IMPACT OF MACRO ECONOMIC FACTORS ON COMMODITY FUTURES PRICE WITH REFERENCE TO AGRICULTURAL COMMODITIES IN INDIAN AND US MARKETS

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Abstract: *Financial markets play a vital role in the mobilization of financial resources for long term investments through financial intermediation. A well structured financial market mechanism is very important in integration of world capital markets.The commodity market in India is not as much developed as in the west but has been increasingly becoming popular and acceptable in India as the issues and challenges in this market is being understood and researched by the academicians and researchers. Present paper studies the macro economic factors like GDP, CPI and the research paper studies the factors affecting the prices of the commodities and inters- linkages between Indian commodities and in US markets. The paper concludes that macro economic factors significantly impact the futures price while wheat has got negative correlation between US and Indian market rest corn, soybean and maize are positively correlated.*

Key Words: *Commodity market, Futures, Integration of world capital markets, Macro economic factors*

1. INTRODUCTION

Indian economy has exhibited a high food inflation environment over the last decade with a high rise in the last there years. Several micro and macro economic factors are responsible for this inflation and major impacting variables are demand and supply factors, GDP and interest rates. The high volatility in agricultural commodity prices is of concern to the public and Government because such price movements hamper increased agricultural productivity and tend to increase the commodity prices. Agricultural commodity prices volatility also increases the uncertainty faced by farmers and agribusiness units. (Kargobo, 2005) study indicated that the fluctuations in money supply, exchange rates and trade policies have great impact on agricultural commodity prices, and real incomes. In particular, these commodity prices are considered as a true indicator of resource allocations and as such price fluctuations affect farmers' investment decisions, with serious effects on land utilization under cultivation, credit, and productivity.

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One of the solutions for facing price risk in this field is entering into derivatives markets and use the price discovery concept in most efficient way. In agricultural commodities Futures market plays crucial role in Indian context. Futures markets contribute in two important ways to the organization of economic activity: (i) they facilitate price discovery; and (ii) they offer a means of transferring risk or hedging. If we talk about agriculture commodities, instability of commodity prices has always been a major concern of the producers as well the consumers in agriculture dominated country like India. Farmers' direct exposure to price fluctuations, for instance, makes it too risky for them to invest in otherwise profitable activities. There are various ways to cope with this problem. Apart from increasing stability of the market through direct government intervention, various factors in the farm sector can better manage their activities in an environment of unstable prices through derivative markets. These markets serve a risk-shifting function, and can be used to lock-in prices instead of relying on uncertain price developments.

Derivatives like forwards, futures, options, swaps etc. are extensively used in many developed and developing countries in the world. The Chicago Mercantile Exchange; Chicago Board of Trade; New York Mercantile Exchange; International Petroleum Exchange, London; London Metal Exchange; London Futures and Options Exchange; "Marche a Terme International de France"; Sidney Futures Exchange; Singapore International Monetary Exchange; The Singapore Commodity Exchange; Kuala Lumpur Commodity Exchange; "Bolsa de Mercadorias & Futuros" (in Brazil), the Buenos Aires Grain Exchange, etc. are some of the leading commodity exchanges in the world engaged in trading of derivatives in commodities. Even in China during the last ten years of liberalization of internal market many exchanges were set up for exclusive trading in commodity futures and most of them like Shanghai Metals Exchange; China Commodity Futures Exchange; China Zhengzhou Commodity Exchange, Beijing Commodity Exchange, etc. have witnessed tremendous growth (UNCTAD, 1998). However, they have been utilized in a very limited scale in India. In spite of long history in derivatives segment India has become underdeveloped because of policy paralysis and government interventions in controlling prices. Forwards and futures trading have only been selectively introduced with strict controls. Free trade is restricted to only limited commodities and many agricultural commodities are still regulated by the ECA Act 1995 and futures contracts are restricted to certain categories under FCRA 1952.

Present study aims to empirically estimate the impact of macroeconomic factors on agricultural commodity products like Wheat, corn and soybean

2. LITERATURE REVIEW

Edurdo (1994) studied the macroeconomic determinants of commodity prices and concluded that demand and supply factors impact the commodity prices which

are evident in most of the economies. Sekhar (2012) studied agricultural market integration in India and found the exact and degree of integration among selected agricultural markets in India. The study also found that markets can play a more effective role if supplemented with more open policy initiatives.

Kargbo (2007) studied the effects of macroeconomic factors on southafrican agriculture and found that real exchange rates, interest rates, inflation and money supply (M3) shocks have significant and continuous impacts on agriculture output. Jeffrey Frankel (2010) study found that two macroeconomic fundamentals global output and inflation both have positive effects on real commodity prices. Bathla (2012) found that "Wheat" the agricultural commodity futures to be increasingly driven by an incentive structure based on its linkages with world price, exchange rate and other factors. One more study on wheat by Khalid Mushtaq (2011) found that real money supply, openness of economy, and the real exchange rate have a significant effect on real whet prices in the long run. According to Roshina Ali (2010) study changes in money supply and interest rates had significant relationships with agricultural income and exports. P.K Gupta (2013) study found that volatility of spot prices, market imperfections and irregularities are responsible for lifting WPI.

The studies on the commodities market are mostly from developed markets like US and UK and as far as studies on Indian commodity futures markets are concerned they are mainly limited to policy related issues and research on impact of macroeconomic indicators on agricultural commodity futures is very limited.. The Indian commodity futures markets have since then matured and have started playing a significant role in price discovery and risk management in the recent period, indicating the significant growth in volumes of trade. Trade and financial liberalization in the country and rest of the world may also have led to strong integration of Indian markets with their world counterparts. In this paper the past literatures are studied, the factors affecting futures prices of commodities are listed and as own research the effect of various macroeconomic factors on commodity prices in India and international markets is evaluated by using simple statistical tools like multiple regression, auto correlation etc. with special reference to agricultural commodities.

Many researchers have studied the integration of various commodity markets worldwide and some of them are especially in the context of emerging markets. Susmel and Engle (1994) study used ARCH model and found that the volatility spill over phenomenon is minimal between these markets which was just within an hour time. In the area of commodity futures, Booth and Ciner (1997) found the strong spill overs between CBOT and TGE and also revealed that corn futures have identical specifications in both these markets during 1993-1999 period. The study finally concluded that TGE has used CBT information which is taken from the opening price of TGE. Low, Muthuswamy, and Webb (1999) studied the future

prices for commodities like soybeans and sugar which are traded on TGE and MIFE with reference to arbitrage possibility in these exchanges. The study concluded that there is no proof of arbitrage activities in these two exchanges .It is evident from this research paper that North American auction markets are having quite opposite phenomenon in this regard. Lin and Tamvakis (2009)studied information transmission and price discovery process in crude oil and refined oil segment traded on NYMEX and London's IPE. They have done research information transmission mechanism by observing spill over effects and attempted to identify which market is leading in price discovery. They concluded that significant spill over effects do exist when both markets are trading simultaneously.

Chialin Chang, Michael McAleer and RoengchaiTansuchat(2010) used a rolling window approach and forecasted the 1 day ahead conditional correlations in crude oil segment in four major bench mark international oil markets namely Texas Intermediate (USA), Brent (North Sea), Dubai/Oman (Middle East), and Tapis (AsiaPacific),With the help of GARCH models. The paper concludes that there is evidence of volatility spill overs and effects on the conditional variances for most pairs of series. In addition, they concluded that the forecast conditional correlations between pairs of crude oil returns have both positive and negative trends. Holder, Pace and Tomas III(2002) studied market linkages between CBOT and TGE with respect to Corn and Soybean futures. Previous research in this area has explained price relationships between these related contracts. They analysed the corn and soybean futures trading volumes on TGE and KCE and concluded that these contracts show a complementary relationship rather than acting as substitutes. Xu and Fung (2002) have used bivariate asymmetric GARCH model and found that cross market information flows for gold , silver and platinum future contracts traded in U.S. and Japanese markets**.** They found that volatility spill over effects exists in both the markets and their impacts observed to be similar.

Kao and Wan (2009) used quadvariate VAR model and studied the price discovery process in spot and futures markets for Natural gas in U.S. and UK. Study concluded that all sport prices and futures price were driven by one common factor, moreover US futures market dominated over UK futures market and stood as the centre for price discovery. Fung, Leung and Xu (2003) study used VECM-GARCH model and stated that information spill over between US futures markets and the emerging commodity futures market in china for copper, soybean and wheat do exist. They concluded that for copper and soybean, US futures market played an important role in transferring information to Chinese market. In case of wheat which is highly subsidised and regulated in china, both markets were highly segmented. Hua and Chen (2007) used Johansen's co-integration test and error correction model in their research and studied international linkages of commodities like Aluminium, copper, soybean and wheat in Chinese markets and CBOT. They concluded that Aluminium, Copper and Soybean futures prices are

integrated with spot prices but did not find such co-integration for wheat spot and futures prices. They concluded that LME had a large impact on Shanghai Copper and Aluminium futures and CBOT had a large impact on Dalian Soybean futures. Li and Zhang (2009) used co-integration and Markov switching VECM model and studied the relationship between copper traded on Shanghai Futures Exchange and London Metal Exchange. They observed a long run relationship between the two copper futures markets and the impact of LME is stronger in SHFE than vice versa. The same authors in an earlier piece of work, Li and Zhang (2008) examined the time varying relationship using rolling correlations and rolling Granger Causality followed by co-integration test. The outcome of co-integration test shows that there is a long run relationship between SHFE and LME copper prices.

Kumar and Pandey (2011) studied nine commodities traded in Indian commodity exchange and the rest of the world. They employed Johansen's co-integration test, error correction mechanism model, granger causality test and decomposition technique to study return spill overs of the commodities across exchanges. They also used bivariate GARCH (BEKK) model to investigate volatility spill over across commodity markets. They concluded that there is presence of co-integration and returns are affected by International markets. On the other hand, there is high need to discuss the misconception of the phenomenon "Price discovery" the operational issues involved in testing the relationship between the futures and physical markets have been widely discussed by Rutten(2009). In majority of cases, researchers used Granger causality tests or Garbade-Silber frameworks to test whether futures prices cause physical market prices. The research outcome reveals that many of the commodity futures exchanges fail to provide an efficient hedge against the risk emanating from volatile prices of many farm products in which they carry out futures trading. The research conclusions from a statistical analysis of the data on price discovery in a sample of six commodities traded in four exchanges showed that the futures market in those commodities are not efficient , which means that the futures prices are not an unbiased predictor of the future ready rates. The difference between the futures prices and the future ready prices is a signal of inefficiency arising from the underdeveloped nature of the market. Many challenges faced by this segment are common across exchanges.

A quantitative analysis of the relationship between price return, volume, market depth and volatility on a sample of twelve markets in six commodity items shows that the market volume and depth are not significantly influenced by the return and volatility of futures as well as ready markets. The research outcome indicates that the futures and ready markets are not integrated. The price volatility in the ready markets does not have any influence on the market conditions in futures markets. The exchange specific problems like low volume and market depth, lack

of participation of trading members and irregular trading activities along with state intervention in many commodity markets are major challenges retarding the growth of futures market.

2.1. Research Gap

PankajSinha and KritikaMathur(2006) studied the linkages in price, return and volatility across the two markets i.e MCX and LME by taking five metals namely aluminum, copper, nickel, lead and Zinc during Nov Ist 2006 to Jan. 30th 2013.Using co-integration methodology, Error correction Mechanism Model, ARMA-GRACH model they concluded that there exists a significant linkage across the price, return and volatility of futures contracts traded on MCX and LME respectively. From the evidence of these research findings we can say that the imposition of Commodity Transaction Taxes on sellers at the time of trading of these five base metals on Indian Commodity exchanges would lead to a decline in their trading volume as traders and speculators would avoid the higher transaction cost of hedging by investing in International Exchanges instead of Indian Commodity exchanges. These migrations from Indian to the International markets would defy the intention of imposition of the tax, as the government expects to earn revenue from the tax, and this would also suppress the very purpose of price discovery in the commodity exchanges in India.

Mr. Mehta, Manager at NSE Treasury-Fixed income securities states that "The Union Budget 2013 in India proposed to levy a commodity transaction tax of 0.01% on transactions of commodities (gold, silver, base metals, processed agricultural commodities and crude oil) traded on Indian Commodity Exchanges. Commodity Transaction Tax (CTT) is similar to Securities Transaction Tax (STT), levied on buy or sale transactions of securities. CTT was proposed in the Union Budget 2008 but was not imposed on commodity transactions. But CTT is now levied on the seller in the trading of commodity futures. The Commodity Transaction Taxes on non-agricultural commodities (including base metals) and processed agricultural commodities traded on commodities exchanges in India was levied from July 1, 2013"

The imposition of the tax is likely to lead to movement of funds invested in Indian Commodity Exchanges to International Commodity Exchanges to escape from the increase in transaction costs in India. This makes it necessary to study commodity market, price discovery and the linkages of Indian Commodity Markets with the International Commodity Exchanges. Moreover there are various macro-economic factors like inflation, unemployment rate etc. which impact the prices and are responsible for the volatility in the prices.

3. NEED OF STUDY

This research paper is quite relevant in today's time when spreading awareness and knowledge about commodities market is becoming essential as receptivity is

increasing and this will help in a big way to understand various aspects of the commodities markets here in India and US.

3.1. Objectives of Research Paper

To study the significant impact of macroeconomic factors on commodity prices

To study the extent of dependence of commodity prices on 4 macroeconomic factors

Compare the extent of impact of the respective factors on Indian and US commodity prices

4. DATA AND METHODOLOGY

4.1. Sample and Data Collection

On the basis of the study done by researchers and academicians above, this research paper analyses 3 agricultural commodities, the impact of macro-economic factors on prices of these commodities when they are traded in India and abroad.

DATA SAMPLING

All the data taken is daily time series data and it is of secondary resource

Source of data: NCDEX, CBOT

Commodity	*Wheat*	*Corn*	*Soybean*
From	20/3/2013	10/1/2009	27/4/2009
To	19/8/2013	20/9/2010	29/8/2013

4.2. Selection of Commodities

Most studies on international linkages across futures markets of the same underlying suggest that there are stronger international market linkages in highly traded commodities as compared to relatively less traded commodities. Hence the commodities selected for analysis are:

- Wheat
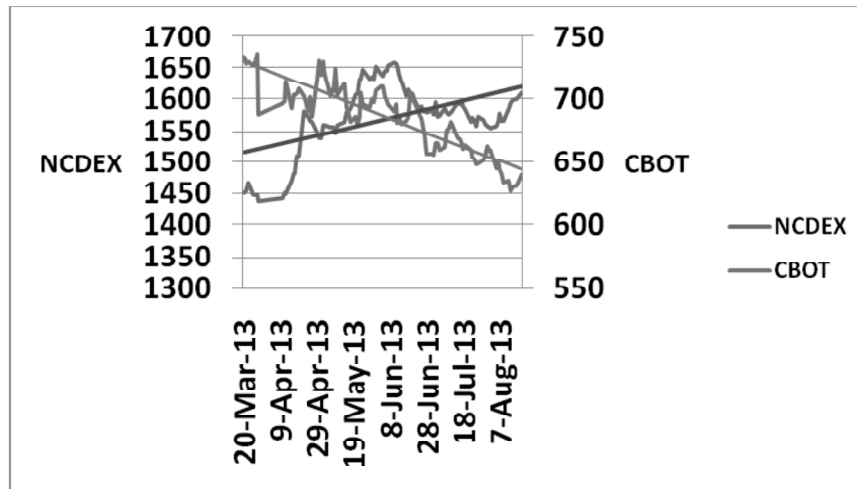- Corn
- Soybean

5. DATA ANALYSIS

TREND ANALYSIS & CORRELATION

Trend analysis of NCDEX vs. CBOT WHEAT Prices

Correlation: -0.2454

It can also be seen from the graph below that the trends are opposite. Hence the negative correlation indicates that there is an inverse relationship in the prices of Indian and US wheat futures. If US wheat futures price increases, Indian wheat futures price decreases and so on.
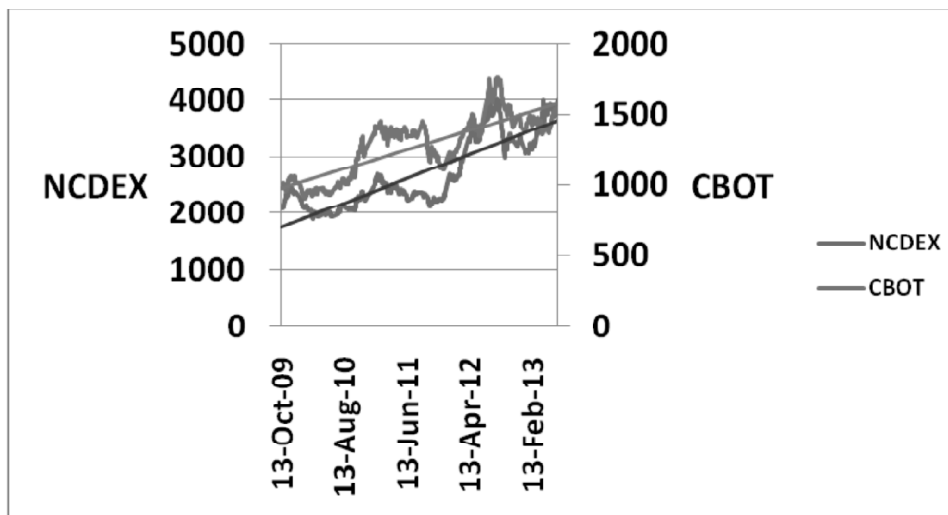
Figure 1

Trend analysis of NCDEX Vs. CBOT SOYBEAN Prices

Correlation: 0.79217 indicates a high positive correlation. The same can be observed in the trend analysis shown below.
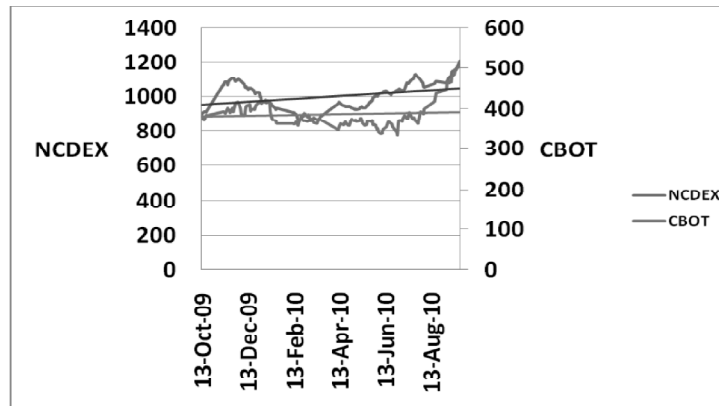
Figure 2

Trend analysis of NCDEX vs. CBOT CORN Prices

Correlation: 0.128 indicates a weak positive correlation. Same can be concluded from the trend analysis below.
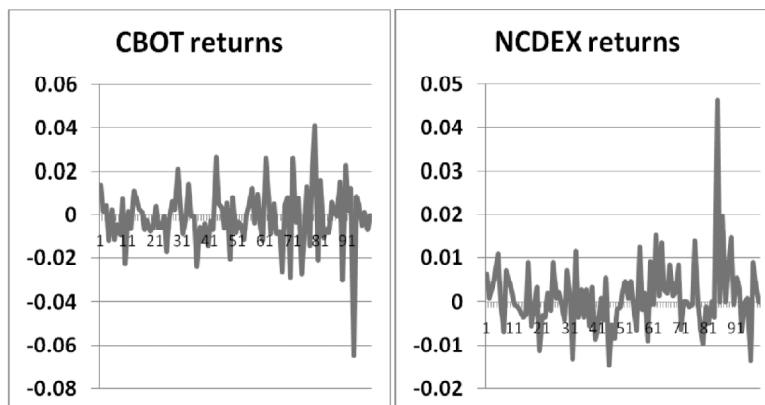
Figure 3

STATIONARY TEST: this test is considered due to the following reasons

- To avoid Autocorrelation of the model, this leads to wrong conclusion.
- In a regression model, if both sides of the equation consist of time series data, the model often obtains a high value of R square, even though the relationship is not meaningful.
- Thirdly, some financial time series present the random walk phenomenon.

It can be seen below that all the data sets are stationary in nature.

TEST FOR WHEAT

Figure 4

TEST FOR SOYBEAN

Figure 5
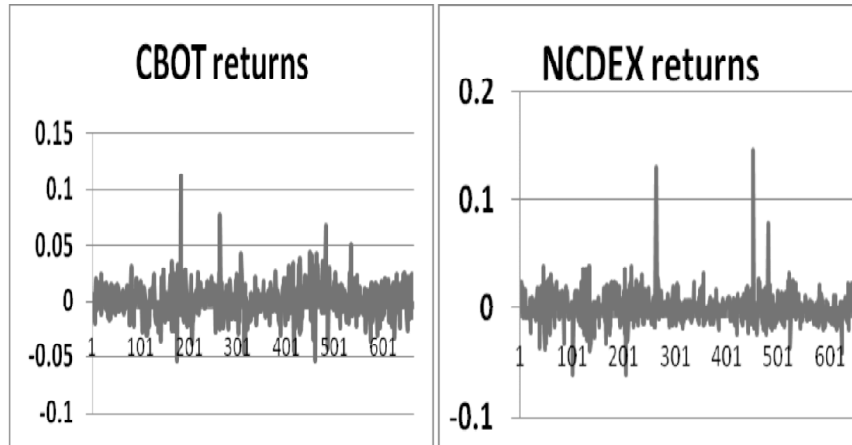
TEST FOR CORN

Figure 6
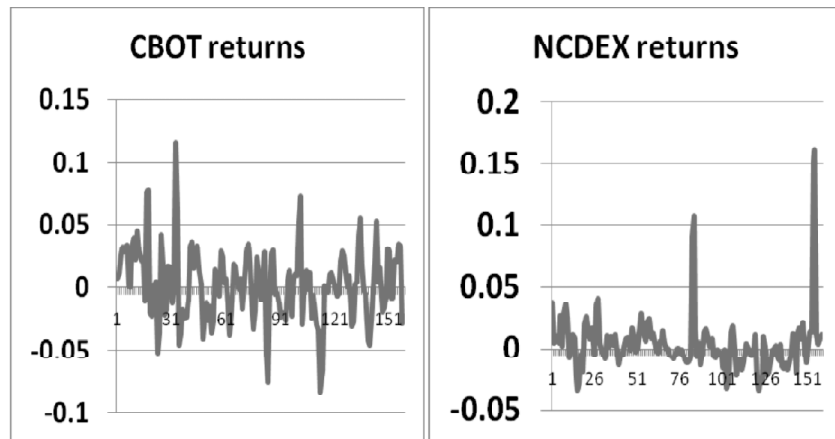
LONG-RUN RELATIONSHIP IN FUTURES PRICES TRADED ON INDIAN AND US COMMODITY FUTURES MARKETS

Statistical Analysis

After analysing the correlation between Indian and US future prices in commodity market it is important to understand various different domestic factors which decide future prices. We have selected some of the macroeconomic factors to analyse their effect on commodity prices.

Factors under consideration are as below;

- Exchange Rate
- Inflation
- For India – WPI
- For US – CPI
- Crude Oil Prices
- GDP
- Population Growth rate, unemployment rate, Index of Industrial Production, etc.

Note: Data related to futures prices have been collected on daily basis. As it wasn't feasible to capture relative data for factors like population growth rate, unemployment rate, Index of industrial production, these factors were excluded from the analysis.

Scatter plot: We have plotted XY chart to see relation between two variables (one dependent and one independent).

According to Andy Field Book on "Discovering Statistics using SPSS "R-squared is a statistical measure of how close the data are to the fitted regression line. The higher the R-squared, the better the model fits your data"

R squared value can range from 0-100% and 100% indicates that the model explains total variance of the data around its mean value

Table 1

Commodity		India		US	
		Line equation	R^2	*Line equation*	R^2
Soybean	Futures Prices vs WPI	y = -11.397x + 2746	0.0039	y = 59.658x + 1182.8	0.1565
	Futures Prices vs GDP	y = 0.3088x - 1456.6	0.03941	y = 0.2256x - 2013.4	0.4474
	Futures Prices vs Crude Oil	y = 0.5586x + 208.08	0.477	y = 10.451x + 370.75	0.3732
	Futures Prices vs Exchange Rate	y = 99.356x - 2271.3	0.5839	y = -57812x + 2461.2	0.2655
Maize	Futures Prices vs WPI	y = 9.9189x + 893.34	0.2926	y = 55.938x + 498.07	0.3122
	Futures Prices vs GDP	y = 9.9189x + 893.34	0.2926	y = 0.118x - 1129.2	0.2776
	Futures Prices vs Crude Oil	y = 0.0569x + 742.32	0.0118	y = 6.5165x + 25.046	0.3293
	Futures Prices vs Exchange Rate	y = -21.32x + 1961.9	0.1724	y = -20102x + 1005.1	0.0728
Wheat	Futures Prices vs CPI	y = -5.422x + 1606.6	0.0078	y = 25.827x + 637.59	0.0907
	Futures Prices vs GDP	y = 0.0208x + 1244.1	0.0205	y = 0.0718x - 367.2	0.14
	Futures Prices vs Crude Oil	y = 0.0199x + 1463.8	0.0261	y = 3.2164x + 400.95	0.1093
	Futures Prices vs Exchange Rate	y = 3.5312x + 1366.5	0.0546	y = -17340x + 1035.1	0.0738

Table 2

"Results for Wheat"

| INDIAN SCENARIO | US SCENARIO |

ANOVA Results						
P value	0.003			0.00		
Decision	Model is fit.			Model is fit.		
Co efficient of determination	0.166			0.410		
Regression output						
Variables	P value	Significance	Coefficient	P value	Significance	Coefficient
WPI/CPI	0.016	Yes	39.1510	.0002	Yes	12.7466
GDP	0.04	Yes	-0.0705	0.00	Yes	0.0726
Crude Oil	0.04	Yes	0.0000 2799	0.00	Yes	0.0434
Exchange rate	0.04	Yes	18.8417	0.00	Yes	2524.73

Observations for commodity Wheat in Indian and US commodity future market:

1. Bowerman, B. L. (19990), Stevens, J. (1992) cited in their papers about the model fit for social sciences and in present study Since p value for both the scenarios is less than 0.05, we say that null hypothesis is rejected (B=0) and relationship exist between mentioned factors and Future prices. And model is fit to proceed further analysis.

2. 16.6% and 41% of variation in future prices is explained by domestic macroeconomic factors mentioned in Indian and US commodity market.

3. All the factors are significant to explain the changes in future prices.

4. Coefficient explains % change in future prices by 1% change in respective factors. For example: For Indian commodity, 1% change in WPI will lead to 39.1510% change in Commodity future prices.

Observations for commodity Maize in Indian and US commodity future market:

1. Since p value for both the scenarios is less than 0.05, we say that null hypothesis is rejected (B=0) and relationship exist between mentioned factors and Future prices. Thus, the model is fit for further analysis.

2. 34.2% and 47.4% of variation in future prices is explained by domestic macroeconomic factors mentioned in Indian and US commodity market.

3. All the factors are significant to explain the changes in future prices except exchange rate.

Table 3

Results for Maize

| INDIAN SCENARIO | | | | US SCENARIO | | |

ANOVA Results						
P value	0.00			0.00		
Decision	Model is fit.			Model is fit.		
Co efficient of determination	0.342			0.474		
Regression output						
Variables	P value	Significance	Coefficient	P value	Significance	Coefficient
WPI/CPI	0.00	Yes	18.7147	.0000	Yes	24.0145
GDP	0.00	Yes	-0.0581	0.00	Yes	0.1750
Crude Oil	0.03	Yes	0.0453	0.11	No	0.6770
Exchange rate	0.20	No	4.2616	0.00	No	29,499

Table 4

Results for Soy Bean

| INDIAN SCENARIO | | | | US SCENARIO | | |

ANOVA Results						
P value	0.00			0.00		
Decision	Model is fit.			Model is fit.		
Co efficient of determination	0.651			0.514		
Regression output						
Variables	P value	Significance	Coefficient	P value	Significance	Coefficient
WPI/CPI	.0002	Yes	17.2464	.0000	Yes	14.9358
GDP	0.00	Yes	0.0891	0.000	Yes	0.1637
Crude Oil	0.00	Yes	0.2427	0.000	Yes	3.8374
Exchange rate	0.00	Yes	55.0598	0.515	No	-3169.17

Observations for commodity Soy bean in Indian and US commodity future market:

1. Since p value for both the scenarios is less than 0.05, we say that null hypothesis is rejected (B=0) and relationship exist between mentioned factors and Future prices. Model is fit.

2. 65.1% and 51.4% of variation in future prices is explained by domestic macroeconomic factors mentioned in Indian and US commodity market. Since for both cases, coefficient of determination is more than 50%, it is more reliable model.

3. All the factors are significant to explain the changes in future prices except exchange rate for US.

6. CONCLUSION

To summarize, most studies on international linkages across futures markets of the same underlying suggest that there are stronger international market linkages. The strength of macroeconomic factors on the commodity prices can be is also explored on futures prices more in detail when more complex statistical tools like GARCH etc. is used. The macro-economic factors do impact the prices but whether the prices also mutually effect is a question to research further. The commodities market holds huge potential and more study done on it will only make it more understandable, efficient and developed

6.1. Limitations of the Study

(1) The research was conducted using time series data according to the availability and continuity of data

(2) The sample is chosen based on frequency, importance, usage in both Indian and US markets

(3) There could be other influencing factors also apart from chosen factors which are considered as exceptional cases

7. SCOPE FOR FUTURE RESEARCH

In current scenario there are many more factors that affect the futures price of the commodities and there is scope for investigating the linkages of Indian commodity futures markets with the counterparts elsewhere in the world trading the futures contracts on the same underlying as the relationship between the Indian and world commodity futures markets has also not been explored adequately. With the help of advance econometrics techniques researchers can find out further relationships in this area and contribute in the integration of world capital markets.

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