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Economic Analysis of Rubber Production in Malaysia Using Ardl Model

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Abstract

The study applies the Autoregressive Distributed Lag (ARDL) Model approach to co-integration analysis and Error Correction Model (ECM) to examine the relationships between the explanatory variables with rubber production in Malaysia and to determine factors influencing the rubber production in Malaysia. The cumulative sum of recursive residuals (CUSUM) were used to test for structural stability of the model. The findings of the study illustrate that the ADF unit root tests indicate that the independent variables at first difference are stationary. The results of estimated long run coefficients using the ARDL Approach for the Rubber Export and Area planted are positively significant. ARDL bounds tests suggest that the independent variable series are co-integrated. The ECM also reveals that the independent variables have significant causative implications for rubber production and able to readjust 56.12% to long-run equilibrium.

Keywords: Rubber Production, Auto Regressive Distributed Lag (Ardl), Economic Analysis, Supply Function Model.

Introduction

Rubber industry is one of the main contributors to Malaysia's economic growth. According to (Dickson, *et. al.*, 2011), this perennial tree could reach the height up to 44m which is about 144 feet. The rubber plantation is also major sector in Malaysia after paddy and oil palm. Global demand of rubber scrap contributes to national income and economic thoroughly. According of Malaysian Rubber Board (MRB, 2011), there have many challenges coming from internal and external factors that impactful on comparative and competitive advantage in rubber scrap production in Malaysia.

According to Razak (2014), the price of rubber latex in the market is feature that cannot be avoided and price of rubber latex was depending on supply and demand in international market. Then, the price also been sensitive to market that affected by economic and socio-political in the world, speculation of rubber market and currency exchange.

Nowadays, rubber becomes second main commodity and acts as a second contributor of national income after oil palm. But, lately Malaysia is facing a declining in area and production

of rubber. Even though many implementations had been done by government for natural rubber industry, Malaysian still facing a declining in world production of natural rubber. With an area of only about 1.06 hectares (LGM, 2013), Malaysia is not able to compete with area under rubber cultivation in the three countries involved. These factors coupled with the loss of more and more rubber is transformed into a real estate development or oil palm plantations, which bring more stable and sustainable returns.

According to Berita Harian Online (2016), every year there are rubber plantations converted into other field that can give more profitable such as, oil palm plantation, residential or commercial buildings, thus causing the country's natural rubber production is declining.

The purpose of the study is to determine factors that influence the rubber production in Malaysia and to observe the relationship between the explanatory variables with rubber production in Malaysia.

According to Achoja (2013), 76.7% of the owners of rubber plantation sector shows their interested to change from rubber sector to other crop such as palm oil, while the other 23.3% shows that they did not want to change to other crop. Olukosi et al. (2005) defined market structure is one of the characteristic an organization of a market where it also can give influence to the pricing within the market.

As indicated by Mohammed (1988), Nasir et al. (1992), Mohamed and Mad Nasir (1993), Alias et al. (1999), Amna et al. (2010), and Arifin and Akyuwen (2011), the export relies upon world industrial (production index), world price of natural rubber and time trend. (Any expansion in world industrial production index,) world natural rubber price and time trend will increase the export of natural rubber in the market (Mohammed, 1988). According to further studies done by Tan (1984) and Dowling (1979), short run price of natural rubber was inelastic. However, in this study the estimation of prices elasticity was lower as compared to the study done by Tan alone (1984).

Meanwhile, the findings of the study estimated long run coefficients using the ARDL Approach for the Rubber Export and Area Planted are positively significant with the rubber production. The export has the sign with rubber production and follows the economic theory as the export value increase will definitely increase the rubber supply simultaneously. Besides that, the positive relationship found between areas planted and rubber production in the long-run is in conformity economic theory.

In addition, this significant research might be able to contribute to the development of the Malaysia rubber industry as Malaysia is the world third rubber producer. Furthermore, the preparation and publication of manual covering all aspects of improved rubber management practice should be encouraged. Government should play a role to make the rubber sector look attractive and worth to keep on in this sector. That is by providing loans to the farmers, make a chemical at more reasonable price, and also provide good infrastructural facilities where it can lead to the improvement in the rubber sector and also improve the income of the farmers. From

the finding of the study, the result found that the rubber export is significantly influenced the rubber production in Malaysia.

Therefore, Malaysia government has to protect domestic markets so that they have experience which is to achieve their comparative advantage and scale of economic. Government also must make budgeting plan by directing limited national resources and open their market in order to learn about new technologies from developed countries. In order to obtain technology, require authorizing the local investor especially encouraging them to improve the transfer of knowledge from their foreign counter parts.

Methodology

A. Autoregressive Distributed Lag (ARDL) Model Approach to Co-integration.

To illustrate the ARDL modeling approach, the following simple model is considered:

$$y_t = \alpha + \beta x_t + \delta z_t + e_t$$

Where y_t , x_t and z_t are three different time series; e_t is a vector of stochastic error terms; and a and b are the parameters. For the above equation, the error correction version of the ARDL model is given by:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-1} + \varepsilon_t$$

The first part of the equation above with b , d and e represents the short run dynamics of the model whereas the second part with λ_s represents the long run relationship. The null hypothesis of no co-integration in the long run relationship is defined by $H_0: \lambda_1 = \lambda_2 = \lambda_3 = 0$, is tested against the alternative of $H_a: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$, by means of linear/ non-linear Wald tests of coefficient restriction. For more information on ARDL see Pesaran, M. H and Shin, Y (1999).

B. Model Specification

The relationship between area planted, price of synthetic rubber and rubber export with rubber production is tested using the autoregressive distributed lag model. Time series data accumulated for 30 years are used.

Functionally, Rubber Production = f (area planted, price of synthetic rubber, rubber export)

$$RP_t = f(Ap_t, Re_t, Srp_t)$$

Where:

1. Rubber Production (RP) is the average rubber production in Malaysia from 1987 to 2016.
2. Area Planted (Ap) is the rubber area planted in Malaysia from 1987 to 2016
3. Rubber Export (Re) is the average rubber export in Malaysia from 1987 to 2016.
4. Synthetic Rubber price (Srp) is the average synthetic rubber price in Malaysia from 1987 to 2016.

Having expressed the functional relationship between the variables, the explicit function for estimation is given as follows:

$$\ln RP_t = \alpha_0 + \alpha_1 \ln AP_t + \alpha_2 \ln RE_t + \alpha_3 \ln SRP_t + \varepsilon_t$$

Where:

α_0 , α_1 and α_2 are parameters to be estimated. ε_t is the error term. The above equation is subjected to dynamic estimation using the lagged structure of the variables

C. Diagnostic and Structural Stability Tests

To ascertain the goodness of fit of the ARDL model, the diagnostic test and the stability test are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM). The null hypothesis of instability is rejected when the plots of the CUSUM within the 5 percent significance level. However, the model is unstable when the plots of the CUSUM move outside the 5 percent critical lines (Brown et al. 1975).

D. Error Correction Representation for the ARDL Model

The error correction model result indicates the speed of adjustment back to the long run equilibrium after a short run shock.

E. Unit Root Tests

It is necessary to test for unit root to ensure that all the variables satisfy the underlying assumption of the ARDL methodology before proceeding to the estimation stage. With this in mind, we start the econometric analysis by analyzing the order of integration of the variables using Augmented Dickey and Fuller Unit Root Tests (ADF).

Estimation Results

From table 1, the results of the ADF unit root tests indicate that the independent variables are stationary at level and integrated at I (0) respectively. At first difference, all variables are integrated at both I (0) and I (1).

Table 2 shows that the selected ARDL passes the standard diagnostic tests (serial correlation).

The results of estimated long run coefficients using the ARDL Approach in table 3 show that rubber export statistically positive significant with rubber production. Meanwhile, the area planted and synthetic rubber price statistically negative significant influence the rubber production at the 5 percent level of significance.

Furthermore, the Wald test of restriction(s) imposed on parameters based on ARDL regression of RP on: AP; RE; SRP and C show that the hypothesis of no co-integration is rejected at the 5 percent level of significance with a Wald Statistic $CHSQ(1) = 9.982406$ and essentially zero probability [.000]. See table 4.

A. Error Correction Model (ECM)

The fact that the variables in the model are co-integrated provides support for the use of an error correction model mechanism (ECM) representation in order to investigate the short run dynamics. Estimation results, still based on the Akaike Information criterion. The R2 is 0.883118 suggesting that such error correction model fits the data well. More importantly, the error correction coefficient has the expected negative sign and is highly significant. This helps reinforce the finding of a long run relationship among the variables in the model. The results suggest that the immediate impact of changes in rubber export is positive and significant at the 5 per cent level.

The size (-0.561172) of the coefficient of the error correction term (ECM (-1)) was observed that the evaluated estimated lagged error-correction term emerges as an important channel of influence and the ECT is about 56.12% and able to readjust to long-run equilibrium. The statistically significant error-correction term confirms the existence of long run relationships between rubber production with the area planted, rubber export and synthetic rubber price.

B. Tests for Structural Stability

Figure 1 below clearly indicates that both the CUSUM plots lie within the 5 per cent critical bound thus providing evidence that the parameters of the model do not suffer from any structural instability over the period of study.

C. Figures and Tables

TABLE 1 STATIONARY TEST AT LEVEL AND FIRST DIFFERENCE

Variable	Augmented Dickey-Fuller			
	Level		First difference	
	<i>T</i> -statistic (Intercept)	<i>T</i> -statistic (Trend intercept)	<i>T</i> -statistic (Intercept)	<i>T</i> -statistic (Trend intercept)
RP	-1.813176	-2.056601	-5.057943	-5.085162
AP	-1.021871	-1.162066	-4.783286	-4.839643
SP	-0.869544	-2.587982	-5.149205	-5.057041
RE	-3.151241	-3.020193	-6.782928	-6.790915

Note: *** 1%, **5%, *10% level of significance

TABLE 2. RESULT OF SERIAL DIAGNOSTIC TEST

Probability Chi-Square (2)	0.2003
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TABLE 3. LONG-RUN COEFFICIENT ESTIMATION RESULT

Variables	Coefficient	Probability
C	28.17426	0.0003
LOG (RE)	0.327851	0.0333
LOG (AP(3))	-0.969012	0.0077

LOG (SP(-3))	-0.239749	0.0500
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TABLE 4. CO-INTEGRATION RESULT OF BOUND TEST-ARDL FOR RUBBER PRODUCTION

Test Statistic	Value	Probability
F-statistic	9.982406	0.0011

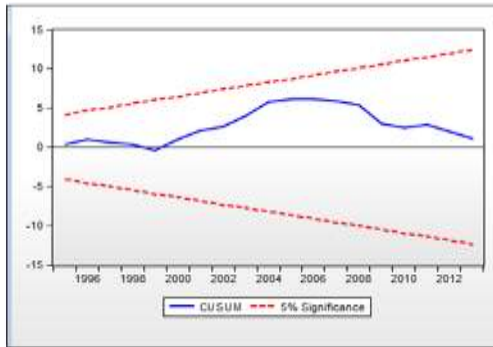


FIGURE 1. PLOT OF CUSUM TESTS FOR THE PARAMETER STABILITY (Note: The straight lines represent critical bounds at 5% significant level)

Conclusions

This paper used the autoregressive distributed lag (ARDL) model approach to co-integration analysis, ADF unit root tests, ARDL bounds tests, both the CUSUM stability tests and the ECM to examine the relationships between the area planted, synthetic rubber price, rubber export with rubber production in Malaysia.

The findings of the study illustrate that the ADF unit root tests indicate that the Area Planted, Rubber Export and Synthetic Rubber Price at first difference are stationary at the 5% significant level. The results of estimated long run coefficients using the ARDL Approach for the Rubber Export and Area planted are positively significant with the rubber production. The results from the ARDL bounds tests suggest that area planted, rubber export and synthetic rubber price are co-integrated. This finding indicates that area planted, rubber export and synthetic rubber price have long run equilibrium relationship. The result from serial correlation show that the model is free from serial correlation problem, heteroscedasticity, and free from misspecification. Tests for Structural Stability clearly indicate that both the CUSUM plots lie within the 5 per cent critical bound thus providing evidence that the parameters of the model do not suffer from any structural instability over the period of study. The results from the ECM reveal that the size (-0.561172) of the coefficient of the error correction term (ECM (-1)) was observed that the estimated lagged error-correction term emerges as an important channel of influence.

The analysis suggests that the government must review the market price of rubber. The government should provide more incentives to facilitate the rubber smallholders and rubber industry players for the sustainability of Malaysia rubber industry.

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