TRENDS IN WHOLESALE PRICES OF ONION AND POTATO IN MAJOR MARKETS OF PAKISTAN: A TIME SERIES ANALYSIS

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ABSTRACT:- **This study was conducted to examine the trends in wholesale prices of onion and potato in the major markets (Lahore, Hyderabad, Peshawar and Quetta) of Pakistan. Time series data about annual average wholesale prices of onion and potato were collected from 1981-82 to 2011-2012. Major findings of the study revealed that wholesale prices of onion and potato were increased with time. Results revealed that wholesale prices of onion in major markets namely Lahore, Hyderabad, Peshawar and Quetta were increased @ 8.97%, 8.82%, 8.53% and 8.88% per annum, respectively. Similarly, those of potato were increased @ 8.42%, in Lahore; 7.73%, Hyderabad; 8.21%, Peshawar and 7.58%, Quetta market. The increasing prices of these two essential household items will be difficult to manage by the consumers. Hence, the government has to make some measures, rules and regulations regarding control of prices.**

Key Words: Onion; Potato; Wholesale Prices; Trends; Major Markets; Growth; Price Control; Pakistan.

INTRODUCTION

Vegetable crops are very important due to their higher yield potential, higher return and high nutritional value and suitability for small land holding farmers. Vegetables provide proteins, minerals and vitamins required for human nutrition. The major vegetable grown in Pakistan are potato, onion, chilies, tomato, turnip, okra, carrot, cauliflower peas and tinda gourd covering 78% of the total area under vegetables accounting for 81% of the total production (Mahmood, 2014). Total area and production of important vegetable crops were 611.7 thousand hectare and 8478.8 thousand tonnes, respectively (GoP, 2013a). According to an estimate, Pakistan annually produces about 3.5 mt of potatoes (GoP, 2013a). According to another estimate, the area under onion and potato crops during 2013-14 was 127.8 and 169.9 thousand hectares, respectively, whereas production of onion and potato crops was 1,661.3 and 3,507.1 thousand tonnes, respectively (GoP, 2014). It is estimated that the total world production of onion was about 86.34 mt and Pakistan occupied 8th position with 2.25% share in production (FAO, 2011). Potato is used as staple diet in many parts of the world. It is one of the main cash crop for the farmers as well as among the main exportable horticulture commodities from the country. It improves the income of farmers as well as a source of foreign exchange earnings.

Many natural and environmental

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conditions affects the agricultural activities at great extent and these environmental natural situation may occur in the form of heavy rainfalls, floods, hailing, earthquakes and, pests and diseases etc. Therefore, highest level of risk, irregularity and unpredictability are involved in agricultural sector. Prices of agricultural commodities depend upon various factors like demand and supply of the product and environmental circumstances. So that, rise and fall in the prices of vegetables also determines the distribution of area for the production of vegetables and it influences the profitability of vegetable production (Erdal et al., 2009).

Regarding earlier studies, Amiri et al. (2011) used geostatistical models, inverse distance weighting, Adaptive Neuro-Fuzzy Inference System (ANFIS) and winter method for forecasting of seasonality in prices of potatoes and onions in Iran found winter and ANFIS as most suitable methods for forecasting of the prices of onion and potato while Adil et al. (2012) used ARIMA models for forecasting the demand and supply of onion in Pakistani Punjab. They forecasted onion area and production to be 47.484 thousand ha and 372.403 thousand tonnes in 2025. Qureshi et al. (1993) studied past and future production potential of potato crop in Punjab. Shah et al. (2011) studied onion production and marketing limitations and its scenario for improvement in the farming system of Punjab, Pakistan. They reported that area under onion crop has been increasing but the productivity is declining due to attack of pest, lack of improved varieties of seeds and sky-scraping input prices. Thus onion prices are very unstable even though

it is being produced round the year in Pakistan.

Koyk model of distributed lag models were used to study the relationship among the prices and production of potatoes in Turkey, results showed high relationship between two variables and it was concluded that time period of 12.33 years is required for changes in the prices of potato which effects the production of potato crop and farmers are very keen for growing this crop (Erdal et al., 2009). Dieng (2008) used parametric and non-parametric methods to generate the forecasts of selected Senegalese vegetable crop prices (potato, tomato and onion). The findings of this study propose that among parametric models Box and Jenkins' autoregressive integrate moving average model will be a good technique for forecasting of vegetable prices for both producers and consumers on the other hand additional research is desirable to test the forecasting accuracy of parametric versus non parametric models regarding other crops. Ray et al. (2006) studied the phenomena of asymmetric whole sale pricing and suggest future theoretical work to explore additional implications of costs of price adjustment on pricing, contracting, and design of channels of distribution.

Potato and onion are the most important kitchen items and leading cash crops for both farmers and consumers among vegetables and condiments, respectively. Therefore, keeping in view the importance of prices of onion and potato for both producer and consumer this study was conducted to examine the trends and growth in wholesale prices these commodities over the time among the

major markets of Pakistan.

MATERIALS AND METHOD

Time series data about annual average wholesale price of onion and potato in major markets (Lahore, Hyderabad, Peshawar and Quetta) of Pakistan from 1981-82 to 2011-2012 were collected from different issues of Agricultural Statistics of Pakistan (GoP, 2006; 2007; 2013). Different statistical tools were applied such as five year averages of wholesale prices of onion and potato, percentage change in prices over the years and semi log model to achieve the objectives of the study by using Minitab Statistical Software and Microsoft Excel.

To find the semi log model we have used the following geometric growth equation:

$$Y_t = Y_0 (1+r)^t \quad \ldots\ldots\ldots\ldots\ldots (1)$$

where,

- Y = Annual average wholesale prices of onion and potato in major markets of Pakistan (response variable)
- t = Time,
- Y_0 = Initial values
- r = Compound rate of growth.

Sometimes it is necessary to transform the values of variables, to provide better interpretation of results. So following that approach subjected as regression analysis using semi-log model was used to find out the trends and estimate the growth rate of wholesale prices of onion and potato in major markets of Pakistan. The semi log model was used because of fluctuations in prices of onion and potato so that, to minimize these fluctuations data is transformed by taking natural log of response variable.

By applying natural 'log' on equation (1), we have

$$\ln Y_t = \ln Y_0 + t \ln (1+r) \quad \ldots\ldots\ldots\ldots (2)$$

Now letting $\beta_0 = \ln Y_0$
$\beta_1 = \ln (1+r)$

So we can write the equation (2) as $\ln Y_t = \beta_0 + \beta_1 t$

Adding the disturbance term then it becomes

$$\ln Y_t = \beta_0 + \beta_1 t + u$$

where

- $\ln Y_t$ = Transformed response variable by using natural logarithm transformation.
- β_1 = Slope coefficient measure the constant proportional change in Y for a given absolute change in the value of regressors or the ratio of the proportionate change in Y to the absolute change in X.
- u = Error term or disturbance term

Here β_1 gives the instantaneous rate of growth by multiplying it with 100 whereas compound growth rate can be found by the following formula

$$\beta_1 = \ln (1+r)$$

where ,

- r = Compound growth rate of wholesale prices of onion and potato.

RESULTS AND DISCUSSION

The prices of onion and potato were increased in Pakistan over the time (1981-2012). The results also revealed that the asymmetric pricing is
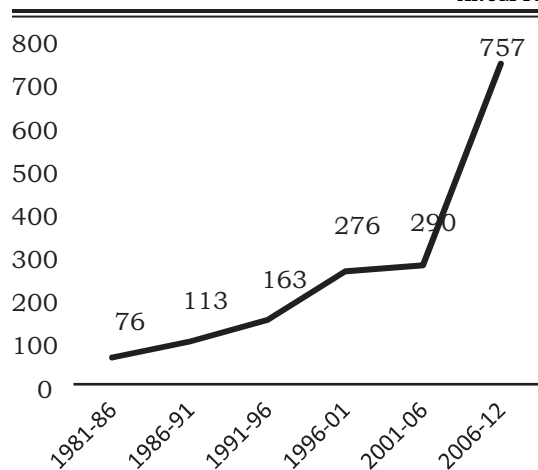
Figure 1. Trends in annual average wholesale prices (40 kg⁻¹) of onion in Pakistan

Figure 2. Trends in annual average wholesale prices (40 kg⁻¹) of potato in Pakistan

most dominant phenomena for both onion and potato in all major markets of Pakistan which means that the prices are increasing speedily and fall very gradually (Figures 1 & 2).

Trends in Wholesale Prices of Onion and Potato

Onion is an important crop of Pakistan, and it is popular both as vegetable and as condiment. It is also important as it is an exportable crop. Along with its importance, the onion is vulnerable to periodic crises, sometimes due to the shortfall in the two main onion producing provinces of Sindh and Balochistan or delayed harvesting and occasionally due to heavy export (Hasan, 2004). During 1981-82 to1985-86 the wholesale prices of onion in major markets of Lahore, Hyderabad, Peshawar, and Quetta were Rs.84.57, Rs.63.70, Rs.90.09 and Rs.65.76 per 40 kg; whereas during 2006-07 to 2011-12 these price raised to Rs.770.23, Rs.751.09, Rs.791.64 and Rs.713.95, respectively (Table 1). Thus wholesale prices of onion were tremendously increased over the time. It was revealed
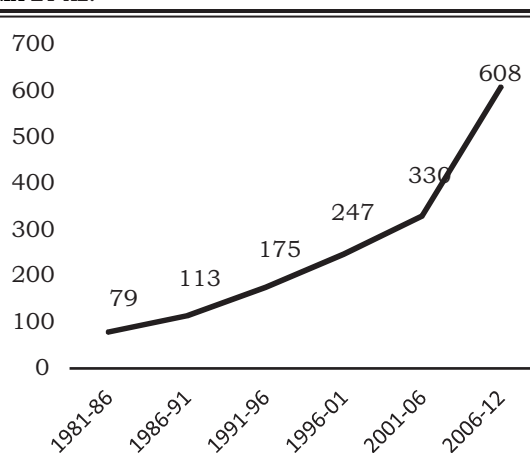
from the data that throughout the period from 1981-82 to 2011-12 wholesale prices of onion in Peshawar market were the highest whereas in Hyderabad market these prices were lowest. The differences in wholesale prices among major markets were due to transaction and transport-ation costs. As Sindh and Balochistan were two main onion producing provinces of Pakistan, so prices of onion at Hyderabad market were recorded the lowest and Peshawar market it were highest due to

Table 1. Trends in average annual wholesale prices (Rs. 40 kg⁻¹) of onion and potato in major markets of Pakistan during 1981-2012

Year	Lahore	Hyderabad	Peshawar	Quetta
Onion				
1981-82 to 1985-86	84.57	63.70	90.09	65.76
1986-87 to 1990-91	96.92	101.31	129.90	124.50
1991-92 to 1995-06	171.35	129.68	184.73	166.92
1996-97 to 2000-01	280.47	230.95	315.20	279.17
2001-02 to 2005-06	304.38	209.03	350.48	296.44
2006-07 to 2011-12	770.23	751.09	791.64	713.95
Potato				
1981-82 to 1985-86	77.15	83.50	73.29	80.63
1986-87 to 1990-91	105.68	118.87	99.52	129.81
1991-92 to 1995-06	172.37	173.08	159.08	196.52
1996-97 to 2000-01	242.92	213.05	243.37	289.33
2001-02 to 2005-06	349.00	276.86	343.22	351.59
2006-07 to 2011-12	626.54	704.16	542.65	557.13

Source: Various issues Agricultural Statistics of Pakistan

transportation cost.

In Pakistan potato has become a vital crop for both farmers and consumers. It is the fourth most important crop by capacity of production. It is high yielding, having a high nutritive value and gives high returns to farmers (PARC, 2011).

During 1981-82 and 1985-86 wholesale prices of potato in markets of Pakistan were recorded as Rs.77.15 in Lahore, Rs.83.50 in Hyderabad, Rs 73.29 in Peshawar and Rs.80.63 in Quetta per 40 kg. Whereas from 2006-07 to 2011-12 these prices increased to Rs. 626.54, Rs. 704.16, Rs. 542.65 and Rs. 557.13 per 40 kg at Lahore, Hyderabad, Peshawar and Quetta respectively; which shows that wholesale prices of potato in Lahore, Hyderabad, Peshawar and Quetta markets were increased 7-8 times as compared to during 1981-82 and 1985-86 (Table 1). The data shows that wholesale prices of potato in major markets of Pakistan were increased over the time, it may be due the rising of input prices and increasing demand of potatoes with population increase.

Growth Rate of Onion and Potato Wholesale Prices

The results of growth analysis of onion and potatoes wholesale prices in major markets of Pakistan during 1981-2012 revealed that semi-log model were highly significant at 1% level of significance for onion wholesale prices in major markets of Pakistan whereas value of co-efficient of determination (R^2) showed that 87.3%, 75.6%, 86.4%, and 84.0% variability were explained by the independent variable (time) in Lahore, Hyderabad, Peshawar and Quetta,

respectively. The trend coefficient of wholesale prices of onion in major markets of Pakistan was positive. The positive sign of compound growth rate shows that wholesale prices were annually increased @ 8.97%, 8.82%, 8.53% and 8.88% in Lahore, Hyderabad, Peshawar and Quetta market over the time. It means that wholesale prices of onion in major markets of Pakistan were increased over the time (1981-2012) (Table 2).

Similarly, the value of F-statistic shows that the semi-log model for wholesale prices of potato in major markets of Pakistan were highly significant at 1% level of significance. The signs of trend co-efficient were positive for wholesale prices of potato in major markets like Lahore, Hyderabad, Peshawar and Quetta. The positive sign of compound growth rate shows that wholesale prices of potato were increasing @ 8.42%, 7.73% 8.21% and 7.58% per annum in Lahore, Hyderabad, Peshawar and Quetta, respectively.

It was concluded from the results that the wholesale prices of onion and

Table 2. **Growth analysis of onion and potatoes wholesale prices in major markets of Pakistan, 1981-2012**

Particulars	Lahore	Hyderabad	Peshawar	Quetta
Onion				
R^2 (%)	87.3	75.6	86.4	84.0
F-statistic	199.0**	89.7**	183.5**	151.7**
Trend Coefficient	0.0859	0.0845	0.0819	0.0851
t-statistic	14.11**	9.47**	13.55**	12.32**
Instantaneous growth rate (%)	8.59	8.45	8.19	8.51
Compound growth rate (%)	8.97	8.82	8.53	8.88
Potatoes				
R^2 (%)	90.01	80.0	89.1	87.9
F-statistic	263.6**	116.1**	237.9**	210.5**
Trend Coefficient	0.0808	0.0745	0.0789	0.0731
t-statistic	16.24**	10.77**	15.42**	14.51**
Instantaneous growth rate (%)	8.08	7.45	7.89	7.31
Compound growth rate (%)	8.42	7.73	8.21	7.58

*** Highly significant at 1 percent level of significance*

potatoes in major markets of Pakistan were increased over the period under study. This may be due to the increasing prices of different inputs such as fertilizers, pesticides and seeds of these crops with passage of time. Secondly the demand of onion and potato is also increasing with population increased as these two commodities are the most important kitchen items. Onion is popular both as vegetable and condiment. While, potato is a good source of dietary energy and some micronutrients, and its protein content is very high in comparison with other roots and tubers. Over the period of time the consumption of potato was increased especially in urban areas, rising levels of income are driving a nutrition transition toward more energy-dense foods and prepared food products. As part of the trend toward greater consumption of convenience foods, demand for fried potatoes is also increasing (FAO, 2008).

CONCLUSION AND RECOMMENDATION

Potato and onion are the most important kitchen items and leading cash crops for both farmers and consumers among vegetables and condiments, respectively. It was concluded that the compound growth rates as well as trend analysis indicated that the wholesale prices of onion and potato in major markets of Lahore, Hyderabad, Peshawar and Quetta were increased during the 1981-2012. It may be due the rising of inputs prices and increasing demand of onion and potato with population increase. The increasing prices of these two essential household items will be difficult to manage by the consumers. Hence, the government has to make some measures, rules and regulations regarding control of prices, at least for these two important commodities.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

S. No	Author Name	Contribution to the paper
1.	Ms. Anum Fatima	Introduction, Data collection, Reference, Results and discussion
2.	Mr. Saleem Abid	Conceived the idea, Wrote abstract, Methodology, Data analysis & Interpretation, Conclusion, Overall management of the article
3.	Ms. Sobia Naheed	Review of literature, Interpretation of Results