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An Investigation of China's Import Demand for Technically Specified Natural Rubber (TSR) from Thailand

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Abstract: This article analyzes China's import demand for TSR from Thailand and other countries, including Japan and South Korea. Secondary sources are used to collect data. The linear equation can be written with some partial derivatives is used as a statistical analysis technique. The investigation found that Chinese consumers' behavior has considered TSR as normal goods. Furthermore, information from trading partners and this comparative study would benefit stakeholders to implement policies when Chinese importing circumstance has been changed. Approximately 90 percent of rubbers produced in Thailand are for exporting, and the major importer is China, which is accounted for 56.60 percent of exported rubbers from Thailand. A substantial exported rubber is in the form of Technically Specified Natural Rubber (TSR) or blocks rubbers to produce tires.

Key Words: Import demand, Technically Specified Natural Rubber (TSR), Thailand

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INTRODUCTION

Rubber is one of major industrial crops in Thailand because rubber's prices have been continuously increasing during the past decade. In addition, with the government's policies to support and promote cropping rubber around Thailand, the production of rubber in 2015 has been raised around 34.3 percent, a million tons increase from 2004 to 2015. Furthermore, Thailand has been a leader in producing and exporting rubber of the world since 1991. However, the rubber production of Thailand in 2015 was only 4 million tons, a 3.2 percent decline from 2014, as a result of the drought and political instability (Bank of Thailand, 2015). The main production of Thai rubber industry is for exporting, as Thailand is a major producer and exporter of Rib Smoked Sheet (RSS) and concentrated latex in the world; and the world's second largest producer and exporter of blocked rubber after Indonesia (Cherdchoongam & Rungreunganun, 2015).

In the world market, the first three exporting countries are Thailand (32.1 percent), with a production of approximately 276 kilogram per rai (6.25 rai = 1 ha), Indonesia (26.4 percent), and Malaysia (8.9 percent), respectively (table 1). These three countries are major producers because of their climates and demographical advantages to grow rubber trees, as well as lower labor costs and high capacity in producing rubber.

Table 1: Production of natural rubber, crop year 2009-2014

Year	Thailand	Malaysia	Indonesia	China	India	Sri Lanka	Liberia	Nigeria
2009	3,164.40	857	2,440.00	644	820.3	137	59.5	45
2010	3,252.10	939	2,736.00	687	850.8	153	62.1	54.2
2011	3,569.00	996.2	2,990.00	727	892.7	158.1	64.5	55.3
2012	3,778.00	922.8	3,012.00	802	919	152	64	57
2013	4,170.00	826.5	3,237.00	865	796	130.5	68.8	57
2014	4,324.00	668.1	3,153.20	840.1	704.5	98.7	59.9	57.5

Source: Statistics Rubber Thailand (2016)
Production reported in Unit: 1,000 Ton

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In terms of gross exporting among these top three exporters of the world (table 2), in 2014 the highest exporter was Thailand, accounting for 48.40 percent, followed by Indonesia and Malaysia, which were 35.64 and 15.96 percent, respectively. Thailand's major exporting products are blocked rubber, RSS, and concentrated latex. The major importing countries are China and Japan for RSS and blocked rubber, whereas Malaysia is for concentrated latex. Indonesian's major importers are USA, Japan and China, whereas Malaysia's major importers are China and EU.

Table 2: Gross exports of natural rubber

Year	Thailand	Malaysia	Indonesia
2004	2,637.10	1,106.10	1,875.10
2005	2,632.40	1,143.30	2,025.10
2006	2,771.60	1,285.20	2,290.30
2007	2,703.80	1,212.90	2,415.70
2008	2,675.30	1,154.50	2,297.30
2009	2,726.20	1,087.70	2,061.30
2010	2,866.40	1,245.40	2,368.70
2011	2,890.00	1,239.50	2,565.80
2012	3,024.30	1,290.90	2,524.90
2013	3,648.70	1,331.60	2,770.20
2014	3,614.90	1,192.40	2,661.70

Source: Statistics Rubber Thailand (2016)
Production reported in Unit: 1,000 Ton

The world's natural rubber consumption is highly related to the world's economy, particularly highly correlated with the Chinese economy since China is the world's highest consumer of natural rubber. Previously, Chinese economy had rapidly grown but it has been slowly grown in the recent years. The world's rubber consumption in 2015 was only 12.4 million tons, a 2.2 percent increase from previous year, which was the lowest growth since 2013. This is due to a gradual decline in Chinese rubber consumption as a result of three factors: A downturn in automobile industry, an Anti-Dumping Duty (AD), and a substitution to use synthetic rubber since price of synthetic rubber is lower as a consequence of lower crude oil prices. Thailand is the world's second largest producer of Technically Specified Natural Rubber (TSR), only after Indonesia (table 3), and the major importer is China. TSR is processed into variety of products including wheel tyres, retreading tyres, spare tyres, engineering materials and parts of many manufacturers. During 2009 to 2014 Thailand's rubber exporting has been continuously rising, accounting for 37.83 percent, while the real price of rubber exporting has fluctuated depending on the world price of rubbers, as accounted for a dramatic increase of 62.33 percent (table 4).

Table 3: Gross export quantity of technically specified rubber by country

Year	Thailand	Malaysia	Indonesia
2004	998.00	1,008.10	1,707.40
2005	1,109.30	1,056.00	1,685.60
2006	1,069.30	1,064.10	1,953.30
2007	1,103.80	952.00	2,124.40
2008	1,132.10	861.80	2,148.50
2009	950.60	617.40	1,905.00
2010	1,106.40	838.50	2,278.80
2011	1,224.10	905.90	2,478.90
2012	1,286.90	726.80	2,374.50
2013	1,470.80	793.10	2,608.20
2014	1,529.00	675.10	2,549.80

Source: United Nations Commodity Trade Statistics Database (2014)
Production reported in Unit: 1,000 Ton

Table 4: Export value technically specified rubber by country

Year	World	Thailand	Indonesia	Malaysia
2009	6,683.91	1,476.28	3,104.65	1,175.15
2010	15,155.25	3,066.44	7,102.86	2,647.36
2011	24,070.04	5,696.20	11,416.10	4,110.11
2012	27,778.56	4,204.53	7,626.72	2,382.67
2013	18,966.02	3,919.27	6,706.86	2,067.70

Source: United Nations Commodity Trade Statistics Database (2014)
Production reported in Unit: Billion baht

Blocked rubber produced in Thailand is mainly for exporting, and the major markets are China, Japan and South Korea (table 5). The total amount of exporting blocked rubber is fluctuated depending on the world's rubber market price as well as Chinese economy, because China is the main rubber importer from Thailand. In addition, total value of exporting is affected by competitiveness between other players: Indonesia and Malaysia.

The study of import demand of blocked rubber from China would prove beneficial in terms of guiding policy makers and rubber producers, together with other stakeholders to cope with trend or changes in China's import demand. Comparisons of TSR import demand with other major importers, Japan and South Korea, are also given.

Table 5: Major importer of TSR from Thailand

Year	World	Thailand	Indonesia	Malaysia
2009	6,683.91	1,476.28	3,104.65	1,175.15
2010	15,155.25	3,066.44	7,102.86	2,647.36
2011	24,070.04	5,696.20	11,416.10	4,110.11
2012	27,778.56	4,204.53	7,626.72	2,382.67
2013	18,966.02	3,919.27	6,706.86	2,067.70

Source: Department of Foreign Trade (2016)
Production reported in Unit: Million baht

This paper is divided into 4 sections. First, brief literature review on structural import demand equations and China's import demand is highlighted. Second, methodology is described. Third, results as well as their interpretations are presented. Last, conclusion is explained.

LITERATURE REVIEW

Many studies have attempted to explain the import demand of various countries and a variety of products. Lo, Sawyer and Sprinkle (2007) found the relationship between the income elasticity of import demand as a result of GDP. The study concludes that as the economy has grown, the income elasticity of import demand will also increase.

Zhang and Gan (2007) tested the factors impacting the China's import demand for forest product from many regions and countries around the world such as Russia, Southeast Asia, Africa, the United States and the European Union using four simulation scenarios: world economic growth, the Yuan currency appreciation, logging restrictions under the Natural Forest Conservation Program (NFCP) in China and the combination of the currency and logging restriction. The results conclude that the world economic growth is a major impact on the import demand as well as the exports for forestry in China. Moreover, the logging restrictions in China and the Chinese Yuan appreciation directly affect the import demand.

Wang and Lee (2012) examined the import demand function for China using lag model. The results appear controversial to the theory that quantities of import for China will decline although there is a reduction in external competitiveness (appreciation). The reason may be due to the anti-dumping duties imposed on some products. However, these economic factors: Domestic economic activity, real

effective exchange rate and the perception of the global risk have directly and significantly affected the import demand of China.

Farinelli, Carter, Lin and Sumner, (2009) estimated the economic factors affecting import demand for Brazilian ethanol of its major importers. The price elasticity for Brazilian ethanol is found in the Caribbean region, Mexico, Japan and Nigeria, whereas the price inelasticity is found in the United States and Europe.

Turner and Buongiorno (2004) studied the static and dynamic model in order to estimate price and income elasticity of import demand for forestry and its related products using panel data from 64 countries. Information was selected between 1970 and 1987. The demand for import products tended to be elastic to income, while the majority of the products were found to be inelastic to price.

Hamori and Matsubayashi (2001) analyzed the stability of Japan's aggregate import demand function applying co-integration test using quarterly data from the first quarter of 1973 to the first quarter of 1998. The variables in the study are real import, real GDP and relative import price. It is concluded that a stable import demand function in Japan cannot be found. In contrast, the study of Tang (2003) which assessed the import demand function of Japan during 1973 to 1997 using bound test approach found the opposite result. It concludes that the import demand function is stable and the import demand in Japan is income elastic.

RESEARCH METHODOLOGY

According to Goldstein and Khan (1985) quantity of imports depends on two factors: Real domestic income (Y_i) and price of the commodity (P_i), as presented in terms of a function as:

$$M_i = f(Y_i, P_i) \tag{1}$$

The linear equation can be written with some partial derivatives as:

$$Mi = \alpha_0 + \alpha_1 P_i + \alpha_2 Y_i + \varepsilon_i \tag{2}$$

Where:

α_1 = import price elasticity

α_2 = income elasticity of import demand

The parameter α_1, import price elasticity, should move in different direction. This is, when the import price increases, the import quantity should decrease; while when the import price decreases, the import quantity should rise. In addition, the parameter α_2 can be positive or negative. If import goods are normal goods, the income elasticity will be positive, while if import goods are inferior goods, the income elasticity will be negative (Yimnak, 2016).

Wang and Lee (2012) studied the import demand model for China. Unlike the demand volume by Bahmani-Oskooee and Hajilee (2011), which assumes that the import demand of China is affected by income and real interest rate, Wang and Lee included a proxy called a VIX and real effective exchange rate in the equation as:

$$lnMt = \alpha_0 + \beta_1 lnIPt + \beta_2 lnREER_t + \beta_3 lnVIXt + \varepsilon_t \tag{3}$$

Where:

M = Import volume

IP = Domestic income

REER = Real effective exchange rate

VIX = Implied volatility of the US market

ε_t = Error term

Khan and Ross (1977) found that the log-linear equation as shown in equation (4) was better since the regression coefficient can provide results about price and income elasticity.

$$logM_i = \alpha_0 + \alpha_1 logP_i + \alpha_2 logY_i + \omega_i \tag{4}$$

Farinelli et al. (2009) analyzed the economic factors affecting the import demand for Brazilian ethanol by its major buyers. The authors include many factors: the world price of crude oil, real Gross

Domestic Product (GDP), real exchange rate, and import tariff. As a result, the estimated long-run import demand by using the multiple regression model as:

$QMeth_{ti} = \beta_1 + \beta_2 Peth_{ti} + \beta_3 Poil_t + \beta_4 GDP_{ti} + \beta_5 ExRt_{ti} + \beta_6 Tariff_{ti} + \beta_7 Trend + \beta_8 LagQMeth_{(t-1)} + \varepsilon_t$ (5)

Where: $QMeth_{ti}$ = Quantity of ethanol imported, in billion liters, in quarter t and country i
Peth = Import price of ethanol, in 2007 US dollars per liter
Poil = World import crude oil price, in 2007 US dollars per liter
GDP = Real Gross Domestic Product (GDP), in 2007 billion US dollars
ExRt = Real exchange rates, 2007 = 100 US (USD per foreign
currency and then indexed by GDP deflator)
Tariff = Import tariff, in 2007 US dollars per liter
Trend = Linear time trend, where t =1 is equivalent to 1st quarter of 1997
LagQMeth = Lagged quantity of ethanol imported, in billion liters $varepsilon_t$ = Estimated residual
i = Country
t = Time (from the 1st quarter of 1997 through the 3rd quarter of 2007)
From the previous studies, the Thailand's import demand of TSR to China, Japan and South Korea in this paper can be written as:

$$Qi = f(RP, RP_{ssr}, REER_i, RGDP_i) \quad (6)$$

Where definition of variable and data sources of each variable is presented in table 6. The data were collected from 2000 to 2015.

Table 6: Definition of variables and data sources of each variable

Variables	Definition	Data source
Q_i	Quantities of imported TSR from Thailand to the importing countries i (China, Japan and South Korea) (ton)	Import amounts from Custom Department Product Code: 101090200 (Blocked rubber) (Department of Foreign Trade, 2016)
RP	Imported price of TSR from Thailand to foreign countries is (China, Japan and South Korea) (USD)	F.O.B price from Thailand (Statistics Rubber Thailand, 2016)
RPssr	Prices of SSR 3 in the world market (USD)	International Rubber Study Group (IRSG), (International Rubber Study Group, 2015)
$REER_i$	Real effective exchange rate of the importers i (China, Japan and South Korea)	Global Economic monitor, World Bank
$RGDP_i$	Real GDP of foreign countries i (China, Japan and South Korea) per capita (USD)	Global Economic monitor, World Bank

The Ordinary Least Square (OSL) using double log-linear is as follows:

$$lnQ_1 = a + b_1 lnRP + b_2 lnRP_{ssr} + b_3 lnREER_1 + b_4 lnRGDP_1 + \mu_1 \quad (7)$$

$$lnQ_2 = a + b_5 lnRP + b_6 lnRPssr_{+} b_7 lnREER_2 + b_8 lnRGDP_2 + \ \mu_2 \quad (8)$$

$$lnQ_3 = a + b_9 lnRP + b_10 lnRPssr_{+} b_11 lnREER_3 + b_12 lnRGDP_(3) + \mu_3 \quad (9)$$

Where: a = Constant
b_1 to b_{12} = Coefficient or elasticity
μ_1, μ_2, μ_3 = Error term
ln Q_1, ln Q_2, ln Q_3 = Quantities of imported TSR from Thailand to China, Japan, and South Korea, respectively
ln RP = Imported value of TSR from China, Japan and South Korea
lnRP_{ssr} = Prices of rubber smoked sheet 3 (RSS 3) in the world market (USD)
ln $REER_1$, ln $REER_2$, ln $REER_3$ = The real effective exchange rate of China, Japan and South Korea

ln $RGDP_1$, ln $RGDP_2$, ln $RGDP_3$ = Real Gross Domestic Products (Real GDP) of China, Japan and South Korea

Note that the Rubber Estate Organization (2016) states that Standard Thai Rubber (STR) classifies RSS 3 as the same quality as TSR 20.

RESULTS AND DISCUSSION

Table 7 demonstrates import demand of TSR from Thailand to the top three importing countries: China, Japan and South Korea in each aspect. Starting with China, which is the top importer of TSR from Thailand, we found that if the Real Price (RP) of TSR from Thailand has increased 1 percent, the TSR importing from Thailand will decrease less than 1 percent ($b_1 = -0.908^{**}$). The price elasticity of demand is less than 1 implying that TSR is necessary good to Chinese customers (TSR is an essential material in manufacturing and a change in price is higher than a change in importing demand).

Table 7: Definition of variables and data sources of each variable

Dependent Variables/	TSR		
Independent Variables	$\ln Q_{CN}$	$\ln Q_{JN}$	$\ln Q_{KR}$
Constant	266.643	70.012**	241.309***
ln RP	-0.908**	-0.681*	-0.247*
ln $RP_S SR$	-1.439*	1.765***	-0.821**
ln REER	-0.027	0. 137*	0.052*
ln RGDP	0.747**	0. 694**	1.314*
R^2	0.863	0.758	0.895
Adjusted R^2	0.813	0.721	0.837
Durbin-Watson	1.62	2.23	1.93

Note:*, **, *** are statistically significant at 0.10, 0.05, and 0.01, respectively
CH, JN and KR denote China, Japan and South Korea respectively

In addition, if the price of SSR has increased 1 percent, importing of TSR from Thailand will decrease 1.439 percent ($b_2 = -1.439^{*}$). We can conclude that Chinese customers view TSR and SSR as substitution goods. In general, SSR is substituted for TSR in manufacturing medical products, footwear, automobile tyres, engineering works and in many manufacturing firms (Rubber Authority of Thailand, 2002 as cited in Phantamit and Limsombunchai, (2010). It is likely that China imports SRR as a substitute with TSR as materials in manufacturing variety of products. The result is consistent with the study of import demand of natural rubber from Thailand to Japan by Phantamit and Limsombunchai, (2010) that price of SSR affects Japanese TSR importing from Thailand.

The real effective exchange rate has significantly affected the China's import demand for TSR from Thailand. The result shows that if the real effective exchange rate has increased 1 percent, the import demand will decline 0.027 percent ($b_3 = -0.027$) result. It may be in accordance with the study of Wang and Lee (2012) about estimating the import demand function from China, in which real effective exchange rate has negative coefficients. This can be implied that the appreciation in the Chinese currency will reduce the import amounts from China as a result of the anti-dumping duties on some imported items.

Real GDP of Chinese, however, has a significant effect on the Chinese's TSR import demand, that is, if the real GDP has increased 1 percent, the import demand will also increase 0.747 percent (0.747**). This implies that Chinese customers view TSR as normal good. The result proved to be in consistent with Ziramba (2010) in which the real GDP has a positive correlation to the import demand.

Among these 3 countries: China, Japan and South Korea, a rising in the real price of TSR from Thailand will lead to a reduction in imported quantities of TSR from Thailand as found in the result of b = -0.908** , -0.681*, -0.247*, respectively.

A raise in real price of the SSR leads to changes in quantities of imported TSR in China, Japan

and South Korea in two ways. If the price of SSR has increased, import quantities of TSR in China and South Korea will conversely decrease ($b = -1.439$*, -0.821**, respectively). This can be interpreted as these two countries treat SSR and blocked rubber as complementary goods. In contrast, Japan gives a different result ($b = 1.765$***), meaning that a rising price of the SSR will increase the import quantities of TSR in Japan. This means the Japanese customers view SSR and TSR as substitution goods.

Interestingly, the real effective exchange rate has a direct effect on the import quantities of Japan and South Korea as $b = 0.137$* and 0.052*, respectively, implying that if the importers currency (Japan and South Korea) appreciates, import quantities of TSR will also increase. On the other hand, import quantities of China will reduce ($b = -0.027$), but not significantly if the Chinese Yuan appreciates.

An increase in Real GDP (RGDP) has significantly affected the import demand of these importing countries: China, Japan and South Korea. That is, quantities of TSR imported will increase as seen in table 7 with a statistically significant result ($b = 0.747$**, 0.694** and 1.314*, respectively). Customers from these countries treat TSR from Thailand as normal good in "necessary goods" categories: If a customer's income has risen, products can be increasingly sold, however, that percentage change of quantities of products sold is less than an increase in percentage change of income.

CONCLUSION AND RECOMMENDATIONS

The three major importing countries of TSR from Thailand: China, Japan and South Korea, consider TSR as major material in manufacturing rubber related products. These countries classify Thailand's TSR as normal good: if income increases or economy grows, imported quantities will also be higher. In addition, TSR is considered to be necessary good, in which a change in price of TSR will affect the import quantities, less than the change in price. This can bring benefits to Thailand if the policy makers encourage the rubber producers to improve the rubber quality in order to sell it as premium quality, and not to compete with other countries in terms of prices. Also, the government would not support the croppers to expand the agricultural areas since the quantities of imported TSR from these countries have a slight effect.

Additionally, since Chinese and South Korean customers consider SSR as complementary good with TSR, the Thai government would implement the production and marketing policies and to these two countries in the same direction.

Lastly, the forecast quantities of TSR importing to China, Japan and South Korea have a result as in the same trend as GDP: As the country has higher GDP, the imported quantities of TSR will also be higher. Consequently, strategies to deal with an economic fluctuation can be extremely complicated. However, what Thailand government can take action now is to continuously develop and improve rubber's quality in order to meet the customers' need or new market in the future.

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