

Factor Determinants on Availability and Consumption of Rubberwood in Peninsular Malaysia

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Abstract

Rubberwood sawntimber has become one of the major contributors to the Malaysian furniture export and economic growth in the past two decades as its demand from wooden furniture manufacturing has increased tremendously. Factors affecting availability and consumption of rubberwood sawntimber are identified through the multiple regression models. The results of the regression analyses have been statistically diagnosed and modified to generate the best models. Availability of rubberwood sawntimber is influenced by replanted area, price of rubberwood log, latex price and previous production of rubberwood sawntimber. Consumption of rubberwood sawntimber is influenced by national income and prices of other light hardwood species that are mainly consumed by sawmills, i.e. Dark Red Meranti and Red Meranti. The findings could be used as a guideline for the policy maker to develop strategies for further strengthens the wood based industry as a whole.

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1. Introduction

The demand and popularity of the timber and its products in the traditional timber-importing countries like Japan and U.S.A. has further stimulated the growth of the downstream processing of the timber. This has in turn attracted the development of similar rubberwood processing industries mainly in the countries such as Malaysia, Indonesia and Thailand. The utilization of rubberwood is indeed a success story for Malaysia - from a valueless timber before 1980, rubberwood has become one of the major resource for making furniture for export [1]. According to Malaysian Furniture Promotion Council (MFPC), rubberwood sawntimber is the top raw material used in the furniture industry, which makes up 85% of total wood furniture exports in Malaysia in 2013[2].

Malaysia is a world famous furniture manufacturer for its quality timber products such as panel and furniture products, particleboards, medium

density fibreboard (MDF) and wood-fibre cementboards. These products are expected to be one of the future growth areas of utilization based on the total world demand and production of these products. However, based on Malaysian Rubber Board (MRB), export value of rubberwood has decreased from RM 7.63 billion in 2012 to RM 6.83 billion in the year 2013[3]. This is mainly due to the rapid production of rubber wood from the two world's largest producers of rubberwood, i.e. Thailand and Indonesia that affected the previous rubberwood consumption in Malaysia. This means that the sustenance of the wooden furniture depends on continued availability of its preferred raw material that is rubberwood. However, Malaysia's sustenance in exporting rubberwood furniture hence maintaining the contribution of this industry towards Malaysia economic growth is in doubt since the availability of rubberwood is no longer able to fulfill the demand. This paper identifies the significant factors that influencing availability and consumption of

rubberwood that can be used to help the policy makers and parties involved in mainstreaming strategy for wood-based industries.

1.1. Literature Review

A regression mixture analysis can provide a detailed description within a sample and the analysis is more flexible than conventional regression analysis [4]. Complex econometric model is able to assess the factors influencing supply, demand and price by developing estimates of coefficient and providing elasticity and flexibility of estimates [5]. They also asserted that the relative efficient performance of the multiple regression model can be attributed to its ability to capture the dynamics of the structural changes in the market due to variation in the fundamentals which are pertinent in the markets. It was an ordinary multiple regression analysis which only consists of two independent variables. A model also must be kept as simple as possible for practical purposes [6]. Among the diagnostic checking that is available are “t value”, “standard error”, R-square (R²), and Durbin-Watson (DW) statistics.

1.2. Data Analysis

As for availability function, it is necessary to understand the factors affecting the extraction and utilization of rubber log. Among the most relevant factors that may influence the rubber sawntimber production are annual replanting rates, stand density, availability of rubber logs and other relevant economic factors such as log and latex price [7, 8, 9 & 10] while the total availability of rubberwood sawntimber is highly dependent on areas replanted and newly planted with rubber per year as well as the tree volumes themselves [7]. Harvested area of rubber tree is the most relevant factor to be used. It is expected that open area for harvested has positive relation with production of rubberwood sawntimber. However, no statistics on harvested area of rubberwood are kept by Department of Statistics (DoS). In addition, these data also are not available from Federal Land Development Authority (FELDA), Federal Land Consolidation and Rehabilitation Authority (FELCRA) and Rubber Industry Smallholders' Development Authority (RISDA). This study used replanted area of rubberwood in smallholdings and estates in Peninsular

Malaysia collected from MRB as proxy for harvested area.

Price of rubberwood sawntimber is also one of the factors that influence production of rubberwood sawntimber. According to basic economy theory, price always has a positive relation with production. Production will increase as price increases and vice-versa. Log price does influenced the supply of hardwood logs supply and demand relationships for hardwood logs in Indonesia [11]. However, statistics on rubberwood sawntimber price is only available from year 1996 onwards. Since this study uses annual data starting from year 1983, rubberwood log price is used instead of rubberwood sawntimber price.

Since rubberwood is originally planted for its latex, latex price might play a significant role especially for the smallholders to decide whether to fell the tree or not. Increase in latex price will give more profit instead of felling trees for replanting therefore this situation will affect their decisions. However, the price of latex may have little influence on large plantations since rising price of latex seems does not affecting the price and the availability of rubberwood logs[7]. Thus, for availability function, area replanted with rubber trees, price of rubberwood sawntimber and price of latex are already sufficient as independent variables. Previous price, previous harvested area and previous production of rubberwood logs might also affect the production of rubberwood sawntimber. The best model with significant factors that affects availability of rubberwood sawntimber will be identified in the next chapter.

Whereas for consumption function, among the most relevant factors that affect rubberwood sawntimber consumption are income, price and buyers preference [6 & 12]. Income is the most significant dependent that certainly affect the consumption of rubberwood sawntimber. Theoretically in a basic economy, the relationship between consumption and income is featured in the form of a Sigmoid-curve [13]. In a study to project trends in demand for paper and board by the U.S. Forest Service, GNP is one of the independent variables used [11].

Price is also one of the independent variables that might influence consumption however the relationship between consumption and price is less

clear since consumption is mainly a function of income [13]. Additional consumption may not be stimulated at all if income is low regardless how low market price are. Therefore, consumption of rubberwood sawntimber possibly decrease even the price is low or vice-versa may be true. Positive relation between income and consumption indicates that rubberwood sawntimber is a superior good while negative relation indicates that rubberwood sawntimber is an inferior good. Previous consumption also could affect consumption of rubberwood sawntimber.

Theoretically, increase in rubberwood sawntimber price will lead to a decrease in its consumption and vice versa. Also, an increase in price of other timber species will lead to an increase in rubberwood consumption. Rubberwood has similarities in physical characteristics with other timber species such as ramin, meranti, teak, oak and pine thus it can be substituted with these species [14]. Consequently, if the above timber prices are increasing the demand for rubberwood will also be increasing. In this situation, basic economic theory on substitution good is applied. In this study, average price of Dark Red Meranti and Red Meranti was used as they are among the major light hardwood species processed and consumed by sawmills and exported.

The number of mills that consume rubberwood also may affect the consumption of rubberwood. Nevertheless, the exact numbers of mills that consume rubberwood sawntimber are not available. However, four factors above are already sufficient to estimate future consumption as [13] use only three independent variables which are export of furniture and moulding, and price to explain per capita consumption on woods. Three factors that affect consumption of forest logs are per capita income, domestic price of logs and import price of logs [12]. In another study, three independent variables that is the domestic price of forest log, annual logging area and ratio of total royalty payments to total revenues from logging operation to explain desired domestic supply or production [15]. For domestic demand for forest logs equation function, he used domestic price of forest logs, world import price of log and industrial production index.

In conclusion, the availability of rubberwood sawntimber is a function of its replanted area (RAR), price of latex (PL) and rubberwood log prices (PRW) at present and previous periods. As for consumption of rubberwood sawntimber, is a function of income (GDP), its own price (PRW) and price of its substitute good (POTS).

2. Materials and Methods

The data used in this analysis is the values of the explanatory variables. The general regression model for availability and consumption of rubberwood sawntimber of this analysis is presented below;

$$QSS_t = \beta_0 + \beta_1 RAR_t + \beta_2 PRW_t + \beta_3 PL_t + e_t$$

QSS_t = Production of rubberwood sawntimber at time t

RAR_t = Replanted area of rubber in Peninsular Malaysia (hectareage) at time t

PRW_t = Price of rubberwood logs at time t

PL_t = Price of latex at time t

RAR and PRW are expected to have a positive relation with QSS (Production of rubberwood sawntimber). Therefore, QSS is expected to increase when RAR and PRW increases and vice-versa. PL is expected to have a negative relation with QSS. Therefore when PL increases, QSS will decrease. However PL might also have positive relation with QSS as it may have only little influence on QSS.

$$QDD_t = \beta_0 + \beta_1 GDP_t + \beta_2 PRW_t + \beta_3 POTS_t + e_t$$

QDD_t = Consumption of rubberwood sawntimber at time t

GDP_t = Income at time t

PRW_t = Price of rubberwood logs at time t

POTS_t = Price of other timber species at time t

GDP and POTS are expected to have a positive relation with QDD (Consumption of rubberwood sawntimber). Therefore, QDD is expected to increase when GDP and POTS increases. PRW is expected to have a negative relation with QDD. Therefore when PRW increases, QDD will decrease.

2.1. Diagnostic Tests

A variety of diagnostic statistics is provided to examine the adequacy and closeness of fit of the data. Lagrange Multiplier (LM) test is applicable to test for auto or serial correlation whether lagged values of the dependent variables appear among the regressors or not. Ramsey's RESET test using the square of fitted values was applied to check serial correlation, heteroskedasticity and the appropriateness of the functional form if there is any can be tested. One of the criteria to choose the best model is Akaike information criteria (AIC) and Schwarz's information criteria (SIC). The model with the lowest value of AIC and SIC is preferred, note that the values can be negative [22]. AIC and SIC also are useful for in-sample and out-of-sample forecasting performance of a regression model [6].

2.2. Performance Measurement

The accuracy of the results that we got from the analyses was tested by several indicators such as statistically significant t values and F-statistics, R², adjusted R² and acceptable DW statistics.

In regression analysis, the objective is not to obtain a high R² per se but rather to obtain dependable estimates of the true population regression coefficients and draw statistical inferences about them. The logical or theoretical relevance of the explanatory variables to the dependent variable, their statistical significance and have signs that are comparable to a priori expectations should be more concerned of. If R² is low, it does not mean the model is necessarily bad [6].

2.3. Data

Secondary time series data from various government agencies and research institutes was used in this study. The data are collected through the statistics books produced by these agencies and from their websites. The availability of data is very limited because of the effort of converting rubber trees to rubberwood logs was only started in the early 1980's [7]. In a study to quantify the relationships among factors in order to predict the export of wooden furniture from Malaysia, regression model is used and the study only covers 16 period of years which is from 1982 to 1997 due to the practically similar reasons such as difficulty in obtaining older data, and the fact that

export of rubberwood furniture started in the 1980s [11]. Effort in finding semi-annually data has been done for this study but semi-annual data is not complete as it only exist for some variables and for certain years only.

In addition, there was different data from different agencies such as data on value of export rubberwood sawntimber from Forestry Statistics Peninsular Malaysia (FSPM), data from MRB website which quoted from Malaysian Timber IndustrialBoard (MTIB), and data from Ministry of Trade (Matrade). As reconciliation, data from FSPM, MRB or Matrade was used if the data from FSPM was not available.

Data on production, import and export of rubberwood sawntimber were collected from FSPM published by Forestry Department Peninsular Malaysia FDP, MTIB, Matrade and Malaysian Timber Council (MTC). Data on PRW and POTS were collected from MASKAYU which published by MTIB while PL and total replanted area under rubber in Peninsular Malaysia (hectareage) were gathered from Annual rubber statistics. The identified general model for production and consumption above based on Gregory's model was employed in this study.

3. Result and Discussion

Both production and consumption equation above have been regressed in linear model as identified before. The final multiple regression equation of production and consumption with the best fit are shown below.

3.1. Availability Equation

$$QSS_t = 158279.6 + 0.142 RAR_t + 1519.911 PRW_t - 331.320 PL_t$$

$$p = (0.002)^{***} \quad (0.267) \quad (0.046)^{**} \quad (0.153) \quad R^2 = 0.2171$$

Note: *, **, *** denote 10%, 5% and 1% significance levels respectively

Regression result for production model shows that all the independent variables included in the model shows the same coefficient signs with the prior expectation however only PRW is significant at 5% level of significant. DW statistics indicate the existence of serial correlation. Breusch-Godfrey Serial Correlation LM Test was used to perform a more general serial correlation test since the Durbin-Watson

statistic can be difficult to interpret. The result indicates the presence of serial correlation in the residuals. Ramsey's RESET test signifies that the model is acceptable and not mis-specified and no heteroscedasticity existed in the model.

Among the common method of accounting for serial correlation is to include AR and/or MA terms and to include lags of the variables in the equation. The model has been modified to take with account the serial correlation problem. AIC, SIC, R2, t and F-stat indicate that, the best model is the model which includes lags of QSS.

$$QSS_t = 108710.6 + 0.283 RAR_t + 740.514 PRW_t - 352.155 PL_t + 0.658 QSS_{t-1}$$

$$P = (0.0104)^{***} \quad (0.0133)^{***} \quad (0.2240)^{**} \\ (0.0573)^{***} \quad (0.175)^{***}$$

$$R^2 = 0.5298$$

Note: *, **, *** denote 10%, 5% and 1% significance levels respectively

All of the independent variables show correct signs as expected. PL is significant at 5% while RAR and previous QSS are significant at 1% level of significant. R2 value obtained from this equation is about 0.5298 % means that 53 % of the variation in rubberwood availability is explained by its replanted area, rubberwood log prices, latex price and previous availability of rubberwood sawntimber.

3.2. Consumption Equation.

$$QDD_t = 64549.85 - 201.523 PRW_t + 375.359 POTSt - 0.358 GDP_t$$

$$se = (33620.18)^* \quad (1314.276) \quad (130.329)^{***} \\ (0.392)$$

$$t = (1.920) \quad (-0.153) \quad (2.880) \quad (-0.914)$$

$$p = (0.0685) \quad (0.8796) \quad (0.0090) \quad (0.3708)$$

$$R^2 = 0.4474$$

Note: *, **, *** denote 10%, 5% and 1% significance levels respectively

Regression result for consumption model shows that all of the independent variables included in the model shows the same coefficient signs with the prior expectation however only POTS is significant at 1%. DW statistics indicate that no serial correlation problem exists. Breusch-Godfrey Serial Correlation LM Test was used to perform a more general serial correlation test since the DW statistic can be difficult

to interpret. The result also indicates non-existence of serial correlation in the residuals. Ramsey's RESET test signifies that the model is acceptable and not mis-specified and no heteroscedasticity existed in the model.

The model has been modified since there is only one independent variable that is significant. This is important to ensure the accuracy of the results that we got from the analyses. AIC, SIC, t and F-stat also indicate that, the best model is the model which omit price of rubberwood logs. This result confirmed that the relationship between consumption and price is less clear since consumption is mainly a function of income.

$$QDD_t = 66739.58 + 362.315 POTSt - 0.409 GDP_t \\ se = (29753.46)^{**} \quad (96.521)^{***} \quad (0.208)^*$$

$$t = (2.243) \quad (3.754) \quad (-1.963)$$

$$p = (0.0353) \quad (0.0011) \quad (0.0624)$$

$$R^2 = 0.4467$$

Note: *, **, *** denote 10%, 5% and 1% significance levels respectively.

All independent variables show correct signs as expected. POTS is significant at 1% while GDP is significant at 10% level of significant. R2 value obtained from this equation is about 0.4467 & means that about 45 % of the variation in rubberwood consumption is explained by income and price of other timber species.

4. Conclusions

This study showed that availability of rubberwood sawntimber is influenced by replanted area of rubberwood, price of rubberwood log, latex price and previous production of rubberwood sawntimber. The significant result of latex price and area of rubberwood planted indicate that there is short and long-term deficit in the availability of rubberwood sawntimber. Consumption of rubberwood sawntimber is influenced by income (Malaysian gross domestic products), previous consumption of rubberwood sawntimber and price of other light hardwood species that is mainly consumed by sawmills that is Dark Red Meranti and Red Meranti. Therefore, proper planning on replantation programme is crucial to ensure consistent availability of rubberwood sawntimber and

stability of the rubberwood log price, as well as the price of latex.

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