
The Determinants of the Unsmoked Rubber Sheet Price in Thailand

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Abstract

This study aims to identify and analyze the factors affecting unsmoked rubber sheet prices using a 60-month dataset from 2014 to 2018 and applying the Ordinary Least Squares (OLS) method. The variables examined include crude oil prices, exchange rates, rubber export quantities, crude palm oil prices, synthetic rubber prices, Thai rubber supply quantities, and Thai GDP. The findings indicate that crude oil prices, crude palm oil prices, and the quantity of Thai rubber supply have a significant impact on rubber sheet prices, with crude oil and Thai rubber supply showing a positive relationship, while Thai GDP exhibits a negative effect. The study's contributions provide valuable insights that can guide policymakers, industry stakeholders, and businesses in making informed decisions regarding rubber prices.

Keywords: Unsmoked Rubber Sheet Price, Supply of Thai Rubber, Ordinary Least Square Method

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1. Introduction

Rubber is one of the products that Thailand relies on and serves as an economic plant supporting both farmers and industrial sectors. Rubber plays three important roles in the Thai economy: fostering economic growth through job creation, distributing income to farmers, and increasing farmers' income (Ratikhunuphakorn, 2019). It is estimated that growing rubber helps support 6 million farmers, and rubber itself is used in various industrial sectors, such as tire manufacturing and medical instruments.

Table 1: Rubber Cultivation

	2009	2010	2011
Total Amount of Rubber Cultivated	3,090,280	3,051,781	3,348,897
Area (Rai)	17,254,317	18,095,028	18,461,231
Productivity Per Rai Per K.G.	266	253	262
Availability to Cultivate (Rai)	11,600,447	12,072,873	12,765,636

(Source: National Statistics Office, n.d.)

Note:

- "Rai" is a traditional Thai unit of area commonly used in Thailand to measure land, particularly agricultural land. It is still widely used in Thailand alongside the metric system.
- 1 Rai = 1,600 Square meters (m²)
- 1 Rai = 0.16 hectares (ha)
- 1 Rai = 0.395 acres

Throughout the historical periods of rubber cultivation in Thailand, there has been an increase in rubber planting, which corresponds to an increase in supply. In other words, more farmers rely on rubber production for their livelihood. However, historically, rubber prices have fluctuated.

Table 2: Price of Unsmoked Rubber Sheet (Baht)

Year	Price	%YoY	Year	Price	%YoY
2008	77.86		2009	57.77	26%
2010	104.49	80%	2011	129.96	24%
2012	91.07	30%	2013	75.55	17%
2014	55.53	26%	2015	45.88	17%
2016	50.37	10%	2017	58.63	16%
2018	41.83	29%	2019	42.99	3%
2020	44.48	3%	2021	54.02	21%
2022	53.46	1%	2023	46.50	13%
2024	70.35	51%			

(Source: Rubber Authority of Thailand, 2024)

Due to the fluctuation in rubber prices, they have remained unstable for decades. However, as seen in Table 1 compared to Table 2, rubber prices have unexpectedly risen despite a noticeable increase in supply and continue to drop after 2011 (National Statistics Office, n.d.; Rubber Authority of Thailand, 2024).

1.1 Statement of the Problem

Despite this, numerous rubber products enter the market simultaneously, causing rubber prices to decrease. The supply of rubber is very high, leading to an oversupply situation. However, production costs for rubber have not decreased, creating problems for farmers. As a result, government agencies must intervene in the rubber market through various policies deemed appropriate for the current situation. The primary goal is to help farmers sell their rubber products at higher prices and increase their income. Since 2000, the government has focused on limiting rubber production due to overproduction issues. Policies have controlled rubber plantations to no more than 12 million rai per year to reduce production levels, while continuing efforts to improve quality (Siripongtugsin, 2019). Nevertheless, despite the initial promotion of rubber production by the government, oversupply issues arose due to excessive domestic supply compared to demand, leading to a drastic decline in rubber prices. Consequently, small farmers who highly depend on income from selling rubber, they would fall into indebtedness (Nicod et al., 2020).

In early 2019, as author's observation finds that the government plays a crucial role in the natural rubber industry, primarily through guaranteed prices and subsidies for rubber farmers. The government guarantees prices for three main types of natural rubber: Additionally, the government provides subsidies for rubber production and supports working capital. Projects are also established to promote the use of rubber in processing and manufacturing to reduce dependence on exports, mitigate rubber price fluctuations, and alleviate farmer hardships. Despite these efforts, both domestic and global rubber prices continue to trend downwards. The decline began when market demand failed to match the increasing number of suppliers (farmers), and prices continued to fall despite the surge in rubber production.

Rubber prices correlate closely with oil prices (Siripongtugsin, 2019). Many industries switch to synthetic rubber or polymers when oil prices rise, while they revert to natural rubber when oil prices are lower. Farmers, however, face challenges in adjusting their rubber cultivation plans without adequate information and knowledge of market trends.

1.2 Research Objectives

The research objective of this study is to identify and analyze the factors influencing the price of unsmoked rubber sheets in Thailand, utilizing a 60-month (5 years) dataset and examining variables such as crude oil price, exchange rate, rubber export quantity, crude palm oil price,

synthetic rubber price, Thai rubber supply quantity, and Gross Domestic Product (GDP) through the application of the Ordinary Least Squares (OLS) method with logarithmic transformations to compare percentage changes. Understanding these determinants will help policymakers, industry stakeholders, and businesses involved in the rubber market to make informed decisions, implement effective strategies, and anticipate market fluctuations, additionally leading to more stable and predictable rubber sheet pricing.

2. Literature Reviews

Many scholars study the movement of the rubber based on various factors. Some factors are not included in one study, but another study does it. Author, therefore, categorize literature reviews based on each factor.

2.1 Crude Palm Oil Price

According to Tangtavornchaikul (2018), economic factors influencing the price of smoked rubber sheets include the price of crude palm oil. The t-statistic value in his econometric model indicates that the crude palm oil price is statistically significant in determining the price of smoked rubber sheets. Also, Tangtavornchaikul (2018) highlights that the prices of crude palm oil and block rubber are positively correlated. This means that an increase in both crude palm oil and block rubber prices results in higher prices for smoked rubber sheets. Indeed, the prices of smoked rubber sheets at the Central Market in Hat Yai have shown an increase accordingly. Also, Kumar et al. (2021) point out that crude oil price affects foreign exchange rate and domestic natural rubber price.

2.2 Synthetic Rubber Price

Researchers generally agree on the relationship involving synthetic rubber, which directly affects the price of natural rubber. Lamchaek (2013) demonstrated that the volume of synthetic rubber exports can influence natural rubber prices because suppliers tend to accept the lowest price available. According to Hasbrouck and Schwartz (1988), Hasbrouck (1995), and Gresse (2010), synthetic rubber exhibits similar price movements to domestic rubber prices because the production of synthetic rubber requires natural rubber as a raw material. Therefore, an increase in natural rubber prices typically results in a decrease in synthetic rubber prices. However, Assanee (2011) argued that natural rubber and synthetic rubber are substitute goods utilized across various industries. The quality of products often depends on the raw materials used, whether natural rubber or synthetic rubber. In countries with high GDP or strong purchasing power, there exists a positive relationship between the demand for natural rubber and synthetic rubber. Moreover, if natural rubber prices rise, synthetic rubber prices also tend to increase. The change in rubber market price could affect the quantity in production of natural and synthetic rubber price (Ramli et al., 2019; Sungkaew, 2024)

2.3 Exchange Rate

The exchange rate plays a dominant role in the economy which involves in terms of the trade sector between countries. The exchange rate and the price of rubber are in a strong negative relationship (Sadali, 2013). Cavalcanti, Mohaddes, and Raissi (2015) explained that when the exchange rate increases, the price of the commodity will accrue. As a result, it will push up the expansion rate. Tangketsiri and Srisuttisaard (2016) illustrate that when Thai Baht appreciates, the price of rubber and other commodities will rise, making the amount and value of the export to fall. Basri, Jaafar, Hapka, and Muhamat (2018) indicated the same direction as a previous scholar that the currency exchange rate is statistically significant negative in relation to rubber price. The author also enhanced that the fluctuation of rubber price volatility can be caused by the movement of the currency. However, there is one investigation indicated that there is an insignificant relationship with the exchange rate and rubber but not significant in terms of the quantity export of natural rubber (Laili, Huey, and Harun, 2017).

2.4 Crude Oil Price

Several researchers have established a significant relationship between crude oil prices and natural rubber prices. Raju (2016) investigated how the sharp decline in crude oil prices leads to a decrease in synthetic rubber prices, thereby affecting domestic rubber prices. The study emphasized that the price of natural rubber is influenced by the co-integration of domestic and international markets, particularly in response to fluctuations in crude oil prices. Similarly, Khin, Mohamed, and Hameed (2013) conducted research on the impact of changes in world crude oil prices on the natural rubber industry in Malaysia, using Vector Error Correlation analysis. Their findings indicated a significant positive relationship between crude oil prices and natural rubber prices. The study highlighted that crude oil serves as a major raw material for synthetic rubber production, and thus all three prices—crude oil, natural rubber, and synthetic rubber—are highly correlated and move in tandem. Additionally, Vinayan, Prasad, and Anuradha (2019) examined the effects of crude oil price changes on the natural rubber industry in India. Their research, employing regression analysis, revealed that increases in crude oil prices have a direct impact on the price, production, and consumption of natural rubber. The article underscored the strong correlation between natural rubber prices and synthetic rubber prices, which are derived from crude oil. These studies collectively demonstrate the interconnectedness and impact of crude oil price fluctuations on the natural rubber market, both domestically and internationally.

However, some studies indicate an insignificant relationship between crude oil prices and the price of natural rubber. Basri, Hapka, Jaafar, and Muhamat (2018) conducted research on the determinants of natural rubber prices in Malaysia, analyzing the impact of rubber demand, supply, currency exchange rates, and crude oil prices using regression analysis. Their findings revealed that

crude oil prices do not significantly influence natural rubber prices in Malaysia. Similarly, Tangtavornchaikul (2018) found no relationship between crude oil prices and the price of smoked sheet No.3 in Thailand in his study on the economic factors affecting rubber prices. This suggests that, in Thailand's context, crude oil prices do not play a significant role in determining the price of smoked sheet rubber. These studies highlight divergent findings regarding the influence of crude oil prices on natural rubber prices, indicating that regional factors and market dynamics may vary in their impact on the rubber industry.

2.5 Quantity of Export

According to Chemat (n.d.), the concept of export refers to the process of selling and sending goods from one country to another. Export activities contribute to the flow of expenditures into the enterprise sector. Moreover, the aggregate expenditure increases due to exports of goods and services, leading to an increase in national income. When net exports are positive, aggregate expenditure rises, which in turn tends to increase national income and employment. It was found that the quantity of exports has a negative relationship with rubber prices, and this relationship is statistically significant. This indicates that changes in export quantities can impact the prices of rubber products significantly (Chemat, n.d.; Sungkaew, (2024).

2.6 Supply

According to Laili, Huey, & Harun (2017), their study identifies factors influencing the world supply of natural rubber, focusing on the exchange rate and interest rates. They found that production volume, domestic consumption, and exchange rates significantly impact the export quantity of natural rubber in Malaysia, thereby influencing global supply. Similarly, Basri, Jaafar, & Hapka (2018) investigated the demand and supply dynamics of natural rubber, along with the effects of currency exchange rates and crude oil prices on the global rubber market. They concluded that the cost of production plays a crucial role in determining the world supply of natural rubber. Increases in production costs lead to decreased supply, while decreases in production costs lead to increased supply. Fluctuations in exchange rates and currency values affect global trade in rubber products. In addition, Sungkaew (2024) points out that the volume of rubber stock, both domestically and internationally, has the most significant impact on domestic natural rubber prices. Additionally, the domestic price is heavily influenced by both domestic and international buyer markets. Empirical analysis suggests that Thailand's rubber market operates as a buyer's market (monopsony). Despite being the largest global producer of rubber, Thailand remains largely dependent on foreign markets. In addition, Phisitsupakul (2016) noted that despite increasing demand for natural rubber, the availability of synthetic rubber as a cheaper substitute has affected consumer choices, leading to decreased demand for natural rubber and subsequently lower prices. Chowacharaensuk (2019)

highlighted that an increase in domestic rubber production indicates higher demand within the economy, leading to increased prices for natural rubber products like smoked rubber or block rubber. These studies collectively underscore the complex interplay of factors influencing natural rubber prices and supply dynamics in global markets.

2.7 Gross Domestic Products (GDP)

One study on the factors affecting Thai natural rubber price by Chawananon (2014), the GDP of foreign GDP has a positive relationship to the rubber price. Also, the GDP variable is a significant factor. Manachotipong (2012) analyzed the demand elasticity for Thailand's exported rubber products and the income (GDP) elasticity of demand among trade partners. Using the instrumental variable estimation method with panel data from January 2001 to July 2012, the study found that the demand elasticity for exported rubber products was relatively low, indicating that a 1 percent increase in rubber prices would lead to less than a 1 percent decrease in demand. However, the income elasticity related to GDP among trade partners, particularly in the automotive industry, was high. As GDP rises, economic growth benefits industries like automotive, leading to increased demand for rubber, especially in tire production. Conversely, a 1 percent decrease in trade partners' GDP would result in a more than 1 percent decrease in rubber demand from Thailand. This underscores the importance of considering GDP fluctuations in trade partner countries when developing export policies for rubber.

3. Methodology

3.1 Model Specification

The model illustrating below is derived from several research conducted by previous scholars. The model is to determine the factors influencing the unsmoked rubber sheet price. The explanation for deriving each variable is illustrated in Table 3 with expectation of sign.

The estimation equation formulated for analysis is shown by:

$$Y_i = \beta_1 + \beta_2 x_i + \beta_3 x_i + \beta_4 x_i + \dots + U_i \dots \dots \dots (1)$$

where,

Dependent Variable	Y = Price of rubber	(THB)
Independent Variable	X ₁ = Crude oil price	(USD)
	X ₂ = Exchange rate	(THB per USD)
	X ₃ = Quantity of exported rubber	(Kilogram)
	X ₄ = Crude Palm oil price	(THB)
	X ₅ = Synthetic rubber price	(THB)
	X ₆ = Quantity of Rubber Supply	(Ton)
	X ₇ = Thai GDP	(USD)
	i = period	

3.2 Research procedure

The method employed in this study is quantitative, utilizing secondary time-series data in the form of monthly observations from 2014 to 2018, totaling 60 months before Covid-19. The study focuses on one dependent variable, the price of unsmoked rubber sheets at the Central Market in Hat Yai, and seven independent variables: (1) crude oil prices, (2) exchange rates, (3) palm oil prices, (4) export rates, (5) synthetic rubber prices, (6) Thai rubber supply, and (7) Thai GDP. One reason to choose Thai GDP instead of foreign GDP is that export reflects the foreign demand, and it is a part of foreign GDP. However, Thai rubber supply is measured by quantity, and Thai GDP refers to the current Thai economic situation. Data cleaning is essential for regression analysis using the Ordinary Least Squares (OLS) method. Additionally, logarithmic transformations are applied to all variables to facilitate the comparison of percentage changes, as the data comprises various units and some variables have large values. This approach aids in interpreting changes across different units effectively. Therefore, the model is structured to compare changes in percentage terms.

$$Y = \beta_1 + \ln\beta_2x_1 + \ln\beta_3 x_2 + \ln\beta_4x_3 + \dots + U \dots\dots\dots(2)$$

Table 3: Expected Signs

Determinant	Citation	Expected Sign
1. Crude oil price	Raju (2016) examines the dramatic decrease in crude oil prices would lead the decline in the price of the synthetic price. Khin, Mohamed, and Hameed (2013) the significant positive relationship between crude oil price and natural rubber prices. Vinayan, Prasad, and Anuradha (2019) point out that natural rubber price goes up when the crude oil price raises. However, Basri, Hapka, Jaafar, and Muhamat (2019) argue that crude oil price reflects an insignificant encouraging factor in natural rubber price.	(+)/(-)
2.Exchange rate	Sadali (2013) illustrates that the exchange rate and the price of rubber are in a strong negative relationship. Cavalcanti, Mohaddes, and Raissi (2015) found that when the exchange rate is depreciated, the price of the commodity will also rise. Srisuttisaard (2016) illustrate that when Thai Baht appreciates, the price of rubber and other commodities will rise to cause the amount and value of the export to fall. Basri, Jaafar, and Hapka (2018) explain that the currency exchange rate is statistically significant negative in relation to rubber price. Laili, Huey, and Harun (2017) find that there is an insignificant relationship with exchange rate and rubber but not significant in terms of the quantity export of natural rubber.	(+)

Determinant	Citation	Expected Sign
3.Quantity of Exported Rubber	Chemat (n.d.) says the export also makes the flow of expenditure will be flowed into the enterprise sector. Moreover, the aggregate expenditure will raise because the export of goods and services, and therefore the national income will also increase. If net exports in a positive state, the aggregate expenditure will also increase. Then it will tend to raise the national income and employment. Sungkaew (2024) says volume of rubber stock, both domestically and internationally, has the most significant impact on domestic natural rubber prices.	(-)
4.Crude Palm oil price	Tangtavornchaikul (2018) investigates that when the price of crude palm increases, farmers try to plant more palm trees than rubber trees. Also, Kumar et al. (2021) conclude that crude oil price could influence domestic rubber price.	(-)
5.Synthetic rubber price	Lamchaek (2013) demonstrates that the amount of exporting of synthetic rubber can affect to the natural rubber price because the suppliers take the lowest price. However, Hasbrouck and Schwartz (1988), Hasbrouck (1995) and Gresse (2010), the synthetic rubber has the similar movements as the domestic rubber prices because the production process of synthetic rubber has to use the natural rubber to produce. Assanee (2011) pointed out that natural rubber and synthetic rubber are substitute goods.	(+)/(-)
6.Thai Supply of Rubbers	Basri, Jaafar & Hapka (2018) study demand and supply of natural rubber and the currency exchange rate and crude oil price that may be affected to the world supply of rubber market with the natural price behavior. In conclude, the world supply of natural rubber depends on the high or low cost of production.	(-)
7. GDP	Chawananon (2014) says the GDP of foreign GDP has a positive relationship to the rubber price.	(+)

4. Results and Discussion

4.1 Results

The descriptive statistic table 4 provides a summary of the variable characteristics of dataset. The average of price of unsmoked rubber is 52, with a standard deviation of 10.83. The unsmoked rubber focus on prices from the Central Market in Hat Yai.

Table 4: Descriptive Statistics

variables	Mean	Median	S.D.	Min	Max
Price of unsmoked	52.82	51.07	10.83	36.95	86.21
Crude oil price	60.43	53.50	19.25	33.62	105.4
Exchange rate	33.82	33.37	1.412	31.44	36.33
Quantity of export rubber	48,776,146	48,099,690	11,278,493	28,524,262	79,292,494
Crude palm oil price	26.46	26.45	5.32	16.22	37.49
Synthetic rubber price	61.07	58.50	9.602	48.00	88.00
Thai Supply	368,185	375,258	109,492	84,573	580,127
Thai GDP	824.9	820.1	42.59	769.3	888.3
Observations	60	60	60	60	60

4.2 Regression Diagnostic Tests

4.2.1 Unit Root Test

Unit Root Test is a test of stillness or stationarity of one's Variations used in the study. The unit root test is tested by The Augmented Dickey-Fuller Test. It has results as the following test as Table 5.

Table 5: The results of unit Root Test

Independent variables	Test-statistic	Result
ln Price of unsmoked	-2.45333	Non-Stationary
ln Crude oil price	-2.20234	Non-Stationary
ln Exchange rate	-1.66141	Non-Stationary
ln Quantity of export rubber	-3.82675	Stationary
ln Crude palm oil price	-1.63188	Non-Stationary
ln Synthetic rubber price	-2.11016	Non-Stationary
ln Thai Supply	-3.48614	Stationary
ln Thai GDP	-0.537844	Non-Stationary

Notice: all unit root test by the Augmented Dickey-Fuller Test

According to Table 5, the results indicate that major variables are non-stationary. To ensure the reliability of the regression model, the residuals from the Ordinary Least Squares (OLS) model need to be tested for stationarity using the Augmented Dickey-Fuller test. Stationarity of the residuals indicates the regression model is reliable. Since the residuals are stationary with a test statistic less than -3, the regression model is deemed reliable, despite some variables being non-stationary.

4.2.2 Multicollinearity Test

According to the regression model, the regression must be tested for multicollinearity test. The multicollinearity test is used to determine if there is a relationship between independent variable to avoid the unreliable and unstable estimates of regression coefficients. A reliable regression model should not be a correlation between independent variables. The results multicollinearity of show from Table 6.

Table 6: The results of multicollinearity

	Price of unsmoked rubber	Crude oil price	Exchange rate	Quantity of export rubber	Crude palm oil price	Synthetic rubber price	Thai supply	Thai GDP
Price of unsmoked rubber	1	0.2687	0.0532	-0.1008	0.5888	0.5696	-0.1115	-0.2569
Crude oil price	0.2687	1	-0.717	0.049	-0.1372	0.4142	-0.1249	-0.2377
Exchange rate	0.0532	-0.717	1	-0.0394	0.4232	-0.196	0.1348	-0.1078
Quantity of export rubber	-0.1008	0.049	-0.0394	1	-0.1779	0.1661	0.0774	-0.1153
Crude palm oil price	0.5888	0.4142	-0.196	0.1661	1	0.1258	0.1518	-0.2457
Synthetic rubber price	0.5696	0.4142	-0.196	0.1661	0.1258	1	0.1518	-0.2457
Thai supply	-0.1115	-0.1249	0.1348	0.0774	-0.0714	0.1518	1	0.0056
Thai GDP	-0.2569	-0.2377	-0.1078	-0.1153	-0.6147	-0.2457	0.0056	1

Based on the Table 6 above, it shows that the data results of multicollinearity test values for price of unsmoked rubber sheet, crude oil, exchange rate, palm oil price, export rate, synthetic rubber, and inflation rate. According to the results, there is no variables which is greater than 0.8. Therefore, there is no multicollinearity in all variables.

4.2.3 Heteroskedasticity Test

Moreover, from regression model, the heteroskedasticity is also needed to investigate. Heteroskedasticity test is brought to test if the variant of two observations in the same study for all the dependent variables with the independent variable in order to see that the estimation result is not biased or not. The heteroscedasticity problem can be tested by Breusch-Pagan test for heteroskedasticity.

Table 7: The results of heteroskedasticity

Heteroskedasticity Test: White			
Null hypothesis: Homoskedasticity			
F-statistic	1.045622	Prob. F(32,27)	0.4566
Obs*R-squared	33.20538	Prob. Chi-Square(32)	0.4083
Scaled explained SS	23.31031	Prob. Chi-Square(32)	0.8683

From Table 7, the result shows that the probability of Chi-Square from the test results using the probability value is $0.4083 > 0.05$. Therefore, there is no heteroskedasticity.

4.2.4 Autocorrelation

Then, the regression model is needed to test for autocorrelation. The result from the data processing of autocorrelation by the Breusch-Godfrey test, for first-order autocorrelation yielded a p-value less than 0.05, indicating significant autocorrelation. Additionally, autocorrelation was also assessed using the Durbin-Watson statistic, which was calculated as 0.787 from the OLS regression, it falls within the range indicating positive autocorrelation. Author concludes that autocorrelation is present in this regression analysis. Then, there is autocorrelation problem, so the problem of autocorrelation must be solved by Cochrane-Orcutt. Therefore, the regression model will be reliable without autocorrelation problem. From Cochrane-Orcutt, the Durbin Watson has the value which is 1.689 and it is closer than 2. There is no positive autocorrelation anymore. This regression model becomes more reliable.

Table 8: The Result of Regression Model

	Constant	ln Crude oil price	ln Exchange rate	ln Quantity of rubber export
Coefficient	-6.920	0.224**	0.957	-0.009
t-ratio	-1.092	2.101	1.162	-0.162
P-value	0.279	0.0406	0.2506	0.8716

	ln Crude palm oil price	ln Synthetic rubber price	ln Thai Supply	ln Thai GDP
Coefficient	0.522***	0.041	-0.076**	0.875
t-ratio	3.302	0.305	-2.182	0.975
P-value	0.0018	0.7614	0.0338	0.3340

Note: * 90% critical value, ** 95% critical value, *** 99% critical value

According to the regression model result from Table 8, the R^2 value indicates that a substantial portion of the variation in the dependent variable can be explained by the independent variables. Among them, three variables stand out as statistically significant: crude oil price, crude palm oil price, and Thai rubber supply. These variables demonstrate significant effects on the price of unsmoked rubber sheet. For crude oil price, it shows significance at a 95% level, suggesting that increases in crude oil price correspond to increases in the price of unsmoked rubber sheet. Similarly, crude palm oil price exhibits significance at a 99% level, indicating its impact on the rubber sheet price. Moreover, Thai rubber supply shows significance at a 95% level, highlighting its influence on the price of unsmoked rubber sheet. These findings underscore the importance of these factors in determining the price dynamics of unsmoked rubber sheet in Thailand.

4.6 Discussion

4.6.1 Crude Oil Price

The regression analysis reveals that crude oil price has a statistically significant and positive effect on the price of unsmoked rubber sheet. This finding aligns with previous research by Khin, Mohamed, and Hameed (2013), which demonstrated a similar positive relationship between crude oil price and natural rubber price. It is well-established that crude oil is a major raw material for synthetic rubber production, and the prices of crude oil, natural rubber, and synthetic rubber are closely correlated (Vinayan, Prasad, & Anuradha, 2019). Hence, an increase in crude oil price tends to elevate the price of unsmoked rubber sheet, reflecting its influence on both production costs and market dynamics.

4.6.2 Exchange Rate

Contrary to expectations, the exchange rate was found to be insignificant in its relationship with the price of unsmoked rubber sheet in the regression model. This result is consistent with the findings of Laili, Huey, and Harun (2017), who observed that while the exchange rate affects the quantity of rubber exports positively, its impact on the price of natural rubber exports remains insignificant. Furthermore, studies such as those by Khin, Chau, Yean, Keong, and Bin (2017) suggest that exchange rate fluctuations may have long-term effects on trade flows rather than immediate impacts on rubber prices.

4.6.3 Quantity of Rubber Export

Historically, an increase in the world market price of unsmoked rubber has typically led to higher export quantities. However, the study finds that the quantity of rubber export is not statistically significant in affecting the price of unsmoked rubber sheet. This contrasts with findings from Chemat (n.d.) and Sungkaew (2024), who reported a negative relationship between export quantity and rubber price. Nonetheless, the results indicate that other factors may be more influential in determining the price dynamics of unsmoked rubber sheet.

4.6.4 Crude Palm Oil Price

The regression results indicate a positive relationship between crude palm oil price and the price of unsmoked rubber sheet, which is consistent with findings from Tangtavornchaikul (2018). Their research highlighted that an increase in crude palm oil price stimulates greater demand for palm tree cultivation, potentially diverting resources away from rubber plantations.

4.6.5 Synthetic Rubber Price

Despite synthetic rubber being a substitute for natural rubber, the study did not find a statistically significant relationship between synthetic rubber price and the price of unsmoked rubber sheet. This outcome aligns with Boonnim (2015), who noted that the price of synthetic rubber, derived from crude oil, fluctuates independently of natural rubber prices due to differing production processes and market dynamics.

4.6.6 Thai Rubber Supply

The study identifies Thai rubber supply as the most statistically significant factor influencing the price of unsmoked rubber sheet. This finding underscores its pivotal role in shaping market conditions, consistent with previous research emphasizing the significant impact of supply-demand dynamics on natural rubber prices (Basri et al., 2018). However, Table 9 shows that compare this study to previous study, the rubber supply result is different from Basri et al. (2018). Their model was rubber price depend on demand, supply, exchange rate, and crude oil price, and the supply of rubber.

4.6.7 Gross Domestic Product

Interestingly, GDP was found to be statistically insignificant in its relationship with the price of unsmoked rubber sheet in the regression model. This contrasts with Chawananon's (2014) findings, which indicated a positive relationship between foreign GDP and rubber prices. While GDP may influence broader economic conditions, its direct impact on rubber prices in the study was not significant.

Table 9: Summary Table

Variable	This study		Previous Study		
	Significance	Relationship	Significance	Relationship	Author(s)
Crude Oil Price	✓	+	✗	+	Khin, Mohamed, and Hameed (2013), Vinayan, Prasad, and Anuradha (2019) Basri, Hapka, Jaafar, and Muhamat (2019)
Exchange Rate	✗	+	✗	+	Laili, Huey, & Harun (2017).
Quantity of Rubber Export	✗	-	✓	-	Chemat (n.d.) and Sungkaew (2024)
Crude Palm Oil Price	✓	+	✓	+	Tangtavornchaikul (2018)
Synthetic Rubber Price	✗	+	✗	+*	Assanee 201 *In a case of import synthetnic rubber
Thai Rubber Supply	✓	-	✓	+	Basri, Jaafar, Hapka, & Muhamat (2018)
Gross Domestic Product	✗	+	✓	+	Chawananon (2014)

Table 9 summarizes that the regression analysis highlights several key factors that significantly influence the price of unsmoked rubber sheet, including crude oil price, crude palm oil price, and Thai rubber supply. These findings contribute to a deeper understanding of the market dynamics affecting natural rubber prices, emphasizing the complex interplay of global economic factors and regional supply-demand dynamics.

4.7 Policy Recommendation and Further Study

To address the decline in the price of unsmoked rubber sheets in Thailand, it is recommended to diversify agricultural activities by encouraging rubber farmers to plant alternative economic trees and reduce reliance on rubber (Agricultural Research Development Agency (Public Organization), n.d.). Strengthening government initiatives to support farmers during low price periods, such as financial assistance and technical support, is important. Implementing market stabilization mechanisms like price floors and promoting investment in domestic value-added processing of rubber products will also help stabilize farmer income and increase economic resilience. Additionally, increasing research and development in rubber alternatives and synthetic substitutes can open new

markets and mitigate the impact of price fluctuations. These measures will contribute to income stability for farmers, sustainable agricultural practices, and enhanced export revenues, ultimately bolstering Thailand's position in the global rubber market as a recommendation for further study.

5. Conclusion

This study explores the key factors influencing the price of unsmoked rubber sheets, a vital component of the Thai economy due to the widespread cultivation of rubber trees by farmers. Using data from a 60-month period and applying the Ordinary Least Squares (OLS) method, the analysis examined variables such as crude oil prices, exchange rates, rubber export quantities, crude palm oil prices, synthetic rubber prices, the quantity of Thai rubber supply, and Thai GDP. The findings reveal that crude oil prices, crude palm oil prices, and the quantity of Thai rubber supply are significant determinants of unsmoked rubber sheet prices in Thailand. To enhance accuracy, all variables were log-transformed for percentage-based comparisons.

6. References

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