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THE FEATURES OF CEREAL GRAIN PRICES IN NORTH-EASTERN NIGERIA

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ABSTRACT
Specifically, the study attempted to estimate the extent of the various components of price. The study was conducted in North-eastern Nigeria. Purposive sampling technique was used to select two states, of Adamawa and Taraba, from the six states that made up the North-east geopolitical zone. Only secondary data were used in the study. Secondary data on monthly bases for the prices of 100kg of three cereal grains, maize, rice and sorghum in both rural and urban markets in the study area were obtained from Adamawa and Taraba States Agricultural Development Programme offices for a period of 10 years (2001-2010). Data were analyzed using price decomposition technique. The results revealed that, the trend component showed an upward movement for all the three commodities. The seasonal variation had indexes ranged from 198.15 to 52.61, 142.83 to 61.88, and 141.44 to 66.25 for maize, rice and sorghum, respectively. The random and cyclical variations had negligible and insignificant indexes with the former having 0.01 all through and the later ranging from 0.93 to 1.26. This study would add to the volume of literatures on price analysis and also be an invaluable source of information to all stakeholders in the field of agricultural marketing and price.

KEYWORDS: Seasonal, Cyclical, Irregular, Trend, Fluctuations, Cereal grains

INTRODUCTION
The most important cereal grain crops grown and marketed in Nigeria are maize, rice, sorghum, millet and wheat (Akpan&Udoh, 2009; Global Information and Early Warning System on Food and Agriculture (GIEWS), 2008; Ismaila, Gana, Twanya&Dogara, 2010; Oguntunde, 1989; Wudiri, 1992). Of these, rice, maize, millet and sorghum are the major sources of energy staple food available and affordable in Nigeria, and are the commodities that are of considerable importance for food security, expenditure and income of households in Northern Nigeria (Ismaila et al., 2010; Maziya-Dixon et al., 2004).

In most parts of Asia and Africa, cereal products comprise 80% or more of the average diet, in central and western Europe, as much as 50% and in the United States, between 20 – 25% (Food and Agriculture Organization, 1996). Also, the increased demand for cereals, as a result of rapid urbanization, means that food crops must increasingly be produced to meet the needs of the rural and urban population (Balarabe, 2003).

It is evident however, that farmers in Nigeria in particular and in Africa in general face dramatic fluctuations in prices of the crops they produce (Akpan&Aya, 2009; Fafchamps, 2000; Nuhu,Ani&Bawa, 2009; Nzomoi, 2008; Okunneye, 2010; Simister&Chanda, 2006;Williams, 2009; Zulauf& Roberts, 2008). Because of the fixed character of inputs in agriculture especially land and partly labour force as well as the nature of production, agricultural producers very often are not able to respond in the most economical way to the changes in prices of agricultural products and inputs. These factors of consequence, which is inelastic demand for most agricultural and food product lead to high fluctuation of agricultural product prices. This further reflects in fluctuation of farmers' incomes leading to deterioration of their welfare (Abdissa&Dereje, 2001; Grega, 2002).

According to Fafchamps (2000) and Grega (2002), these fluctuations in grain prices make agriculture a risky business. In the opinion of Grega (2002), even if inelastic supply of inputs is eliminated (e.g. there is increased flexibility of using agricultural inputs) still many other factors such as weather, disease and pest would be present. Consequences of the risk in agricultural production are the existence of deviations from the balanced volume of agricultural production demanded by the market leading to price instability of this production (Balarabe, Ahmed &Chikwendu, 2006; Doll &Orazem, 1984; Livingstone &Ord, 1984). Though some level of price fluctuation provides information signals about market situation and may serve as an instrument for adjustment of supply to demand, high price fluctuation has a deteriorating effect on the whole economy and makes social structure unstable (Grega, 2002).

Agricultural prices greatly influence the pace and direction of agricultural development. Prices serve as market signals of the relative scarcity or abundance of a given product. Prices also serve as incentives to direct the allocation of economic resources and to a large extent they determine the structure and rate of economic growth (Ariyo, Voh& Ahmed, 2001). Information on agricultural commodity price in both developed and developing countries like Nigeria is important to both producers and consumers. Prices vary among markets and almost throughout the year, and understanding the nature and trend of such variations is essential for good planning by the producers, consumers and policy makers alike (Adegeye&Dittoh, 1985; World Bank, 2000).

Previous studies such as Fafchamps (2000), Nuhu et al. (2009), Abbott, (2009), Akpan and Aya (2009), Simister and Chanda, (2009) and Okunneye(2010), claimed an alarming increase and instability in staple food prices in the northern Nigeria. To what extent were those fluctuations? This, answers were provided for in this study. The various components of price were estimated for maize, rice and sorghum, because the extent of uncertainty caused by price inefficiency and instability in the agricultural sector has made the industry a risky one. This study would add to the volume of literatures on agricultural prices, also, stakeholders in the area of agricultural marketing and prices may find the information invaluable. Specifically the study attempted to estimate the extent of the various components of prices of maize, rice and sorghum.

DATA COLLECTION

Only secondary data were used in the study. Secondary data on monthly bases for the prices of 100 kilogramme of three cereal grains, maize, rice and sorghum in both rural and urban markets in the study area were obtained from Adamawa and Taraba States Agricultural Development Programme (ADPs) offices for a period of 10 years (2001-2010). Adamawa and Taraba states are two of the six states that made up the North-east geopolitical zone in Nigeria. At the time of this study, the remaining four, being Bauchi, Borno, Gombe and Yobe States were extremely vulnerable as a result of Boko Haram sect, thus, traveling to those states was risky, hence avoided. The authors would have loved to use data generated by National Bureau of Statistics (NBS), unfortunately, it does not have data on both rural and urban markets. The only available data were that of Agricultural Development Programme (ADPs).

DATA ANALYSIS

The lone objective was achieved using time series analysis such as the isolation of the prices in components using a decomposition techniques as well as graphs, in this case, the prices of rural and urban markets were averaged to make each year with twelve observations (100kg/month) to have one hundred and twenty observations in all, then observations in each year were made into four quarters.

Components of Time Series

It is assumed that each component is independent of the others and can be analyzed separately, and that each component is generated by a particular underlying process or model (Adekanye, 1988; Grega, 2002; Ojile, 2002). These components are; secular trend (Tt), cyclical variations (Ct), seasonal variations (St) and irregular (random) variations (Ir).
The graph of such a time series data gives a rough idea about the nature of fluctuations in the value of the variable with time. The fluctuations have the combined effect of various causes such as the ones mentioned above which sometimes induce sharp rise and fall. Segregating these various types of fluctuations in the time series is known as analysis of time series. The important basic components of time series are i) secular trend (Tt) ii) seasonal variation/periodic movements (St) iii) cyclical movements (Ct) and iv) irregular variations (It).

Secular trend (Tt): Over a long period of time, time series is very likely to show a tendency to increase or decrease over time. The factors responsible for such changes in time series are the growth of population change in the taste of people, technological advances in the field *etc.*

There are different types of trends, some of them are linear and some are non-linear in their form. For shorter period of time, in most of the situations the straight line provides the best description of trend and for longer period of time, the non-linear form generally provides a good description of the trend. Often, it may be possible to describe such movements a structured mathematical model. In the absence of such a definite format, approximately a polynomial or a free hand could describe the movements.

Periodic movement (seasonal variation) (St): The variation within a year is called as seasonal variation. The main causes of seasonal variations are customs, climates *etc.* Such seasonal components can be analyzed through harmonic analysis.

Cyclical movements (Ct): Cyclical movements are fluctuations which differ from periodic movements (cyclical movements) have longer duration than a year and have periodically of several years as in business cycles.

Irregular variations (It): Here the effects could be completely unpredictable, changing in a random manner. A given observation is affected by episodic and accidental factors. These are also known as causal series and are affected by the unknown causes.

These unknown causes act in an unpredictable manner.

Isolation of Time Series Components

For analysis of time series data, a model is essential. Generally two broad approaches are resorted to. One is a multiplicative model and the other is an additive model. There could be other approaches too resulting in a hybrid model of these two. In this present study, multiplicative model has been employed, since many agricultural data admit such a model as a more appropriate one.

Let the original observation at the time point to be denoted by Yt and the four components *viz.*, trend, seasonal, cyclical and irregular variations by Tt, St, Ct and It respectively, for a time period t (where, t = 1, 2, 3…).Then the multiplicative model can be expressed as; $Yt = Tt \times St \times Ct \times It$, $t = 0, 1, 2 \ldots t_n$. In obtaining the trend component, a four point moving average for the price (Y) was computed by adding the first four values and dividing the result by four and placed against second value of price (Y), next, the second, third, fourth and fifth values were added and divided by four and the value was placed against the third price (Y) value on the next row (trend). This went continuously until the last trend value was obtained, by doing that the first and last two values on the trend row were missed. This was applied for the computation of trend values on Table 1, 2 and 3.

RESULTS AND DISCUSSION

Components of Price

Tables 1, 2 and 3show the isolation of the price series into its various components; trend, seasonal, cyclical and random/irregular variations, decomposed from the price of maize, sorghum and rice respectively. Maize and Sorghum are normally harvested between November and December, after this period, in January/February, the supply reaches its peak and prices drop to their lowest level. After the month of March and possibly April when the farmers are left with marketable surplus (differences between total agricultural output and the subsistence needs), the supply start to decline and the prices start to increase. In general and in a normal year, prices start to decline immediately before December in anticipation of the new harvest and rise as supply dwindles after May and keep on rising to August.

As shown in the tables, the magnitudes of all the components were negligible except for the seasonal component which fluctuated over time. Cyclical and random components did not exhibit any form of fluctuation. This was much likely due to short period of time undertaken by the study as it confirmed report by Reddy, Ram, Sastry and Devi (2009) that a minimum period of 30-40 years was required to analyze a cyclical component. Random variation had also exhibited a stationary and negligible value indicating that variables attributed to this component such as war, extreme flood and drought were not experienced during this period under study. The study is in agreement with that of Abdissa and Dereje (2001) that this component is as a result of unforeseen circumstances that if absent the component may not be seen.

Figures 1 and 2, 3 and 4, and 5 and 6 depict the graphical presentation of Tables 1, 2 and 3, respectively. In the figures, especially 1 and 2, and 3 and 4, they looked more alike when compared to Figures 5 and 6 indicating that maize and sorghum were close substitutes and there was higher seasonal effect on sorghum than maize. Figures 5 and 6 are graphs of local dehusked rice. This kind of locally processed rice is mostly consumed by low income group who cannot either afford or access the so called "foreign" rice. In all the commodities, there was only price hike in 2008. While previous studies (Abbott, 2009; Okunneye, 2010; Simister&Chanda, 2009) claimed an alarming increase and instability in staple food prices in the northern Nigeria, evidence from data in this study has shown that the increasing price of these staples was a function of time. Abbott (2009) emphasized that, through 2002 to mid-2008, agricultural commodities including cereals have experienced unprecedented fluctuations and continuous increases prices, this is unfounded. In 2007-2008, developing country markets including Nigeria, experienced unprecedented shifts in the prices of staple foodstuffs. Very sharp rises were experienced in the prices of many products-notably; rice, wheat, corn, meat, coffee and milk-and the world faced its worst food crisis in generation. This is shown on Tables 2 and 3 being rice and sorghum, respectively. Most worrisome, is that, whenever reports are being made about increasing prices of staple food, few or no report is made on the increasing cost of production inputs such as fertilizer, herbicides and other cost of agronomic activities.

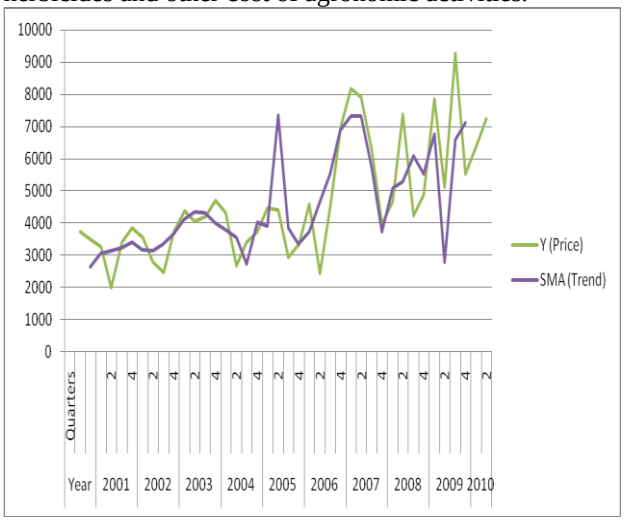

Figure 1: Isolation of Actual Price and Trend Components of Maize
Source: Field Data, 2001-2010

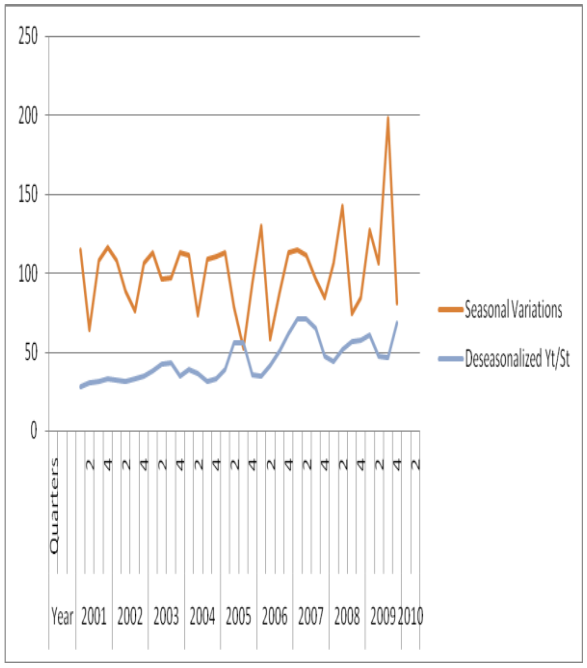

Figure 2: Isolation of Seasonal Component and Deseasonalized data (Seasonal Adjustment) for maize
Source: Field Data, 2001-2010

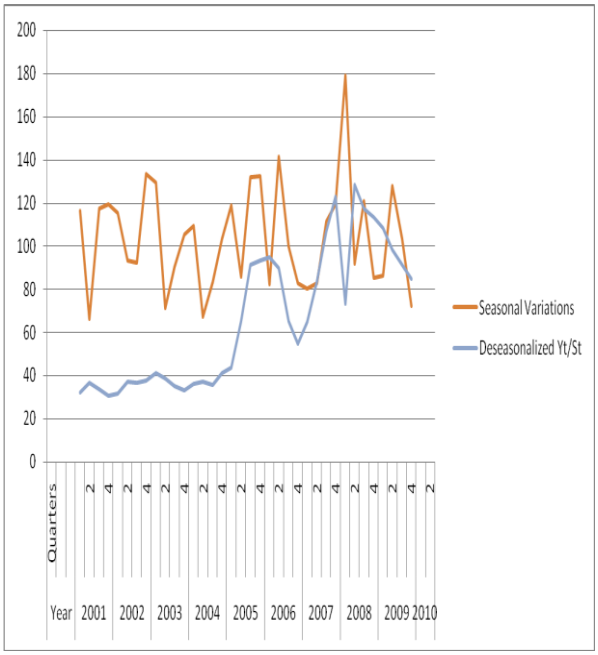

Figure 4: Isolation of Seasonal Component and Deseasonalized Data (Seasonal Adjustment) for Sorghum
Source: Field Data, 2001-2010

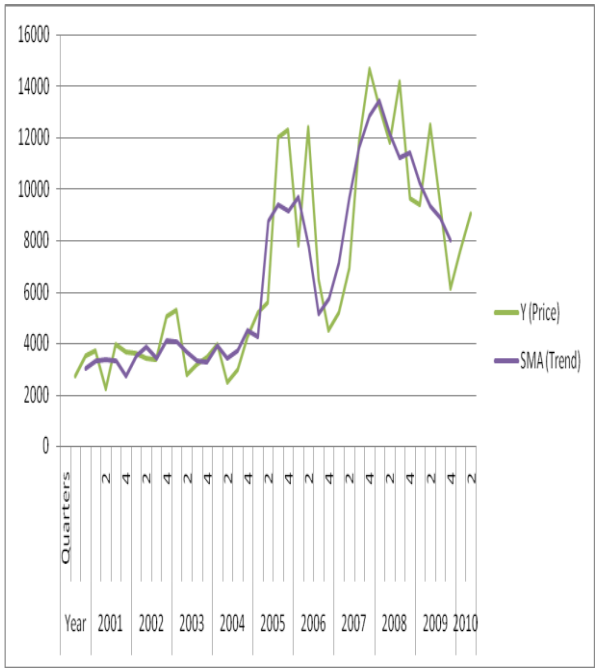

Figure 3: Isolation of actual Price and Trend Components of Sorghum
Source: Field Data, 2001-2010

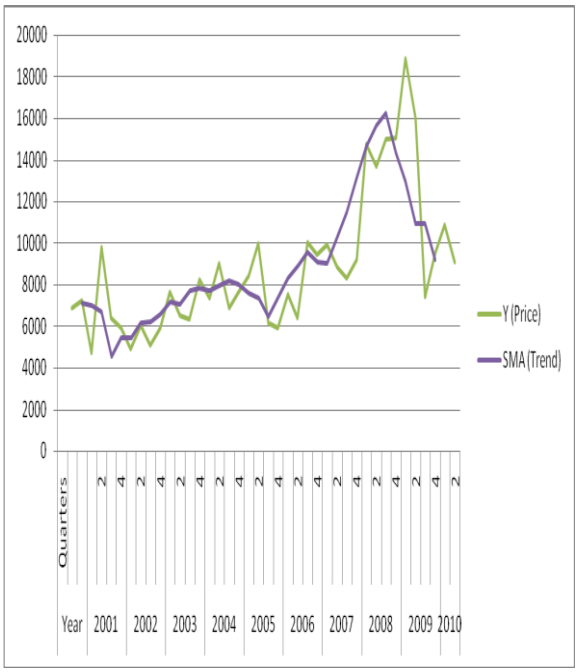

Figure 5: Isolation of actual Price and Trend Components of Rice
Source: Field Data, 2001-2010

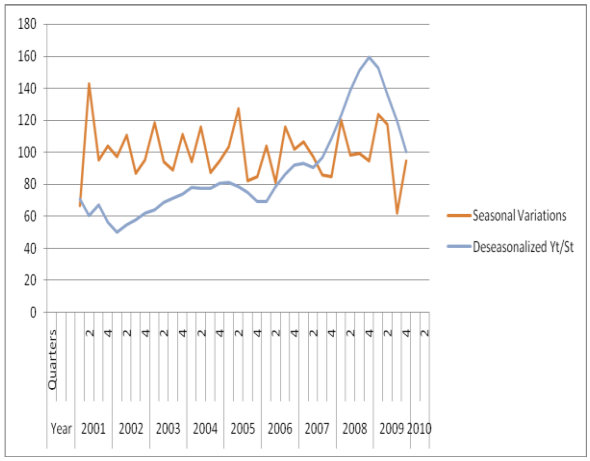

Figure6: Isolation of Component and Deseasonalized Data (Seasonal Adjustment) for Rice
Source: Field Data, 2001-2010

CONCLUSION

Fluctuations quite existed, but not at an alarming rate as claimed by Fafchamps (2000), Nuhu et al. (2009), Akpan and Aya, (2009) and Okunneye (2010), because, variations of commodity price between locations and over time is a natural market phenomenon (Rashid & Minot, 2010). In fact, price variation is necessary for the existence of a market as it create the incentives that attract market actors to engage in trade. Excessive variability and, in some cases, no variability of staple food prices should rather be a point of concern.

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APPENDIX

Table 1: Trend, Seasonal, Cyclical and Random Variations for Maize

Year	Quarters	Y (Price)	SMA (Trend)	CMA SMA1+2/2	Seasonal Variations Y/CMA*100	Deseasonalized Yt/St	Cyclical Varaitions CMA/T	Random Variations Yt/T.S.C.
2001	1	3737.83						
	2	3504.66	2622.99					
	3	3249.5	3041.03	2831.01	114.78	28.31	0.99	0.01
	4	1997.16	3125.62	3038.33	64.77	30.83	0.99	0.01
2002	1	3412.83	3201.89	3163.76	107.87	31.64	0.99	0.01
	2	3843	3399.57	3300.73	116.43	33	0.97	0.01
	3	3554.16	3164.37	3281.97	108.29	32.82	1.04	0.01
	4	2788.33	3135.21	3149.79	88.52	31.49	1.05	0.01
2003	1	2472	3341.82	3238.52	76.33	33.39	0.97	0.01
	2	3726.33	3657.28	3499.55	106.48	34.99	0.96	0.01
	3	4380.66	4092.1	3874.69	113.06	38.75	0.95	0.01
	4	4050.16	4334.33	4213.22	96.13	42.13	0.97	0.01
2004	1	4214.83	4318.54	4326.44	97.42	43.26	1	0.01
	2	4691.66	3976.75	4147.52	113.12	35.2	1.04	0.01
	3	4317.5	3777.25	3877	111.36	38.77	1.03	0.01
	4	2683	3537.29	3657.27	73.36	36.45	1.03	0.01
2005	1	3416.83	2721.08	3129.19	109.19	31.29	1.15	0.01
	2	3731.83	4005.37	3363.23	110.95	33.63	0.84	0.01
	3	4469.16	3885.4	3943.88	113.31	39.44	1.02	0.01
	4	4403.66	7345.56	5615.48	78.42	56.15	0.76	0.01
2006	1	2937	3818.83	5582.19	52.61	55.82	1.46	0.01
	2	3354.83	3326.71	3572.77	93.89	35.73	1.07	0.01
	3	4579.83	3706.37	3516.54	130.24	35.16	0.95	0.01
	4	2435.16	4613.49	4159.93	58.54	41.59	0.9	0.01
2007	1	4455.66	5506.95	5060.22	88.05	50.6	0.92	0.01
	2	6983.33	6872.07	6189.51	112.83	61.89	0.9	0.01
	3	8153.66	7319.62	7095.85	114.91	70.96	0.91	0.01
	4	7895.66	7319.62	7095.71	111.28	70.95	0.97	0.01
2008	1	6245.83	5700.33	6509.98	95.94	65.09	1.14	0.01
	2	3977.66	3726.41	4713.37	84.39	47.13	1.26	0.01
	3	4682.16	5059.41	4392.76	106.59	43.93	0.87	0.01
	4	7361.16	5285.25	5172.33	142.32	51.72	0.98	0.01
2009	1	4216.66	6073.95	5679.6	74.24	56.79	0.94	0.01
	2	4881	5508.08	5791.02	84.29	57.9	1.05	0.01
	3	7837	6767.54	6137.81	127.68	61.29	0.91	0.01
	4	5097.66	2775.03	4771.29	106.84	47.71	1.72	0.01
2010	1	9254.5	6565.54	4670.54	198.15	46.71	0.71	0.01
	2	5521.83	7100.58	6833.06	80.81	68.33	0.96	0.01
	3	6388.16						
	4	7237.83						

Source: Field Data, 2001-2010

Table 2: Trend, Seasonal, Cyclical and Random Variations for Sorghum

Year	Quarters	Y (Price)	SMA (Trend)	CMA SMA1+2/2	Seasonal Variations Y/CMA*100	Deseasonalized Yt/St	Cyclical Variations CMA/T	Random Variations Yt/T.S.C
2001	1	2726.33						
	2	3499.33	3043.87					
	3	3718.66	3349.91	3196.89	116.32	31.97	0.95	0.01
	4	2231.16	3385.33	3367.62	66.25	36.68	0.99	0.01
2002	1	3950.5	3358.79	3372.06	117.15	33.72	1	0.01
	2	3641	2745.96	3052.38	119.28	30.52	1.11	0.01
	3	3612.5	3512.54	3129.25	115.44	31.29	0.89	0.01
	4	3430.33	3860.83	3686.69	93.05	36.87	0.95	0.01
2003	1	3366.33	3444.29	3652.56	92.16	36.53	1.06	0.01
	2	5034.16	4107.33	3775.81	133.33	37.76	0.92	0.01
	3	5276.66	4058.95	4083.14	129.23	41.12	1.01	0.01
	4	2752.16	3669.58	3864.27	71.22	38.64	1.05	0.01
2004	1	3172.83	3338.74	3508.16	90.44	35.08	1.05	0.01
	2	3476.66	3272.16	3305.45	105.18	33.05	0.01	0.01
	3	3953.33	3953.33	3612.72	109.43	36.13	0.91	0.01
	4	2485.83	3413.46	3683.39	67.49	36.83	1.08	0.01
2005	1	2963	3724.5	3568.98	83.02	35.69	0.96	0.01
	2	4251.66	4499.29	4111.89	103.39	41.12	0.91	0.01
	3	5197.5	4259.04	4379.17	118.69	43.79	1.03	0.01
	4	5585	8774.5	6516.77	85.7	65.32	0.74	0.01
2006	1	12002	9425.13	9099.82	131.89	91	0.97	0.01
	2	12313.5	9177.88	9301.51	132.38	93.02	1.01	0.01
	3	7800	9728.13	9453.01	82.51	94.53	0.97	0.01
	4	12396	7799.88	8764.01	141.44	89.64	1.12	0.01
2007	1	6486	5175.83	6487.86	99.97	64.88	1.25	0.01
	2	4517.5	5773.43	5474.63	82.52	54.74	0.95	0.01
	3	5171.83	7114.33	6443.88	80.26	64.43	0.91	0.01
	4	6918.33	9649.41	8381.87	82.54	83.82	0.87	0.01
2008	1	11849.66	11652.75	10651.08	111.25	106.51	0.91	0.01
	2	14657.83	12870.49	12261.62	111.25	122.61	0.95	0.01
	3	13185.16	13455.41	7371.45	111.25	73	0.55	0.01
	4	11789.33	12186.54	12820.98	111.25	128.21	1.05	0.01
2009	1	14144	11231.08	11708.81	111.25	117.09	1.04	0.01
	2	9627.66	11409.5	11320.29	111.25	113.2	0.99	0.01
	3	9363.33	10233.08	10821.29	111.25	108.22	1.06	0.01
	4	12503	9356.42	9794.75	111.25	97.98	1.05	0.01
2010	1	9438.33	8917.83	9137.13	111.25			
	2	6121	8045.89	8481.86	111.25	84.81	1.05	0.01
	3	7609						
	4	9015.23						

Source: Field Data, 2001-2010

Table 3: Trend, Seasonal, Cyclical and Random Variations for Rice

Year	Quarters	Y (Price)	SMA (Trend)	CMA SMA1+2/2	Seasonal Variations Y/CMA*100	Deseasonalized Yt/St	Cyclical Variations CMA/T	Random Variations Yt/T.S.C
2001	1	6855.33						
	2	7219.16	7145.96					
	3	4703.5	7031.08	7088.52	66.35	70.89	1.01	0.01
	4	9805.83	6744.12	6865.62	142.83	60.65	1.02	0.01
2002	1	6395.83	4580.41	6722.14	95.15	67.21	0.1	0.01
	2	5896.16	5470.29	5662.27	104.13	56.62	1.23	0.01
	3	4878.66	5470.12	5025.35	97	50.3	0.92	0.01
	4	6047.16	6154.71	5470.21	110.55	54.7	1	0.01
2003	1	5059.16	6260.49	5812.42	87.04	58.12	0.94	0.01
	2	5895.5	6577.25	6207.6	94.97	62.08	0.99	0.01
	3	7617	7166.58	6418.87	118.67	64.19	0.98	0.01
	4	6470.33	7099.25	6871.92	94.16	68.72	0.96	0.01
2004	1	6326.16	7731.66	7132.92	88.67	71.33	1	0.01
	2	8252.83	7858.58	7415.46	111.29	74.18	0.96	0.01
	3	7347.66	7706.21	7795.12	94.26	77.95	0.99	0.01
	4	9000	7972.33	7782.4	115.65	77.82	1.01	0.01
2005	1	6833.33	8219.79	7839.29	87.17	77.92	0.98	0.01
	2	7643.83	8050.62	8096.06	94.41	80.96	0.98	0.01
	3	8412.16	7607.45	8135.21	103.4	81.36	1.01	0.01
	4	9989.83	7386.37	7829.03	127.1	78.59	1.03	0.01
2006	1	6156.66	6485.04	7496.91	82.12	74.97	1.01	0.01
	2	5871.16	7446.03	6935.71	84.65	69.36	1.07	0.01
	3	7527.83	8332.4	6965.54	104.07	69.66	0.94	0.01
	4	6384.5	8929.61	7889.22	80.93	78.89	0.95	0.01
2007	1	10000.61	9543.94	8631.01	115.87	86.31	0.97	0.01
	2	9416.66	9110.45	9236.78	101.95	92.37	0.97	0.01
	3	9916.66	9060.2	9327.1	106.32	93.27	1.02	0.01
	4	8841.83	10271.2	9085.33	97.32	90.85	1.02	0.01
2008	1	8266.66	11474.25	9665.7	85.53	96.65	0.94	0.01
	2	9215.66	13158.87	10872.73	84.76	108.73	0.94	0.01
	3	14760.66	14615.83	12316.56	119.84	123.17	0.95	0.01
	4	13654	15642.79	13887.35	98.32	138.87	0.94	0.01
2009	1	15005.16	16223.33	15129.31	99.18	151.13	0.95	0.01
	2	15043.5	14317.42	15933.06	94.42	159.33	0.97	0.01
	3	18868.5	12931.17	15270.38	123.56	152.71	0.98	0.01
	4	15976.16	10927.46	13624.3	117.26	136.25	0.01	0.01
2010	1	7381.5	10927.46	11929.32	61.88	119.29	1.05	0.01
	2	9510.5	9203.08	10065.27	94.49	100.65	1.09	0.01
	3	10841.66						
	4	9078.66						

Source: Field Data, 2001-2010