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Spatial Price Integration and Price Transmission among Major Chickpea Markets in India

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ABSTRACT

Chickpea commonly known as Gram or Bengal gram is the important pulse crop of India. Chickpea occupies about 40 per cent of area under pulses and contributes about 50 per cent of the total pulse production of India. The present study attempts to analyze the extent and degree of market integration in major chickpea markets of India. The study used monthly price data of major pulses (tonnes/ kg) sourced from Directorate of Economics and Statistics spanning (2009-2014). The data relating to chickpea prices quoted in 12 spatially separated markets was compiled. The results of the study revealed that the short term integration of chickpea in five major markets is very much existent, indicating that short term changes in prices in markets may lead to stable long run equilibrium in the system. The speed of adjustment of the prices found to be moderate in few markets and weaker in many of the markets, thus it is said that prices correct a very small percentage of the disequilibrium in the markets with the greatest percentage by the external and internal forces. This necessitates the need for future research, to investigate the influence of external and internal factors such as market infrastructure, government policy and self-sufficient production, product characteristics and utilization towards market integration.

Key words: *Chickpea, price integration, price transmission, India*

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INTRODUCTION

During the period from the 1970s to the 1990s, many developing nations including India liberalized their agricultural Marketing policies (Rocchi, Romano, & Hamza, 2013). Well it has been argued that, until the agriculture markets are integrated, producers and consumers will not realize the potential gains from liberalization (Reddy A, 2012). If agricultural markets are not integrated, then any local food scarcity will tend to persist, as distant markets (with no scarcity) will not be able to respond to the price signals of such isolated markets (Dreze and Sen, 1995). Lack of integration can often lead to localized food scarcity, even famines (Currey and Hugo, 1985). Thus, a well-integrated market system is central to a well-functioning market economy **(**Dercon, 1995).

Spatial market integration refers to a situation in which prices of a commodity in spatially separated markets move together due to arbitrage and the price signals and information are transmitted smoothly across the markets. With the free flow of information in a competitive market, the difference in prices of a product in the two markets would be equal to or less than the transportation cost between them (Vasciaveo et al., 2013). The more markets are integrated the greater is the likelihood the price system will more efficiently allocate resources and products across regions and time. This will allow the benefits of technical change and productivity improvements to alleviate poverty and help achieve food security. (Wilson, 2000). An integrated market can mitigate the effect of price shocks because it induces trade between surplus and deficit areas (Ojo *et al.,* 2013).

Although there are several studies that have dealt with the measurement of market cointegration, majority of the empirical studies in India use simple bivariate correlation coefficients between prices as a measure of market integration (Ghosh,2000; Patil R, 2013; Samarpitha,2014) All these studies suffer from the limitation that they use raw price series data and as a result the calculated price correlations are biased upwards. The raw price series are more likely to include the influences of common factors such as climate patterns, inflation or any other shocks that affect all the markets. (Sekhar C.S.C, 2012) With the advances in time-series and econometric techniques, recent studies have started using the cointegration methodology. (Reddy and Reddy,2012; Bannor and Sharma, 2015; Patil, 2014). Bannor and Sharma (2015) analysed Spatial Price Transmission in Groundnut Markets of Rajasthan. The descriptive statistics, Johansen bivariate co-integration approach, error correction model and the unrestricted vector autoregressive model were used for the analysis. The coefficient of variance results indicated that Sikar market has low volatility of 18.17 percent compared to 34.78 percent in Niwai market which is the highest. The co-integration tests results showed Bikaner and Bhilwara, Jaipur and Bhilwara, Jodhpur and Laslot, Jodhpur and Niwai and Jodhpur and Sikar are not integrated in the long run. Results from the error correction model showed the lowest speed of adjustment towards long run equilibrium was from Jaipur to Sikar at rate of 8.2 percent. The highest speed of adjustment was 87 percent, running Fatehnagar to Bikaner market towards long run equilibrium, followed by a speed of adjustment of 50.3 percent running from Jodhpur to Sri Madhpour market towards along run equilibrium in a period of at most two months.

Reddy and Reddy (2011) used Johansen cointegration and Engle Granger Bivariate Cointegration test groundnut pod, oil and cake markets in India in the post liberalization period, they concluded that out of eleven groundnut pod and ten oil wholesale markets, only four markets are co-integrated, while in case of groundnut cake only two markets are co-integrated out of five major markets. In case of groundnut oil and cake, price information flows from major import/export markets like Mumbai and Chennai to major producing centers, as price of groundnut oil and other edible oils (like palm oil, soya oil) are interrelated and being freely traded. Internationally, edible oil price discovery takes place in these centers and are linked to border prices. Wilson (2001) used the monthly wholesale prices of wheat, Jowar, paddy rice, groundnut and rapeseed-mustard to analyze the degree of integration among different markets both before and after liberalization (in 1992) using Johansen cointegration method. The major drawback of Wilson's study is the categorization of pre and post liberalization period. Although structural reforms were initiated in Indian economy in the early 1990s, Indian agriculture remained virtually insulated until 1994, when edible oil imports were liberalized. All other major food commodities continued to remain under controls of various forms even after 1994. Reddy (2014) analysed the market integration of chickpea in north India. Out of twelve markets, only three markets were co integrated, indicating weak integration of chickpea markets in India. However, the terminal markets located in major consuming (Delhi) and export/import locations (Dohad/Gujarat) clearly played an important role in price discovery and influenced other domestic markets indicating the relevance of the import prices and large consuming centers on local market prices. In line with the Reddy A (2014), the present study attempts to analyze the extent and degree of market integration in major chickpea markets of India.

Scenario of chickpea markets in India

Chickpea commonly known as Gram or Bengal gram is the important pulse crop of India. India alone has nearly 52.5 per cent of the world acreage and production of gram with 5630 thousand tonnes production in an area of 6670 thousand hectares and productivity 544 kg/ha. Chickpea occupies about 40 per cent of area under pulses and contributes about 50 per cent of the total pulse production of India. (MoA, 2015). However, the growth in the domestic production of oilseeds has not been able to keep pace with the growth in the demand in the country. Stagnant productivity coupled with declining availability has created substantial demand supply gap, forcing India to import around 14 per cent of pulses in the world (NABARD, 2015). Majority percent of total chickpea traded in the Indian market is channeled from the main producing areas of Madhya Pradesh, Maharashtra, and Rajasthan to other parts of the country, with the remaining percent imported by licensed importers from major chickpea exporting countries, namely, Canada, Australia, Iran, Myanmar, Mexico, Tanzania, Pakistan, Turkey and France.

Chickpea is sold in primary or secondary wholesale markets directly by the producer. Importers who are licensed to import chickpea into India sell directly to a broker, commission agent, middlemen or directly to a secondary wholesaler, miller or processor. The bulk of chickpea from brokers and commission agents are sold to primary wholesalers who in turn sell to millers and processors of dhal or to secondary wholesalers. The majority of chickpea from the primary wholesalers go to millers and processors. Only a small quantity of whole chickpea moves from the primary market to the secondary market and reaches the consumer via the retailer. The dhal produced by the millers is sold to large mills or to secondary wholesalers. The flour moves to consumers via retail markets. A proportion of the dhal from dhal millers and primary wholesalers goes to secondary wholesalers, and is then sold to consumers as dhal through the retailer. Whole chickpea from secondary wholesalers are sold to frying mills. Puffed or roasted chickpea move to consumers via retail markets. (Agbola et al., 2004).

The study used monthly price data of major pulses (tonnes/ kg) sourced from Directorate of Economics and Statistics spanning (2009-2014). The data relating to chickpea prices quoted in 12 spatially separated markets was compiled from the above source. All these markets are major chickpea producing and consuming centers, even though the choice of the states and the markets from each state has been constrained by the availability of consistent data for the period under consideration. On that basis, the following markets were chosen: Amritsar (Punjab), Coimbatore (Tamil Nadu), Delhi, Dohad (Gujarat), Hissar (Haryana), Jaipur (Rajasthan). Patna, Kanpur & Mathura (Uttar Pradesh). Kolkata & Sainthia (West Bengal), and Sehore (Madhya Pradesh).

MATERIALS AND METHODS

The study used monthly price data of major pulses (tonnes/ kg) sourced from Directorate of Economics and Statistics spanning (2009-2014). E views econometric software package was used to analyze the data.

Analysis of data

3.1 To check the stationarity of the series: A stationary series is a type of series whose statistical properties such as mean, variance and autocorrelation are all constant over time and non-stationary time series as having time dependent statistical properties (Gopal, Raveendaran, & Rajan, 2009).

In analysing any time series data, testing for stationarity is a precondition since econometric relation between the time, series has the presence of trend components (Davidson & Mackinnon, 1993). This involves testing for stationarity using tests such as Dicky-Fuller (DF) test, Augmented Dicky-Fuller (ADF) test. If one identifies the series to be non-stationary, the first difference of the series is tested for stationarity to determine the order of integration. The number of times (d) a series is differenced to make it stationary is termed as the order of integration, I (d). In this study, the ADF test was used to determine the data properties due to its common application in the time series literature. The ADF test as mentioned considers the null hypothesis that a given series is non stationary. In this test a sequential testing has been used, which involves step-by-step testing procedure, by considering different equations.

$$\Delta Yt = a_0 + \delta T + \beta Yt\text{-}1 + a_1 \sum_{t=1}^{m} \beta \Delta Yt - 1 + \epsilon \quad \text{---------} \; (i)$$
$$\Delta Yt = T + \beta Yt\text{-}1 + a_1 \sum_{t=1}^{m} \beta \Delta Yt - 1 + \epsilon \quad \text{---------} \; (ii)$$
$$\Delta Yt = \beta Yt\text{-}1 + a_1 \sum_{t=1}^{m} \beta \Delta Yt - 1 + \epsilon \quad \text{---------} \; (iii)$$

After running through the above series of equations, from the observations, the best fit equation was the (iii) with no trend and no constant. Hence, the test is applied by running a regression of the following form:

$$\Delta Yt = \beta Yt\text{-}1 + a_1 \sum_{t=1}^{m} \beta \Delta Yt - 1 + \epsilon$$

Where,

Yt = Price of commodity in a given market at time t

ΔYt = Yt - Yt-1

ϵ = Pure white noise error term

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

The regressions provide a t-statistic of the estimated į. The t-statistic is then compared to the critical value t-statistic (The test statistic from the testing regression is known as the statistic critical values (Dickey & Fuller, 1979), If the value of the ADF statistic is less, that is more negative, (because these values are always negative) than the critical value at the conventional significant level (usually the five percent significant level) then the series (Yt) is said to be stationary and vice versa. Once it was confirmed that either of two price-series were stationary or of the same order of integration, the co-integration of markets was tested by Johansen maximum-likelihood techniques.

Cointegration test: Cointegration explains the extent of deviation from the long run equilibrium relationship by the non-stationary series. It is concerned with the existence of a stable relationship among prices in different localities. The ADF test which is a test for stationarity is supplemented by Johansen-Julius Maximum likelihood method. Johansen (1988) and Johansen and Juselius (1990), developed a multivariate co-integration method which was a robust procedure for testing long run relationship between stationary prices variables and also allow tests for multiple co-integrating vectors. The number of cointegrating vectors indicated by the tests is an important indicator of the extent of co-movement of prices. An increase in the number of co-integrating vectors implies an increase in the strength and stability of price linkages.

3.3 Test for Granger-causality: After undertaking co-integration analysis of the long run linkages of the various variables, and having identified they are linked, an analysis of statistical causation was conducted. The Granger causality test conducted within the framework of a vector auto regressive (VAR) model is used to test the existence and direction of long-run causal price relationship between the markets. The causality test uses an error correction model (ECM) of the following form:

$Pt^1 = \alpha + \beta_0 + \sum_{j=1}^{j} \beta j\, P^1 t\text{-}j + \sum_{k=1}^{k} h k\, P^2 t\text{-}k + \epsilon t$

Where, T is the time period,

ϵt is the error term,

P^1 and P^2 are the prices in the 2 markets at time t. j and k are the number of lags of both the variables in the system respectively.

3.4 Error Correction Method (ECM):

An Error Correction Model (ECM) is an efficient way of combining the long run co integrating relationship between the levels variables and the short run relationship between the first differences of the variables. It has the merit that all the variables in the estimated equation are stationary; thus there is no problem of spurious correlation. The procedure of differencing results in the loss of valuable long run information in the data and so an error correction term is introduced in the theory of co integration to integrate the short run dynamics of the series with its long run value. The residuals obtained from the equation are introduced as explanatory variables into the system of variables in levels. The error correction term thus captures the adjustment towards long –run equilibrium.

If the price series are I (1), then a linear combination will result in co integration and if there is the existence of co integration between the variables, it is not sufficient to estimate relationship between the two variables using the standard regression model. But it is important to incorporate the long run equilibrium relationship between them in their regression relationship subsequently; an error correction model is specified to relate the changes in the dependent variable to the independent variable as well as the error correction term where the error correction term measures the deviation from the long run equilibrium. A negative and significant coefficient of the ECM (i.e. t-l) indicates that any short term fluctuation between variables will give rise to a stable long run relationship between the variables. A generalized ECM formulation to understand both short-run and long-run behavior of prices can be considered by first taking the autoregressive distributed lag equation as follows

$\Delta Yt = a_{00} + \sum_{i=0}^{k-1} ai_1 \Delta Xt - i + \sum_{i=0}^{k-1} ai_2 \Delta Yt - i + m_0 [m_1 Xt\text{-}k - Yt\text{-}k] + \epsilon t$

Where, $m_0 = (1 - \sum_{i=0}^{k} ai_2)$, $m_1 = \sum_{i=0}^{k} ai_1 / m_0$

The parameters m_0 measures the rate of adjustment of the short-run deviations towards the long run equilibrium. Theoretically, this parameter lies between 0 and 1. The value 0 denotes no adjustment and 1 indicates an instantaneous adjustment. A value between 0 and 1 indicates that any deviations will have gradual adjustment to the long-run equilibrium values.

In the present study we have used Johansen's Vector Error Correction Model (VECM). This approach permits the testing of co-integration as a system of equations in one step. In addition, it does not require the prior assumption of endogenity or exogenity of the variable.

RESULTS AND DISCUSSION

Market integration depicts that there is smooth transmission of prices from one market to the other. Integration of market has been used as an excellent marker of an efficient marketing system.

1 Unit Root Test

As a first step to determine the price transmission mechanism in chickpea an Augmented Dickey Fuller (Dickey and Fuller 1979) and Phillips-Perron tests (PP) (Phillips and Perron, 1988) unit root test was applied to ascertain the stationarity of the monthly price series obtained from various markets across the states of the country. The results of this exercise are presented in table 1. The test was applied to each variable over the period of 2009 – 2014. The variables were all stationary at their first difference at 5% level of significance and integrated of same order i.e. I (1) level. The H_0 of unit root for all the time series were rejected at their first difference, since their ADF & PP result test statistic was greater than the critical values at 5 % level of significance.

Table1. Result of Unit Root Test for Chickpea Prices

Market	ADF test statistics		Phillips Perron test		Order of Integration
	Level	1st Difference	Level	1st Difference	
Amritsar	-0.150	-9.235*	-0.152	-9.231*	I (1)
Coimbatore	0.944	-6.908*	1.315	-6.908*	I (1)
Delhi	0.481	-7.534*	0.433	-7.530*	I (1)

Dohad	0.417	-8.216*	0.409	-8.227*	I (1)
Hissar	0.859	-7.163*	0.827	-7.124*	I (1)
Jaipur	0.585	-8.995*	0.585	-8.970*	I (1)
Kanpur	0.576	-8.260*	0.545	-8.282*	I (1)
Kolkata	0.561	-7.600*	0.536	-7.604*	I (1)
Mathura	0.320	-8.921*	0.399	-9.061*	I (1)
Patna	1.028	-7.105*	1.157	-7.165*	I (1)
Sainthia	0.466	-8.589*	0.496	-8.588*	I (1)
Sehore	1.265	-10.753*	1.329	-10.794*	I (1)

MacKinnon critical values for rejection of hypothesis of a unit root are -2.597, -1.945 and -1.613 at 1%, 5% and 10% respectively. * indicates significant at 5% level of significance.

Given that all the prices are now integrated in the same order (Order I) by measuring the ADF and PP tests, now cointegration tests can be conducted.

2 Johansen Co-Integration Test

Johansen co-integration test addresses existence of long run relationship among the variables. The results of the multivariate cointegration tests are reported in table 2. The results based on trace test likelihood ratio and Max-Eigen test show that five markets out of twelve markets are cointegrated at 5 % level of significance. There are about seven stochastic trends meaning seven independent chickpea markets in the country. The presence of seven common stochastic trend implies the absence of pair-wise cointegration of prices, suggesting that even though the markets are cointegrated the Law of One Price (LOP) does not hold. On the whole, the results of cointegration test indicate that the regional chickpea markets are moderately integrated in the long run.

Table 2. The Result of Johansen Co-Integration Test of Chickpea markets in India

		Trace test			**Max-Eigen test**		
Null hypothesis	**Eigen value**	**Trace statistics**	**Critical Value**	**Prob. (0.05)**	**Max-Eigen Statistic**	**Critical Value**	**Prob. (0.05)**
r = 0	0.759	468.454*	311.129	0.000	98.103*	73.091	0.000
r ≤ 1	0.716	370.351*	263.260	0.000	86.945*	67.076	0.000
r ≤ 2	0.635	283.406*	219.402	0.000	69.588*	61.034	0.006
r ≤ 3	0.573	213.818*	179.510	0.000	58.673*	54.966	0.020
r ≤ 4	0.516	155.146*	143.669	0.010	50.104*	48.877	0.037
r ≤ 5	0.460	105.042	111.781	0.124	42.563	42.772	0.053
r ≤ 6	0.281	62.479	83.937	0.615	22.743	36.630	0.728
r ≤ 7	0.210	39.736	60.061	0.719	16.281	30.440	0.824
r ≤ 8	0.131	23.454	40.175	0.737	9.704	24.159	0.930
r ≤ 9	0.117	13.750	24.276	0.558	8.577	17.797	0.642
r ≤ 10	0.071	5.174	12.321	0.544	5.086	11.225	0.465
r ≤ 11	0.001	0.087	4.130	0.808	0.087	4.130	0.808

Source: Calculated by authors

* denotes rejection of the null hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

3 Granger causality test

In order to know the direction of causation between the markets Granger Causality test was employed. When a cointegration relationship is present for two variables, a Granger Causality Test (Granger, 1969) can be used to analyze the direction of this co-movement relationship. Theoretically, a variable is said to Granger-cause another variable, if the current value is conditional on the past value.

A glance on the table 3 gives us the results of Granger causality tests which indicate the strength of causality in each market with reference to every other market, based on the significance level of F (causality) statistics. The results show that the null hypothesis of chickpea market of Delhi does not granger cause the markets of Amritsar, Kanpur, Kolkata, Mathura, Patna and Sainthia is rejected, signifying that Delhi market influences the prices in the above mentioned markets at 1% significance level. Likewise, price movements in Dohad market (Gujarat) influenced the prices in Amritsar, Hissar, Kanpur, Mathura, Coimbatore at 1% and Patna, Delhi at 5% level of significance. The chickpea markets in Amritsar (Punjab), Jaipur (Rajasthan) and various markets like Kanpur, Mathura and Sainthia are influenced by the events of price changes of Hissar market. The Amritsar market influence the prices of chickpea in Mathura and Sainthia. The Coimbatore market in Tamil Nadu (South India) influences the prices in Sainthia (WB), whereas Patna causes price changes in Coimbatore. The price movement in Kanpur cause changes in Kolkata, Mathura, Patna. In line with granger and causality tests, it can be concluded that major markets of the country like Delhi, Dohad (Gujarat), Hissar (Haryana), Kolkata (WB) and Jaipur (Rajasthan) are important source of price information according to Granger causality approach.

Table 3: Granger casualty test

Independent Variable		Dependent Variable											
		Amritsar	Coimbatore	Delhi	Dohad	Hissar	Jaipur	Kanpur	Kolkata	Mathura	Patna	Sainthia	Sehore
Amritsar	f-stat		1.67	1.10	1.37	0.74	2.67	1.4	0.72	5.37***	3.08	4.73***	1.1
	prob.		0.2	0.34	0.26	0.48	0.08	0.25	0.49	0.01	0.05	0.01	0.34
Coimbatore	f-stat	2.39		1.46	0.62	0.58	0.71	1.19	2.14	3.24	1.01	6.29***	3.54
	prob.	0.10		0.24	0.54	0.57	0.49	0.31	0.13	0.05	0.37	0.00	0.03
Delhi	f-stat	5.11***	2.14		0.57	1.83	3.49	13.6***	4.11***	16.95***	5.49***	5.49***	2.8
	prob.	0.01	0.13		0.57	0.17	0.04	0.00	0.02	0.00	0.01	0.01	0.07
Dohad	f-stat	12.5***	5.75***	4.26**		3.98***	0.41	15***	3.75	21.34***	4.06**	3.71	3.43
	prob.	0.00	0.01	0.02		0.02	0.00	0.00	0.03	0.00	0.02	0.03	0.04
Hissar	f-stat	7.3***	2.99	3.3	0.01		5.73***	9.24***	1.98	23.23***	3.38	4.23**	2.77
	prob.	0.00	0.06	0.04	0.99		0.01	0.00	0.15	0.00	0.04	0.02	0.07
Jaipur	f-stat	5.43***	2.17	1.49	0.41	2.81		8.35***	2.77	20.8***	3.24	3.58	4.6***
	prob.	0.01	0.12	0.23	0.66	0.07		0.00	0.07	0.00	0.05	0.03	0.01
Kanpur	f-stat	1.72	2.38	0.23	0.53	0.77	0.75		12.55***	0.98	0.8	1.58	3.79
	prob.	0.19	0.10	0.80	0.59	0.47	0.48		0.00	0.38	0.45	0.21	0.03
Kolkata	f-stat	8.48***	1.62	1.61	0.2	0.54	1.67	12.55***		10.4***	7.95***	2.89	2.01
	prob.	0.00	0.21	0.21	0.82	0.59	0.2	0.00		0.00	0.00	0.06	0.14
Mathura	f-stat	0.76	2.27	1.22	1.16	0.16	1.35	0.98	0.21		1.20	14.77***	2.6
	prob.	0.47	0.11	0.30	0.32	0.85	0.27	0.38	0.81		0.31	0.00	0.08
Patna	f-stat	1.20	3.98**	1.25	0.24	1.11	0.31	0.80	1.90	2.62		2.44	2.87
	prob.	0.31	0.02	0.29	0.79	0.34	0.74	0.45	0.16	0.08		0.10	0.06
Sainthia	f-stat	0.08	0.08	0.92	1.09	0.26	1.26	1.58	0.15	0.90	3.19		0.32
	prob.	0.93	0.92	0.4	0.34	0.78	0.29	0.21	0.86	0.41	0.05		0.73
Sehore	f-stat	0.97	4.00**	0.22	0.27	0.22	0.94	0.39	0.12	0.51	0.93	4.51***	
	prob.	0.38	0.02	0.81	0.76	0.80	0.40	0.68	0.88	0.60	0.40	0.01	

***, **&* denotes significance at 1%, 5% and 10% level.

4 Vector Error Correction Model

Existence of co-integration among prices of chickpea in the states gave rise to estimation of Vector Error Correction Model. Table 3 showed the result of short run estimates.

Since the Johansen's Multiple Co-integration test result showed that the few of the selected chickpea market having long run equilibrium relationship and there exists co-integration between them. Hence the Vector Error Correction Model (VECM) is employed to know the speed of adjustments among the chickpea markets for short run and long run equilibrium. The results of VECM showed in Table 4.

The coefficients of ECTs indicate the speed of adjustment of any disequilibrium towards the long-run growth path. The error correction coefficient of VECM estimates turns out to be positive in many cases as seen in the table. These coefficients apparently reflect the short-run deviations of the system from the long run equilibrium level. As from the visual examination of the results it is clear that the most of the coefficients of ECTs are positive indicating that the short run disequilibrium adjustment process might not lead to stable long run prices in most of the markets viz., Hissar, Kanpur, Kolkata, Mathura, Patna, Sainthia, Sehore.

The prices of chickpea from markets of Coimbatore, Hissar, Kolkata and Sehore are transmitted to Amritsar market in the same direction in the short-run as indicated by the Coimbatore price coefficient (0.47) Hissar price coefficient (0.61), Kolkata price coefficient (0.69) and Sehore price coefficient (0.26) for the Amritsar regression equation. Hissar gave positive price signals whereas Sehore negative price signals to the Coimbatore market. The price adjustment in any of the market did not influence any price change in chickpea market of Jaipur, Mathura and Delhi. The Delhi market transmitted price signal to Sainthia and positive price signal to the Patna market. Likewise, the Jaipur price was negatively transmitted to the Sainthia and Sehore market and the Kanpur price was negatively transmitted to Sehore. On the other hand, Mathura prices were positively transmitted to Sainthia and Sehore markets likewise Sehore prices were positively transmitted to Kanpur. These negative coefficients indicate that in addition to spatial price differences, some unknown factors are playing predominant role in spatial price transmission. As in many cases the ECTs tends to be positive which indicates that short term changes in prices in many markets may not lead to long turn equilibrium in the system. By this it can be concluded that in the present study including major chickpea markets, the short term integration is not noticeable in line with the study carried out be Reddy (2012).

Table 4. The Result of Vector Error Correction Model showing the short Run Effects

	Dependent price series																							
	D(AMRITSAR)		D(COIMBATORE)		D(DELHI)		D(DOHAD)		D(HISSAR)		D(JAIPUR)		D(KANPUR)		D(KOLKATA)		D(MATHURA)		D(PATNA)		D(SAINTHIA)		D(SEHORE)	
series	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat
D(AMRITSAR)(-1)	-0.43	-2.37	0.09	0.72	0.04	0.18	0.03	0.15	-0.31	-1.45	0.07	0.34	0.07	0.56	-0.16	-0.97	-0.37	-1.91	0.07	0.62	0.17	1.08	-0.50	-2.36
D(AMRITSAR)(-2)	-0.42	-3.22	0.03	0.31	-0.15	-0.92	-0.08	-0.48	-0.35	-2.20	-0.07	-0.51	0.04	0.40	-0.30	-2.48	0.01	0.06	0.02	0.22	-0.08	-0.74	-0.61	-3.93
D(COIMBATORE)(-1)	0.47	2.15	0.42	2.77	0.15	0.57	0.42	1.55	0.21	0.81	0.17	0.73	0.21	1.40	0.11	0.57	0.11	0.46	0.15	1.01	-0.30	-1.56	-0.33	-1.27
D(COIMBATORE)(-2)	0.02	0.10	0.24	1.80	-0.08	-0.34	0.14	0.60	0.03	0.13	0.13	0.62	0.07	0.51	-0.21	-1.19	-0.09	-0.42	-0.07	-0.59	0.11	0.65	-0.88	-3.91
D(DELHI)(-1)	0.04	0.19	-0.18	-1.12	-0.33	-1.18	-0.24	-0.86	0.01	0.05	0.18	0.71	-0.04	-0.28	-0.35	-1.63	-0.03	-0.11	0.15	0.99	-0.59	-2.95	0.35	1.29
D(DELHI)(-2)	0.18	0.84	-0.01	-0.05	-0.13	-0.50	-0.29	-1.09	-0.14	-0.54	-0.07	-0.31	0.02	0.13	-0.04	-0.21	-0.28	-1.19	0.34	2.41	-0.25	-1.31	0.23	0.89
D(DOHAD)(-1)	-0.16	-0.42	0.06	0.23	0.45	1.01	0.64	1.39	0.17	0.38	0.34	0.84	0.00	-0.02	0.07	0.20	0.03	0.07	0.03	0.12	0.78	2.38	-0.12	-0.27
D(DOHAD)(-2)	-0.67	-2.24	-0.34	-1.62	0.04	0.11	0.33	0.90	0.24	0.67	0.07	0.22	0.01	0.07	0.19	0.68	0.27	0.85	-0.22	-1.13	0.07	0.28	-0.51	-1.45
D(HISSAR)(-1)	0.60	2.01	0.56	2.69	-0.11	-0.32	0.16	0.44	0.34	0.95	0.51	1.58	0.00	0.02	0.15	0.54	0.40	1.23	0.17	0.88	-0.65	-2.50	0.21	0.59
D(HISSAR)(-2)	0.53	2.12	0.40	2.28	-0.26	-0.87	-0.10	-0.34	-0.32	-1.07	-0.05	-0.17	-0.08	-0.44	-0.22	-0.94	0.23	0.86	0.36	2.20	-0.23	-1.05	0.08	0.26
D(JAIPUR)(-1)	-0.10	-0.43	-0.22	-1.37	-0.10	-0.36	-0.48	-1.70	-0.34	-1.22	-0.63	-2.55	-0.20	-1.26	-0.52	-2.44	-0.26	-1.03	-0.13	-0.89	-0.53	-2.65	-0.91	-3.39
D(JAIPUR)(-2)	0.37	1.55	-0.22	-1.33	0.12	0.43	-0.32	-1.09	-0.18	-0.63	-0.32	-1.25	-0.17	-1.05	-0.39	-1.77	-0.31	-1.22	-0.10	-0.67	-0.22	-1.08	-0.06	-0.22
D(KANPUR)(-1)	0.06	0.20	0.13	0.61	-0.05	-0.14	-0.39	-1.08	-0.70	-1.94	-0.14	-0.43	0.12	0.60	-0.22	-0.81	0.19	0.60	0.14	0.71	0.11	0.43	-0.80	-2.28
D(KANPUR)(-2)	0.24	1.00	-0.37	-2.22	-0.07	-0.24	-0.09	-0.30	-0.09	-0.31	0.08	0.31	-0.07	-0.40	0.12	0.55	-0.07	-0.27	-0.20	-1.27	0.05	0.23	-0.04	-0.13
D(KOLKATA)(-1)	0.32	1.27	-0.25	-1.45	0.07	0.22	-0.11	-0.36	0.15	0.51	-0.35	-1.28	-0.16	-0.91	0.33	1.45	-0.09	-0.33	0.07	0.40	0.18	0.83	1.16	3.92
D(KOLKATA)(-2)	0.70	3.11	0.07	0.45	0.48	1.77	0.33	1.22	0.46	1.71	0.20	0.82	0.03	0.22	0.46	2.22	0.23	0.94	-0.06	-0.44	0.13	0.65	1.24	4.74
D(MATHURA)(-1)	-0.22	-0.91	-0.07	-0.39	0.16	0.56	-0.08	-0.26	0.30	1.03	0.08	0.29	-0.01	-0.05	0.19	0.86	0.26	1.00	-0.11	-0.67	0.77	3.63	0.63	2.23
D(MATHURA)(-2)	-0.	-0.	-0.3	-2.	-0.	-0.	-0.	-1.	-0.	-0.	-0.	-0.	-0.	-1.	-0.	-0.	-0.	-0.	0.0	0.14	-0.	-0.	0.1	0.46

	18	91	2	32	14	60	32	35	02	10	13	62	15	13	10	53	12	56	2		04	22	1	
D(PATNA)(-1)	-0.49	-1.43	0.06	0.25	0.08	0.19	0.15	0.35	0.38	0.92	-0.23	-0.63	-0.31	-1.31	0.47	1.47	-0.25	-0.67	-0.30	-1.32	0.23	0.77	0.51	1.26
D(PATNA)(-2)	-0.37	-1.29	0.18	0.90	0.19	0.56	0.50	1.42	0.52	1.53	0.34	1.09	-0.10	-0.52	0.26	0.99	0.03	0.11	-0.06	-0.31	0.32	1.29	-0.30	-0.88
D(SAINTHIA)(-1)	-0.22	-1.21	0.22	1.78	0.06	0.26	0.36	1.64	-0.08	-0.37	0.10	0.50	-0.04	-0.32	-0.06	-0.35	-0.05	-0.25	0.07	0.55	-0.05	-0.33	-0.33	-1.55
D(SAINTHIA)(-2)	-0.40	-3.07	0.10	1.09	-0.17	-1.09	0.13	0.80	-0.10	-0.62	0.04	0.29	-0.09	-0.98	-0.23	-1.93	0.00	0.03	0.00	-0.05	0.03	0.29	-0.27	-1.82
D(SEHORE)(-1)	0.26	2.29	-0.23	-2.90	-0.03	-0.21	-0.18	-1.29	-0.01	-0.09	-0.04	-0.31	0.10	1.30	-0.04	-0.38	0.10	0.82	0.06	0.74	-0.01	-0.14	0.15	1.14
D(SEHORE)(-2)	0.10	1.10	-0.17	-2.69	-0.05	-0.41	-0.08	-0.67	0.02	0.21	-0.04	-0.39	0.15	2.38	0.02	0.22	0.08	0.82	0.03	0.46	0.07	0.84	0.18	1.61
C	0.00	-0.27	0.01	1.15	0.00	0.31	0.00	0.20	0.00	0.40	0.00	0.58	0.01	1.00	0.01	0.87	0.00	0.52	0.00	0.89	0.00	0.71	0.02	2.14
CointEq1	0.03	0.20	-0.19	-1.60	-0.05	-0.26	-0.20	-0.94	0.23	1.12	-0.16	-0.87	-0.08	-0.70	0.20	1.25	0.39	2.13	0.03	0.25	0.21	1.38	1.33	6.63
CointEq2	-0.51	-2.87	-0.59	-4.81	-0.01	-0.07	-0.33	-1.53	-0.35	-1.67	-0.15	-0.79	-0.15	-1.26	-0.20	-1.25	0.16	0.86	-0.08	-0.70	0.38	2.46	0.58	2.81
CointEq3	0.13	0.54	0.55	3.34	0.19	0.67	0.90	3.10	0.66	2.33	0.38	1.48	0.37	2.24	0.82	3.75	0.25	0.96	-0.03	-0.20	0.56	2.71	0.02	0.07
CointEq4	0.80	1.77	0.22	0.70	-0.16	-0.29	-1.39	-2.51	-0.30	-0.56	-0.48	-0.99	0.41	1.32	0.09	0.22	0.19	0.39	0.08	0.29	-0.63	-1.60	0.93	1.75
CointEq5	-1.20	-3.45	-0.46	-1.91	0.27	0.64	0.09	0.22	-0.80	-1.93	0.07	0.18	-0.21	-0.89	-0.06	-0.18	-0.33	-0.89	-0.30	-1.32	1.00	3.29	-0.64	-1.57
CointEq6	0.26	1.32	0.23	1.67	0.08	0.34	0.51	2.08	0.72	3.04	0.10	0.45	0.08	0.57	0.47	2.57	0.53	2.50	-0.04	-0.27	0.31	1.82	0.21	0.91

*indicates significance @ 5% level.

CONCLUSIONS

It can be concluded that major markets of the country like Delhi, Dohad (Gujarat), Hissar (Haryana), Kolkata (WB) and Jaipur (Rajasthan) are important source of price information according to Granger causality approach. As it is clearly noticeable that the short term integration of chickpea in these five markets is very much existent out of twelve selected markets, indicating that short term changes in prices in markets may lead to stable long run equilibrium in the system. The speed of adjustment of the prices found to be moderate in few markets and weaker in many of the markets, thus it is said that prices correct a very small percentage of the disequilibrium in the markets with the greatest percentage by the external and internal forces. This necessitates the need for future research, to investigate the influence of external and internal factors such as market infrastructure, government policy and self-sufficient production, product characteristics and utilization towards market integration.

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