Challenges of the Export for Natural Rubber Latex in the ASEAN Market

Aye Aye Khin 1, Raymond Ling Leh Bin 2, Sia Bik Kai 3, Kevin Low Lock Teng 4, Fong Yi Chiun 5

1 Assistant Professor, Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, MALAYSIA
2 Lecturer, Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, MALAYSIA
3 Senior Lecturer, Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, MALAYSIA
4 Associate Professor, Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, MALAYSIA
5 M.Phil Student, Faculty of Accountancy & Management (FAM), Universiti Tunku Abdul Rahman (UTAR), Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, MALAYSIA

E-mail: ayekhin@utar.edu.my

Abstract. There are approximately 90% of the world natural rubber (NR) supplies are produced by the top 4 NR exporting countries, particularly Thailand, Indonesia, Malaysia and Vietnam. The export challenges and uncertainties of the NR latex in the ASEAN market are influenced by many factors. All these issues have driven the motivation of this study that aims to investigate the factors affecting the export of the NR latex, to analyse the relationship among the export price, production and exchange rate with the export, and to predict the export of the NR latex of the four countries. The data from 1999 to 2016 are utilized as the panel data analysis and granger homogeneously causality test for estimations. Estimation reveals that the independent variables, namely export price and production are exhibiting significant positively and the exchange rate shows a negative relationship with export. To conclude, Indonesia and Malaysia are estimated to have decreasing trends of NR latex export. Inversely, Thailand and Vietnam are predicted to exhibit increasing trends of NR latex export. The novelty of this study concerns effectively on the enhancement and stability of NR production in the ASEAN market despite of the challenges arising from the global market integration.

1. Introduction

With the utilization of econometric panel data analysis, the factors that affecting the NR export and challenges arise on natural rubber latex in ASEAN market will be examined extensively in this paper. The export of Natural rubber (NR) plays a vital role as one of the major contributions to the economic growth in ASEAN developing countries. Concurrently, the rubber latex has been considered as one of the crucial natural rubber commodities and contributing to the rise of exports in the emerging ASEAN economies. Latex [1] is better known as white liquid sticky form that has been extracted and collected from “tapping” process which is a long cut made on rubber trees (Fig. 1). Generally, the exports of rubber products are namely the dry and latex natural rubber, compound rubber, tyres, inner tubes, catheters, gloves, footwear, rubber bands, rubber sheets, condoms and so forth. On the other hand, the gloves, condoms, catheters, latex thread, and many more are the usual exports of rubber latex products.

The export challenges and uncertainties of the rubber latex in the ASEAN market are influenced by many factors. According to the past study of rubbers’ supply and the export challenges [2], the supply of rubber was determined by the expected price in the market place, in line with
production capacity of rubber such as planted area, new planting, replanting, and the age of the rubber tree, input costs, and underlying technological progress. In other circumstances, the rubber production was also influenced by the public (government) policy and private contributors that involved in the rubber production and development. In retrospect, in the case if the rubber productions have been increased in a particular country, the rubber latex export would be increased simultaneously, holding other variables as constant [3]. Similarly, for the NR exporting countries, if there is a continuous rise in NR export price, the rubber export will be increased as well.

![Image of rubber plantation and latex collection](image1.jpg)

**Fig. 1.** The Rubber Plantation and Collection of Latex from a Tapped Rubber Tree
Source: [1]

The past literatures were later interacted the rubber production with dynamic and recursive manner of demand. Demand was set by the expected rubber price, as well as the income level in the overall economy, prices of rubber substitutes, and prices of final goods, technology, consumer preferences, stocks, and utilization of manufacturing capacity [2]. The organizational structure of rubber production, marketing, consumption, and the government measures were also significant [2], however, the emphasis of rubber framework must examine both the supply and demand factors. It is possible to examine these relationships by constructing the rubber export model to capture the interdependencies between these factors in the emerging ASEAN market.

There are other past literatures [3, 4] elucidated the potential challenges of the export model utilization. Numerous challenges namely the favourable weather, political stability in the leading rubber producing countries, revival of abandoned rubber plantings due to long run high prices, instability of the demand side, slowing down of the GDP growth following sharp rises in oil prices and numerous factors are bound to have a direct impact on the long-term stability of rubber prices. The rise of NR price may also lead the great concern of some NR consuming countries and producers to acquire for more synthetic rubber (SR) in place of NR demand for more reclaimed NR and the hunt for more alternatives to NR products. Fundamentally, the NR prices were strongly influenced by numbers of external factors, namely the integration of global economic situations, supply-demand gap, export-import situation, and primarily the changes in crude petroleum oil prices, exchange rate volatility, time-lag, slowing growth in agricultural productivity, as well as government policies, futures markets interventions, rubber stock and unstable demand [5].

All these factors and challenges will provide a good starting point in constructing a solid theoretical framework in this study, in line with the general rubber economy perspectives, the export challenges and uncertainties of rubber latex.

Table 1 portrays the top 10 largest rubber exporters and importers in the world in 2016 and exhibits a huge opportunity for ASEAN developing countries as the main exporters and of NR in
the world economy. There are about 65% of global supplies are contributed by Thailand and Indonesia. Diversely, there are approximately 90% of the world NR supplies are produced by the top 4 NR exporting countries, particularly Thailand, Indonesia, Malaysia and Vietnam. Currently, Malaysia stands in the lists of both the top 10 rubber exporters and importers; and is the country has grows to be the 1st exporter of rubber latex glove products (in Fig. 2) and 3rd largest producers of the world rubber producing countries in 2017.

Fig. 2. Malaysia’s Rubber and Rubber Products Export Countries [6]

In Malaysia, for the rubber latex glove products have been increased from approximately 12,000 million pairs to 37,000 million pairs in 2001 to 2017. Moreover, the rubber latex products’ export volumes have been increased continuously from RM 4,000 million to RM 17,000 million in 2001 to 2017. In addition, the rubber latex import volumes has raised from approximately RM 200 million to RM 700 million in between 2001 to 2017 [7]. Conversely, Thailand was the largest exporter and amounting to 36.8% of the world rubber export, followed by Indonesia (28.1%), Vietnam (7.5%), Malaysia (7.3%) and Cote d’Ivoire (6.1%) in 2016. China was the largest importer, amounting to 26.7% of the world rubber import, followed by United States (11.7%), Malaysia (9.3%), Japan (7.4%) and India (5.2%) in 2016 (Table 1).

Table 1: Top 10 Largest Rubber Exporters & Importers in the World in 2016 [8]

| Rank | Country            | Export Value (USD) |
|------|--------------------|--------------------|
| 1.   | Thailand           | 4.4 billion (36.8%)|
| 2.   | Indonesia          | 3.4 billion (28.1%)|
| 3.   | Vietnam            | 904.1 million (7.5%)|
| 4.   | Malaysia           | 871.1 million (7.3%)|
| 5.   | Côte d’Ivoire      | 726.3 million (6.1%)|
| 6.   | Myanmar (Burma)    | 194.1 million (1.6%)|
| 7.   | Germany            | 153.4 million (1.3%)|
| 8.   | Belgium            | 126.4 million (1.1%)|
| 9.   | Guatemala          | 120.9 million (1.0%)|
| 10.  | Liberia            | 106.3 million (0.9%)|

| Rank | Country     | Import Value (USD) |
|------|-------------|--------------------|
| 1.   | China       | 3.4 billion (26.7%)|
| 2.   | United States| 1.5 billion (11.7%)|
| 3.   | Malaysia    | 1.2 billion (9.3%) |
| 4.   | Japan       | 927.2 million (7.4%)|
| 5.   | India       | 656 million (5.2%)  |
| 6.   | Rep. of Korea| 537.1 million (4.3%)|
| 7.   | Germany     | 478.9 million (3.8%)|
| 8.   | Brazil      | 321.7 million (2.6%)|
| 9.   | Spain       | 241.8 million (1.9%)|
| 10.  | France      | 239.1 million (1.9%)|

2. Literature Reviews

The research on “Factor Affecting Thailand’s Major Agricultural Exports Using Panel Co-integration Method” illustrates the export volumes of Thailand’s agricultural products that were affected by number of variables [9]. The unit root tests, panel co-integration test, and ordinary least squares (OLS) have been tested on annual panel data from 2001 to 2010. This research concludes a negative relationship between export volume and rubber’s domestic price. Also, this
research summarizes that when there is a decrease in domestic price of natural rubber, it will lead to the decrease in export of the rubber. Inversely, if the NR is highly demanded from other countries, there will still be a high exportation of the nature rubber.

Another research on “An Econometric Analysis of Natural Rubber Market in Malaysia” aims to investigate how NR industry in Malaysia is affected by essential factors [10]. The unit root test, cointegration test and two stages least squares (2SLS) have been utilized in this research. The outcomes of the export equation of this research show a relationship between world industrial production index and time trend at 5% significance level. The results revealed that there is a positive relationship between export and production of natural rubber, but a negative relationship between production and time trend of rubber trees. This research also concludes that in the case if the time trend of the rubber trees were increased above 30 years, the production of NR product will be reduced year by year.

In the perspective of the neighbourhood country, a research on “Determinant Analysis for Rubber Export in Indonesia” was executed to evaluate the factors that affect the rubber export in Indonesia [11]. Robust regression is used in conducting this research. The researchers revealed that there is a negative relationship between exchange rate and export quantity of rubber and there is also a positive relation between production and export quantities of rubber. The novelty of this research explains the connection among the exchange rate, production level, and export of natural rubber in Indonesia. Within the same ASEAN region, a research on “Exchange Rate Variations and Agricultural Exports in Vietnam” aims to investigate on how exchange rate variations will affect the agricultural export market in Vietnam [12]. The results revealed that the depreciation of exchange rate will lead to the decline of agricultural products’ exports in Vietnam. The data utilized the agricultural market in Vietnam, however, the specification of specific agricultural products are not clearly defined.

3. Methodology
In retrospect, the export challenges and uncertainties of the NR latex in the ASEAN market were affected by many factors. This study (Fig. 3) assessed the breakdowns of both the supply and demand factors in line with the modifications made on the functional form of NR export model and some key factors such as the export price, production and exchange rate. All these key factors have driven the motivation of this study that aims 1) to investigate the factors affecting the export of the rubber latex, 2) to analyse the relationship among the export price, production and exchange rate with the export, and 3) to predict the export of the rubber latex of the selected ASEAN countries. The data from 1999 to 2016 are utilizing the panel data analysis and granger homogeneously causality test for estimations. All the secondary data of four selected countries are gathered from Malaysian Rubber Board (MRB), Malaysian Rubber Export Promotion Council (MREPC) and The Association of Natural Rubber Producing Countries (ANRPC).

![Fig. 3. Conceptual Framework of the Export of the Rubber Latex of the 4 ASEAN countries](image)

Thailand: $n_{expTH} = \alpha + \beta_1n_{rstr} + \beta_2e^{THB} + \beta_3n_{ropher} + e_{1it}$
Indonesia: \( n\text{rexpIN}_t = \alpha_2 + \beta_2 n\text{rsir20}_t + \beta_3 \text{exIDR}_t + \beta_4 n\text{rpin}_t + e_{2t} \)
Malaysia: \( n\text{rexpMS}_t = \alpha_3 + \beta_7 n\text{rsir20}_t + \beta_8 \text{exRM}_t + \beta_9 n\text{rpms}_t + e_{3t} \)
Vietnam: \( n\text{rexpVN}_t = \alpha_4 + \beta_{10} n\text{rsir20}_t + \beta_{11} \text{exVN}_t + \beta_{12} n\text{rpvt}_t + e_{4t} \)

where:
\( n\text{rexpTH} \) = NR export of the rubber latex in Thailand (’000 tonnes)
\( n\text{rexpIN} \) = NR export of the rubber latex in Indonesia (’000 tonnes)
\( n\text{rexpMS} \) = NR export of the rubber latex in Malaysia (’000 tonnes)
\( n\text{rexpVN} \) = NR export of the rubber latex in Vietnam (’000 tonnes)
\( n\text{rsir20} \) = SIR20 NR Indonesia export price (USD/ton) deflated by the CPI
\( n\text{rsir20} \) = SIR20 NR Indonesia export price (USD/ton) deflated by the CPI
\( n\text{rsr20} \) = STR20 NR Thailand export price (USD/ton) deflated by the CPI
\( n\text{rsr20} \) = STR20 NR Thailand export price (USD/ton) deflated by the CPI
\( n\text{rsr20} \) = STR20 NR Thailand export price (USD/ton) deflated by the CPI
\( n\text{rsr20} \) = STR20 NR Thailand export price (USD/ton) deflated by the CPI
\( \text{exTHB} \) = Exchange rate (THB100/USD) (THB = Thai Baht)
\( \text{exIDR} \) = Exchange rate (IDR100/USD) (IDR = Indonesian Rupiah)
\( \text{exRM} \) = Exchange rate (RM/USD) (RM = Malaysian Ringgit)
\( \text{exVN} \) = Exchange rate (VND/USD) (VND = Vietnamese Dong)
\( n\text{rpth} \) = NR latex production of Thailand (’000 tonnes)
\( n\text{rpvt} \) = NR latex production of Vietnam (’000 tonnes)
\( n\text{rpms} \) = NR latex production of Malaysia (’000 tonnes)

3.1 Hypothesis Development

\( H_01: \) There is no positive relationship between export price and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.
\( H_{A1}: \) There is a positive relationship between export price and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.

\( H_02: \) There is no negative relationship between exchange rate and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.
\( H_{A2}: \) There is a negative relationship between exchange rate and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.

\( H_03: \) There is no positive relationship between NR latex production and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.
\( H_{A3}: \) There is a positive relationship between NR latex production and export of the rubber latex of Thailand, Indonesia, Malaysia and Vietnam.

3.2 Panel Data Analysis

Panel data is a set of data that consists of the combination of time series and cross-sectional data in the dataset, or better known as longitudinal data which is a study over times of a group of variables [16]. There are 72 observations (18 years x 4 countries) in total consists of Thailand, Indonesia, Malaysia and Vietnam from 1999 to 2016. The panel data are used to analyse the issues that are hardly to be solved by time series data or cross-sectional data, and to avoid the issues of omitted variables that would cause bias in cross-sectional data [16, 17]. There are four different kinds of variables used in this research: 1) variables that vary among individuals but do not change
over time (country code); 2) variables that vary over times but are similar for all individuals in a specific time period (price of natural rubber and exchange rate); 3) variables that changed on both over times and among individuals (export volume and export price); and 4) tendency variables that vary in predictable ways (exchange rate) [17,18].

3.2.1 Selection of Panel Data Models
The observations of panel data \((it)\) will be indicated by both cross-section dimension (indicated by subscript \(i\)) and time series dimension (indicated by subscript \(t\)). Panel data models will examine the individual-specific effects, time effects, or both in order to deal with heterogeneity or better known as individual effect (cross-sectional or time specific effect). There are three panel data models will be utilized in this study, namely Pooled OLS (POLS), Fixed Effect Model (FEM) and Random Effect Model (REM). POLS is preferred if the individual effect does not exist, due to the reason that ordinary least square method (OLS) can produce more efficient and consistent parameters estimates. If utilising both POLS vs FEM, the testing of the Redundant Fixed Effects can be done. If comparing both POLS vs REM, the Breusch-Pagan LM test can be done in line with the past researches and testing by [16], [17] and [18]. In order to test the presence of individual effects, both fixed and random effects can be examined. A FEM model will examine in the case if the intercepts vary across groups or time periods, whereas a REM explores differences in error variance components across individuals or time periods. Hausman test [19] needs to be carried out to confirm which of the models (REM vs FEM) will be the most appropriate method for analysis. In short,

\textbf{POLS vs FEM} : \textbf{Redundant Fixed Effects test} will examine the assumptions of variances for individual effect

\textbf{POLS vs REM} : \textbf{Breusch-Pagan LM test} will examine the assumptions of variances for individual effect

\textbf{REM vs FEM} : \textbf{Hausman test} will detect the significant differences between the two estimators

Finally, the Hausman test will be appraised in order to select between both \textbf{REM and FEM}, and the results outlines in Table 2. \(H_0\): REM is preferred; and \(H_A\): FEM is preferred.

\textbf{Table 2: Results of the Correlated Random Effects - Hausman Test}

| Equation: REM | Test period random effects |
|---------------|----------------------------|
| Test Summary  | Chi-Sq. Statistic Chi-Sq. d.f. Prob. |
| Period random | 2.5359 | 3 | 0.4688 |

Source: Own Data Analysis

Table 2 shows that p-value (0.4688) is larger than \(\alpha \) 0.05, and therefore, the null hypothesis will be accepted. In this case, the \textbf{REM} is more preferred rather than \textbf{FEM}. Eventually, \textbf{REM} serves as the more appropriate panel data analysis to be employed for the export model of the ASEAN market.
4. Results & Discussion

4.1 REM of the Natural Rubber Latex Export Model

\[
\text{Export}_t = 1.4322 + 0.0323 \text{Price}_t + 0.0512 \text{Production}_t - 0.0221 \text{Exr}_t + 0.0129 e_t
\]

\([2.7661^{**}] \quad [4.2039^{**}] \quad [-11.7833^{***}]\]

\[R^2 = 0.2369; \quad \text{Adjusted } R^2 = 0.2033\]

Residual Diagnosis: Jarque-Bera Statistics = 2.4517; sig-p value = 0.2935

As refer to the export model among the ASEAN 4 countries, NR latex export is set as the dependent variable while the independent variables in this model include export price, NR production and the exchange rate of the individual country. R-squared means that there is approximately 23.69 percent of total variation in the export equation is well explained by the explanatory variables, namely the export price, NR production and exchange rate. Amongst the 3 explanatory variables, the NR production portrays as the most important variable in the NR latex export model. Every 1 unit increase in export price, in average, has a positive effect by increasing 0.0323 unit in NR latex export with statistically significance at \(\alpha=0.05\) level. In addition, every 1 unit increase in NR production, in average, has a positive impact by increasing 0.0512 unit in NR latex export with statistically significance at \(\alpha=0.05\) level. Lastly, every 1 unit increase in exchange rate, in average, will have a negative impact by decreasing 0.0221 unit in NR latex export with statistically significance at \(\alpha=0.01\) level. Besides, based on the residual analysis of the normality test, the Jarque-Bera Statistics = 2.4517; and sig-p value = 0.2935 is more than \(\alpha=0.05\). Therefore, the residuals are proven to be normally distributed.

Based on the outcomes of the Granger Homogeneously Causality Test [20], the PRODUCTION is homogeneously granger causes the EXPORT. Therefore, PRODUCTION and EXPORT are having long term equilibrium and co-integrated with statistically significance at \(\alpha 5\%\) level (sig-p value = 0.0107 < \(\alpha 0.05\)). PRODUCTION \(\rightarrow\) EXPORT, it is proven to have a unidirectional relationship. The PRICE is homogeneously granger causes the PRODUCTION. Therefore, PRICE and PRODUCTION are having long term equilibrium and co-integrated with statistically significance at \(\alpha 5\%\) level (sig-p value = 0.0292 < \(\alpha 0.05\)). PRICE \(\rightarrow\) PRODUCTION, it is also proven to have a unidirectional relationship. Lastly, the PRODUCTION is homogeneously granger causes the EXCHANGE_RATE. Therefore, PRODUCTION and EXCHANGE_RATE are having long term equilibrium and co-integrated with statistically significance at \(\alpha 5\%\) level (sig-p value = 0.0397 < \(\alpha 0.05\)). PRODUCTION \(\rightarrow\) EXCHANGE_RATE, it is also proven to have a unidirectional relationship.

4.2 Model Simulation of the Prediction of the NR Latex Export Trends
Fig. 4. Model Simulation of the Export of the NR Latex of the 4 ASEAN countries
Source: Own Development

Fig. 4 illustrates that Indonesia and Malaysia are estimated to have decreasing trends of NR latex export. Inversely, Thailand and Vietnam are predicted to exhibit increasing trends of NR latex export from 1999 to 2016. In general, all the NR latex export trends on the 4 countries are predicted to be increased from 2017 to 2020.

5. Conclusion
Based on the Random Effect Model (REM) of the NR latex export model equation, there is a positive relationship between export price and export NR latex of Thailand, Indonesia, Malaysia and Vietnam. In summary, the results shown that exchange rate exhibits a negative relationship with export NR latex among the four selected ASEAN countries. In addition, NR production illustrates a positive relationship with the export NR latex among Thailand, Indonesia, Malaysia and Vietnam. This study examines some significance of variables that are beneficial for prediction and forecasting of the export of latex in the rubber sector (export price, exchange rate and NR latex production). All the significant variables within the REM equation utilize the correct functional form and a strong long-term relationship exhibits among the variables. In addition, the important identified variables in this study may benefit the authorities, businesses and other related sectors in different countries. The novelty of this study concerns effectively on the enhancement and stability of NR production in the ASEAN markets despite of the challenges arising from the global market integration.

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