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ORIGINAL ARTICLE

DYNAMICS OF EGG PRICES IN MAJOR MARKETS OF INDIA: AN ECONOMETRIC ANALYSIS

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Abstract: Egg has become the major food component and is being universally accepted without being forbidden by and religious taboo. Egg is the cheapest food sources of animal protein as compared to others. For the study four major markets of egg were selected. The period for which the data was collected was 2009 to 2016. For the selected markets trend in prices, seasonal indices and price forecasting of eggs were observed. Trend analysis indicated that there is rise in prices of eggs yearly. Seasonal indices showed more index in the month of November and December. Prices of egg would be increasing for next one year as indicated by the Auto regressive moving average model.

Key words : Trend, Price, Seasonal Index, Probability, Forecasting.

1. Introduction

The poultry industry in India represents a major success story. What was largely a backyard venture before the 1960s has been transformed into a vibrant business with an annual turnover of Rs. 30,000 crores. Today, India is the third largest egg producer in the world (after China and the United States of America), and the nineteenth largest broiler producer. Undoubtedly, this impressive growth is a result of several factors, such as active developmental support from the State and Central government, research and development support from research institutes, international collaboration and private sector participation. Commercial layer farming is not only a source of employment, income and food . The demand for egg is increasing with the rapid increase in population. To meet up the increasing demand, apart from egg production, efficient egg marketing is necessary. It is difficult to run a profitable business without proper and organized marketing system. Poultry provides eggs and meat. Eggs are a highly nutritive supplementary food. Economic improvement of rural can be substantially achieved with introduction of scientific poultry farming. Poultry farming as a tool of socio economic transformation of rural poor has immense potential in country like the people who live below the poverty line. Poultry farming requires less investment to start the enterprise. Eggs and table birds can be sold for cash as the pullet starts layering at about five months of age.

2. Materials and Methods

For the study major markets of egg as indicated by National Egg Coordination Committee was selected namely Namakkal, Hyderabad, Ahmedabad and Bangalore. The prices of eggs were collected from the National Egg Coordination Committee from January 2009 till May 2016. The data collected were analyzed using following techniques in order to draw meaningful results.

Seasonal Indices

To measure the seasonal variations in prices seasonal indices were calculated employing monthly averaging method and expressed in percentages. In the first step, 12 months moving totals were generated. These totals were divided by 12 to compute 12 months moving average. Then a series of centered moving averages were worked out.

The seasonal indices were calculated by adopting

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the following steps:

In the first step, monthly averages for the study period were computed. In the second step, overall average was computed for the whole length of the study period. Then the monthly average values were converted into seasonal indices by computing the ratio of monthly average values by the overall average value and expressed in percentage.

SI_i = Average$_i$/Overall average

Where, SI_i = Seasonal Index for *i*th month

Average$_i$ = Average value for *i*th month

ARIMA

This method consists of four steps,

(a) Identification

(b) Estimation

(c) Diagnostic checking

(d) Forecasting

(a) Identification

To find out the appropriate values of p, d and q, chief tool of identification are the Auto-Correlation Function (ACF), the Partial Auto-Correlation Function (PACF), and the resulting correlograms, which are simply the plots of ACF and PACFs against the lag length.

One way of accomplishing this is to consider the ACF and PACF and the associates correlograms of a selected number of ARMA processes, such as AR(1), AR(2), MA(1), MA(2), ARMA (1,1), ARMA (1,2) and so on. Since each of these stochastic processes exhibits typical pattern of ACF and PACF, if the time series under study fits one of these patterns, one can identify the time series with that process. Of course, one has to apply diagnostic tests to find out if the chosen ARIMA model is reasonably accurate [Brockwell and Richard (2002)].

(b) Estimation

After identifying the appropriate values of p and q the next step is to estimate the parameters of the autoregressive and moving average terms included in the model. Sometimes this calculation can be done by simple least squares, but sometimes one will have to resort to non linear (in parameter) estimation method.

(c) Diagnostic checking

In this step, one has to see whether the chosen model fits the data reasonably well. One simple test of the chosen model is to see if the residuals estimated from these models have white noise, if they have, one can accept the particular fit.

(d) Forecasting

One of the reasons for the popularity of the ARIMA modeling is its success in forecasting. To forecast the values of a time series, the basic Box-Jenkins strategy has to be followed. The steps involved in computation are given below.

First examine the stationarity. This step can be done by computing the ACF and PACF values or by a normal root analysis.

(i) If the time series is not stationary, difference it one or more times to achieve stationarity.

(ii) The ACF and PACF of the stationary time series are then computed to find out if the series is purely autoregressive or purely of the moving average type or a mixture of the two.

(iii) The tentative model is then estimated.

(iv) The residuals from this model are examined to find out if they have white noise. If they have, the

Table 1 : Trend of prices in egg of major markets.

Market	Equation	R^2	F value
Namakkal	Y=2534+221.89**	0.83	26.14
Hyderabad	Y=2326+224.32**	0.87	32.57
Ahmedabad	Y=2533+247.83**	0.89	42.05
Bengaluru	Y=2375.85+258.89**	0.92	58.08

** Significant at one per cent.

Table 2 : Seasonal indices of egg in major markets.

Month	Namakkal	Hyderabad	Ahmedabad	Bengaluru
Jan	100.46	106.95	106.95	102.01
Feb	94.14	94.24	94.79	103.32
Mar	89.58	88.66	90.17	95.83
Apr	84.27	79.51	81.02	90.25
May	94.94	88.98	89.15	85.68
Jun	108.37	106.16	104.90	96.08
Jul	100.66	99.30	98.78	109.35
Aug	95.19	94.56	94.25	99.95
Sep	102.61	102.86	101.94	97.09
Oct	103.91	104.03	103.74	102.71
Nov	114.48	116.85	116.48	105.18
Dec	111.38	117.91	117.84	112.56

tentative model is probably a good approximation to the underlying stochastic process. If they have not, the process is started all over again. Therefore, the BOX-JENKINS method is an iterative process. The model finally selected can be used for forecasting [Box and Jenking (1970)].

3. Results and Discussion

Table 1 depicts trend in egg prices in major markets

Table 3 : Price forecasting of egg prices in Namakkal market.

Year	Month	Actual Price	Year	Month	Actual Price	Year	Month	Actual Price	Forecasted Price
2009	Jan	188	2012	Jan	284	2015	Jan	318	
	Feb	197		Feb	261		Feb	272	
	March	201		March	261		March	261	
	April	197		April	230		April	261	
	May	226		May	269		May	313	
	June	244		June	310		June	388	
	July	243		July	290		July	324	
	August	212		August	311		August	324	
	September	237		September	356		September	297	
	October	238		October	314		October	311	
	November	275		November	309		November	354	
	December	236		December	305		December	387	
2010	Jan	253	2013	Jan	336	2016	Jan	405	
	Feb	240		Feb	365		Feb	369	
	March	237		March	310		March	330	
	April	223		April	296		April	340	
	May	258		May	289		May	391	
	June	272		June	368		June		417
	July	252		July	334		July		379
	August	233		August	323		August		360
	September	235		September	332		September		368
	October	252		October	345		October		362
	November	280		November	389		November		394
	December	250		December	381		December		391
2011	Jan	283	2014	Jan	343	2017	Jan		385
	Feb	225		Feb	319		Feb		359
	March	224		March	294		March		337
	April	217		April	258		April		326
	May	226		May	314		May		364
	June	258		June	323		June		404
	July	250		July	316				
	August	242		August	282				
	September	254		September	323				
	October	265		October	306				
	November	292		November	353				
	December	298		December	348				

Table 4 : Price forecasting of egg prices in Hyderabad market.

Year	Month	Actual Price	Year	Month	Actual Price	Year	Month	Actual Price	Forecasted Price
2009	Jan	189	2012	Jan	272	2015	Jan	333	
	Feb	183		Feb	241		Feb	269	
	March	193		March	239		March	219	
	April	176		April	207		April	237	
	May	209		May	239		May	271	
	June	227		June	285		June	368	
	July	222		July	269		July	309	
	August	197		August	282		August	308	
	September	223		September	329		September	295	
	October	228		October	296		October	301	
	November	272		November	297		November	349	
	December	231		December	293		December	391	
2010	Jan	243	2013	Jan	325	2016	Jan	395	
	Feb	226		Feb	338		Feb	350	
	March	218		March	286		March	300	
	April	195		April	244		April	295	
	May	226		May	240		May	381	
	June	242		June	335		June	432	
	July	227		July	306		July	404	
	August	201		August	291		August	392	
	September	224		September	306		September	403	
	October	239		October	318		October	406	
	November	265		November	372		November	451	
	December	257		December	386		December	476	
2011	Jan	282	2014	Jan	367	2017	Jan	463	
	Feb	199		Feb	316		Feb	409	
	March	208		March	304		March	359	
	April	192		April	244		April	366	
	May	197		May	291		May	427	
	June	232		June	307		June	501	
	July	225		July	309				
	August	215		August	284				
	September	237		September	320				
	October	255		October	319				
	November	281		November	361				
	December	293		December	366				

of India. Four major markets of egg were selected. Among the selected one, highest rise in price of eggs was observed in case of Bengaluru market with Rs. 258 per 100 eggs which was explained by the time variable to the tune of 92 per cent. In case of Ahmedabad market it was observed annual increase

Table 5 : Price forecasting of egg prices in Ahmedabad market.

Year	Month	Actual Price	Year	Month	Actual Price	Year	Month	Actual Price	Forecasted Price
2009	Jan	208	2012	Jan	303	2015	Jan	365	
	Feb	201		Feb	275		Feb	299	
	March	211		March	266		March	280	
	April	194		April	231		April	274	
	May	227		May	266		May	296	
	June	245		June	313		June	378	
	July	240		July	293		July	338	
	August	213		August	308		August	330	
	September	241		September	359		September	316	
	October	246		October	323		October	330	
	November	292		November	321		November	384	
	December	250		December	316		December	430	
2010	Jan	262	2013	Jan	355	2016	Jan	432	
	Feb	245		Feb	368		Feb	377	
	March	237		March	308		March	329	
	April	214		April	268		April	331	
	May	246		May	264		May	398	
	June	262		June	365		June		449
	July	249		July	337		July		423
	August	222		August	316		August		413
	September	244		September	332		September		420
	October	260		October	349		October		429
	November	288		November	408		November		480
	December	287		December	417		December		507
2011	Jan	306	2014	Jan	400	2017	Jan		493
	Feb	220		Feb	341		Feb		433
	March	229		March	323		March		399
	April	213		April	272		April		397
	May	218		May	316		May		444
	June	256		June	338		June		509
	July	248		July	326				
	August	235		August	314				
	September	259		September	345				
	October	279		October	346				
	November	309		November	393				
	December	324		December	399				

in price of eggs was around Rs. 247 with time variable explaining to the tune of 89 per cent. With respect to Hyderabad market it was around Rs. 224 increase in price yearly with time variable explaining at 87 per cent. At last it was Namakkal market with the price increase of Rs. 221 having the time variable supporting value at

Table 6 : Price forecasting of egg prices in Bangalore market.

Year	Month	Actual Price	Year	Month	Actual Price	Year	Month	Actual Price	Forecasted Price
2009	Jan	190	2012	Jan	300	2015	Jan	378	
	Feb	193		Feb	284		Feb	347	
	March	199		March	261		March	295	
	April	191		April	261		April	283	
	May	224		May	231		May	280	
	June	242		June	268		June	325	
	July	237		July	310		July	402	
	August	205		August	286		August	335	
	September	234		September	302		September	331	
	October	235		October	354		October	303	
	November	278		November	311		November	323	
	December	232		December	307		December	369	
2010	Jan	222	2013	Jan	302	2016	Jan	408	
	Feb	245		Feb	334		Feb	411	
	March	235		March	357		March	367	
	April	227		April	296		April	327	
	May	211		May	273		May	328	
	June	252		June	278		June		356
	July	268		July	362		July		401
	August	242		August	335		August		367
	September	215		September	314		September		350
	October	232		October	323		October		361
	November	252		November	334		November		362
	December	279		December	378		December		400
2011	Jan	251	2014	Jan	387	2017	Jan		411
	Feb	279		Feb	374		Feb		404
	March	219		March	341		March		368
	April	219		April	319		April		341
	May	210		May	276		May		329
	June	218		June	329		June		364
	July	255		July	342				
	August	247		August	339				
	September	235		September	301				
	October	251		October	346				
	November	265		November	330				
	December	293		December	382				

83 per cent. The analysis was found significant at one per cent probability level.

In order to analyze the long run seasonal variations in the prices of eggs in the selected markets, seasonal indices for prices were computed. The seasonal indices of monthly prices of egg in the selected markets are

presented in the Table 2. With respect to Namakallal market highest seasonal indices was observed in the month of November 114.48. The least was observed in the month of April with 84.27. In case of Hyderbad market highest seasonal index was observed in the month of December 117.91 and least was observed in the month of April 79.51. In case of Ahmedabad market highest index was in the month of December 117.84 and least was observed in the month of April having 81.01. In case of Bengaluru market, highest index was observed in the month of December 112.56 and least was observed in the month of May with 85.68. The results were confined to kartheykian and Nedunchizian (2014). This clearly indicates that the seasonal variations in egg price index are almost similar irrespective of the location and type of the market. The reason for uniformity in price behavior might be due to the organized egg marketing method and uniform price fixation procedures by National Egg Coordination Committee.

In order to ascertain the future prices that might prevail, in that context price forecasting of eggs in selected market was studied using Auto regressive moving average model. In case of Namakkal market the best fit model was observed with 111. It can be observed from the table that wholesale prices for 100 eggs had never crossed Rs. 400. According to the ARIMA model it has been predicted that in the month of June 2016 it might go for Rs. 417, further there will be slight decrease in prices. The analysis revealed that the prices of egg may be in between Rs. 300 to 400. In case of Hyderbad market which is depicted in Table 4, the best fit model was observed with 110. It can be observed from the table that the prices of egg may increase at Rs. 432 in the month of June 2016. There are ups and downs in prices of eggs which can be observed from the table. The prices of eggs might prevail in between Rs. 400 to Rs. 500 till June 2017. Table 5 depicts the price forecasting at Ahmedabad market. It can be observed from the table that from the month of June 2016 there is a spurt in increase of prices of eggs till December 2016 with Rs. 507. After the December 2016, it has been observed that the prices of egg are going to reduce gradually till May 2017. In the month of June 2017 the prices of egg is expected to observe around Rs. 509. Table 6 presents the forecast of prices in Bengaluru market. The best fit model was observed 111, the prices of eggs will be increased till December 2016. It has been observed that by December 2016, it is expected to reach Rs. 400 per 100 eggs. There are normal variations in prices of eggs till June 2017 with Rs. 364 per 100 eggs. Results obtained were at par with Mani and Shanumagasundaram (1995). In all the selected markets the prices of eggs are going to increase in the months between November to January which is mainly due to egg consumption results more body heat production. In order to benefit the profit at the same time to meet the demand the prices are expected to go high.

4. Conclusion

The findings of the research indicated that there is increase in prices of egg yearly in selected market indicating the demand of eggs in domestic market which was indicated by the linear pattern of trend analysis. The monthly seasonal indices indicated the results coincide with the other markets indicating that the consumption of eggs in winter season is more rather than summer season. There is also a strong influential character since during the months of festivals such as Christmas, Bakrid etc the prices and consumption of eggs are going to increase. Forecasting of prices indicated that, the prices of wholesale eggs are going to increase by crossing Rs. 300 per 100 eggs in all the selected markets.

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