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Capturing the Price Volatility of Onion and Potato in Selected Markets of Gujarat

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Abstract: The study investigates four selected markets of onion and potato for capturing the price volatility. The monthly wholesale price data were used for study of price behavior. The results indicated that a negative trend in arrival was observed in Ahmedabad and Vadodara market and price trends was positive in both the commodities. In seasonal indices, fluctuation in the monthly indices of onion and potato arrivals was more than the monthly indices of their prices in selected markets during the study period. Potato crop observed relatively more stability as compared to onion in the selected markets. The results confirmed that there was high volatility in prices of onion in these selected markets as compared to potato. Policies need to be developed to control the volatile nature of onion prices, which is directly affecting people in the low income group.

Key words: Onion, potato, wholesale price, Gujarat.

Onion and potato are important vegetable crops in India and integral component of Indian culinary. India's onion production is estimated to rise to 267.15 lakh tons in 2019-20 from 228.19 lakh tons in the previous year according to State Directorate of Horticulture. India's potato production also estimated to increase to 501.96 lakh tons in 2019-20, from 491.74 lakh tons in previous year (GoI, 2020a). In India onion is mainly grown in three crop seasons, namely kharif (harvested in October-November), late kharif (harvested in January February) and rabi (harvested in April-May) and potato grown in two season rabi and kharif. Gujarat is fourth largest state of potato production and fifth in onion production in India. Its contribution is about 7.01% in total potato production and 4.65% in onion production of the country (GoI, 2020b). Both are very price sensitive crops. This study is intended to contribute to the existing knowledge on agricultural commodity price volatility. In this study, volatility is defined as the variation (amplitude and frequency) of commodity price changes around their mean value. The impact of price volatility can be two fold. First, high volatility may involve quick declining prices. On the other hand, high price volatility may also encompass rapid increase in the price. Additionally, if the price volatility persists the price can come down even faster (Pietola *et al*., 2010).

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The analysis of prices and market arrivals over time is important for formulating a sound agricultural price policy. Fluctuations in market arrivals largely contribute to the price instability of onion and potato in the State. The transaction in commodity exchanges also plays an important role on the spot price of onion and potato as it gives some indication of future price. In order to reduce the instability in price fluctuations of onion and potato, there is a need to have a thorough understanding of the price behavior over time and space. Hence, the present study was an attempt to capture the price volatility with seasonal indices of onion and potato in selected markets of Gujarat.

Data and Methods

For the study of price behavior of onion and potato in Gujarat monthly wholesale price data were collected from September, 2007 to September, 2020. The study analyzed price behavior of the selected two commodities at four markets viz. Ahmedabad, Rajkot, Surat and Vadodara in Gujarat. The selection of the market was due to high total market arrivals of onion and potato and availability of regular price and arrival data. Ahmedabad, Rajkot, Surat and Vadodara markets were selected as secondary wholesale markets. From the time series data on arrivals and prices trends, seasonal Indices with moving average method and the intra-year price rise (IPR), coefficient of average seasonal price variation (ASPV) and

coefficient of variation (CV) were calculated (Acharya and Agargal, 1994).

Trend

The trend in wholesale prices was worked out using linear trends. The linear trend was estimated using the equation:

$Pt = a + bT$

where, Pt = Annual index numbers of wholesale prices; T = Time variable (years); a and b = Parameters to be estimated.

Computation of seasonal indices

The seasonal price indices were computed by taking 12 months moving average of the original data with the following multiplicative model of time series analysis:

$P = T \times S \times C \times I$

where, P = Monthly price; T = Trend value; C = Cyclic component; S = Seasonal component; I = Irregular component

The ratio to moving average method was used for the construction of the seasonal price indices. The effect of trend and cyclical variations were eliminated by twelve months centered moving averages. Thereafter, the ratios of original price indices to centered twelve months moving averages were worked out. These ratios were averaged and the twelve months indices were equal to 1200.

Extent of intra year price rise (IPR)

The difference between the lowest and the highest price within the year is termed as intra year price rise (IPR). The prices of most commodities usually remain the lowest in the harvest season and rise thereafter till they reach the highest level in the next pre-harvest season.

Average seasonal price variation (ASPV)

The average seasonal price variation was computed using the following formula.

$$ASPV = \frac{HSPI - LSPI}{\left(\frac{HSPI + LSPI}{2}\right)} X100$$

where, ASPV = Average seasonal price variation; HSPI = Highest seasonal price indices; LSPI = Lowest seasonal price indices.

This coefficient has some advantages over IPR and indicates the average variations in prices during the year.

Coefficient of variation

It expresses the variability of the price from its average. It indicates or measures the stability or instability of a given parameter. It was computed by using the formula:

$$C.V. = \frac{SD}{AM} X\ 100$$

where, SD = The standard deviation; AM = Mean of the seasonal indices.

Since the mean of seasonal indices is 100, then the coefficient of variation is the magnitude of standard deviation.

Price volatility was captured through ARCH-GARCH model in E-View software (Sharma and Burark 2015).

Result and Discussion

Trend in arrivals and prices of onion and potato

trend represents the general direction of change in arrivals and prices over a period of time. Trend component is affected by changes in demand such as change in population, income, habits, customs, establishment of processing industries, etc. Price trend is also affected by adjustment in supply arising out of development of cold storage and marketing facilities, production technology and market arrivals over long period. The estimated parameters for trend value for arrivals (A) and prices (P) of onion and potato crops for different markets viz., Ahmedabad, Rajkot, Surat and Vadodara are given in Table 1. A negative trend with respect to both the commodities in arrival was observed in Ahmedabad and Vadodara market but price trends was positive in both the commodities.

Seasonal behavior in onion arrivals and prices

Monthly seasonal indices were calculated in order to ascertain the long run seasonal variations in arrivals and prices of onion and existing seasonality in selected markets. Higher

Table 1. Trend equations of onion and potato arrival and price in selected markets

Market	Trend equations for Markets	
	Arrivals Y= a (Constant) + b (Slope) * t (Arrivals)	Price Y= a (Constant) + b (Slope) * t (Price)
Onion		
Ahmedabad	Yt = 17732 - 69.5×t	Yt = 1279 + 3.08×t
Rajkot	Yt = 10088 + 194.1×t	Yt = 863 + 6.75×t
Surat	Yt = 2999 + 42.95×t	Yt = 1460 + 0.40×t
Vadodara	Yt = 6324 - 53.2×t	Yt = 1372 + 2.04×t
Potato		
Ahmedabad	Yt = 21890 - 131.5×t	Yt = 628.3 + 14.09×t
Rajkot	Yt = 12421 + 130.4×t	Yt = 518.6 + 12.36×t
Surat	Yt = 8989 + 143.6×t	Yt = 588.0 + 13.20×t
Vadodara	Yt = 12778 - 146.4×t	Yt = 650.7 + 12.08×t

indices of market arrivals of onion were noticed immediately after harvest in the selected markets. Arrivals were generally high during January to June in all selected market except Rajkot which is major leading producer onion and high arrivals starts from December (Table 2). The highest arrivals indices was observed in Rajkot market (165) in January month. In Ahmedabad market, the peak indices was found in May (113) followed by Jan (107). Surat market showed lowest arrivals in August (77) while it peaked during March (123). Vadodara market witnessed the lowest arrivals in October (78) and highest during March (124). Drop in arrival indices (less than 100) were observed during July to November in all selected markets except Ahmedabad.

The price index in Ahmedabad market was the highest in the month of October (145) and relatively high during the months of August to January. Rajkot market witnessed peak price during October (144). A peak of 150 in index was observed during October in Surat market also. However, the price index of other months was between 59 and 113. The market price of onion in Vadodara was the highest in November (147) while the lowest index was observed in May (62) in Vadodara. It can, thus, be concluded that the arrivals of onion has negative relation with the price. Similar trend of negative relation between arrival and price was also observed in seasonally analysis of rice by Meera and Sharma (2017). This is so because the majority of the produce was sold soon after the harvest probably for want of cash or lack of storage facilities. Most of onion growers used traditional methods for storage of onion. However, farmers who are financially sound can store for long time and look forward for advantageous period and

Table 2. Seasonal indices of onion arrivals and prices in selected market of Gujarat

Month	Ahmedabad		Rajkot		Surat		Vadodara	
	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals
Jan	116.0	107.0	115.0	165.0	117.0	102.0	112.0	112.0
Feb	112.0	90.0	87.0	134.0	88.0	102.0	98.0	116.0
Mar	75.0	101.0	71.0	114.0	75.0	123.0	78.0	124.0
Apr	72.0	105.0	69.0	111.0	69.0	112.0	71.0	108.0
May	59.0	113.0	61.0	116.0	59.0	115.0	62.0	120.0
Jun	80.0	102.0	73.0	56.0	71.0	111.0	84.0	110.0
Jul	105.0	101.0	113.0	53.0	109.0	94.0	104.0	89.0
Aug	118.0	98.0	113.0	66.0	117.0	77.0	109.0	89.0
Sep	101.0	98.0	106.0	61.0	107.0	80.0	102.0	79.0
Oct	145.0	95.0	144.0	76.0	150.0	79.0	138.0	78.0
Nov	115.0	98.0	137.0	98.0	140.0	86.0	147.0	88.0
Dec	102.0	92.0	111.0	150.0	98.0	119.0	95.0	87.0

Table 3. Seasonal indices of potato in selected market of Gujarat

Month	Ahmedabad		Rajkot		Surat		Vadodara	
	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals
Jan	87.0	130.0	94.0	107.0	91.0	105.0	91.0	108.0
Feb	84.0	106.0	76.0	109.0	74.0	108.0	81.0	115.0
Mar	84.0	110.0	84.0	124.0	83.0	110.0	89.0	107.0
Apr	106.0	93.0	102.0	95.0	101.0	104.0	111.0	101.0
May	109.0	89.0	108.0	99.0	109.0	104.0	114.0	98.0
Jun	115.0	85.0	122.0	92.0	119.0	98.0	113.0	97.0
Jul	106.0	90.0	112.0	91.0	103.0	98.0	98.0	97.0
Aug	97.0	94.0	103.0	87.0	96.0	95.0	96.0	99.0
Sep	109.0	86.0	103.0	94.0	101.0	96.0	102.0	75.0
Oct	103.0	84.0	112.0	90.0	103.0	95.0	110.0	86.0
Nov	109.0	102.0	113.0	99.0	113.0	86.0	106.0	94.0
Dec	91.0	131.0	71.0	113.0	107.0	101.0	89.0	123.0

high prices. The results are in line with those observed in case of wheat (Meera and Sharma 2016). Onion crop were sown in the month of October to December. It comes to harvest during February to April. Thus, fluctuation in the monthly indices of onion arrivals (varying from 53 to 165) was more than the monthly indices of prices (varying from 59 to 150) in selected markets during the study period.

Seasonal behavior in potato arrivals and prices

Ahmedabad witnessed high arrival indices (more than 100) during November to March, Rajkot during December to March, Surat during December to May and Vadodara, during December to April. In the remaining period arrivals of potato in the markets were low. The highest arrival indices were observed during the month of December in Ahmedabad (131) and Vadodara (123) but March in Rajkot (124) and Surat (110). The decline in arrivals was more prominent from April in Ahmedabad and Rajkot market while it was from June in Surat and from May in Vadodra.

The price indices of potato were high in the month of April to July and September to November. The price indices in all selected market were less than 100 during the months of December to March except at Surat. Many numbers of potato storage (around 412 storage) were working in Gujarat so prices were less fluctuating as compared to onion[1].

1 http://agriexchange.apeda.gov.in/Ready%20Reckoner/Cold_Storage/WesternRegion/GUJARAT.aspx

Thus, it can be concluded that the arrivals of potato and onion had negative relation with the price. Similar results were found in other crops by Basavaraja (1993) at Bijapur.

Coefficients of average seasonal variation

With a view to ascertain the difference in the magnitude of the seasonal variations in the selected crops, the analysis was carried out in terms of IPR, ASPV and C.V. For this purpose, the magnitude of fluctuations in seasonal indices of selected crops was measured with the help of the coefficient of average seasonal price index variation. The difference between lowest and highest intra-year price rise ranged between 83% in Rajkot market to 91% in Surat market for onion and 31% in Ahmedabad market to 51% in Rajkot market for potato (Table 4). The highest coefficient of average seasonal price variation (ASPV) of onion was recorded in Surat (87.1%) and lowest in Vadodara market (69.7%). In case of potato, ASPV was the highest in Rajkot (52.8%) and lowest in Ahmedabad Market (31.2). The coefficient of variation for onion was more than 60% in all selected markets. In case of potato, however, the coefficient of variation was less than 50% in all markets with highest (46.4) at Rajkot and lowest (39.0) at Ahmedabad market. Potato crop observed relatively more stability as compared to onion in the selected market. The variability in fresh arrivals, stock of the products in market and the demand affects the price to a great extent. Farmers can obtain better prices by matching the supply of demand with the market requirement.

Table 4. Coefficients of average seasonal price variation

Market	Onion			Potato		
	IPR	ASPV	C.V. for price	IPR	ASPV	C.V. for price
Ahmedabad	86.0	84.3	63.8	31.0	31.2	39.0
Rajkot	83.0	81.0	85.2	51.0	52.8	46.4
Surat	91.0	87.1	64.5	45.0	46.6	45.0
Vadodara	85.0	81.3	61.6	33.0	33.8	40.9

Table 5. ARCH-GARCH analysis results for selected markets

	Ahmedabad	Rajkot	Surat	Vadodara
Onion				
Alpha(A)	2.393358	2.35805	2.48317	2.48566
Beta (B)	-0.82331	-0.75109	-0.83432	-0.77849
Sum of A & B	1.57005	1.60695	1.64886	1.70717
Potato				
Alpha(A)	1.218428	1.31317	1.24454	1.41365
Beta (B)	-0.41086	-0.63688	-0.63547	-0.78056
Sum of A & B	0.807568	0.67629	0.60907	0.63309

Price volatility

To assess the presence of price fluctuations in different markets for onion and potato ARCH-GARCH analysis was carried out for the following series viz., Ahmedabad, Rajkot, Surat and Vadodara onion and potato markets. The sum of alpha and beta values indicated the presence of persistent fluctuation. The value close to 1 indicates the persistence of volatility in the market (Lama *et al.,* 2015). The results confirmed that there was high volatility in prices of onion in these selected markets as compared to potato (Table 5). The sum as alpha (A) and beta (B) values were more than one so onion was highly volatile in nature with values varying from 1.57 to 1.70. Similar results were earlier observed by Sharma *et al.* (2018) while studying the performance of commodity markets for onion in Gujarat. In case of potato, however, the values ranged between 0.60 to 0.67 reflecting of less volatility.

Conclusion

The positive price trends were observed in all the study markets but in two markets, viz. Ahmedabad and Vadodara negative arrivals trends were observed. In seasonal indices, fluctuation in the monthly indices of onion and potato arrivals was more than the monthly indices of prices in selected market during the study period. The high volatility in price of onion was observed in all selected markets. Uncertainty in weather conditions, heavy or low rains and temperature affect the crop production. Low stocks facility and delayed shipments is also the source of high prices. A large part of the area of Gujarat is cultivated in the rabi season and is rainfed. Hence production of the crop is subject to weather and rainfall conditions which also impact prices and consequently causes fluctuations which are sometimes quite severe. Policies need to be developed to control the volatile nature of onion prices, which is directly affecting the low income group. Therefore, in order to continue the present system of market integration, there is need to establish cells to generate market information and market intelligence which would provide a better platform for guiding the farmers in marketing their produce. If markets have strong associations for selected commodity, prices at different markets could be influenced with a lag of one or two months. This would help to transfer the price signals from one market to another and help in stabilizing the prices and also create a healthy competitive environment. Additionally, this would also help to protect the interest of producer sellers

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