Financialisation of Commodity Market in India : A Closer Look at the Evidence

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In recent years, it is observed that there is a huge inflow of investment towards a commodities futures market in India. At the same time, we are also facing very high price and also volatility in commodity prices in India. Therefore, this has generated a heated debate about whether financialisation distorts commodity prices in India. Though there is the lack of studies on the financialisation of commodity market in India, this paper made an attempt to empirically examine the financialisation of Commodity market in India using the time series techniques. From the unconditional correlation, it is found that commodity index price is highly correlated with the stock index price during the study period. The causality test indicates that commodity price granger causes to the stock price in India but reverse is not. Therefore, I found no strong evidence on the financialisation of commodity markets in India. This result is quite similar to the report of the Reserve Bank of India (RBI, 2009-10).

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Introduction

In recent years, commodity prices have experienced a significant surge not only in India but also in the world. The sustained commodity price rose that peaked in mid- 2008, led by the soaring of crude oil prices, fall sharply and bottomed out in early 2009. Thereafter, the price rose again (Inamura et al., 2011). Policy makers and researchers have found two major factors, i.e. fundamental factors, and financialisation of the commodity markets including speculation are responsible for the high volatility in commodity prices (UNCTAD, 2011).

In the UNCTAD TDR (2009), mentioned that there is financialisation of commodity market if a positive correlation exists between commodity price and stock price. Now a question may arise; if financial investors taking a position in commodity markets, is there any relationship between the stock market and the commodity market? This is worth examining. Therefore, this study is an attempt to examine the dynamic relationship between commodity prices and stock price.

The equity market crisis in 2000 gives an opportunity to find out an alternative investment asset, whose return is negatively related to financial assets. Therefore, the investors focus on the commodity markets, whose returns are negatively correlated with financial/stock returns (Gorton and Rouwenhorst, 2006). As a result, there are wider uses of the commodity market, particularly commodity futures market, which is used as an alternative asset to the stock market, which attracted billions of dollars of investment worldwide from financial institutions, insurance companies, pension funds, hedge funds, and wealthy individuals (Tang and Xiong, 2010).

One interesting point to be noted here is that when the financial investors choose to invest in commodity markets, they have two options - either to invest (a) on individual commodities or (b) on commodity indexes to avoid storage cost, convenience yield and also marketing. Therefore, to avoid such type of cost, investors prefer to invest either in commodity futures or indexes. It is seen that during the financial crisis, investors prefer to invest in the commodity market. According to the Kyle and Xiong (2001), the diversified index investors' act like a channel to correlate commodity prices with the prices of other assets in their portfolios, as a result the nature of such spillover effects depends on the index investors' portfolio composition and rebalancing strategies. Though commodity index investors invest a large fraction of their portfolios in stocks, commodity prices are exposed to shocks to stocks. Therefore, the relationship between the commodity markets and stock market varies from country to country and also from time to time. When a positive shock increases the weight of the stocks in the investors' portfolios, diversification incentives motivate them to shift some money into commodities, which cause commodity prices to move positively with stock prices and vice versa. The rapid growth of commodity futures investments in recent years in India is a global phenomenon and a significant fraction of the investment flow comes from international investors who are exposed to shocks to the exchange rate.

This paper is organized in the following way. In section-2, we have reported the role of speculation in commodity markets. In section-3, we have analyzed the role of speculation in commodity markets. Section-3 gives the review of some previous studies on the relationship between stock prices and commodity price. Section-4 provides the data sources and methodology of the study. In section-5, we have analyzed the estimation results and the last section-6 gives the conclusion.

The Role of Speculation in Commodity Markets

Recent global financial and food crisis has evidenced and realized the assumptions of speculation trading. Speculators are trend-spotters. The concern is that trend spotting creates the trends that are subsequently identified. J.M. Keynes and J.R. Hicks are well known for the "theory of risk-transfer hypothesis" [Keynes (1930), v.2, Chapter 29 and Hicks (1946), p. 137-139]. The major distinction between hedgers ("commercials"[2]) and speculators ("non-commercials"[3]) is that speculators are relatively risk-tolerant individuals who are rewarded for accepting price risks from risk-averse "hedgers". Speculators in the forwards or futures markets may be on the long or short side of any such single transaction, but in the aggregate, their commitments must upset any net imbalance of the long and short hedger's position. Speculation is commonly understood to mean the purchase of a good for later sale rather than for the use and vice versa (Hirshleiper, 1977). It has the following fundamentals and idealizing assumptions- (a) speculation occurs only in "informative situations", (b) in informative situations, individuals must adjust both to "price risk" and "quantity risk", (c) in an informative situation, there are two interrelated market equilibrium, and (d) speculative behavior is conditioned upon the scope of markets.

Speculation in commodity derivatives markets performs a valuable economic function. Firstly, speculation in these markets allows for the transfer of price risk from those less willing to bear it (commodity producers and consumers, or end users) to those with the greatest appetite and capacity to do so (generically, speculators). Secondly, derivatives markets transmit valuable information about supply and demand conditions. In recent years, increased amount of capitals has been flowing to the commodity futures trade. Thus, there is a need to analyze the role futures market participants can possibly play in

[2] An investment in a commodity index is involved in the buying and/or selling of goods and/or services that are expected to generate cash flow. A commercial investment can be assumed by an individual, group or institution. Frequently, a commercial investment is shared by a group of investors combining assets in order to fund the investment. A commercial investment arises where an investor commits money or capital to purchase, either entirely or a percentage of, a for-profit property or business.

[3] A classification used by the Commodity Futures Trading Commission (CFTC) to identify traders that use the futures market for speculative purposes.

forming or distorting prices in the market for the underlying commodity (Bose, 2009). The increase in speculative activity in futures markets, i.e., large percentage of the marketplace has no intent of taking futures to delivery, causing price volatility. Therefore, speculators can create a price distortion and speculative bubble with the anticipation of making significant profits from major movements in the markets (Hull, 2008, p.40). Persistent inflationary pressures in global commodity prices in the recent years have sparked a debate over its nature. Index investments are different from traditional speculative positions in three respects, such as (a) traditional speculators can be long or short positions. Index investors are almost invariably long, (b) traditional speculators hold for short periods. Index investors hold over long periods and roll positions forward at contract maturity, and (c) traditional speculators pick markets (for details, see Appendix Table A.1). Index investors track specific indices rather than taking positions on specific markets. They can also be large (up to 30-40% of total interest) in relation to the overall market. Now the question is whether speculators (traditional or dynamic) can influence movements in commodity prices, if so, whether they have created any distortion and bubble in Indian commodity markets. A more appropriate characterization of this debate is the scope for commodity markets to be affected by destabilizing speculation. The present analysis attempts to shed some light to provide empirical evidence for the above.

Review of Some Previous Studies

Basically, the relationships between the stock market and commodity markets are studied by financial economists and practitioners to carry out better portfolio diversification. There are a very less number of studies is available on the relationship both between stock prices and commodity prices. Studies like Irwin and Sanders (2011), Falkowski (2013), Mayer (2012) etc. also give reviews on the financialisation of commodity markets.

Ankrim and Hensel (1993) examined the return of collateralized commodities to determine whether the returns had been competitive and verified their low correlation with other financial assets like real estate, stock, and bond. They found that the collateralized commodities offered the greatest diversification for stock returns during periods of inflation. They also found that the correlations between the commodities and the S&P500 and the Ibbotson Intermediate Government Bonds Index were generally low and collateralized commodities had experienced competitive returns and appeared to offer good diversification opportunities.
Empirical studies on the relationship between commodity prices and stock prices are quite interesting as these studies are contradictory to each other. Jensen et al. (2000) examined whether commodity futures were inefficient use in the portfolio diversification. Therefore, they had comprised commodity futures with stocks, bonds, T-bills and real estate for the period of 1973-1997. They found dramatically different results when they used a simple ex-ante measure of monetary stringency to dichotomize the sample period into expensive-versus-restrictive monetary policy periods. In restrictive monetary policy, commodity futures are shown to have substantial weight in the efficient portfolios, with significant return enhancement at all levels of risk. But in the expensive monetary policy period, commodities futures are shown to have little or no weight in the efficient portfolios, with no return enhancement at all levels of risk.
Lee et al. (1985) examined whether commodity futures market provides diversification for the underlying stock market and there were arbitrage possibilities between stock and commodity markets resulting from lead-lag relations. They found that there was no relationship between the rates of return of the two series. Risk and return increased with time horizon, whereas skewness and kurtosis were generally negatively related to the horizon. The lead-lag relationship shows that two series were independent. Therefore, the

results suggested that commodity futures might be used in conjunction with an equity portfolio to help reduce risks and enhance portfolio returns.

Miffre and Rallis (2007) investigated whether the short-term price continuation and the long-term mean reversion identified in equity markets were present in the commodity futures market. They also looked at the performance of 56 momentum and contrarian strategies in the commodity futures market. They found that the momentum returns were less correlated with the returns of traditional asset classes, making commodity futures relatively strength portfolios for inclusion in well-diversified portfolios. The momentum strategy bought backwardation contracts and sold contango contracts, which implicitly suggests that a momentum strategy that consistently trades the most backwardation and contango contracts is likely to be profitable.

Carter et al. (1983) evaluated the portfolio interpretation of future market investment risk, but they mainly focused on the generalization of the Keynesian notion of a risk premium provided by the capital asset pricing model (CAPM). They found that there was significant and positive systematic risk for a number of futures contracts. They also found that for an efficient portfolio, an application of the CAPM model for changing speculative position was supported by the generalized Keynesian theory of normal backwardation.

Over the years, there had been increasing studies in the financial literature in the support of portfolio diversification in which commodity future was an addition to the existing portfolio diversification instruments. But there are very few empirical studies which have examined whether the benefits are indeed statistically significant. Cheung and Miu (2010) examined several issues on potential diversification benefits of commodities. They found that there were diversification benefits exist and were statistically significant in the long-run. There was also regime-switch in commodity futures like most other asset classes, but with low (high) return environment for commodity futures, it was also associated with low (high) volatility. Commodity futures are an asset class far more suitable for conservative investors with relatively high-risk aversion.

Baur and McDermott (2009) examined whether gold was a safe haven against the stocks of major emerging and developing countries over a sample period of 30 years from 1979-2009. They found that gold was performed both as a hedge and a safe haven for major European stock markets and the US, but not in Australia, Canada, Japan and large emerging markets such as BRIC countries. Gold also acts as a stabilizing force for the financial system by reducing losses in the face of extreme negative market shocks. During the peak of the financial crisis, gold was a strong, safe haven for most of the developed markets.

Piplack and Straetmans (2010) examined the linkages between four different US asset classes, i.e., US stocks, government bonds, T-bills, and gold in times of market turbulence or crisis periods and the linkages were characterized by their tail dependence. They used extreme value analysis to assess the bivariate exposure of one asset class to extreme movements in the other asset classes. They found that the bivariate extreme linkages estimates displayed time variation for certain asset pairs, caused by exogenous factors like oil shocks or shifts in monetary policy.

Sanders et al. (2008) expressed skepticism about the assertion that speculation had led to bubbles in agricultural futures prices. Other authors share somewhat different views. Robles et al. (2009) identified speculative activity in the futures market as a source of the 2007/08 agricultural commodity price increases. In the non-ferrous metals market, Gilbert (2007) found no direct evidence of the impact of investor activity on the prices of metals, but found strong evidence that the futures positions of index providers had affected the prices of soybeans (though not of maize) in the US futures exchanges. Perhaps, the strongest evidence was a subsequent study by Gilbert (2010), who concluded that "by investing across the entire range of commodity futures, index based investors appear to have inflated food commodity prices."

The increase in long speculative positions was surpassed by an increase in short hedging in commodity markets (Sanders et al., 2008), financial investment in commodity trading appears to have caused prices might deviate, at least in the short run (Mayer, 2009), index speculators frustrated the futures market (Van der Molen, 2009), the recent wide fluctuations of commodity prices had been driven by the financialisation of commodity markets (UNCTAD, 2009).

The above review of the literature, it is found that very few studies available which examined commodity future market as an alternative investment asset to stock market not only in developed countries but also for developing and emerging countries like India. Therefore, this study mainly examines the financialisation of commodity market in India and particularly we examine the Indian commodity futures market as an alternative investment portfolio asset to the stock market.

Data and Methodology[4]

To examine the above objective, this study uses monthly data for both commodity price and stock price from the period January 2001 to June 2012 (i.e., sample period is 138 months). The specific variables are S&P CNF Nifty future index collected from National Stock Exchange (NSE) of India and commodity index of India. The specific commodity index is constructed by taking the respective sub-index prices from the RBI Hand Book of Statistics. The composition and construction of commodity index price are shown in Appendix A.2.

The study uses the econometric techniques like the Granger-Causality to examine stated objectives. A variable X Granger-causes Y if the past changes of X could help to predict current changes of Y. If X Granger-causes Y and not vice versa, it is called unidirectional

[4] The methodology is drawn upon Tsay (2010), and Engle and Kroner (1995).

causality. If X Granger causes Y and Y also Granger causes X, it would be said that there is bi-directional causality between these two variables (Brooks 2002).
When we conduct Granger causality tests, two cases should be considered depending on whether the variables are cointegrated or not.
If the variables are not cointegrated, the following VAR estimation equations in the first differences are tested.

$$\Delta Y_t = \sum_{j=1}^{n} b_j \Delta X_{t-j} + \sum_{j=1}^{n} c_j \Delta Y_{t-j} + \varepsilon_{t-1} \quad (1)$$

$$\Delta X_t = \sum_{j=1}^{n} b_j^* \Delta Y_{t-j} + \sum_{j=1}^{n} c_j^* \Delta X_{t-j} + \varepsilon_{t-1}^* \quad (2)$$

(b) If the variables are cointegrated, the following error correction models (ECM) are tested.

$$\Delta Y_t = \sum_{j=1}^{n} b_j \Delta X_{t-j} + \sum_{j=1}^{n} c_j \Delta Y_{t-j} + \varphi e_{t-1} + w_t \quad (3)$$

$$\Delta X_t = \sum_{j=1}^{n} b_j^* \Delta X_{t-j} + \sum_{j=1}^{n} c_j^* \Delta Y_{t-j} + \varphi e_{t-1}^* + w_t \quad (4)$$

Let ΔY_t and ΔX_t denote the stock returns of country x and country y, respectively. $e_{t-1}$and e_{t-1}^*, are the lagged residuals from two equations in case (a). The null hypothesis for the Granger test in the above equations is 'X does not cause Y' (all b_j=0), the alternative hypothesis is 'X causes Y' (at least one $b_j \neq 0$ and all b_j^*=0). If the null hypothesis is rejected, the conclusion that X Granger- causes Y is obtained (Roca, 1999). The reason to use ECM to test the causality between cointegrated variables is that regressing on the first difference cointegrated variables could lead to misspecification error.
It should be noted that Granger-causality really represents only a correlation between the current value of one variable and the previous values of others. It does not mean that movement of one variable cause movements of another (Brooks 2002). Moreover, although causality in VAR examines whether the current value of variable X can be explained by the past values of variable Y, it still does not explain the sign of the relationship or how long these effects last.

GARCH (1,1)-BEKK Model

According to Chong and Miffre (2008), the strategic decision on a well-diversified portfolio is not based solely on the temporal risk-return characteristics of the contracts. But the decision also depends on how an asset, say, commodity futures correlate with the rest of the portfolio over time. Therefore, to study the volatility spillover between the variables, the present study uses the Generalized Autoregressive Conditional Heteroscedasticity of BEKK Model (named after Baba, Engle, Kraft and Kroner, 1990). It is explained in the following.

In conventional econometric models, the variance of the error terms is assumed to be constant (homoskedasticity) over time. But it is unlikely in the context of the financial time series. Many financial time series have exhibited the property of long-memory, i.e., the presence of statistically significant correlations between observations that are a large distance apart (Harris and Sollis, 2003). Another distinguishing feature of the financial time series is known as volatility clustering, i.e., large (small) volatility followed by large (small) volatility. In other words, the current level of the volatility is positive with its level during the immediately preceding periods (Brooks, 2002).

Engle (1982) developed the ARCH (Autoregressive Conditional Heteroscedasticity) model that allows for the conditional variance to be time-varying. However, there are some limitations for ARCH (q) model. Bollerslev (1986) extended the ARCH model to a more general one – GARCH (Generalized Autoregressive Conditional Heteroscedasticity), which allows for the conditional variance to be dependent upon previous own lags.

However, some researchers are interested in quantifying the interactions between the volatility of *N* different financial time series. In this context, the multivariate GARCH models are utilized instead of univariate counterparts. In multivariate GARCH models, considering a stochastic vector series r_t with a dimension of (N×1), the conditional mean of r_t is a (N×1) vector μt and the conditional covariance of r_t is a (N×N) matrix Ht. Let I_{t-1} denotes the information set generated by the past information until time t-1 and θ is a finite vector of parameters (Bauwens et al. 2006).

A traditional approach to testing volatility spillovers is to estimate a GARCH model and to test the significance of the parameter estimates. A popular type of multivariate GARCH model used to examine volatility spillover effects is the BEKK model, which ensures the positive semi-definite property of the variance-covariance matrix. The purpose of estimating a BEKK-GARCH model using futures price returns is to compare our results from the VAR model with those from the traditionally used method. A BEKK model can be written as the following:

$$[r_t] = \mu_t(\theta) + \varepsilon_t \quad (5)$$

Where, $\mu_t(\theta)$ is the conditional mean vector and

$$\varepsilon_t = H_t^{1/2}(\theta) Z_t \quad (6)$$

Where, $H_t^{1/2}(\theta)$ is a positive definitive matrix and Z_t is assumed to be I.I.D vector Nx1, with $E(Z_t) = 0 \; and \; Var(Z_t) = I_N$

(7)

Depending on the formulation of Ht, several different multivariate GARCH models have been developed. In the BEKK model, the H_t matrix is

C'C+Ai'εt−1'εt−1Ai+Bi'Ht−1Bi, which can be written as,

$$H_t = C^{'}C + A_i^{'}\varepsilon_{t-1}^{'}\varepsilon_{t-1}A_i + B_i^{'}H_{t-1}B_i \quad (8)$$

Where C is a N×N upper triangular matrix of constants, while Ai and Bi are N×N matrices of parameters. We focus on a GARCH (1,1) specification since it is considered to be a parsimonious representation of conditional variance that can adequately fit many econometric time series (Tim Robert et al., 1988). In the case of two variables (N=2) and p=q=1, the above equation can be written out in the following.

$$\begin{bmatrix} h_{11,t} & h_{12,t} \\ h_{21,t} & h_{22,t} \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} \\ 0 & c_{22} \end{bmatrix} \begin{bmatrix} c_{11} & 0 \\ c_{12} & c_{22} \end{bmatrix} +$$
$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{1,t-1}^2 & \varepsilon_{1,t-1}\varepsilon_{1,t-1} \\ \varepsilon_{1,t-1}\varepsilon_{1,t-1} & \varepsilon_{1,t-1}^2 \end{bmatrix} \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} +$$
$$\begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} h_{11,t-1} & h_{12,t-1} \\ h_{21,t-1} & h_{22,t-1} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}$$

The symmetric matrix A captures the ARCH effects, the elements a_{ij} of the symmetric matrix A measure the degree of innovation from market *i* to market *j*. While the matrix B focus on the GARCH effects, the elements b_{ij} in matrix B represent the persistence in conditional volatility between market *i* and market *j* (Worthington and Higgs, 2004). In other words, the diagonal parameters in matrices A_i and B_i– a_{11} ,a_{22} and b_{11} ,b_{22} capture the effects of own past shocks and volatility on its current conditional variance. The off-diagonal parameters in matrices Ai and Bi, a_{ij} and b_{ij}, measure the cross-market influences on the conditional variances and covariances, which is also known as 'volatility spillover 'effects.

Under the assumption of conditional normality, the parameters of the multivariate GARCH model can be estimated by maximizing the log likelihood function.

$$L(\vartheta) = -\frac{TN}{2} log2\pi - \frac{1}{2}\sum_{i=1}^{t}[\log(H_t) + \varepsilon_t' H_t^{-1} \varepsilon_t]$$
(10)

where, θ denotes all the unknown parameters to be estimated. N is the number of the series in the system and T is the number of the observations. This log-likelihood function is maximized by using the BHHH (Berndt, Hall and Hausman, 1974) algorithm.

Analysis of Estimated Results

In relation to the analysis of the estimated results, we can quote the UNCTAD Trade and Development Report (2008, p.67). This report mentioned that "the positive correlation between commodity and equity prices during the period from 2005 to 2008 suggests that financial investors may have had a strong influence on commodity prices". We have estimated the descriptive statistics of commodity price index and the stock index price. The results show that stock price provides higher average return (5.61%) than the commodity price index in the study period, but stock price provides the highest variation/volatility (11.34%). The skewness and kurtosis result show that the commodity index price is positively skewed.

Table 1: Descriptive Statistics of Commodity and Stock Price, January 2008 to June 2012

	Mean	Std. Dev.	CV	Skewness	Kurtosis
Commodity	4.77	0.21	4.40	0.23	2.02
Stock	5.61	0.64	11.34	-0.38	1.62

Source: Author's Estimation

In Table-2, we have reported the unconditional return correlations between commodity index price with stock index price. As existing studies have said that stock returns have a very low correlation with commodity return, here we find that high correlation between commodity index price and stock index price in India (Table-2).

Table 5.2: Correlation between Commodity Price and Stock Price, January 2008 to June 2012

Full-sample period		
Variable	Commodity	Stock
Commodity	1.00	0.91
Stock	0.91	1.00

Source: Author's Estimation

In Table-3, have reported the Unit Root test by Augmented Dickey Fuller test (ADF) and Phillips Perron Test (PP)) for the commodity and stock index price. It indicates that the intercept, and intercept with the trend of ADF and PP tests (in level) values are insignificant, that means both commodity and stock prices are non-stationary. But at the first difference, variables are stationary at intercept and also intercept with the trend. Therefore, it can be said that both commodity and stock index prices are I(1).

Table 5.3A: Unit Root Test Results of Commodity and Stock price, Jan 2008 to June 2012

Augmented Dickey Fuller Test				
	Intercept		Intercept with Trend	
Variable	Level	First Diff	Level	First Diff
Commodity	0.81	-9.72	-2.77	-9.76
Stock	-0.74	-10.76	-1.91	-10.72
Phillips Perron Test				
Commodity	0.63	-9.70	-2.31	-9.73
Stock	-0.82	-10.81	-2.26	-10.77

Source: Author Estimation

Notes: a. Critical values for unit root test (ADF & PP) are: -3.49 and -4.10 (without trend) and -4.04, -4.10 (with trend) respectively at 1% level and 5% levels

Since the main aim of this study is to examine the financialisation of commodity market in India, therefore, we have estimated the Granger causality test between commodity index price and the stock index price, and the results are reported in Table-4. In Table-4, there are two null hypotheses: first, stock index price does not cause commodity index price, whereas the alternative hypothesis is stock index price cause commodity index price. The second null hypothesis is the commodity index price does not cause stock index price, whereas the alternative hypothesis is commodity index price causes stock index price. It shows that the null hypothesis, i.e., the stock index price does not cause commodity index price cannot be rejected, but the second hypothesis commodity index price does not cause the stock index price is rejected at the 10% significance level. Therefore, there exists only one-way causality from commodity index price to the stock index price.

Table 4: Granger Causality Test between Commodity and Stock Index price, January 2001 to June 2012

Null Hypothesis	F-Statistic	Prob.	YES/NO
Stock Index price does not cause commodity Index Price	1.24	0.30	No
Commodity Index price does not cause Stock Index price	2.26	0.07	Yes

Source: Author's Estimation

Volatility spillovers between cross markets, i.e., commodity market and stock markets improve the chance for speculators to shift their investments from one market to another. Therefore, we have estimated the bivariate GARCH(1,1)-BEKK model to effectively capture the own and cross-market volatility spillovers between the stock market and commodity market in India. We have reported the BEKK results in Table-5. The estimated BEKK results are categorized into two types: mean equations where mean co-efficient results are only reported. Secondly, we have reported the variance equation coefficients, where, the own-volatility spillover effects as well as cross-volatility spillover effects are reported.

The Table-5 indicates that the two mean coefficients (0.557 and 1.292) are significant at 1% and 10% significance level respectively. But in GARCH-BEKK model estimation results, it is very important to analyze the variance equation coefficients because these coefficients value talks about the volatility spillover between variables. The variance coefficients have three types of coefficient - constant coefficients, own-volatility coefficients and cross market volatility. The constant co-efficient C(2,1) is significant at 1% significance level. Unfortunately, the own-volatility spillover effect, namely A (1, 2), is insignificant at 10% significance level. But the cross market volatility spillovers between commodity and stock price, B(2,1) is significant at 1% significance level, which means that there is volatility spillover from the stock index price to the commodity index price but the reverse, i.e., B(1,2), is not significant. Therefore, there is only one-way volatility spillover effect of the stock market for the commodity index price.

Table 5: GARCH-BEKK Estimation between Commodity and Stock Prices

January 2001 to June 2012					
	Variable	Coeff	Std Error	t-stat	Signif
Mean Coff.	Mean(1)	0.557	0.105	5.299	0.000
	Mean(2)	1.292	0.727	1.777	0.075
Var. Coff	C(1,1)	0.275	0.238	1.156	0.248
	C(2,1)	7.178	0.441	16.294	0.000
	C(2,2)	0.000	61.625	0.000	0.962
	A(1,1)	0.078	0.123	0.637	0.524
	A(1,2)	0.497	0.793	0.627	0.531
	A(2,1)	0.031	0.017	1.831	0.067
	A(2,2)	0.226	0.194	1.162	0.245
	B(1,1)	0.325	0.261	1.244	0.214
	B(1,2)	-0.699	1.355	-0.516	0.606
	B(2,1)	0.144	0.028	5.168	0.000
	B(2,2)	-0.302	0.090	-3.335	0.001

Notes: A(p, q), B(p, q) and C(p, q) denote respectively………

Source: Author's Estimation

Conclusion

This study empirically examines the financialisation of commodity markets in India by using the time series techniques of causality test and the volatility spillover tests. From the relationship of stock price with commodity price, it is found that average stock price return was more than the commodity price return, but compared to the commodity price volatility, the stock price was more volatile than commodity price. Among the commodity price indices, energy price index provided more price return with the highest volatility, whereas food price had the least return with less volatility in three periods. From the unconditional correlation, it is found that commodity price indices were highly correlated with the stock prices in three periods.

From the Granger causality test, it is found that commodity price does granger causes to the stock price in India but the reverse is not. Therefore, we found no strong evidence on the financialisation of commodity markets in India. This result is quite similar to the report of the Reserve Bank of India (RBI, 2009-10). The RBI annual report (2009-10) mentioned that commodity prices in India seemed to be influenced more by other drivers of price changes, particularly demand-supply gap in specific commodities, the degree of dependence on imports and international price movements in these commodities.

References

Ankrim, E. M., and C. R. Hensel (1993), "Commodities in Asset Allocation: A Real-Asset Alternative to Real Estate?", *Financial Analysts Journal,* 49(3): 20-29.

Baur, D.G. and T. K. McDermott (2009), "Is Gold a Safe Haven? International Evidence", IIIS Discussion Paper, No. 310.

Bose, S. (2009), "The role of Futures Market in Aggravating Commodity Price Inflation and the Future of Commodity Futures in India". ICRA Bulletin, Money & Finance.

Brooks, C. (2002), "Introductory Econometrics for Finance", Cambridge University Press, U.K.

Carter, C. A., G. C. Rausser and A. Schmitz (1983), "Efficient Asset Portfolios and the Theory of Normal Backwardation", *Journal of Political Economy*, 91(2): 319–331.

Cheung, C.S., and P. Miu (2010), "Diversification Benefits of Commodity Futures", *Journal of International Financial Markets, Institutions & Money*, 20(5): 451-74.

Engle, R.F. and Kroner, K.F. (19950, "Multivariate Simultaneous Generalised ARCH", Econometric Theory, Vol. 11, 01, 122-150.

Falkowski, M. (2011), "Financialisation of Commodities", *Contemporary Economics*, 5(4): 4-17.

Gilbert, C.L. (1996), "International Commodity Agreements: An Obituary Notice", *World, Development*, 24(1): 1–19.
Gorton, G. and K.G. Rouwenhorst (2006), "Facts and Fantasies about Commodity Futures", *Financial Analysts Journal*, 62(2): 47- 68.
Hicks, J.R. (1939, 2nd ed. 1946), "Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory", Oxford: Clarendon Press.
Hirshleifer, J. (1977), "Economics from a biological View-point", Journal of law and Economics, 20, 1-52.
Hull, J.C. (2008), "Options, Futures and Other Derivatives", Prentice Hall; 7 Edition.
Inamura, Y., T. Kimata, T. Kimura and T. Muto (2011), "Recent Surge in Global Commodity Prices- Impact of Financialisation of Commodities and Globally Accommodative Monetary Conditions", *Bank of Japan Review*, March 2011.
Irwin, S.H., D. R. Sanders and M. E. Wetzstein (2012), "Financialisation and Structural Change in Commodity Futures Markets", *Journal of Agricultural and Applied Economics*, August, 44(3): 371-396.
Jensen, G. R., R. R. Johnson and J.M., Mercer (2000), Efficient Use of Commodity Futures in Diversified Portfolios", *Journal of Futures Markets*, 20(5): 489 – 506.
Keynes, J.M. (1930), "*Treatise on Money: The Applied Theory of Money*", Macmillan.
Kyle, A. and W. Xiong (2001), "Contagion as a Wealth Effect", *Journal of Finance*, 56(4): 1401–1440.
Lee, C. F., R. M. Leuthold and J. E. Cordier (1985), "The Stock Market and the Commodity Futures Market: Diversification and Arbitrage Potential", *Financial Analysts Journal*, 41(4): 53-60.
Meyer, J. and Cramon-Taubadel, S. (2004), "Asymmetric Price Transmission: A Survey", *Journal of Agricultural Economics*, 55(3): 581-611.

Miffre, J. and G. Rallis (2007), "Momentum Strategies in Commodity Futures Markets", *Journal of Banking and Finance*, 31(6): 1863-1886.
Piplack, J.P. and S.S. Straetmans (2010), "Comovements of Different Asset Classes during Market Stress", *Pasific Economic Review*, 15(3): 385-400.
Sanders, D.R., S.H. Irwin and R.P. Merrin (2009), "A Speculative Bubble in Commodity Futures Prices? Cross-Sectional Evidence", NCCC-134.
Tang, K. and W. Xiong (2012), "Index Investment and Financialisation of Commodities", *Financial Analysts Journal*, 68(6): 54-74.
Tsay, R.S. (2010), Analysis of Financial Time Series, 3rd Edition, Willey.
UNCTAD (2009), "The Growing Interdependence between Financial and Commodity Markets", Discussion Paper, No. 195.
UNCTAD (2011), "Price Formation in Financialized Commodity Markets: The Role of Information", United Nations, New York and Geneva.
Van der Molen, M. (2009), "Speculators Invading the Commodity Markets: A Case Study of Coffee", University of Utrecht.

Appendix-5

In appendix Table-A.5.1, we have reported the composition of commodities and their weights in the MCX COMMODITY of the year 2009. The MCX Indices based on futures prices are on a real time basis with the change in last traded price in MCX. The MCX COMMODITY is the simple weighted average of the three group indices, i.e., MCX Agri, MCX Metal and MCX Energy. The group indices are computed through geometric mean. MCX Agri index includes six different commodities (i.e., Ref. Soy Oil, Potato, Chana, Crude Palm Oil, Kapaskhalli and Mentha Oil) and it is weighted 20.0% in the total weights in MCX COMMODITY. Similarly, MCX Energy Index has only two commodities (Crude Oil and Natural Gas) in the Index but it is weighted 40.0% in the total weight of MCX COMMODITY. MCX Metal Index includes 7 different commodities (i.e., gold, silver, copper, zinc, aluminium , nickel and lead). The MCX Metal Index is weighted 40.0% in total MCX COMMODITY weight. It can be seen that both metals and energy commodities have more weights than that of agricultural commodities in MCX Commodity