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# An Econometric Analysis of Maize and Poultry Market Integration in India

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**Maize is an important staple food in many countries and its acreage is on the increase continuously at global level. In India maize is mainly used to manufacture poultry feed. Higher marketing efficiency in maize markets would technically imply that all the major markets are integrated and also the changes in the prices of final products, viz., egg and chicken closely reflect the prices of major inputs raw material viz., maize. The price linkages between maize and poultry products are studied through co-integration and Vector Error Correction Model approach. Price transmission is observed across maize to poultry products. The results proved that maize markets in India are integrated over space and form implying higher order of marketing efficiency. Hence achieving the production target of 42 million tonnes of maize in India is not a difficult task provided policies are conducive and bird flu does not occur in our nation.**

**Key words**: Price transmission, Market Integration, maizem poultry, VECM.

Maize is an important staple food in many countries and its acreage is increasing continuously at global level. Global area of maize shows a positive trend growth and the Compound Annual Growth Rate (CAGR) is 0.808 per cent. Similarly world production of maize has been increasing at a positive CAGR of 2.73 per cent and productivity with a rate of 1.91 per cent during 2001-2011. The area and production of this grain increased from 138 million hectare and 608 million tonnes in 2001 to 167 million hectare and 860 million tonnes in 2010-11. Similarly the productivity increased from 4.37 tonnes/ha to 5.11 tonnes/ha during the above period.

India produces around 15 million tonnes of maize annually. This contributes to about two per cent of total world production. Area, production and productivity of maize in India have seen a positive growth over the last four decades. India's maize production has increased from less than 3 million tonnes to 15 million tonnes with a CAGR of 1.18 per cent in area and 3.09 per cent in production during 2001-2011. This is because of growth in technology coupled with rising demand for the produce. Diversified uses of maize also prompted higher production in the country. International Maize Development Authority estimated that total production of maize in India to rise to 42 million tonnes in 2025, if the output increases by 6-7 per cent annually.

In India maize is mainly used to manufacture poultry feed. It is estimated that about 70-75 per cent of the feed is constituted by maize alone. It is possible to achieve the anticipated 42 million tonnes of maize production in India provided the following activities take place properly. Maize markets should be efficient across the country, policies of the Government are conducive for the growth of poultry industry and poultry industry grows as in the past.

Higher marketing efficiency in maize markets technically implies that all the major markets should be integrated. In other words the changes in prices of maize in any one market should be reflected in all other major maize markets throughout the nation. Also the changes in the prices of final products, viz., egg and chicken should reflect in the prices of the raw material viz., maize. Thus price transmission has to take place over space and form leading to horizontal and vertical integration of markets. If these two integrations occur over the markets, then only marketing is considered to be efficient and such a higher marketing efficiency is a necessary condition for the growth of the commodity.

Most of the studies have been on market integration of food grains, fish and horticultural crops. But, the issue concerning market co-integration in respect of livestock and poultry products has not been dealt with adequately (Sandeep Saran, 2008). Sandeep Saran (2008), studied the performance of egg markets in India using Engle-Granger Co-integration test procedure and concluded that the major wholesale markets are integrated. The high degree of co-integration amongst various markets indicates that the major wholesale egg markets are competitive and efficient at the wholesale levels. He did not consider the transmission of price across value chain.

Hence the present study was undertaken with a

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broad objective of analyzing the market integration of maize markets in India. The specific objectives are to analyze the integration of regional maize markets in India, to know the transmission of prices from maize to poultry products, to find the direction of relationship across the markets and to find the short - run and long - run equilibrium relationship of the integrated markets.

## Methodology

***Selection of Markets***

In India poultry industry - both layer and broiler - is concentrated in South India, especially in Tamil Nadu, Andhra Pradesh and Karnataka. These three States put together accounts for 55 per cent of egg production and 33 per cent of broiler production in India as on 2010-11. Hence maize markets viz., Udumalpet of Tamil Nadu, Nizamabad of Andhra Pradesh and Davanegre of Karnataka were purposively selected besides the selection of Namakkal, (Tamil Nadu) market for eggs, where egg prices are fixed by National Egg Coordination Committee every day. Similarly chicken prices were collected from Broiler Coordination Committee functioning at Palladam market from 1st January, 2009 to last week of November, 2010 which were analysed for the purpose.

***Selection of Models***

The problem in time series data is that of non-stationarity. Before analysing any time series data, testing for stationarity is a pre-requisite since econometric relation between the time series has trend components. This involved testing for stationarity of the variables using the Augmented Dickey-Fuller (ADF) test. The ADF test considers the null hypothesis that a given series has a unit root, i.e. it is non-stationary. The test is applied by running the regression in the following form:

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \alpha_i \sum_{k=1}^{n} \Delta Y_{t-1} + e_t$$

[t-1: 1 week lagged price, Δ : differenced series, k= number of lags to include]

$Y_t$ denoted the price series of Udumalpet, Nizamabad and Devenagre maize markets, Egg and Chicken price

{( MD-Maize price at Davanegre Egg – Egg price at Namakkal

MU-Maize price at Udumalpet Chicken – Chicken Price at Coimbatore

MN-Maize price at Nizamabad )}

If the coefficient ä is not statistically different from zero, it implies that the series have a unit root, and, therefore, the series is non- stationary. To verify that the first differenced price series is indeed stationary, ADF unit root tests are used. The null hypothesis of non-stationary is tested using a t-test. The null hypothesis is rejected if the estimated variable is significantly negative.

Once the variables are checked for stationarity and are of the same order, integration between them can be tested using ADF or Johansen Maximum Likelihood Test in a bivariate as well as multivariate framework. The cointegration test was first introduced by Engel and Granger (1987) and then developed and modified by Johansen (1988) and Johansen and Juselius (1990).

The Johansen's cointegration tests are very sensitive to the choice of lag length. Firstly, a Vector Auto Regression model is fitted to the time series data in order to find an appropriate lag structure. The Schwarz Criterion (SC) and the Likelihood Ratio (LR) test are used to select the number of lags required in the co integration test. The lagged terms are included to ensure that the errors are uncorrelated. The maximum lag length begins with 3 lags and proceeds down to the appropriate lag by examining the Akaike's Information Criterion (AIC) and Schwarz criterion (SC) information criteria. The number of lagged difference terms to be included can be chosen based on t-test, F-test or the AIC (Greene 1993).

If the estimated value of error term exceeds critical values at 1 %,5%, and 10 % levels of significance, the conclusion would be that the residual term is stationary and hence the two individual series, though non-stationary, are cointegrated in the long run.

***Granger Causality Test***

The Granger test is based on a premise that if forecasts of some variable, say X, obtained by using both the past values of X and the past values of another variable Y, is better than the forecasts obtained using past values of X alone, Y is then said to cause X. the model proposed by Granger (1969) was:

$$Y_i = a_i Y_{t-i} + b_i X_{t-i} + e_i \quad (1)$$

$$X_i = c_i Y_{t-i} + d_i X_{t-i} + v_i \quad (2)$$

Where, $X_i$ and $Y_i$ are two stationary time series with zero mean: $e_i$ and $v_i$ are two correlated series. Since the series of the variable are usually non-stationary and integrated of order I (1), first difference of the variable is normally taken which is stationary. The optimal lag length of the variables is determined by minimizing Akaike's Information Criterion. Based on the equations 1 and 2, unidirectional causation from one variable X to Y (i.e. X Granger causes Y) is observed if the estimated coefficient on the lagged X variable in equation (1) is statistically non-zero as a group and the set of lagged Y coefficient is zero in equation (2).Similarly, unidirectional causation from Y to X (i.e. Y Granger causes X) is implied if the estimated coefficient on the lagged Y in equation (2) are statistically different from zero as a group and the set of estimated coefficient on the lagged X variable in equation (1) is not statistically different from zero. Feedback or mutual causality (bi-directional) would occur when the set of coefficients on the lagged X variable in equation (1) and on lagged variable Y in equation (2) are statistically different from zero. Finally, independence exists when the coefficients of both X and Y variables are equal to zero.

For the proposed study, $X_i$ denoted maize prices where i=1, (1-MD) and Yi denoted domestic maize and poultry product prices i =1, 2,., 4, (1-MU, 2-MN, 3-Egg, 4-Chicken). Causality test is done to know the direction of information flow across the maize market and poultry products.

For the present study based on AIC criterion 3 weeks lag for maize market and two weeks lag for poultry products are selected in the VAR framework.

The price linkages between the domestic market prices of maize and poultry products are studied through co integration and VECM approach.

***Error Correction Model (ECM)***

An Error Correction Model (ECM) is a neat 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 also has the advantage that all the variables in the estimated equation are stationary, hence there is no problem with spurious correlation.

Engel and Granger (1987) demonstrated that once a number of variables are found to be co integrated, then there existed a corresponding error correction representation which implied that the changes in the dependent variable are a function of the level of disequilibrium in the co integrating relationship (captured by the error correction term) as well as changes in other variables.

Even if one demonstrates market integration through co integration, there could be disequilibrium in the short run, i.e., price adjustment across markets may not happen instantaneously. It may take some time for the spatial price adjustments. ECM can incorporate such short run and long run changes in the price movements.

Thus, in order to test for co-integration we use the Johansen (1988) and Johansen and Juselius (1990) full information maximum likelihood of a Vector Error Correction Model. The generalized form of this equation for k lags and an intercept term is as follows:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + \mu + \varepsilon_t$$

Where,

$y_t$ - (*n x 1*) vector of the *n* variables, i.e., price series of Udumalpet, Nizamabad and Devenagre maize markets, Egg and Chicken prices

μ- (*n x* 1) vector of constants,

Γ - (*n x (k*-1*)*) matrix of short-run coefficients,

$\varepsilon_t$- (*n x 1*) vector of white noise residuals, and ∏- (*n x n*) coefficient matrix.

If the matrix ∏ has reduced rank (*0 < r < n*), it can be split into a (*n x r*) matrix of loading coefficients α, and a (*n x r*) matrix of co-integrating vectors β.

α - Importance of the co-integration relationships in the individual equations of the system and of the speed of adjustment to disequilibrium,

β - long-term equilibrium relationship, so that ∏ = αβ

*k* - number of lags, *t* - time and

Δ -Difference operator.

So the Vector Error Correction Mechanism is used to distinguish short term from long term association of the variables included in the model. When the variables are not integrated, then in the short term, deviation from this long term equilibrium would feed back to the changes in the dependent variable in order to force the movement according to the long run equilibrium relationship. The long term casual relationship among the maize markets is implied through the significance of't' tests of the lagged error correction term as it contains the long term information because it is derived from the long term relationship. The coefficient of the lagged error correction term is a short-term adjustment coefficient and represented the proportion by which the domestic maize market adjusted in response to the long run disequilibrium.

***Model for Maize markets with Poultry products***

$$\Delta Egg_t = \alpha_0 + \beta_1 EC + \alpha_{11} Egg_{t-1} + \alpha_{12} Egg_{t-2} + \alpha_{21} MN_{t-1} + \alpha_{22} MN_{t-2} + \alpha_{31} MU_{t-1} + \alpha_{32} MU_{t-2} + \alpha_{41} Chicken_{t-1} + \alpha_{42} Chicken_{t-2} + + \alpha_{51} MD_{t-1} + \alpha_{52} MD_{t-2} + e_{1t}$$

$$\Delta Chicken_t = \alpha_0 + \beta_2 EC + \alpha_{11} Chicken_{t-1} + \alpha_{12} Chicken_{t-2} + \alpha_{21} MN_{t-1} + \alpha_{22} MN_{t-2} + \alpha_{31} MU_{t-1} + \alpha_{32} MU_{t-2} + \alpha_{41} Egg_{t-1} + \alpha_{42} Egg_{t-2} + \alpha_{51} MD_{t-1} + \alpha_{52} MD_{t-2} + e_{2t}$$

$$\Delta MN_t = \alpha_0 + \beta_3 EC + \alpha_{11} MN_{t-1} + \alpha_{12} MN_{t-2} + \alpha_{21} MU_{t-1} + \alpha_{22} MU_{t-2} + \alpha_{31} MD_{t-1} + \alpha_{32} MD_{t-2} + \alpha_{41} Egg_{t-1} + \alpha_{42} Egg_{t-2} + \alpha_{51} Chicken_{t-1} + \alpha_{52} Chicken_{t-2} + e_{3t}$$

$$\Delta MU_t = \alpha_0 + \beta_4 EC + \alpha_{11} MU_{t-1} + \alpha_{12} MU_{t-2} + \alpha_{21} MN_{t-1} + \alpha_{22} MN_{t-2} + \alpha_{31} MD_{t-1} + \alpha_{32} MD_{t-2} + \alpha_{41} Egg_{t-1} + \alpha_{42} Egg_{t-2} + \alpha_{51} Chicken_{t-1} + \alpha_{52} Chicken_{t-2} + e_{4t}$$

$$\Delta MD_t = \alpha_0 + \beta_5 EC + \alpha_{11} MD_{t-1} + \alpha_{12} MD_{t-2} + \alpha_{21} MN_{t-1} + \alpha_{22} MN_{t-2} + \alpha_{31} MD_{t-1} + \alpha_{32} MD_{t-2} + \alpha_{41} Egg_{t-1} + \alpha_{42} Egg_{t-2} + \alpha_{51} Chicken_{t-1} + \alpha_{52} Chicken_{t-2} + e_{5t}$$

{EC=Error Correction term

$\beta_1 - \beta_5$= Nature of price transmission

$\alpha_{ij}$ = Degree of association between selected markets

$e_{1t}$- $e_{5t}$ = White noise residuals }

For the present analysis, Johansen's vector error correction model (VECM) has been used. It permits the testing of co-integration as a system of equations in one step. Another advantage of this approach is that we do not need to carry over an error from one step into the rest. In addition, it does not require the prior assumption of endogeneity or exogenity of the variables.

## Results and Discussion

### *Stationarity*

To verify level and first differenced price series were indeed stationary, Augmented Dickey-Fuller (ADF) unit root test was used. The ADF test results are presented for the period January, 1st week ,2009 - November, last week, 2010. The results are presented in Table 1 for Augmented Dickey-Fuller (ADF) unit root tests for each price series. The null hypothesis of non stationarity was tested based on the critical values reported by MacKinnon (1991). All the price series appeared non stationary in the levels, but all the series were stationary after taking first differences.

**Table 1.Results of Unit Root Test (ADF test)**

| Market | Level | First difference | Critical value (1%) |
|---|---|---|---|
| MD | -0.83 | -7.88 | -3.050144* |
| MN | -1.06 | -9.49 | |
| UD | -1.27 | -10.13 | |
| Egg | -1.40 | -10.93 | |
| Chicken | -2.95 | -9.81 | |

* MacKinnon critical values for rejection of hypothesis of a unit root.

After confirming the price series were stationary in their first differences, co integration between the markets was tested using Johansen's maximum likelihood procedure. The bivariate co integration technique of Engle and Granger was also tested for the presence of long run relationship between the domestic maize markets and associated price transmission in the domestic markets for maize and poultry products.

### *Results of Granger's Causality Test*

The causal relationship between the price series of domestic maize markets, relationship between domestic maize market and egg and chicken prices were approached through Granger's causality technique.

**Table 2. Results of Causality Test for Domestic Maize Markets**

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| MN does not Granger Cause MDMD does not Granger Cause MN | 95 | 3.968811.04799 | 0.0223**0.3549 |
| MU does not Granger Cause MDMD does not Granger Cause MU | 95 | 4.07678 5.07800 | 0.0202**0.0081 |
| MU does not Granger Cause MNMN does not Granger Cause MU | 95 | 6.422086.40472 | 0.0025***0.0025*** |

(Note: *** significant at 1 percent level, ** significant at 5 percent level)

The test for causality is based on F statistics that is calculated by using unconstrained and constrained forms,

$$F= \{SSE_r + SSE_f )/ m\} / \{SSE_f / (T-2m-1)\},$$

Where $SSE_r$ and $SSE_f$ are residual sum of squares of the reduced and full models respectively; T= total number of observations, and m= number of lags.

**Table 3. Results of Causality Test for Domestic Maize Markets and Poultry Products**

| Null Hypothesis | Obs | F-Statistic | Prob |
|---|---|---|---|
| Egg does not Granger Cause MDMD does not Granger Cause Egg | 95 | 3.86932 | 0.0245** |
| | | 9.08901 | 0.0003*** |
| Chicken does not Granger Cause MD MD does not Granger Cause Chicken | 95 | 3.83199 | 0.0253* |
| | | 5.42679 | 0.0060*** |
| MN does not Granger Cause chick Chick does not Granger Cause MN | 95 | 3.64041 | 0.0302** |
| | | 4.95993 | 0.0091*** |
| Egg does not Granger Cause MN MN does not Granger Cause Egg | 95 | 3.07541 | 0.0511** |
| | | 7.78479 | 0.0008*** |
| Chicken does not Granger Cause MUMU does not Granger Cause Chicken | 95 | 2.95493 | 0.0572** |
| | | 2.97362 | 0.0578** |

(*** 1% level of significance * *5% level of significance)

The results of the analysis showing the relationship are presented in Table 2. Udumalpet maize market and Nizamabad market exhibited bidirectional causality and prices are transmitted vice versa. Udumalpet maize price shows bidirectional causality with Davanegre market also. Nizamabad maize price shows unidirectional causality with Davanagere price. So the influence of Nizamabad prices played a significant role over the other markets prices and the influence is so strong that F values happened to be significant at one percent level. Thus a strong market integration of the three markets, viz., Udumalpet, Nizamabad, Davanegre are established through the results of the analysis.

The results of the analysis clearly indicated the bidirectional relation between prices of maize with egg and vice versa and maize with chicken and vice versa. Thus maize markets in Nizamabad (Andhra Pradesh), Udumalpet (Tamil Nadu) and Davanegre (Karnataka) are integrated among them besides integration with egg (Namakkal, Tamil Nadu) and chicken (Coimbatore,Tamil Nadu) markets.

In other words the forward and backward integration of maize with egg and chicken are confirmed through the results of the study. The results have clearly indicated that there exists marketing efficiency in maize, egg and chicken markets in India. At the same time the time taken for price adjustment over the markets are to be studied to prove that the marketing efficiency is of high order and hence multiple co-integration analysis was done.

***Results of Johansen's Multiple Co-integration Analysis for domestic maize markets***

Results of multivariate co-integration tests for maize markets of India and Tamil Nadu with poultry products are given below. As the entire data series were integrated of the same order, the tests for co-integration was done using the Johansen and Juselius maximum likelihood test procedure as it provided most efficient estimate of the co-integrating vectors and also identified the number of co-integrating relationships among the non-stationary variables.

**Table 4. Results of Multiple Co-integration Analysis for Domestic Maize Markets**

| Hypothesized No of Cointegration Equation(s) | Trace Statistic | Critical Value | Prob | No of Cointegration Equation | |
|---|---|---|---|---|---|
| None * | 92.80727 | 47.85613 | 0.0000 | 1 | Trace test indicates 3 cointegrating eqn(s) at the 0.05 level |
| At most 1 * | 42.79183 | 29.79707 | 0.0010 | 2 | |
| At most 2 * | 20.09501 | 15.49471 | 0.0094 | 3 | |
| At most 3 | 0.490073 | 3.841466 | 0.4839 | | |

* denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values

| Hypothesized No of Cointegration Equation(s) | Max eigen value | Critical Value | Prob | No of Cointegration Equation | |
|---|---|---|---|---|---|
| None * | 50.01544 | 27.58434 | 0.0000 | 1 | Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level |
| At most 1 * | 22.69682 | 21.13162 | 0.0299 | 2 | |
| At most 2 * | 19.60494 | 14.26460 | 0.0065 | 3 | |
| At most 3 | 0.490073 | 3.841466 | 0.4839 | | |

Results of co-integration analysis of domestic maize markets with poultry products revealed that there was three co-integrating vector among them. This proved that there was long run relationship among the variables and they were co-integrated. Sekhar (2012) concluded that Indian rice markets are not integrated because of inter-state movement restrictions and the markets can play a more effective role if supplemented with more open policy initiatives.

***Results of Vector Error Correction Model***

Since the domestic maize markets and poultry products are integrated in the long run, it is important to study the short run and long run association for equilibrium among the markets. Hence Vector Error Correction Model (VECM) was employed to know the speed of adjustments among the markets for long run equilibrium.

From the results presented in Table 5. it is clearly known that markets came to short run equilibrium as indicated by the level of significance and the speed of adjustment is rapid where as the prices are influenced by its own weekly lags for long run equilibrium. In Nizamabad market 6.5 per cent of the short run disequilibrium get corrected and came to long run equilibrium with egg and chicken markets of Tamil Nadu with one week lag. In Udumalpet market 7 per cent of the disequilibrium get corrected and came to equilibrium with egg and chicken markets at one and two weeks lag. In egg market 12 per cent of the disequlibrium get corrected in short run and came to equilibrium with Udumalpet and Davanegre market at one and two weeks lag. Around 2 per cent of the disequilibrium got corrected in short run and influences its own prices at one week lag. Ronald A. Babula (1990) concluded that farm egg price had immediate reaction to corn price change. The study reported by Ronald A.Babula uses monthly data to examine egg-related price effects of a farm sector shock that influences corn price.

Cesar C. Rufino (2011) also concluded the price signals and other market information are being transmitted efficiently across rice markets in Philippines, thus negating the potential occurrences of unexploited arbitrage opportunities.

## Conclusion

Selected maize markets and poultry products are integrated of order one. There exists co integrating relationship between the variables. Bidirectional causality found between all the markets except Davangere. Speed of adjustments is high for chicken when compared to egg. Across the maize markets Nizamabad market came to short run

**Table 5. Results of Vector Error Correction Model for Domestic Maize Markets with poultry products**

| Error Correction | | | | | |
|---|---|---|---|---|---|
| CointEq1 | | | | | |
| D(MD) | 1 | | | | |
| D(MN) | 1.585371 | | | | |
| D(MU) | 2.082295 | | | | |
| D(EGG) | 0.181920 | | | | |
| D(CHICKEN) | -0.061803 | | | | |
| C | -3.930053 | | | | |
| Error Correction | D(MD) | D(MN) | D(MU) | D(EGG) | D(CHICKEN) |
| CointEq1 | -0.077660 | 0.065760 | -0.069806 | 0.120110 | -0.019076 |
| | [-1.39528] | [ 1.71849] | [-1.7333] | [ 5.80215] | [-2.40538] |
| D(MD(-2)) | -0.280035 | 0.069065 | -0.126746 | -0.142898 | -0.007350 |
| | [-2.28029] | [ 0.53241] | [-0.88327] | [-3.12860] | [-0.42003] |
| D(MN(-1)) | 0.024332 | -0.004873 | 0.126387 | 0.120243 | -0.038097 |
| | [ 0.15732] | [-0.02983] | [ 0.69935] | [ 2.09033] | [-1.72872] |
| D(MN(-2)) | 0.046659 | -0.141320 | -0.108549 | 0.132105 | -0.032874 |
| | [ 0.33827] | [-0.96994] | [-0.67350] | [ 2.57512] | [-1.67265] |
| D(MU(-1)) | 0.197322 | 0.052065 | 0.001025 | -0.119105 | 0.038822 |
| | [ 1.38077] | [ 0.34491] | [ 0.00614] | [-2.24091] | [ 1.90653] |
| D(MU(-2)) | 0.077961 | -0.095948 | 0.140891 | -0.124072 | 0.044994 |
| | [ 0.61741] | [-0.71936] | [ 0.95491] | [-2.64191] | [ 2.50080] |
| D(Chicken(-1)) | 0.744549 | 0.405075 | -0.238768 | 0.335299 | -0.235296 |
| | [ 0.97724] | [ 0.50333] | [-0.26820] | [ 1.18328] | [-2.16743] |
| D(Chicken(-2)) | 0.095344 | -0.265815 | -0.341844 | 0.084288 | -0.255704 |
| D(Egg(-1)) | 0.223990 | -0.065951 | 0.163882 | -0.376985 | -0.038493 |
| | [ 1.86329] | [-0.16488] | [ 0.42203] | [-0.69889] | [-0.68203] |
| D(Egg(-2)) | 0.001406 | -0.166130 | -0.682281 | -0.328534 | -0.031175 |
| | [ 0.01189] | [-0.42224] | [-1.78629] | [-0.61922] | [-0.56157] |

equilibrium at a faster rate than other two markets. Price transmission is observed across maize to poultry products. All the above prove that maize markets in India are integrated over space and form leading to a higher order of marketing efficiency. Hence achieving the production target of 42 million tonnes of maize in India is not a difficult task provided policies are conducive and bird flu does not occur in our nation.

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