# A Study on Efficacy of Cotton Futures in India

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**Abstract**

One of the focal issues in Indian agriculture is to ensure remunerative prices to farmers by mitigating price risk. An important mechanism in ensuring that will be by integrating agricultural markets with futures market and it is possible if markets are efficient. The present study makes an attempt to explore that whether agricultural derivatives market like MCX are efficient by taking cotton as the sample commodity. Secondary data pertaining to daily prices relating to future & spot of cotton taken from MCX. Applying the Stationarity test, VAR Model and Causality Test, the study confirms that cotton futures market is efficient resulting in futures prices causing or influencing spot prices. Therefore, policy implication of the study is suggestive that cotton farmers can take advantage of price risk mitigation by engaging in the futures market.

**Keywords: derivatives, price discovery, spot prices, future prices, MCX**

## I. INTRODUCTION

Ensuring remunerative price for the farmers is perhaps one of the most important challenges in the development of agriculture in India today. In a country where agriculture contributes around 18% of GDP and employs 50% of its labour force, this can be ignored at its own peril. Concept of MSP is one such way of providing farmers remunerative price for their produce. Going by experience, many difficulties starting from fixing Minimum Support Price (MSP) of agricultural commodity to disbursal of it exists in the system. Further there is a limit to which Government intervention can solve the issue. This fact has also been recognized by the NITI Ayog and in one of its policy dialogue organized in2018 it was suggested that “Market reforms are needed to integrate markets and connect it with smallholders. Karnataka’s model of electronic agricultural marketing platform with the NCDEX (National Commodity and Derivative Exchange) spot exchange is a success. One of the biggest impediments of farmers not getting remunerative price is the wide price fluctuation of agricultural commodities which often forces the farmers to go in for distress sale. MSP is not the only answer, more market channels and efficient markets are the only sustainable way to do it. So the point is whether agricultural derivative markets like NCDEX and MCX can be used to manage the price risk of farmers and what are the mechanisms to do so. In view of the above, this paper tries to explore whether commodity futures are efficient in price discovery.

## II. Literature Survey

Recent emphasis of NITI Ayog to link farmers to derivative market has generated lot of interest about the ability and efficacy of derivative market in discovering prices. A closer look at the recent studies conducted in this regard is summarized below.

Efe-omojevwe (2013) focused his research on the efficiencies of Indian wheat and maize futures market. To gauge future and spot prices relationship, co-integration test and VECM models were used. The study used data from NCDEX, whose stationarity test was determined by the Augmented-Dickey fuller method. The result of his study depicted that the maize and wheat futures are a little more unstable from their spots. The study attributed additional information that would have been used to make speculative gains by the traders as a major reason for inefficiency in the market. The findings concluded that inefficiency in the market is not always due to result of volatility. Kumar, R. (2017) studied daily price data of nine commodities for the period 2009-14 for studying the price discovery efficiency of the commodity market. Augmented Dicky-Fuller test, Phillips-Perron test used to taste data stationarity and both linear and non-linear Granger causality test was applied to study the lead-lag relationship between future and spot returns. The paper concluded that future market has dominance over the spot market and the strong evidence of future market discovering prices. In the same year, Shanmugam, V., & Irshad, V. K. (2017) studied daily price movement of spot and futures market of five agricultural commodities for a period of 7 years from 2007 to 2014. Price movements were observed by using unit root test and Engel-Granger test of co-integration. It was evident that there was significant interrelationship between two prices. Hence the authors concluded that markets are efficient in disseminating price information and can be used for hedging. Vijayakumar, A. N. (2018) tested efficacy of rubber futures in price risk management. A bidirectional causal relationship was observed in case of rubber futures. Vijay Kumar also studied constraints of small farm holders in participating in the derivative market.

It is evident from the existing literature that in most cases the commodity derivative market is efficient in discovering prices for the agri commodities. But no such recent study has been conducted post-merger of Forward Market Commission with SEBI. So, the study intends to test the futures market efficiency for commodity under the study i.e. cotton.

## III. HYPOTHESIS

$H_0$: Cotton Futures Market is not efficient in discovering prices

$H_1$: Cotton Futures Market is efficient in discovering prices

## IV. DATA & METHODOLOGY

Cotton has been taken as the sample commodity for the research to study future market efficiency in price discovery. Secondary data pertaining to daily future closing price and spot closing price of cotton has been collected from MCX. Reference period for study is from January'19 to Dec'19.Daily spot and futures price relating to 11 contracts during 2019 has been taken into consideration which covers around 1,386 no of observations.

According to Fama (1970), in an efficient commodity market, spot market fully integrates the available information; i.e. price signal shall be sent immediately from futures market to spot market to avoid abnormal gain arising out of arbitraging due to dissimilarity in price at maturity. So this market efficiency can be denoted by Equation (1):

$FP\ t, t\text{-}k = SP\ t, t\text{-}k + dt$ ………(1)

where, *dt* denoted carrying cost, *FPt, t-k* denoted futures price at time *t* to be delivered at time *t-k*, and *SPt-k* denoted expected maturity date spot price, i.e. time *t-k.* So it is necessary that to evaluate the efficacy of futures market two necessary criterions are SP & FP shall be integrated of same order and also both prices shall be co-integrated. Otherwise there is a chance of drifting apart in the long run. Further futures shall be the cause and spot price the effect to indicate the direction of causality.

For testing the hypothesis, following methodology has been adopted:

 

- Stationarity of the time series is first tested using Augmented Dickey-Fuller (ADF) test. According to Granger & Newbold (1977), as non-stationary data will have unpredictability, the model will produce spurious results.
- Upon satisfying stationarity criterion, Vector Auto Regression (VAR) is applied to evaluate the interdependencies amongst the endogenous variables. A Vector Auto Regression model enumerates the evolution of *endogenous variables* over same observed period ($t$ = 1, $t$) as a linear function of their past values. VAR ($p$) signifying A *VAR of p-th order*, is given by equation (2):

$$y_t = C + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t \ldots\ldots(2)$$

- To examine causality between studied variables Granger causality test is performed. This is necessary to ascertain whether one variable can be a predictor for the other variable. Particularly, application of this causality test was essential to study the relationship between $p$ lagged values of St & Ft by estimating the regression models specified in equation (3) and (4):

$$S_t = a_0 + \sum_{k=1}^{p} a_{1k} S_{t-k} + \sum_{k=1}^{p} a_{1k} F_{t-k} + e_t \ \ldots\ldots(3)$$

$$F_t = a_0 + \sum_{k=1}^{p} a_{1k} F_{t-k} + \sum_{k=1}^{p} a_{1k} S_{t-k} + e_t \ \ldots\ldots.(4)$$

## V. Results And Discussion

Table 1 depicts the calculated figures of ADF 't' stat for all cotton contracts at 5% significance level. The unit root test confirms the stationarity of the variables at I(1) which is the first indication of efficiency. It can be seen from the table 1 that absolute critical value at 5% is lower than the calculated *tau* statistics of future and spot prices in absolute terms. So the null hypothesis i.e these series contain a unit root and are non-stationary can be rejected. Thus the time series are I(1) meaning stationary at first difference.

After establishing stationarity of the time series, in order to gauge the interdependency between the two study variables (i.e. cotton futures and spot prices), VAR equations are done in its level form. As a prerequisite to the VAR model, optimal lag was selected under various criterions.

Table 2 exhibits the result for all the contracts. Lag selected under highest number of criterion is chosen as optimal lag. The results display the optimal lag for one contract is '1' and '2' for 10 contracts.

After determining the optimal lag, VAR estimations are done for the studied contract. Table 3 in the Annexure may be referred for the result. The result of the VAR model is depicted in Table 3. Only negative coefficients are considered at significant level as it indicates long run convergence. Coefficients of lag at 5% significance have been considered. From the table 3, it can be observed that only 1 lags of spot has influence on future in negative direction. Whereas there are 7 lags of futures having negative influence on spot in negative direction. Hence the conclusion is lag values of futures are having more impact on spot price.

Results of relationship between variables evaluated by applying Granger causality test and are summarized in Table 4. The null hypothesis is that FP does not granger cause SP and vice-versa. This can be observed from the F statistic column. In case of 6 out of 11 contracts, at 5% significance the results show future prices granger causing the spot prices (F →S) and in case of 3 out of 11 contracts, at 5% significance the results show spot prices granger causing the future prices (S→F). Only for 1 contract bidirectional causality relationship (F ←→S) was observed. The values of the F statistics for the contracts are strongly indicated that spot prices are influenced by future prices at a higher degree. The above results are conclusive of cotton future market efficiency in facilitating the price discovery in the spot market which also eliminates possibility of supernormal profit from arbitraging due to price differential.

The empirical analysis to ascertain efficacy of cotton futures market is being done using various statistical tools. The VAR model has demonstrated that spot prices are more influence by lag of futures. The Granger causality test further established that futures market prices are leading spot market prices or spot prices of cotton are discovered in the agri futures market. Hence the null hypothesis, "futures market is inefficient" is rejected. So it can be concluded that futures prices causes or influences the spot price, implying fact that Indian commodity futures market for cotton is evidently efficient.

## VI. CONCLUSIONS

 

The study is motivated from the approach that market-oriented solutions via future and spot markets, may be attempted as a solution to the lack of remunerative prices to the farmer. In this regard the study proved the market efficiency of cotton futures which implies that the cotton farmers can participate in the future market to mitigate the price risk. Though many states like Gujarat, Maharashtra, and Karnataka have already been encouraging the farmer's participation yet there are still certain cotton growing states like Odisha wherein the farmers have low access to the derivatives market.

It is thereby imperative to study the factors that hinder the farmers' participation in the futures market. According to Salvadi and Ramasunduram (2008), the efficiency of cotton futures can be improved if factors like lack of awareness about futures market, underdeveloped spot and delivery markets, inadequate grading and standardization mechanism, absence of storage houses, low outreach of price dissemination programmes etc. can be substantially addressed by policy makers.

**Policy Suggestions:**

1. Establishment of aggregators like FPOs and other farmer associations to collectivize the farm produce and operate on behalf of the farmers.
2. Regular awareness, orientation and training programmes regarding the benefit and operational aspects for all the stake holders involved in the supply chain .
3. Access to market information through price information dissemination via installation of price ticker boards in all areas which display a substantial footfall of farmers.
4. Establishment of more storage and warehouse units to function as delivery centers in all states.
5. Support of Government organizations such as Food and Civil Supplies Corporation, State Agriculture Marketing Board etc. to promote pro-growers programmes on how to market their produce.

## References

1. Bhagwat, S., Maravi, A. S., Chand, D., & More, R. (2015). Journal of Business Management & Social Science Research , Volume 4, No.2, February 2015,pp 215.

2. Easwaran, R. S., & Ramasundaram, p. (2008). Whether commodity futures market in agriculture is efficient in price discovery?—An econometric analysis. Agricultural Economics Research Review , 337-443.

3. Efe-Omojevwe, Z. A. (2013). A Study of the Efficiencies of Maize and Wheat Futures Markets in India. IOSR Journal of Agriculture and Veterinary Science, 2319-2380.

4. Gupta, R. (2011). Commodity Derivative Market in India: The Past, Present and Future. Analytique , Vol VII, No 2,pp 4.

5. Karamala, P. (2013). Growth and challenges of commodity derivative market in India. International Journal of Management, Information Technology and Engineering, 1(3), 205-218.

6. Kumar, S. (2004). Price discovery and market efficiency: Evidence from agricultural commodities futures markets. South Asian Journal of Management , 32-47.

7. Kumar, R. (2017). Price Discovery in Some Primary Commodity Markets in India. Economics Bulletin, 37(3), 1817-1829.

8. Naik, G., & Jain, S. K. (July 27, 2002). Indian agricultural commodity futures markets: a performance survey. *Economic and Political Weekly* , 3161-3173.

9. Radha, K., & Balakrishnan, S. (2017). The Role of Commodity Futures in Risk Management: A Study of Select Agricultural Commodities. IUP Journal of Financial Risk Management, 14(4).

10. Ranganathan, T., & Ananthakumar, U. (2017). Hedging in Presence of Crop Yield, Crop Revenue and Rainfall Insurance. Journal of Quantitative Economics, 15(1), 151-171.

11. Shakeel, M., & Purankar, S. (2014). Price discovery mechanism of spot and futures market in India: A Case of selected Agri commodities. *International Research Journal of Business and Management* , 50-61.

12. Shanmugam, V., Raghu, R. R., & Saravanan, A. (2017). *Efficiency in Agricultural Spice Commodities Futures Markets in India*. Retrieved from ssrn: https://ssrn.com/abstract=2995335

13. Singh, M. B. & John, A.R. (2019) Indian Commodity Market in Its New Awakening: Possibilities and Obstacles. *Asia Pacific Journal Of Research,* October, 2019.

14. Vijayakumar, A. N. (2018). Price risk management practices and viability of rubber futures contract for small farm holders. *Wealth: International Journal of Money, Banking & Finance*, *7*(3), 38–48.

15. Multi Commodity Exchange of India,http://www.mcxindia.com

**Table 1: ADF Test**

| Contract | No of Observations | Spot 't' Statistics | Futures 't' Statistics | Critical 't' at 5% |
|---|---|---|---|---|
| January'19 | 122 | -9.91 | -10.95 | -2.88 |
| February'19 | 121 | -10.23 | -10.36 | -2.88 |
| March,19 | 120 | -9.74 | -9.16 | -2.88 |
| April,19 | 118 | -9.86 | -10.2 | -2.88 |
| May'19 | 121 | -9.02 | -11.04 | -2.88 |
| June'19 | 120 | -8.88 | -10.88 | -2.88 |
| July'19 | 120 | -8.91 | -11.09 | -2.88 |
| August'19 | 120 | -7.79 | -8.91 | -2.88 |
| October'19 | 121 | -8.54 | -10.11 | -2.88 |
| November'19 | 141 | -9.33 | -9.82 | -2.88 |
| December' | 162 | -10.11 | -9.92 | -2.88 |

❖ *Source: Authors' estimations*

**Table 2: Selection of Optimal Lag**

| Month | Jan'19 | Feb'19 | March'19 | April'19 | May'19 | June'19 | July'19 | Aug'19 | Oct'19 | Nov'19 | Dec'19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Optimal Lag | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

*Source: Authors' estimations.*
*Note: Lags corresponding to highest number of '* 'marked criterions are considered as optimum lag*

**Table 3 : VAR (Vector Auto Regression) Model**

| Year | Cotton | | | | | |
|---|---|---|---|---|---|---|
| | Contract | Equation of | One lag of SP | Two lags of SP | One lag of FP | Two lags of FP |
| | | | $S_{t-1}$ | $S_{t-2}$ | $F_{t-1}$ | $F_{t-2}$ |
| 2019 | January | $S_t$ | 0.88(0.00) | 0.03(0.71) | 0.37(0.00) | **-0.29(0.00)** |
| | | $F_t$ | -0.01(0.89) | 0.04(0.71) | 0.98(0.00) | -0.02(0.80) |
| | February | $S_t$ | 0.96(0.00) | | 0.02(0.20) | |
| | | $F_t$ | 0.20(0.00) | | 0.83(0.00) | |
| | March | $S_t$ | 1.03(0.00) | -0.06(0.52) | 0.22(0.01) | **-0.22(0.01)** |
| | | $F_t$ | -0.03(0.73) | 0.13(0.21) | 1.06(0.00) | -0.16(0.10) |

 

| | | | | | | |
|---|---|---|---|---|---|---|
| | April | $S_t$ | 0.98(0.00) | 0.01(0.95) | 0.37(0.00) | **-0.39(0.00)** |
| | | $F_t$ | 0.06(0.54) | -0.01(0.91) | 0.98(0.00) | -0.03(0.68) |
| | May | $S_t$ | 1.10(0.00) | -0.13(0.16) | 0.05(0.28) | **-0.11(0.04)** |
| | | $F_t$ | -0.00(0.98) | 0.01(0.95) | 0.93(0.00) | 0.01(0.88) |
| | June | $S_t$ | 1.12(0.00) | -0.15(0.10) | 0.07(0.16) | **-0.11(0.02)** |
| | | $F_t$ | 0.00(0.99) | -0.02(0.90) | 0.95(0.00) | -0.022(0.82) |
| | July | $S_t$ | 1.13(0.00) | -0.15(0.10) | 0.11(0.04) | **-0.12(0.04)** |
| | | $F_t$ | 0.22(0.16) | -0.23(0.15) | 0.90(0.00) | 0.04(0.65) |
| | August | $S_t$ | 1.10(0.00) | -0.16(0.08) | 0.20(0.00) | **-0.15(0.01)** |
| | | $F_t$ | 0.32(0.04) | **-0.32(0.03)** | 1.04(0.00) | -0.07(0.46) |
| | October | $S_t$ | 1.17(0.00) | -0.17(0.06) | 0.12(0.07) | -0.13(0.08) |
| | | $F_t$ | 0.25(0.06) | -0.20(0.14) | 0.86(0.00) | 0.03(0.71) |
| | November | $S_t$ | 1.19(0.00) | -0.19(0.01) | 0.11(0.08) | -0.12(0.06) |
| | | $F_t$ | 0.15(0.15) | -0.12(0.26) | 1.03(0.00) | -0.11(0.17) |
| | December | $S_t$ | 1.17(0.00) | -0.18(0.02) | 0.11(0.06) | -0.11(0.05) |
| | | $F_t$ | 0.20(0.05) | -0.17(0.09) | 1.07(0.00) | -0.15(0.05) |

- *Source: Authors' estimations*
- *() represents P-values*

**Table 4: Granger Causality Test Results for cotton**

| Year | Contract | Hypothesis | F-statistics | Probability | Direction | Relation |
|---|---|---|---|---|---|---|
| 2019 | January | S/-->F | 0.1712 | 0.8429 | Unidirectional | F-->S |
| | | F/-->S | 13.9897 | 4.00E-06* | | |
| | February | S/-->F | 22.8753 | 5.00E-06* | Unidirectional | S-->F |
| | | F/-->S | 1.64509 | 0.2022 | | |
| | March | S/-->F | 3.36696 | 0.0379* | Bidirectional | F←→S |
| | | F/-->S | 3.36276 | 0.0381* | | |
| | April | S/-->F | 2.20667 | 0.1148 | Unidirectional | F-->S |
| | | F/-->S | 12.5605 | 1.00E-05* | | |
| | May | S/-->F | 0.01812 | 0.982 | Unidirectional | F-->S |
| | | F/-->S | 5.07804 | 0.0077* | | |
| | June | S/-->F | 0.21499 | 0.8069 | Unidirectional | F-->S |
| | | F/-->S | 4.10079 | 0.019* | | |
| | July | S/-->F | 1.06205 | 0.3491 | Unidirectional | F-->S |
| | | F/-->S | 2.13992 | 0.0223* | | |
| | August | S/-->F | 2.39358 | 0.0958 | Unidirectional | F-->S |
| | | F/-->S | 6.59103 | 0.002* | | |
| | October | S/-->F | 3.3484 | 0.0386* | Unidirectional | S-->F |
| | | F/-->S | 1.82201 | 0.1663 | | |
| | November | S/-->F | 2.89896 | 0.0585* | No Direction | S-X-F |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | F/-->S | 1.68119 | 0.19 | | |
| | December | S/-->F | 3.40906 | 0.0355* | Unidirectional | S-->F |
| | | F/-->S | 1.85675 | 0.1596 | | |

- *Source: Authors' estimations*
- **shows rejection of null hypothesis i.e S granger causes F or F grange causes S at 5% significance*