

A STUDY OF PRICE BEHAVIOUR AND MARKET INTEGRATION OF ONION IN GUJARAT

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Abstract: The present study was undertaken to analyse price behaviour and market integration of onion in Gujarat. It seeks to ascertain the optimum period for farmers to sell their produce, for the consumers to buy their goods and for the Government to take necessary policy decisions with regard to price support, procurement, storage and helping authorities to take up timely action. Thus, the analytical results of time series data related to prices and arrivals of onion in regulated markets of Gujarat is more useful as market intelligence for farmers, traders, exporters and policy makers. The compound growth rate of wholesale prices of onion in Vadodara market was found positive and significant. The onion arrival and price indices did not continuously increase or decrease uniformly over the years in all the selected markets. The negative relationship was observed between arrivals and prices of onion irrespective of the selected markets as expected. In Mahuva market, the seasonal arrival indices of onion increased gradually from February onwards and reached peak in the month of April. The highest seasonal price indices were observed in the month of May (143.11). Therefore, it was suggested that farmers can sell their produce during May because in this month prices found maximum. In Vadodara, Surat and Bharuch market the seasonal price indices of onion were above 100 from February to July. While in Rajkot market it was from January to July. Hence, it could be better if farmer's sell their produce during the period from February to July for fetching higher prices in these markets.

Keywords: *Allium cepa* (L.), Market integration, Price and Growth behavior

INTRODUCTION

The onion (*Allium cepa* L.), is a vegetable that is most widely cultivated species in India. Its close relatives include garlic, shallot, leek, chive and Chinese onion. Onion is cultivated and used around the world and as a food item usually it is served cooked, as a vegetable or part of a prepared savory dish, but can also be eaten raw or used to make pickles or chutneys. It is an important vegetable crop and has integral components of culinary preparations. Biochemical components, viz., thiosulfinate and many others present in onion make it exclusive medicinal commodities too. The problems of heart diseases, rheumatism, cancer, digestive disorders, blood sugar and prolonged cough are known to be resolved by regular consumption of onion and garlic (Anonymous, 2013). The area and production of onion in Gujarat was about 44.33 thousand hectares and 1111.09 thousand metric tonnes, respectively, during the year 2018-19. Onion is one of the most important commercial crops grown in India and it can be stored and consumed throughout the year. In terms of area, India occupies first position in the world and in production ranks second. The major contributing districts in Gujarat are Bhavnagar, Girsomnath, Amreli, Rajkot, Junagadh, Jamnagar, Dahod and Surendranagar. It is produced for both domestic consumption as well as exports. In the wake of galloping price rise in onion, it is imperative to understand the nature and causes

of price rise and effect on consumer. In view of many policy changes at the international, national and state level in recent times, it is imperative to study the influence of agricultural sector exclusively on marketing and price behavior. The likely impact of WTO regime on marketing of agricultural products and fluctuation of prices becomes utmost important, since it has a bearing on farmer's income and ultimately on the standard of living. Mainly four time elements: trend, cyclical, seasonal and irregular are associated with the change in prices. The trend is that component of variation which reveals general direction of change over a period of time. Secular trend and seasonal fluctuations play an important role in guiding the farmers and traders. Inter and Intra-year variation in prices of agricultural commodities is a normal feature.

Moreover, the seasonality and dependency on rain are more pronounced situation in production and arrival of commodity in Gujarat. As such, the producers have little control over prices which ultimately causes the price uncertainty. Therefore, the study on behavior of arrival and prices would be useful to take decision "when to grow and when to sell" on the part of farmers and "when, where and how to store and dispose off" on the part of businessmen. Market integration reflects the degree of competitiveness of the marketing system as a whole. Therefore, a study to examine the degree of market integration is necessary for explaining pricing efficiency in spatially located markets. The present

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study is devoted to a study of price behavior and market integration of onion in Gujarat. It seeks to ascertain the optimum period for the farmers to sell their product, for the consumer to buy their goods and for the Government to take necessary policy decisions with regard to procurement and storage and helping authorities to take up timely steps in the desired direction. Thus, the analytical results of time series data related to prices and arrivals of onion in regulated markets of Gujarat is more useful as market intelligence for farmers, traders, exporters and policy makers. The present study is devoted to a study of price behavior and market integration of onion in Gujarat. It seeks to ascertain the optimum period for the farmers to sell their product, for the consumer to buy their goods and for the Government to take necessary policy decisions with regard to procurement and storage and helping authorities to take up timely steps in the desired direction. Thus, the analytical results of time series data related to prices and arrivals of onion in regulated markets of Gujarat is more useful as market intelligence for farmers, traders, exporters and policy makers.

METHODOLOGY

Gujarat is a state in western part of India, enclosed within the North Latitude $20^{\circ}10'$ to $24^{\circ}50'$ and East Longitude $68^{\circ}40'$ to $74^{\circ}40'$. It has an area of 196,024 km² with a coastline of 1,600 km and a population above 60 million. The state is bordered by Rajasthan to the north, Maharashtra to the south, Madhya Pradesh to the east, and the Arabian Sea and the Pakistani province of Sindh to the west. Its capital city is Gandhinagar, while its largest city is Ahmedabad. This study has been carried out in Gujarat state and total eight regulated markets were selected purposively based on maximum arrivals of onion in the markets during TE 2017-18. The present study was pertained to the year 2007-2016 but the markets selected on the basis of maximum arrivals in TE 2017-18, because the study was proposed in the year 2016 under distance mode but analysis was carried out in the year 2019. Therefore, for selection of markets the data considered for the year average of TE 2017-18.

The data collected from various APMCs is being systematically arranged, organized and finally subject to tabular analysis for drawing inferences to assess trend, seasonality and market integration.

Inter-Year Price Behavior

The Inter-year price behavior was studied using the following methods given below;

To examine the general behavior of wholesale prices, the year to year price behavior was ascertained by examining the price of onion crop over the period. The general price behavior of wholesale prices was studied through their price indices.

Annual price index was calculated by using the following formula:

$$I_t = P_t/P_0 \times 100$$

Where,

I_t = price index for year t,

P_t = price in period t,

P_0 = price in the base year

To know the trend and rate of increase or decrease in annual wholesale prices the Compound Growth Rate (CGR) was calculated by using the exponential model as given in equation (1) and (2).

Intra-Year Price Behavior

The intra-year price behavior was studied by calculating the seasonal price indices of monthly wholesale prices of onion crop in selected markets. To know the seasonal pattern of wholesale prices of onion the following multiplicative model of time series analysis is being used.

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

Where,

O = Monthly wholesale prices,

T = Trend value,

C = Cyclical variation

S = Seasonal variations, and

I = Irregular variations.

The seasonal index numbers was constructed by using the twelve months moving average method. To remove the effects of trend (T) and cyclical variations (C), twelve months moving average was calculated and centered. Further, ratios of original price indices to centered moving average were calculated to obtain the combine effect of S x I. In order to eliminate the effect of irregular component (I), these ratios were averaged and finally adjusted and seasonal indices (S) were obtained.

Market Integration

Market integration shows the extent to which prices in different markets move together (Barret, 2001). It is considered as a pre-condition for effective marketing reform to take place. The high degree of market integration indicates the competitiveness of the markets. The well-integrated market provides the ways for the farmers to specialize according to the comparative advantage. The markets that are not integrated presents inaccurate picture about price information, which may distort production decisions of the producers and contribute to inefficiencies in agricultural markets, harm the ultimate consumers and lead to low production and sluggish growth (Mukhtar and Javed, 2008). Market integration also plays a vital role in determining pattern and pace of diversification towards the high value crops (Sidhu *et al.*, 2010). Further, it also becomes difficult to comprehend trade policy as several obstructions such as stocking limits, inefficient markets, weak supply chains and trade cartels often restrict the efficient functioning of the markets (Chengappa *et al.*, 2012). To study the market integration total eight regulated markets on the basis of maximum arrivals in the state are being selected. All the relevant data is being collected from website of www.agmarknet.gov.in. The monthly wholesale prices (during the period

2007-2016) data for selected markets are compiled and analyzed by using Pearson's correlation coefficient and Johansen's Co-integration analysis approach to assess the relationship between market pairs.

The following formula was used to calculate the correlation coefficient between the markets;

$$r = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{n \sum X^2 - (\sum X)^2} \sqrt{n \sum Y^2 - (\sum Y)^2}}$$

Where,

r = correlation coefficient;

n = number of observations;

X = monthly average prices of selected crop (Rs/qt) in one market;

Y = monthly average prices of selected crop (Rs/qt) in another market.

The value of correlation coefficient (r) varies from -1 to +1. The positive value indicates that there is a positive relationship among the markets that means increase the prices in one market leads to increase in prices of other market. Degree of relationship is strong when the value is closer to +1. If the value is exactly +1, it indicates perfect relationship either positive or negative depending on the sign of the value.

RESULTS AND DISCUSSIONS

Trend in Annual Wholesale Price Indices of Selected Markets

The annual price indices of onion in the selected markets of Gujarat were observed and recorded (Table 1). It was found that the price indices of onion at Mahuva market during the period of 2007 to 2016 were ranged from 56.55 to 253.36. It reached maximum at 253.36 in the year 2015 and at the minimum in the year 2008 (56.55). No specific trend observed in the price of onion in Mahuva market. This may be due to the fluctuated arrivals in the

market. Similarly, in Gondal market no specific trend was observed may be due to fluctuated arrivals and trend was ranged from 62.04 in the year 2016 to 228.43 in the year 2015. In Ahmedabad, market price indices are not continuously increasing or decreasing uniformly. It was ranged from 94.87 to 308.71 during the year 2008 and 2013, respectively. No specific trend was observed in the wholesale price indices of onion also in Ahmedabad market. In Bhavnagar district, the market trend of price indices was continuously increasing from the year 2012 to 2015. It was ranged from 87.42 in the year 2008 to 279.18 in the year 2015. If price indices compare with area, production trend than it may be due to the results of fluctuated trend of area and production. While, it was observed that the onion price indices did not continuously increase or decrease uniformly over the years in Vadodara market. It was ranged from 91.61 to 315.94 during the year 2008 and 2013, respectively. No specific trend was observed in the Vadodara market for onion price. In the case of Rajkot, the trend of price indices in this market ranged from 73.69 in the year 2008 to 231.86 in the year 2013. No specific price trend observed may be due to fluctuated arrivals in Rajkot market. In Surat market the trend of price indices ranged from 82.25 to 271.44. It reached maximum in the year 2015 (271.44) and minimum in the year 2008 (82.25). No specific trend observed, it may be due to fluctuation of area and production in the surrounding area of Surat market. Similarly, in Bharuch the trend of price indices ranged from 87.70 in the year 2016 to 206.95 in the year 2013. Here also there is no specific trend of price indices of onion was observed (Figure 1). So in nutshell, it was concluded that all most in all the selected markets there is no specific increasing or decreasing price trend was found. This may be due to the fluctuated quantity of arrivals, area and production of onion.

Table 1. Annual price indices of onion in the selected markets of Gujarat

Sr. No.	Years	Markets							
		Mahuva	Ahmedabad	Bhavnagar	Gondal	Vadodara	Rajkot	Surat	Bharuch
1.	2007	125.93	73.78	95.90	90.09	93.03	111.68	108.68	97.03
2.	2008	56.55	94.87	87.42	94.48	91.61	73.69	82.25	89.71
3.	2009	117.52	131.34	116.68	115.43	115.36	114.63	109.07	113.25
4.	2010	174.62	173.70	142.13	145.89	131.90	136.65	144.61	139.67
5.	2011	131.90	114.70	104.19	87.08	126.36	101.66	100.36	105.40
6.	2012	86.34	119.00	120.94	92.30	125.22	149.34	98.57	98.44

7.	2013	236.30	308.71	173.85	222.17	315.94	231.86	263.25	206.95
8.	2014	162.55	170.92	271.99	135.78	193.83	175.66	165.22	149.49
9.	2015	253.36	277.94	279.18	228.43	311.67	212.24	271.44	197.19
10.	2016	97.94	100.87	94.46	62.04	118.69	83.89	96.22	87.70

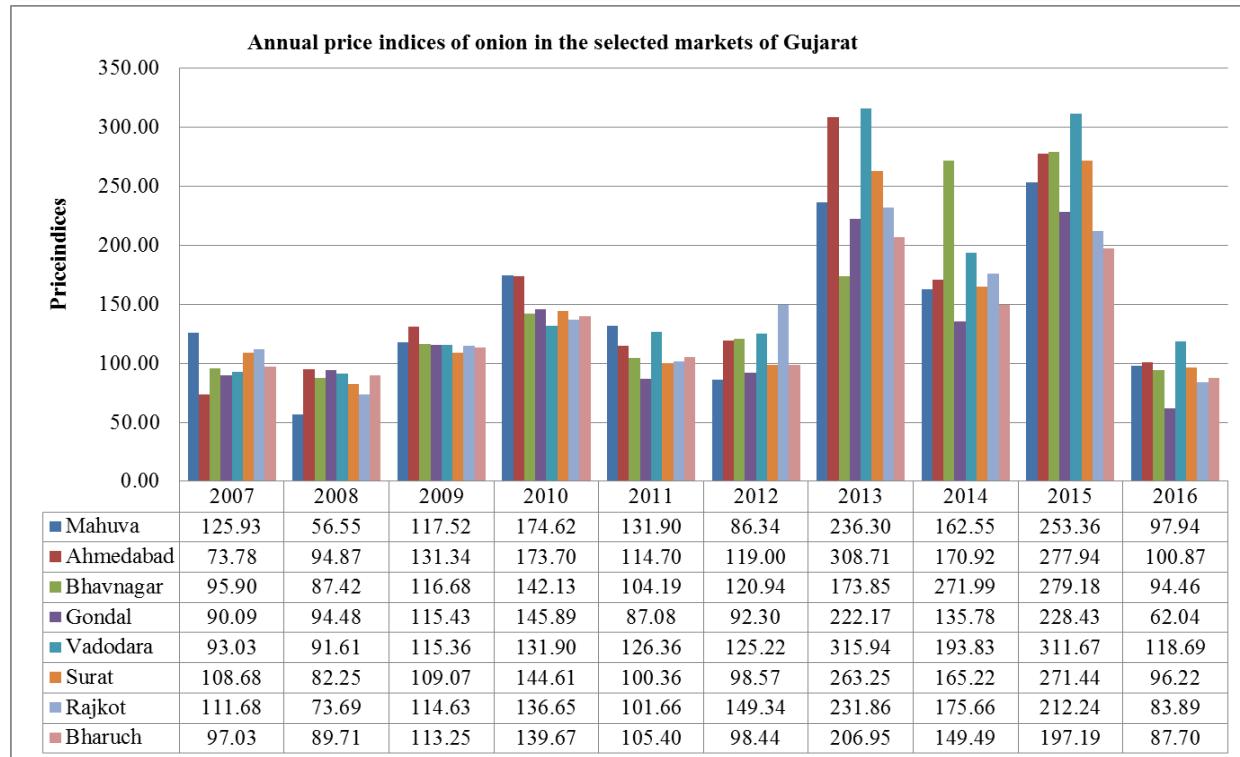


Figure 1. Annual price indices of onion in the selected markets of Gujarat

SEASONALITY (INTRA-YEAR VARIATION)

Seasonal variations are regular phenomena in the market and have an importance in agricultural marketing as it provides signal to the growers about appropriate time of selling of commodities to earn more profit. A seasonal variation generally occurs throughout the year with upswings or downswings trend. Prices and arrivals generally have opposite relation as price goes down with high arrivals in the market and increase in prices indicate decreasing arrivals trend but it may not be true all the times. Seasonal indices of prices and arrivals are very important in this study as onion crop has high value and has an export value with the possible effect of international factors. The study on behaviour of arrival and prices would be useful to take decision “when to grow and when to sell” on the part of farmers. With this in view, the intra-year variation in arrivals and wholesale prices of onion was analyzed

and constructing the seasonal index numbers using percentage centered 12-months moving average method.

In this present study, results revealed that the seasonal arrival indices of onion were above 100 from July month to November month for Mahuva market (Fig. 2). Mahuva market registered higher seasonal indices of arrivals ranging from 6.65 to 263.60 in the month of March to August, respectively. The seasonal wholesale price indices of onion were found more than 100 from February to July month in the Mahuva market. It increased gradually from February onwards and reached peak in the month of April. Further, the low-price indices were observed during August to December (ranging from 61.92 to 81.35). It can be concluded that as per expected there was mostly negative relationship was observed between wholesale price and arrivals of onion in Mahuva market.

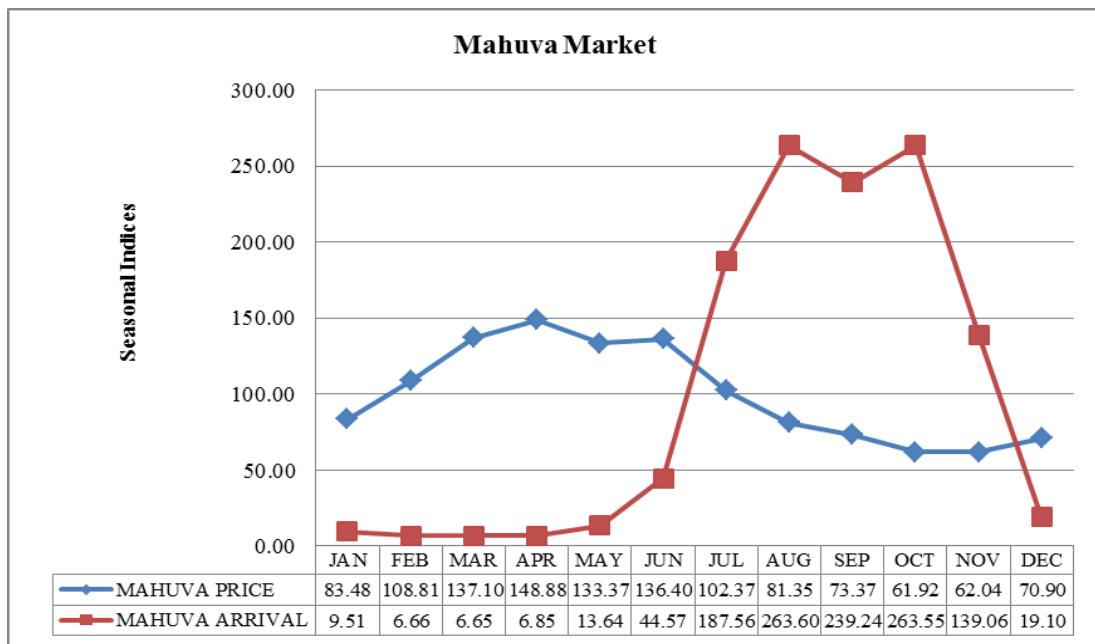


Figure 2. Seasonal indices of arrivals and prices of onion at Mahuva

In this study, results revealed that seasonal arrival indices of onion were above 100 from July to December month in Ahmedabad market except in August month (Fig 3). It was highest in the month of October (119.08). It can also be seen that during January to June month, the seasonal arrival index was lower than the average 100. The seasonal price indices of onion were above 100 from February to

July month in the Ahmedabad market. The highest seasonal price indices were observed in the month of May (143.11) while it was lowest in the month of October (51.46). It concluded that farmers can sale their produce during the month of May because in this month price found maximum. Further, the relationship between the arrivals and prices were found opposite as expected.

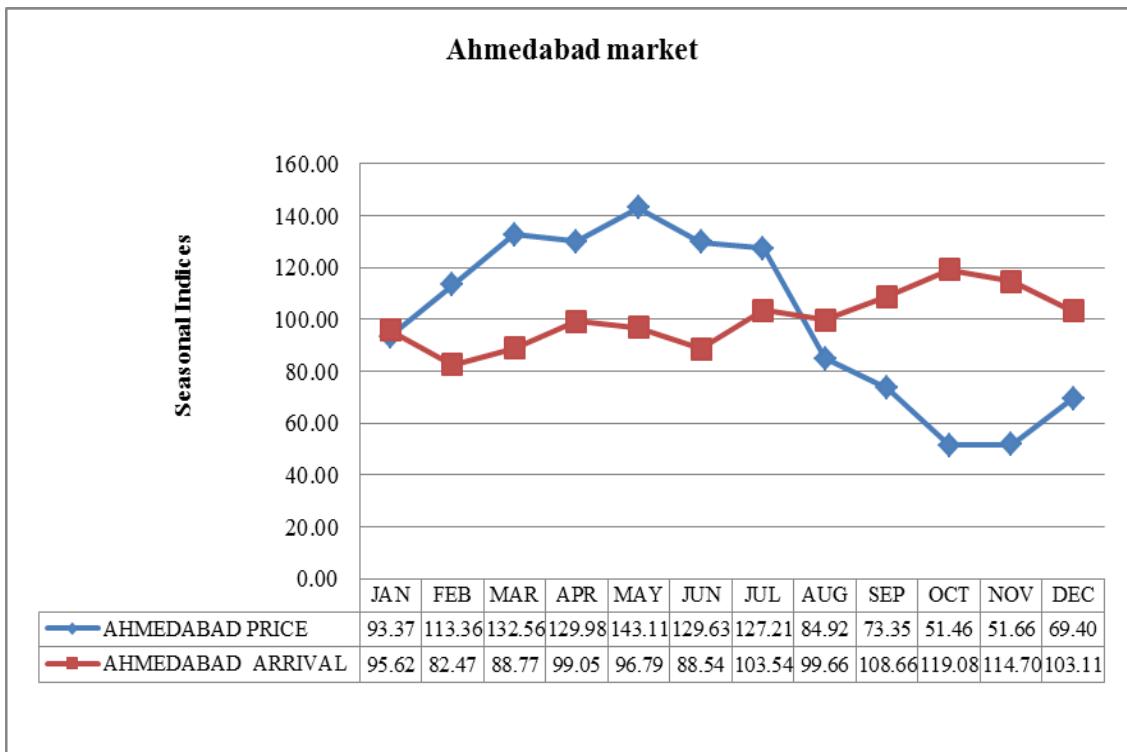


Figure 3. Seasonal indices of arrivals and prices of onion at Ahmedabad

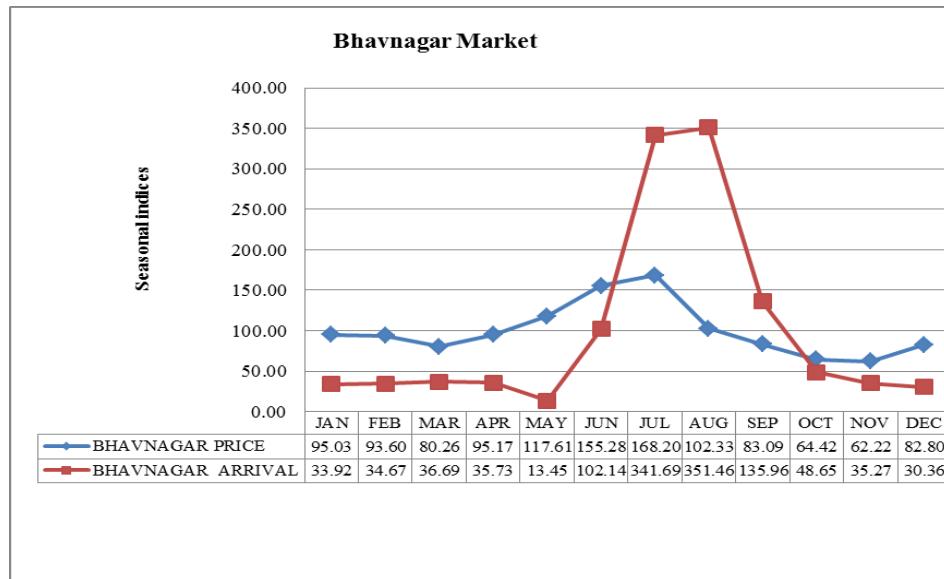


Figure 4. Seasonal indices of arrivals and prices of Onion at Bhavnagar

The data presented in Figure 4 reveals that seasonal arrival indices of onion were above 100 for the month of June to September during the study period. The highest seasonal arrival indices were observed in the month of August (351.46) while lowest seasonal arrival indices were seen in the month of May (13.45) (Fig 4). The highest seasonal price indices were observed in the month of July (168.20) in Bhavnagar market, whereas lowest seasonal price indices were seen in the month of November (62.22). It is concluded that as per expectations more or less negative relationship was prevailing between arrivals

and price of onion. The data presented in Figure 5 shows that seasonal arrival indices of onion were above 100 in the month of July to November at Gondal market. The highest seasonal arrival indices were observed in July (161.53) month and the lowest seasonal arrival indices were seen in the month of April (42.67). Further, the seasonal price indices of onion were above 100 from February to July in this market. The highest seasonal price indices were seen in the month of May (132.09) and lowest price indices were in the month of November (58.64).

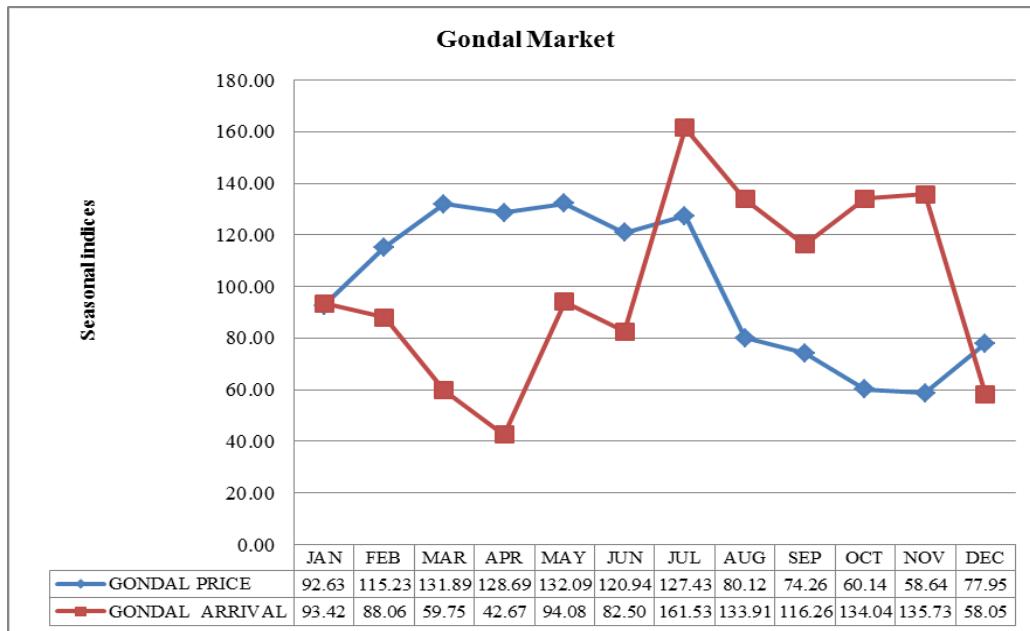


Figure 5. Seasonal indices of arrivals and prices of onion at Gondal

The data in Fig 6 reveals that seasonal arrival indices of onion were above 100 in the month of January, February, October, November and December at Vadodara market. The highest seasonal arrival

indices were observed in the month of December (134.31) and the lowest seasonal arrival indices were seen in the month of March (73.96). Whereas, the seasonal price indices of onion were above 100 from

February to July in this market. The highest seasonal price indices were seen in the month of July (137.59) and lowest price indices were found in the month of

October (56.97). It could be better if farmers sell their produce during the period from February to July for fetching higher price in Vadodara market.

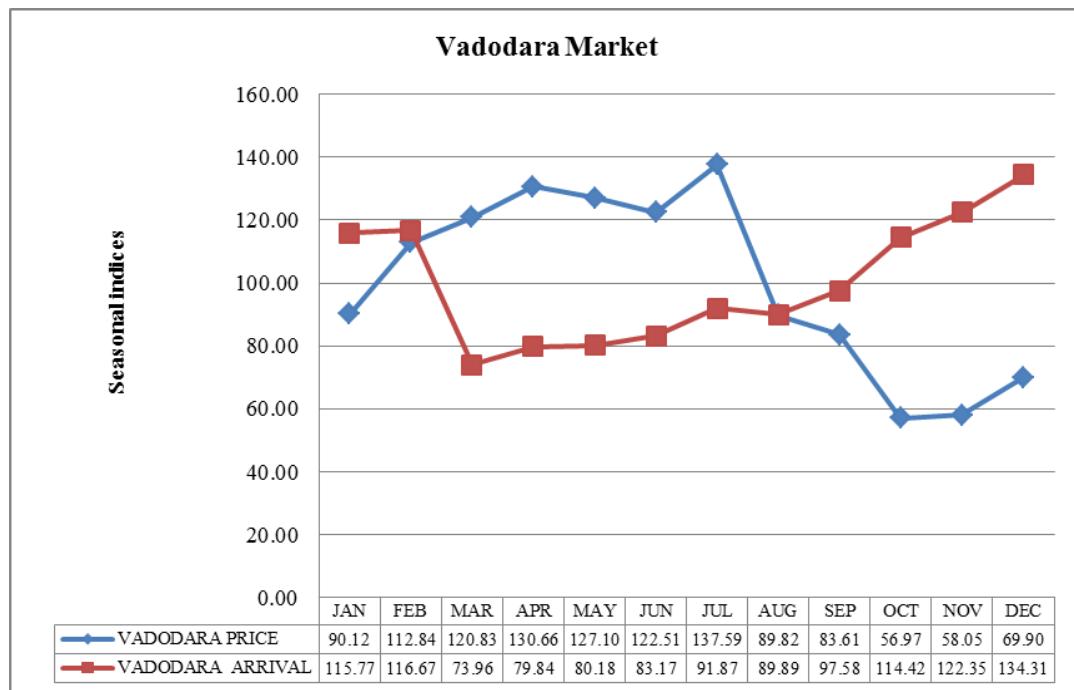


Figure 6. Seasonal indices of arrivals and prices of onion at Vadodara

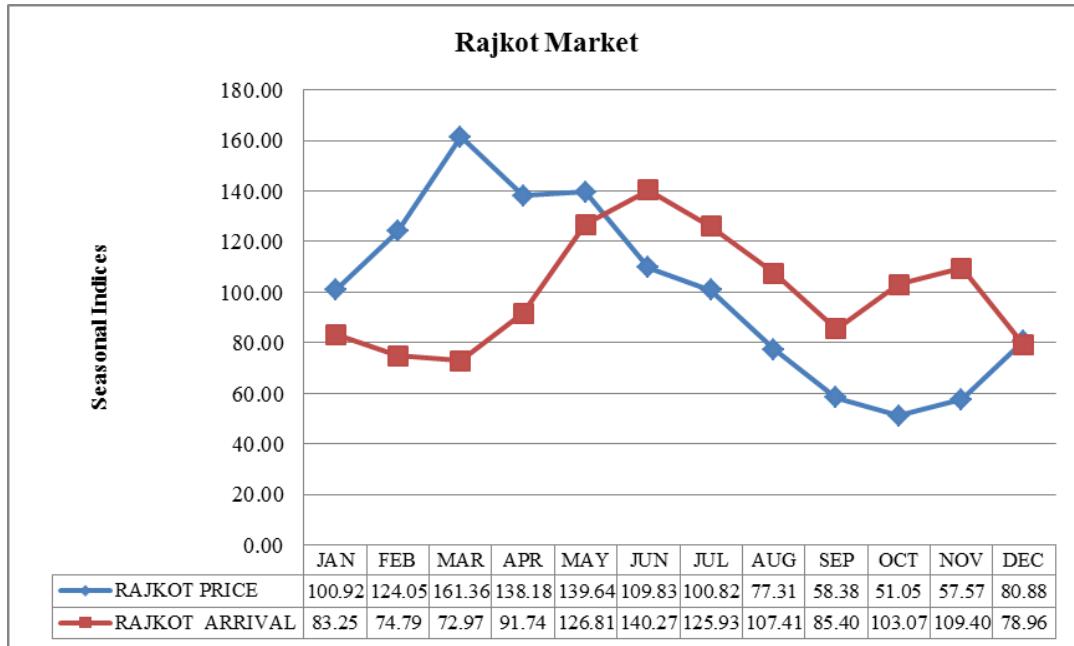


Figure 7. Seasonal indices of arrivals and prices of onion at Rajkot

The data presented in Figure 7 revealed that seasonal arrival indices of onion were found above 100 in May to November except September month at Rajkot market. The highest seasonal arrival indices were observed in the month of June (140.27), whereas the lowest seasonal arrival indices were seen in the month of March (72.97). The seasonal price indices

of onion were above 100 from January to July and the highest seasonal price indices were observed in the month of May (139.64) and it was lowest in the month of October (51.05) (Fig. 7). Therefore, it was suggested that farmers can sell their produce during the period from January to July for fetching higher price in Rajkot market.

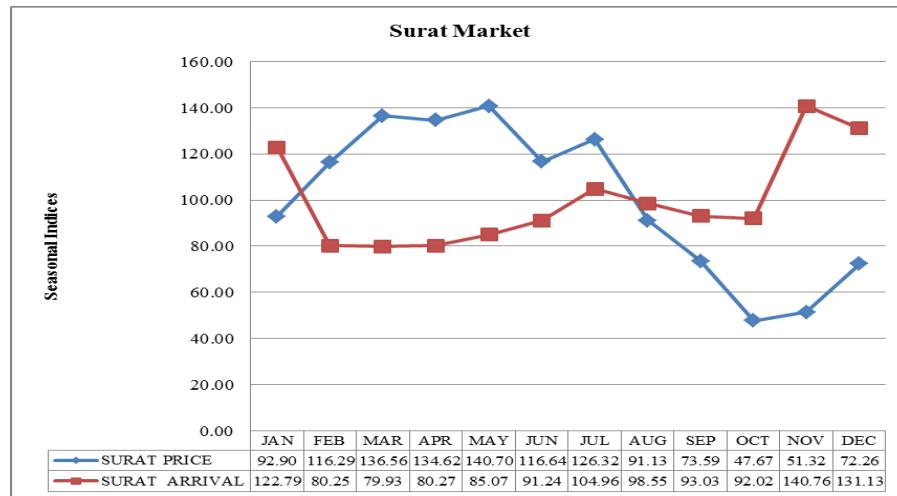


Figure 8. Seasonal indices of arrivals and prices of onion at Surat

The data furnished in Figure 8 revealed that seasonal arrival indices of onion were above 100 in the month of January, July, November and December at Surat market. The highest indices were observed in the month of November (140.76) and it was lowest in the month of March (79.93). Further, it was observed that the seasonal price indices of onion were above 100 from February to July in this market. The highest seasonal price indices were observed in the month of May (140.70) and it was lowest in the month of October (47.67). This indicated that it could be better if farmers sell their produce during the period from February to July for fetching higher price in Surat market.

The data furnished in the Figure 9 reveals that seasonal arrival indices of onion were above 100 in the month of January, September, October, November and December at Bharuch market. The highest indices were observed in the month of November (160.99) and it was lowest in the month of March (68.28). In case of seasonal price indices, the indices were found above 100 from February to July in the Bharuch market. The highest seasonal price indices were observed in the month of April (143.06) and it was lowest in the month of November (54.18). Hence, it was suggested that farmers can sell their produce during the period from February to July for fetching higher price in Bharuch market.

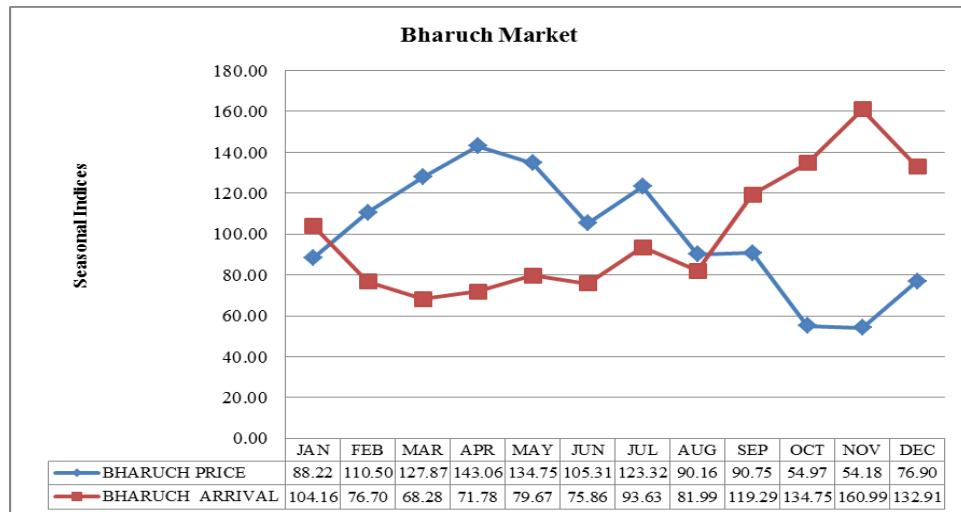


Figure 9. Seasonal indices of arrivals and prices of onion at Bharuch

Market Integration

Correlation Co-efficient of Wholesale Prices of Onion in Selected Market Pairs

The correlation co-efficient of wholesale prices of onion in different market pairs was calculated to determine the degree of market integration between two markets. The results are depicted in Table 10. The results indicated that, the value of correlation co-

efficient between two market pairs Mahuva-Ahmedabad, Mahuva-Bhavnagar, Mahuva-Gondal, Mahuva-Vadodara, Mahuva-Surat, Mahuva-Rajkot, Mahuva - Bharuch, Ahmedabad - Bhavnagar, Ahmedabad - Gondal, Ahmedabad - Vadodara, Ahmedabad-Surat, Ahmedabad-Rajkot, Ahmedabad-Bharuch, Bhavnagar-Gondal, Bhavnagar-Vadodar, Bhavnagar-Surat, Bhavnagar-Rajkot, Bhavnagar-

Bharuch, Gondal-Vadodara, Gondal-Surat, Gondal-Rajkot, Gondal-Bharuch, Vadodara-Surat, Vadodara-Rajkot, Vadodara-Bharuch, Surat-Rajkot, Surat-Bharuch, Rajkot-Bharuch was found positive and highly significant (0.911), (0.747), (0.920), (0.902), (0.952), (0.872), (0.952), (0.712), (0.967), (0.967), (0.968), (0.918), (0.982), (0.738), (0.769), (0.777), (0.788), (0.781), (0.930), (0.969), (0.902), (0.979),

(0.979), (0.924), (0.960), (0.927), (0.983) and (0.936), respectively (Table 2), that means the wholesale prices of onion was interlinked in all the selected regulated markets, if the prices of onion increased in one market it leads to increase the prices in other markets, that is showing the positive market integration among the markets in terms of prices.

Table 2. Correlation Co-efficient of Wholesale Prices of Onion in Selected Market Pairs

Sr.No.	Market pairs	Correlation Coefficient
1	Mahuva-Ahmedabad	0.911**
2	Mahuva-Bhavnagar	0.747**
3	Mahuva-Gondal	0.920**
4	Mahuva-Vadodara	0.902**
5	Mahuva-Surat	0.952**
6	Mahuva-Rajkot	0.872**
7	Mahuva-Bharuch	0.952**
8	Ahmedabad-Bhavnagar	0.712**
9	Ahmedabad-Gondal	0.967**
10	Ahmedabad-Vadodara	0.967**
11	Ahmedabad-Surat	0.968**
12	Ahmedabad-Rajkot	0.918**
13	Ahmedabad-Bharuch	0.982**
14	Bhavnagar-Gondal	0.738**
15	Bhavnagar-Vadodara	0.769**
16	Bhavnagar-Surat	0.777**
17	Bhavnagar-Rajkot	0.788**
18	Bhavnagar-Bharuch	0.781**
19	Gondal-Vadodara	0.930**
20	Gondal-Surat	0.969**
21	Gondal-Rajkot	0.902**
22	Gondal-Bharuch	0.979**
23	Vadodara-Surat	0.979**
24	Vadodara-Rajkot	0.924**
25	Vadodara-Bharuch	0.960**
26	Surat-Rajkot	0.927**
27	Surat-Bharuch	0.983**
28	Rajkot-Bharuch	0.936**

Balappa (2000) have made an attempt to examine the extent of price integration of onion and potato in the selected markets of North Karnataka, comprising Belgaum, Bijapur, Dharwad, Gulbarga, Raichur and Hubli markets. Zero-order correlation and coefficient of variation techniques were used. Sabur *et al.* (2006) conducted research on the marketing system, seasonality in prices and Integration of onion markets in Bangladesh and concluded that analysis of market integration of the onion market was well integrated. Reddy *et al.* (2012) studied price trends and the integration of wholesale markets for onion in metro cities of India. Singh (2014) conducted a study on the integration of markets for onion and potato in South Gujarat. Charles *et al.* (2016) studied spatial market integration and short-run dynamics under

varying data periods: Evidence from maize markets in Karnataka, India. Sinha *et al.* (2016) studied price transmission and causality in major onion markets of India. The study was conducted in three major onion markets in India *viz.*, Mumbai, Nashik, and Delhi. Ahmed and Singla (2017) conducted a study on market integration and price transmission in six major onion markets of India. Devi *et al.* (2019) conducted a study on price behaviour and co-integration of green gram in Gujarat. Gummagolmath and Raja Laxmi (2019) studied spatial price integration and price transition in major markets of onion in India. Sharma *et al.* (2019) conducted research on management of market risk through market integration: study of price volatility in the domestic market of onion in Gujarat. Shohe

and Hazarika (2019) conducted a study on the spatial integration of selected potato markets in Assam and revealed that markets under study are integrated.

CONCLUSION

The inter-year price analysis shows that the compound growth rate of wholesale prices of onion in Vadodara market was found positive and significant. This indicated that the price of onion was increased significantly in vadodara market in last ten years. Except these markets the price and arrival indices did not continuously increase or decrease uniformly over the years in the selected markets. The intra-year price analysis inferred that the general pattern of seasonal variations in prices was found with increase the prices in lean season and decreased in main season all most in all the selected markets. Further, the negative relationship was observed between wholesale price and arrivals of onion all most in all the selected markets as expected. It was also inferred from the results and the arrival pattern showed the immediate sale of crop after harvesting period. Therefore, it was suggested that farmers should avoid the immediate sale of crop and store for some time and release in the market when prices are goes up to fetch better prices in the market. The results of market integration revealed that there was positive and significant correlation was found for each market pairs that means the wholesale price of onion was integrated in all the selected markets. Thus, it can be inferred from the above results that the prices increased in one market, it leads to increase the prices in other markets, and it showed the positive market integration among the markets in terms of prices. The general pattern of seasonal variations in prices was found with increase the prices in lean season and decreased in peak season all most in all the selected markets. So it is suggested that farmer should store the product when the prices are goes down and disposed their produce in the market when prices are goes up. The seasonality or arrival pattern of onion all most in all the selected markets showed the immediate sale of crop after harvesting period which results in low price on offer. Therefore, it is suggested that farmers should avoid the immediate sale of crop and store for some time to fetch better prices in the market. This obviously necessitates developing adequate post-harvest infrastructure facilities for high value crops in order to protect farmers from undue low prices for their produce. It was observed in the study that the selected market pairs was integrated to each other, so it is suggested that farmer should sale their produce in regulated market instead of local market. The price support mechanism and efficient market information network can help the farming community to stabilize the price throughout the year and also avoid wide fluctuations of prices in the markets.

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