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Volatility Linkages in Commodity Futures Markets: Evidence from the Rubber Futures Market in India

P. Narayanan[1], T. K. Sebastian[2] and N. Karunakaran[3*]

[1]E K Nayanar Memorial Government College, Elerithattu, Kasaragod - 671314, Kerala, India

[2]Nirmalagiri College, Kuthuparamba, Kannur - 670701, Kerala, India

[3]People Institute of Management Studies (PIMS), Munnad-Post, Chengala (Via), Kasaragod - 671541, Kerala, India;

Abstract

The volatility spill-over effect of the commodity futures markets has been a matter of debate ever since the establishment of futures markets in India. The apprehensions regarding the price destabilizing role of futures trade called for overcautious regulatory supervision. The actions like suspension of contracts, bans on futures trade in certain commodities, and restrictions on trade volumes were very frequent; making the growth of the commodity futures market a chequered one. The Expert Committee appointed in 2007 to examine the effect of futures trade on commodity prices failed to make any categorical remark partly on account of the absence of long-term data. A commodity-specific analysis is much warranted as the price effect of the futures trade varies across the markets. The paper examined the volatility spill-over effect of the rubber futures market using a bivariate GARCH model with BEKK parameterization and found that there is no positive volatility spill-over from futures to spot. The weak linkage between futures trade and futures price variation further strengthens the finding. The absence of volatility spill-over from futures to spot in the case of rubber is due to the failure of the futures market to lead the spot market in pricing the commodity.

Keywords: Futures, GARCH, India, Spot, Spill-Over, Volatility

1. Introduction

Futures trade in commodities promotes price stability as they improve information level and contribute to market perfection and less spot price volatility (Stoll & Whaley, 1988). In the case of agricultural commodities, futures trade can reduce seasonal price variations as speculative interventions would support the demand side during seasons of excess supply (Powers, 1970). Contrary to this, there are arguments that futures trade has the potential to destabilize spot markets if poorly informed speculators, attracted by low transaction costs, distort the price discovery process by inducing noise and lowering the information content (Stein, 1987; Streit, 1980).

From the very inception of commodity futures trade in India, there have been allegations about the price-destabilizing role of the futures market. The confusion created by arguments and counter-arguments was so big that the very growth of commodity futures markets became a chequered one with frequent bans and suspension of contracts by the Forward Market Commission (FMC)[1]. The Securities and Exchange Board of India (SEBI), the present regulator of commodity derivatives trade, banned futures trading in seven commodities with effect from 20 December 2022 for the stated reason of curbing inflation. This has

[1] FMC was the apex regulator of commodity futures trade in India during the period from 1952 to 2015. On 28 September 2015, FMC got merged with SEBI.

*Email: narankarun@gmail.com

further triggered a debate on the effect of futures trade on prices. Answering this question is very important in evaluating the validity of decisions like an outright ban on futures trade, a measure often taken up in India. The Expert Committee to Study the Impact of Futures Trading on Agricultural Commodity Prices could not make a categorical conclusion on the effects of commodity futures trade on commodity prices partly on account of lack of long-term data (Expert Committee, 2008). To answer the question of whether futures trade leads to price destabilization in the spot market, a commodity-specific analysis with considerably long-term data is much warranted. Rubber was among the commodities selected for analysis by the Expert Committee, but the time period of analysis was very short, from 2004 to 2008. The present study is an attempt to analyze the impact of futures trade on the price level of rubber with considerably longer-term data. Specifically, we analyze the volatility spill-over effects of the rubber futures market in India using data for a considerably longer time interval from 2003 to 2018. The analysis used a bivariate GARCH model as it is the most suitable technique used for analyzing volatility spillover (Xiao and Dhesi, 2010).

2. Review of Literature

Many studies indicate the price-destabilizing role of futures markets. If there is a possibility for noise trading which may lead to price destabilization (Stein, 1987; Streit, 1980). One allegation against the futures market is that it promotes speculation and leads to increased price volatility. Certain features of financial markets such as feedback trading and herd behaviors cause more volatile futures prices and volatility spill-over (e.g. De Long, *et al*., 1990; Shleifer & Summers, 1990). The study provides a hint regarding probable herd behavior. A few studies found spill-over of futures price volatility to the spot market (Crain & Lee, 1996; Hammoudeh, *et al*., 2003). A positive influence of speculative trading on futures price volatility is found by Du *et al.* (2011) and McPhail, *et al.* (2012).

On the other hand, there are a large number of studies negating volatility spillover from the futures market to the spot market. Gray (1958) distinguished between professional speculation and trading by the general public. While the former is necessary for basic price discovery, liquidity, and enhanced hedging effectiveness, the latter leads to destabilization. Emerson and Tomek (1969) enquired whether the decline in the price of Maine potato was caused by futures trade and concluded that decline in price was due to increased supply and not increased volume of futures trade. Chatrath and Song (1999) detected a negative relationship between spot price jumps and both the number of speculative futures contracts and the number of speculators for five agricultural commodities. Büyükşahin and Harris (2011) found that price changes precede speculative position changes rather than the other way around. With respect to the six heavily traded agricultural and energy commodities in the USA, Bohl and Stephen (2013) concluded that the speculative activity in the futures market did not increase spot price volatility.

During the late fifties and sixties, future trading in many commodities was prohibited in India, on the basis of allegations that futures trade distorted prices by aggravating its rising trend. This decision of the government resulted in a strong debate on the ban on commodity futures trading in the country (Dasgupta, 2004). The critics of futures trade assumed that there is a definite upward bias in futures price forecasts which resulted in abnormally high spot prices. Contrary to this common view, Pavaskar (1967) found that futures trade underestimated future cash prices. The monopoly interests often blame futures markets as they find their powers distorted by the competition unfolding through such markets (Streit, 1980; Pavaskar, 1969). In the Indian context, Ghosh (2009) observed that the government had been overcautious about the evil consequences of the commodity derivatives market which was the main reason for strict regulations.

In India, high inflationary pressures in 2007-08 again led to the discontinuation of futures contracts in red gram, black gram, chickpeas, wheat, rice, potato, refined soybean oil, and rubber. The Expert Committee (2008) found no confirmatory evidence of a link between futures trading and inflation. The report, thus, has not solved the ambiguity on the real impact of futures trading on commodity prices. Research findings are also bipolar on this issue. The study by Sabnavis and Jain (2007) pointed out that price volatility for a comparable period before and after futures trade shows that, price volatility has actually decreased after the introduction of futures trade.

Some studies found a significant role played by futures markets in price escalation and volatility spillover. Sahi and Raizada (2006) show that an unexpected increase in futures activity in terms of rise in volume and open interest caused an increase in cash price volatilities. Nath and Lingareddy (2008) concluded that volatilities of Urad gram and Wheat prices were high during the post-futures period. Pavaskar and Ghosh (2008) criticized this study for the faulty econometric methods used in the study. Mahalik, *et al.* (2009) analyzed volatility spill-over effects from futures to spot market for various indices constructed by MCX. Significant volatility spillover was found for all except MCXAGRI. Sendhil, *et al.* (2014) analyzed 20 agricultural commodity futures markets for volatility spill-over and got a mixed result. Parsa and Mallikarjunappa (2014) concluded that unexpected futures volume has a significant impact on spot price volatility across commodities. Sharma and Malhotra (2015) found a relationship between unexpected futures trade volume and volatility of spot price, thereby indicating a probable destabilizing impact. The study observed significant volume-volatility linkage.

The literature available for India has mixed conclusions on the price effects of commodity futures trade. The studies suffered from two serious limitations. First, most of the studies were based on short-term data, making the findings weaker. Second, many of the studies depended on elementary measures like the Cuddy-Valle index and simple standard deviation for measuring the effect of futures trade on price. GARCH models are considered to be superior to any other class of models for volatility analysis. In the present study, we used a bivariate GARCH model with BEKK parameterization as it is considered to be the ideal model available for analyzing the volatility spill-over effect (Xiao and Dhesi, 2010). The data considered was for a considerably longer period, from 2003 to 2018. The studies on rubber are few in number and studies with an exclusive focus on rubber are totally missing. The present study, thus, tries to fill the literature gap existing in the field of commodity futures markets in India.

3. Rubber Futures Trade in India

Globally, futures trading in rubber existed for years in Singapore, Malaysia, Japan, and China. The Tokyo Commodity Exchange (TOCOM) in Japan and the Shanghai Futures Exchange (SHFE) in China, are the two leading exchanges for rubber at the global level. The TOCOM contract represents 5 metric tons of Ribbed Smoked Sheet No. 3 Rubber (RSS 3), while the SHFE contract settles into 10 MT of natural rubber. In India, futures trading in rubber started in 2003, with two national exchanges National Multi-Commodity Exchange Limited (NMCE) and Multi Commodity Exchange of India Limited (MCX) commencing trades respectively in the months of April and December. While the trade had been a success in terms of volume and turnover at NMCE, MCX had to drop the trading in rubber in 2009 due to shortages in the volume of trading. Another exchange, namely National Commodities and Derivatives Exchange Limited (NCDEX), tried with rubber futures contracts from 2004 onwards. Due to its limited attractiveness, the could not offer continuous contracts. In 2007, the exchange made some modifications in contract specifications and offered the contract as 'Rubber New'. Due to a dull response from the part of traders, the volume never picked up and the trading was ultimately stopped in 2014. Thus, so far, trading in rubber futures has been confined practically to one exchange, namely NMCE except for the period 2004-08 during which MCX had some liquidity in rubber futures trade.

The volume of futures trade in rubber at NMCE and MCX has been shown in Figure 1. At NMCE, the trade was almost continuous during the entire study period from 2003 to 2018. Also, the volume had been considerable with an average volume of 81700 Metric Tonne (MT) per contract. The maximum volume was 381940 MT which occurred with the contract for March 2011 delivery.

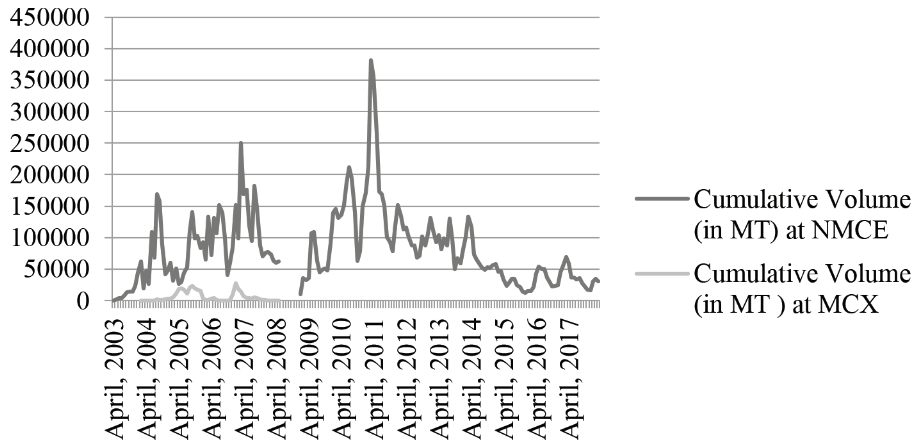

Figure 1. The contract-wise cumulative volume of rubber futures trade.

Source: NMCE and MCX data

At MCX, the trade was almost illiquid during the study period with some liquidity during the short period 2004-2008 as shown in Figure 1. The average volume of futures trade per contract at MCX was 5810 MT and the maximum trade occurred with contracts for January 2007 delivery, at 27418 MT. Both the average trade and the maximum were very low when we compared the figures with the corresponding figures for NMCE.

4. Data and Methods

The study is based on the daily spot and futures price information of rubber from the National Multi-Commodity Exchange of India Limited (NMCE) for the time period from 1 April 2003 to 31 March 2018[2]. A nearby daily price series was constructed by rolling over to the next contract on the expiry of a given contract. The official agencies, be it FMC or SEBI, usually adopted closing quotation of each day as an adequately representative futures price of that day. Following this, the closing quotations of the futures contracts were used in this study as representative futures prices. The basic variety of rubber at NMCE is Ribbed Smoked Sheets – 4 (RSS 4) and the basis locality is Kochi, Kerala. The spot price information given by the exchange represents the daily price for the basis variety at the basis center and is in correspondence with the futures price.

[2] NMCE has been merged with Indian Commodity Exchange (ICEX) on 3 September 2018.

Since long series of daily data from the nearby series were available, we fit General Auto-Regressive Conditional Heteroskedasticity (GARCH) models, both univariate and bivariate. The GARCH model provides for a framework for analyzing the interaction between volatilities on daily basis. The volatility, in a GARCH framework, is the variation in unexpected return in the concerned market where the unexpected return is the residual part in a mean equation for daily return. The GARCH model, thus, requires a mean model to be estimated at first such that the residuals from it form the input for variance equation in GARCH fashion. The mean equation had to be framed for both spot and futures returns individually. Since, in the present case, both returns were found to be I(0) or stationary in their levels, a simple Auto Regressive Moving Average (ARMA) model was fitted as the mean model in univariate GARCH for both cases. The mean equation is given as Equation (1).

$$r_t = \mu + \sum_{i=1}^{n} \beta_i r_{t-i} + \sum_{j=1}^{m} \gamma_j \varepsilon_{t-j} + \varepsilon_t \qquad (1)$$

Where, is the mean return in a given market, are the Auto Regressive (AR) terms and are the Moving Average (MA) terms. The best fitting ARMA models for spot and futures returns were obtained using Bayesian Information Criterion (BIC). The residuals of the mean models were tested for Auto-Regressive Conditional Heteroskedasticity (ARCH) effect using Ljung-Box test on squared residuals. Once the ARCH effect was detected, as the next step univariate GARCH

(1, 1) models were estimated with the conditional mean equation as provided in Equation (2).

$$h_t = \alpha + \beta\varepsilon_{t-1}^2 + \gamma h_{t-1} + \epsilon_t \quad (2)$$

Where, is the conditional variance on the day 't', is the ARCH term which relates squared innovations in a market with the conditional variance and is the GARCH term which connects past volatility with the present one. The volatility persistence is there for any return series if the sum of α and β is equal to or greater than one. The GARCH (1, 1) model was an arbitrary choice as it is found to capture the volatility persistence almost completely in addition to the fact that higher order GARCH modeling leads to complexities in interpreting spill-over effects.

The volatility spill-over was modeled using bivariate GARCH models. The model estimated is one of Vector Auto-Regressive-GARCH (VAR-GARCH) with BEKK parameterization. The reason for using this model is that with adequate lag selection, a VAR-GARCH does as good as a VARMA-GARCH in describing variance dynamics in a multivariate system. The BEKK model has been preferred over many other parameterizations possible for a multivariate GARCH due to certain advantages of the BEKK model over the others[3]. Firstly, the estimation process ensures a positive definite variance-covariance matrix. Secondly, a BEKK model estimates cross-effects in variance completely and is therefore an ideal choice for volatility spill-over analysis (Xiao & Dhesi, 2010). Thirdly, the number of parameters to be estimated is less in the BEKK model compared to VEC parameterization which is another technique allowing for cross-effect[4]. We selected a BEKK parameterization for all these reasons. The general representation of a GARCH (1,1) – BEKK model is given in Equation (3).

$$H_t = CC' + A' u_{(t-1)} u'_{(t-1)} A + B' H_{(t-1)} B \quad (3)$$

Where, is the conditional variance matrix of order 2 x 2 in a bivariate case, C is the matrix of constants which is again of the ame order a. The matrices A and B are of 2 x 2 order in a bivariate case. On default, this is a positive semi-definite regardless of the values of the parameters as far as the B or C is full rank. The off-diagonal elements in A and B represents volatility spill-over. For instance, A_{ij} (i≠j) represents the spillover from the ith market to jth one on account of squares and cross-products of innovations. Similarly, B_{ij} (i≠j) represents spill-over in the same direction on account of the variance/covariance in two markets. In addition to testing the significance of these volatility spill-over terms, Wald tests of block exclusions were done by forming relevant hypotheses. The GARCH models were estimated through Maximum Likelihood estimation, Finally, in order to confirm the role of futures trade volume on futures price variation, the intra-day range in futures price (the difference between maximum price and minimum price on a day) was first correlated with daily trade volume. In case of a significant correlation, further, the relationship was quantified through OLS regression. A significant relationship between the two is taken as the confirmation of volatility spillover.

5. Empirical Results

As the study is entirely based on nearby daily series of spot and futures prices, a summary statistic of the two variables is presented in Table 1.

Table 1. Summary statistics of nearby daily series of spot and futures prices

Description	Spot Price	Futures Price
Number of observations	4081	4081
Mean	12251	12289
Median	12000	12028
Minimum	4350	4425
Maximum	24233	24607
Std. Deviation	5058.1	5047
Co-efficient of Variation	0.41286	0.41071
Skewness	0.31901	0.32461
Kurtosis	-0.87308	-0.86056

Source: Computed by the authors using NMCE data

[3] BEKK stands for Baba, Engle, Kraft and Kroner after the names of the economists who proposed the parameterisation for the first time.

[4] For a detailed discussion on alternative parameterisations of multivariate GARCH models, see Wolfgang Scherrer, & Eva Ribarits. (2007). On the Parameterization of Multivariate GARCH models. Econometric Theory, 23(3), 464-484.

5.1 Modelling of Daily Return

The possibility for volatility transmissions across spot and futures markets is analyzed in this section by using the nearby series of daily spot and futures prices of rubber. Firstly, the researcher considered daily returns in each market by taking the difference in log-transformed prices. The daily returns in spot and futures markets are shown in Figure 2. From Figure 2 it can be seen that there is a clustering of volatility in both spot and futures returns with a period of low volatility followed by that of high volatility. This calls for testing the GARCH effect in volatility in spot and futures prices individually and a Bivariate GARCH for analyzing the spill-over of volatility. The GARCH model requires two equations, the first one for specifying the mean and the second one for specifying variance.

The starting point is to determine the level of integration in the return series for both spot and futures prices. Both spot and future return of rubber was found to be I (0) or stationary around zero mean, towards which an indication is already there in Figure 2. The details of the ADF test for stationarity in the two series are provided in Table 2. The null hypothesis of the test is that there is unit root in the given series or the series is non-stationary.

From Table 1 it is clear that both return series are stationary as the unit root null hypothesis is rejected in each case. The returns in spot and futures markets are moving around a constant mean and so the ARMA model for the mean equation is proposed in both cases. The best fitting ARMA model in the case of spot return is obtained through BIC criterion as ARMA (1,2) with mean zero and in the case of futures returns the suggested one is ARMA (0,0) with non-zero mean. In both mean equations, we kept a constant or mean to avoid distortions in estimations. The squared residuals from the mean equations respectively of spot and futures returns were then subjected to the Ljung-Box test to inspect the presence of the ARCH effect and the null hypothesis of 'no ARCH effect' was rejected at 5% level of significance (Table 3).

5.2 Univariate GARCH Estimation for Rubber Spot and Futures Returns

Since the presence of the ARCH effect was detected in the rubber spot and futures returns, the GARCH (1, 1) model was estimated individually for these two-return series. The GARCH (1, 1) model was selected quite arbitrarily as it is found to be catching the ARCH effect almost completely. The estimation results are provided in Table 4.

There is high volatility persistence in both spot and futures prices of rubber as shown by the sum of ARCH and GARCH terms which take values of 0.97 and 0.86 respectively (see Table 4). Since the values are less than one, the volatility is not exploding in nature. The residuals of the univariate GARCH model are found to be free from further ARCH effect and serial correlation

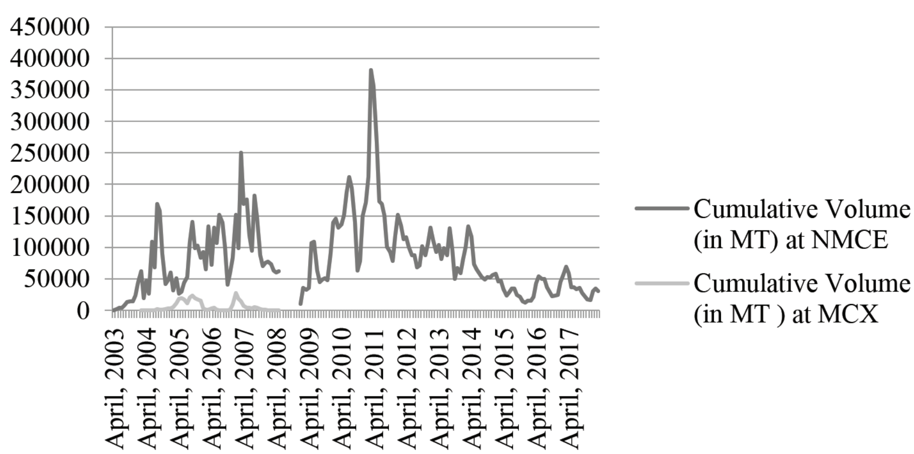

Figure 2. Daily returns in rubber spot and futures markets.

Source: Plotted by the authors using NMCE data

Table 2. Stationarity test results for rubber spot and futures returns

Series	Level/ First Difference	Specification	ADF Test Statistic	Order of Integration
Spot Return	Level	Without Trend	1.187e-041***	I(0)
Futures Return	Level	Without Trend	9.338e-009***	I(0)

*** Significant at 1%

Source: Source: Estimated by the authors using NMCE data

Table 3. Test for ARCH effect in the Mean Equation for Rubber Spot and Futures Returns

Series	AR Order	MA Order	Ljung-Box Test p Value (H_0: No ARCH Effect)
Spot Return	1	2	< 2.2e-16***
Futures Return	0	0	< 2.2e-16***

***Significant at 1%

Source: Estimated by the authors using NMCE data

Table 4. GARCH(1,1) coefficients for rubber spot and futures returns

Co-efficient	Estimate	Std. Error	t value	p-value
Spot Return				
Mean	0.015688	0.025682	0.61086	0.541291
AR 1	0.841394	0.036732	22.90601	0.00000***
MA1	-0.60915	0.040868	-14.9053	0.00000***
MA 2	-0.08103	0.023955	-3.38265	0.000718***
GARCH Coefficients for Spot Return				
Constant	0.034408	0.00826	4.16578	0.000031***
ARCH Term	0.129002	0.014261	9.04583	0.00000***
GARCH Term	0.849789	0.018377	46.24275	0.00000***
ARCH LM Test p-value (Lag=7)				0.5241
Ljung-Box test p-value for squared residuals (Lag=5)				0.1983
Futures Return				
Mean		0.021613	2.5358	0.01122**
GARCH Coefficients for Futures Return				
Constant	0.346134	0.05962	5.8057	0.00000***
ARCH Term	0.170121	0.022343	7.614	0.00000***
GARCH Term	0.692124	0.040756	16.9822	0.00000***
ARCH LM Test p-value (Lag=7)				0.575
Ljung-Box test p-value for squared residuals (Lag=5)				0.720

***Significant at 1%, ** Significant at 5%, *Significant at 10%

Source: Estimated by the authors using NMCE data

as the null hypothesis regarding the absence of these effects is not rejected in ARCH-LM Test and Ljung – Box test on squared residuals.

5.3 Bivariate GARCH Modelling with Rubber Spot and Futures Returns

The estimation results of the bivariate GARCH-BEKK model are given in Table 5. The volatility spill-over parameters are A(1,2), A(2,1), B(1,2) and B(2,1). All these co-efficient are significant at a 1% level of significance except B(1, 2) which is significant only at a 10% level of significance. Of these parameters, the elements in matrix A are all associated with the relationship between conditional variance in a period and squared innovations in the previous period. As such, A(1,2) shows how the lagged innovation in spot return affects the conditional variance in futures return, and A(2,1) shows the reverse case of how the lagged innovation in futures price affects the conditional variance of spot return. These terms can be considered as the cross-ARCH parameters. Here, A(1,2) is positive, and A(2,1) is negative showing that there is a positive spill-over of volatility from spot to futures and there is no positive volatility spill-over from futures to spot through the ARCH channel.

The elements in matrix B show how the lagged volatility affects present volatility and are the GARCH parameters. The elements B(1,2) and B(2,1) show the volatility transmission from spot return to futures and futures return to spot return respectively. Here also, the cross-volatility linkages are from spot to futures markets as B(1,2) is positive and significant whereas B(2,1) is negative and significant. A 1% increase in volatility in spot market leads to 23% increase in the volatility in futures market on an average. At the same time a 1% increase in futures price volatility reduces the spot price volatility by 32%. This again negates a positive volatility spill-over from futures to spot.

The Wald Test was conducted to analyze the joint significance of cross-effect coefficients and the results are provided in Table 6. Two null hypotheses were considered, one is that there is no significant spill-over of volatility in either direction and the other is that there is no significant spill-over of volatility from futures to the spot market. The two hypotheses are rejected at a 1% level of significance, showing some volatility spillover. This, however, does not indicate the presence of positive volatility spill-over from futures to spot. The Wald Test results in the case of rubber have to be interpreted with caution as we saw negative signs for the cross-effect parameters representing spill-over from futures to spot. The Wald test considers all types of volatility linkages, positive and negative, whereas we are interested in only positive volatility linkages as negative ones are not a matter of concern.

5.4 Futures Trade Volume and Intra-day Range in Futures Price

In order to confirm the role of the futures market on the price, we obtained the correlation coefficient between the intra-day range in futures price expressed as a proportion of the closing price and futures trade volume. The correlation coefficient is 0.35 and is significant at 1%. It shows that the volume has an effect on the intra-day variation in futures price. In order to quantify the effect, we ran an OLS regression between the two by keeping the intra-day range as the dependent variable and volume as the independent variable. The variables were taken in their log-transformed levels are found to be I (0) as the unit-root null hypothesis was rejected at 5% level of significance. The estimation results are provided in Table 7. As there was the problem of heteroskedasticity, robust standard error was applied.

Table 5. Bivariate Garch (BEKK) model estimation for rubber spot and futures returns

Sl. No.	Variable	Coeff	Std Error	t-Stat	p-value
Mean Model (Spot Return)					
1	RSPOT{1}	-0.21597	0.028899	-7.47346	0.000000
2	RSPOT{2}	0.009937	0.026429	0.37597	0.706937
3	RSPOT{3}	0.059964	0.019256	3.11397	0.001846
4	RCLOSE{1}	0.355397	0.016868	21.06974	0.000000
5	RCLOSE{2}	0.175986	0.016702	10.53659	0.000000
6	RCLOSE{3}	0.047835	0.016744	2.85675	0.00428
7	Constant	-0.00437	0.019539	-0.2238	0.822914
Mean Model (Futures Return)					
8	RSPOT{1}	-0.05486	0.048125	-1.13988	0.254335
9	RSPOT{2}	0.130982	0.041556	3.15191	0.001622
10	RSPOT{3}	0.048833	0.026301	1.85671	0.063353
11	RCLOSE{1}	0.03997	0.022478	1.7782	0.075371
12	RCLOSE{2}	0.039938	0.025161	1.58727	0.112452
13	RCLOSE{3}	-0.01201	0.023611	-0.50879	0.610899
14	Constant	0.039267	0.023269	1.68757	0.091495
GARCH (1,1)-BEKK Parameters					
15	C(1,1)	0.418478	0.064854	6.45259	0.000000
16	C(2,1)	1.032943	0.070452	14.66162	0.000000
17	C(2,2)	-3.4E-07	0.055731	-6.03E-06	0.999995
18	A(1,1)	1.447349	0.299812	4.82752	1.38E-06
19	A(1,2)	1.384346	0.341898	4.04901	5.14E-05
20	A(2,1)	-0.52763	0.1172	-4.50194	6.73E-06
21	A(2,2)	-0.66253	0.133371	-4.96758	6.8E-07
22	B(1,1)	0.601518	0.116933	5.14413	2.7E-07
23	B(1,2)	0.236445	0.295819	0.79929	0.424123
24	B(2,1)	-0.32046	0.066155	-4.84411	1.27E-06
25	B(2,2)	0.440268	0.152859	2.88022	0.003974

***Significant at 1%, **Significant at 5%, *Significant at 10%
Source: Estimated by the authors using NMCE data

From Table 7, it can be seen that the coefficient of volume is statistically highly significant in determining the intra-day range of futures price. At the same time numerically, the regression coefficient associated with the trade volume is very low and near to zero. A 1% increase in volume leads to only a mere 0.0003% increase in intra-day range. The indication is that the relationship between futures trade volume and futures price is found to be weak. Such a weak relationship between futures trade volume and futures price volatility itself is an indication that futures trade cannot have any direct effect on spot price volatility. To that extent. Our results stand substantiated.

Theoretical and empirical explanations are possible for the results obtained from our study. The rubber futures market in India is thin compared to the global counterparts and its role in price discovery is very weak. Theoretically, a thin futures market is not able to perform a price leadership role effectively. The rubber

Table 6. Wald test for volatility spill-over effects in rubber

Null Hypothesis	Estimated χ^2	Estimated F	p- value
There is no Volatility Spill-over in either direction	114.55	28.64	0.000***
There is no Volatility Spill-over from Futures to Spot Market	110.19	55.10	0.000***

*** Significant at 1% level of significance
Source: Estimated by the authors using NMCE data

Table 7. Relationship between futures price and futures trade volume of rubber

Variable	Coefficient	Std. Error	t-ratio	p-value
Const	1.31	0.03	37.46	7.94e-264
Volume	0.0003	1.84163e-05	13.82	1.74e-042
No. of Observations			4043	
R^2			0.121	

***Significant at 1%, **Significant at 5%, *Significant at 10%
Source: Estimated by the authors using NMCE data

futures market, being a thin market, cannot lead to spot price and the absence of price leadership explains the absence of volatility spill-over as volatility spill-over occurs only when the price in one market is followed by the price in another. Empirically, most of the studies on the rubber futures market in India concluded that the price discovery and price leadership role of the market is weak. Narayanan and Sebastian (2019) showed that the futures market for rubber in India did not have informational superiority and was weak in price discovery and price leadership. This empirically substantiates the findings of the present study.

6. Conclusion

The study on the volatility spill-over effect of rubber futures market in India found no evidence for positive volatility spill-over from futures to spot market. Major explaining factors are the thinness and lack of price leadership of the futures market. The study used longer term data, making the conclusion stronger. The regulator of commodity markets in India, SEBI, needs to base any decision to ban or suspend futures trade on strong evidence. It considered only a single commodity and studies on a wide range of commodities are required for a broader generalisation. The present study is expected to form a part of the efforts needed to make a general conclusion on the price effects of commodity future trade.

7. References

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