# Examining Linear Relationship between Spot and Future Prices of Selected Agro Commodities

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**ABSTRACT**
Volatility or risk spillover from one market or asset to another market or asset is an important drawback in commodity derivatives market. As we know, in a competitive environment information transmission is a key factor in price discovery. Similarly, risk also transmits from one segment to another segment. Derivatives market helped in reducing volatility in spot markets due to increase in the information flow from future market to the spot market. Also, it attracts the speculators to the spot market and take alternate positions at lower cost. This helps in reducing volatility in spot markets. Derivative markets perform many functions like Price Discovery, reducing volatility spillover, hedging and risk management. The objective of the study was identified to Examine Linear Relationship between Spot and Future prices of Selected ten Agro Commodities. Ten agricultural commodities frequently traded on NCDEX i.e. Mustard Seed, Refined Soy Oil, Crude Sunflower Oil, Refined Castor Oil, Groundnut, Raw Yellow Peas, Moong, Bajra, Paddy (Basmati), Maize Feed were undertaken in the study. The results reported the presence of high positive significant correlation between the Agro spot and future commodity prices. Higher the spot prices of the Agro commodities, higher is the future prices. The Spot and future prices of all the agro commodities showed fluctuations during the period of study. Mean spot prices were greater than mean future prices for all agro commodities except Mustard Seed, Groundnut and Paddy (Basmati). ADF Unit root test showed that time series was not stationary at level 0. However, the time series became stationary at first log transformation for all 10 commodities. High positive significant correlation existed between the Agro spot and future commodity prices which showed that during the period of study they were moving in the same direction. Volatility in agricultural markets is a known devil due to the nature of the commodities (seasonal and dependent on rainfall). Volatility shall exist in both spot and future markets of commodities. The only way it can be managed well in the interests of stakeholders by having a larger segment of the market participants on the online trading platforms and the latest information is always available to them.

**Key words: Agro Commodities, Spot Prices, Future Prices, Linear Relationship, NCDEX**

**Introduction**

Derivative is an instrument which derives its value from an underlying asset. This underlying asset can be equity, commodity, forex, or any other asset. It is traded on the platform for the investors, who can trade the assets on it quoted price and not enter into physical trading. In India commodity forward/futures are regulated by "Forward Markets Commission" (FMC) under the provisions of the "Forward Contracts (Regulation) Act",1952. Nevertheless, for derivative trading in securities, the term "Security" was introduced in 2001 by amending the Securities Contract (Regulation) Act, 1956 (SC(R) A). Later in 2015, "Securities Exchange Board of India" (SEBI) became the regulatory body for derivatives markets. Under the terms of the "Forward Contracts (Regulation) Act,"1952, commodity forward/futures are governed in India by the "Forward Markets Commission" (FMC). However, the Securities Contract (Regulation) Act, 1956 (SC(R) A) was amended in 2001, introducing the term "Security" for derivative trading in securities. The "Securities Exchange Board of India" (SEBI) took over as the authority for the derivatives markets later in 2015.

Price changes of a commodity are referred to as "price volatility." The percentage difference in the commodity price from day to day is used to calculate volatility. A market is volatile if there is significant volatility, not if prices are high or low.

Commodities are more volatile for a variety of reasons, including liquidity problems, possible susceptibility to natural disasters, and geopolitics. Commodities are more popular with speculative traders than long-term investors due to their volatility.

**Review of Literature**

Malhotra & Sharma (2018) studied the volatility spill over, (i.e., information transmission process between spot and future markets) and impact of future market prices on spot market prices in Indian vegetable oil market, which is the fifth largest in the world. It was found that there is an efficient transmission of information between spot and futures markets but it is the spot market which leads to the flow of information to futures. This in turn causes greater spill-over of volatility. The spot market has a greater impact on the volatility of futures market, indicating that informational efficiency of oilseeds spot market is stronger than that of the respective futures market. Mukherjee & Goswami (2022) examined the volatility of selected commodity futures including gold, crude oil and mentha oil. They found in their study that there is presence of persistent and increasing volatility in all commodities except potato futures. The gold and crude oil future markets were found as developed markets.

Furthermore, Books, web links, NCDEX website were looked into to strengthened the understanding for the study.

**Research Methodology**

The objective of the study was identified as to Examine Linear Relationship between Spot and Future prices of Selected Agro Commodities.

**Sampling Design**

The sampling design approach followed in the study was given below.
- Population of the study: Agricultural Commodities traded on NCDEX
- Sampling Design: Ten agricultural commodities frequently traded on NCDEX i.e. Mustard Seed, Refined Soy Oil, Crude Sunflower Oil, Refined Castor Oil, Groundnut, Raw Yellow Peas, Moong, Bajra, Paddy (Basmati), Maize Feed
- Data Collection: Secondary data from NCDEX
- Sample size: Selected ten agricultural commodities were selected based on March, 2018 observed trading volumes from two major commodity groups of NCDEX, namely Cereals & Spices and Oil & Oil seeds and duration of the study was for 6 years i.e. from April 2018 to August 2024.

**Tools used for Data Analysis**

Various appropriate statistical tools models were applied for analyzing the data, which are described below:

o **Augmented Dickey Fuller (ADF) Unit Root Test:** ADF Test was used to test whether the time series data is stationary or not. Stationarity of data implies that data should be independent of time period and not influenced by it like seasonal rainfall data is non-stationary data.
o **Pearson Coefficient of Correlation:** The correlation analysis was applied to examine the linear relationship between the spot and future prices of selected Agro commodities. The Pearson coefficient of correlation was estimated in the study.

**Sampled Agriculture Commodities**

A brief information about agriculture commodities undertaken in the study is described as:

1. **Bajra** Pearl millet/Bajra (Pennisetum glaucum) is the most widely grown type of millet. It goes by several common names, including Bulrush millet, Babala, Ddukn (in Sudan), and Bajra (in India). It appears to have emerged and first been domesticated in the Sahel zone of West Africa, which is known to be the crop's main center of diversity. It has been grown in Africa and on the Indian subcontinent since prehistoric times.
2. **MOONG** Moong (Green Gram) is one of the major legume crop of South and Southea'st Asia. Moong was first domesticated in India and it is a short duration crop's and requires very a smaller number of inputs. Due to its high domestic & international demand, low cost of cultivation and drought-resistant properties, it is a prominent rotational crop among the smallholder farmers.
3. **MAIZE FEED INDUSTRIAL GRADE** Maize (Zea mays) belongs to the grain's family Graminae and is known as Queen of Cereals due to its diverse uses. Also called corn, maize requires moderate climate for growth, excess or deficient rains adversely affect yields as well quality. It grows well in loamy soils. Maize in India is grown in both Kharif (80%) and rabi (20%) seasons.
4. **PADDY (BASMATI) - PUSA 1121** The word Basmati is derived from the Hindi word 'Bas' means aroma and 'mati' means 'full of'. The Basmati-Indian rice is unique in the region. It can be grown where precise climatic conditions, soil fertility, irrigation water, and temperature exist. This occurs only in Indo-Gangetic plains.

5. **Unprocessed Whole Raw Yellow Peas** Whole Yellow Peas (Pisum sativum), also known as Dry Peas, are a part of the legume family. Pea is one of the most popular food crops in the world as they are very nutritious and an easy to grow crop. They usually grow in the cooler areas of the world unlike the other major pulses of the world.

6. **GROUNDNUT** Groundnut, also known as peanut or Arachis hypogaea, is a popular oilseed crop cultivated for its edible seeds. It is widely grown in several regions across the world, including Africa, Asia, and the Americas. Groundnuts are an essential commodity due to their nutritional value and diverse applications. Groundnut seeds are rich in protein, healthy fats, vitamins, and minerals, making them a valuable food source.

7. **CRUDE SUNFLOWER OIL** Sunflower oil is one of the most common edible oils; it is obtained by the mechanical pressing of sunflower seeds. The Sunflower seed contains about 48 – 53 percent edible oil. The oil is mainly used for cooking and shortening, and for preparing salad dressing and margarine. Sunflower oil is a health benefitting oil due to its low content of saturated fats, high levels of PUFAs and monounsaturated fatty acids, and vitamin E.

8. **REFINED CASTOR OIL** Castor Oil (Ricinus Oil), is a non-volatile fatty oil obtained from the seeds of the castor bean (Ricinus communis) of the spurge family (Euphorbiaceae). Castor Oil is the primary product obtained from Castor Seed. In terms of production, India is the largest producer of castor seed in the world, followed by China and Brazil and 30 other countries. Gujarat, Rajasthan, and Andhra Pradesh are three major castor-producing states in India.

9. **REFINED SOY OIL** Soy oil is the oil extracted from soybeans. Crude soybean oil undergoes further refinement-degumming, refining, bleaching, and deodorizing and forms refined soy oil. Soybean oil is the leading vegetable oil traded in the international markets, next only to palm oil.

10. **MUSTARD SEED** Mustard seeds (Brassica Napus) also known as Rape, Oilseed rape, Rapeseeds, and Canola are very widely cultivated throughout the world. Mustard seed is the third leading source of vegetable oil in the world after Soya bean oil and palm oil. It is world's second-leading source of protein meal after soybean meal.

**Data Analysis and Interpretation**

The data analysis results of the various tools and econometric models used are summarized as:

**ADF unit root test**

Unit root test showed that in all agri-commodities taken for study, the series was non-stationary. It became stationary after applying the first level log transformation. **Table-1** represents the results of ADF test, applied on the included Agro commodity time series.

**Table-1**
**ADF Unit Root Test**

| Agriculture Commodity Series | ADF Statistics (p value) | | Remark |
|---|---|---|---|
| | At Level | At First Difference | |
| Mustard Seed Spot Series | -2.112 (0.537) | -29.790 (0.000) | The included time series are found to be random walk at level and stationary after transforming series applying first difference log transformation |
| Mustard Seed Future Series | -2.300 (0.432) | -49.390 (0.000) | |
| Refined Soy Oil Spot Series | -1.902 (0.652) | -33.861 (0.000) | |
| Refined Soy Oil Future Series | -2.281 (0.443) | -51.329 (0.000) | |
| Crude Sunflower Oil Spot Series | -1.002 (0.942) | -1.002 (0.000) | |
| Crude Sunflower Oil Future Series | -1.788 (0.710) | -37.988 (0.000) | |
| Refined Castor Oil Spot Series | -2.192 (0.493) | -35.770 (0.000) | |
| Refined Castor Oil Future Series | -2.234 (0.469) | -21.191 (0.000) | |
| Groundnut Spot Series | -2.022 (0.588) | -36.951 (0.000) | |
| Groundnut Future Series | -2.902 (0.161) | -30.499 (0.000) | |
| Raw Yellow Peas Spot Series | 0.475 (0.999) | -13.207 (0.000) | |
| Raw Yellow Peas Future Series | -0.659 (0.974) | -38.038 (0.000) | |
| Moong Spot Series | -3.510 (0.038) | -11.572 (0.000) | |
| Moong Future Series | -3.583 (0.031) | -11.681 (0.000) | |
| Bajra Spot Series | -2.091 (0.549) | -9.691 (0.000) | |
| Bajra Future Series | -2.163 (0.509) | -10.325 (0.000) | |
| Paddy (Basmati) Spot Series | -3.446 (0.045) | -26.242 (0.000) | |
| Paddy (Basmati) Future Series | -3.417 (0.049) | -50.009 (0.000) | |
| Maize Feed Spot Series | -3.822 (0.015) | -42.555 (0.000) | |
| Maize Feed Future Series | -3.406 (0.050) | -31.394 (0.000) | |

The results reported that the all the included Agro commodities time series were non-stationary or random walk at level

(p-value less than 0.05). However, the first log difference transformation of the selected Agro commodity series made them stationary.

**Correlation Analysis**

The correlation analysis was applied to examine the linear relationship between the selected Agro commodities. The result of correlation analysis is shown below:

**Table-2**
**Correlation Analysis**

| Correlation between | Price | Returns |
|---|---|---|
| Mustard Seed spot and future Series | .990 (0.000) | .500 (0.000) |
| Refined Soy Oil spot and future Series | .978 (0.000) | .440 (0.000) |
| Crude Sunflower Oil spot and future Series | .968 (0.000) | .392 (0.000) |
| Refined Castor Oil spot and future Series | .932(0.000) | .367 (0.000) |
| Groundnut spot and future Series | .941 (0.000) | .499 (0.000) |
| Raw Yellow Peas spot and future Series | .988 (0.000) | .313 (0.000) |
| Moong spot and future Series | .989 (0.000) | .975 (0.000) |
| Bajra spot and future Series | .991(0.000) | .632 (0.000) |
| Paddy (Basmati)s spot and future Series | .980 (0.000) | .795 (0.000) |
| Maize Feed spot and future Series | .905 (0.000) | .350 (0.000) |

The results reported the presence of high positive significant correlation between the Agro spot and future commodity prices. Higher the spot prices of the Agro commodities, higher is the future prices. During the period of study Spot and future prices of all the agro commodities showed fluctuations. During the period of study, mean spot prices were greater than mean future prices for all agro commodities except Mustard Seed, Groundnut and Paddy (Basmati).

**Summary**

ADF Unit root test showed that time series was not stationary at level 0. However, the time series became stationary at first log transformation for all 10 commodities. High positive significant correlation existed between the Agro spot and future commodity prices which showed that during the period of study they were moving in the same direction.

The study contributed to the existing academic literature and knowledge of agricultural commodity markets in India. It gives a better understanding of functioning of commodity markets for the academicians. The study has extended the applicability and predictive power of commodity markets and their potential power for various stakeholders. This study has applied the practical approach to factors which determine price balance between spot and commodity futures market in India.

Upon going through the research process, it was observed clearly that there is a great scope or improvement, both at policy and implementation levels for the overall development of Commodity Derivative markets in India. Be it the policy makers, traders, farmers or investors, all of them need to participate and work towards a system which is not only robust for them but for the Economy as well. There should be more emphasis on proper training and education of various stakeholders in Commodity markets, like Farmers, Traders and Investors. This would go a long way in generating their interest in market platforms used by NCDEX and other markets. As spot and future markets get better integrated both in terms of scope and geographical coverage, it would help in economic development of India as over 60% of its population is still engaged in Agriculture, with more scientific price discovery process between these markets in place. Volatility in agricultural markets is a known devil due to the nature of the commodities (seasonal and dependent on rainfall). Volatility shall exist in both spot and future markets of commodities. The only way it can be managed well in the interests of stakeholders by having a larger segment of the market participants on the online trading platforms and the

latest information is always available to them. Proper training and educational requirements for various participants and stakeholders should be laid down by SEBI and other regulators. This should cover free and proper demonstration and knowledge sharing sessions with farmers, traders and investors so that they can hedge their positions/risk by using various instruments available at the commodity exchanges. Government should prepare necessary policies for ensuring proper competition at the commodity markets and their efficiency. This would ensure that proper price discovery so that the various stakeholders can take sound decisions about the trading in the commodity markets.

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