

# Co-Integration of Agricultural Commodities Spot and Future Prices – An Evidence from India

Ajay .B & Dr. Suresha .B

## Abstract

Since Post Liberalization in 1991, the Derivative Market in India has seen over all growth, consisting the need for price discovery of spot and the future market. Where the study is based on the collection of the daily closing of Spot and Future Prices on the 7 Selected Agricultural Commodities such as Barley, Chana, Castor Seed, Coriander (Dhanya), Soya Bean, Turmeric and Wheat based annually for 5 years from 2013-17 from Market data on historical spot and future quotes (NCDEX). The study considers to identify the Lead & Lag relationship between the Spot and Future Prices of the underlying assets and to verify if there is a co-integration between them, while the spot and futures markets are in partial equilibrium. The research conducted to analyze the spot and future prices through techniques such as the Vector Error Correction Model, Johansen Cointegration Test and Granger Causality Test. Which the results show that the 5 commodity Spot does not Granger cause Future price and 2 commodity Future does not Granger cause Spot Prices. In case for Barley, Chana, Coriander, Soya bean and Turmeric, we reject null hypothesis and state that Spot prices has a leading impact over the Future Price. For Castor seed and Wheat there is Future prices impact on the spot price where we reject hypothesis and state that Castor and Wheat future prices have an impact on Spot prices having granger non-causality and there is a unidirectional causality running from spot to future market vice-versa. With Findings in Johansen's Cointegration test also stating that we need to reject null hypothesis and accept

*alternative hypothesis that there is co-integration between the spot and future prices for the study undertaken.*

Keywords: Johansen's Cointegration test, Granger's Causality Test, Contango and Backwardation

\* Student, Master of Business Administration-Finance Management | Department of Management Studies, Christ University, Bangalore 560 029 | Contact: 9731500177

Email: [ajay.balraj11@gmail.com](mailto:ajay.balraj11@gmail.com)

\*\* Associate Professor, Department of Management Studies, Christ University, Bangalore 560 029

## 1. Introduction and Conceptual Background

In India, the Commodity Derivatives market is one of the oldest trading form used for agricultural products, precious metals etc. which led to financial trading of these commodities in stock exchanges around the world, Due to its historical background for production of agricultural goods and precious stones which led to the introduction of the future market in 1875, which started trading with cotton as one of its first future contract purchased and sold by the Bombay Cotton Trade Association. Ever since then the Indian government has been focusing on the developmental activities of the Agricultural Sector in order to tackle various issues such as unconditional climate changes, Shift in demand and supply, Natural disasters etc. which are faced by the Agro based industries and producers (farmers). By establishing infrastructural development in order to meet such requirements, so currently the Government of India has initiated various Financial Institutions and Commodity Exchanges that Trade and also provide services on such commodities

,which totally comprises of 22 Commodity Exchanges in India of which 6 are national commodity exchanges and 16 are local/state commodity exchanges .Indian Agriculture has seen immense growth over the years making them the 4<sup>th</sup> largest Agricultural producers in the world with almost 59% of the household population depending on agriculture products for their livelihood with consumption of goods worth \$ 1.13 trillion-dollar. India has been emerging as one of the top exporters ,as the world's second largest producers of Rice, Rabi , Wheat , Sugarcane , Cotton with production of 275.68 million tonnes and about 68.53 hectares of Kharif was produced in FY 16-17 . The commodity futures market is the main mechanism for price discovery and price risk management. The price of any commodity is discovered by the actual demand and supply position in the market. The futures market merely discovers the probable cost/prices of a given commodity at future points of time depending on expected demand and supply in the market. Through various National commodities derivatives exchange and its online platforms help identify the future prices which are discovered in a transparent manner. The future market leads to reduction in seasonal price volatility which leads to better price realization for the farmer at the time of harvest. With the help of information on future price trends, and probable supply and demand of various commodities, the farmers can plan their cultivation as well as storage and sale of their produce in advance. By setting up a national-level, coordinated market for Agricultural products through the Planning Commission. From the recommendations of Rangarajan Committee the Government of India conceded authorization to NSEL alongside two other spot trades to begin operations. The Gazette notification issued by the Govt of India on June 5, 2007 which allowed general exception under

Section 27 of the Forward Contracts Regulation Act. An important component in understanding and managing market price risk for different commodities is identifying and comparing the relationship between futures market and spot market by cost of carry relationship. Where the economic growth, employment, overall business and international trade, political and economic stability are the main factors affecting the future prices, which leads to fluctuation of prices due to increase in consumption impacting the increase in future prices vice versa .The most outstanding commodity exchange currently trading in India is the Multi Commodity Exchange of India (MCX), which has seen a regular increase from Rs.14.88 million to during the period 2013 -2017. Whereas the National Commodity and Derivatives Exchange Limited (NCDEX) has gained a multiple increase in trade of value of Rs.1.59 million in 2013 to in 2017.

## 2. Review of Literature

- **Neeti Agarwal and Gurbandini Kaur (2013)** in their research paper which is based on the up gradation of future commodity exchange market in India and on how the indicators for the parameter for the market is reviewed by the researchers having a mixed view on the study. Also stating that certain unanticipated changes in price movements can be measured to an extent resulting in efficient growth in the market.
- **Gouri Prava Samal, Dr. Anil Kumar Swain, Dr. Ansuman Sahoo and Amit Soni (2013)** in the research paper presented as shows that there is a significant correlation between the spot and future prices of the 3 Agricultural commodities studied for a period of 12 months conducted through

Dicky-Fuller test, Vector Auto Regression model, causality test and OLS regression analysis which find that there is a High Correlation of 1% level of significance in the Corresponding Coefficient Variables and that these both prices are integrated and cointegrated to provide market efficiency.

- **Hilary Till (2014)** in her article which talks about the strategies used to forecast Spot and future prices to determine the risks involved such as weather, Financial Structure etc. By Analyzing the beta of each parameter which is to be less than 1 by providing better yield on return of the risk analysis done. This study does not contain any tools for prediction of price movements but only theoretical data used to determine the strategies to overcome the risk with use of appropriate benchmark.
- **Angad Singh Maravi (2015)** in his study that speaks about the growth of the commodity market resulting in employment opportunities due to increase in organizations undertaken by the government to provide benefits to traders, sellers and buyers. Which the research conducted here shows the data of various 113 Agricultural and Non-Agricultural Commodities traded in the Exchanges have seen potential growth between the period 2009-14 due to infrastructural growth, policies and regulation changes and also through risk management mechanism like warehouse receipt system resulting from wide spread of commodity market networks and developmental policy alternatives.
- **AntoJoseph, Suresh K G and GarimaSisodia (2015)** in their research article which speaks about how agriculture plays a significant

role in the Indian economy which study performed on the underlying assets used to determine the risk analysis and risk management strategies and techniques to provide the parameter undertaken as trading activity. As such observations on the causality between the variables is integrated with all 11 Commodities showing significant future to spot price causality and 2 commodities with significant spot to futures prices to indicate Market efficiency influenced with positive and negative aspects.

- **Raushan Kumar (2015)** in his study which speaks about the impact of economic reforms which has brought in Growth in the futures and spot markets and on how various introduction of financial instruments to minimize risks due to fluctuating market conditions . By understand the lead-lag relationship between the future and spot prices in order to identify the interdependence between them .Here the study uses spot and future prices from the period of 2009 to 2014 for agro products like barley, wheat, maize, mustard, gram , coriander , castor seed , soya bean, chilli, jeera ,sugar , pepper ,seed oil cake and cotton to analyze the linkages by testing them through granger causality test , ADF , ECM and Johansen Co integration Test found that due to high demand and lower transaction cost for future markets which have good advantage over the spot markets.
- **Na Li, Alan Ker, Abdoul Sam and Satheesh Aradhyula (2016)** states that the study is conducted on 10 various agricultural commodities at weekly closing prices to determine the volatility of price of each commodity by using

GARCH processes in differentiating each commodity prices by using out of sample and in sample test to forecast the future price by comparing NM-AGARCH and A-GARCH to provide risk-return factor for commodities traded. Which in the research done shows the expected price change correspond to changes in volatility and also in the case for inverse leverage effect there was less significance with certain commodities like Corn which saw fall in prices over a period of research done. So by stating that better Risk management techniques should be undertaken to hedge such risk involved.

- **Raghavendra RH, Velmurugan PS and Saravanan A (2016)** in their study which speaks about the efficiency and transparency between the agricultural commodities which comprises with price discovery, risk management (hedge risk analysis), Regulatory bodies, Commodity delivery system which determines the long term equilibrium relationship between the Spot and Future prices from the study made on the co-integration results indicating 95% critical value as rejected.

### 3. Objectives.

- To analyze the return and volatility of the Future prices of Agricultural Commodities traded for period of 5 years.
- To find the stationary between the series of spot and future price for selected commodities.

- To study the long-run relationship and impact between the agricultural commodities spot and future prices.

### 4. Hypothesis for the Study

Here, the research gap for the study is to identify the Lead & lag relationship between the Spot and Future Prices on the Selected Agricultural Commodities for the period from 2013 to 2017 in India. After Considering the Past data Collected and literature's reviewed by Re-validating the impact of Spot and Future prices on the 7 selected Underlying Agricultural Commodity market in India from January 2013 to December 2017. Based on the motivation for the study also requires to consider whether there will be cointegration between the spot and futures markets and whether there will be partial equilibrium if the futures price is equal to the spot price plus a premium which reflects the deferred payment on a futures contract and also by identifying the interdependence between Spot and Future Prices.

Here in the Study we consider to analyze the outcome of future prices over spot prices, given that we assume that future price will be equal to the expected spot price during the delivery date.

- $H_0$ : There is no co-integration between spot and future price of select agro commodities in India
- $H_1$ : There is co-integration between spot and future price of select agro commodities in India

### 5. Methodology

The Research is based on the descriptive study undertaken with historical data of future and spot price which is collected on the 7 Selected agricultural commodity such as Chana, Turmeric, Barley, Wheat, Soya Bean, Coriander (Dhanya) and Castor Seed traded daily based annually for 5 years from 2013-17 from Market data



on historical spot and future quotes (NCDEX). The rationale selection for these commodities can be because these commodities represent as the highly traded contracts in the commodity market .By adopting Co-integrated technique for the study to analyze the prices inter-dependently by assuming mean of the Spot and Future prices compared from the Exchanges and using Asymmetric Causality Test to identify the relationship causality of variables and also by using the collected spot and future daily closing price data and analyzing by adopting Johansen's Co integration model, Granger causality test to find the lead lag relationship between the future and spot prices. Where based on the model

undertaken to provide certain basis to the spot and future prices Backwardation is considered Positive basis and Contango is Negative basis. So when the market for the Spot prices can be more volatile due to Backwardation. So to consider we take the, Basis = Spot Price - Future Price.

### Johansen's Cointegration and Vector Error Correction Model

Johansen test is used to identify cointegration between the two series, we consider the spot and future prices of the selected agricultural commodities. By considering the rank of the  $\Pi$  matrix via its Eigen values which is arranged in a descending order.

$$\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \dots \geq \lambda_n$$

Where,  $\lambda_n$  is the smallest value and  $\lambda_1$  is the largest value. For testing the null hypothesis which cointegration rank is equal to  $r$  against the alternative hypothesis which is cointegration rank equal to  $r + 1$ . to test statistic which is calculated below.

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \lambda_{r+1})$$

Where,  $\lambda$  is the Eigen value for the test which is repeated for  $r = 1 \dots k$  until one series fails to reject the null hypothesis followed by the lamda test which is conducted in inverse sequence that is  $r = k, k - 1, k - 2 \dots 0$ .

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^k \ln(1 - \lambda_i)$$

The above two equation,  $r$  is the number of cointegration vectors and  $\lambda_i$  is the estimated value for the  $i^{th}$  ordered Eigen value from the  $\Pi$  matrix.

To verify the stationarity of the series of Relationship between Spot and Future Prices, Further to examine the lead lag relationship between the selected agro commodities. The formula below denotes the Co-integration of Spot and Future Prices for **Granger Causality test** to infer cause and effect relationship between two

time series which is based on Bi-variate regression model. Which the equilibrium relationship is then used to construct an error correction model. An error correction model is a statistical specification of economic dynamics which through the pull and push forces restore back to equilibrium relationship whenever disequilibrium takes place. To test the causality VECM maybe estimated using OLS in each of the equation.

$$\Delta S_t = \alpha_{s,0} + \sum_{i=1}^{p-1} \alpha_{s,i} \Delta S_{t-i} + \sum_{i=1}^{p-1} b_{s,i} \Delta F_{t-i} + \alpha_s Z_{t-1} + \varepsilon_{s,t}$$

$$\Delta F_t = \alpha_{F,0} + \sum_{i=1}^{p-1} \alpha_{F,i} \Delta S_{t-i} + \sum_{i=1}^{p-1} b_{F,i} \Delta F_{t-i} + \alpha_F Z_{t-1} + \varepsilon_{F,t}$$

Where,  $S_t$  and  $F_t$  are both Spot and Future closing market prices of selected commodities or stocks at time  $t$ .  $\alpha_{s,0}$  and  $\alpha_{F,0}$  are intercept terms.  $\alpha_{s,i}, \alpha_{F,i}, b_{s,i}$  and  $b_{F,i}$  are the short run coefficients.  $Z_{t-1}$  is the error correction term derived from the cointegration equation.  $F_t$  Granger causes  $S_t$  if some of the  $b_{s,i}$  coefficients are significant and  $\alpha_s$  is also significant vice versa.

### 6. Analysis and Empirical Evidence / Results.

The Analysis of the study shows that the data of both spot and future prices of the daily closing prices collected for 5 years based on the unit roots of the Co integration which results indicate that the

study variables are non-stationary and the spot and futures prices are integrated. With Steps indicating the results from the Vector Error Correction Model, Covariance, Johansen's Co integration and Granger's Causality Test in the following table.

### Descriptive Statistics

**Table 1.** Collected data of the spot and future prices for all 7 commodities of the price series data for 5 years and calculation below shows the mean for each spot and future prices and standard deviation, Kurtosis, Jarque Bera and Probability to find out the volatility and also by identifying the negative and positive skewness for the mean.

		Mean	Std.Dev	Skewnes s	Kurtosis	Jarque- bera	Prob.
Barley	Spot	1472.71	153.466	0.266084	2.524468	20.0550	0.13375
	Future	1460.86	138.808	-0.02628	2.684667	4.02408	0.00004
Castor	Spot	3918.82	358.841	0.189850	2.231221	22.2017	0.00001
	Future	4014.98	379.916	0.401598	2.443410	17.0932	0.00019
Chana	Spot	3636.57	1055.282	2.278665	9.73514	1769.01	0.00000
	Future	3737.36	968.5153	2.659472	1109861	2916.85	0.00001

Coriander	Spot	7772.18	1973.353	0.624030	2.638431	62.3295	0.00000
	Future	8012.19	2136.465	0.848415	2.976538	106.312	0.00000
Soyabean	Spot	3699.85	376.3752	0.083106	2.821253	3.08310	0.21404
	Future	3643.75	399.7566	0.271851	2.415481	32.9789	0.00000
Turmeric	Spot	7306.55	1199.00	0.035252	2.713043	3.74364	0.15384
	Future	7022.87	1211.86	0.066521	2.112073	34.5622	0.00000
Wheat	Spot	1700.22	141.9961	1.350112	5.44550	496.583	0.00000
	Future	1643.04	112.1503	1.568495	6.99032	963.979	0.00000

### Interpretation

The mean for Barley, Soy bean, Turmeric and Wheat spot prices are more than the mean future prices except for Castor seed, Chana and Coriander. As for the Std.Dev which is used to identify the volatility shows that Spot prices for Barley, Chana and wheat are more volatile compared to their future prices. Whereas for Castor, Coriander, Soyabean and Turmeric Future prices are more volatile compared to Spot prices. Kurtosis normal distribution is 3 as for Chana and Wheat spot and future. For the other commodities it is below 3 and negative skewness was only found for

barley future prices and the remaining commodities are in positive skewness undertaken for the study.

### Augmented Dicky Fuller Unit Root Test

We have to test series of data collected by unit root test series to determine augmented dicky fuller test to find stationarity between series of spot and future prices. In order to further study the co-integration of the spot and future we need to consider to examine the level of integration.

**Table 2:** Below showing the ADF test results between the selected commodities

			T-stat	Prob.*
	Future	With Intercept	-2.683972	0.0772
		With Intercept and trend	-2.908526	0.1602
		None	0.036913	0.6944

Barley	Spot	1 <sup>st</sup> Difference	-30.72595	0.0000
		With Intercept	-1.710469	0.4256
		With Intercept and trend	-1.698408	0.7515
		None	0.288667	0.7693
		1 <sup>st</sup> Difference	-32.00374	0.0000
Castor seed	Future	With Intercept	-2.241437	0.1919
		With Intercept and trend	-2.361654	0.3994
		None	-0.491585	0.5030
		1 <sup>st</sup> Difference	-23.57542	0.0000
	Spot	With Intercept	-1.693413	0.4341
		With Intercept and trend	-1.343916	0.8757
		None	-0.488449	0.5042
		1 <sup>st</sup> Difference	-22.72955	0.0000
Chana	Future	With Intercept	3.061053	1.0000
		With Intercept and trend	1.630745	1.0000
		None	2.460561	0.9969
		1 <sup>st</sup> Difference	-23.20006	0.0000
	Spot	With Intercept	1.076105	0.9973
		With Intercept and trend	-0.328908	0.9897
		None	1.347706	0.9556
		1 <sup>st</sup> Difference	-7.986497	0.0000
Coriander	Future	With Intercept	-1.925966	0.3204
		With Intercept and trend	-2.322403	0.4208
		None	-0.583163	0.4647
		1 <sup>st</sup> Difference	-29.55301	0.0000
		With Intercept	-1.375742	0.5953
		With Intercept and trend	-1.829514	0.6897



	Spot	None	-0.304764	0.5759
		1 <sup>st</sup> Difference	-25.86301	0.0000
Soya bean	Future	With Intercept	-2.734587	0.0685
		With Intercept and trend	-2.711416	0.2320
		None	-0.338796	0.5632
		1 <sup>st</sup> Difference	-34.03035	0.0000
	Spot	With Intercept	-2.349061	0.1568
		With Intercept and trend	-2.579512	0.2899
		None	-0.385400	0.5454
		1 <sup>st</sup> Difference	-29.02120	0.0000
Turmeric	Future	With Intercept	-2.265751	0.1835
		With Intercept and trend	-2.359553	0.4007
		None	-0.257513	0.5934
		1 <sup>st</sup> Difference	-30.51295	0.0000
	Spot	With Intercept	-1.718652	0.4215
		With Intercept and trend	-1.901196	0.6531
		None	0.246336	0.7575
		1 <sup>st</sup> Difference	-16.03689	0.0000
Wheat	Future	With Intercept	-2.876498	0.0485
		With Intercept and trend	-3.214081	0.0823
		None	-0.096803	0.6501
		1 <sup>st</sup> Difference	-30.75766	0.0000
	Spot	With Intercept	-1.970857	0.2999
		With Intercept and trend	-2.495536	0.3303
		None	0.225784	0.7516
		1 <sup>st</sup> Difference	-22.80921	0.0000

By indicating that Critical value for p value should be less Significance of 0.05%. So as the tested data showed that 6 commodities except Wheat are non-stationary at level and stationary at their 1<sup>st</sup>

Differences .Whereas Wheat is stationary at level with significance in case for future and for spot is stationary at 1<sup>st</sup> Difference value lesser than 0.05%

**Johansen Co-integration**

**Table 3:** Showing the co-integration between the spot and future prices of Barley, Castor seed, Chana, Coriander, Soya bean, Turmeric and Wheat

Commodity	Ho:vector(r)	Trace Stat	p-value	Max-Eigen Stat	p-value
Barley	$r = 0$	31.05355	0.0001	27.24782	0.0003
	$r \leq 1$	3.841466	0.0511	3.805734	0.0511
Castor Seed	$r = 0$	41.37760	0.0000	37.50276	0.0000
	$r \leq 1$	3.87840	0.0490	3.874840	0.0490
Chana	$r = 0$	27.15524	0.0006	25.66172	0.0005
	$r \leq 1$	1.493520	0.2217	1.493520	0.2217
Coriander	$r = 0$	30.30678	0.0002	27.51129	0.0002
	$r \leq 1$	2.795497	0.0945	2.795497	0.0945
Soya bean	$r = 0$	34.83112	0.0000	29.75215	0.0001
	$r \leq 1$	5.078971	0.0242	5.078971	0.0242
Turmeric	$r = 0$	25.77381	0.0010	22.68743	0.0019
	$r \leq 1$	3.086379	0.0789	3.086379	0.0789
Wheat	$r = 0$	33.75007	0.0000	30.89670	0.0001
	$r \leq 1$	2.853373	0.0912	2.853373	0.0912

So the above we assume that the agricultural commodities of spot and future prices of Barley, Castor seed, Chana, Coriander, Soya bean, Turmeric and Wheat has to have lesser p-value which is to be lesser than significant of critical value 0.05 for which below

We reject H<sub>0</sub>: There is no co-integration

between spot and future price of select agro commodities in India

We Accept H<sub>1</sub>: There is co-integration between spot and future price of select agro commodities in India.

And that there is long-run relationship between the Spot and Future prices of the agricultural commodities for the study undertaken.

- Above for Spot and future of Soya bean and castor seed have 2 co-integrating values considering P-value of 0.0490 and 0.0242 respectively. Where the Eigen value for test is repeated with the series to reject null hypothesis.
- As critical significance is to be considered below as 0.05% for p value, we consider above that the next series is higher than the critical value we have to reject null hypothesis and accept alternative hypothesis.

## 6. Conclusion and Discussions

- The Study based on Granger causality test for all the 7 Selected agricultural spot and future price show that spot does not Granger cause future prices. In case for Barley, Chana, Coriander, Soya bean and Turmeric and we reject null hypothesis and state that Spot prices has a leading impact over the Future Prices.
- The Future prices does not granger Spot prices for 5 agricultural commodities but whereas for Castor and Wheat future prices have an impact on the spot prices.
- Consisting above shows the granger non-causality and that there is a unidirectional causality running from spot to future market vice-versa.
- There is significance in the long run relationship between Spot and Future prices and the Cointegration varies from commodities of spot and future.
- For which we reject null hypothesis and accept alternative hypothesis stating that there is co-integration between the spot and future prices of the selected agricultural commodities vice versa.
- As there is cointegration which results in efficiency in the Spot and future market for the agricultural commodities, investor can take advantage of the market

perfection and also small investor can invest to gain substantial return with less risk of huge arbitrage affecting the dominance in the market place.

## 7. References

- [1] Joseph, A., K.G, S., & Sisodia, G. (2015). Is the Causal Nexus between Agricultural Commodity Futures and Spot Prices Asymmetric? Evidence from India. *Theoretical Economics Letters*, 5(2), 285–295.  
<https://doi.org/10.4236/tel.2015.52034>
- [2] Maravi, A. S. (2015). Performance Analysis of Indian Agricultural Commodity Market. *International Journal of Commerce, Business and Management (IJCBM)*, 4(2), 1125–1135.
- [3] Agarwal, N., & Kaur, G. (2013). Agricultural Commodity Future Trading and Its Implications – a Note. *AIMA Journal of Management & Research*, 7(2)..
- [4] Causal Nexus between Commodity Derivatives Market Reforms and Economic Growth – Evidence from Indian Agricultural Sector. (2015), 6(21), 42–49.
- [5] Easwaran, R., & Ramasundaram, P. (2008). Whether commodity futures market in agriculture is efficient in price discovery?—An econometric analysis. ... *Economics Research Review*, 21, 337–344. Retrieved from <http://core.kmi.open.ac.uk/download/pdf/6653145.pdf>
- [6] Till, H. (2014). Practical Commodity Futures Trading Principles, (November).
- [7] Benavides, G. (2009). Price volatility forecasts for agricultural commodities: an application of volatility models, option implieds and composite approaches for futures prices of corn and wheat. *Revista de Administración, Finanzas Y Economía (Journal of Management, Finance and Economics)*,

3(2), 40–59. Retrieved from [http://www.csf.itesm.mx/egade/publicaciones/articulos/Guillermo\\_Benavides.pdf](http://www.csf.itesm.mx/egade/publicaciones/articulos/Guillermo_Benavides.pdf)

[8] Kumar, R. (2014). Price discovery in some agricultural commodity markets in India, 1–53.

[9] RH, R., & PS, V. (2016). Relationship between Spot and Futures Markets of Selected Agricultural Commodities in India: An Efficiency and Causation Analysis. *Journal of Business & Financial Affairs*, 5(1), 1–8. [https://doi.org/10.4172/2167-](https://doi.org/10.4172/2167-0234.1000160)

[0234.1000160](https://doi.org/10.4172/2167-0234.1000160)

[10] Li, N., Ker, A., Sam, A., & Aradhyula, S. (2016). Modelling regime-dependent agricultural commodity price volatilities, (July).

[11] Samal, G.V., Swain, A.K., Shoo, A., & Soni, A. (2015). Market Efficiency of Agricultural Commodity Futures in India: A Case of Selected Commodity Derivatives Traded On Ncdex During 2013. *International Journal of Business and Management Invention*, 4(1), 32–49.