Original Research Article

Market Integration for Cotton Markets in India

Assessment of Level of Market Integration in Indian Cotton Markets.

ABSTRACT

The present study aimed at using the co-integration among the select cotton markets in India. The monthly data on prices of cotton were collected for the period from 2008-09 to 2016-17 from AGMARKNET website. The advanced time series econometric tools like Augmented Dickey-Fuller(ADF) test, Johansen co-integration test and Granger Causality test were used to study market integration using E-Views software. The price seriesoffor cotton in selectselected markets were subjected to the consequences of unit root and were stationary at first difference. The long-run equilibrium relationship among the cotton markets indicated that these markets were integrated with each other. This impliedimplies that prices in Indian cotton marketsexhibited together in response to changes in the demand and supply of cotton. Granger Causality test revealedthat Salem market as the lead cotton market because it influenced the prices of Kurnool and Warangal cotton markets.

Key words: Cotton, Market Integration, Time Series Econometrics.

INTRODUCTION

Cotton - a seed hair fiber, is commonly found in subtropical areas across the world. It is an important cash crop in many developing countries, supporting the livelihoods of millions of households.India is one of the largest producers of cotton in the world accounting for about 22 per cent of the world's total cotton production.In the world, cotton is cultivated in an area of 33.48 million hectares with a production of 26.36 million metric tonnes and productivity of 787 kgs per hectare (the crop year 2020-21).

India has the distinction of having the largest area under cotton cultivation which is about 37 per cent of the world's area under cotton cultivation between 12.0 million hectares to 13.5 million hectares and production of 5.79 million metric tonnes (the crop year 2020-21).The yield per kgs hectare which was presently 469 kgs/ha still lower than the world average yield of about 787 Kgs/ha.In India, cotton is mainly cultivated in the states of Gujarat, Maharashtra, Telangana,Punjab, Rajasthan, Haryana, Tamil Nadu,Madhya Pradesh and parts of Andhra Pradesh & Karnataka.

The textile industry in India traditionally, after agriculture, is the only industry thathas generated huge employment for both skilled and unskilled labour. The textile industry continues to be the second-largest employment generating sector in India. It offers direct

employment to over 35 million in the country.India is alsothe second-largest producer of fibre in the worldand the major fibre produced is cotton and the third-largest cottonexporterand cotton product exporting country in the world. Sixty per cent of the Indian's textile industry is cotton-based. Other fibres produced in India include silk, jute, wool, and man-made fibres.

LITERATURE REVIEW

An efficient market provides remunerative prices for the produce to both the farmers and sellers. The extent to which markets make the commodity available and keep price stable depends on how the markets are integratedtobetweeneach other.The degree of benefits derived by the producers and consumers also depends on how domestic markets are integrated with world markets and the nature of integration among the various regional markets (Varela et al, 2012). Stable prices play an important role toin determining the farm income (Devi et al., 2016).Similarly, prices of agricultural commodities play an important role in efficient resource allocation and signals shortages and surpluses andthat help farmers to respond to dynamic market conditions (Haji and Gelaw, 2011). The stability of prices and market performance depends upon the degree of market integration and their prices, give important signals of marketing to both producers and consumers regarding the level of production and consumption. Market integration shows the extent to which prices in different markets move together (Barret, 2001). The integration of markets can be measured in terms of strength and speed of price transmission between markets across different regions of the country (Ghafoor et al, 2009).Integrated markets can be defined as markets in which prices of comparable goods do not behave independently.In an integrated market, the price of a commodity is responsive to price changes of the same quality products in other markets. As such, price differences for a particular variety of products in different markets of thewithinan area, as a rule, should not exceed the costs involved in the transportation and handling of the produce.The study of market performance byusing market integration characterizes the degree of co-movement of prices across spatially separated markets. It also guides the producers as to where, when and how much to sell.

MATERIALS AND METHODS

Monthly dataofon cotton prices for the period 2007-08toand 2016-17 were collected from the AGMARKNET website to study the market integration among selected cotton markets in India. The major cotton-producing districts in the states of Tamil Nadu, Telangana and Andhra Pradesh **were selected purposively for the study on the basis ofarrivals of cotton in these markets.** ThusSalem market(Tamil Nadu), Warangal market(Telangana), and Kurnool market(Andhra Pradesh) were selected for the study. The analysis of market co-integration of cotton markets involves the following steps:

(i) Correlation Analysis: One simple method to study market integration is to consider the correlation of price series for different markets. The correlation coefficient is a measure of the degree of linear association between two variables. Karl-Pearson's correlation coefficient was used to analyse integration of cotton markets.

Correlation coefficient between two markets' prices X and Y;

$$r(X,Y) = \frac{Cov(XY)}{\sqrt{Var(x)Var(y)}}$$

To test the significance of correlation coefficient (r), t-test was used:

The significance of correlation was tested using the following formula;

$$t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2} \sim \text{t (n-2) degrees of freedom}$$

(ii) Augmented Dickey-Fuller (ADF) test to check Stationarity: Markets are considered to be integrated when long-term equilibrium exists between them. Before analysing such relationship stationarity of price series is a pre-requisite. The time-series data on cotton prices in selected markets were checked for stationarity by using the Augmented Dickey-Fuller (ADF) unit root test. A stationary series is one whose parameters are independent of time, exhibiting constant mean and variance and having autocorrelations that are invariant through time. If the series is found to be non-stationary at level, the first differences of the series are tested for stationarity. The number of times (d) a series is differenced to make it stationary is referred to as the order of integration, I(d). The test was applied after running a regression of the following form:

$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum^{m}_{i=1} a_i \Delta Y_{t-i} + \varepsilon$

Where, Y_t = Price of cotton in a given market at time 't'

$\Delta Y_t = Y_t - Y_{t-1}$;

β_1 = constant ;

β_2= coefficient on a time trend ;

ε= Pure white noise error term ;

m = optimal lag which is selected on the basis of Schwartz Information Criterion (SIC).

(iii) Co-integration test: Johansen and Juselius(1990) developed Co-integration test to test the long run relationship among the price series and Likelihood Ratio test statistics are proposed to test number of co-integrating vectors. Trace-statistic and maximum Eigen values are used to test the null hypothesis of at most 'r' co-integrating vectors against 'more than r' (the alternative hypothesis co-integrating vectors.

Trace statistic (λ – trace) = $-T\sum^{n}_{i=r+1} \ln(1 - \hat{}\lambda i)$

Maximum Eigen value statistic (λ – max) = $- T \ln (1 - \hat{}\lambda i)$

λ_i s are the estimated Eigen values (characteristic roots) obtained from the markets, T is the number of usable observations. The number of co-integrating vectors indicated by the tests is an important indicator of the existence of co-movement of the prices. As the number of co-integrating vectors increases, it implies the strength and stability of price linkages.

(iv) Granger Causality Test: Granger causality test provides testing whether variable X_t causes variable Y_t and vice versa. All permutations are possible: unidirectional Granger causality from X_t to Y_t or from Y_t to X_t , bidirectional causality or absence of causality. An Autoregressive Distributed Lag (ADL) model for the Granger-causality test is specified as below:

$$X_t = \sum^{n}_{i=1}\alpha_i Y_{t-i} + \sum^{n}_{j=1}\beta_j X_{t-j} + \mu_{1t}$$

$$Y_t = \sum^{n}_{i=1}\gamma_i Y_{t-i} + \sum^{n}_{j=1}\delta_j X_{t-j} + \mu_{2t}$$

Where,

X and Y are the price series of different cotton markets ;

t is the time period ;

α, β, γ, δ are coefficients of respective price series ; and

μ_{1t} and μ_{2t} are the error terms.

RESULTS AND DISCUSSION

Correlation Analysis:

The results related toof the correlation analysis of monthly wholesale prices of cotton among selected markets in order to check the integration are shown in Table 1. The results revealed that the correlation coefficients of prices were tending towards unity and significant at 1 per cent level,of significance indicating that the selected markets were integrated with eachother. The prices of cotton markets were correlated among each other with 'r' value ranging from 0.80 to 0.88.

Table 1: Correlation coefficients of prices of cotton markets.

Markets	Kurnool	Salem	Warangal
Kurnool	1.00***	0.80***	0.88***
Salem	0.80***	1.00***	0.86***
Warangal	0.88***	0.86***	1.00***

*** indicated significant at 1 per cent probability level.

Augmented Dickey-FullerTest:

To establish the long run equilibrium relation among the price series, it is necessary to co-integrate them. The co-integration among the price series in turn requires checking offor the order of integration in the given price series and it cannot be integrated in the presence of unit root, the same can be examined through conducting a stationarity test. Therefore, Augmented Dickey-Fuller (ADF) test was employed to check whether the time series data on cotton prices in the selected markets are stationary at their level, followed by their differences.

Table 2 indicated that the ADF values for cotton price series of all the selected markets were more than critical value (1%) given by MacKinnon statistical table at level in both cases i.e. only intercept and intercept with trend implying the existence of unit root and non-stationarity. At first differences, the ADF values for cotton prices of all markets ranged from -8.37 to -13.39 (only intercept) were less than critical value (1%) of -3.48 and in case of intercept with trend the ADF values ranged from -8.37 to -13.36 were lower than critical value (1%) of -4.03 indicating that all the price series were stationary and free from consequences of unit root after differencing. Similar results were observed by V. Mahesh, R.K. Grover and R.S. Geetha (2019), Awasthi et al. (2016) and Anuja et al. (2013).

Table 2: Results of Augmented Dickey-Fuller test (ADF).

Markets	Particulars	At level	At first difference	0.01 critical value
Kurnool	Intercept	-3.06	-13.39***	-3.48
	Intercept and Trend	-4.25	-13.36***	-4.03
Salem	Intercept	-2.15	-9.43***	-3.48
	Intercept and Trend	-2.77	-9.44***	-4.03
Warangal	Intercept	-3.1	-8.37***	-3.48
	Intercept and Trend	-4.57	-8.37***	-4.03

Null Hypothesis: Series has a unit root

*** indicated significance at 1 per cent probability level

Johansen Co-integration Analysis:

The integration among the selected cotton markets in the states of Andhra Pradesh, Tamil Nadu and Telangana viz. Kurnool, Salem and Warangalwere analysed using the time series data byand employing Johansen multiple co-integration procedure. The analysis was done using E-Views software. The results of both unrestricted co-integration rank tests i.e. Maximum Eigen statistic and Trace statistic are indicated in Table 3. The table indicated the presence of at least one co-integrating equation at 5 per cent level of significance (Maximum Eigen statistic) and three co-integrating equations at 5 per cent level of significance (Trace statistic). The strength of co-integration depends upon the number of co-integrating equations. Thus all the selected cotton markets are having long-run equilibrium

relationship.The above findings are in line with findings ofPaul and Sinha (2015) and Suresh (2017).

Table 3: Results of Johansen Co-integration Analysis of selected cotton markets

Co-integrating Equations	Max-Eigen Statistic	0.05 Critical Value	Trace Statistic	0.05 Critical Value
None	25.74 **	21.13	42.05 **	29.79
At most 1	10.62	14.26	16.30 **	15.49
At most 2	5.68 **	3.84	5.68 **	3.84

** denoted rejection of the hypothesis at 0.05 level

Granger Causality Test:

The direction of causation or causal relationship between the price series of selected markets in the states of Andhra Pradesh, Tamil Nadu and Telangana viz. Kurnool, Salem and Warangal marketswere estimated through Granger Causality test and results are represented in Table 4. Among the selected cotton markets, the unidirectional causality relationship in price transmission were found in betweenSalemand Kurnoolmarkets, Warangaland Kurnool markets, Salem and Warangalmarkets. The Salem market had influenced the cotton prices of both Kurnool and Warangal markets.Whereas, Kurnool market does not influencethe cotton prices of both Salem and Warangal markets.

Table 4: Results of Pair-wise Granger Causality Test of selected cotton markets

Null Hypothesis	Obs.	F-Statistic	Prob.	Relation-ship
Salem market does not Granger Cause Kurnool market	119	12.37***	0.00	S→K
Kurnool market does not Granger Cause Salem market		0.01	0.89	NS
Warangal market does not Granger Cause Kurnool market	119	13.07***	0.00	W→K
Kurnool market does not Granger Cause Warangal market		1.14	0.28	NS
Warangal market does not Granger Cause Salem market	119	0.58	0.44	NS
Salem market does not Granger Cause Warangal market		15.59***	0.00	S → W

*** indicated significance at 1 per cent probability level, NS - Non-Significant

CONCLUSION

The correlation analysis indicated that the price series of selectcotton markets were correlated among each other. The long-run equilibrium relationship provideda clear evidence of the integration of selected cotton markets which implied that prices in cotton markets have movedmove together in response to changes in the demand and supply and cost of inputs. Granger Causality test revealed Salem market as the lead cotton market because its prices influenced the prices of theseother cotton markets i.e.Kurnool and Warangal markets. As the markets were integrated with each other in long run, adequate market support with fair price for producers of cotton led to higher production of cotton. The study would suggest that the market integration and forecasts of prices in different markets would be a guiding principle for selecting the most efficient market and the cotton producers and other market participants would find it most useful.

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