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CO-INTEGRATION ANALYSIS: AN EMPIRICAL STUDY OF SPOT AND FUTURE METAL INDEX OF MULTI COMMODITY EXCHANGE OF INDIA.

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Abstract:

Metal market acquires the major portion of the commodity market of India. This research paper aims to find out that if spot and future metal markets are having any co-integration or not. The study is based upon the time series data of about 10 years from July 1, 2005 to February 28, 2015. The research paper is divided into three sections; introduction, empirical analysis and findings & conclusion. The first section introduces about the objectives, scope, data and sample frame, source of data, sample size and units of observation and data transformation of the research study. The second section includes the details of hypothesis, results and findings of applying unit root test, Johansen co-integration test and Granger causality test. The third section of the study defines the summary of the all the techniques applied to find out co-integration among the MCXSMETAL and MCXMETAL. The analysis of the data reveals that the markets are efficient and there is positive results regarding transmission of information between both the markets.

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1. Introduction: The commodity market is a favorable segment of research in economics. The existence of this market is early as compare to other markets such as foreign or stock market, but this market remains far behind in terms of regulatory framework and accessibility to investors, so research in this particular area of economy needs an active attention. The study conducted in the field of commodity market get obsolete rapidly, due to the dynamic nature of the commodity market and as a result, it becomes necessary to continuously update the previous research work by understanding new research from time to time. Therefore, the present study is an extension of existing works on commodity markets with the use of recent data.There are few studies if any which are conducted to examine the co-integration among the spot and future commodity market in India as compare to same research in stock market. This is important because one needs to understand the validity of results in particularly commodity market to undertake the investment decisions. The relevance of the present research study is to examine the relationship between spot and commodity future market and studying trend of their indices.With advances in the field of computer science, and the recent developments of time series techniques, it is likely that the improved and more appropriate results can be figure out. Therefore the present research study will provide benefit to the participants of spot as well as future commodity market and accordingly take probable right decisions.

1.1 Objectives of the Study: The main objectives of the present research study are to analyze the commodity market. The specific issues which are covered in this study are:

(i) To test the validity of the random walk hypothesis in spot metal Index.

(ii) To test the validity of the random walk hypothesis in future metal Index.

(iii) To examine whether a relationship exists between the spot and futures metal market.

1.2 Scope of the Study: The scope of the study is restricted to:

(i) The analysis of commodity market behavior is restricted to only Multi-Commodity Exchange of India (MCX) as it is the largest commodity exchange of our country.

(ii) This study consists of the entire group of MCX commodities index series both spot as well as future market for about ten years fromJuly 1, 2005 to February 28, 2015, which includes the followings:

(a) Metal Spot Indexes (MCXSMETAL)

(b) Metal Future Indexes (MCXMETAL)

(iii) Testing the random walk hypothesis by using the Unit Root Test.

(iv) The Granger causality test has been used for determining whether spot or future time series is useful in forecasting another.

(v) Testing the co-integration among the spot and future market Co-integration and Error correction Mechanism

1.3 Data and Sample Frame: The closing index value of daily observations were obtained. The daily observation of the day when there is any public holidays or non-availability of data is excluded from the data series. The data used in the study consists of two sets;

(i) The First set consists of 2877observations for Spot Metal Index. The data pertaining to this index was collected on daily basis for the study period of July 1, 2005 to February 28, 2015.

(ii) The First set consists of 2877 observations for Future Metal Index. The data pertaining to this index was collected on daily basis for the study period of July 1, 2005 to February 28, 2015.

1.4 Sources of the Data: The main source of data is the official website of Multi-Commodity Exchange of India (www.mcxindia.com). The data has been taken from 'Market Data-Index History'. MCX COMDEX was launched in June 2005 so the data from its next date is available. From there Spot/Future Indexes for Metal, from July 1, 2005 to February 28, 2015 on daily basis has been taken.

1.5 Sample Size and Units of Observation: The method that has been followed while selecting the sample is the simple random sampling. However, in a situation where the required data was missing, the criteria that was followed for selecting the sample was based on the availability of data, so as to minimize the number of missing observations. The sample size and the unit of observation has been shown in table 1.

Table 1

Sample Size and Unit of Observation

Series	Description of the Series	Time Interval	Study Period	Total Observations
MCXSMETAL	Commodity Spot Index-METAL	Daily	July 1, 2005 to February 28, 2015	2877
MCXMETAL	Commodity Future Index-METAL	Daily	July 1, 2005 to February 28, 2015	2877

1.6 Data Transformation: Generally, the original index is unstable and is characterized by non-stationarity. Non-stationarity may be due to serval factors; Random walk, Outliers and Heteroscedasticity. If a non-stationary series is driven by the trend, the series possess an average change in level overtime, if it is characterized by heteroscedasticity, then there will be changing variance overtime in the series and these will violate the basic assumptions of the analysis.

2. Empirical Analysis of Spot and Future Metal Market Index: This part of study includes the empirical analysis of spot and future metal market index of India. Unit root test, Johansen co-integration and Granger causality test are applied in order to fulfil the objective of this research paper. The findings of each test is as follows;

2.1 Unit Root Test: This section will test spot metal market index and future metal market index series individually in order to find if they are stationary or not.

2.1.1 Testing Spot Metal Market Index (MCXSMETAL) is Random: MCXSMETAL is the indicator of spot metal market index of MCX (Multi-Commodity Exchange of India). Again the time period of data is from July 1, 2005 to February 28, 2015 on daily basis is consider to apply unit root analysis. The data series constitute 2877 number of observations.

(a) Hypothesis: The hypothesis for conducting this analysis is, as under;

H_0: MCXSMETAL is not stationary or got unit root.

H_1: MCXSMETAL is stationary.

There is a requirement for the above mention hypothesis that it is to be tested twice first at level and then at first difference of the series. As per the recommendation of the study there is a need of acceptance of null hypothesis at level and rejection at first difference to move the study ahead. The preset hypothesis of the research problem is suggested to get acceptance or rejection on the basis of decision rule of ADF test. The decision rule to accept or reject a hypothesis is mention in the below section.

(b) Decision rule: If t* > ADF critical value at 1%, 5% and 10% then null hypothesis will be accepted, i.e., unit root exists.

On other hand, If t* < ADF critical value at 1%, 5% and 10% then null hypothesis will be rejected, i.e., unit root does not exist.

(c) Analysis of the data: With the use of E-views 8,statistical package for Windows, used mainly for time-series oriented econometric analysis, Augmented Dickey-Fuller Test has been applied. The maximum lag length 27 is automatically selected by Schwarz Info Criterion, the option available in unit root analysis under E-views 8.

(d) Results of the study: The results of the stationarity test on spot metal commodity market index are shown in Table 2 by applying Augmented Dickey Fuller for three equations i.e. intercept only, trend & intercept and no trend no intercept.

Table 2

Stationary Test for Spot Metal Market Index (MCXSMETAL)

Used Augmented Dickey-Fuller Test with lag length Automatic selection: Schwarz Info Criterion; Maximum Lags: 27

Augmented Dickey-Fuller test statistic		
	Levels	**1st Difference**
t-statistics: Equation 1-Intercept only		
Critical Value	-0.178257	-30.74508
1%	-3.432441	-3.432441
5%	-2.862349	-2.862349
10%	-2.567245	-2.567245
t-statistics: Equation 2-Trend and Intercept		

Critical Value	-2.700964	-30.74564
1%	-3.961244	-3.961244
5%	-3.411375	-3.411375
10%	-3.127536	-3.127536
t-statistics: Equation 3-No Trend and No Intercept		
Critical Value	1.430377	-30.70328
1%	-2.565769	-2.565769
5%	-1.940934	-1.940934
10%	-1.616625	-1.616625

(e) Findings of the study: After applying Augmented Dickey-Fuller test (ADF) on the spot metal index series to check for stationarity of data, the table 2 is come out. The outcome of the analysis reveal that the spot metal index series is not stationary at level as t value is greater than the critical values at 10%, 5% and 1% levels of significance. That means the index series of spot commodity market is found to be non-stationary at levels. On the other side when same ADF test is applied to the first difference of the spot commodity index series; it has been found that t-value is smaller than the critical values at 10%, 5% and 1% levels of significance; that result in rejection of null hypothesis so the alternative is choose, that state First difference of the index series of spot commodity is stationary. By achieving the first condition of stationarity, so the index series is compatible to carry our further research.

2.1.2 Testing Future Metal Market Index (MCXMETAL) is random: The main objective of the present study is to find out co-integration among spot and future commodity market on whole as well as on individual group level. The precondition to find out the co-integration is to find out the stationarity of individual data series. Spot metal market index series proven to fulfill the basic condition, now there is a need to run same analysis on the future metal market index. Though the procedure is same for future metal index series and there is a requirement of getting the same results to move on further. The data of MCXMETAL from July 1, 2005 to February 28, 2015 on daily basis is consider to conduct unit root analysis. The data series constitute2877 number of observations.

(a) Hypothesis: The hypothesis for conducting this analysis is, as under;

H_0: MCXMETAL is not stationary or got unit root.

H_1: MCXMETAL is stationary.

The above mention hypothesis is required to be tested twice first at level and then at first difference of the series. As per the recommendation of the study there is a need of acceptance of null hypothesis at level and rejection at first difference to move the study ahead. The preset hypothesis of the research problem is suggested to get acceptance or rejection on the basis of decision rule of ADF test. The decision rule to accept or reject a hypothesis is mention in the below section.

(b) Decision rule: If t* > ADF critical value at 1%, 5% and 10% then null hypothesis will be accepted, i.e., unit root exists.

On other hand, If t* < ADF critical value at 1%, 5% and 10% then null hypothesis will be rejected, i.e., unit root does not exist.

(c) Analysis of the data: With the use of E-views 8,statistical package for Windows, used mainly for time-series oriented econometric analysis, Augmented Dickey-Fuller Test has been applied. The maximum lag length 27 is automatically selected by Schwarz Info Criterion, the option available in unit root analysis under E-views 8.

(d) Results of the study: Table 3 shows the results of stationarity test for future metal market index (MCXMETAL) by applying Augmented Dickey Fuller for three equations i.e. intercept only, trend & intercept and no trend no intercept.

Table 3

Stationary Test for Future Metal Market Index (MCXMETAL)

Used Augmented Dickey-Fuller Test with lag length Automatic selection: Schwarz Info Criterion; Maximum Lags: 27

Augmented Dickey-Fuller test statistic		
	Levels	**1st Difference**
t-statistics: Equation 1-Intercept only		
Critical Value	-1.770883	-58.29229
1%	-3.432435	-3.432435
5%	-2.862347	-2.862347

10%	-2.567244	-2.567244
t-statistics: Equation 2-Trend and Intercept		
Critical Value	-1.531984	-58.31100
1%	-3.961235	-3.961235
5%	-3.411370	-3.411370
10%	-3.127533	-3.127533
t-statistics: Equation 3-No Trend and No Intercept		
Critical Value	0.793659	-58.26619
1%	-2.565767	-2.565767
5%	-1.940934	-1.940934
10%	-1.616625	-1.616625

(e) Findings of the study: Table 3 shows the result of applying Augmented Dickey-Fuller test (ADF) on the future metal index series to check for stationarity of data. When t-value is compared to critical values at 10%, 5% and 1% levels of significance, t-value found greater than other; that means the index series of future metal market is found to be non-stationary at levels, on other hand t-value is less than the critical values at 10%, 5% and 1% levels of significance when the first difference of the data series is taken; the result suggested to reject of null hypothesis that means at first difference the future metal index series become stationarity. These results are positive to our present study to conduction co-integration among spot and future metal index series.

2.2 Johansen Co-Integration Analysis: Metal market index is the index of all the commodities related to precious or non-precious metals. This includes gold, silver, copper zinc, aluminium, nickel and lead. The spot metal index of MCX is called as MCXSMETAL and future metal index of MCX is known as MCXMETAL. In this section, Johansen Co-Integration Test is conducted to test the presence of a long run relationship between the Spot and Futures metal index series. MCXSMETAL is the indicator of spot metal market index of MCX (Multi-Commodity Exchange of India) and MCXMETAL is the indicator of future metal market index of MCX (Multi-Commodity Exchange of India). The data from July 1, 2005 to February 28, 2015 on daily basis is consider to conduct co-integration analysis. The data series constitute 2873 number of observations.

(a) Hypothesis: The hypothesis for co-integration analysis is as under;

H_0: There is no long run relationship between the variables.

H_1: There is long run relationship between the variables

(b) Decision Rule: To test the hypothesis the following are the guidelines;

- If p-value is less than 0.05 (5%) then null hypothesis will be rejected.
- If p-value is more than 0.05 (5%) then null hypothesis will be accepted.

(c) Lag Length Selection: For testing co-integration by using Johansen co-integration test there is a need to select the lag length. Hence in order to find out optimum lag VAR lag order selection criteria is being used. The outcome of the test is mentioned in table 4.

Table 4

Optimum Lag Selection for MCXSMETAL and MCXMETAL by using VAR Lag Order Selection Criteria

Endogenous variables: MCXMETAL MCXSMETAL						
Total observations: 2872						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-47360.91	NA	7.23e+11	32.983	32.987	32.984
1	-37803.72	19094.40	9.33e+08	26.330	26.342*	26.334
2	-37792.92	21.582*	9.29e+08*	26.325*	26.346	26.333*
3	-37791.65	2.521	9.31e+08	26.327	26.356	26.338
4	-37789.44	4.417	9.32e+08	26.328	26.366	26.342

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

The result of the VAR lag order selection criteria suggest to choose two lags as all the sequential modified LR test statistic (each test at 5% level), Final prediction error, Akaike information

criterion, and Hannan-Quinn information criterion supports the lag 2 as optimum. And only Schwarz information criterion suggest lag 1. Hence going with majority the lag 2 is selected to use for further study.

(d) Results of the study: The Johnsen co-integration test is applied twice with trace value and maximum Eigen value on two index series i.e. MCXMETAL and MCXSMETAL by using e-views statistical mechanism. The results are shown in table 5.

Table 5

Results of Johansen Co-integration Test on MCXSMETAL & MCXMETAL

Trend assumption: Linear deterministic trend				
Series: MCXMETAL MCXSMETAL				
Unrestricted Co-integration Rank Test				
Included observations: 2872 after adjustments				
Lags interval (in first differences): 1 to 2				
Unrestricted Co-integration Rank Test (Trace Value)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.248014	822.0755	15.49471	0.0001
At most 1	0.001100	3.163191	3.841466	0.0753
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max- Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.248014	818.9123	14.26460	0.0001
At most 1	0.001100	3.163191	3.841466	0.0753
Trace test indicates 1 co-integrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

(e) Findings of the study: From the results in table 5, it is found that the index series are co-integrated asp-values are significant in both tests. It is therefore securely assumed that the

integration exist between the markets. In order to analyze causality between the markets the Vector Error Correction Model is suggested to construct.

2.3 Causality Test: With the help of this test pair wise causality can be determined. The prime object to conducted causality test is to ascertain there is a unidirectional or bidirectional relationship exist between both markets. Granger causality test is run on the index series to find the direction of the information flow between both the markets. Here in the study MCXSMETAL and MCXMETAL index series are taken. MCXSMETAL is the indicator of spot metal market index of MCX (Multi-Commodity Exchange of India) and MCXMETAL is the indicator of future metal market index of MCX (Multi-Commodity Exchange of India). The data from July 1, 2005 to February 28, 2015 on daily basis is consider to apply Granger causality test. The data series constitute 2874 number of observations.

(a) Hypothesis: The laid hypothesis to test the causality between MCXSMETAL and MCXMETAL is as under;

First Hypothesis; H_0: MCXSMETAL does not cause MCXMETAL

H_1: MCXSMETAL cause MCXMETAL

Second Hypothesis; H_0:MCXMETAL does not cause MCXSMETAL

H_1:MCXMETAL cause MCXSMETAL

(b) Decision Rule: The decision rule to accept or reject the hypothesis is as below;

Null hypothesis is accepted if $p \geq 0.05$

And, Alternative hypothesis is accepted if $p < 0.05$.

(c)

(d) Results of the study: In order to check causality among MCXSMETAL and MCXMETAL the granger causality test is applied. The results of the test are shown in table 6 as below;

Table 6

Causality of MCXSMETAL on MCXMETAL and vice versa with lag 2

Pairwise Granger Causality Tests		
Observations: 2874		
Null Hypothesis	**F-Statistic**	**Probabilities (p-value)**
MCXMETAL does not Granger Cause MCXSMETAL	587.933	1E-214
MCXSMETAL does not Granger Cause MCXMETAL	0.03670	0.9640

(e) Findings of the study: First, Null hypothesis is rejected that means MCXMETAL cause MCXSMETAL. That means future metal market influence spot metal market. Whereas Second, Null Hypothesis is accepted that means MCXSMETAL does not cause MCXMETAL. That means spot metal market does not influence future metal market.

3. Findings and Conclusion: The analysis of the data reveals that the markets are efficient and there is positive results regarding transmission of information between both the markets. The summary of the all the techniques applied to find out co-integration among the MCXSMETAL and MCXMETAL is mentioned in table 7, given below;

Table 7

Summarized results of Co-Integration Analysis between MCXSMETAL & MCXMETAL

Technique of Co-integration Analysis	**Acceptance/ Rejection of Hypothesis**		**Findings**
	H_o	**H_1**	
1. Unit Root Analysis			
MCXSMETAL (at Level)	Accepted	Rejected	Series got unit root at level but not when first difference is taken
MCXSMETAL (at First Difference	Rejected	Accepted	
MCXMETAL (at Level)	Accepted	Rejected	Series got unit root at level but not when first difference is taken
MCXMETAL (at First Difference	Rejected	Accepted	

2. Johansen Co-Integration Analysis			
	Rejected	Accepted	There is long run relationship between the variables
3. Granger Causality Test			
	First; Rejected	First; Accepted	MCXMETAL causes MCXSMETAL
	Second; Accepted	Second; Rejected	MCXSMETAL does not cause MCXMETAL

Bibliography:

- Acharya, V., and Johnson, T., Insider trading in credit derivatives. Journal of Financial Economics, 84, 2007.
- Agnihotri, A. and Sharma, A., Study of convergence of spot and future prices in Commodity market (with reference to zeera, Channa, zink and natural gas for 2005-2010), International Journal of Multidisciplinary Research, 1(2), 2011.
- Agrawal, P., The Relation between Savings and Growth: Co-integration and Causality Evidence from Asia. Applied Economics, 33, 2001.
- Ahuja, N. L., Commodity Derivatives Market in India: Development, Regulation and Future Prospects. International Research Journal of Finance and Economics, (2), 2006.
- Asche, F., Osmundsen, P. and Sandsmark, M., The UK Market for Natural Gas, Oil and Electricity: Are the Prices Decoupled?, Energy Journal, 27(2), 2006.
- Asche, F., Osmundsen, P. and Tveterås, R., Market Integration for Natural Gas in Europe. International Journal of Global Energy Issues, 16 (4), 2001.
- Balke, N. S., and Fomby, T. B., Threshold co-integration, International economic review, 1997.
- Basu, D., and Miffre, J., Capturing the Risk Premium of Commodity Futures: The Role of Hedging Pressure. EDHEC-Risk Institute, 2011.

- Birthal, P. S., Jha, A. K., and Singh, H., Linking Farmers to Markets for High-Value Agricultural Commodities. Agricultural Economics Research Review, 20, 2007.
- Bohl, M. T., and Stephan, P. M., Does Futures Speculation Destabilize Spot Prices? New Evidence for Commodity Markets. Journal of Agricultural and Applied Economics, 45(4), 2013.
- Bollerslev, T., Generalized Autoregressive Conditional Heteroskedasticity. Journal of Econometrics, 31, 1986.
- Bonfiglioli, A., and Favero, C. A., Explaining co-movements between stock markets: The case of US and Germany. Journal of International Money and Finance, 24, 2005.
- Booth, G. G., Brockman, P., and Tse, Y., The relationship between US and Canadian wheat futures. Applied Financial Economics, 8, 1998.
- Bose, S., Commodity Futures Market in India-A Study of Trends in the National Multi-Commodity Indices, Money and Finance, 3(3), 2008.
- Brunetti, C., and Gilbert, C. L., Metals price volatility from year 1972 to 1995, Resources Policy, 1995.
- Caporale, G. M., Ciferri, D., and Girardi, A., Time-Varying Spot and Futures Oil Prices Dynamics. Economics and Finance Working Paper Series, (10-06), 2010.
- Chaarlas, L. J., Lydia, J., et. al., An assessment of safety in investing commodity Derivatives of base metals traded in MCX, Arabian Journal of Business and Management Review, 1(9), 2012.
- Channabasanagowda, C., P. M., Venu, B. N., and Patil, R., Commodity Futures Market in India: Impose, Growth, Roles and Obstacles. Research Journal of Agricultural Sciences, 4(2), 2013.
- Chen, A. S., and Lin, J. W., Co-integration and detectable linear and nonlinear causality: analysis using the London Metal Exchange lead contract, Applied Economics, (36), 2004.
- Chen, L. H., Finney, M., and Lai, K. S., A Threshold Co-integration Analysis of a Symmetric Price Transmission from Oil to Gasoline Prices. Economics Letters, 89(2), 2005.
- Ciner, C., On the long run relationship between gold and silver prices-A note, Global Finance Journal, 12, 2001.

- Deo, M., Srinivasan, K., and Devanadhen, K., The empirical relationship between stock returns, trading volume and volatility: Evidence from select Asia-Pacific stock market. European Journal of Economics, Finance and Administrative Sciences, 12, 2008.
- Dickey, D. A., Hasza, D. P., and Fuller, W. A., Testing for Unit Roots in Seasonal Time series. Journal of American statistical Association, 79(386), 1984.
- Dickey, D., and Fuller, W., Distribution of the estimators for autoregressive time series with a unit root, 1979.
- Engle, R. F., and Yoo, B. S., Forecasting and testing in co-integrated systems, Journal of Econometrics, 35, 1987.
- Foster, A. J., Price discovery in oil markets: a time varying analysis of the 1990– 1991 Gulf conflict. Energy Economics, 18(3), 1996.
- Garag, A., and Ramesh, B., Relationship between Futures Price and Open Interest in Stock and Index futures in the Indian Stock Markets: Empirical Analysis. International Proceedings of Economics Development and Research, 2011.
- Garbade, K. D., and Silber, W. L., Price movements and price discovery in futures and cash markets. The Review of Economics and Statistics, 65(2), 1983.
- Gaulati, D., Relationship between Price and Open Interest in Indian Futures Market: An Empirical Study. Pacific Business Review International, 5(1), 2012.
- Goodwin, B. K., and Schroeder, T. C., Co-integration tests and spatial price linkages in regional cattle markets. American Journal of Agricultural Economics, 73(2), 1991.
- Granger, C. J., Some Properties of Time Series Data and their Use in Econometric Model Specification. Journal of Econometrics, 16, 1981.
- Gulati, D., Relationship between Price and Open Interest in Indian Futures Market: An Empirical Study. Pacific Business Review International, 5(1), 2012.
- Gulen, S. G., Efficiency in the crude oil futures market, Journal of Energy Finance and Development, 3(1), 1998.
- Harri, A., Nalley, L. and Hudson, D., The Relationship between Oil, Exchange Rates, and Commodity Prices. Journal of Agricultural and Applied Economics, 41(2), 2009.
- Huang, R. D., Masulis, R. W., and Stoll, R. H., Energy Shocks and Financial Markets. Journal of Futures Markets, 16(1), 1996.

- Hui, and Gao, Co-integration analysis of commodity futures prices in Shanghai, China and London, UK. Natural Science Journal of Harbin Normal University, 2004.
- Inoue, T., and Hamori, S., Market efficiency of commodity futures in India. Institute of developing economics, 2012.
- Johansen, S., Statistical Analysis of Co-integration Vectors, Journal of Economic Dynamics and Control, 12(3), 1988.
- Jones, J. D., A comparison of lag–length selection techniques in tests of Granger causality between money growth and inflation: evidence for the US (1959–86), Applied Economics, 21(6), 1989.
- Kang, S. H., Kang, S. M., and Yoon, S. M., Forecasting volatility of crude oil markets, Energy Economics, 31(1), 2009.
- Kellard, N., Newbold, P., Rayner, T., and Ennew, C., The Relative Efficiency of Commodity Futures Markets, Journal of Futures Markets, 19(4), 1999.
- Kenourgios, D. F., and Samitas, A. G., Testing efficiency of the copper futures market: New evidence from london metal exchange. Global Business and Economics Review, 2004.
- Khoury, N., and Yourougou, P., Determinants of agricultural futures price volatilities: Evidence from Winnipeg Commodity Exchange, Journal of Futures Markets, 13(4), 1993.
- Kothiwal, R. and Goel, A., Understanding Indian Commodity Markets (A Diversified Platform for Retail Investors), A Journal of Radix International Educational and Research Consortium, 1(3), 2012.
- Krehbiel, T., and Adkins, L.C., Co-integration Tests of the Unbiased Expectations Hypothesis in Metals Markets. The Journal of Futures Markets 13, 1993.
- Kumar, B., and Pandey, A. International Linkages of the Indian Commodity Futures Markets, Modern Economy, 2, 2011.
- Kumar, B., Effect of Futures Trading on Spot Market Volatility: Evidence from Indian Commodity Derivatives Markets, 2009. Available at SSRN: http://ssrn.com/abstract=1364231 or http://dx.doi.org/10.2139/ssrn.1364231.
- Linkages between the US and European Equity Markets: Further Evidence from Co-integration Tests, Applied Financial Economics, 2011.

- Lucey, B. M., and Tully, E., The evolving relationship between gold and silver (1978-2002): evidence from a dynamic co-integration analysis: a note. Applied Financial Economics Letters, 2006.
- M. D., and Coibion, O., The Predictive Content of Commodity Futures. Journal of Futures Markets, 2013.
- M. J., McKenzie, A. M., and Huylenbroeck, G. V., Is there co-movement of agricultural commodities futures price sand crude oil? Energy Policy, 39, 2011.
- MacKinnon, J. G., Critical Values for Co-integration Tests, 1991. Retrieved from http://qed.econ.queensu.ca/working_papers/papers/qed_wp_1227.pdf
- Malyadri, G., and Sudheer Kumar, B., A Study on Commodity Market, International Journal of Computer Science and Management Reseach, 2012.
- Mukherjee, K. N. Impact of Futures Trading on Indian Agricultural Commodity Market. Retrieved from http://ssrn.com/abstract=1763910
- Park, K. and R. A. Ratti., Real Activity, Inflation, Stock Returns, and Monetary Policy, The Financial Review, 2000.
- Patel S.A., Causal Relationship between Stock Market Indices and Gold Price: Evidence from India. The IUP Journal of Applied Finance, 19(1), 2013.
- Pereia, L. M., Oliveira Ribeiro, C. D., and Securato, J. R., Agricultural Commodities Pricing Model Applied to the Brazilian Sugar Market, Australian Journal of Agricultural and Resource Economics, 56(4), 2012.
- Pierre, G., and Sébastien, S., Market risk in commodity markets: a VAR approach, November- 2013, Retrieved from http://dial.academielouvain.be/downloader/ downloader.py?pid=boreal:4909anddatastream=PDF_01
- Pindyck, R. S., Volatility and Commodity Price Dynamics. Journal of Futures Markets, 24(11), 2004.
- Ramaswami, B., and Singh, J. B., Underdeveloped Spot Markets and Futures Trading: The Soya Oil Exchange in India, AgEcon Search: Home, 2007, Retrieved February 9,2013,fromhttp://ageconsearch.umn.edu/bitstream/7919/1/s p07si01.pdf
- Rao, D. T, Commodity Futures Market in India: Its Impact on Production and Prices, Indian Journal of Agricultural Economics, Vol. 64 Issue 3, 2009.

- Sehgal, S., Futures Trading and Spot Market Volatility: Evidence from Indian Commodity Markets. Asian Journal of Finance and Accounting, 4(2), 2012.
- Shiller, R.J., Co-movements in Stock Prices and Co-movements in Dividends, Journal of Finance, 44(3), 1989.
- Silber, W. L., The Economic Role of Financial Futures, 1985. Retrieved February 9, 2013, fromhttp://farmdoc.illinois.edu/irwin/archive/books/Futures-Economic/Futures-Economic_chapter2.pdf
- Silvapulle, P., and Moosa, I. A., The relationship between spot and futures prices: evidence from the crude oil market. Journal of Futures Markets, 19(2), 1999.
- Sinha, P., and Mathur, K., International Linkages of Agri-Processed and Energy commodities traded in India, 2013.
- Thornton, D. L., and Batten, D. S., Lag-length selection and tests of Granger causality between money and income, Journal of Money, credit and Banking, 1985.
- Vashishtha, V., and Kumar, S., Development of Financial Derivatives Market in India? A Case Study. International Research Journal of Finance and Economics, 37, 2010.
- Vidyamurthy G., Pairs Trading: Quantitative Methods and Analysis. John Wiley, 2004.
- Watkins, C., and McAleer, M., Related commodity markets and conditional correlations. Mathematics and Computers in Simulation, 2005.
- Yang, J., Bessler, D. A., and Leathan, D., Asset storability and price discovery in commodity futures market: A new look. Journal of Futures Markets, 2001.
- Yang, J., R Brian, B. and David, J., Futures Trading Activity and Commodity Cash Price Volatility., Journal of Business Finance Accounting, 32(1), 2005.