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# Does Rubber Agriculture Development Affects the Rubber Crop Production Rate in Malaysia?

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**Abstract:** Productivity is an ability to produce an output from a given set of inputs. Indirectly generated productivity will reflect efficiency and effectiveness in the use of resources such as technology, labor and others. Therefore, the objective of this study is to examine the long -term relationship and short -term relationship between the products of the rubber agriculture sector affect the income of Malaysia. Next, is to study the cause and effect relationship in the study variables. Several components have been identified in this study such as natural rubber production in Malaysia (TP), national income (GDP), investment (INV), and labor productivity (LF). This study examines the relationship between the extent to which the output of the rubber agriculture sector affects the income of Malaysia for the years 1990 to 2014. The data of this study was obtained from the Department of Statistics Malaysia, World Bank, and the Department of Labor Malaysia. The analyzes used to analyze these variables are the root unit method, Autoregressive Distributed Lag (ARDL) and Granger Causality method. The results of this study found that there is a positive relationship between the variables that can increase the output of the rubber agriculture sector. To increase the output of the rubber agriculture sector, various things need to be done. Besides, in improving technology related to rubber agriculture as well as open more job opportunities for the youth. At the same time, training schemes and capital incentives from the government are also able to encourage entrepreneurs to thrive in this sector.

Keywords: output; labor; agriculture; rubber; crop production rate.



## 1. Introduction

The agricultural sector plays a role in developing rural and remote areas (Gale, 1997). This sector supplies food to the country's growing population as well as reducing dependence on food imports from abroad. At the same time, the agricultural sector contributes to the country's source of income through exports, especially products made from commodities such as palm oil, rubber and cocoa. The Government, through the 3rd National Agricultural Policy (1998-2010) put in place efforts to maximize income through optimal use of resources in the agricultural sector. The history of rubber in Malaysia began in the 1870s, when 70,000 seeds were brought from Brazil. It was taken to London; the rest was taken to Ceylon and finally to Malaysia (then known as Malaya) as well as Southeast Asia. The cultivation of rubber

trees is growing rapidly, a large amount of forest area is cut down for the cultivation of rubber trees. This situation continues to make Malaysia one of the most important rubber tree planting areas in the world. The rubber industry plays an important role in contributing to the economic development of the country (Abdullah et al., 2020). The high contribution of this industry has affected the changing landscape as well as the growth pattern of the Malaysian economy (Jongwanich, 2020).

The specific objectives of this study to examine the long -term relationship between Malaysian national income affects the output of the rubber agriculture sector in Malaysia. Next, to study the short -term relationship between Malaysia's national income affects the output of the rubber agriculture sector in Malaysia. And lastly, to study the cause and effect relationship in the study variables. The results of this study can give an idea to the community about the importance of the agricultural sector to the country so that it can be used as a fuel to produce better quality output. In addition, this study can also give importance to the performance of the agricultural sector to continue to compete healthily and strive to increase national income. Therefore, based on this study will be able to help a little related to the performance of the agricultural sector based on the factors of independent variables in this study.

Pradhan & Phuyal (2020) studied the best impact of FDI sector on economic growth in Nepal represented by Gross Domestic Product (GDP) and identified the direct impact of FDI on GDP using data from 2007 to 2016. Using Linear regression analysis method, Correlation Analysis and Regression Analysis, showed that FDI in the industrial, tourism and agriculture sectors had a very positive and significant impact on GDP during the given period. The study also suggests that key stakeholders and governments need to create new policies to open up foreign investment in other sectors that also help shift informal activities into the formal economy.

Further, Johari et al., (2016) assessed the level of land access, irrigation systems and subsidies affecting farmers' productivity mukim kayang, Perlis. Using purposive sampling, the results show that the total labor force in the study area is declining, and the poverty rate of small farmers has not changed because the use of this new technology is carried out to the maximum to save time, energy and increase farmer productivity. Thus, the poverty rate continues to involve small farmers, and even these small farmers have to find other alternatives to increase their productivity other than employers. Thus, productivity is achieved by engaging with other economies such as gardening and so on.

In addition, Hanipah et al., (2012) studied the growth of employment and labor productivity in the manufacturing sector in Malaysia in 2000 and 2005. Using the method Input-Output Analysis, Labor Industry Model, Employment Growth Estimation Model and Labor Productivity, the results of the study have shown that labor productivity growth in the manufacturing sector is still at a low level and the manufacturing sector is seen to have an impact on job creation to society. Meanwhile, employment growth by final demand component showed that exports dominated employment growth in the manufacturing sector for 2000 and 2005. Therefore, more focus should be given in training more skilled and highly skilled labor so that the quality and efficiency of labor can be further improved. can stimulate the growth of national productivity.

## 2. Materials and Methods

Methodology is such an important to obtain information and data to perform analysis. For this study, the data used in this study were from secondary sources. This secondary data is pre-existing data obtained from old government websites or from world bank data or the like. The methodology of this study will explain the data estimation methods that are appropriate to the questions that arise and the objectives of the study to be achieved in the study to be conducted. The formation of the model is based on econometrics and statistics as well as information from previous studies. The tests that will be conducted on these variables play an important role in ensuring that the results of the study are accurate. The software that will be used in the preparation of this study is E-VIEWS. The purpose of this software used is because of the experience in implementing and efficiency of E-VIEWS in analyzing data to get accurate results. The method of implementation of the study which consists of data sources, measurement of variables, and research methodology.

### 2.1. Area of Study

Rubber is the second most important commercial commodity in Malaysia after oil palm. In order to comply with this study on natural rubber production, the country that has been selected for the study is Malaysia. Malaysia is one of the leading rubber producers in the world after Indonesia and Thailand. Car companies using natural rubber tires have led to increasing world demand for natural rubber. Rubber trees have now become a major industry in Malaysia.

### 2.2. Data Sources

The data used in this study are secondary data. This data was also taken from 1990 to 2014. The data for the dependent variable in this study is Natural Rubber Product obtained from Data of Statistics Malaysia. While for the independent variable is Gross Domestic Product, investment and labor can be obtained through the Malaysian Economic Planning Unit and World Bank Data & Statistics.

## 2.3. Study Model Specifications

This framework describes all the variables used in this study. These variables are divided into two categories, namely dependent variables, and independent variables.

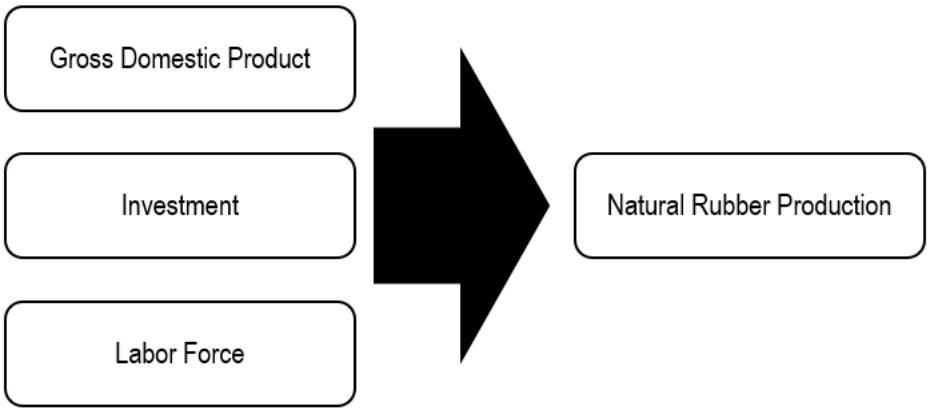


**Figure 1.** Research Framework

This independent variable is represented by several variables such as GDP, Investment and Labor. While the dependent variable is represented by the country's Natural Rubber Product. Based on the study variables above, an economic model can be formed in general:

$$\mathrm{TP} = \mathrm{f}(\mathrm{GDP}, \mathrm{INV}, \mathrm{LF}) \tag{1}$$

Equation 1 above shows that the economic model is a general model used to look briefly at the variables found in this study. The dependent variable is TP which refers to the natural rubber product of Malaysia. Next, the independent variables are GDP, INV, LF which respectively refer to gross domestic product, investment, and labor force. The symbol f refers to the equation function for the independent variable against the dependent variable. This model describes the independent variables (GDP, INV, LF) giving effect to the dependent variables (TP).

## 2.4. Methods of Data Analysis

The method in this study uses econometric method which is a time series data approach over a period of time.

### 2.4.1 Autoregressive Distributed Lag Model (ARDL)

This ARDL model is used to look at the existence of short- and long -term relationships between variables. The relationship between the variables can formulated as follows:

$$\begin{aligned}\Delta\mathrm{Ln}(\mathrm{TP})_t = \alpha_0 &+ \sum_{i=1}^{p} \alpha\Delta\mathrm{Ln}(\mathrm{TP})_{t-i} + \sum_{i=0}^{q} b\Delta\mathrm{Ln}(\mathrm{GDP})_{t-i} + \sum_{i=0}^{q} c\Delta\mathrm{Ln}(\mathrm{INV})_{t-i} \\ &+ \sum_{i=0}^{q} d\,\Delta\mathrm{Ln}(\mathrm{LF})_{t-i} + \delta_1\mathrm{Ln}(\mathrm{TP})_{t-1} + \delta_2\mathrm{Ln}(\mathrm{GDP})_{t-1} + \delta_3\mathrm{Ln}(\mathrm{INV})_{t-1} \\ &+ \delta_4\mathrm{Ln}(\mathrm{TF})_{t-1} + e_t\end{aligned} \tag{2}$$

Equation 2 shows the ARDL model (p, q, q, q) with the variables TP, GDP, INV and LF. To examine long -run relationships, boundary testing for cointegration based on adopted critical values was used with the following null hypothesis (for no long -run relationships) and alternative hypotheses (for long -run relationships).

### 2.4.2. Granger Causality Test

The Granger Causality Test is a way to investigate the relationship between two variables in a time series. This method is a causal probability account because it uses empirical data sets to find correlation patterns. It has to do with the idea of cause and effect, though not the same. The variable X is causal to the variable Y if X is the cause of Y or Y is the cause of X. According to Abdalla (2011: 101), the Granger Causality Test with the Vector Autoregression (VAR) model equation is:

$$y_{1t} = \sum_{i=1}^{p} \left[ \alpha_{11,i} y_{1,t-i} + \alpha_{12,i} y_{2,t-i} \right] + u_{1t} + c \quad (3)$$

$$y_{2t} = \sum_{i=1}^{p} \left[ \alpha_{21,i} y_{1,t-i} + \alpha_{22,i} y_{2,t-i} \right] + u_{2t} + c \quad (4)$$

Where, $y_{1t}$ , $y_{2t}$ = endogenous variables at time to *t*, $\alpha$ = variable coefficient, *p* = total lag, $u_t$ = residual at the time to *t*, $c$ = constant and *t* = time (1, 2, 3, …, n)

## 3. Results

The time series data approach was applied to all selected variables. The data used in this study also covers 25 years from 1990 to 2014. This section also describes the relationship of each variable does not depend on the total production of natural rubber in Malaysia. This analysis shows the regression results for each of the identifiable variables that can affect the total natural rubber output of the country.

### 3.1. Unit Root Test

In this study, the unit root test was conducted using two methods, namely Augmented Dickey-Fuller (ADF) and Phillip Perron (PP). This test is used to look at the relationship between individual variables.

**Table 1.** Unit Root Test using Argumented Dickey-Fuller (ADF).

| Variable | Intercept | | Intercept and Trend | |
|---|---|---|---|---|
| | Level | First Difference | Level | First Difference |
| Total Production | -1.065350 | -3.768604*** | -1.389168 | -3.695657** |
| | [1] | [1] | [1] | [1] |
| | (0.7121) | (0.0070) | (0.8380) | (0.0433) |
| Gross Domestic Product | -0.552265 | -4.513270*** | -2.101295 | -4.407038** |
| | [1] | [1] | [1] | [1] |
| | (0.8638) | (0.0019) | (0.5192) | (0.0107) |
| Investment | -2.340022 | -5.010482*** | -4.307988** | -4.938245*** |
| | [1] | [1] | [1] | [1] |
| | (0.1684) | (0.0006) | (0.0120) | (0.0036) |
| Total Labor | 0.343924 | -4.972367*** | -1.697044 | -4.907123*** |
| | [1] | [1] | [1] | [1] |
| | (0.9757) | (0.0006) | (0.7210) | (0.0035) |

Note: *** and ** are significance at the 1% and 5%.

Table 1 displays the result of unit root test using Argumented Dickey-Fuller (ADF). For the variables of total production and gross domestic product, it is significant at the significance level of one percent on the first differentiation for intercept and at the first differentiation for intercept and trend the significance level is five percent. Next, the investment variable shows a value that is significant at the significance level of one percent on the first differentiation for intercept and the first differentiation for trend and intercept. At the level of trend and intercept it is also significant by showing a significance level of five percent. The variable of total labor force shows that it is significant at the significance level of one percent at the first differentiation, that is, at both intercept and intercept and trend.

**Table 2.** Unit Root Test using Phillips Perron (PP).

| Variable | Intercept | | Intercept and Trend | |
|---|---|---|---|---|
| | Level | First Difference | Level | First Difference |
| Total Production | -1.065350<br>[1] (0.7121) | -3.768604***<br>[1] (0.0070) | -1.389168<br>[1] (0.8380) | -3.695657**<br>[1] (0.0433) |
| Gross Domestic Product | -0.552265<br>[1] (0.8638) | -4.513270***<br>[1] (0.0019) | -2.101295<br>[1] (0.5192) | -4.407038**<br>[1] (0.0107) |
| Investment | -2.340022<br>[1] (0.1684) | -5.010482***<br>[1] (0.0006) | -4.307988**<br>[1] (0.0120) | -4.938245***<br>[1] (0.0036) |
| Total Labor | 0.343924<br>[1] (0.9757) | -4.972367***<br>[1] (0.0006) | -1.697044<br>[1] (0.7210) | -4.907123***<br>[1] (0.0035) |

Note: *** and ** are significance at the 1% and 5%.

Table 2 shows the result of Unit Root Test using Phillips Perron (PP). The variables of total production and gross domestic product have shown a significant relationship on the first differentiation for both intercept and intercept and trend. Both variables were significant at the one percent significance level in the intercept. The intercept and trend also showed a significant relationship only at the first differentiation at the five percent significance level. The investment variable showed a significant relationship at the one percent significance level for the first differentiation in both intercept and intercept and trend. At the level of trend and intercept it is also significant by showing a significance level of five percent. The variable of total labor force shows that it is significant at the first differentiation for both intercept and intercept and trend where it is significant at the significance level of one percent as well.

## 3.2. Autoregressive Distributed-Lag (ARDL) Test.

This test method is used to determine whether the objectives of this study are achieved or not.

**Table 3.** Results of the Autoregressive Distributed-Lag (ARDL).

| Variable | Coefficient | Std. error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -5.881716 | 4.411062 | -1.333401 | 0.2000 |
| LNTP (-1) | 0.008684 | 0.186813 | 0.046487 | 0.9635 |
| LNGDP (-1) | -0.346952** | 0.161048 | -2.154332 | 0.0459 |
| LNINV (-1) | -0.077407 | 0.045866 | -1.687694 | 0.1097 |
| LNLF | 1.077671* | 0.559426 | 1.926386 | 0.0709 |

Note: * and ** are significance at the 10% and 5%.

Table 3 captures the results of the Autoregressive Distributed-Lag (ARDL). The variable production volume (-1) shows a positive relationship with total production which is 0.008684. This variable does not show a significant value on total production. The probability value of this variable is 0.9635. A one per cent increase in total production resulted in total production (-1) also increasing by 0.8684 per cent. The GDP variable shows a negative relationship with total production of -0.346952. This variable shows a significant relationship with the total production at the level of significance of five percent. This is because the probability value of this variable is 0.0459 which is greater than one percent of the significance level. This indicates that a one per cent increase in GDP will cause total production to decrease by 0.346952 per cent. Investment also shows that there is a negative relationship between this variable with total production of -0.077407. This variable also shows an insignificant relationship to total production. This is because the probability value of this variable is 0.1097 which is greater than ten percent of the significance level. The variables of total labor force and total production are positively related between the two variables. This variable is also categorized as a significant variable on total production. This variable is significant at the ten percent significance level with a probability value of 0.0709. A one per cent increase in GDP caused productivity to also increase by 1.077671 per cent.

### 3.3. Pairwise Granger Causality Test

The Pairwise Granger Causality test method is a Granger Causality test between two variables that cannot be interpreted as a real cause-and-effect relationship but only shows that one variable can help predict the other better.

**Table 4.** Result of the Pairwise Granger Causality Test

| Null Hypothesis: | F-Statistic | Probability |
|---|---|---|
| LNGDP does not cause LNTP | 2.81681 | 0.1081 |
| LNTP does not cause LNGDP | 0.62982 | 0.4363 |
| LNINV does not cause LNTP | 5.43550** | 0.0298 |
| LNTP does not cause LNINV | 1.57066 | 0.2239 |
| LNLF does not cause LNTP | 1.46300 | 0.2399 |
| LNTP does not cause LNLF | 1.39762 | 0.2503 |
| LNINV does not cause LNGDP | 0.19576 | 0.6627 |
| LNGDP does not cause LNINV | 7.28453** | 0.0134 |
| LNLF does not cause LNGDP | 1.57662 | 0.223 |
| LNGDP does not cause LNLF | 2.50039 | 0.1288 |
| LNLF does not cause LNINV | 12.9169*** | 0.0017 |
| LNINV does not cause LNLF | 2.22369 | 0.1508 |

Table 4 shows the result of the Pairwise Granger Causality Test. LNGDP did not cause LNTP to show an F-Statistic value of 2.81681 at a probability value of 0.1081. LNTP does not cause LNGDP is 0.62982 at a probability value of 0.4363. LNINV did not cause LNTP to show an F-statistic value of 5.43550 ** at a probability value of 0.0298. This relationship indicates that it is significant at the five percent significance level. So, this indicates the existence of a one -way relationship between INV and TP. And it shows that INV is the cause of TP. LNTP does not cause LNINV to show an F-Statistic value of 1.57066 at a probability value of 0.2239. LNLF does not cause LNTP to show an F-Statistic value of 1.46300 at a probability value of 0.2399. LNTP does not cause LNLF to show F-Statistic 1.39762 at a probability value of 0.2503. LNINV did not cause LNGDP to show an F-Statistic value of 0.19576 at a probability value of 0.6627. LNGDP did not cause LNINV to show F-Statistic 7.28453 ** at a probability value of 0.0134. This relationship indicates that it is significant at the five percent significance level. So, this shows that there is a one -way relationship between INV and GDP. And it shows that INV is the cause of GDP. LNLF does not cause LNGDP to show an F-Statistic value of 1.57662 at a probability value of 0.2230. LNGDP does not cause LNLF to show F-Statistic 2.50039 at a probability value of 0.1288. LNLF did not cause LNINV to show an F-Statistic value of 12.9169 *** at a probability value of 0.0017. This relationship indicates that it is significant at the one percent level of significance. So, this indicates the existence of a one -way relationship between LF and INV. And it shows that LF is the cause of INV. LNINV does not cause LNLF to show F-Statistic 2.22369 at a probability value of 0.1508

## 4. Discussions

In the pursuit of progress in the developed world, various efforts need to be made and all parties need to work together as a team. This situation will depend on our own capabilities, institutional quality, private competitiveness and so on. This is because if a country only has sufficient capital and manpower but is not used efficiently and productively with good R&D and technology resources then it will not be able to increase productivity to drive the increase in output of the rubber agriculture sector in Malaysia. Chaudhuri & Banerjee (2010) in FDI in agricultural land, welfare and unemployment in a developing economy has revealed there are four factors of production: land, capital, unskilled labour and skilled labour. The land endowment of the economy can be increased by allowing the entry of foreign capital in agriculture (Deininger & Byerlee, 2012). Inflows of foreign capital may take place also in the secondary sectors of the economy. Consequences of foreign capital inflows in different sectors of the economy have been studied on national welfare and unemployment of either type of labour. The most important finding of the paper is that flow of FDI in agriculture unambiguously improves social welfare.

Furthermore, it lowers the magnitude of unemployment problem of each type of labour. On the contrary, an inflow of foreign capital into the secondary sectors may affect social welfare adversely. The paper, therefore, justifies the desirability of FDI flow in agricultural land in the developing world from the viewpoint of both unemployment and social welfare. These results shed some new light on a long-standing policy debate as to whether priority should be given to agriculture or to secondary or services sector for achieving a decent economic growth and eradicating poverty in a developing economy. China has been amply successful in both economic growth and poverty fronts by giving top priority to agriculture (De Janvry & Sadoulet, 2009; Ravallion, 2009). After witnessing China's exemplary success on the agricultural front, the developing economies like India are of late toying with the idea of permitting foreign investment in

agriculture. The analysis of the paper provides a theoretical foundation of such a move by the developing nations. Based on the results of this study found that there is a positive relationship between natural rubber production in Malaysia (TP), national income (GDP), investment (INV), and labor productivity (LF) that can increase the production of rubber agriculture sector. To increase the output of the rubber agriculture sector, various things need to be done. Among others, by improving technology related to rubber agriculture and opening more job opportunities for the youth (Hammond et al., 2017; Leavy & Hossain, 2014). At the same time, training schemes and capital incentives from the government are also able to encourage entrepreneurs to thrive in the sector.

## 5. Conclusions

In conclusion, this indicated that the production of the agricultural sector, especially rubber affects Malaysia's income, but the effect may not be perfect because there are other variables that affect the rate of natural rubber production in Malaysia. The production variables of the rubber agriculture sector have a positive long -term relationship with national income. The increase in Malaysia's national income can increase the production of the rubber agriculture sector. The production variables of the rubber agriculture sector also have a positive short -term relationship to national income. The increase in Malaysia's national income can increase the production of the rubber agriculture sector. There is a one -way cause and effect relationship between the study variables. LNINV does not cause LNTP and LNGDP does not cause LNINV has shown a significant relationship at the five percent significance level. Meanwhile, LNILF did not cause LNINV to show a significant relationship at the significance level of one percent. These variables have shown that there is a long-term and short-term relationship to national income. There is no doubt that the increase in national income plays a very important role in increasing the output of a country's rubber agriculture sector. High national income can produce more goods and services domestically and abroad which can contribute to the increase in output of the rubber agriculture sector. This study only looks at the relationship between the rubber agriculture sector with a few variables only. In order to obtain a more comprehensive profile and increase in rubber production for the Malaysian economy, the relationship between total rubber production with time period, level of technology and growth of the economic sector in Malaysia needs to be done. In addition, this study can also be improved by using more time series data. This study uses a short time series data of 25 years only, therefore the error correction formed contains only one lag, with the use of annual time series data more lags can be added, and the results of the study will be more accurate.

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