Impact of Crude Oil Price Changes on Natural Rubber

Industry in India

Mr. Aabi Kakkanatt Vinayan[a], Mr. Leo Prasad V[b], Dr. Anuradha P.S[c]

a) Post Graduate Research Scholar, Christ (Deemed to be University), Bengaluru
b) Post Graduate Research Scholar, Christ (Deemed to be University), Bengaluru
c) Associate Professor, Christ (Deemed to be University), Bengaluru

Abstract

Crude oil price is a major factor which affects various sectors of an economy. The study analyses the influence of changes in crude oil price on Indian natural rubber industry with respect to its price, production and consumption. The period of study is from April 2008 to March 2018 and the tools used are correlation analysis, regression analysis and Granger causality test. The results show that price variations in crude oil have a significant influence on prices of natural rubber. However, the production and consumption of natural rubber are not significantly affected by price variations in crude oil. Moreover, crude oil prices granger cause natural rubber prices. Even though crude oil prices increases regularly but the price of natural rubber is still on the downfall, which ultimately affects the rubber cultivators in India.

Keywords: Crude oil prices, Natural rubber prices, Production, Consumption, Granger Causality

Introduction

In the commodities market as well as in the world's economy, crude is been widely traded. Presently, the economic growth and Gross Domestic Product (GDP) of a nation are heavily dependent on crude oil and the supply and demand largely affect the prices and profitability of crude oil. History has witnessed significant fluctuations in crude oil prices but its volatility has bolstered in recent years. The magnitude of the effect of oil price changes greatly influence the oil importing countries like India and its volatility is a major cause for concern. The unanticipated changes in crude oil prices can potentially affect various industries and sectors of the economy by similar movements in stock prices, exchange rates, inflation rate, and the unemployment rate. **(Kilian, 2008)**

Price variations in crude oil have a direct or indirect influence on industries such as automobile, chemicals, paint, petroleum etc. in varying degrees, where crude oil is used as a primary or secondary source of raw material for these industries. **(Seth, Giridhar, & Krishnaswami, 2016)** Furthermore, any rise in oil price affects the demand and supply of various products and services

which subsequently increases the production and transportation costs of such commodities. Hence, the volatility of crude oil prices is likely to have a significant brunt on most of the industrial sectors in the world, as the majority of industries relies on crude oil.

Similarily, natural rubber industry in India is also impacted by the fluctuations in crude oil prices. This is because of the significant impact that crude oil price variations can cause on synthetic rubber prices. As synthetic rubber is manufactured from processed crude oil and any changes in crude oil price will definitely affect the synthetic rubber prices. This, in turn, can impact the prices and production of its substitute product, particularly natural rubber. Among the total rubber production in India, only twenty percent constitutes synthetic rubber and the remaining eighty percentage is natural rubber which is produced within India. The demand for natural rubber has declined over the years because of the cheap availability of synthetic rubber.
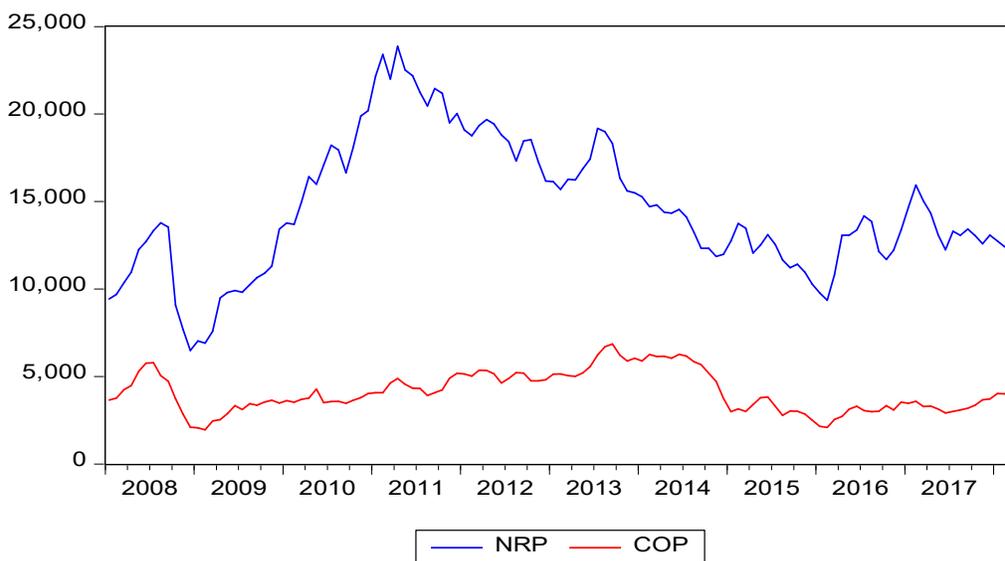

Figure 1: Price variations of crude oil (COP) and natural rubber (NRP)

On contrary, more competitiveness can be brought to synthetic rubber prices by lowering the crude oil prices which will put further pressure on natural rubber price**s. (Khin, Mohamed, & Hameed, 2013)** When the global crude oil price reached an average of above $100/barrel in 2011, natural rubber prices in India reached an all-time high record at RS. 243 per kilo. Since then, natural rubber prices have been on a fall, hitting a low of RS. 95/kg in 2015. The crude oil prices increased by 18.2 per cent in December 2017 quarter and at the same time, prices of synthetic rubber increased significantly. Moreover, the prices of natural rubber also moved in a narrow range at RS. 13,100 per ton in the same period. In May 2018, when crude oil attained the highest price since 2014, the prices of natural rubber shot to RS. 120/kg. **(Industrial Sources)**

Therefore, when the crude oil price changes, it can impact the natural rubber industry in India. This situation can eventually influence the prices, demand, supply, production and consumption of natural rubber in India, both in the short run and long run. Thus, the study is conducted to assess the influence of crude oil price variations on natural rubber prices in India. Furthermore, the study also analyses the effect on the production and consumption of natural rubber by the price variations of crude oil in India.

Statement of Problem

Historically, prices of crude oil and synthetic rubber have moved in tandem as synthetic rubber is produced from crude oil. However, it has severely affected the prices of natural rubber, being the substitute product of synthetic rubber. The price of synthetic rubber naturally firms up when the crude oil price rises. In such a situation, consumers might reject synthetic rubber and turn to natural rubber. Thus, it increases the demand for natural rubber, making it favourable for rubber producers. But for the last several years, it has been seen observed that if there is a boom in rubber prices, then a fall is inevitable. This has impacted the income of rubber growers in India. The rubber cultivators still face inadequacy of profits because of the decline in natural rubber prices over the years, especially in recent years. This situation makes rubber cultivators to shift their cultivation to other agricultural commodities and for rubber producers to curtail natural rubber production in India. This problem has been a major concern for rubber cultivators in Kerala, as natural rubber is widely cultivated in lands there. The future of natural rubber to a great extent depends on the movements in oil prices, which is uncertain. Thus, the study analyzes the problems which arise from the crude oil prices changes that affect the rubber cultivators in India with respect to its price and production.

Review of Literature

Research studies all over the world have examined the close relationship between natural rubber prices and crude oil prices, exchange rate fluctuations, macroeconomic factors etc. Examination of existing studies revealed the volatility effect of crude oil prices on natural rubber prices. **(Hamilton, 2009)** aims to analyze the determinants that affect crude oil prices fluctuations and also shows the statistical behaviour of prices as well as essential characteristics of petroleum's demand and supply. The paper has investigated factors like crude oil price speculation, time lag or geographical barriers on increasing production, high global demand and monopoly pricing of OPEC countries have lead to high crude oil prices in summer 2008. **(Obadi, Othmanova, & Abdova, 2013) s**tudied that the crude oil prices are adversely affected by the supply, demand, speculation in crude oil prices,exchange rate of U.S dollars and prices of crude oil's substitute product.The paper also

exhibits co-integration among crude oil prices and natural rubber prices in the long run and thus, the decline in natural rubber price has led to stabilization of crude oil prices.

(Raju, 2016) examined that the sharp decline in prices of crude oil, the decline in synthetic rubber prices, the economic slowdown in the developed and developing countries and depreciation of currencies in natural rubber exporting countries are the reasons that have led to the volatility and decline in natural rubber prices in the producing countries. Because of the cointegration of the domestic market and international market, instability of natural rubber prices in the international market has influenced the price of natural rubber in the domestic market. **(Pareed & Kumaran, 2017)** conducted a study by evaluating the natural rubber prices during the six-month period that ended in March 2016. The results show that every one per cent change in oil prices leads to 0.68 per cent change in natural rubber.

(Khin, Mohamed, & Hameed, 2013) contributes to the research on the influence of world crude oil prices on the Malaysian rubber industry (both natural rubber and synthetic rubber) on their prices, demand and supply using the Vector Error Correction Method (VECM). The results show that the crude oil price and the demand as well as the supply of both synthetic and natural rubber, are cointegrated. In line with, **(Murshidi & Aralas, 2017)** examined the existence of a short and long-run relationship of price shocks on crude oil, crude palm oil and rubber towards the economic growth of Malaysia using autoregressive distributed Lag (ARDL) bounds test and error correction model (ECM). The outcome indicates that the price shocks of crude oil and palm oil affect the GDP growth. On the other hand, there does not exist a statistically significant relationship between rubber price shocks and growth of GDP. **(Khin, Chau, Yean, Keong, & Bin, 2017)** goes beyond and states that exchange rate volatility of Malaysian Ringgit has an effect on prices of natural rubber in Malaysia.

(Kumar & Maheswaran, 2013) employed the DCC-BVGARCH model to study the volatility dynamics of crude oil on the stock price of industrial sectors. "Evidence of the positive return spillover effect from oil prices to the metal sector returns and negative return spillover effect from oil prices to the auto sector are seen. In the case of volatility spillover, there is a positive impact of crude oil price to the energy sector and the automobile sector in the short run, but it is negative in the long run. Conditional correlations between the crude oil market and the Indian industrial sectors reached highest during the period of the global financial crisis (2008-2009)". In agreement with, **(Seth, Giridhar, & Krishnaswami, 2016)** have observed the existence of interrelation between crude oil price variations and production of certain commodities such as refined petroleum products, chemicals and plastics, where crude oil is used as a primary source of inputs for those

industries. He is of the opinion that rubber industry is not benefited from the decline in prices of crude oil. **(Pinno & Serletis, 2013)** in his research shows that nonlinear impacts of the price of oil on the aggregate economy vary depending on time period by undertaking a cross-decade comparison of the 1980s, 1990s and 2000s. He finds that volatility of oil price has a strong nonlinear effect on aggregate indices of manufacturing (NAICS), total industrial production, manufacturing (SIC), durable goods and non-durable goods. This impact of oil price volatility on industrial indices was evident even in periods of low volatility, such as the 1990s. A slightly different approach was adopted by **(Wei & Chen, 2016)**, where he conducted impulse response analysis to indicate that returns of futures from agricultural commodities such as wheat, soybeans and corn are affected by crude oil returns. He suggests the association of oil price returns and agriculture commodity returns in the long term, where one standard deviation to the oil price returns has a relatively 9.12 percent, 13.18 percent, and 12.04 percent brunt on wheat, soya beans and corn's returns.

(Ram, 2017) studied that NIFTY 50 and COMDEX index prices predict crude oil prices as there is unidirectional causality between them. The volatility of the MCX and NIFTY50 is influenced by crude oil prices. Also, oil price fluctuations granger cause inflation with a high degree of positive correlation. Lastly, the study finds that the decline in prices of crude oil leads to growh in GDP rate. In confirmation, **(Jain, 2013)** emphasize that crude oil price has a significant influencen on inflation in India. Similarily, a study on US securities market by **(Kilian & Park, 2009)** revealed that the oil's demand or supply shocks have resulted in the high variations of U.S. stock market returns. These shocks account for twenty per cent of the variations in U.S. real stock returns. On the other hand, **(Kang, Ratti, & Yoon, 2015)** investigated the volatility effect of dynamic oil price shocks on the returns of U.S. share market by employing co-variance analysis. The study reveals that positive shocks to the total demand have adversely affected the stock market returns. But there is a positive effect on U.S share market return and volatility of oil prices due to supply disruptions in the oil market.

Research Gap

The impact of crude oil price variations on the Indian natural rubber industry has been a neglected field of study and hence, our research provides knowledge in this context. Most of the research studies were done on the volatility of crude oil prices and its effect on share markets, commodity markets, industries such as automobiles, tyre, energy, mining and also on selected macroeconomic variables like GDP, inflation etc. Some research studies in Malaysia, Thailand etc. have focused on the influence of rubber price fluctuations on its production, its consumption, imports and exports.

Still, no sufficient studies were done in the Indian scenario taking into consideration the spot prices of crude oil and natural rubber in India. Majority of them used data of crude oil prices in US dollars. Even though ample researches were done to examine the impact of crude oil price changes and the synthetic rubber industry, but sparse research was done to know the linkage between crude oil prices and natural rubber prices. Researchers have identified and analyzed the factors that affect the natural rubber prices in India, such as exchange rate fluctuation in currencies, fluctuations in demand from the automobile industry and tyre industry, crude oil prices and climatic changes. However, a proper study has not been done to quantify the effect of crude oil price variations on the rubber industry, where the price of crude oil is a major factor affecting the natural rubber prices in India. Thus, this study examines the effect of price changes of crude oil on the natural rubber industry in India.

Objectives

1. To analyse the relationship of crude oil prices and natural rubber prices in India.
2. To examine the impact of crude oil price variations on the prices of natural rubber in India.
3. To investigate the influence of crude oil price changes on the production and consumption of natural rubber in India.

Methodology

The study is an analytical research on secondary data collected from various published sources such as websites, journals, newspaper etc. The independent variable selected for this study is crude oil prices (COP) and the dependent variables are natural rubber prices (NRP), production of natural rubber (PNR) and consumption of natural rubber (CNR). Data related to daily prices of crude oil in India is extracted from Multi-Commodity Exchange (MCX) of India and the monthly average natural rubber prices of Ribbed Smoked Sheet (RSS-4), traded in the domestic market are collected from Indian Rubber Board, Kottayam. Monthly production and consumption of natural rubber are also gathered from Indian Rubber Board, Kottayam. The period of study extends from April 2008 to March 2018; i.e. post-sub-prime crisis. The data are analyzed in E views using tools such as Unit root test, Correlation analysis, Regression analysis and Granger Causality Test. The stationarity of all series at five percent level of significance is confirmed by Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. In order to study the relationship between crude oil prices and natural rubber prices, we use correlation analysis. We apply regression analysis to estimate the effect of crude oil prices on natural rubber prices, its production and consumption. We employ Granger causality test to estimate the future prices of natural rubber using past prices of crude oil.

Findings and Discussions

UNIT ROOT TESTS: Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) tests are done to determine whether the time series data is stationary or not. Data are said to be non-stationary if it contains unit root which can lead to further regression analysis. Here, variables been Crude oil prices (COP), Natural rubber prices (NRP), Production of natural rubber (PNR) and Consumption of natural rubber (CNR) have been tested for stationarity. The outcome of unit root tests is presented in Table-1.

TABLE 1: Results of unit root test using ADF test and PP test

VARIABLES	ADF TEST		PP TEST	
	LEVEL	1ST DIFFERENCE	LEVEL	1ST DIFFERENCE
Crude Oil Prices (COP)	-2.469761	-7.434095**	-2.197278	-7.462011**
Natural Rubber Prices (NRP)	-2.005162	-8.499082**	-1.811168	-8.487768**
Production of Natural Rubber (PNR)	-1.153941	-3.612108**	-4.803884**	-
Consumption of Natural Rubber (CNR)	-1.432551	-13.90907**	-2.272569	-18.02196**

**the null hypothesis is rejected at a 5% significance level

The prices of crude oil(COP), prices of natural rubber(NRP), production of natural rubber (PNR) and consumption of natural rubber (CNR) are non-stationary at level but they are stationary at the 1st difference (0.05 level of significance) using Augmented Dickey-Fuller (ADF) test. The Phillips-Peron's test for unit root shows that crude oil prices (COP), natural rubber prices (NRP) and consumption of natural rubber (CNR) are stationary at 1st difference whereas production of natural rubber (PNR) is stationary at level itself.

Covariance Analysis: Ordinary

Date: 08/31/18   Time: 23:11

Sample: 2008M01 2018M03

Included observations: 123

Correlation	NRP	COP
NRP	1.000000	
COP	0.513295	1.000000

t-Statistic	NRP	COP

NRP	-----	
COP	6.579081	-----

Probability	NRP	COP
NRP	-----	
COP	0.0000	-----

The above table depicts the correlation analysis, which is applied to determine the strength of the association between the prices of crude oil and the prices of natural rubber. In these results, the correlation between the prices of crude oil and prices of natural rubber is approximately 0.513295, which indicates that both the variables move in the same direction. This signifies the existence of a strong positive relationship between the prices of crude oil and prices of natural rubber. So if the prices of crude oil increases, prices of natural rubber follow in tandem and vice versa.

TABLE 2: Results of Regression Analysis

Dependent Variable	Coefficient	t-statistics	R-squared	Probability Value
D(NRP)	0.945285	3.887919	0.111874	0.0002
D(PNR)	0.446799	0.135567	0.000153	0.8924
D(CNR)	1.228173	1.438601	0.016954	0.1529

The above table depicts the output of the regression analysis. The results show that the coefficient of crude oil price is 0.945285, which means that there is a strong positive relationship between the prices of crude oil and prices of natural rubber. It implies that every unit increase in the prices of crude oil is accompanied by 0.945285 units increase in natural rubber prices. From the output, the p-value of crude oil price is 0.0002 which is less than 0.05. It tells us that the crude oil price is significant at 5% confidence level. Hence, the prices of crude oil have a significant influence on the prices of natural rubber. The value of R-square is 0.111874 which implies that crude oil price can be relied on to explain 11.18% of the variations in natural rubber prices.

 The regression output of the price of crude oil and the production of natural rubber shows the presence of a positive relationship between them. It indicates that one unit increase in crude oil price causes 0.446799 unit increase in natural rubber production. The p-value of crude oil price is 0.8924 which is greater than 0.05. Also, the R-square value is 0.000153 which signifies that prices of crude oil do not have a statistically significant impact on the production of natural rubber.

On the other hand, the regression analysis of the price of crude oil and the consumption of natural rubber also depict a positive relationship between them. The coefficient of crude oil price is 1.228173. It means every unit increase in crude oil price is accompanied by 1.228173 unit increase in consumption of natural rubber. The p-value of crude oil price is 0.1529 which is greater than 0.05. Thus, the price of crude oil does not significantly influence the consumption of natural rubber. The R-square value is 0.016954 which implies that 1.69% of variations in consumption of natural rubber is explained by prices of crude oil.

On examining the impact of crude oil prices and natural rubber prices, the study reveals a strong relationship between them. It means that natural rubber prices increase during the period when the crude oil price is in the surge. However, in the present domestic market, the rubber growers in India still face downfall or decline in the prices of natural rubber. This situation might be the reason for the prices of crude oil to insignificantly affect the production and consumption of natural rubber in the domestic market.

Pairwise Granger Causality Tests
Date: 09/11/18   Time: 12:34
Sample: 2008M01 2018M03
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
NRP does not Granger Cause COP	121	2.15183	0.1209
COP does not Granger Cause NRP		4.26047	0.0164

The above output shows the causality between the prices of crude oil and natural rubber prices. It enables to forecast the prices of natural rubber using crude oil prices. On comparing the natural rubber price and crude oil price, we found that p-value is 0.1209 which is greater than 0.05. So we accept the null hypothesis. Thus, natural rubber prices do not Granger cause crude oil prices.

On the other hand, by comparing the prices of crude oil with the prices of natural rubber, the outcome depicts that the p-value is 0.0164 which is less than 0.05. So we reject the null hypothesis indicating that crude oil prices granger cause natural rubber prices. Therefore, there exists one-way causality among the prices of crude oil and prices of natural rubber.

Suggestions

Since there is a strong interrelationship between the crude oil market and the natural rubber market, the government must ensure that the volatility in prices of crude oil does not adversely affect the prices of natural rubber. Prior research studies have revealed that weakened natural rubber market and its price has been revived back by a surge in crude oil prices. A hike in crude oil prices can be potentially strategized to lift natural rubber prices because natural rubber prices have a strong correlation with those of synthetic rubber, which is made from crude oil. But still, rubber prices are within the range of RS. 120 - RS. 130 per kg and it has led to a situation where farmers are not able to tap rubber trees. The worst affected parties from the low price of natural rubber prices are the rubber cultivators. The government should increase the Minimum Support Price (MSP) for rubber so that it does not fall below the price expected by the farmers, even when there is a dynamic variation in crude oil prices. To safeguard the interest of domestic rubber producers, the flow of rubber imports must be controlled and the import duty has to be raised. The production of natural rubber increases only when domestic prices of natural rubber are stabilized. The market for natural rubber has to be promoted by meeting the demand of tyre industries.

Conclusion

The paper has analyzed the influence of crude oil prices (COP) on the prices of natural rubber (NRP) and to know the effect of price fluctuations in crude oil on the production (PNR) and consumption (CNR) of natural rubber. The study revealed the presence of a strong positive relation among the prices of crude oil and prices of natural rubber. Thus if the prices of crude oil (COP) increases, it leads to a hike in prices of natural rubber (NRP). This further proves the exsistence of a strong influence of crude oil prices on natural rubber prices. In addition to that, the study reinforced the existence of the strong effect of crude oil prices on production (PNR) and consumption (CNR) of natural rubber. The causality test confirms that crude oil prices help the rubber cultivators and various industries in forecasting prices of natural rubber as the crude oil price granger causes natural rubber prices.

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