Research Paper Management

Price Discovery and Volatility Spillover in Indian Commodity Futures Markets Using Selected Commodities

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ABSTRACT

With the current pace of growth, India would emerge as a major player in the international market in terms of commodity consumption, production and trade. This paper examines the Price Discovery and volatility spillover effects in Indian Commodity market by using Johansen co integration test, VECM and bivariate EGARCH model with respect to selected commodities of NCDEX. The empirical findings significantly indicate that the role of futures market in information dissemination leading to a significant price discovery and risk management can successfully develop the underlying Commodity Market in India. The results of the research study indicate that the future market of the commodities is more efficient. The VECM results show that the spot market corrects most of the errors in commodity markets. Analysis of the volatility spill over in all the commodities considered for the research study shows that the volatility spillover exists in almost all the selected commodities.

Keywords : Volatility Spillover, Price discovery, Cointegration

Introduction

The Commodity market is poised to play an important role of performs two important functions of price discovery and price risk management for the development of agriculture and other sectors in the economy. Since 2002 the commodities futures market in India has experienced an unexpected boom in terms of modern exchanges, number of commodities allowed for derivatives trading as well as the value of futures trading. Commodity Futures Market plays an important role in price discovery, the information on which helps the producers to plan their activities on production, processing, storage, and marketing of commodities. The issue of Price Discovery and Volatility Spillover is of interest to traders, investors, financial economists and analysts.

Literature Review

By investigating the price performance of live beef cattle on the futures market during April 1965 to February 1971 (see e.g. Leuthold (1974) found that cash cattle prices were found to be more accurate indicators of subsequent cash cattle price conditions than are the futures prices for distant contracts. In other words, evaluation of live beef cattle price relationships revealed that for distant futures, the cash price is a more accurate indicator of future cash price conditions than is the futures price. Futures trading infuse efficiency in the functioning of the commodity Market (see e.g. Tomek, 1980). Yang et al. (2001) have examined the price discovery performance of futures markets for storable and non-storable commodities in the long run, allowing for the computing factor for scholastic interest rates using Co integration procedures and VECM. The evidence shows that asset storability does not affect the existence of Cointegration between cash and future prices and the usefulness of future markets in predicting the future cash prices. Batra (2004) analyzes time-varying volatility in Indian stock market on account of process of financial liberalizations from the period, 1979 to 2003 employing EGARCH, augmented GARCH models and Pagian and Sussounav (2003) methodology to examine the volatility and its leverage effect. By using VECM and EGARCH models, the empirical evidence shows that the futures price index acts as a useful price discovery vehicle and futures trading have also been a source of instability for the spot market. Azizan et al. (2007) employed bivariate ARMA-EGARCH model specifications to investigate the effects of the Malaysian futures-cash market relationship found that the volatility transmission is asymmetric in nature but the sign of asymmetric differs based on the direction of spillovers. It can seen be from the existing literatures on Price Discovery and Volatility Spillover, *that even though spot and futures markets react to the same information, the major question is which market reacts first.* Considerable volume of research has been conducted on the subject, *but still there exist conflicting evidences in the literature regarding the price discovery mechanism and volatility spillover effects*.

3. Data and Methodology

The data consists of daily futures and spot price for Gaurseed and Ref Soyoil. The spot market prices and the future prices have been taken from NCDEX website. *In Spot as well as future prices, the last price or the closing price is considered for the study. The sample period used in the analysis varies each commodity based on the availability of data. If there is any missing observation due to non- trading in any day, and in any of the market, the specific intervals removed from the data series (sample).* To test the process of price discovery and volatility spillover effects Augmented Dickey Fuller test, Phillip-Perron test, Johansen Cointegration test, Vector Error Correction Model and bivariate EGARCH model were used.

4. Results and Discussion

4.1. Unit Root Test Results

The results of the unit root statistics of all the selected commodities are shown in Table1 to 2. It is found that the price series of both spot and future market of all the selected commodities are having unit root. It follows that the price series follows I (1) process. The result also indicate that in case of all the commodities in all the exchanges, the first difference series becomes stationary and the results are supported by all the test statistics (ADF, PP) indicating that the first difference series is stationary.

Table 1: Unit Root Result for Gaurseed

Time Series Variable		ADF Unit Root Test Statistic			Philip Perron Test Statistic		
		None	With Intercept	With Trend and Intercept	None	With Intercept	With Trend and Intercept
Spot price of G seed	At Level	3.2501 (0.9998*)	6.4685 (1.0000*)	6.8686 (1.0000*)	8.5865 (1.0000*)	18.0105 (1.0000*)	19.3655 (1.0000*)
	At First Difference	-0.0048 (0.6810)	-0.1773 (0.9376)	-0.6677 (0.9744)	-36.6622 (0.0000)	-36.5664 (0.0000)	-37.2185 (0.0000)
Future price of G seed	At Level	2.9538 (0.9993*)	5.8862 (1.0000*)	6.1342 (1.0000*)	8.4907 (1.0000*)	13.1224 (1.0000*)	12.0566 (1.0000*)
	At First Difference	1.2711 (0.9487)	1.0903 (0.9975)	0.6058 (0.9995)	-37.4821 (0.0000)	-37.4317 (0.0000)	-37.8227 (0.0000)

Table 2: Unit Root Result for Ref Soyoil

Time Series Variable		ADF Unit Root Test Statistic			Philip Perron Test Statistic		
		None	With Intercept	With Trend and Intercept	None	With Intercept	With Trend and Intercept
Spot price of Ref Soyoil	At Level	1.0675 (0.9259*)	0.0146 (0.9588*)	-1.8117 (0.6990*)	1.1037 (0.9304*)	0.0757 (0.9639*)	-1.7585 (0.7246*)
	At First Difference	-39.8661 (0.0000)	-39.8824 (0.0000)	-39.9290 (0.0000)	-39.7483 (0.0000)	-39.7159 (0.0000)	-39.7388 (0.0000)
Future price of Ref Soyoil	At Level	1.0539 (0.9241*)	-0.0061 (0.9569*)	-1.8899 (0.6594*)	0.9825 (0.9143*)	-0.1390 (0.9433*)	-2.0302 (0.5839*)
	At First Difference	-45.1937 (0.0001)	-45.2056 (0.0001)	-45.2443 (0.0000)	-45.1890 (0.0001)	-45.1967 (0.0001)	-45.2249 (0.0000)

4.2 Johansen Cointegration Results

After checking for stationarity, Johansen cointegration test was used to analyse the existence of long-term relationship between the spot and future market. The results of Johansen Cointegration test on Spot and Future prices of selected commodities are shown in Table 3.

Table 3: Johansen's Co-Integration Test Results

Commodity	Cointegration Between	Lag length	Cointegration test using	No. of CE's	Eigen Value	Statistic	Critical value at 5%	Probability **
Gaurseed	Spot and Future Price of Gaurseed	1 to 4 (in first difference of 2 series)	Trace test	H_0: r=0(None) H_1: r ≤ 1(At most 1)	0.1192 0.0357	387.6486 86.3788	15.4947 3.8414	0.0001 0.0000
			Max-Eigen Value test	H_0: r=0(None) H_1: r ≤ 1(At most 1)	0.1192 0.0357	301.2697 86.3788	14.2646 3.8414	0.0001 0.0000
Ref Soyoil	Spot and Future Price of Ref Soyoil	1 to 4 (in first difference of 2 series)	Trace test	H_0: r=0(None) H_1: r ≤ 1(At most 1)	0.0268 1.32E-06	64.6461 0.0029	15.4947 3.8414	0.0000 0.9548
			Max-Eigen Value test	H_0: r=0(None) H_1: r ≤ 1(At most 1)	0.0268 1.32E-06	61.6431 0.0029	14.2646 3.8414	0.0000 0.9548

Trace test indicates 2 Cointegrating equations at 5% level of significance
Max-eigen test indicates 2 Cointegrating equations at 5% level of significance
Denotes rejection of null hypothesis at 5% level of significance
****Mackinnon et.al.(1999) estimated p values**

The empirical results found that there exists long-term equilibrium relationship between spot and future prices in case of all the selected commodities. As there are only two series are involved, the number of cointegrating vectors can be at most one for each commodity. The hypothesis of no cointegration vector(r=0) can be rejected for all the elected commodities, as the trace statistics are higher than the critical values at 5 % level. Eigen values are lower for at least one cointegrating vector. Cointegration analysis measures the extent to which two markets have achieved long run equilibrium. Efficiency can be concluded because future prices and spot prices are cointegrated in all the selected commodities since cointegration is a necessary condition for market efficiency.

4.3. VECM Results

VECM is used to analyse the error correction mechanism between the future market and the spot market in case of disturbance between them. The results of Vector Error Correction Model selected commodities for all exchanges are shown in Table 4. The VECM results show that the spot market corrects most of the errors in commodity markets. The results also indicate that in almost all the commodities the volatility spillover comes in spot market mainly due to the previous volatility in the future market.

Table 4: Error Correction Model Results

Commodity	Variables	∆(Spot)		∆(Future)	
		Coefficient	t value	Coefficient	t value
Gaurseed	Equilibrium Error	-0.341081	-8.25448	0.036467	1.29028
	∆Spot(-1)	0.542133	14.4817	0.851336	33.2482
	∆Future(-1)	-0.287037	-8.40189	-0.426473	-18.2509
	Constant	8.057860	2.19261	5.578164	2.21916
Ref Soyoil	Equilibrium Error	-0.053178	-4.19192	0.020967	1.31687
	∆Spot(-1)	-0.087944	-2.74746	0.100885	2.51119
	∆Future(-1)	0.270265	9.89668	-0.005637	-0.16445
	Constant	0.105509	1.10031	0.117554	0.97676

The EGARCH model has been used to analyse the volatility spillover impact between spot and future market for respective commodities (Table 5). Volatility Spillover effect implies that if volatility comes in one market on a particular day it will influence the volatility of the other market on the next day. The directions of volatility spillover in Gaurseed, Ref Soyoil are from future to spot market because the coefficient of spot is higher than the coefficient of future market. If future market increases the flow of information, volatility in the underlying spot market will rise. This implies that the volatility of the asset price will rise as the rate of information flow increases. This implies bad news effect is more than good news effect for spot to futures.

Table 5: Volatility Spillover Results

Variance Equation	Gaurseed		Ref Soyoil	
	Spot	Future	Spot	Future
Constant	-0.492113 (-12.66073) [0.0000]	-0.529986 (-8.616578) [0.0000]	0.071037 (7.698258) [0.0000]	0.008339 (1.521499) 0.1281
ABS(RESID(1)/@ SQRT(GARCH(-1)	0.134643 (9.156634) [0.0000]	0.058095 (4.735329) [0.0000]	0.166647 (17.72565) [0.0000]	0.126181 (15.43219) [0.0000]
RESID(1)/@SQRT(GARCH(-1)	0.070026 (9.640572) [0.0000]	0.034389 (4.317374) [0.0000]	-0.001497 (-0.291140) [0.7709]	0.006468 (1.712263) [0.0868]
LOG(GARCH(-1)	0.956345 (226.2432) [0.0000]	0.941498 (128.5536) [0.0000]	1.018853 (728.2280) [0.0000]	1.010311 (1239.178) [0.0000]
Volatility	70.46113 (7.387165) [0.0000]	58.91880 (6.868202) [0.0000]	-33.57600 (-5.450226) [0.0000]	-26.81142 (-4.770701) [0.0000]

5. Concluding Remarks

The results of the research study indicate that the future market of the commodities is more efficient as compared to spot market. The future market also helps spot market in the process of Price Discovery. The derivative instruments are available for the underlying commodities significantly influence the volatility of the spot market. In India, it is perceived that the commodity prices are volatile in nature due to the presence of many local markets of the commodities the spot prices vary in different markets. It can be concluded that in commodity futures market is more efficient in terms of price discovery and information dissemination as compared to spot market.

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