by investigating the relationship between the government expenditure on agriculture sector and the agriculture production in Malaysia based on the Armey curve theory. The finding of this study is expected to provide some valuable suggestion for policy makers in planning the new policy in order to increase the agriculture production.

3. Materials and Method

This study utilised a secondary data, which covers from the year 1983 to 2016. The data of Malaysia's agriculture production (VA) was derived from the variables including the government expenditure in agriculture and rural development (GE) and the interest of lending (IR) were collected from the Bank Negara Monthly Statistical Bulletin (BNM, 2017). Besides that, the number of labor use in agriculture sector was obtained from the World Development Indicator (WDI, 2017).

The unit root test was used to examine the stationary of each variable. According to Hamilton and Susmel (1994), the null hypothesis for the ADF test would be that the variable has a unit root, which indicated that the variable was unstable. Meanwhile, the alternative hypothesis was the series did not have a unit root and the variable was stable. The true model of the ADF test would be tested by using Equation 1:

$$\boldsymbol{y_t = \alpha + \rho y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + u_t} \quad (1)$$

Where ρ is the coefficient for lagged one endogenous (y_{t-1}) and the β_i denotes as the coefficient for the difference term and u_t is assumed to be zero-mean error term. According to Dickey and Fuller (1979), if the ρ is fall in the between 0 and -1, it indicated that the series were stationary. Besides that, the Phillips-Perron (PP) also generally used to check stationary of the entire variable.

Co-integration test is the next step which is a basic approach as a confirmation for the estimated time series regression does not produce a spurious regression. The Engle-Granger co-integration test (hereafter the EG test) is a single equation residual-based co-integration test. Engle and Granger (1987) noted that a linear combination of two or more order one series may be stationary, or I (0) in which case we concluded that the series were co-integrated.

The beginning of the step was to test the co-integration in EG test with the purpose to estimate the long-run Equation 2 with the ordinary least square (OLS) method, such as:

$$\boldsymbol{Y_t = c + \beta_1 X_t + \varepsilon_t} \quad (2)$$

Where Y_t denotes as the endogenous variable and the X_t denotes as the exogenous variable(s). In this study, the Equation 2 is re-written as Equation 3:

$$\boldsymbol{InVA_t = C + \beta_1 ln\,GE + \beta_2 ln\,GE^2 + \beta_3 lnLA + \beta_4 lnIR + \varepsilon_t} \quad (3)$$

Where β_1, β_2, β_3 and β_4 are the long-run co-efficients, namely: government expenditure on agriculture and rural development (GE), number of labours in agriculture sector (LA) and the interest rate of lending (IR), respectively, whereby VA is equivalent to the Malaysia's agriculture production (VA), The *ln* denotes that all variables were transformed into a logarithm form.

After doing the regression analysis, the residual series was gained, and a k lag augmented regression of the form can be postulated as in Equation 4:

$$\Delta\hat{\varepsilon}_t = (\rho - 1)\hat{\varepsilon}_{t-1} + \sum_{j=1}^{k} \delta_j \Delta\hat{\varepsilon}_{t-j} + u_t \tag{4}$$

Where the $\Delta\hat{\varepsilon}_t$ indicates the first different of the estimated error term which was obtained from the equation 3 represented by ε_t.

After the co-integration test, the analysis was extended into the ECM estimation in order to confirm the short-run equilibrium among the estimated variables. In the ECM, the error term (ε_t) implies as the long-run equilibrium error or the disequilibrium magnitude in the Equation 5. Thus, the error term can be used to relate the short-run behavior of Malaysia's agriculture production (VA) to its long-run value. In general, the ECM can be expressed as in Equation 5:

$$\Delta y_t = \Omega_0 + \alpha\hat{\varepsilon}_{t-1} + \sum_{i=1}^{k} \emptyset_i \Delta y_{t-i} + \sum_{h=0}^{r} \theta_h \Delta x_{jt-h} + u_t \tag{5}$$

where the u_t is the stochastic term, while $\hat{\varepsilon}_{t-1}$is the lagged value of the error term in the Equation 4. Additionally, the y_t represents the VA_t and the $x_j$represents the exogenous variables including GE, GE^2, LA and IR, respectively, in the Equation 3. The *k* and *r* are the optimum lag length selected based on the general to specific approach and in order to avoid the auto-serial correlation on u_t. Nevertheless, α is the long-run speed of adjustment or call it as an error correction coefficient plus $\emptyset_i$and θ_h illustrate the short-run elastricity.

In the study, the ECM Equation 6 can be proposed as:

$$\Delta \ln VA_t = \Omega_0 + \alpha ECT_{t-1} + \sum_{i=1}^{k} \emptyset_i \Delta\, lnVA_{t-i} + \sum_{h=0}^{r} \theta_h \Delta lnGE_{t-h} + \sum_{h1=0}^{p} \theta_{h1} \Delta lnGE\text{^}2_{t-h1} + \sum_{h2=0}^{q} \theta_{h2} \Delta lnLA_{t-h2} + \sum_{h3=0}^{S} \theta_{h3} \Delta lnIR_{t-h3} + u_t \tag{6}$$

4. Result and Discussion

Stationary test was used to test the stationary level of the data in this study. Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were used to test either the data are stationary at order I (0) or at order one I (1). The results of ADF test shows that all data retrieved were not stationary at all levels, however, after all data were transformed into first difference, all data showed stationary at 1% significance level. Moreover, this result was supported by PP test, when PP test shows the same result as ADF test. In short, all series are stationary at order one or I (1) variables (refer to Table 2).

Table 2. Stationary Test Result (ADF and PP test).

Variable	ADF Test		PP Test	
	Level	**First Diff**	**Level**	**First Diff**
VA	-1.162	-5.955***	-1.175	-5.790***
	(0)	(1)	(4)	(6)
GE	-2.102	-5.639***	-2.120	-5.814***
	(0)	(0)	(1)	(5)
GE^2	-1.968	--5.619***	-1.996	-5.777***
	(0)	(0)	(1)	(5)
LA	-1.113	-8.562***	-2.538	-10.558***
	(1)	(0)	(18)	(13)
IR	-1.937	-5.328***	-1.705	-7.920***
	(0)	(2)	(8)	(34)

Note: All variables are converted into the form of logarithm, ***, ** and * represents as significant at 1%, 5% and 10% significance level, respectively. The number in the parenthesis (…) represents the optimum lag selected for the test.

The co-integration regression was estimated on the four independent variables that determine the Malaysian agricultural production. Table 3 shows that the residual from the long-run regression was statistically significant at 10% significance level in EG test. This indicates that the exogenous variables were weakly co-integrated with the agricultural productivity.

Table 3. Summary of Engle-Granger Co-integration test.

Engle-Granger Co-integration Test: -4.158*			
Critical Values	**1%**	**5%**	**10%**
	-5.017	-4.324	-3.979

Note: * represents as significant at 10% significant level. The number in the parenthesis (…) represents standard error value.

All independent variables are statistically significant at 1% significance level, except the IR is not significant (refer to Table 4). The trend variable was estimated in magnitude 0.015 and this indicated that the technology increase leads to increase in the VA. Besides that, the elasticities of LA werre about 0.535 which indicated that 1% increase in the mean of number of labor, leads to the increase in average agriculture productivity by 0.535%, holding other constant. The GE and GE^2 represents that the government expenditure has a nonlinear effect on the agriculture productivity. The positive elasticities in GE and negative elasticities in GE^2 represents that there were a quadratic impact (∩ shape) of government expenditure to the agriculture productivity. Increasing government expenditure (GE) at the beginning stage shall resulted to increase in the productivity of agriculture (VA) in Malaysia. However, the productivity will decline drastically if the government over-spending on the agriculture sector. The threshold value is computed based on the partial equation which $\frac{\partial VA}{\partial GE} = 0$. After first different the long-run regression, we obtained that $\frac{\partial lnVA}{\partial lnGE} = 1.054 + 2\,(-0.154)lnGE$ and further transformed into exponential function which is exp(3.42) * 100. Finally, the threshold magnitude for government expenditure was estimated to RM 3,057 million. This indicates that the productivity of agriculture will decrease if government increases their expenditure beyond this value. This finding was supported by the Armey Curve theory propounded by Armey (1995) and similar findings from Altunc and Aydin (2013) which found that "inverted U" relationship between government optimal size and economic growth.

Table 4. Summary of long-run regression.

VA	C	Trend	GE	Ge^2	LA	IR
	∂	T	β_1	β_2	β_3	β_4
	8.083***	0.015***	1.054***	-0.154***	0.535***	-0.015
	(0.656)	(0.002)	(0.334)	(0.050)	(0.124)	(0.060)

Note: All variables are converted into the form of logarithm, ***, **, * represents as significant at 1%, 5%, and 10% significant level, respectively. The number in the parenthesis (…) represents standard error value.

Error-Correction Mechanism or ECM is a time series econometric model that was used to determine the long-term and short-term time series between two variables (Gujarati, 2003). The results of the short-run analysis by using the ECM model are reported in the summary Table 5. The negative coefficient for ECT lagged one was estimated in value of -0.56 and it was significant at 1% significance level, this indicated that the market self-adjustment was playing a significant impact to auto-converge the short-run disequilibrium back to the equilibrium point. Moreover, the magnitude speed of adjustment (-0.56) showed that the market itself have a moderate speed to converge in the short-run.

Table 5. Summary of error-correction mechanism analysis.

Variable	Coefficient	Std. Error	P-Value
C	0.009***	0.004	0.006
ECT(-1)	-0.560**	0.208	0.012
Δ(GE)	1.096**	0.435	0.018
Δ(GE^2)	-0.165**	0.065	0.0182
Δ(LA)	0.292**	0.117	0.0194
Δ(IR)	-0.019	0.055	0.7211

Note: All variables are converted into the form of logarithm, ***, **, * represents as significant at 1%, 5%, and 10% significant level.

The short-run elasticity for government expenditure (ΔGE) is estimated in magnitude of 1.096, which is the highest short-run elasticity than other factors on determine the changes of Malaysia's agriculture production in short-run. The R-squared in this ECM model is 0.486, which means that around 48.6% of the variation of ΔVA was explained by theΔGE, ΔGE^2, ΔLA and ΔIR, and the remaining value of 51.4% was not explained in the estimated regression.

5. Conclusions

Based on the findings of this study, it is relevant that the government expenditure is one of the important factors and having a quadratic effect on the Malaysia's agriculture production. Hence, the policy makers should be careful of the budget spending in agriculture sector, which must not exceed the threshold spending RM 3,057 million. Based on this "inverted U" relationship, if the government spending is more than the threshold value, it will cause the decline in agriculture productivity, such as over relying on the government support and limit the innovation development in this sector. According to Armey (1995), the "inverted U" relationship between government spending and economic growth is mainly due to the law of diminishing returns. Furthermore, the findings also show the importance of innovation and technology to increase the agriculture productivity. Therefore, the agriculture sector should invest more on the technology and reduce the dependency on the usage. For example, there is a vital need to integrate the farming system into the digital system, mechanical system or high-tech system in order to reduce the cost of production and labour usage. Moreover, the number of labours involve in agriculture sector is also important to influence the agriculture production in Malaysia. Policy makers have to design and implement a good policy in order to increase the number of labours in this industry to overcome the labour shortage problem.

Conflict of Interest: The authors declare that there is no conflict of interest in this work.

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