

# Instability in Onion Production and Marketing in Maharashtra

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**Abstract:** *The study looks into the instability in Agricultural Produce Market Committee (APMC) markets, export, area, production and yield of onion in Maharashtra. To accomplish this, the present study commenced on secondary data on arrival and prices of onion in A.P.M.C., Pune, Solapur, Pimpalgaon, Mumbai, Lasalgaon, Yeola, Malegaon, Manmad, Kolhapur and Nagpur for the period 2000 to 2015. The area, production, yield and month-wise export of onion in Maharashtra composed from National Horticultural Research and Development Foundation (NHRDF) website. The multiplicative scheme for seasonal instability and Cuddy-Della Valle index for instability in area, production, yield and export executed to analyze data. All investigated markets revealed positive trend in prices and arrival. The price of onion registered high instability within a year as well as between the years. Price of onion ascertained highest during lean and lowest during peak arrival period. Instability in onion export noticed higher during August-January. After globalization high growth rate with high instability observed in area, production and yield. The study will be of immense use to the farmers in providing direction as to when and where it will be more lucrative for them to dispose off their onion, as well as policy maker in price stability programme.*

**Keywords:** Onion, price, market, instability, Maharashtra

## 1. Introduction

Onion is an important crop of almost all landmasses and is commercially cultivated in several countries. It is an essential item in every kitchenette as vegetable and condiment in India. Presently India rank second largest producer of onion in the world (Horticultural Statistics, 2015). Major onion producing states in India are Maharashtra, Karnataka, Madhya Pradesh, Bihar, Gujarat and Rajasthan, though onion is also grown in Andhra Pradesh, Telangana, Tamil Nadu, West Bengal and many other states. Maharashtra is a leading onion producing state in the country. It produces about 5361960 Metric ton of onion from 441900 hectare area. During 2014-15, this state accounted 37.66 per cent area and 28.33 per cent total output of onion in the country (NHRDF, 2016-17). The state of Maharashtra is, therefore, called *onion basket of India*. The principal onion growing districts in Maharashtra state are Nashik, Ahmednagar, Pune, Solapur, Osmanabad, Jalgaon, Satara, etc. Nashik books bulk of the total onion production in state.

Onion is predominantly a Rabi crop and its major portion influx in market during February to May, but the consumption is spread throughout the year (Chengappa *et al.*, 2012). Owing to inelastic demand and seasonal production of onion, the prices for onion are not stable throughout the year. Price fluctuation creates uncertainty in the income levels of crop growers and price paid by the consumer. The low producer's share in consumer's rupees, particularly during high production and arrival period has been matter of serious concern for policy makers in India (Acharya and Agarwal, 1994). An understanding the nature of price fluctuation is a prerequisite for stability programme. It gives some idea to the government for designing import-export policies. It is helpful to the farmers in providing guidance as to when and where it will be more profitable for them to dispose off their onion. Therefore, present study commenced to ascertain the instability in major APMC

markets as well as area, production, yield and export of onion in Maharashtra.

## 2. Materials and Methods

The present study carried on secondary data composed from NHRDF website, [www.nhrdf.com](http://www.nhrdf.com). The time series data on area, production and productivity of onion in Maharashtra collected for the period 1974-75 to 2013-14. The data on month-wise export assembled for 1991-92 to 2013-14. The price and arrival data of foremost A.P.M.C. markets *viz.* Pune, Solapur, Pimpalgaon, Mumbai, Lasalgaon, Yeola, Malegaon, Manmad, Kolhapur and Nagpur wholesale markets of Maharashtra composed from 2000 to 2015.

Time series analysis of price and arrival of major markets of Maharashtra were worked out. Owing to exponential nature of agricultural growth and unrealistic assumption used by additive scheme that is each component of the time series are independent in the data, multiplicative scheme (Winters, 1960) chosen for the study. Mathematically it can be represented as  $Y = TSCR$ . Where Y is the original time series data, T is the trend component describes the time path traced due to change in demand and supply, S is the seasonal component owing to nature of production, C is the cyclical and R is the irregular component of the series. Seasonal component of the time series isolated from the original data using Ratio to Moving Average Method which outshine other methods goes through the following procedures.

- 1) Trend and cyclical (TC) component contained centered 12 month Moving Average (MA) computed from the original data
- 2) Divided the original data by the centered moving average;

$$\frac{Y}{MA} = \frac{TSCR}{TC} = SI \dots \dots \dots (1)$$

- 3) The irregular component eliminated by averaging the data for each month over the years that we got in step two

- 4) After averaging the data, multiplied it by hundred then the result is seasonal index (SI) for each month. The sum of seasonal indices (1200) adjusted using a correction factor =  $1200/S$ , Where,  $S$  = Sum of seasonal indices.

The extent of variation estimated using coefficients of Intra-Year Price Rise (IPR), Average Seasonal Price Variation (ASPV) and Coefficient of Variation (CV) measures the stability or instability of a specified parameter. The estimates computed using;

$$IPR = \left[ \frac{HSPI - LSPI}{LSPI} \right] \times 100 \text{ and} \dots\dots\dots(2)$$

$$ASPV = \left[ \frac{HSPI - LSPI}{(HSPI + LSPI)/2} \right] \times 100 \dots\dots\dots(3)$$

Where,

HSPI = the highest seasonal price index and

LSPI = the lowest seasonal price index.

The trend effects estimated using least squares/ straight line (Hair *et al.*, 2006) method represented by;

$$Y = a + bT + U \dots\dots\dots(4)$$

Where,

Y = Prices / arrivals per month

T = Time period in months

a = Intercept

b = Regression coefficient and

U = Random error

Besides, this study intends to measure the extent of instability in area, production and yield as well as export volume of onion in Maharashtra. To calculate instability, Cuddy-Della Valle index (Cuddy and Della Valle, 1978) used in the present study. A low value of this index indicates the low instability and vice-versa.

$$\text{Cuddy-Della Valle Index} = C.V. \times (1 - R^2)^{0.5} \dots\dots\dots(5)$$

Where,

C.V. = Coefficient of Variation

$R^2$  = ESS/TSS i.e. ratio of explained variation to total variation

ESS = Variation explained by explanatory variable

TSS = Total Variation

Compounded Annual Growth Rate (CAGR) estimated to know the smoothed annual growth of area, production and productivity of onion in Maharashtra.

$$CAGR(t_0, t_n) = \left( \frac{V(t_n)}{V(t_0)} \right)^{\frac{1}{t_n - t_0}} - 1 \dots\dots\dots(6)$$

Where,

$V(t_0)$  = first value

$V(t_n)$  = end value

$t_n - t_0$  = number of years

### 3. Result and Discussion

#### Selection of onion markets

Based on quantity of arrivals in Maharashtra APMC markets during 2015 and availability of long-term data, ten markets namely Solapur, Pune, Lasalgaon, Pimpalgaon, Mumbai, Malegaon, Yeola, Manmad, Nagpur and Kolhapur selected for this study (Table 1). Among ten markets, Solapur market observed largest whereas Kolhapur witnessed lowest arrival during 2015.

#### Trend in onion arrival and prices

Trend represents the general direction of change in arrivals and prices over a period of time. Trend component can be affected by changes in demand such as change in population, income, habits, customs, establishment of processing industries, exports, etc. Price trend also affects by adjustment in supply arising out of development of cold storage and marketing facilities, production technology, export-import policies and market arrivals over long period (Meera and Sharma, 2016). The arrival trend can be affected by production and price. The estimated parameters for price and arrival trend of onion obtained through least square method are given in Table 2. The price and arrival coefficients indicate positive increasing trend in all stated markets like Solapur, Pune, Lasalgaon, Pimpalgaon, Mumbai, Malegaon, Yeola, Manmad, Nagpur and Kolhapur.

#### Seasonal instability in onion prices

Table 3 shows that seasonal price indices of onion are lowest during the month of April in Pune and Pimpalgaon wholesale markets. The Solapur, Mumbai, Lasalgaon, Yeola, Malegaon, Manmad, Kolhapur and Nagpur wholesale markets reported lowest price during May. The seasonal price indices revealed highest in the month of October in Pimpalgaon, Lasalgaon, Yeola, Malegaon and Manmad markets. Onion prices examined at peak in Pune, Mumbai, Kolhapur and Nagpur wholesale markets during November. Solapur wholesale market revealed highest prices during December.

The seasonal price index for onion observed below average (100) in all ten markets during February to July and above average in rest of the year. The price of onion starts increasing from May and reaches its peak during October in Lasalgaon, Yeola, Malegaon and Manmad wholesale markets. An onion price starts increasing during May and reaches its peak in December in Solapur and November in Mumbai, Kolhapur and Nagpur markets. It starts increasing during April and reached its peak in October in Pimpalgaon and November in Pune wholesale market.

#### Seasonal instability in onion arrivals

Seasonal indices of onion arrival are presented in Table 4. The highest indices of arrival observed during January in Solapur, Lasalgaon and Manmad markets. In Pune and Yeola markets utmost arrival reach during February. Highest influx in Mumbai and Kolhapur markets reported during March. May revealed peak influx month for Pimpalgaon and Nagpur markets. In Malegaon wholesale market maximum onion enters during December. In general, arrivals of onion reported below average during June to November and above average during rest of the year.

#### Intra-year price instability

The intra year variations worked out using Intra-Year Price Rise (IPR), coefficient of Average Seasonal Price Variation (ASPV) and Coefficients of Variation (CV), which is presented in Table 5. The Intra-Year Price Rise for onion reported 200.4, 178.2, 167.9, 166.8, 161.2, 159.9, 134.7, 126.2, 126.0 and 116.8 per cent in Yeola, Manmad, Malegaon, Lasalgaon, Pimpalgaon, Pune, Nagpur, Mumbai, Solapur and Kolhapur markets respectively. The value of ASPV for Yeola, Manmad, Malegaon, Lasalgaon, Pimpalgaon, Pune, Nagpur, Mumbai, Solapur and Kolhapur

wholesale markets revealed 100.1, 94.2, 91.3, 91.0, 89.2, 88.8, 80.5, 77.4, 77.3 and 73.7 per cent respectively. The coefficients of variation for price observed 34.22, 31.75, 31.44, 31.24, 31.04, 30.19, 28.93, 26.40, 25.94 and 25.90 per cent respectively in Yeola, Pune, Pimpalgaon, Lasalgaon, Manmad, Malegaon, Mumbai, Nagpur, Solapur and Kolhapur wholesale markets. Yeola wholesale market reported higher intra-year price rise followed by Manmad, Malegaon, Lasalgaon, Pimpalgaon, Pune, Nagpur, Mumbai and Solapur wholesale markets. Further, Kolhapur wholesale market discovered lowermost intra year price variation. More instability in prices observed in Yeola wholesale markets followed by Pune and Pimpalgaon. And, less price instability observed in Kolhapur wholesale market followed by Solapur and Nagpur.

#### Inter-year price instability

Between the year price instability for selected APMC markets assessed using Cuddy Della Index and presented in **Table 6**. The price of onion registered high instability (34.6 to 44.4 point Cuddy Della Index) between the years. The lowest inter-year price instability observed in Mumbai and highest in Malegaon wholesale markets.

#### Instability in area, production and productivity

Compound annual growth rate and Cuddy Della Index (instability index) of area, production and yield of onion in Maharashtra calculated and presented in **Table 7**. The study characterized in pre and post-reform period to assess its impact. Before globalization, instability in onion area, production and yield in Maharashtra was about 4.76, 8.78 and 7.57, but after globalization it has increased up to 34.85, 34.34 and 12.27 point Cuddy Della Index. Rate of growth in area has increased by 6 times after globalization.

#### Export Instability

Month-wise export instability for the year 1991-92 to 2013-14 estimated and given in **Table 8**. According to Cuddy Della Index, instability in onion export observed higher during August-January. Highest instability in export reported during October month.

## 4. Discussion

A positive onion arrival trend in all markets may be due to expansion of area, liberalization of economy, augmentation of improved technology adoption at farmers field leads to higher production, more marketable surplus, etc. Below average seasonal price indices in various markets was more prominent during February to July. This happens because of fact that maximum surpluses sold after harvest and remaining kept in storage for release in lean period. The glut in market may be depicted due to late kharif influx from January, which contributes 30-40 per cent of total onion production. Further Rabi harvest which accounts 50-60 per cent of total production enters in markets from April with huge quantity. The additional causes may be poor cold

storage facilities and lack of retention power of onion growers beside others. Large arrivals during post-harvest period creates glut in market which consequence lower price and considerable losses to the onion growers. The onion growers can obtain better price by matching supply to the market requirements during the period of high seasonal price indices.

The price of onion registered high instability within a year as well as between the years. Instability in onion export witnessed higher during August-January. Instability is one of the important decision parameters in development dynamics, more so in the context of agricultural production. Wide fluctuations in crop output not only affect prices and bring about sharp fluctuations in them but also results in wide variations in the disposable income of the farmers. For protecting against such high fluctuations in price of onion, the producers can organize themselves into growers associations and plan to grown different varieties of onion which have different sowing and harvesting periods. High growth in production accompanied by low level of instability for any crop is desired for sustainable development of agriculture (Tripathi and Prasad, 2009). However, in our study high growth rate with high instability observed during last 25 years which is matter of serious concern for policy makers.

**Table 1:** Major onion wholesale markets during 2015 in Maharashtra

Sr. No.	Markets	Arrivals (Qtls)
1.	Solapur	4162041
2.	Pune	3591209
3.	Lasalgaon	3581359
4.	Pimpalgaon	3455265
5.	Mumbai	2971205
6.	Malegaon	1711605
7.	Yeola	1682393
8.	Manmad	1405420
9.	Nagpur	1011713
10.	Kolhapur	805520

**Table 2:** Price and arrival trend of major onion wholesale markets of Maharashtra

Markets	Coefficients (Price)		R <sup>2</sup>	Coefficients (Arrival)		R <sup>2</sup>
	Constant	b		Constant	b	
Solapur	44.10	96.17	0.623	73779	381559	0.839
Pune	66.07	99.95	0.637	3315483	7844	0.007
Lasalgaon	21.48	103.19	0.628	2854743	27512	0.069
Pimpalgaon	63.74	95.19	0.592	2864814	13423	0.014
Mumbai	79.01	125.55	0.668	1991117	64654	0.393
Malegaon	108.38	125.35	0.549	1030840	79348	0.235
Yeola	99.10	123.61	0.592	942114	92840	0.461
Manmad	28.25	97.93	0.631	1211419	24072	0.190
Nagpur	56.30	119.49	0.583	200740	27785	0.146
Kolhapur	21.40	142.13	0.658	583280	33625	0.314

Data: 2001-2015 = Pune, Pimpalgaon, Lasalgaon & Manmad; 2002-2015 = Mumbai & Nagpur; 2004-2015 = Solapur, Yeola, Malegaon & Kolhapur.

Table 3: Seasonal Index of Prices

Month Market	Seasonal Factor (%)											
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Pune	111.9	81.1	62.2	<b>58.8</b>	61.2	81.7	93.6	110.2	117.8	137.9	<b>152.8</b>	130.6
Solapur	115.2	103.0	73.6	58.3	<b>57.8</b>	83.1	102.3	125.3	106.7	116.3	127.7	<b>130.6</b>
Pimpalgaon	111.2	86.3	63.8	<b>58.7</b>	59.4	81.4	92.1	112.8	121.9	<b>153.3</b>	140.9	118.3
Mumbai	117.5	89.8	70.8	64.2	<b>63.4</b>	76.1	87.9	102.0	115.2	140.5	<b>143.4</b>	129.1
Lasalgaon	111.4	87.4	64.7	58.4	<b>56.7</b>	82.5	92.8	114.5	122.4	<b>151.3</b>	139.3	118.6
Yeola	122.3	96.1	62.7	54.8	<b>49.7</b>	74.1	91.8	111.9	118.6	<b>149.3</b>	148.3	120.4
Malegaon	120.1	92.3	72.3	57.4	<b>54.2</b>	77.5	90.5	111.8	121.5	<b>145.2</b>	130.5	126.7
Manmad	110.5	87.6	63.5	59.4	<b>55.4</b>	83.8	95.7	117.7	122.2	<b>154.1</b>	131.9	118.2
Kolhapur	134.8	93.6	72.4	75.9	<b>63.1</b>	80.0	90.8	97.7	100.5	120.0	<b>136.8</b>	134.3
Nagpur	118.2	106.2	80.0	64.1	<b>59.0</b>	73.6	89.2	110.0	116.7	133.7	<b>138.5</b>	110.9

Table 4: Seasonal Index of Arrivals

Month Market	Seasonal Factor (%)											
	Jan	Feb	Mar	April	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Pune	122.5	<b>167.4</b>	156.6	114.1	103.1	86.0	76.8	<b>73.6</b>	66.5	72.7	74.9	85.9
Solapur	<b>179.6</b>	150.1	146.3	135.6	100.3	65.6	60.6	56.5	<b>45.0</b>	53.5	76.2	130.7
Pimpalgaon	136.4	113.5	85.7	108.6	<b>138.0</b>	97.9	96.6	87.8	81.4	<b>58.5</b>	67.1	128.5
Mumbai	115.7	109.9	<b>119.0</b>	106.6	92.4	96.3	93.4	<b>81.7</b>	89.2	91.9	97.4	106.6
Lasalgaon	<b>157.2</b>	134.4	102.6	104.6	109.3	85.0	92.2	85.6	77.6	61.8	<b>62.9</b>	126.8
Yeola	182.9	<b>217.3</b>	156.5	100.0	85.5	58.0	77.3	67.2	73.6	59.0	<b>22.9</b>	99.8
Malegaon	143.1	126.6	112.6	100.4	114.8	87.9	96.1	74.0	63.1	<b>46.5</b>	89.9	<b>145.1</b>
Manmad	<b>185.6</b>	152.4	121.6	112.2	110.6	68.6	62.9	65.6	50.1	<b>41.4</b>	68.6	160.5
Kolhapur	91.3	145.3	<b>158.6</b>	134.8	129.4	87.0	72.9	84.2	81.4	74.1	<b>67.4</b>	73.7
Nagpur	101.0	111.0	128.3	115.5	<b>129.0</b>	107.2	88.7	72.2	<b>61.4</b>	75.3	98.7	111.5

Table 5: Descending order of onion markets according to IPR, ASPV and CV

IPR (%)		ASPV (%)		CV (%)			
				Price		Arrival	
Yeola	200.4	Yeola	100.1	Yeola	34.22	Yeola	56.98
Manmad	178.2	Manmad	94.2	Pune	31.75	Manmad	47.59
Malegaon	167.9	Malegaon	91.3	Pimpalgaon	31.44	Solapur	46.30
Lasalgaon	166.8	Lasalgaon	91.0	Lasalgaon	31.24	Pune	33.83
Pimpalgaon	161.2	Pimpalgaon	89.2	Manmad	31.04	Kolhapur	32.42
Pune	159.9	Pune	88.8	Malegaon	30.19	Malegaon	30.36
Nagpur	134.7	Nagpur	80.5	Mumbai	28.93	Lasalgaon	28.79
Mumbai	126.2	Mumbai	77.4	Nagpur	26.40	Pimpalgaon	25.86
Solapur	126.0	Solapur	77.3	Solapur	25.94	Nagpur	21.73
Kolhapur	116.8	Kolhapur	73.7	Kolhapur	25.90	Mumbai	11.41

Table 6: Between the year price instability among APMC markets

Markets	IX	R <sup>2</sup>
Malegaon	44.41	0.55
Nagpur	43.09	0.54
Yeola	40.96	0.59
Pimpalgaon	40.59	0.56
Solapur	40.31	0.62
Kolhapur	39.10	0.66
Lasalgaon	38.94	0.61
Manmad	38.52	0.61
Pune	36.41	0.62
Mumbai	34.64	0.65

Table 7: Growth and instability in onion in Maharashtra

Variables	Index	1974-75 to 1990-91	1991-92 to 2013-14	1974-75 to 2013-14
Area	IX	4.76	34.85	49.11
	CAGR	1.76	9.83	5.89
Production	IX	8.78	34.34	54.28
	CAGR	-0.49	9.24	5.01
Yield	IX	7.57	12.27	14.57
	CAGR	-2.21	-0.54	-0.82

IX – Cuddy Della Index, CAGR – Compound Annual Growth Rate (%)



**Table 8:** Month-wise export instability

Index	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
IX	40.1	30.2	36.7	46.3	56.6	54.8	60.2	46.1	48.7	50.0	42.4	40.3
CAGR	9.61	7.12	7.20	6.64	1.28	0.01	4.04	3.17	8.14	5.95	5.09	2.70

IX – Cuddy Della Index, CAGR – Compound Annual Growth Rate (%)

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