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SEASONAL PRICE INDICES AND PRICE FORECAST FOR MAIZE IN OGUN STATE, NIGERIA

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Target Audience:Poultry extension officers, feed millers, poultry farmers.

ABSTRACT

The study investigated the accuracy of seasonal price number system in forecasting maize price. The accuracy of average monthly price forecast was affected by the accuracy of forecasting annual average price, the length of period into the future for which forecasting was made and how representative the seasonal indices are for the period for which the forecast is made. The error of price forecast for the months of August to November in 1998 based on 1998 (1993 - 1997 average price indices) seasonal price indices, ranged between 2.22 - 5.8 percent and thus confirms the competitiveness of seasonal index number forecasting system, given its degree of accuracy.

Key words: Maize, Price forecast, Seasonal price indices, Forecast error.

DESCRIPTION OF PROBLEM

Feed millers have often attributed high cost of livestock feeds to speculative stocking of maize at the time price is considered to be at its lowest ebb, only for such speculation to be proved wrong by further price decline. Reliable maize price forecast is therefore *sine qua non* to efficient livestock and livestock products pricing. It was observed that among the critical issues impinging on the demand for the products of the poultry industry, is the production efficiency manifested as lower production cost with implications for profit margin and lower selling price(1). The declining performance of the poultry industry in Nigeria could be attributed to the high input cost which has raised the overall cost of production quite significantly(2). It was observed for example, that the price of maize (which is major component of poultry feed) rose from ₦65 to ₦1000 per tonne between 1986 and 1988 (2).

Since maize production takes place at a particular period during the year and consumption is steady throughout the year, maize price exhibits a seasonal price pattern(3). For efficient livestock and livestock products pricing system therefore, seasonal maize price pattern must be of concern. A large percent of maize produced in Nigeria is consumed in livestock feed industry and maize represents between 45-50 percent of livestock feed weight, depending on the feed type. Seasonal price of maize is therefore of immense interest to livestock

feed millers and livestock enterpreneurs because of the need to keep down feed prices and make poultry enterprise attractive. The poultry industry in Nigeria not only constitutes an important agricultural enterprise in terms of profitability and quick economic returns, it also plays a major role in protein production in the livestock sub-sector of the Nigerian economy. This sub-sector together provides about 36.5 percent of total protein intake of Nigerians (4). The poultry industry according to Central Bank of Nigeria report (1989), contributed about ₦5.1 billion which represented 5.8 percent of total GDP in Nigeria. Accurate seasonal maize price forecast is therefore of prime importance to feed millers and livestock enterprenuers because it constitutes a major component of total cost of feed which is an important input in livestock industry. Many individuals lack the training to use sophiscticated econometric forecasting models and the experience to make accurate judgement of price forecast made by others yet, they must make price forecasts. The thrust of this paper is to discuss a relatively simple method for forecasting average monthly price of maize. The method makes use of seasonal price indices. Trapp (5) had reported that index price forecasting system is of comparable accuracy to the sophisticated econometric forecasting method used by professional price forecasters.

MATERIALS AND METHODS

Monthly average maize price data for the period of 1993 to 1998, and 1999 January and February prices were used for this sudy and were obtained from Animal Care Konsult Nigeria Limited, a private and a major feed miller in Ogun State, Nigeria. Monthly price indices defined as the average monthly price expressed in a percentage of annual average price were calcualted. The average of 5-year monthly price indices of 1993 to 1997 were used in calculating 1998 seasonal price pattern because monthly indices for 1997 are the latest used in the seasonal indices calculation. In Table 1, column 1, the seasonal price indices are given wih the corresponding standard deviation in coluumn 2.

The study initially assumed that only January to July 1998 monthly prices were known while those of August to December were unknown although they were known, and proceeded to forecast these monthly prices referred to as future actual prices. Since August to December 1998 actual prices were known, the forecast errors of the prices were calculated to assess the reliability of our forecasts. The scenario painted here is that price forecast is being made in early part of 1998, for the later months of the years, August to December.

The expected seasonal prices plus and minus one standard deviation are given in columns 4 and 5, while column 6 contains the actual known monthly prices. Comparison of columns 3 and 6 in Table 1 shows that the calculated expected seasonal price from January to July do not exactly match the actual prices, but they follow a similar pattern. The discrepancies are due to the fact that no individual year follows the typical seasonal price pattern exactly.

The results obtained for the months of August to December 1998 constitute forecast prices since the price data for those months were not used in determining the expected annual average price. The actual prices that occurred for these months (which will be unknown at the time the forecasts were made) are given in column 7.

The values listed in columns 2, 4, and 5 provide judgement for the accuracy of the forecasts made. Column 2 reports the standard deviation of the 5 year average index reported in column 1. Columns 4 and 5 report the respective expected seasonal price plus and minus one standard deviation. Column 4 was derived by adding columns 1 and 2 together and using the result to multiply the forecasted average annual price. For January price for example we have (83.05 - 12.46) *₦(24,697) = ₦23,588.

Likewise for column 5, for January it is (83.05-12.46) *₦(24,697) = ₦17,434. The interpretation of these two values is that in two out of three years, when average annual maize price is ₦24,697/tonne, the January price will fall between ₦17,434 and ₦23,588/tonne. This range of expected prices is due to the fact that prices do not follow exactly the same seasonal pattern each year.

The forecasts made in Table 1 were based on using seven historical average monthly prices (January to July) in calculating the index-weighted annual average expected price. There is no rule specifying how many historical monthly prices should be used. The seven months prices were used just to be able to have price forecasts for five other months of the year. One might think that the more months of data used to forecast the annual average price the better. However, as pointed out by Trapp (5), if the market has recently experienced a significant change, a long series of historical prices may not be representative of future market conditions. The effect of the number of months used to calculate the forecasted annual average price upon the accuracy of seasonal price forecasts is considered in this study.

One to seven months' historical prices of 1998 were used to estimate the expected annual average price. The forecasted price values and the actual were examined for the difference. The percent errors of the forecasted annual average prices and monthly prices of August to December are reported in Table 2, in order to allow for an evaluation of the accuracy of our forecasts. In addition, the percent errors of the price forecasts based on pevious vear's price for the same month is given in Table 2.

In order to investigate the influence of forecasting price further into the future than the end of 1998, the prices during January and February 1999, which are six and seven months away, were forecasted based on different weights in calculating average annual price. The forecasted prices were compared with their actual and the percent errors were calculated. The results of the exercise are reported in Table3.

RESULTS AND DISCUSSIONS

In Table 1, the 5-year seasonal indices with their respective standard deviations are given. It showed that maize price was weak (below annual average) from January to April with an index number range value between 80.94 to 91.00.

Table 1: Seasonal Price Index Values and Historical Prices used in making hypothetical Seasonal Index-based Price forecasts for maize during August to December 1998.

Month	5-year (1993-1997)		Expected seasonal	Expected Seasonal Prive		Known actual price	Future actual
	Average Index (1)	Standard Deviation (2)	Price(₦) (3)	Plus one Std. Dev (4)	Minus one Std. Dev (5)	(₦) (6)	price (₦) (7)
January	83.05	12.46	20,511	23,588	17,434	21,000	-
February	81.54	8.32	20,130	22,193	18,083	20,000	-
March	80.94	2.91	19,990	20,708	19,271	21,500	-
April	91.00	8.36	22,474	24,539	20,410	23,000	-
May	103.99	11.47	25,682	28,515	22,850	24,500	-
June	100.24	11.31	24,756	28,537	22,950	25,000	-
July	107.06	7.97	26,440	28,409	24,472	25,000	-
August	115.54	12.35	28,535	31,585	25,485	-	27,000
September	113.72	11.30	28,085	30,874	25,292	-	26,500
October	107.61	4.42	26,576	27,668	25,485	-	26,000
November	102.55	13.26	25,327	28,602	22,052	-	26,000
December	112.77	19.24	27,850	32,726	22,976	-	26,000

Last 7-month index - weighted forecsted annual average/expected price₦ 24,697

From May to December, maize price became strong (above annual average) with an index number range value of 100.24 to 115.54. The price trough and peak months for maize were March and August respectively. Contrary to the expectation that at harvest when the market is glutted, price is low; while just before harvest, price is very high, at the harvest month period which is June, (given that planting occurs in March/April and with 12 weeks gestation period), the price of maize is strong. Harvesting period is June/July and price indices then are 100.24 and 107.06 respectively. This is because we are considering the price of dry maize and not fresh maize. Millers do not use fresh maize whose price has declined but dry maize.

Using the seven-month index weighted annual average price to determine the expected price in August to December, (a forecast of five months into the future), the most accurate and the least accurate forecasts were for August and December with forecast errors of 2.22 and 11.40 respectively. The forecast errors for August, September, October, November and December (for 7-month index weighted annual average prices) are respectively 5.98, 2.22, 2.59 and 11.40 (Table 2). Contrary to the initial expectation of an increasing error of forecast trend the further into the future the forecast made is, the observed trend did not support this, though December price forecast is consistently the least accurate.

Table 2: Forecasting Accuracy in percentages for forecasts of monthly average prices one to five months (August through December) into the future and for the annual average price

Time period data used to calculate the expected annual price	Forecasted index weighted annual avg. price	Percent Errors of Forecasted Price					
		Aug.	Sept.	Oct.	Nov.	Dec.	Annual Avg.
Previous year's price for the same month	--	14.81	20.75	17.31	19.23	15.60	18.86
Last 7-month index weighted average	24,697	5.69	5.98	2.22	2.59	11.40	2.02
Last 6-month index weighted average price	24,965	6.70	7.13	3.33	1.53	12.61	3.13
Last 5-month index weighted average price	24,970	6.85	7.15	3.35	1.51	12.64	3.15
Last 4-month index weighted average price	25,406	8.72	9.03	5.15	0.21	14.60	4.95
Last 3-month index weighted average price	25,465	8.97	9.28	5.40	0.44	14.87	5.19
Last 2-month index weighted average price	24,910	6.60	6.90	3.10	1.75	12.36	2.90
Last 1-month index weighted average price	25,286	8.20	8.51	4.65	0.27	14.06	4.45
Actual average annual price₦ 24,208							

The general pattern noted in Table 2 is that the last 7-month index weighted average monthly price gave the best forecasts of all the months irrespective of how far into the future the forecast was made. This is followed by the last 2-month index weighted average price, though with relatively larger percent errors of 6.60, 6.90, 3.10, 1.75, and 12.36 for August to December price forecasts. Going by the percent errors of forcast, the last 6-month index weighted average price was almost as good as the last 2-month index weighted average price regardless of the extent of the projection into the future. The last 5-month index weighted price forecast was poorer than the last 6-months index weighted averge price no matter how far into the future the forecast was made. This trend is followed by the last 4-months and 3-months index weighted average price forcast. The last 2-month index weighted average price forecast is as good as the 6-month index weighted forecast and even better no matter how far into the future. The last 1-month index weighted average price forcast was as good as the 4-month index weighted forecast and even better, no matter how far into the future the forecast. This judgement is based on comparison of absolute values of forecast errors.

Hypothetically, the accuracy of the shorter forecast is expected to increase as fewer months are used to estimate the annual average price, while the accuracy of the longer period forecasts (November, December) is expected to decline as fewer months are used to predict the annual average price. This pattern is hypothesized for these logical reasons. Market conditions for the next one or two months are likely highly dependent upon current market conditions. Using a longtime period to determine the implied annual average price masks the most recent market conditions through the averaging process. Thus, if current market conditions, are depressed or strong, or a recent shift in supply or demand has changed market condition, this will be reflected in a short period average, but not in a long period average. The reverse would appear true for longer-term forecasts.

In making longer-term forecasts one should not be overly influenced by recent market conditions which may be temporary. Hence a longer base period which would more accurately reflect the general level of market price is expected to be better.

Trapp (5), in his study of Oklahoma cattle prices in the U.S.A., showed the limitations of index forecasting method. Based on error of forecast, he showed that index-based forecast beyond about six months into the future appears to be no better than forecast made using previous year's price. The forecasting accuracy repoted in Table 3, which is for price forecasts of more than six months into the future is generally poorer than that reported in Table 2; thus corroborating the finding by Trapp. The forecast errors for those periods ranged between 9.69 and 15.28 percent.

Table 3: Forecasting errors in percentages for forecasts of monthly average prices, 6 and 7 months into the future

Time period data used to calculate the expected annual price	Percent Errors of Forecasted Price	
	Jan. '99	Feb. '99
Last 7-month index weighted average price	15.10	9.69
Last 6-month index weighted average price	15.08	10.00
Last 4-month index weighted average price	13.60	11.91
Last 3-month index weighted average price	13.40	12.17
Last 2-month index weighted average price	15.28	9.73
Last 1-month index weighted average price	14.00	11.38

CONCLUSION AND APPLICATIONS

1. Using the various different last n-month index weighted average price, the annual average price forecasts have between 2.02-5.19 percent forecast error. Likewise, for monthly price forecasts of August to November, average forecast error percentage range is 0.21 to 9.28. This however increased to 14.87 when December forecast values are icluded. Basing forecast on previous year's value for the same month gave larger percent errors which ranged between 14.81 to 20.75.
2. The index based forecasting system is recommended for people anticipating future prices. It however requires information on updated seasonal indices which the authors hope to regularly publish for use of people anticipating price in some commodities for which prices are collected.
3. Trapp (1992) in his study of cattle prices showed the limitations of the index forecasting method and it is corroborated in this study. Based on error of forecasts, forecasting into the future than six months, appear to be no better than forecasts made using previous year's price. Further, index weithted averages using more than seven months of historical

data appear to cause no further improvement in forecasts for any length of time.

4. The following conclusions can be made: Short forecasts of one to two months into the future are best made using only one or two months historical prices to calculate the expected annual average price. Longer future price forecasts of four to five months in length are better made using approximately five to seven months of historical data to determine the average annual price.

5. A good rule of thumb appears to be to use one or two months more of historical data to calculate the expected annual price than months into the future one desires to forecast. Forecasting more than six months into the future with index forecasting method appears to be no more accurate than using last year's price during the same month as the forecast.

6. In this study, the desire is to forecast August to December, 1998 future prices, (a period of five months into the future) therefore the appropriate 6 to 7 months historical price data were used in the calculation of the expected price. The 7-month historical price however gave a better accuracy of price forecasts than the 6-month historical data.

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