A Study of the Spot and Futures Market of Agricultural Commodities

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Introduction

Commodity Market has been in existence for a time immemorial. Its existence dates back to the human civilization. Like the human civilization going through the periods of changes, the commodity market has also undergone through the periods of changes. One of the important features of Indian commodity market is that organised and unorganised markets exist together even today. It is unlikely that any amount of reforms can displace the unorganised markets. What is really happening in the Indian commodity market is that there are organised markets for the manufactured goods and the vast majority of agricultural commodities still depend on unorganised markets. In India commodity market is organised in two broad ways; one is the wholesale market and the other is the retail market. The wholesale market consisted of whole sellers who specialise in buying goods from the farmers and manufacturers and selling them to retailers. This market is still the most influential market inspite of the presence of a number of agencies which want to eliminate them. Wholesellers/distributors buy the goods/commodities from the producers and sell them to the retailers who, in turn, sell them to the consumers. Therefore, it is the retailers who have the direct knowledge of the consumers. The retailers act as the intermediaries to buy and sell the goods. Although with the establishment of the large retail chains, the channel of whole sellers has been disturbed, they continue to influence the supply and the price of the agricultural commodities in India. The establishment of the commodity exchanges and the entry of corporate giants into the retail market has revolutionised the supply chain of the Indian commodities market. However, it is to be noted that the whole sellers still exist as they cannot be eliminated from all the commodity markets. The improvement in the communication, net working, and transportation facilities has leaded the transition where the major organised retail chains have adopted the market where the seller directly interacts with the farmers and producers, buys the commodities from them and sells them to the ultimate consumers. This model is still evolving and we have to see how far it will go to replace the institution of whole sellers. The commencement of screen based trading in the commodities market in organised market whose trading terminals are available throughout the country in all the stock brokers offices has also changed the structure of the organised commodity market in India.

Over a period of time, efforts have been made by the governments to establish organised markets in the commodities market. Although a lot of progress has been made in this direction, India continues to have unorganised markets. Therefore, any systematic effort to study the Indian commodity market has to take into consideration the presence of both these segments. The study of commodity market can be complete only if both these segments of the markets are studied. Studying both organised and unorganised commodity market requires a lot of time and effort. An attempt is made in this study to analyse a part of the organised market. Commodity market, like any other market, has different segments. In India we have the spot and futures markets in the organised section. While the spot market serves the purpose of all the producers, suppliers, distributors and consumers, the futures market enables all these categories of the commodity market to plan and organise their activities. Therefore, it would be necessary to understand the characteristics of the Indian commodity futures market.

The commodity market in India, like in any other country, serves the basic needs of the citizens of the country.

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Therefore, any attempt to analyse the features of the commodity market will benefit the citizens of the country. Commodity market has different product categories. Analysing the features of these product categories takes time and effort. Further, in a single paper of this type, it may not be possible to study all these product categories. Therefore, I select only a specific category of the commodity for analysis. We can analyse the category like the agriculture, energy, metals etc. Since agriculture sector has been backbone of this country as a large section of the population still depends on this segment for their employment and livelihood, I chose to analyse the features of the organised agriculture market in selected commodities. I chose to analyse the spot and futures prices of the agriculture commodities for which the data is available in the National Commodity Derivatives Exchange of India Limited (NCDEX). Major agriculture products are traded on this exchange and it has a dominant presence in the agriculture commodity futures market in India. Therefore, this exchange has been chosen to collect the data. The major organised derivatives exchanges in India host the spot and futures prices on their websites, although only the futures prices are the prices transacted on the exchanges. The spot prices of the commodities are the prices prevailing in the major markets in different parts of the country. Therefore, the analysis of the spot prices is the analysis of the commodity prices in major markets of the country and the analysis of the futures prices is the analysis of the derivative prices on the specific exchange. However, it is to be noted that no derivatives exchange can exist without the presence of the spot market. Therefore, the analysis of the futures prices on any exchange would throw light on the futuristic view of the Indian commodity market while the analysis of the spot market would through light on the characteristic features of the commodities as they are traded on major markets. This paper is an attempt to analyse the features of part of the organised commodity market in the spot and futures segment. The paper is organised in five sections. The second section deals with the literature, the third section deals with the sample, data and methodology, the fourth section presents the results and discussions and the last section presents the conclusions of the study.

Literature Review

Like in any field of knowledge the researchers probing the different aspects of the market, the researchers in finance and economics have worked on various issues relating to agricultural commodities market and the stock market. Some of these studies are important as they have examined the prices of the organised exchanges for understanding the different features. This section presents the review of some of the studies in this and the related areas.

O'Hara (1984) analyzeed the economic role of commodity bonds by examining the nature of the demand for these securities. The result show that while commodity bonds protect against relative price changes, they do so by introducing variability into the future real income stream. Frankel (1986) found thatthe monetary policy has an effect on real agricultural commodity prices even though they are flexible, because the prices of other goods are sticky. Jabara & Schwartz (1987) found that agricultural commodity prices may not be as flexible as commonly perceived. Rather, commodity prices may respond asymmetrically to an exchange rate change under certain circumstances. Barnhart (1989) analyzed the immediate reaction of a representative sample of commodity prices and two T-bill yields to the unanticipated components of thirteen macroeconomic announcements. The results provide strong support for the policy anticipations hypothesis and against the inflationary expectations hypothesis. Golec (1993) showed that commodity trading advisors' (CTAs) investment performance may be partially explained by their incentive compensation contracts. Results indicated that incentive parameters are positively related to return means and standard deviations. Vercammen (1995) used standard comparative statistics to show that options are relatively more valuable for reducing the skewness of a nonsymmetric price distribution. Depending on the direction of the skewness and the underlying price

expectations, hedgers may write options as well as purchase them. Serena (1996) examined the nonlinearity in the price data of commodity markets and tested the theory in the context of threshold autoregressive models under the assumption that shocks to harvest are i.i.d. The results show that the degree of persistence found in the stockout regime is rather strong; the autoregressive coefficient exceeds 0.8 in many cases. Given that the data exhibit such high level of serial correlation, a model which constrains the stockout regime to have zero persistence is clearly inappropriate. Bjornson & Carter (1997) studied the conditional risk and return characteristics of commodities. They found that expected returns to commodities are lower during times of high interest rates, expected inflation, and economic growth. This suggests that commodities provide a natural hedge against business cycles. Geczy, eet al. (1997) examined the use of currency derivatives in order to differentiate among existing theories of hedging behavior. They conclude that firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives. Clancy (1998) concluded that the commodity chain analysis is useful for examining the political economy of tourism, especially in highlighting power and exchange relationships and it must be broadened to 'account' fully for the unique organization of the global tourism industry. Rajgopal (1999) provided evidence on the informativeness of commodity price risk measures required by the Securities and Exchange Commission's new market risk disclosure rules (SEC 1997). It was found that proxies for the tabular and the sensitivity analysis format are significantly associated with O&G firms' stock return sensitivities to oil and gas price movements.

Hentschel& Kothari (2001) investigated whether firms systematically reduce or increase their riskiness with derivatives. They found that many firms manage their exposures with large derivatives positions. They concluded that compared to firms that do not use financial derivatives, firms that use derivatives display few, if any, measurable differences in risk that are associated with the use of derivatives. Lence & Hayes (2002) found that U.S. grain market volatility in 1995-2000 was due to fundamental market forces and because of Federal Agricultural Improvement and Reform (FAIR) Act of 1996. Giot & Laurentb (2003) examined Value-at-Risk models relevant for commodity traders who have long and short trading positions in commodity markets and found that skewed ARCH model delivers good results and its estimation does not require non-linear optimization procedures. He & Westerhoff (2005) found that price limiters influence the price dynamics in an intricate way and may cause volatility clustering. Ai, et al. (2006) addressed the question of whether the observed correlation in the prices of commodities is "excessive"? They fit a partial equilibrium model that controls for commodity-factor correlations. The result suggest that the majority of the comovements among commodities with high price correlation, and all of the comovements among those that are marginally correlated. Miffre & Rallis (2007) tested for the presence of short-term continuation and long-term reversal in commodity futures prices. A closer analysis of the constituents of the long- short portfolios reveals that the momentum strategies buy backwardated contracts and sell contangoed contracts. Pieroni & Ricciarelli (2008) estimated the model for the world copper market by taking into account both spot price and convenience yield equations. They fournd that the estimated models are statistically robust and economically coherent with the theory, even though the patterns of the inventory accumulation process show high sensitivity to the uncertainty about worldwide economic conditions. Sieczka & Holyst (2009) analyzed dependencies in commodity markets, investigating correlations of future contracts for commodities. They constructed a minimal spanning tree based on the correlation matrix. The tree provides evidence for sector clusterization of investigated contracts. Westerhoff & Wieland (2010) found that the impact of speculators on price dynamics is non-trivial: depending on the market structure, speculative transactions may either be beneficial or harmful for market stability. Nazlioglu

& Soytas (2011) supported the neutrality of agricultural commodity markets in Turkey to both direct and indirect effects of oil price changes. Arango & Moxnes (2012) examined market behavior in a series of cobweb-like experiments. The experiment indicates that the basic cobweb design is not well suited to test endogenous theories of cyclicality in commodity markets. Viviana & Wohar (2012) found that commodity volatility persistence remains very high for many commodity returns even after structural breaks are accounted for. Creti, et al. (2013) showed that the correlations between commodity and stock markets evolve through time and are highly volatile, particularly since the 2007-2008 financial crisis. Liz & Rost (2013) studied the global behavior of the price dynamics in a commodity market governed by a balance between demand and supply. They opined that dependence of demand on price is considered instantaneous, the supply term contains a delay, leading to a delay-differential equation.

The review of the literature indicates that although a number of researchers have examined the commodity market taking the developed countries, the studies on emerging market economies are rare and the issues relating to the relationship between spot and futures prices, future prices and the index prices and the characteristics of the commodities are also rare. Therefore, this study is undertaken to focus on the Indian commodities market and to study the characteristics of the commodity market and to examine the relationships of spot with futures, futures with index etc.

Data, Sample and Methodology

Since the purpose of this study is analyse the characteristics like the returns, risks and the relationship between spot and futures market of the selected agricultural market, the data for the study is collected from the NCDEX website. The spot prices of the agriculture commodities are available from different time periods in different markets and the futures prices of the commodities are available for those commodities which are permitted to be traded on the derivatives segments of the organised market. The commodity futures prices are collected from the year 2003, the year in which the futures trading started, and collected upto December 2011, the latest period for which the data was available at the time of collecting this data for the study. As already discussed in the introduction section, the sample for the study consists of the agriculture commodities for which the spot and futures prices are available in the NCDEX website.

Different methodologies can be used for analysing the characteristics of the commodity market. I use the descriptive statistics, regression of index futures on the agriculture commodity futures and the influence of agriculture commodity futures on spot and vice versa for this study. In the regression analysis involving commodity and index futures return, I take the agriculture commodity futures returns as the dependent variable and the agriculture futures index returns as the independent variable. Since the regression output gives a large number of results, I report only the most essential statistics that are necessary for analysis and the understanding of the relationship between the chosen variables. The reported statistics are the intercept, the p-value corresponding to intercept, the regression (X) co-efficient, the p-value corresponding to the X-co-efficient, the adjusted R square value (Adj R2) for each of the regressions and their corresponding test statistic probabilities (p-values). I also use the vector auto-regressive models for examining the dependence of the spot on its own lags and the lags of the futures and; dependences of the futures on its own lags and the lags of the spots. The appropriate model equations are given in the results section of the paper.

Commodity market Results and Analysis

The data collected for the selected commodities has been subjected various statistical computations. The descriptive statistics of the selected commodities is presented in Table 1, the regression results of commodity and the index futures results are presented in Table 2, and the regression results of the futures on the spot returns and the spot on the futures returns are presented in table 3.

Table 1a: Summary Statistics of the Returns on Agriculture Commodity Futures.

M-Rank	COMTY NAME	SUM	N	MEAN	STDEV	SD-Rank	Q 1	Q 3	P 10	P 90
1	Coriander	0.909	1025	0.00089	0.03957	3	0.0104	-0.0068	0.0222	-0.0234
2	Potato	0.461	764	0.00060	0.08384	1	0.0256	-0.0227	0.0572	-0.0611
3	Castor seed	0.410	796	0.00052	0.01500	18	0.0063	-0.0054	0.0154	-0.0134
4	Chilly	0.785	1844	0.00043	0.02660	6	0.0096	-0.0093	0.0241	-0.0226
5	Chana	0.698	1791	0.00039	0.01771	13	0.0079	-0.0075	0.0168	-0.0156
6	Mustard seed	0.483	1684	0.00029	0.01302	21	0.0057	-0.0048	0.0121	-0.0112
7	Barley	0.377	1532	0.00025	0.01733	14	0.0055	-0.0062	0.0153	-0.0136
8	Wheat	0.304	1431	0.00021	0.01335	20	0.0039	-0.0041	0.0103	-0.0094
9	Cotton seed oilcake	-0.157	738	-0.00021	0.04999	2	0.0180	-0.0199	0.0496	-0.0492
10	Soya bean	-0.595	1966	-0.00030	0.01480	19	0.0063	-0.0068	0.0138	-0.0137
11	Ref Soya Oil	-0.579	1792	-0.00032	0.01175	22	0.0052	-0.0054	0.0095	-0.0112
12	Jeera	-0.659	1966	-0.00034	0.02638	7	0.0096	-0.0089	0.0203	-0.0220
13	Turmeric	-0.663	1966	-0.00034	0.02940	5	0.0094	-0.0107	0.0231	-0.0280
14	Maize Feed	-0.221	488	-0.00045	0.01501	17	0.0046	-0.0044	0.0136	-0.0137
15	Maize	-0.817	1581	-0.00052	0.01668	15	0.0053	-0.0055	0.0118	-0.0137
16	Kapas	-0.862	1430	-0.00060	0.01659	16	0.0047	-0.0062	0.0122	-0.0136
17	Shankar kapas	-0.475	734	-0.00065	0.03210	4	0.0030	-0.0026	0.0088	-0.0093
18	Guar seed	-1.341	1966	-0.00068	0.01961	11	0.0082	-0.0095	0.0194	-0.0214
19	Gur	-0.942	1272	-0.00074	0.01792	12	0.0050	-0.0055	0.0127	-0.0130
20	Sugar M Grade	-0.803	997	-0.00081	0.01978	9	0.0052	-0.0056	0.0121	-0.0135
21	Guar Gum	-1.615	1966	-0.00082	0.01974	10	0.0080	-0.0096	0.0205	-0.0227
22	Pepper	-1.746	1966	-0.00089	0.02313	8	0.0083	-0.0101	0.0207	-0.0233

Notes:

1. The commodities are arranged in the order of mean returns from the highest to the lowest. The decimal values are reduced to either five or four. Only those commodities which have more than 450 observations are reported in the table and taken for analysis.
2. M-Rank is the rank of the commodities as per the mean returns from the highest to the lowest; COMTY NAME is the Commodity name; STDEV is the standard deviation of the returns; SD-Rank is the rank of the commodities per the standard deviations when commodities are arranged in the order of the highest to the lowest values; Q 1 is the quartile 1; Q 3 is the quartile 3; P1 is the percentile 10; P 90 is the percentile 90.
3. The correlation statistics between mean and standard deviation are: N=22, Correlation Value = 0.328311, t = 1.554, degrees of freedom = 20, Directional Probability = 0.067884, Non-Directional Probability = 0.135678.

Table 1a shows some of the important descriptive statistics like the sum, number of observations (n), mean returns, standard deviation, first quartile, third quartile, tenth and ninetieth percentiles. Since these show of the important characteristics of the commodities, I have chosen these statistical measures. For the purpose of analysis, the commodities are sorted based on the mean and standard deviations of the returns series. The table shows that coriander, potato, castor seed, chilly and chana have given the highest returns and; pepper, gur gum, sugar, gur, gurseed have given the lowest returns. The returns are the daily average returns and do not necessarily belong to the same periods (in terms of days) as the number of observations for each commodities is different. One of the important features that we can notice in the return patterns of these commodities is that only eight of the 22 commodities have positive returns and the remaining 14 have negative returns. Therefore, majority of the agriculture commodities futures have yielded negative returns for the investors. The utility of this measure is that it shows how much return each commodities would yield and which of these have the highest and the lowest returns. Logically the commodity which has the highest returns is the one that is preferred for investment by the investors and the one which has the lowest returns is the one that is least preferred by the investors. Apart from the returns, investors would also like to consider risk involved in holding the commodities. Therefore, I consider the standard deviation of the returns to know whether the commodities which have the highest returns also have the highest risks. When the commodities are sorted by standard deviation, the ranking shows that potato, cotton seed oil cake, coriander, shankar kapas, turmeric have the highest risk and; refined soya oil, mustarseed, wheat, soya bean, and castor seed have the lowest risk. I then compare whether the top five return yielding commodities also have the highest risk. The comparison shows that of the highest returns yielding commodities only two commodities, potato and coriander, are in the top five risk bearing securities. The comparison of the lowest returns and the risk shows that none of the bottom five returns yielding commodities are in the bottom five risk bearing commodities. The risk and returns pattern seem to indicate that some of the commodities which have highest returns do have highest risk and those with lowest returns do not have the lowest risk. Therefore, I subject the returns and risk relationship to correlation test to check whether the returns and risk have significant positive correlation. The value of correlation is 0.328311 and the t-test for the significance of correlation indicates that it is not statistically significant at five percent level as the computed probability is 0.067884 when directional probability is taken and 0.135678 when non-directional probability is taken. Therefore, I conclude that there is no significant positive correlation between returns and risks of agricultural commodities in the Indian market. However, the correlation value does indicate that there is a positive correlation between returns and risks.

Some of the other measures of summary statistics reported are the positional measures. The quartiles divide the returns into four equal parts and percentiles into 100 parts. I report only two quartile and percentile values here. The first quartile value and tenth percentile values show that all the commodities have positive returns and third quartile and ninetieth percentile values show that all the commodities have negative returns. The first and third quartile values for coriander are Rs 0.01041 and Rs -0.00683, respectively. This shows that coriander yields more than Rs. 0.01041 returns for 25 percent of the days and less than this value for 75 percent of the days and; this commodity yields more than Rs. -0.00683 returns for 75 percent of the days and less than -0.00683 returns for 25 percent of the days. Similar analysis is true for the first and the third quartile values of other commodities which are reported in Table 1. The tenth and ninetieth percentile returns of Chana are Rs 0.007917 and Rs. -0.01561, respectively. This shows that chana yields more than Rs. 0.007917 returns for 25 percent of the days and less than this value for 75 percent of the days and; this commodity yields more than Rs. -0.01561 returns for 90 percent of the days and less than this value for 10

percent of the days. The analysis of the tenth and ninetieth percentile values of other commodities, reported in Table 1, is identical to chana and therefore, the analysis of every commodity is omitted here for want of space and to avoid monotony. However, the analysis can be done, on similar lines as done for the sample commodities here, with the help of the summary measures relating to quartiles and percentiles reported in Table 1.

Table 1b: Summary Statistics of the Returns on Selected Agriculture Commodity Futures.

Rank	COMMODITY NAME	MEDIAN	MODE	MAX	MIN	RANGE	SKEWNESS	KURTOSIS
1	Shankar kapas	0	0	0.1675	-0.8032	0.9707	-21.2001	535.9559
2	Coriander	0	0	0.6620	-0.8588	1.5208	-5.1043	295.0601
3	Pepper	0	0	0.1886	-0.4415	0.6300	-5.0518	104.3474
4	Chana	0	0	0.1614	-0.2903	0.4517	-2.7103	52.1053
5	Guar Gum	-0.00022	0	0.1515	-0.3220	0.4735	-2.0012	38.1305
6	Gur	0	0	0.2102	-0.2415	0.4517	-1.9050	54.7335
7	Barley	0	0	0.2529	-0.3098	0.5627	-1.8850	100.2846
8	Wheat	0	0	0.1271	-0.1816	0.3087	-1.4718	41.6132
9	Mustard seed	0.000123	0	0.1178	-0.1437	0.2614	-1.4102	30.1341
10	Maize	0	0	0.2105	-0.2513	0.4618	-1.2084	57.2528
11	Sugar M Grade	0	0	0.2875	-0.3106	0.5981	-1.1028	110.5911
12	Maize Feed	0	0	0.1335	-0.1357	0.2691	-0.5165	27.0595
13	Guar seed	0	0	0.2361	-0.2482	0.4843	-0.3680	26.9338
14	castor seed	0	0	0.1377	-0.1240	0.2617	-0.2432	17.2218
15	Chilly	0	0	0.2958	-0.3651	0.6610	-0.0793	38.0825
16	Cotton seed oilcake	0	0	0.2050	-0.2056	0.4106	0.0197	3.8456
17	Potato	0	0	0.6764	-0.4952	1.1715	0.3498	16.6841
18	Jeera	0.00019	0	0.5486	-0.3736	0.9221	1.7844	138.6350
19	Soya bean	0	0	0.2658	-0.1500	0.4158	2.1683	62.7596
20	Turmeric	0	0	0.4217	-0.4072	0.8289	2.8368	73.6442
21	Kapas	0	0	0.3508	-0.1987	0.5496	4.5607	164.1351
22	Ref Soya Oil	0	0	0.2690	-0.0980	0.3670	6.2612	157.3205

Table 1b shows that the median and mode values are either zero or closer to zero for all the commodities. Median indicates that for about 50 percent of the days on which the commodity futures are traded the returns almost equal to zero and the value which occurs maximum number of times is also zero. The indication of this is that the investors have not earned any returns on these commodities for more than 50 percent of the days. The maximum and minimum values indicate the maximum returns and the minimum returns, respectively, that these commodities have given on any day during the period considered for analysis. All the commodities have positive returns when the maximum values are considered and negative returns when the minimum returns are considered. Potato and coriander have the maximum returns of all the commodities. The values of range in the table are more than the maximum returns. This is because the minimum value is negative and when the difference between the maximum and minimum values is taken, the result is the range. Higher value of the range show that there is a large gap between the maximum and minimum values. A large gap indicates the high risk. For the commodities I have chosen, coriander, potato, Shankar

kapas, jeera and turmeric have the highest risk in that sequence. Skewness measure shows the ways returns of the commodities are distributed. If the value is zero it indicates that there is symmetry in the returns distribution, if it is positive it indicates that the returns are positively skewed and if it is negative, the returns are negatively skewed. The high values of skewness are an indication of the lack of symmetry in the daily returns distribution. The values in the table show that Shankar kapas, pepper, coriander, chana, guar gum have very high skewness (negative) indicating the returns are negative on more number of days. Cotton seed, potato, jeera, soya bean, turmeric, kapas and refined soya oil have positive skewness. These commodities have given positive returns on more number of days. The values of kurtosis show the relative bulginess of the returns distribution curve. All the kurtosis values are very high which indicate that the returns of the commodities deviate from the normal distribution. The returns patterns of all the commodities indicate long height of the curve which shows that the returns are leptokurtic. Leptokurtic values show that most of the returns are concentrated around some value which, in the case of the agricultural commodities is zero.

Relationship between commodity Futures Returns and the Agriculture Index Futures Returns:

One of the important determinants of the returns of the commodities/securities in any organised market is the market index. Since the index is constructed to reflect the market wide movement of the prices of the listed securities, it is considered to be an important indicator of the individual security returns. Therefore, I propose to analyse the how far the agriculture index influences the returns of the individual commodity returns. Table 2 contains the summary of the regression results of the commodity market for the selected commodities. In this analysis, I chose commodity futures prices returns as the dependent variable and agriculture index futures prices returns (index, for brevity) as the independent variable. The following is the regression equation used for analysing the relationship.

$$R_i = \alpha_i + \beta_i \, Rm + \varepsilon_i$$

In the above equation, R_i is the return on commodity i futures, α_i is the intercept of the regression equation, β_i is the regression co-efficient which reflects the strength of the relationship between the individual commodity futures returns and the agriculture market futures Index returns, Rm is the returns on the agriculture commodity futures index , ε_i is the error term of the regression equation of the commodity i futures on market index futures. The error term has the usual assumptions of the normal distribution. The analysis of these results is presented after the table.

Table 2: Regression Results of Commodity Futures Returns With Agriculture Commodity Index Futures Returns as the Independent Variable.

	Period		Intercept		X-Agri Index		Regression Fit	
Commodity	**From**	**To**	***Coeffici ents***	***P-value***	***Coeff icient s***	***P-valu e***	**Adj R2**	***Significa nce F***
Wheat	3/30/2011	12/20/2011	-0.0003	0.6106	0.2725	0.0003	0.0526	0.0003
	7/6/2010	3/29/2011	-0.0005	0.2757	0.1291	0.1122	0.0068	0.1122
	10/9/2009	7/5/2010	0.0000	0.9880	0.0541	0.6994	-0.0038	0.6994
	4/16/2007	10/8/2009	0.0004	0.5694	0.6240	0.0000	0.2447	0.0000
	7/19/2006	4/13/2007	0.0007	0.5491	0.2107	0.2338	0.0019	0.2338
	9/19/2005	7/18/2006	-0.0001	0.9476	0.4343	0.0191	0.0200	0.0191
	No. + ve/<0.05		2	0	6	3	5	3
	No. - ve/>0.05		4	6	0	3	1	3
	Total		6	6	6	6	6	6
	P + ve/<0.05		33.33	0.00	100.00	50.00	83.33	50.00
	P - ve/>0.05		66.67	100.00	0.00	50.00	16.67	50.00

Continued...

Turmeric	3/30/2011	12/20/2011	-0.0008	0.5391	-1.0888	0.0000	0.4344	0.0000
	7/6/2010	3/29/2011	-0.0010	0.4500	-0.0584	0.4324	-0.0017	0.4324
	10/9/2009	7/5/2010	0.0012	0.3361	0.3890	0.0432	0.0138	0.0432
	1/10/2009	10/8/2009	-0.0037	0.0080	0.0892	0.3840	-0.0011	0.3840
	4/17/2008	1/9/2009	0.0007	0.6619	0.9615	0.0000	0.5639	0.0000
	7/20/2007	4/16/2008	-0.0024	0.2427	1.1070	0.0000	0.4288	0.0000
	10/24/2006	7/19/2007	-0.0008	0.7438	-0.2541	0.6163	-0.0034	0.6163
	1/18/2006	10/23/2006	0.0019	0.3804	-0.6854	0.0611	0.0112	0.0611
	No. + ve/<0.05		3	1	4	4	5	4
	No. - ve/>0.05		5	7	4	4	3	4
	Total		8	8	8	8	8	8
	P + ve/<0.05		37.50	12.50	50.00	50.00	62.50	50.00
	P - ve/>0.05		62.50	87.50	50.00	50.00	37.50	50.00
Sugar M Grade	3/30/2011	12/20/2011	-0.0005	0.5396	0.6446	0.0000	0.0829	0.0000
	6/1/2009	3/29/2011	-0.0019	0.3616	0.1817	0.2643	0.0011	0.2643
	9/2/2008	5/30/2009	-0.0020	0.0504	-0.0791	0.3841	-0.0011	0.3841
	12/7/2007	9/1/2008	-0.0001	0.9442	-0.5545	0.0000	0.2660	0.0000
	No. + ve/<0.05		0	0	2	2	3	2
	No. - ve/>0.05		4	4	2	2	1	2
	Total		4	4	4	4	4	4
	P + ve/<0.05		0.00	0.00	50.00	50.00	75.00	50.00
	P - ve/>0.05		100.00	100.00	50.00	50.00	25.00	50.00
Soya bean	3/30/2011	12/20/2011	0.0006	0.5539	0.5597	0.0000	0.0975	0.0000
	7/6/2010	3/29/2011	-0.0009	0.2817	0.0102	0.9185	-0.0044	0.9185
	10/9/2009	7/5/2010	-0.0002	0.7836	0.3869	0.0057	0.0294	0.0057
	1/10/2009	10/8/2009	-0.0022	0.0115	0.1260	0.0472	0.0131	0.0472
	4/17/2008	1/9/2009	0.0007	0.6901	0.0833	0.6015	-0.0033	0.6015
	7/20/2007	4/16/2008	0.0005	0.6295	0.6573	0.0001	0.0608	0.0001
	10/24/2006	7/19/2007	0.0009	0.1732	0.7379	0.0000	0.0990	0.0000
	1/18/2006	10/23/2006	-0.0001	0.8445	0.7505	0.0000	0.1421	0.0000
	No. + ve/<0.05		4	1	8	6	6	6
	No. - ve/>0.05		4	7	0	2	2	2
	Total		8	8	8	8	8	8
	P + ve/<0.05		50.00	12.50	100.00	75.00	75.00	75.00
	P - ve/>0.05		50.00	87.50	0.00	25.00	25.00	25.00
Shankar kapas	10/28/2009	12/28/2011	-0.0014	0.0411	0.0489	0.3198	0.0000	0.3198
	11/4/2008	10/27/2009	0.0010	0.1330	0.1773	0.0000	0.0701	0.0000
	2/9/2008	11/3/2008	-0.0008	0.8038	1.6018	0.0000	0.3266	0.0000
	No. + ve/<0.05		1	1	3	2	2	2
	No. - ve/>0.05		2	2	0	1	1	1
	Total		3	3	3	3	3	3
	P + ve/<0.05		33.33	33.33	100.00	66.67	66.67	66.67
	P - ve/>0.05		66.67	66.67	0.00	33.33	33.33	33.33
Ref Soya Oil	3/30/2011	12/20/2011	0.0003	0.5258	0.2835	0.0000	0.2642	0.0000
	7/6/2010	3/29/2011	-0.0008	0.1870	0.5376	0.0000	0.1779	0.0000
	10/9/2009	7/5/2010	-0.0002	0.6857	0.3320	0.0005	0.0489	0.0005
	1/10/2009	10/8/2009	0.0000	0.9755	0.0516	0.6329	-0.0035	0.6329
	9/20/2007	1/9/2009	0.0008	0.3202	0.1928	0.0090	0.0259	0.0090
	12/22/2006	9/19/2007	-0.0001	0.7997	0.2260	0.0236	0.0184	0.0236
	3/25/2006	12/21/2006	-0.0007	0.3278	0.7140	0.0000	0.1566	0.0000
	No. + ve/<0.05		2	0	7	6	6	6
	No. - ve/>0.05		5	7	0	1	1	1
	Total		7	7	7	7	7	7
	P + ve/<0.05		28.57	0.00	100.00	85.71	85.71	85.71
	P - ve/>0.05		71.43	100.00	0.00	14.29	14.29	14.29

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	12/28/2010	9/20/2011	-0.0034	0.4436	0.2242	0.5759	-0.0031	0.5759
	4/5/2010	12/27/2010	0.0019	0.7702	-2.8525	0.0149	0.0219	0.0149
	3/23/2009	4/3/2010	0.0033	0.5937	1.7551	0.0945	0.0081	0.0945
Potato	No. + ve/<0.05		2	0	2	1	2	1
	No. - ve/>0.05		1	3	1	2	1	2
	Total		3	3	3	3	3	3
	P + ve/<0.05		66.67	0.00	66.67	33.33	66.67	33.33
	P - ve/>0.05		33.33	100.00	33.33	66.67	33.33	66.67
	3/30/2011	12/20/2011	-0.0003	0.8004	1.2261	0.0000	0.2951	0.0000
	7/6/2010	3/29/2011	-0.0011	0.6920	2.0763	0.0000	0.1775	0.0000
	10/9/2009	7/5/2010	0.0013	0.4130	0.9619	0.0011	0.0425	0.0011
	1/10/2009	10/8/2009	-0.0010	0.3829	0.1934	0.0160	0.0214	0.0160
	4/17/2008	1/9/2009	0.0010	0.3741	0.0010	0.9926	-0.0045	0.9926
	7/20/2007	4/16/2008	-0.0006	0.5398	0.4055	0.0106	0.0246	0.0106
Pepper	10/24/2006	7/19/2007	-0.0017	0.1390	0.2531	0.2917	0.0005	0.2917
	1/18/2006	10/23/2006	-0.0011	0.2650	0.5973	0.0005	0.0486	0.0005
	No. + ve/<0.05		2	0	8	6	7	6
	No. - ve/>0.05		6	8	0	2	1	2
	Total		8	8	8	8	8	8
	P + ve/<0.05		25.00	0.00	100.00	75.00	87.50	75.00
	P - ve/>0.05		75.00	100.00	0.00	25.00	12.50	25.00
	4/29/2010	1/20/2011	-0.0001	0.8400	0.4125	0.0000	0.0700	0.0000
	7/31/2009	4/28/2010	-0.0003	0.7031	0.2939	0.0240	0.0183	0.0240
	11/3/2008	7/30/2009	-0.0008	0.5434	0.0845	0.4590	-0.0020	0.4590
	2/8/2008	11/1/2008	0.0010	0.4513	0.0425	0.6633	-0.0036	0.6633
	5/14/2007	2/7/2008	0.0006	0.3489	0.6187	0.0000	0.0723	0.0000
	8/17/2006	5/12/2007	0.0008	0.3690	0.1900	0.1226	0.0062	0.1226
Mustard seed	10/24/2005	8/16/2006	-0.0001	0.8261	0.1741	0.0410	0.0142	0.0410
	No. + ve/<0.05		3	0	7	4	5	4
	No. - ve/>0.05		4	7	0	3	2	3
	Total		7	7	7	7	7	7
	P + ve/<0.05		42.86	0.00	100.00	57.14	71.43	57.14
	P - ve/>0.05		57.14	100.00	0.00	42.86	28.57	42.86
	3/30/2011	12/20/2011	0.0001	0.9203	0.5988	0.0000	0.3459	0.0000
	7/6/2010	3/29/2011	0.0001	0.9016	0.3067	0.0467	0.0132	0.0467
Maize Feed	No. + ve/<0.05		2	0	2	2	2	2
	No. - ve/>0.05		0	2	0	0	0	0
	Total		2	2	2	2	2	2
	P + ve/<0.05		100.00	0.00	100.00	100.00	100.00	100.00
	P - ve/>0.05		0.00	100.00	0.00	0.00	0.00	0.00
	12/28/2009	9/20/2010	0.0000	0.9906	0.1646	0.2513	0.0014	0.2513
	3/30/2009	12/26/2009	-0.0001	0.9622	1.3687	0.0000	0.1953	0.0000
	7/2/2008	3/28/2009	-0.0006	0.5301	0.8976	0.0000	0.1691	0.0000
	10/8/2007	7/1/2008	-0.0001	0.9054	-0.3520	0.0000	0.2824	0.0000
	1/10/2007	10/6/2007	0.0004	0.6729	0.0267	0.7908	-0.0042	0.7908
	4/11/2006	1/9/2007	-0.0004	0.6148	0.2762	0.0307	0.0164	0.0307
Maize	6/14/2005	4/10/2006	-0.0006	0.3404	0.4072	0.0032	0.0340	0.0032
	No. + ve/<0.05		2	0	6	5	6	5
	No. - ve/>0.05		5	7	1	2	1	2
	Total		7	7	7	7	7	7
	P + ve/<0.05		28.57	0.00	85.71	71.43	85.71	71.43
	P - ve/>0.05		71.43	100.00	14.29	28.57	14.29	28.57
	8/4/2010	4/29/2011	-0.0005	0.4497	0.1689	0.0641	0.0109	0.0641
	11/7/2009	8/3/2010	-0.0004	0.4593	0.2948	0.0402	0.0143	0.0402
	2/10/2009	11/6/2009	0.0000	0.9953	0.1798	0.0008	0.0452	0.0008
	5/16/2008	2/9/2009	0.0007	0.5642	0.9166	0.0000	0.6563	0.0000
	8/8/2007	5/15/2008	0.0000	0.9955	0.9925	0.0000	0.1182	0.0000
	11/11/2006	8/7/2007	-0.0008	0.3618	0.4487	0.0022	0.0369	0.0022
Kapas								
	No. + ve/<0.05		2	0	6	5	6	5
	No. - ve/>0.05		4	6	0	1	0	1
	Total		6	6	6	6	6	6
	P + ve/<0.05		33.33	0.00	100.00	83.33	100.00	83.33
	P - ve/>0.05		66.67	100.00	0.00	16.67	0.00	16.67

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Jeera	3/30/2011	12/20/2011	0.0010	0.3672	1.4611	0.0000	0.6256	0.0000
	7/6/2010	3/29/2011	-0.0003	0.8738	2.0628	0.0000	0.5267	0.0000
	10/9/2009	7/5/2010	-0.0014	0.6299	0.0156	0.9059	-0.0044	0.9059
	1/10/2009	10/8/2009	-0.0001	0.9696	0.0736	0.3841	-0.0011	0.3841
	4/17/2008	1/9/2009	0.0000	0.9879	0.0339	0.7751	-0.0041	0.7751
	7/20/2007	4/16/2008	-0.0002	0.8100	0.4693	0.0025	0.0359	0.0025
	10/24/2006	7/19/2007	0.0000	0.9709	0.2277	0.3631	-0.0008	0.3631
	1/18/2006	10/23/2006	0.0004	0.6916	0.5394	0.0023	0.0364	0.0023
	No. + ve/<0.05		3	0	8	4	4	4
	No. - ve/>0.05		5	8	0	4	4	4
	Total		8	8	8	8	8	8
	P + ve/<0.05		37.50	0.00	100.00	50.00	50.00	50.00
	P - ve/>0.05		62.50	100.00	0.00	50.00	50.00	50.00
Gur	3/30/2011	12/20/2011	-0.0017	0.2130	0.0886	0.3707	-0.0009	0.3707
	7/6/2010	3/29/2011	-0.0012	0.2643	0.2834	0.0000	0.1733	0.0000
	10/9/2009	7/5/2010	-0.0012	0.2566	0.3624	0.0000	0.4221	0.0000
	1/10/2009	10/8/2009	0.0006	0.5932	-0.0369	0.8637	-0.0044	0.8637
	4/17/2008	1/9/2009	-0.0003	0.7397	-0.2385	0.0045	0.0313	0.0045
	No. + ve/<0.05		1	0	3	3	3	3
	No. - ve/>0.05		4	5	2	2	2	2
	Total		5	5	5	5	5	5
	P + ve/<0.05		20.00	0.00	60.00	60.00	60.00	60.00
	P - ve/>0.05		80.00	100.00	40.00	40.00	40.00	40.00
Guar seed	3/30/2011	12/20/2011	0.0001	0.9600	1.2129	0.0000	0.5348	0.0000
	7/6/2010	3/29/2011	-0.0001	0.9689	0.1986	0.1666	0.0041	0.1666
	10/9/2009	7/5/2010	0.0004	0.7108	1.1646	0.0000	0.1161	0.0000
	1/10/2009	10/8/2009	-0.0004	0.6466	0.0873	0.1807	0.0036	0.1807
	4/17/2008	1/9/2009	0.0006	0.5748	0.1283	0.2472	0.0015	0.2472
	7/20/2007	4/16/2008	-0.0021	0.0414	0.2849	0.0665	0.0106	0.0665
	10/24/2006	7/19/2007	0.0015	0.1423	0.2552	0.2338	0.0019	0.2338
	1/18/2006	10/23/2006	-0.0019	0.0981	0.5213	0.0057	0.0294	0.0057
	No. + ve/<0.05		4	1	8	3	8	3
	No. - ve/>0.05		4	7	0	5	0	5
	Total		8	8	8	8	8	8
	P + ve/<0.05		50.00	12.50	100.00	37.50	100.00	37.50
	P - ve/>0.05		50.00	87.50	0.00	62.50	0.00	62.50
Guar Gum	3/30/2011	12/20/2011	0.0007	0.6306	1.2028	0.0000	0.5458	0.0000
	7/6/2010	3/29/2011	0.0001	0.9436	0.4538	0.0003	0.0528	0.0003
	10/9/2009	7/5/2010	0.0006	0.4780	0.8046	0.0000	0.0885	0.0000
	1/10/2009	10/8/2009	-0.0006	0.4309	0.1067	0.0517	0.0125	0.0517
	4/17/2008	1/9/2009	0.0014	0.2181	0.1126	0.2870	0.0006	0.2870
	7/20/2007	4/16/2008	-0.0021	0.0749	0.2177	0.2185	0.0023	0.2185
	10/24/2006	7/19/2007	0.0010	0.3725	0.2938	0.2250	0.0021	0.2250
	1/18/2006	10/23/2006	-0.0031	0.0129	0.6323	0.0028	0.0349	0.0028
	No. + ve/<0.05		5	1	8	4	8	4
	No. - ve/>0.05		3	7	0	4	0	4
	Total		8	8	8	8	8	8
	P + ve/<0.05		62.50	12.50	100.00	50.00	100.00	50.00
	P - ve/>0.05		37.50	87.50	0.00	50.00	0.00	50.00
Cotton seed oilcake	3/30/2011	12/20/2011	0.0000	0.9909	0.2041	0.4458	-0.0019	0.4458
	7/6/2010	3/29/2011	0.0006	0.8382	0.8351	0.1126	0.0068	0.1126
	10/9/2009	7/5/2010	0.0001	0.9787	0.5638	0.5200	-0.0026	0.5200
	No. + ve/<0.05		3	0	3	0	1	0
	No. - ve/>0.05		0	3	0	3	2	3
	Total		3	3	3	3	3	3
	P + ve/<0.05		100.00	0.00	100.00	0.00	33.33	0.00
	P - ve/>0.05		0.00	100.00	0.00	100.00	66.67	100.00

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	3/30/2011	12/20/2011	0.0036	0.0308	0.0728	0.6352	-0.0035	0.6352
	7/6/2010	3/29/2011	0.0016	0.1030	0.2336	0.1450	0.0051	0.1450
	10/9/2009	7/5/2010	0.0034	0.0130	3.3811	0.0000	0.8844	0.0000
	1/10/2009	10/8/2009	-0.0003	0.8198	2.2243	0.0000	0.7834	0.0000
Coriander	No. + ve/<0.05		3	2	4	2	3	2
	No. - ve/>0.05		1	2	0	2	1	2
	Total		4	4	4	4	4	4
	P + ve/<0.05		75.00	50.00	100.00	50.00	75.00	50.00
	P - ve/>0.05		25.00	50.00	0.00	50.00	25.00	50.00
	3/30/2011	12/20/2011	-0.0007	0.5832	-0.0002	0.9990	-0.0045	0.9990
	7/6/2010	3/29/2011	0.0024	0.2061	0.2863	0.3518	-0.0006	0.3518
	10/9/2009	7/5/2010	-0.0008	0.5381	0.2848	0.2063	0.0027	0.2063
	1/10/2009	10/8/2009	0.0007	0.6398	0.0829	0.5350	-0.0027	0.5350
	4/17/2008	1/9/2009	0.0000	0.9782	0.0038	0.9749	-0.0045	0.9749
	7/20/2007	4/16/2008	0.0008	0.5945	0.1725	0.5223	-0.0026	0.5223
	10/24/2006	7/19/2007	-0.0016	0.4846	0.0755	0.8730	-0.0044	0.8730
Chilly	1/18/2006	10/23/2006	0.0025	0.3267	-0.2917	0.3519	-0.0006	0.3519
	No. + ve/<0.05		5	0	6	0	1	0
	No. - ve/>0.05		3	8	2	8	7	8
	Total		8	8	8	8	8	8
	P + ve/<0.05		62.50	0.00	75.00	0.00	12.50	0.00
	P - ve/>0.05		37.50	100.00	25.00	100.00	87.50	100.00
	3/29/2011	12/19/2011	0.0010	0.3199	0.6257	0.0000	0.0894	0.0000
	7/5/2010	3/28/2011	-0.0001	0.9207	0.4082	0.0033	0.0338	0.0033
	10/8/2009	7/3/2010	-0.0002	0.8266	0.5087	0.0017	0.0389	0.0017
	1/9/2009	10/7/2009	0.0002	0.8459	0.1218	0.2559	0.0013	0.2559
	9/19/2007	1/8/2009	0.0000	0.9711	0.1099	0.1856	0.0034	0.1856
	12/21/2006	9/18/2007	-0.0003	0.7649	0.4042	0.0734	0.0099	0.0734
Chana	3/24/2006	12/20/2006	0.0001	0.9563	0.1990	0.3864	-0.0011	0.3864
	No. + ve/<0.05		4	0	7	3	6	3
	No. - ve/>0.05		3	7	0	4	1	4
	Total		7	7	7	7	7	7
	P + ve/<0.05		57.14	0.00	100.00	42.86	85.71	42.86
	P - ve/>0.05		42.86	100.00	0.00	57.14	14.29	57.14
	3/29/2011	12/19/2011	-0.0013	0.1771	0.3578	0.0045	0.0313	0.0045
	7/5/2010	3/28/2011	0.0012	0.3999	0.1743	0.4556	-0.0020	0.4556
	10/8/2009	7/3/2010	0.0014	0.0147	0.0841	0.4382	-0.0018	0.4382
castor seed	No. + ve/<0.05		2	1	3	1	1	1
	No. - ve/>0.05		1	2	0	2	2	2
	Total		3	3	3	3	3	3
	P + ve/<0.05		66.67	33.33	100.00	33.33	33.33	33.33
	P - ve/>0.05		33.33	66.67	0.00	66.67	66.67	66.67
	3/29/2011	12/19/2011	0.0001	0.8987	0.1344	0.3066	0.0002	0.3066
	7/5/2010	3/28/2011	-0.0002	0.8422	0.1547	0.3386	-0.0004	0.3386
	10/8/2009	7/3/2010	0.0012	0.1923	0.2853	0.0913	0.0083	0.0913
	1/9/2009	10/7/2009	-0.0003	0.7471	0.0972	0.2597	0.0012	0.2597
	4/16/2008	1/8/2009	-0.0014	0.0661	0.0163	0.7841	-0.0041	0.7841
	7/19/2007	4/15/2008	0.0015	0.4373	-0.0550	0.8749	-0.0044	0.8749
Barley	No. + ve/<0.05		3	0	5	0	3	0
	No. - ve/>0.05		3	6	1	6	3	6
	Total		6	6	6	6	6	6
	P + ve/<0.05		50.00	0.00	83.33	0.00	50.00	0.00
	P - ve/>0.05		50.00	100.00	16.67	100.00	50.00	100.00

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The regression results of wheat show that of the 6 periods, two intercepts are positive and 4 intercepts are negative. When the intercept is negative, it implies that the returns on the commodity would be negative when the index does not give any returns. When the intercept value is positive it shows that the commodity would yield positive returns when the index does not give any returns. The probability value (p-value) corresponding to the intercept show that all the values are more than 0.05 and this implies that the intercept values are not significantly different from zero. Therefore, I infer that the commodity returns are almost equal to zero when the market does not give any returns.

The X-co-efficient of the regressions of wheat show that all the values are positive which implies that as the returns of the index increases (decreases), the returns of the wheat also increase (decrease). To test the statistical significance of the regression co-efficients, I use t-test. The results of the t-test show that only three co-efficients have their p-values less than the chosen level of significance (0.05) and the other three co-efficients have p-values more than 0.05. When the p-values are less (more) than the chosen level of significance they imply that the co-efficients are statistically significant (insignificant) and therefore, the index has considerable influence on the commodity returns. When the p-values are more than the chosen level of significance they imply that the co-efficients are statistically not significant and therefore, the index does not have considerable influence on the Wheat returns. Based on this interpretation, we can observe that the wheat returns are significantly influenced by index during the year 2005-06, 2007-09 and 2010-11.

The Adj R^2 values show the strength of the relationship between the dependent and the independent variable. The value of Adj R^2 varies between 0 and 1. The higher the value, higher is the influence of the independent variable on the dependent variable. In the case of wheat, this value varies between 0.002 and 0.245. One of the Adj R^2 values is negative because of the adjustment of the numerator and denominator degrees of freedom. We also test to ascertain whether the Adj R^2 value is significantly different from zero. The p-values corresponding to the Adj R^2 show that the three of these are less than 0.05 (the chosen level of significance) and the other three values are more than 0.05. When the p-values are less than 0.05, the independent variable has significant influence on the variation of the dependent variable and when the p-values are more than 0.05, the independent variable does not have much influence on the variation of the dependent variable. The test indicates that in three periods, the index has considerable influence on the wheat returns and in another three periods, the index does not have much influence on the wheat returns.

In case of Turmeric, five intercept values are negative and of these only one value for period 2009 is significant. The remaining three intercept values are positive and their p-values are more than 0.05. Therefore, I infer that none of the intercept values are significantly different from zero. When we examine the regression co-efficients, four are positive and of them three are significant, four are negative and of them only one is significant in the year 2011. Therefore, only four periods have significant relationship between the Turmeric returns and the Index returns. These periods are 2007-08, 2008-09, 2009-10 and 2011. The Adj R^2 values for these periods are positive and statistically significant which also imply that the Index has considerable influence on the Turmeric returns variation. In the other periods, the Index does not have significant influence on the Turmeric returns as indicated by the p-values of the X-coefficients and the Adj R^2 values.

For sugar, we have values from year 2007 to 2011. All the intercept values are negative and insignificant and therefore, I infer that sugar does not give any return if index returns are zero. Two regression coefficients are negative and one of them is significant for 2007-08 and two coefficients are positive and one of them is significant for 2011 which implies that the returns of sugar have positive and significant relationship for the year 2011 and negative and significant relationship for the year 2007-08. The Adj R^2 is positive and significant for 2007-08 and 2011 and negative and insignificant for 2008-09 and positive and insignificant for 2009-11.

For soya bean, 7 of 8 intercepts are not significant. Only one intercept for the year 2009 is negative and significant. Therefore, soya bean does not give any returns if the index does not have any returns. Of the 8 regression coefficients 6 are positive and significant and the remaining 2 are positive and insignificant. Of the 8 Adj R^2 values, 2 are negative and insignificant and 6 are positive and significant. Therefore, soya returns are influenced by index returns for a significant 6 out of 8 periods.

In the case of Shankar kapas, 2 intercepts are negative and one is significant for the year 2009-11. One intercept is positive and insignificant. Therefore, in only one period the returns of this commodity will be negative when index is giving no returns. The 2 regression coefficients and their corresponding Adj R^2 values are positive and significant and one of the regression coefficients is positive and insignificant and the corresponding Adj R^2 value of this is negative and insignificant for the year 2009-11.

In the case of Refined Soya Oil, 2 intercepts are positive and insignificant and 5 intercepts are negative and insignificant. Of the 7 regression coefficients, 6 are positive and significant and their corresponding Adj R^2 values are also positive and significant. One of the regression coefficients is positive and insignificant and the Adj R^2 value of this period is negative and insignificant. From this I infer that index has considerable influence on the returns of Refined Soya Oil.

In the case of potato, 2 intercepts are positive and insignificant and 1 intercept is negative and insignificant. Of the 3 regression coefficients, 2 are positive and insignificant and 1 is negative and significant. One Adj R^2 value is positive and significant, one is negative and insignificant and one is positive and insignificant. The inference for potato is that only in one period the returns of the potato have significant inverse relationship with index.

In the case of pepper, of the 8 intercepts, 2 are positive and insignificant, 6 are negative and insignificant. All the 8 regression coefficients are positive and 6 of these are significant. Adj R^2 values indicate that of the 7 positive values 6 are significant and one is insignificant and one is negative and insignificant. Therefore, the results indicate that pepper returns are considerably influenced by the index.

Mustard seed results have 3 positive and 5 negative intercepts and none of them are significant. Therefore, Mustard seed will have no returns when the index does not give any returns. For this commodity, of the 8 regression coefficients which are positive, 5 of them are significant for the years 2005-06, 2007-08, 2009-10 and 2010-11 and 2011. The Adj R^2 values are also significant for these regressions. The 2 Adj R^2 values for the year 2008-09 are negative and their values are also insignificant. The Adj R^2 values for the year 2006-07 is positive and insignificant. Therefore, Mustard seed futures give positive and significant returns for majority of the periods when the index futures give positive returns.

The two intercepts of Maize Feed are positive and insignificant. So the Maize Feed does not give any returns when the index does not give any returns. Two regression coefficients and Adj R^2 values are positive and significant. Therefore, Maize Feed returns are positively influenced by the index returns in the periods, 2010 and 2011.

Maize has two intercepts positive and 5 intercepts negative and all the seven have their p-values greater than the level of significance. So returns of maize are zero when index returns are zero. The regression coefficients of maize are positive for 6 periods and these are significant for 4 periods and insignificant for two years; one is negative and significant. The Adj R^2 values for one period is negative and insignificant and another period positive and significant. For the remaining 5 years they are positive and significant. Therefore, maize returns are influenced by the index returns in most of the periods.

The returns of Kapas show that 4 intercepts are negative and 2 intercepts are positive but none of them are significant. The regression coefficients of 6 periods are positive for all periods and significant for 5 periods and insignificant for one period. All the Adj R^2 values are positive and significant for five periods and insignificant for one period. Therefore, kapas returns have significantly positive relationship with index for most of the periods.

Jeera has 3 positive and 5 negative intercepts and none of them are significant. All the eight regression coefficients are positive and 4 of them are significant. Therefore, for these periods jeera returns have positive relationship with index and for the remaining period although there is direct relationship, the returns do not significantly get influenced by the index. Four of the 8 Adj R^2 values are positive and significant and 4 are negative and insignificant. Therefore, returns of the periods when Adj R^2 values are positive and significant are influenced by the index and when they are insignificant they are not influenced by the index.

In the case of Gur, of the 5 intercepts 4 are negative and insignificant and 1 is positive and insignificant. Of the 5 regression coefficients and Adj R^2 , 3 are positive and significant and 2 are negative and insignificant. Therefore, in majority of the periods, the returns of this commodity futures has positive and significant relationship with the index futures returns.

For Guar seed, 7 of 8 intercepts are insignificant. Only one intercept for the year 2007 is negative and significant. Therefore, Guar seed does not give any returns if the index does not have any returns. Of the 8 regression coefficients, 3 are positive and significant and the remaining 5 are positive and insignificant. Of the 8 Adj R^2 values 3 are positive and significant and 5 are positive and insignificant. Therefore, I infer that in only in three periods the index influences the variations Guar seed returns and in majority of the periods, the index does not influence the returns of this commodity.

In the case of Guar Gum, of the 8 intercepts, 1 is negative and significant and 2 are negative and insignificant and 5 are positive and insignificant. Therefore, I infer that in majority of the periods, Guar Gum does not have returns when the index does not yield any returns. All the 8 regression coefficients are positive and 4 are significant. Adj R^2 values indicate that all are positive values and 4 are significant and 4 are insignificant. Therefore, the results indicate that Guar Gum returns are considerably influenced by the index in about 50 percent of the periods.

All the intercepts and regression coefficients of Cotton seed oilcake are positive and insignificant. The Adj R^2 values are positive and insignificant for two periods and negative and insignificant for one period. Therefore, I infer that the index does not influence Cotton seed oilcake returns in any periods.

In the case of Coriander, of the 4 intercepts 2 are positive and significant, 1 is positive and insignificant and 1 is negative and insignificant. Therefore, coriander will have positive returns in two periods when the index does not have returns and it have no returns in the remaining two periods when index does not have any returns. For this commodity, 4 regression coefficients are positive and 2 of them are significant for the year 2009 and 2010. The 2 Adj R^2 values are also significant for these regressions. One Adj R^2 value for the year 2011 is negative and its value is insignificant. The Adj R^2 values for the 2009 and 2010 are positive and significant. Therefore, I infer that index influences the returns of Coriander in 50% of the peirods and in another 50% of the periods, the index does not have significant influence on the commodity returns.

The returns of Chilly show that 3 intercepts are negative and 5 intercepts are positive but none of them are significant. The regression coefficients of 8 periods show positive association for 6 periods and negative association for 2 periods and are insignificant for all the periods. The Adj R^2 are negative and insignificant for 7 periods and positive and insignificant for one period. Therefore, I infer that the index does not influence Chilly returns.

In the case of Chana, of the 7 intercepts 4 are positive and insignificant, 3 are negative and insignificant. All the 7 regression coefficients are positive and 3 are significant. Adj R^2 values indicate that of the 6 positive values 3 are significant and one is negative and insignificant. Therefore, the results indicate that Chana returns are influenced by the index in about 50% of the periods.

The returns of Castor seed have 2 positive intercepts and one of them is significant and 1 negative intercept and this is insignificant. All the 3 regression coefficients are positive and 1 of them is significant. Therefore, for this period Castor seed returns have positive relationship with index. 1 of the 3 Adj R^2 values are positive and significant and 2 are negative and insignificant. Therefore, returns of the period when Adj R^2 values are positive are influenced by the index and when they are insignificant they are not influenced by index. On

the whole, castor seed returns are not significantly influenced by the index returns in most of the periods.

In the case of Barley, 3 intercepts are positive and insignificant and 3 intercepts are negative and insignificant. Of the 6 regression coefficients, 5 are positive and insignificant. One of the regression coefficients is negative and insignificant. The 3 Adj R^2 values are positive and 3 values are negative and none of them is significant. Therefore, I infer that the index does not influence Barley returns.

The analysis of the relationship between agriculture index returns and the commodity returns indicate that in most of the cases intercept values are not significantly different from zero indicating that the commodities do not yield any returns when the index does not have any returns. On the other hand, the regression co-efficients and the Adj R^2 values show that for some of the commodities, the index has considerable influence on their returns and in case of some other commodities, the index does not have influence on their returns. Therefore, there is no clear indication of the index influencing the commodities returns in all cases.

Relationship between Futures and Spot Returns:

The issue of whether the futures prices have influence on the spot price and vice versa has been a matter of great interest not only for the traders but also for the regulators. Therefore, it is interesting to understand whether the futures influence the spot or the other way. I analyse both these relationships using the regression technique. In this analysis, I chose spot market as the dependent variable and futures market as the independent variable. The following regression equation is used:

Spot equation:

$$Spot\ Returns = Intercept + Slope * Futures\ Returns$$

Symbolically the above equation is expressed as:

$$S_i = \alpha_i + \beta F_i + \varepsilon_i$$

Table 3a contains the summary of the regression results of the spot commodity market on the futures market.

Table 3a: Regression results of futures on spot returns.

Commodity	Intercept	P value	Slope	P value	Adjusted R square	F statistics	P. value	Durbin Watson
Barley	0.00017	0.614	0.39654	0.0000	0.25324	367.923	0.0000	1.82513
Chana	0.00028	0.3283	0.38245	0.0000	0.17999	421.328	0.0000	2.40861
Chilly	0.00081	0.2358	0.5072	0.0000	0.35829	491.787	0.0000	1.74068
Coriander	-0.0003	0.5093	0.63315	0.0000	0.64378	1417.91	0.0000	2.27998
Gaur seed	0.00043	0.2039	0.46347	0.0000	0.24565	686.808	0.0000	2.69728
Gaur	0.00051	0.5782	0.48678	0.0000	0.27319	227.277	0.0000	1.68457
Jeera	0.00032	0.2938	0.2267	0.0000	0.08527	169.913	0.0000	2.67407
Maize feed	6.6E-05	0.9129	-0.0048	0.9309	-0.0032	0.00754	0.93085	2.59071
Maize	0.00051	0.0149	0.02827	0.09302	0.0012	2.82488	0.09302	2.35451
Pepper	0.00055	0.0124	0.21225	0.0000	0.11187	274.578	0.0000	2.11998
Refined Soya oil	8.1E-05	0.6107	0.50432	0.0000	0.37574	1295.66	0.0000	2.26079
Wheat	0.00029	0.2487	0.19846	0.0000	0.07209	94.6222	0.0000	1.43528
Caster seed	0.00357	0.2248	0.35352	0.0648	0.00433	3.42377	0.06479	1.97432

In the above table, most of the intercept values are positive and their corresponding p-values are not statistically significant. This shows that spot returns will be almost equal to zero when the futures returns are zero. In the above table, the slope coefficients are positive and statistically significant at five percent in all the commodities except maize feed, caster seed and maize. Most of the p-values of the regression co-

efficients are closer to zero which is an indication that the futures returns cause the spot returns. Therefore, I conclude that the spot returns clearly depend on futures returns. This is also supported by the significant F-statistics. Most of the p-values corresponding to F-statistics are close to zero, except for the three commodities mentioned above, which indicates that the independent variable has significant influence on the dependent variable. Most of the Durbin - Watson values are either closer to 2 or exceed this value which indicate that this model results need to be viewed with caution as it violates some of the assumptions of ordinary least square (OLS) regression. Having known that the spot returns are influenced by the futures returns, I now turn to examine whether the futures returns are influenced by the spot returns.

To examine the impact of the spot market on the futures market, I take spot returns as the independent variable and futures returns as the dependent variable and fit the following regression equation:

Futures equation:

$$Futures\ Returns = Intercept + Slope * Spot\ Returns$$

Symbolically the above equation is expressed as:

$$F_i = \alpha_i + \beta\ S_i + \varepsilon_i$$

Table 3b contains the summary of the regression results of the futures commodity market on the spot market.

Table 3b: Regression results of futures on spot returns

Commodity	Intercept	P value	Slope	P. Value	Adjusted R square	F statistics	P. value	Durbin Watson
Barley	0.000118	0.785	0.64036	0.0000	0.25324	367.923	0.0000	2.07426
Chana	0.000199	0.5269	0.47174	0.0000	0.17999	421.328	0.0000	2.33781
Caster seed	0.000117	0.8846	0.70785	0.0000	0.35829	491.787	0.0000	1.93067
Chilly	3.54E-05	0.9542	1.01752	0.0000	0.64378	1417.91	0.0000	2.36755
Coriander	0.000247	0.4926	0.5308	0.0000	0.24565	686.808	0.0000	2.58573
Gaur	0.000777	0.4323	0.5637	0.0000	0.27319	227.277	0.0000	2.01146
Jeera	0.000241	0.5373	0.37837	0.0000	0.08527	169.913	0.0000	2.11671
Maize feed	0.000402	0.5234	-0.0051	0.9309	-0.0032	0.00754	0.93085	1.99715
Maize	0.000408	0.1967	0.0655	0.093	0.0012	2.82488	0.09302	1.90099
Pepper	0.000286	0.4118	0.52897	0.0000	0.11187	274.578	0.0000	2.39243
Refined Soya oil	2.41E-05	0.9011	0.74561	0.0000	0.37574	1295.66	0.0000	2.53591
Wheat	0.000149	0.663	0.36715	0.0000	0.07209	94.6222	0.0000	2.02524
Caster seed	0.000784	0.2276	0.01728	0.0648	0.00433	3.42377	0.06479	1.8958

The table 3b shows that all the intercept values are positive but statistically insignificant as their p-values are more than 0.05, the chosen level of significance. Therefore, these intercept values indicate that futures returns will be almost zero when the commodity spot returns are almost zero. The above table shows that all the slope coefficients are positive and significant at five percent level except in case of maize feed, maize and caster seed. In the case of maize and caster seed, the p-values are significant at ten percent level. The p-values of these co-efficients of all commodities are also close to Zero, except for the three commodities. These results show the dependency of futures returns on the spot returns. Most of the F-statistics are also significant as their p-values are close to zero, except for the three commodities, supporting the influence of spot returns on futures returns. Most of the Durbin - Watson values are either closer to 2 or exceed this value which indicate that this model results need to be viewed with caution as it violates some of the assumptions of ordinary least square (OLS) regression.

Vector Auto-Regressive Models (VAR Models):

In time series like the prices of the equity shares, commodities, mutual fund units, futures and options is

has been argued that apart from different endogenous factors influencing the returns of the variable, its own past values have influence on the returns. Further, the past values of the independent variables also cause the variations in the dependent variable. These effects are captured by the vector auto regressive models (VAR). Therefore, I use the the VAR models to know the whether the spot and futures returns series can be explained by these models. One of the important issues in the VAR models is choosing the lag length. There are many criteria for choosing the lag length. Further, for each commodity we need to determine the appropriate lag length.

VAR model is used to capture the linear interdependencies among multiple time series. All variables are treated symmetrically in a structural sense, each variable explaining its evolution based on its own lags and the lags of the other model variables. I use the bivariate VAR model to study the VAR model results for the commodities. The bivariate VAR model used is given by the following equations:

$$R_{St} = \alpha_S + \sum_{i=1}^{k} \beta_{Si} R_{St-i} + \sum_{j=1}^{l} \gamma_{Fj} R_{Ft-j} + \varepsilon_{St}$$

$$R_{Ft} = \alpha_F + \sum_{i=1}^{k} \beta_{Fi} R_{Ft-i} + \sum_{j=1}^{l} \gamma_{Sj} R_{St-j} + \varepsilon_{Ft}$$

Where the α_s, α_F, are the intercepts of the equations; β_S, β_F, co-efficients of the lagged spot and futures returns in the VAR model of spot on futures and futures on spot, respectively, in the two equations; γ_F and γ_S are the co-efficients of the lagged futures and spot returns in the VAR model of spot on futures and futures on spot, respectively, in the two equations; and ε_{St} and ε_{Ft} are the residuals of the VAR model of spot on futures and futures on spot, respectively, in the two equations. In the above equations the residuals are independently and identically distributed (iid) random vector. In table 4b, I present the results of VAR model where spot market returns are dependent variables and lags of spot market returns and lags of futures market returns are independent variables. In table 4c we present the results of VAR model where futures commodity market returns are dependent variables and lags of futures market returns and lags of spot market returns are independent variables. The optimal lag selection is done based on the Akaike Information Criteria (AIC), a widely used method for optimal lag selection. I chose lags of 2 for all the commodities and present the two sets of results for spot on futures and futures on spot. A sample lag structure is given in table 4a.

Table 4a: The lag length results showing lag length criteria for Barley

Lag	LogL	LR	FPE	AIC	SC	HQ
0	6193.387	NA	3.41e-08	-11.51886	-11.50959	-11.51535
1	6233.168	79.33951	3.19e-08	-11.58543	-11.55763*	-11.57490*
2	6239.055	11.71924*	3.18e-08*	-11.58894*	-11.54261	-11.57139
3	6241.101	4.065556	3.19e-08	-11.58530	-11.52045	-11.56074
4	6241.913	1.610050	3.21e-08	-11.57937	-11.49599	-11.54779
5	6244.304	4.732482	3.22e-08	-11.57638	-11.47446	-11.53778
6	6247.460	6.235530	3.22e-08	-11.57481	-11.45436	-11.52919
7	6249.119	3.271903	3.24e-08	-11.57045	-11.43147	-11.51782
8	6249.987	1.709999	3.26e-08	-11.56463	-11.40712	-11.50497

Note: * indicate the optimum lag length. Similar lag length results can be obtained for all other commodities. However, all these values are not reported here as the number of tables will be too many.

Table 4b. Results of VAR Model: Spot to futures

Commodity	$\alpha_{s,0}$	P. value	$\beta_{S,1}$	P. value	$\beta_{S,2}$	P. value	$\gamma_{F,1}$	P. value	$\gamma_{F,2}$	P. value
Barley	0.0000	0.555	0.075	0.034	-0.08	0.019	0.159	0.0000	0.088	0.001
Caster seed	0.003	0.316	-0.004	0.933	-0.006	0.88	0.421	0.026	0.845	0.0000
Chana	0.001	0.193	0.077	0.028	0.11	0.002	0.109	0.01	-0.068	0.102
Chilly	0.001	0.193	0.109	0.01	-0.068	0.102	0.077	0.028	0.11	0.002
Coriander	-0.001	0.382	-0.055	0.365	-0.08	0.185	0.148	0.002	0.113	0.019
Guar Seed	0.001	0.054	-0.535	0.0000	-0.134	0.0000	0.755	0.0000	0.239	0.0000
Guar	0.001	0.352	0.113	0.02	0.073	0.132	0.042	0.344	-0.034	0.448
Guar gum	0.0000	0.15	-0.16	0.0000	-0.123	0.0000	0.278	0.0000	0.131	0.0000
Jeera	0.0000	0.018	-0.435	0.0000	-0.119	0.0000	0.361	0.001	0.148	0.0000
Maize	0.0000	0.015	-0.167	0.0000	0.097	0.0000	0.057	0.001	0.059	0.0000
Maize Feed	0.0000	0.983	-0.322	0.0000	-0.064	0.27	0.101	0.058	0.05	0.341
Pepper	0.0000	0.015	-0.226	0.0000	0.051	0.002	0.428	0.0000	0.16	0.0000
Refined soya oil	0.0000	0.524	-0.175	0.0000	-0.082	0.001	0.415	0.0000	0.117	0.0000
Wheat	0.0000	0.623	0.126	0.003	0.009	0.83	0.206	0.0000	0.095	0.043

Table 4c. Results of VAR Model: Futures to spot

Commodity	$\alpha_{F,0}$	P. value	$\beta_{F,1}$	P. value	$\beta_{F,2}$	P. value	$\gamma_{S,1}$	P. value	$\gamma_{S,2}$	P. value
Barley	0.000	0.565	0.062	0.078	0.052	0.144	0.000	0.993	-0.076	0.092
Caster seed	0.001	0.207	0.005	0.61	-0.012	0.211	0.059	0.169	0.041	0.346
Chana	0.000	0.000	-0.081	-0.081	0.016	0.016	0.03	0.03	0.103	0.103
Chilly	0.001	0.295	-0.02	0.686	-0.052	0.3	0.087	0.039	0.034	0.425
Coriander	-0.001	0.534	0.183	0.018	0.053	0.495	-0.056	0.357	0.005	0.932
Guar Seed	0.001	0.153	-0.032	0.392	-0.024	0.419	0.076	0.005	0.023	0.517
Guar	0.001	0.202	-0.071	0.176	0.029	0.576	0.017	0.734	-0.015	0.759
Guar gum	0.000	0.195	0.007	0.655	-0.048	0.003	-0.053	0.001	0.108	0.000
Jeera	0.000	0.167	0.033	0.325	-0.013	0.745	0.715	0.004	0.000	0.38
Maize	0.000	0.167	-0.014	0.726	-0.013	0.745	0.06	0.019	-0.001	0.973
Maize Feed	0.000	0.58	-0.174	0.005	-0.017	0.784	-0.006	0.922	0.004	0.938
Pepper	0.001	0.094	-0.037	0.469	-0.059	0.109	-0.043	0.074	0.143	0.000
Refined soya oil	0.000	0.57	0.014	0.71	-0.082	0.015	0.034	0.239	0.064	0.037
Wheat	0.000	0.439	0.004	0.914	-0.006	0.871	0.09	0.035	-0.028	0.512

It is clear from the table 4b that spot market returns significantly depend on its own previous values and also on the previous returns of the futures market. The coefficients of lagged spot returns are significant at lag 1 for all commodities except caster seed and coriander. At lag 2, they are insignificant in case of 6 out of 14 (43%) commodities and significant in case of 8 out of 14 (57%) of the cases. This indicates the importance of previous spot prices in deciding the current spot prices. Similarly, the coefficients of lagged futures returns are significant at lag 1 except for guar and maize feed. Two days back futures prices are also significant in deciding the current day's spot prices in 11 of 14 (79%) commodities under study. From the above analysis I infer that spot prices (or returns) significantly depend on its own past prices (or returns) and also on futures prices (or returns).

In table 4c, I present the results of VAR model where futures market returns are depending variables and lags of spot market returns and lags of futures market returns are independent variables. Table 4c confirms

that previous day's futures prices are not significant deciding factors of current day's futures prices. The result is the same for the second lag also. Therefore, I infer that lagged futures returns do not significantly influence the futures returns. But I found that in 50% of majority of the commodities, futures prices significantly depends on lagged spot prices at five percent level of significance and one commodity futures has dependence on first lag returns of the spot market at 10% level of significance. When the second lag is taken, I found that only three commodity spots influence the futures returns at five percent level of significance and one commodity futures has dependence on second lag returns of the spot market at 10% level of significance. Therefore, I infer that futures returns of the commodities are influenced by the first lag spot returns in majority of the commodities and second lag returns of the spot does not influence the futures returns. Further, the futures lags do not have significant influence on the futures returns.

Conclusions

Agricultural commodities are the most essential part of human civilisation. Ever since the human beings started exchanging the commodities, the importance of these commodities has only increased. Agriculture commodities have evolved from the barter system to the current system technology driven market system. In India agriculture commodities are traded through both organised and unorganised markets. There are different supply chains for different commodities. Therefore, price formations in these commodities are influenced by different factors. The setting up of screen based trading system and starting of electronic exchanges to trade in different commodities, has opened up new avenues for different classes of investors. Since agriculture commodities market is the oldest market, an attempt is made in this paper to study characteristics and the risk-return relationships of the agriculture commodities. This paper analyses the characteristics of the agriculture futures market and focuses on the relationship between the spot and futures market prices. Using summary statistics I have analysed the risk-returns characteristics of the selected commodities. The results show that coriander, potato, castor seed, chilly and chana have given the highest returns and; pepper, guar gum, sugar, gur, guar seed have given the lowest returns. The risk analysis indicates that potato, cotton seed oil cake, coriander, shankar kapas, turmeric have the highest risk and; refined soya oil, mustard seed, wheat, soya bean, and castor seed have the lowest risk. The comparison of the top five return yielding commodities with their risk ranking shows that only two commodities, potato and coriander, are in the top five risk bearing securities. The comparison of the lowest returns and the risk shows that none of the bottom five returns yielding commodities are in the bottom five risk bearing commodities. This analysis also reveals that many of the agriculture commodity futures have yielded negative returns and the risk-returns relationships indicate that not all the commodities with high returns have high risk. The analysis also shows that the commodities with low returns do not have low risk. The correlation between the risk and returns is positive but not statistically significant indicating that there are opportunities that the investors can exploit in select commodities. The summary statistics also show that most of the commodities have zero median and mode returns and the returns have negatively skewed distribution with bulginess in the returns distribution curves (as indicated by high kurtosis values). The results of this study deviate from that of Bjornson & Carter (1997) who studied the conditional risk and return characteristics of commodities and found that commodities provide a natural hedge against business cycles. My study indicate the returns of most of the agriculture commodities are negative which show that they are not good investment opportunities.

The commodities like Soya bean, Shankar Kapas, refined soya oil, pepper, mustard seed, maize fee, maize, kapas, guar are influenced by the agriculture index in majority of the periods as indicated by the regression co-efficient and Adj R2 which are significant. In these cases agriculture commodity index has significant influence on the commodity futures returns. In case of Wheat, turmeric, sugar, jeera, guar gum, and coriander in 50 percent of the periods the index has significant influence and in another 50 percent of the periods, the index does not have significant influence. When commodities like Potato, guar seed, cotton seed oil cake, chilly, chana, castor seed, and barley are considered, we can notice that in majority

of the periods the index does not have significant influence on the commodity futures returns. The conclusions that emerge based on the analysis of the relationship between the commodity futures and the agriculture index futures is that although the index influences the commodity futures returns in majority of the commodities, the index does not have significant influence on the returns of commodity futures in a considerable number of commodities and periods. This indicates that apart from the agriculture index there are other factors which have bearing on the returns of commodities.

The regression of the commodity spot on futures shows that spot market influences the futures market and the regression of the futures on the spot shows that futures market influences the spot market. Therefore, I conclude that there is by-directional relationship between spot and futures market in the agriculture commodities in India. However, the Durbin-Watson statistics for the regression of spot on the futures and the futures on the spot indicates that the model is not very robust and therefore, the results need to read with caution. The model problems are also shown by high skewness and kurtosis values.

The VAR models have shown that that spot prices (or returns) significantly depend on their own past prices (or returns) and also on futures prices (or returns). In the second case of the futures on the spot, I found that futures returns of the commodities are influenced by the first lag spot returns in majority of the commodities and second lag returns of the spot market does not influence the futures returns. Further, the futures lags do not have significant influence on the futures returns. The overall results show that the spot market depends on their own past and the futures market past values. The futures market does not show much dependence on its own past, but the spot market lags have some influence when the first lags are considered.

References:

1. *Ai, C., Chatrath, A. & Song, F., 2006. On the Comovement of Commodity Prices. American Journal of Agricultural Economics, 88(3), pp. 574-588.*
2. *Arango, S. & Moxnes, E., 2012. Commodity cycles, a function of market complexity? Extending the cobweb experiment. Journal of Economic Behavior & Organization , 84, pp. 321- 334.*
3. *Barnhart, S. W., 1989. The Effects of Macroeconomic Announcements on Commodity Prices. American Journal of Agricultural Economics, 71(2), pp. 389-403.*
4. *Bjornson, B. & Carter, C. A., 1997. New Evidence on Agricultural Commodity Return Performance under Time-Varying Risk. American Journal of Agricultural Economics, 79(3), pp. 918-930.*
5. *Clancy, M., 1998. Commodity Chains, Services and Development: Theory and Preliminary Evidence from theTourism Industry. Review of International Political Economy, 5(1), pp. 122-148.*
6. *Creti, A., Joëts , M. & Mignon, V., 2013. On the links between stock and commodity markets' volatility. Energy Economics , 37, pp. 16-28.*
7. *Frankel, J. A., 1986. Expectations and Commodity Price Dynamics: The Overshooting Model. American Journal of Agricultural Economics, 68(2), pp. 344-348.*
8. *Geczy, C., Minton, B. A. & Schrand, C., 1997. Why Firms Use Currency Derivatives. The Journal of Finance, 52(4), pp. 1323-1354.*
9. *Giot, P. & Laurentb, S., 2003. Market risk in commodity markets: a VaR approach. Energy Economics, 25, pp. 435-457.*
10. *Golec, J. H., 1993. The Effects of Incentive Compensation Contracts on the Risk and Return Performance of Commodity Trading Advisors. Management Science, 39(11), pp. 1396-1406.*
11. *He, X.-Z. & Westerhoff, F. H., 2005. Commodity markets,price limiters and speculative price dynamics. Journal of Economic Dynamics & Control, 29, pp. 1577-1596.*
12. *Hentschel, L. & Kothari, S. P., 2001. Are Corporations Reducing or Taking Risks with Derivatives?. The Journal of Financial and Quantitative Analysis, 36(1), pp. 93-118.*
13. *Jabara, C. L. & Schwartz, N. E., 1987. Flexible Exchange Rates and Commodity Price Changes: The Case of Japan. American Journal of Agricultural Economics, 69(3), pp. 580-590.*
14. *Lence , S. H. & Hayes, D. J., 2002. U.S. Farm Policy and the Volatility of Commodity Prices and Farm Revenues. American Journal of Agricultural Economics, 84(2), pp. 335-351.*
15. *Liz , E. & Rost, G., 2013. Global dynamics in a commodity market model. Journal of Mathematical Analysis and Applications, 398, pp. 707-714.*

16. *Miffre, J. & Rallis, G., 2007. Momentum strategies in commodity futures markets. Journal of Banking & Finance , 31, pp. 1863-1886.*
17. *Nazlioglu, S. & Soytas, U., 2011. World oil prices and agricultural commodity prices: Evidence from an emerging market. Energy Economics , 33, pp. 488-496.*
18. *O'Hara, M., 1984. Commodity Bonds and Consumption Risks. The Journal of Finance, 39(1), pp. 193-206.*
19. *Pieroni , L. & Ricciarelli, M., 2008. Modelling dynamic storage function in commodity markets: Theory and evidence. Economic Modelling , 25, pp. 1080-1092.*
20. *Rajgopal, S., 1999. Early Evidence on the Informativeness of the SEC's Market Risk Disclosures: The Case of Commodity Price Risk Exposure of Oil and Gas Producers. The Accounting Review, 74(3), pp. 251-280.*
21. *Serena, N., 1996. Looking for evidence of speculative stockholding in commodity markets. Journal of Economic Dynamics and Control, 20, pp. 123-143.*
22. *Sieczka , P. & Holyst, J. A., 2009. Correlations in commodity markets. Physica , 388, pp. 1621-1630.*
23. *Vercammen, J., 1995. Hedging with Commodity Options When Price Distributions Are Skewed. American Journal of Agricultural Economics, 77(4), pp. 935-945.*
24. *Viviana, A. & Wohar, M. E., 2012. Commodity volatility breaks. Journal of International Financial Markets, Institutions & Money, 22, pp. 395-422.*
25. *Westerhoff, F. & Wieland, C., 2010. A behavioral cobweb-like commodity market model with heterogeneous speculators. Economic Modelling, 27, pp. 1136-1143.*

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