

AN ANALYSIS ON NATURAL RUBBER PRODUCTION AND EXPORT IN MYANMAR

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Abstract

Aims of this study are to find out the status of production and export of natural rubber in Myanmar and to explore the factors which influence on its export and production. To analyze the factors affecting on the production and export, multiple regression model (OLS) has employed and two models were constructed to examine. Status of Myanmar's rubber export and production and influencing determinants were analyzed for 35 years ranging from 1983 to 2018. The production and export of natural rubber grew significantly after the adoption of market-oriented economic policy in late 1988. Major locations of natural rubber resources are from Mon state and Taninthayi division, Karen and Rakhine state accounting for 17%, 19.5%, 27% and 19.7% of rubber supplied respectively. Determining the variables affecting natural rubber production and export in Myanmar, the overall results revealed that production of natural rubber is significantly influenced by the export, import and land acres of rubber with the significant level of probability value 5%, 1% and 0% respectively. Moreover, findings showed that natural rubber export is positively influenced by control variable such as exchange rate while the import is negatively associated with the export.

Keywords– Myanmar, Production, Export, Ordinary Least Squares (OLS)

JEL Classification – E23, F14, C30, C32

Introduction

Natural rubber has been called “White Gold”, also known as India rubber is precious and profitable as gold and economically important in the world wide. The use of rubber has been increasing with the rising world population and higher demand for automobiles demanding natural rubber. The global demand for natural rubber is estimated to increase at an average annual growth rate between 3.4% and 3.7 from the year 2018 to 2024 (Yai 2019).

Natural rubber shows as an important role in the Indonesian economy with 86.9 percent of productions exported to foreign nations and providing the main livelihood for above one million of its citizens. Indonesian government is trying to promote expanding the rubber planted area alliance with tire industry with the aim of increasing the rubber production (Mirawati Yanita M.Yazid 2016). (Joe Gigy George 2014) mentioned that India is the fourth world's largest producer of natural rubber with the contribution of 0.19 percent in its national income. Natural rubber is the back bone of the India and has a profound influence on the socio-economic conditions of the people.

Natural rubber is an economically important crop and source for employment in Thailand. Moreover, as being the world's largest producer and exporter, it influences world market price. Through out of the nation, rubber growing area has been developed and expanded. Government of Thailand has launched various policies and provides various measurements such as research in high-yielding varieties, good-practice harvesting systems and tree maintenance and teaching new technology, and aided farmers for higher rubber production in its nation (Soontaranurak 2011).

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Table-1 shows the leading exporting countries of natural rubber in worldwide based on export value in 2018. Thailand is top exporter of natural rubber with the amount of 4,600 million U.S. dollars and Indonesia, Vietnam, Malaysia and Cote d'Ivoire are following and taking a place as 2nd, 3rd, 4th, and 5th top exporters with the value of 4,000 million U.S. dollars, 987.3 million U.S. dollars, 936.5 million U.S. dollars, and 752.6 million U.S. dollars respectively. Myanmar exports with the small value of 260 million U.S. dollars compared to Thailand, Indonesia and Malaysia, however, it is ranking at 6th in the world exports of natural rubber market. Thailand command 34.5% share of total exported natural rubber in world market while the Indonesia influences almost 30% of the global rubber market. In terms of rubber producing, ASEAN member countries such as Indonesia, Malaysia, Vietnam and Thailand are leading rubber producers in Asia Pacific and holding the largest share of rubber exports accounting for around 84 percent of exports market share. Besides, these top 15 countries are major supplier of natural rubber resource contribution with 95.5 % of the global market.

Table1 Top Rubber Exporting Countries (2018)

Country	Million \$	Market Share %
Thailand	4600	34.5
Indonesia	4000	29.9
Vietnam	987.3	7.5
Malaysia	936.5	7.1
Cote d'Ivoire	752.6	5.7
Myanmar	260	2.0
Belgium	202	1.5
Laos	168.3	1.3
Guatemala	152.7	1.2
Liberia	127.2	1.0
Germany	115	0.9
United States	101.1	0.8
France	96.1	0.7
Luxembourg	94.8	0.7
Netherlands	94.2	0.7

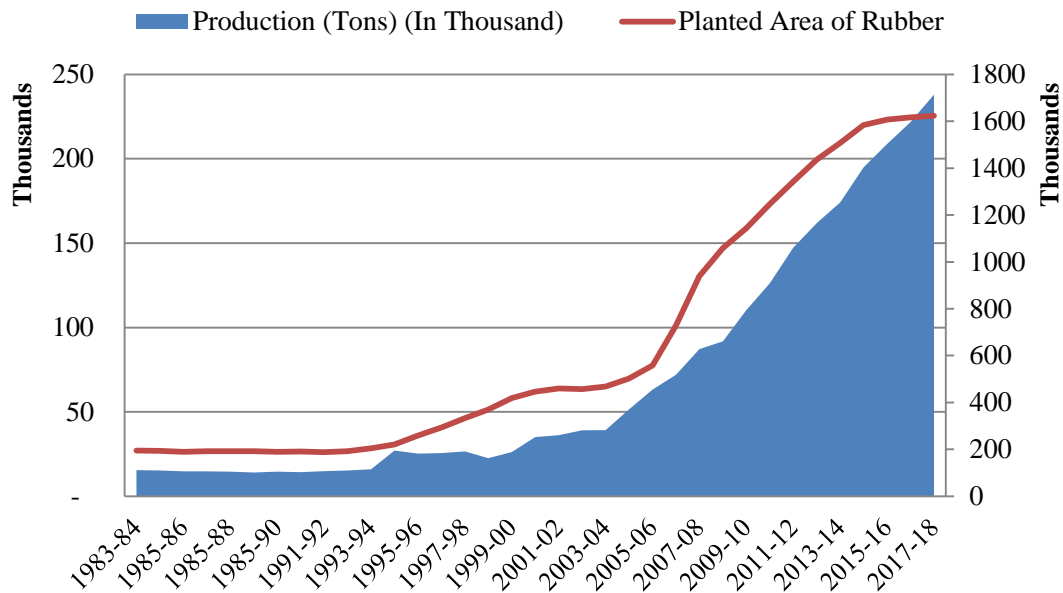
Source: Statista Research Department, 2019

Moreover, according to the previous studies and findings, some of these leading countries earn foreign currencies exporting natural rubber, which creates more job opportunities for its households, smallholders and hence largely influence on their economic and social status. The importance of natural rubber and its contribution to country's national income brought the great interest to study this research paper. Main intention of this paper is to answers these specific research questions: what is the status of rubber production and export of natural rubber in Myanmar, and what factors are influencing on its production and export.

Status of Myanmar's Rubber Production and Export

Agriculture sector plays mainly in the economy of Myanmar with the contribution of 37.8 percent of its Gross Domestic Product (GDP) in year 2018. Many cash crops grow in Myanmar especially major exporting commodities, such as rice, a variety of pulses, cereal crops,

and including natural rubber. Variety of agricultural crops including natural rubber was able to plant and produce freely, after the adoption of market-oriented economic policy in late 1988. It was only partially liberalization from state control. However, for exports of rubber were still under the control of government, while local producers were allowed to sell to domestic buyers after they fulfilled 45% of their production to the government(Woods 2012). Rubber production in Myanmar liberalized fully in 2004 and hence, rubber planted areas and production tons have increased continuously and significantly shown in Figure-1. As the growing acreage of rubber is expanding year after year, tons of rubber production followed the same direction and increasing simultaneously.



Source: CSO, Statistical Year Book

Figure 1 Myanmar Sown Acreage and Production of Natural Rubber (1983-84 to 2017-18)

Natural rubber can grow especially in the tropical countries. Therefore, rubber grows throughout of all of the regions of Myanmar. Table-2 shows the land size of states and regions of rubber where natural rubber is grown. As of 2017-2018, 1,623,260 acreage in aggregate rubber planted area, 551,729 acres in harvested area and 204,676 tons in total production. Southern part of Myanmar, Mon state, Taninthayi division, and Karen state are major locations of rubber resources in Myanmar. Mon state has highest sown acres of rubber plantation (494,840 acres) and secondly (347,487 acres) in Taninthayi and thirdly (269,055 acres) in Karen state. But, its production tons in Mon state were only 17% while Karen (27%) and Taninthayi (19%). These three main rubber suppliers' states and division accounted for 68% of sown acres, 76% of harvested areas, and 63% of rubber production. Moreover, Bago, Rakhine, and Shan state accounted for 21% of planted area, 20% of harvested acres and 34% of production respectively (Table-2).

Myanmar exports natural rubber mainly, while imports value added rubber products from neighboring countries China and Thailand. Around 90% of rubber exported products includes raw natural rubber named Ribbed Smoked Sheets (RSS) and Technically Specified Rubber (TSR), which are mainly traded to the markets of China and Malaysia accounted for 61% and

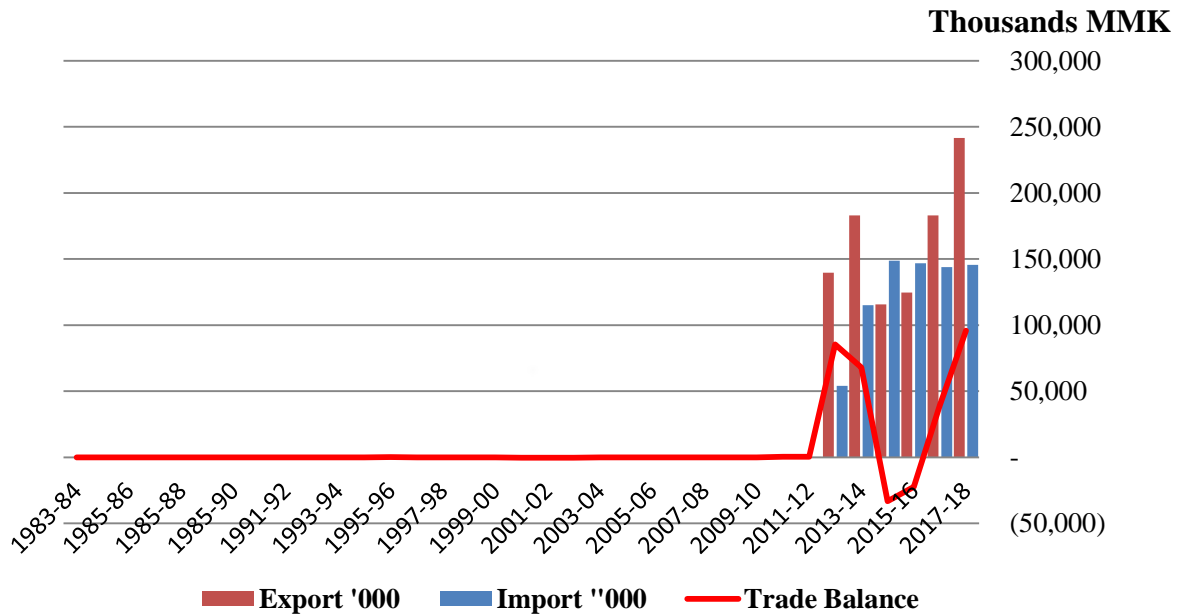
32% respectively. At the processing level of RSS and TSR , imported production integrands from foreign countries mainly includes of chemicals and machinery and complex inputs such as synthetic rubber, testing equipment, rubber chemicals, and machinery for working rubber are imported for the industrial level (The Department of Trade Promotion 2019).

Positive trade balance shown for four consecutive years from 2010-11 to 2013-14, but deficit of (33,335) Kyat millions and (22,230) kyat millions showed between 2014 and 2016 continuously. Trade imbalances have been severely impacted and influenced by the recent drop of world's natural rubber prices. However, trade surplus happened after 2016 due to higher exporting value relative to imports of value-added products (Figure-2).

Table 2 Regional Locations of Rubber Sown Acres, Harvested Acres, and Production Ton (2017-2018), absolute values

Regional Location	Production (Ton)	Harvested Acreage	Sown Acreage	Production%	Sown Acres %	Harvested acres %
Kachin	1928	7251	80530	0.94	4.96	1.31
Kayah	-	0	66	0.00	0.00	0.00
Karen	54307	168028	269055	26.53	16.57	30.45
Chin	-	0	9		0.00	0.00
Sagaing	113	603	12491	0.06	0.77	0.11
Taninthayi	39853	144147	347487	19.47	21.41	26.13
Bago	15972	50928	118096	7.80	7.28	9.23
Magwe	-	0	0	0.00	0.00	0.00
Mandalay	-	0	114	0.00	0.01	0.00
Mon	35400	108352	494840	17.30	30.48	19.64
Rakhine	40293	2476	35592	19.69	2.19	0.45
Yangon	2074	8552	43105	1.01	2.66	1.55
Shan	13600	58009	185121	6.64	11.40	10.51
Irrawaddy	1136	3383	36754	0.56	2.26	0.61
Naypyitaw	-	-	-	0.00	0.00	0.00
Total	204676	551729	1623260	100	100	100

Source: CSO, Statistical Year Book, 2018 and Author's Calculation



Source: Statistical Year Book (CSO)

Figure 2 Myanmar Imports and Exports for Rubber Products (1983-84 to 2017-18)

(Ministry of Commerce 2015-2019) Major problem for Myanmar’s rubber in the international market is quality. With its inferior quality without any guarantee and certification system, necessities to build its image, and accordingly is not receiving prevailing international market prices. Moreover, other issues remain unsolved to penetrate western international markets. However, Myanmar’s rubber mainly exported to the markets of China, Malaysia and Republic of Korea. (Joanna van Asselt 2016) the challenges of Myanmar faces are poor process of production in farming, techniques and management led to lower quality and yielding. Besides, the lack of institutional support and quality standard and certification for farmers and hence processors received lower price rather than the market price.

Review of Previous Studies

Natural rubber production and export and its related research papers were studied and analyzed using the various approach from different perspectives by many scholars. In the analysis of natural rubber production and export in India using the Ordinary Least Squares (OLS) technique, natural rubber stock, world market price and domestic price, and world population are significantly influence on its natural rubber export of India. Moreover, the production of natural rubber is positively related with the export quantity, stock and domestic price while it has negative relation with the import (M. Kannan, 2013). From another perspective, (Joe Gigy George 2014) have mentioned that Kerala is the largest producer of rubber in India with the 78 percent of planted area and 90 percent of rubber production.

The export markets for India natural rubber are Indonesia, China, Malaysia, Turkey, Spain, Srilanka and Nepal. An econometric analysis of Natural Rubber Market in Malaysia by (Nur Hazirah, Shri Dei, Hussin, 2016) using the 2SLS model, have shown that plantation area, time trend, production with lagged 1 year are vital for natural rubber producing. Natural’s rubber

price in domestic and global are directly related that if the world price rises, the domestic price will go the same direction.

(Mirawati Yanita M.Yazid 2016) examined the determinant for rubber export in Indonesia and found out that exports of crumb rubber has significant relationship between quantity of export in the lag time, exchange rate, and rubber production level. Moreover, from crumb rubber exports, Indonesia earned substantial foreign exchange.

Another study discovered that outside of U.S and U.S markets, Indonesia's natural rubber demand was perfectly price inelastic. In addition, level of production is largely depends on the maturity tree area and yield, which determines the export supply of rubber. Besides, domestic and world price of natural rubber has an influence on the yield(Soependi 1993). (Chawananon 2014) analyzed factors on the Thai's natural rubber market equilibrium and resulted shows that the production of natural rubber in Thailand had been effected by the GDP per capita, the estimated price, price of rice and rainfall significantly.

Materials and Method

This research paper conducted using OLS model and secondary time series data has been applied during the period from 1983 to 2018. For the analysis, to meet the objective of the study, two models were constructed factors affection export and production, the annual data of endogenous variables: export earnings and productions and exogenous variables: natural rubber planted area, production, export earnings, import, exchange rate, and world rubber price and world population were included in respective two models. In reality, the other variables may effect on the production and export of natural rubber, therefore, those indicators will be described in the error term of this study. Majority of data resources were collected from CSO, Statistical Year Book, World Bank, Singapore Commodity Exchange (SITCOM) and further figures and facts were obtained from previous studies and relevant web sites.

The Method of Ordinary Least Squares (OLS)

Ordinary least-squares (OLS) regression or linear least square is a method that may be applied to model a single response variable which has been recorded on at least an interval scale (Hutcheson 2011). Moreover, it is usable for estimating the unknown parameters. The OLS technique may be used to single or multiple explanatory variables.

Simple Regression Model

Simple regression model is also called two-variable linear regression or bivariate regression model due to it relates the two-variable. It can be illustrated with a single explanatory variable as follow,

$$y_i = \partial_0 + \partial_1 x_i + \varepsilon_i$$

Where, y is called dependent variable or explained variable, response variable can be used interchangeably, while x is called independent variable or explanatory variable or the control variable. The variable ε can be called error term or disturbance.

Multiple Linear Regression Model

Multiple regression analysis can be applied to find out problems that cannot be solved by simple regression model. It can accommodate many explanatory variables that may be correlated. Thus, for estimation of dependent variable building better models, multiple regressions can also be used. It allowed many observed factors to affect dependent variable (Wooldridge 2013).

The following general equation with two independent variables can be set up:

$$y_i = c_0 + \partial_1 x_1 + \partial_2 x_2 + \partial_3 x_3 + \dots + \partial_k x_k + \varepsilon_i$$

Where, ∂_0 is the intercept, $\partial_1, \partial_2, \partial_3$ are parameters associated with x_1, x_2, x_3 respectively.

In order to find out the determinants affecting on the production and export on natural rubber in Myanmar, multiple regression model has been used. Annual data were collected for 35 years ranging from 1983 to 2018. Two simple equations were set up as stated below.

For the analysis of natural rubber production, simple equations can be constructed as follows:

$$R_{pro(t)} = \sigma_0 + \sigma_1 R_{acre(t)} + \sigma_3 R_{imp(t)} + \sigma_3 R_{Exp(t)} + \sigma_4 D_{Pop(t)} + \mu(t)$$

Response Variable

$R_{pro(t)}$

Control Variable

$R_{acre(t)}, R_{exp(t)}, R_{imp(t)}, D_{pop(t)}$

Where,

σ_0 = intercept

$R_{pro(t)}$ = Production of natural rubber (tons) at time t

$R_{acre(t)}$ = Acreage of natural rubber at time t

$R_{imp(t)}$ = Import of rubber products at time t

$R_{exp(t)}$ = Exports of raw rubber at time t

$D_{pop(t)}$ = Domestic Population of Myanmar at time t

$\mu(t)$ = Error term

$\sigma_1, \sigma_2, \sigma_3, \sigma_4$ = Regression Coefficient

For the analysis of factors influencing the exports of natural rubber, simple equation can be written as stated below:

$$R_{Exp(t)} = \sigma_0 + \sigma_1 R_{imp(t)} + \sigma_2 R_{Wp(t)} + \sigma_3 W_{Pop(t)} + \sigma_4 EX_{rate(t)} + \varepsilon(t)$$

Response Variable

$R_{exp(t)}$

Control Variable

$R_{Wp(t)}, W_{pop(t)}, EX_{rate}, R_{imp(t)}$

Where,

σ_0 = intercept

$R_{exp(t)}$ = Exports of raw rubber at time t

$R_{imp(t)}$ = Import of rubber products at time t

$R_{Wp(t)}$ = World market price of natural rubber at time t

$W_{pop(t)}$ = World Population at time t

EX_{rate} = Exchange rate at time t

$\mu(t)$ = Error term

$\sigma_1, \sigma_2, \sigma_3, \sigma_4$ = Regression Coefficients

Results and Findings

This section presents empirical results of the analysis of factors influencing for the natural rubber production and export by using multiple linear regression model. For the production of natural rubber analysis, production is response variable and export (Exp), import (Imp), rubber growing areas (acres) and domestic population of Myanmar (Dpop) were taking into account as control variables for determining the association and contribution of various determinants for the production. For the export analysis, dependent variable is export (Exp), and independent variables are rubber price in world market (R_{wp}), world’s population (W_p), exchange rate (Ex_{rate}) and import (Imp).

Factors affecting on natural rubber production

For the analysis of factors affecting on natural rubber production in Myanmar using OLS technique, consider the below the below equation,

$$R_{pro(t)} = (0.3094) + 0.1027 R_{acre(t)} + 0.00022 R_{imp(t)} + 0.00012 R_{Exp(t)} + (0.00006)D_{Pop(t)} + \mu(t)$$

Table 4 Results of determinants affecting the natural rubber production

Production	Intercept	Acres	Import	Export	Domestic Population
Coefficients	-0.3094	0.1027315	0.0002174	0.0001206	-0.000061
Standard Error	23028.47	0.0073634	0.0000803	0.0000601	23028.47
t Stat	-0.13	13.95	2.71	2.01	-0.13
P-value	0.894	0.000	0.011	0.054	0.918

$R^2 = 0.9884$

Source: Calculation, Stata

The result indicates that sown acreage, export, and import had positive relationship with the natural rubber production since p values are significant at 0% (0.000), 5% (0.054), and 1% (0.011) respectively. However, p value for the domestic population is more than 5% level, which means that it cannot be said whether production and domestic population are positively or negatively related. R-squared value of (0.9884) revealed that 99 percent of variation in the production was explained by the four variables. In other words, production and rubber acres, export, import are positively related. Thus, when the 1 percent increase of plantation area, this will lead to increase production (Tons) by 0.1027315 and 1% increase of import and export will lead to rise on the rubber production with the value of (0.0002174) and (0.0001206) correspondingly presented in Table-4.

Again, to ensure that natural rubber production in Myanmar is significantly influenced by rubber growing acreage, import of rubber products, export, the equation is written as follows without considering the domestic population.

$$R_{pro(t)} = (0.3094) + 0.1027 R_{acre(t)} + 0.00022 R_{imp(t)} + 0.00012 R_{Exp(t)} + \mu(t)$$

Table 5 Results of determinants affecting the natural rubber production excluding population

Production	Intercept	Acres	Import	Export
Coefficients	-5484.277	0.1021017	0.0002185	0.0001209
Standard Error	2425.908	0.0041516	0.0000784	0.0000591
t Stat	-2.26	24.59	2.79	2.05
P-value	0.031	0.000	0.009	0.049

R² = 0.9884**Source:** Calculation, Stata

In Table-5, t Statistics values of acres, import and export have become huge 24.59, 2.79, and 2.05 respectively compared to the previous values of t stat showed in Table-4. Besides, probability value of import and export became slightly lower with 0.9% and 4% level. This highlight that rubber growing acres, import and export are positively influence the rubber production (Tons), i.e., increasing the rubber growing areas will lead to increase the production significantly and increasing export and import will also have positive impact on tons of production.

Factors influencing the exports of natural rubber

For the analysis of factors influencing the exports of natural rubber, simple equation can be written as stated below:

$$R_{Exp(t)} = 8973523 + (-1.57761)R_{imp(t)} + (4873062)R_{Wp(t)} + (-0.0028592)W_{Pop(t)} + (336760.7)Ex_{rate(t)} + \varepsilon(t)$$

Table 6 Results of determinants affecting the natural rubber export

Export (Exp)	Intercept	Import (Imp)	World Rubber price (RWp)	World's Population (Wpop)	Exchange Rate (Exrate)
Coefficients	894651.9	-1.57761	4873062	-0.0028592	336760.7
Standard Error	1.4657	0.3854859	3436351	0.0049051	46035.89
t Stat	0.06	-4.09	1.42	-0.58	7.32
P-value	0.951	0.000	0.166	0.564	0.000

R² = 0.9824**Source:** Calculation, Stata

The result of determinants influence on natural rubber export of Myanmar illustrated in Table-5. The value R-squared (0.9824) indicates that 98 percent in the endogenous variable (Exp) was explained by the exogenous variables import (Imp), world market price of rubber (R_{Wp}), world's population (W_{pop}) and exchange rate (Ex_{rate}) involved in the model. This says that the relationship between dependent and independent variables are strongly related. Among the control variables, import and exchange rate of the p values showed significant at the level of 0%

showed in Table-6. Nevertheless, probability value of rubber price in the international market and world's population are very large means insignificant since more than 5% or 10% level.

Regarding to the results, there is negative relation between import of rubber manufactures and export of natural rubber; 1 percent increase of import has (1.57761) negative impact on the export. However, exchange rate showed positive and significant relation with the export indicates that 1% rise of Ex rate, increases export. Thus, appreciation of currency (exchange rate falls) will lead the rubber export decreased and depreciation of currency (exchange rate rises) increases and stimulates revenue of exports. Though world's rubber price is not significant in this study, there is direct relationship found that revenues generated from the exports decreased in 2011 was the result of price depreciation of rubber price in international market (The Department of Trade Promotion 2019). Otherwise, it stated that if world rubber price rises, export revenue will increase as they are positively related.

Conclusions

Myanmar is the six largest supplier of rubber in the world market. Nevertheless, production of rubber is comparatively low than the neighboring countries Thailand, Indonesia, Vietnam and Malaysia. Moreover, Myanmar rubber has lower quality with poor planting techniques and process of production. (Joanna van Asselt 2016) Myanmar has lower yield level rather than the Thailand and Vietnam due to poor farming practices in the process of value chain and limited governance in rubber sector.

Major supplier for rubber resources are Mon state, Taninthayi division, Karen and Rakhine states producing 82 percent of natural rubber. Mon state has highest sown acres of rubber plantation (31%) followed by Taninthayi (21%) and Karen state (17%). For the export sector, natural rubber is only exported, which named Ribbed Smoked Sheets (RSS) and Technically Specified Rubber (TSR) and imported the value added rubber manufactures especially from Thailand and China. In particulars, majority of natural rubber products in the region of 93% are mainly exported to bordering countries China and Malaysia markets.

The analysis of the determinants which influence on the rubber export and production, multilinear regression method (OLS) has used. The overall results revealed that export (Exp), import (Imp) and sown acreage have profound influence on the rubber production of Myanmar. The positive relationship has found, thus increase of sown acres, import and export will have positive impact on its production of natural rubber and vice versa. (Kannan 2013) also found out that there is a positive relationship between export and production of natural rubber in India. The export revenue of raw rubber in Myanmar is directly influenced by the exchange rate; if the exchange rate goes up, export will head to the same direction as well and oppositely, if it falls, exports of natural rubber will decrease as they are positively associated. However, import and export are negatively related.

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