

An Application of Heteroskedasticity Testing In Economic Growth Model

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Abstract

This study is intended to analyze the contribution of agriculture to economic growth in Malaysia. Time series data, ranging from 1983 to 2014, and Ordinary Least Least (OLS) method are used in this study. This study reveals that agricultural sector provides an important contribution to the gross domestic product (GDP) and exports, at a declining rate. In fact, this sector also contributes to the industrial chain in manufacturing and services sectors. In addition, the analysis of the t test shows that the variables of agricultural growth and the contribution of agriculture are positively related, while the workforce in agriculture is negatively related to economic growth. From heteroskedasticity analysis, the growth of agriculture and agriculture's contribution are not important in influencing Malaysian economic growth, in line with the declining growth and contribution of agricultural sector toward GDP. This situation is consistent with changes in structure of Malaysoan economy from agriculture to industry to services.

Keywords: Econometrics, Economic growth, Time Series Data, Agriculture, Labor force.

Introduction

Agriculture had become an important sector in Malaysia since colonization era. Over the years, this sector has been the backbone of the Malaysian economy to produce agricultural products for domestic consumption and as a source of foreign exchange earnings. Agriculture also contributes to the Gross Domestic Product (GDP). Agriculture provides employment for people in rural areas. The sector's contribution to Gross Domestic Product (GDP) was in third place after the manufacture and trading (Bank Negara Malaysia, 2000). In 2014, this sector has more than 1.6 million people or 10.9 percent of total employment, accounting for more than 23 per cent of total export earnings and about 7.2 percent of GDP (BNM, 2015).

In this regard the government has designed programs for these people involved and committed to agricultural activities. Activities are implemented through various agricultural projects by various agencies such as the Department of Agriculture, the Ministry of Youth and Sports, Small Holders Development Authority (RISDA), and Land Consolidation and Rehabilitation Authority (FELCRA). Apart from government and semi-government agencies

there are also voluntary organizations that carry out agricultural activities, such as the 4B Youth Movement, which operates under the coordination of the Malaysian Youth Council.

Agricultural growth, agricultural contribution and the workforce in this sector is continually decreasing. Mohd Noor (1994) states that only rural youth who have grown up in the farming community and agricultural fields inherit them from their families. They have thought of agriculture sector as not promising careers and dirty jobs beside getting very low pay.

Thus, this paper is conducted to examine the relationship of agriculture sector toward the economic growth in Malaysia. The independent variables are used, that are agricultural growth, agricultural contribution and agricultural workforce, to test whether these variables are able to explain the economic growth in Malaysia. The time series data from 1983 until 2014 are employed and explained using deterministic approach in statistical and econometric analyses.

Literature Review

The definition of agriculture is actually referring to the description of the production of food and goods through farming, cultivation, animal husbandry and forestry. Agriculture is an important development to the rise of civilization when planting and breeding led to food surpluses that enabled the development of a society increasingly crowded and classy. The agricultural sector is one of the economic activities that are categorized as primary sectors (primary) other than mining and quarrying (Da Silva & Rankin, 2013). Agricultural sources cover all of agriculture, livestock, fisheries and forestry.

Throughout history, Malaysia has followed many other developing countries to shift away from agriculture sector to the manufacturing sector to services sector as a major contributor to the national income. It can be seen when the industrial development in Malaysia has led to agriculture's contribution to Gross Domestic Product (GDP) declining since 1983. (Economic Report, various issues). Agriculture sector has experienced a decline in production as well. Nik Hashim and Mohd. Fauzi (1995) emphasis that part of the decline in agriculture is contributed by the resource management issues such as water and air pollution, lack of agricultural zoning, market failure and so on.

In one hand, the agricultural sector has played a major role in the development of world civilization, with most of the world's population is involved in agriculture until the beginning of the industrial revolution. Malaysia's agricultural sector has developed rapidly since Malaysia has gained independence (Bank Negara Malaysia, 2000). In addition, Quah (1999) stresses that the agricultural sector before Malaysia's independence until the 1980s has played a significant role in contributing to lasting economic growth, poverty alleviation, and food security of the country.

On the other hand, the sector has faced a significant drop in production and low contribution to GDP. To illustrate, Ruttan (2002) has viewed his concern about the widen differences between developed countries and developing countries in dealing with the declining agricultural sector. The output per hectare and per worker gap will further deteriorate the agricultural sector and worsen the situation. In addition, Wong (2007) states that the agricultural benefit or loss in Malaysia is uncertain; the benefit or loss from agricultural developments depends on the net benefits to consumers and producers arising from better prices, time costs, and food safety as well as access to markets, employment generated, skills and wage effects in the whole agri-food supply chain.

Besides, the involvement of young people in agriculture is declining. Norsida (2008) have stressed because the first is that many youth are not informed properly about the courses on agriculture, and second, entrepreneurship is usually associated with the unstable profit returns as well as agricultural entrepreneurship is seen as high business risk with unobstructed risk of failure. Furthermore, Charlton and Taylor (2016) prove that the workforce in agriculture sector is declining in their study in Mexico. Meanwhile, Othman and Jafari (2014) highlights the various issues in agricultural sector, ranging from the emerging notion of agricultural multi-function, the location efficiency of land, deforestation, shortages of labor and extensive use of agrochemical.

Methodology

This study uses the method of ordinary least squares (OLS) for estimation purposes in determining the variables that affect the growth of Malaysian economy. In addition, the results of this study are analyzed in three categories. The categories are as follows: economics analysis, statistical analysis and econometrics analysis. Analysis of the economic criteria is defined by the economics theory; usually, it is referred according to trend, sign and size of the parameters in the model. As such, it is known that the coefficient is fixed for a particular model (i.e. elasticity, the marginal propensity to consume (MPC), and so on). Through this analysis, we then proceed to the statistical analysis.

In the statistical analysis, we can see that the relationship of variables have not-perfect affinity due to the random element of variables that have certain probability distribution. Among the statistical criteria commonly used is the coefficient of determination as well as the standard deviation. In this study, t-test and F-test are used to test its significance in order to determine the validity of the estimated parameters in a model.

Lastly, econometric analysis is intended to determine whether the assumptions used in the estimation of an econometric theory meet the requirements or otherwise. Here, we only test for the autocorrelation and heteroscedasticity problem.

Based on theories and previous studies that have been done, sign and sizes of the required parameters are determined. There is a difference between the variable unit, therefore, the data is converted to a linear form (ln) for estimation purposes so as to avoid problems in the model specification. The following is the equation of ln linear model of economic growth that has been formed in Multiple Regression Model:

$$KDNK_t = \beta_0 + \beta_1 PP_t + \beta_2 SP_t + \beta_3 PSP_t + u_t$$

where,

$KDNK_t$ = Economic growth in year t

PP_t = Agricultural growth in year t

SP_t = Contribution of agriculture in year t

PSP_t = Labor in agriculture in year t

u_t = The random error in year t

Result Findings

Based on the specification model, the agricultural growth is deemed as the main factor that affect the growth of the Malaysian economy. In addition, this study shows that two other factors, namely, agriculture's contribution to GDP and employment in the agricultural sector, are important in influencing economic growth in Malaysia.

From this study, the model is stated as follows:

$$KDNK_t = 14.362 - 1.915PP_t + 1.470SP_t - 0.471PSP_t \quad (1)$$

$$Se = (2.579) \quad (0.356)^{***} \quad (0.169)^{***} \quad (0.356)^{**}$$

$$t^* = (5.569) \quad (-5.380) \quad (8.672) \quad (-1.325)$$

$$\text{Test: } R^2 = 0.935 \quad DW = 0.832 \quad F^* = 134.364$$

Data notation:

*** = Important at confidence level 99%

** = Important at confidence level 80%

Note: All data in ln

Table 1: Regression Estimated Models

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate	Durbin-Watson
1	.967 ^a	.935	.928		.1685431	.832

In Table 1, $R^2 = 0.935$ implies that agricultural growth (PP), the contribution of agriculture (SP) and the workforce in agriculture (PSP) variables are able to explain the economic growth. The multicollinearity problem that exists for all variables is not perfect, so the estimation is obtained. While the standard deviation is too large, but it is not infinite. As a result, more and more difficult estimation purposes with very high values. Acceptance of H_0 and this shows that there is no relationship between the variables of agricultural growth, the contribution of agriculture and labor in agriculture. While using Durbin Watson test at the significance level of 1 percent (0.01) and 5 percent (0.05) indicates that there is the existence of positive autocorrelation problem with the 0.832.

Table 2 : ANOVA Analysis Of The Estimated Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.451	3	3.817	134.364	.000 ^b
	Residual	.795	28	.028		
	Total	.12.246	31			

Table 2 demonstrates that F -test is 134.364, which shows the goodness of each independent variable on the dependent variable of the model. The result of F -test = 134.364 > 2.95 means we reject H_0 . In other words, a combination of independent variables: agricultural growth, contribution of agriculture and workforce in agriculture can explain the dependent variable, Gross Domestic Product (GDP_t) at 95% confidence level.

Table 3 : Schedule Of Tests For The Estimated Model

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	14.362	2.579		5.569	.000
	Aggrowth	-1.915	.356	-.307	-	.000
	Sharegdp	1.470	.169	.879	5.380	.000

Employ	-.471	.356	-.123	8.672	.196
				-	
				1.325	

From table 3, with $t^* > t$ for agricultural growth and contribution of agriculture, we do not accept H_0 . This means that agricultural growth is an important variable in explaining the gross domestic product (GDP) at confidence level of 99 percent. Whereas, for labor in agriculture, work force in agriculture is important in explaining the Gross Domestic Product (GDP) at confidence level of 80 percent. Agricultural growth and contribution of agriculture variables are significant at significance level less than 0.05. Meanwhile, workforce in agriculture is not significant, with $0.196 > 0.05$ level of significance.

Table 4: Results Of Heteroscedasticity Analysis For The Estimated Model

Model	Variable	Hypothesis	Result	Significant / Not Significant
Original Model	Agricultural growth (PP)	$H_0 : \beta = 0$ $H_1 : \beta \neq 0$	Reject H_0	Significant
	The contribution of agriculture (SP)	$H_0 : \beta = 0$ $H_1 : \beta \neq 0$	Reject H_0	Significant
	Labor in the agricultural sector (PSP)	$H_0 : \beta = 0$ $H_1 : \beta \neq 0$	Accept H_0	Not Significant
Park Model	Agricultural growth (PP)	$H_0 : \beta = 0$ (Non-existent problem heteroskedasticity) $H_1 : \beta \neq 0$	Accept H_0	Not Significant
	The contribution of agriculture (SP)	$H_0 : \beta = 0$ (Non-existent problem heteroskedasticity) $H_1 : \beta \neq 0$	Accept H_0	Not Significant
	Labor in the agricultural sector (PSP)	$H_0 : \beta = 0$ (Non-existent problem heteroskedasticity) $H_1 : \beta \neq 0$	Accept H_0	Not Significant
Glejsier Model	Agricultural growth (PP)	$H_0 : \beta = 0$ (Non-existent problem heteroskedasticity) $H_1 : \beta \neq 0$	Accept H_0	Not Significant
	The contribution of agriculture (SP)	$H_0 : \beta = 0$ (Non-existent problem heteroskedasticity) $H_1 : \beta \neq 0$	Accept H_0	Not Significant

Labor in the agricultural sector (PSP)	$H_0 : \beta = 0$ problem heteroskedasticity $H_1 : \beta \neq 0$	(Non-existent Accept H_0)	Not Significant
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In table 4, heteroscedasticity is tested by using two tests, that are, park test and glejsier test. Both park and glejsier tests connote that all independent variables, agricultural growth, agricultural contribution and agricultural workforce have no problem of heteroskedasticity. Thus, the variables are not important to explain Malaysian economic growth. It is true since agricultural sector no longer important sector as compared to services and industrial sectors that which contribute more in recent years.

Conclusion

Throughout this study, we can see the contribution of agriculture to the country is constantly declining from 1983 to 2014. The contribution of agriculture has deteriorated and kept on falling significantly, especially since 1992 to the present. This decreasing rate of agriculture has been due to the fact that structural change has occurred since then. Industrial sector, later the services sector have been growing rapidly in Malaysia. This situation is consistent with changes in structure of Malaysoan economy from agriculture to industry to services.

Therefore, authorities of the ministry of agriculture and agro-based industries should improved in order to boost the agricultural production. Among them are to concentrate on the development of R&D so as to increase the quality and productivity of agriculture. Furthermore, biotechnology is also needed as well as usage of modern technology and loan provisions in encouraging farmers to engage in commercial agriculture. Various training of farmers to the modern technology can further develop the awareness and motivation of farmers to excel in agriculture field. These aids will help solving the problem of agricultural markets and able to compete with other countries. Also, the agricultural sector entrepreneurs should think to develop this sector by creating a paradigm shift in the thinking of their involvement in the business. In addition, modern methods have to be used by employers to production faster and better quality results. Variety of programs to commercialize enhance agricultural growth and encourage involvement in agriculture, particularly among youth people.

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