

# Analysis of Tomato Prices in India

<sup>1</sup> Dr. Deepak J. Waghmode, <sup>2</sup> Mr Sandeep S. Ingale

<sup>1</sup>Research Officer, <sup>2</sup>Information Technology Officer

<sup>1</sup>Centre for Indian Agricultural Marketing Intelligence, MACP, Pune, India

<sup>2</sup>Centre for Indian Agricultural Marketing Intelligence, MACP, Pune, India

**Abstract:** Tomato is an important commercial and dietary vegetable crop. Tomato ranks third in priority after Potato and Onion in India but ranks second after potato in the world. From commercial point of view, it is a short duration, high-yielding, remunerative crop, and hence area under its cultivation is increasing day by day. The paper examines the behaviour of market prices of tomato and their nature trends in markets during October 2004 to September 2017. The seasonality in prices of tomato also examine Cycle is prices.

**IndexTerms - Tomato Prices, Trend and Seasonality.**

## I. INTRODUCTION

Tomato is an important commercial and dietary vegetable crop. Tomato ranks third in priority after Potato and Onion in India but ranks second after potato in the world. From commercial point of view, it is a short duration, high-yielding, remunerative crop, and hence area under its cultivation is increasing day by day. India ranks second in the area as well as in production of Tomato. Total area under tomato in the country is around 7.7 lakh ha with production of 16 million tonnes. With a Production of 0.7 million tonnes, Maharashtra contributes around 4.7% of the total tomato production in the country and is one of the leading tomato-producing states. Next to onion, tomato is widely grown in Nasik, Pune and Solapur. Tomato are cultivated in all seasons in Maharashtra State, therefore they are available throughout the year. The sowing starts in June-July for Kharif, Sept.-Oct. for Rabi and Dec-Jan for summer.

The behaviour of market prices of tomato and their nature trends in markets during October 2004 to September 2017. The seasonality in prices of tomato also found also Cycle is traced in prices. The selected market was also found integrated as shown by the monthly price variations across the markets.

## II. OBJECTIVES

- To study the behaviour of Tomato prices.
- To examine the Trend, Seasonality and Cycles in Tomato prices

## III. METHODS

### A. TREND:

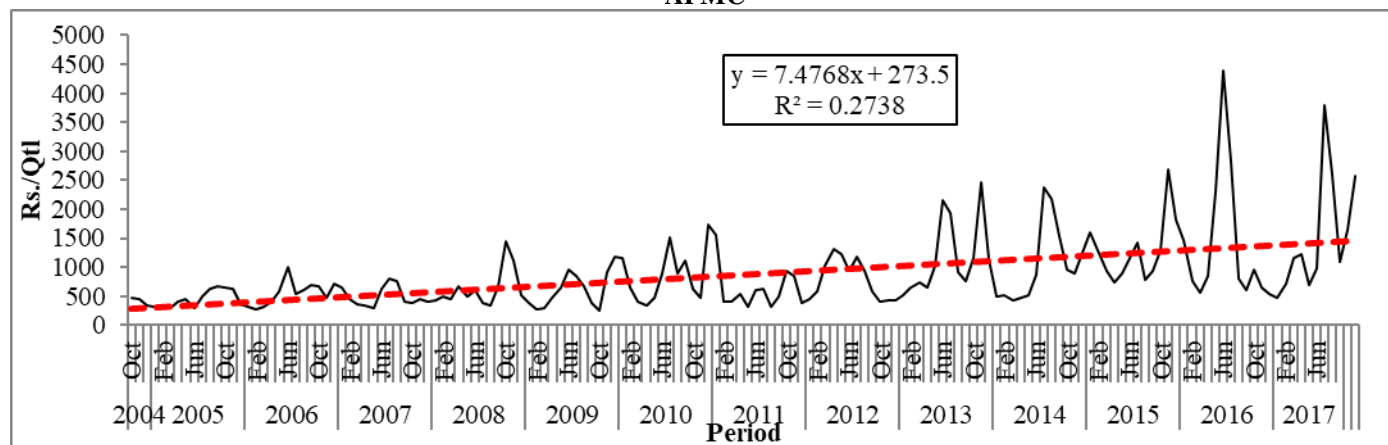
The market price behavior of tomato during October 2004 to September 2017 in the Pune Agriculture Produce Market Committee was examined using descriptive statistics like minimum, maximum and average values and variations (Table 1). The analysis of tomato prices showed that on an average, the mean prices of tomato varied between Rs 852 per quintal in the selected market, whereas, minimum and maximum price per quintal varied between Rs 250 to Rs 4384. Prices of tomato show a slightly rising trend (Chart 1).

$$\text{Equation of Trend: } y = 7.4768x + 273.5$$

Where x is define trend in price.

The variable Trend (expressed as 1, 2, 3, etc.) as Proxy for both rise in price level as also rising net demand.

**Chart 1: Monthly Average Prices of Tomato in Pune  
APMC**



**Table 1: Descriptive Statistics of Tomato Prices**

TOMATO PRICES	
MEAN	852
STANDARD ERROR	51
MEDIAN	647
MODE	900
STANDARD DEVIATION	640
SAMPLE VARIANCE	409975
KURTOSIS	9
SKEWNESS	3
RANGE	4134
MINIMUM	250
MAXIMUM	4384

Trend explains 27% variations in prices. The coefficient for Trend is 7.4768 and statistically significant. This indicates that every year, on an average, the price of Tomato increases by 0.70 paisa per quintal.

**Table 2 : Yearly Growth Rate of Tomato**

Sr. No.	Year	Price	Growth Rate in %
1	2004-05	427	
2	2005-06	529	24.1
3	2006-07	544	2.7
4	2007-08	480	-11.7
5	2008-09	677	41.0
6	2009-10	817	20.6
7	2010-11	676	-17.3
8	2011-12	868	28.5
9	2012-13	883	1.7
10	2013-14	1177	33.2
11	2014-15	1071	-8.9
12	2015-16	1696	58.3
13	2016-17	1238	-27.0

During the period from 2004 to 2017 Tomato price are increased every year by 10.5% Wholesale Price Index (WPI) of Tomato: Calculation of Monthly prices (October to September) Base Year (2011-12 =100).

The compound rate of growth in the Wholesale Price Index (All Commodities, base: 2011-12) for the same period is 5.4 per cent. Tomato monthly Wholesale Price Index (WPI) shows (Chart 2) the index is always above than 100 also and compare with monthly prices (Chart 1) WPI move with Prices simultaneously with each other.

For analysis to compare WPI of Tomato with other group of commodities likes Potato and Brinjal shows as (Chart 3). The price behavior of each commodity is difference with each other. Tomato index are more fluctuated with other commodities in group.

**Chart 2: Monthly Wholesale Price Index (WPI) of Tomato**

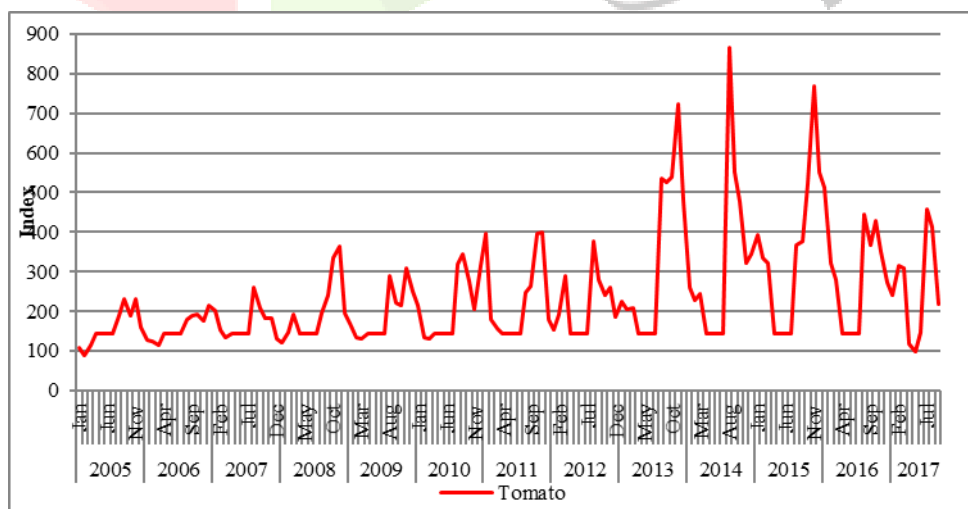
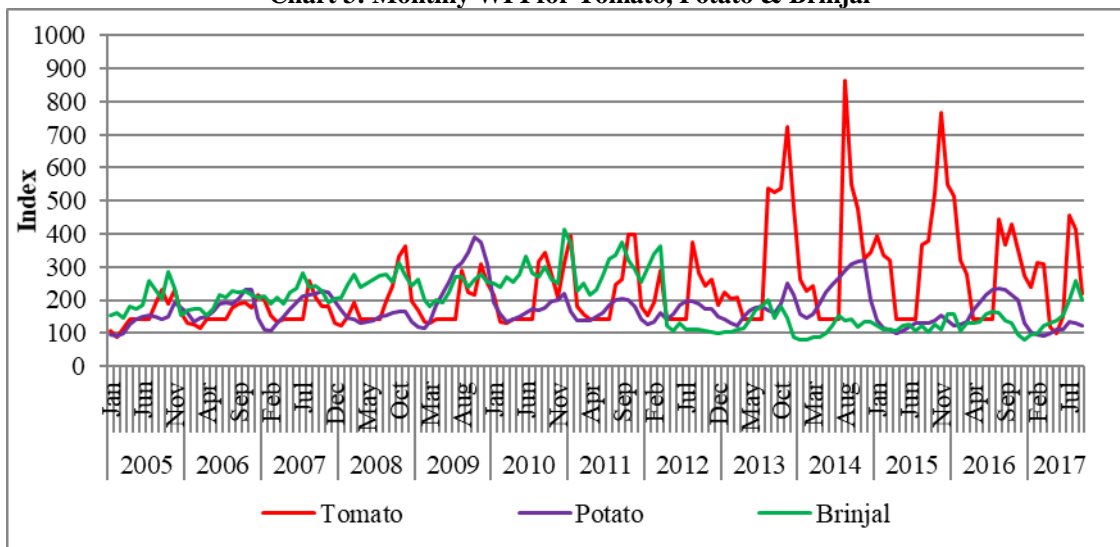


Chart 3: Monthly WPI for Tomato, Potato & Brinjal



**B. SEASONALITY:**

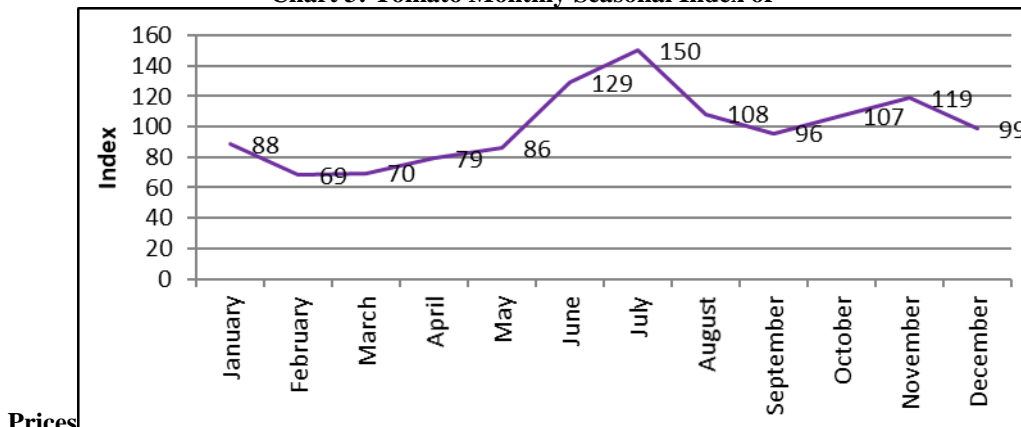
Seasonal indices of price were estimated using ratio to moving average method and results are presented in Table 3. The measurement of seasonal variation by using the ratio-to-moving-average method provides an index to measure the degree of the seasonal variation in a time series. Seasonal fluctuations were observed in prices of tomato across the selected market. The perishability and varied short duration production period of tomato in different regions. The overall seasonality in selected markets has been estimated prices taking into the lowest and highest monthly index value. It was found that price seasonality of tomato varied between 69 - 150 per cent. This shows that seasonality in price was higher in July and Lower In February.

Table 3 Seasonal Index of Tomato Prices with significant Level

	Seasonal Index	Diff	n	SE	t	P
January	88	11.7	13	12.4	0.9	0.37
February	69	31.5	13	5.9	5.3	0.00
March	70	30.4	13	7.2	4.2	0.00
April	79	20.8	13	9.0	2.3	0.04
May	86	13.7	13	10.1	1.4	0.20
June	129	29.2	13	18.9	1.5	0.15
July	150	50.1	13	15.0	3.3	0.01
August	108	8.4	13	12.1	0.7	0.50
September	96	4.3	12	9.6	0.4	0.67
October	107	6.8	13	14.9	0.5	0.66
November	119	18.6	13	16.4	1.1	0.28
December	99	1.5	13	12.9	0.1	0.91

To check seasonality of Tomato is significant or in particular month T test is identifying seasonality is significant or not. Seasonality in February, March, April and July is significant because P values in these months is <0.05. Chart 3 shows the monthly seasonal Index of Tomato prices.

Chart 3: Tomato Monthly Seasonal Index of



In actual the prices of tomato is not always varies as seasonality define for that compare seasonality using to different time period and

**C. RESIDUALS**

Residual can be viewed as the deviation between the data and the fit. So it is also a measure of the variability in the response variable that is not explained by the regression model. Residuals can be thought as the observed values of the model errors. Analysis of residual helps is finding the model inadequacies. To Scaling of residuals using normal distribution with 3-

sigma. The first thing to notice is that the normal distribution is symmetrical about the mean, so the probability from  $-\infty$  up to the value of the mean is 0.5. Suppose we have a normal distribution with a mean of  $\mu = 2$  and a standard deviation of  $\sigma = 0.5$ . How would we use this table to calculate the probability of a value greater or equal to e.g. 3 being real? (That is, any value greater and including 3).

Where the definition of Z is,

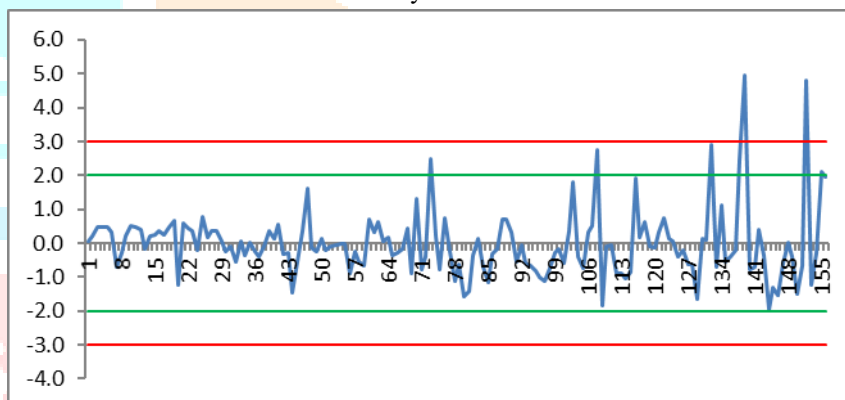
$$Z = \frac{|x - \mu|}{\sigma}$$

Where the modulus in the numerator is so that Z is always positive. With our example,  $Z = (3-2)/0.5 = 2.0$ . So, finding  $Z = 2.0$  in the table gives the cumulative probability P (Z) of the value x being between  $-\infty$  and 2 being  $P (Z=2) = 0.9772$ . So the probability of a value of x from  $-\infty$  to 3 is 0.9772 or 97.72%. When we say that detection is made at the 3-sigma level, what we are saying is that it is 97.72%. Certain or that it has just a 2.28% probability of being false. Usually in science, a 3-sigma detection is taken as being the minimum to be believed, and quite often 5-sigma is chosen, which is essentially 0% probability of the result being false.

Residual analysis of Tomato prices shows (Chart 3) 3-sigma level are cross on two time and 2 sigma level cross 6 time. Summarizing the significances (Table-4), to two decimal places.

The significance of various levels of $\sigma$	
$\sigma$	Confidence that Result is real
$1\sigma$	84.13%
$1.5\sigma$	93.32%
$2\sigma$	97.73%
$2.5\sigma$	99.38%
$3\sigma$	99.87%
$3.5\sigma$	99.98%
$> 4\sigma$	100%

Chart 4: Residual analysis with 2  $\sigma$  and 3  $\sigma$  Level



### CONCLUSIONS:

The study examined price behavior of Tomato in Pune APMC. The trend analysis showed that the prices of tomato in the markets are highly volatile and studied moved in an increasing trend of each year and the growth rate is 10.5%. Tomato wholesale price indexes also explain volatility in prices. WPI of Other group of commodity with Tomato WPI behave different. Seasonality is statistically significant only in few months i.e. February, March, April. Cycle is not statistically significant. So that no cyclic price movement present in tomato prices. Most of values in residuals are in between 2-sigma so a result quoted as a 2-sigma result (or confidence) means that it has a 2.28% of being false, and a 97.72% of being real.

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