Research Paper

THE IMPACT OF INFLATION ON COMMODITY PRICES: A CAUSALITY AND COINTEGRATION STUDY

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ABSTRACT

Commodity prices are said to be leading indicators of inflation through two basic channels that is they respond more quickly to general economic shocks, such as an increase in demand and some changes in commodity prices reflect idiosyncratic shocks, such as a flood that reduces the supply of certain agricultural products, which are subsequently passed through to over-all prices. Depending on the type of the shock, the observed link between commodity prices and inflation would be expected to be different. The strongest case for commodity prices as indicators of future inflation is that they are quick to respond to economy wide shocks to demand. In this study the relationship between prices of commodities and domestic inflation in India has been explored empirically for the period 2006 to 2011. For this purpose future and spot commodity price and domestic WPI and CPI weights has been constructed. The empirical results show that cointegration and causality between them.

KEYWORDS: *Commodity prices, inflation, cointegration, causality, future and spot commodity price*

1. INTRODUCTION

India is among the top-5 producers of most of the commodities and major consumer of bullion and energy products. Agriculture contributes about 22% to the GDP of the Indian economy. It employees around 57% of the labour force on a total of 163 million hectares of land. Prices of commodities, metals, shares and currencies fluctuate over time.

Inflation is an increase in the price of a basket of goods and services that is representative of the economy as a whole. Inflation rate refers to a general rise in prices measured against a standard level of purchasing power. In India like most other economies like US, UK, Japan, France, Singapore inflation is calculated with CPI. The main difference between WPI and CPI is that wholesale price index measures inflation at each stage of production while consumer price index measures inflation only at final stage of production.

CPI is a statistical time-series measure of a weighted average of prices of a specified set of goods and services purchased by consumers. It is a price index that tracks the prices of a specified basket of consumer goods and services, providing a measure of inflation.CPI are a fixed quantity price index and considered by some a cost of living index. Under CPI, an index is scaled so that it is equal to 100 at a chosen point in time, so that all other values of the index are a percentage relative to this one.

The possibility of adverse price changes in future creates risk for businesses. Derivatives are used to reduce or eliminate price risk arising from unforeseen price changes. A derivative is a financial contract whose price depends on, or is derived from, the price of another asset. Two important derivatives are futures and options.

Commodity futures are now becoming an important issue for the increasing rate of inflation in India and also for the volatile spot market, especially for the agricultural commodities. As against the argument of Price Discovery, Hedging of Price Risk, Risk Sharing, etc. as the important functions of futures market, several arguments are also offered against the unbridled trade in the commodity future market in India. These are:

i. Possibility of future trading leading to a rise in spot prices and inflation;

ii. Possibility of future trading leading in driving up spot market volatility;

iii. Possibility of future trading not necessarily to be in transparent or costless manner.

The prevalent influence of commodity futures trading in intensifying the price inflation in India can be primarily tested through the co-movement of Indian price indices, viz. Wholesale Price Index (WPI) and Consumer Price

Index (CPI) with the total traded value of commodity futures trading in India. The comovement of these two price indices with the growing size of commodity futures trading .Given the fact that there is an upward co-movement, reflecting the influence of commodity futures trading on rising inflation, the influence is essentially expected to be temporal in nature and it will be quite extraneous to blame the growth of commodity futures market for such inflationary situation.

There are several other which can also be significantly accounted for such rising inflation in Indian economy.

The futures markets can act as a catalyst of change for spot markets, but whenever futures markets grows faster than the under developed spot market, the gap between the two gets widened thereby exposing the futures market to criticism of being driven by speculators, even if closely regulated by the concerned regulatory bodies
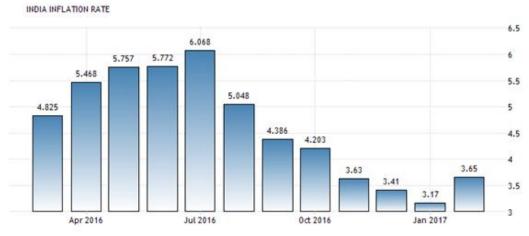
Fig1.1: Trend of inflation

2. LITERATURE REVIEW

ZeckLauser and Niederoffer (1983) first studied Stock index futures contracts with reference to United states and the correlation technique was employed to examine the objective and the analysis reveals that future leads to spot market.

Finnerty and Park (1987) examined the hypothesis that Major Market Index (MMI) futures price changes determine cash index changes. It was pointed out that correlation analysis provides only unidirectional results without any evidence for a causal relationship.

Kawaller, Koch and Koch (1987) examined the intraday price relationship between the S&P 500 futures and index prices for the year 1984-1985. Three-stage-least-square regression analysis was employed to examine the objective. The analysis revealed that futures price movements consistently lead the spot index movements by up to 45 minutes.

Herbst, McCormack and West (1987) employed cross correlation analysis to determine that futures lead the cash index for S&P 500 and value line futures contracts. They found that future index lead the spot index between 0 to 16 minutes.

Harris (1989) examined the relationship between S&P 500 index and futures during the October 1987 stock market crash using five-minute data. A correlation technique and weighted least squires (WLS) model have been employed to examine the objective. The analysis revealed that futures market leads the spot market. An ARMA (p, q) process has been employed by Stoll and Whaley (1990) to study the intraday price relationship between S&P 500 and the Major Market Index (MMI) futures for the year 1982-1987. They found a strong evidence of futures market leading the spot market.

Ryoo and Smith (2004) finds bidirectional relationship between spot index and future prices least squares and two stage least squares regression methods were employed to examine the objective. The analysis reveals that futures returns lead the spot index returns.

Raju and Karande (2003) examined the price discovery between the NSE nifty and its corresponding futures during the period 2000-2002. Cointegration technique and Error Correction models were employed forexamining the objectives. The analysis revealed that price discovery occurs in the both futures and the spot market.

Sah and Kumar (2006) had employed Cointegration and Error Correction models for the daily data series from June 2000 to March 2005 and finds a feedbackmechanism between nifty spot and nifty futures in India.

Mukherjee and Mishra (2006) employed cross correlation and error correction model to investigate the intra day lead-lag relationship between nifty futures and spot index from April to September 2004. They found bidirectional relationship between future and spot markets. However, the study results reveals that spot market had a major role in price discovery and leads over the futures market.

Bhatia (2007) employed Cointegration and error correction model to examine the intra day lead-lag relationship between NSE nifty futures and nifty index for the period April, 2005-March, 2006. The analysis reveals that nifty futures lead the spot index by 10 to 25 minutes.

The above existing literatures pertaining to lead-lag relationship between price changes in international futures and spot markets are well established by information

dissemination. They are related to different countries and consequently economics with different capital market structure and macro economic fundamentals. Further, they are drawn at different time periods and employed different models with different assumptions in each case along with certain market imperfection, market-wide and stock-specific information release variables. Hence, the results are seems to be mixed.

Most of the studies were employed Cointegration test and Error Correction Model (ECM) to examine the causal nexus between futures and spot markets. It revealed that Johansen's Cointegration test and Vector Error Correction Model are the superior techniques to investigate the issue because it indicatesthe possibility of long-run equilibrium between future and spot markets which gives the chance for equilibrium price for investors and traders after adjusting the short-run price fluctuations. Further, it is important for investors and traders for trading in the leading market in the short-run. So they can makearbitrage profit by trading in the leading market. The Error Correction Model estimates the leading market between spot and futures markets. Thus, the study can be done by employing Johansen's Cointegration test and Vector Error Correction Model to investigate the causality between spot and futures which will throw light pertaining to the possibility of acting spot or future prices as an efficient price discovery vehicle and this will be immensely useful for the traders to hedge.

3. METHODOLOGY

The research methodology adopted for carrying out the study in this project Descriptive research methodologies were used at the first stage theoretical and historical study is attempted. At the second stage empirical analysis is done.

Data Source

Spot prices and future prices from MCX website is taken on daily basis and then converted on monthly basis for 6 years from 2006 to 2011 for 8 commodities.

Data Period

The period taken is 2006 to 2011. This period is selected because during this period India faced Hyper Inflation.

Tools and Techniques

GRANGER CAUSALITY TEST has been used to check the causal relation between commodity prices (spot and future) and inflation.

ADF (AUGMENTED DICKY FULLER) has been used to check the time series properties of the variables under study.

JOHANSEN has been used to check the co integration test.

4. OBJECTIVE OF STUDY

To analyze the impact of inflation on commodity prices and to check the causality stationarity and cointegration of spot and future commodity prices.

5.DATA ANALYSIS AND INTERPRETATION

E Views 6 software package has been used for all the statistical calculations. The following tables illustrate the correlation, cointegration and causality among the selected commodities.

CORRELATION (FCP AND SCP)

Correlation study indicates whether there is significant and positive relationship between spot price and future price across the commodities during the study.

Table 1.1: Correlation of selected Commodity prices.

Commodities	Pearson Correlation Coefficient
Copper	.8935
Gold	.9944
Crude Oil	.8018
Cardamom	.674
Potato	.2661
Cotton	.725

From Table 1.1, it is evident that, there is a high correlation between all the commodities except Cardamom and Potato as the gap between Spot and Future price is more in this two commodities.

UNIT ROOT TEST

In this section we have employed JOHANSEN Co-integration test and GRANGER Causality test in order to estimate the short run and long run dynamics between spot price and future price of all commodities considered in the study.

Before going for it, we have to examine the time series properties of all the variables under study as the Co-integration technique needs the variables to be Stationary under order 1.

For this we have used Augmented Dickey Fuller Unit Root Test and the results are reported below:

Table 1.2: Unit Root Test of Copper

Variable	H^0: Variable has a unit root		H^0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	level	1st difference
SCP	-1.83 (0.36)	-5.89 (0.00)	-2.26 (0.45)	-5.88 (0.00)
FCP	-1.82 (0.37)	-5.89 (0.00)	-2.26 (0.45)	-5.88 (0.00)

Table 1.3: Unit Root Test of Gold

Variable	H^0: Variable has a unit root		H^0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	level	1st difference
SCP	2.27 (1.00)	-7.777(0.00)	-1.89 (.8955)	8.45(0.00)
FCP	2.47 (1.00)	-7.499(0.00)	-.72(0.966)	-8.22 (0.00)

Table 1.4: Unit Root Test of Crude Oil

	H_0: Variable has a unit root		H_0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	Level	1st difference
FCP	-1.614 (0.47)	-3.24(0.02)	-1.216 (0.89)	-3.18(0.009)
SCP	-2.99 (0.04)	-4.82 (0.00)	-3.155 (0.02)	-4.81(0.00)

Table 1.5: Unit Root Test of Cardamom

Variable	H_0: Variable has a unit root		H_0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	Level	1st difference
SCP	-1.07 (0.722)	-6.00 (0.00)	-2.81 (0.19)	-5.94 (0.00)
FCP	-2.42(0.37)	-7.65 (0.00)	-3.06 (0.125)	-7.64 (0.00)

Table 1.6: Unit Root Test of Potato

Variable	H_0: Variable has a unit root		H_0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	level	1st difference
SCP	-2.15 (0.22)	-7.71 (0.00)	-2.12 (0.52)	-7.64 (0.00)
FCP	-5.11 (0.000)	-18.71 (0.00)	-5.07 (0.00)	-18.58 (0.00)

Table 1.7: Unit Root Test of Cotton

Variable	H_0: Variable has a unit root		H_0: Variable has a unit root	
	ADF			
	ADF with Intercept		ADF with Trend &Intercept	
	Level	1st difference	level	1st difference
FCP	-2.83 (0.05)	-8.52 (0.00)	-2.76 (0.21)	-8.64(0.00)
SCP	1.78 (0.38)	-5.76 (0.00)	-2.24 (0.45)	-5.93 (0.00)

So it is clear that variables are non-stationary (with different Mean and Standard Deviation) at level and stationary at first difference that means the variables are integrated at same order i.e., Order 1Since the variables are integrated at same order, we can proceed with co integration mechanism to examine the short run and long run dynamics of commodity prices (Spot and Future prices).

CO-INTEGRATION BETWEEN SCP AND FCP

In order to check the short run and long run dynamics of commodity prices (Spot and Future prices), we employ JOHANSEN JUSELIUS COINTEGRATION TECHNIQUE and the results are reported in table below:

Table 1.8: Co-Integration Between SCP AND FCP

Variables	Trace Statistic		Maximum Eigen Value	
	H_0: r=0 C.Value		⁼=0 CRITICAL VALUE	
COPPER	25.35**	15.49*	21.89**	15.49
GOLD	25.22**	15.49*	21.39**	14.26
CRUDE OIL	17.45*	16.49*	15.45*	14.26
CARDAMOM	16.66**	15.49*	16.404*	15.26
POTATO	17.48**	15.48*	15.60*	14.26
COTTON	17.82*	15.49	15.12*	14.26

To check the null hypothesis we consider Trace Statistics and maximum Eigen Value. Here Trace Statistics should be more than the critical value and even maximum Eigen Value should be more than trace statistics in order to consider it as significant and to accept the null hypothesis.

Trace Statistics ad Maximum Eigen Value indicate the presence of atleast one co integrating between Spot and Future prices at 5% level of significance.So here Copper and Gold are in equilibrium in long run as quiet expected theoretically.

GRANGER CAUSALITY TEST

In order to check the causal relation between commodity prices (Spot and Future prices) we opt for Granger Causality test which also requires the commodity prices to be stationary at level. Since they are non-stationary we made them stationary through difference process.
The results are reported below:

Table 1.9: Granger Causality Test

COMMODITIES	OBSERVATIONS	F STATISTICS	PROBABILITY
GOLD			
FCP does not Granger cause SCP			8.E
SCP doesnot cause Granger cause FCP	64	49.15	0.76
		0.38	
COPPER			
FCP does not Granger cause SCP		13.903	6.E
SCP doesnot cause Granger cause FCP	64	0.304	.8419
CRUDE OIL			
FCP does not Granger cause SCP		4.97	0.02
SCP doesnot cause Granger cause FCP	64	1.17	0.2833
POTATO			
FCP does not Granger cause SCP		6.90	0.0019
SCP doesnot cause Granger cause FCP	64	0.627	0.53
COTTON			
FCP does not Granger cause SCP	64	2.24	0.11
SCP doesnot cause Granger cause FCP		0.63	0.54
CARDAMOM			
FCP does not Granger cause SCP		2.73	.07
SCP doesnot cause Granger cause FCP	64	1.92	.1564

The result indicates Future commodity prices cause spot prices that means future price causes spot price to go up (Future prices granger cause the spot prices) for all commodities but not the other way that is spot prices does not granger cause the future prices.

6. CONCLUSION

We have examined the short run and long run dynamics of commodity prices (Spot and Future prices) with the help of econometrics analysis. Here we have selected 6 commodities from different sectors: Copper, Crude oil, Cardamom, Gold, Potato, Cotton. In order to check the dynamics we adopted unit root test and found that the commodity prices are not stationary at level so we converted and made them stationary through difference process and further proceeded to Cointegration test we found that the future and spot commodity prices are cointegrated and they will achieve equilibrium in the long run with this result we can assume that there might be at least one causal relation between spot and future prices so we conducted Granger Causality test where we found that future prices affects the spot prices. Which is quiet expected as per the results of earlier studies done Spot prices include inflation so with the increase in future prices spot prices also increase along with rise in inflation. So for this reason, many economist and many earlier studies recommend that future trading in agricultural commodities should be banned so that it can control inflation to certain extent

REFERENCES

1. Kawaller, Koch and Koch ,(1987). The dynamics of S&P 500 Index and S&P Future Intraday Price Volatilities.The review of future markets..9(2),458-86.

2. Pradhan and Mishra (2011), The Efficiency of India's Stock Index Futures Market: An Empirical Analysis. International Research Journal of Finance and Economics 69:178-184 ·

3. Raju and Karande (2003), Price Discovery and Volatility on NSE Futures Market. SEBI Working Paper Series.

4. Athma, Rao(2013), Commodity Derivatives In India: A Study of Mcx Comdex. International Journal of Marketing, Financial Services & Management Research. 2(6).

5. Aloysius Edward .J, Narasimha Rao T.V(2013),Price Discovery Process and Volatility Spillover of Chilli spot and Futures Prices Evidence from National Commodity and Derivative Exchange Ltd (NCDEX). IJEMR.3(12)

6. Kumar(2015), Price discovery in some agricultural commodity markets in India. Agricultural Finance Review.71(2).

7. P Chellasamy(2015), An Empirical study on commodity derivatives market in India. EPRA International Journal of economics and Business Review.3(6).

8. Chhajed , Mehta (2013), Market Behavior and Price Discovery in Indian Agriculture Commodity Market. International Journal of Scientific and Research Publication.3(3).

9. Sumathy, Ambrose (2016), Price Discovery in Commodity Market – An Empirical Study on the Silver Market. IOSR Journal of Economics and Finance.7(2).

10. Elumalai, K, N. Rangasamy, Sharma, 2009 Price Discovery in India s Agricultural Commodity Futures Markets , Indian Journal of Agricultural Economics, 64(3),pp 315-23.

11. Sharma,G. and Mahendru. M, 2010, „ Impact of macroeconomic variables on stock prices in India .Global Journal of Management and Business Research, Vol. 10, no. 1, pp 19-26.

12. R.Salvadi, P.Ramasundaram, 2008 „Whether Commodity Futures Market in Agriculture is Efficient in Price Discovery?-An Econometric Analysis Agriculture Economic Research Review, vol. 21, pp. 337-34.