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Price behaviour of Tomato in Major Markets of Nagpur District

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Abstract— *This research undertakes a comprehensive analysis of trends, variability, and seasonal fluctuations in arrivals and prices as well as the interrelationship between arrivals and prices of selected vegetable in kalamna, kalmeshwar and kamthi Markets of Nagpur District, Maharashtra for the year (2014-2023) by utilizing secondary data sourced from the website (www.agmarknet.nic.in).An analysis of market arrivals and prices of Tomato reveals a positive trend in arrivals and prices across all the three Nagpur District markets, Although statistical significance was only observed in two markets excluding kalamna market. Highest variability in Tomato arrivals i.e 82.04 was recorded in kamthi APMC, Nagpur while Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur saw the highest price variability i.e 86.30. In contrast lowest variability in Tomato arrival i.e 62.84 was recorded in Pt. Jawaharlal Nehru Market Yard ,Kalamna, Nagpur and lowest price variability i.e 80.20 was observed in kamthi APMC, Nagpur. Highest seasonal indices for Tomato arrivals and prices observed in December and October at Pt. Jawaharlal Nehru Market Yard, kalamna, Nagpur. March and July at kalmeshwar APMC, Nagpur and December and July at kamthi APMC, Nagpur. A statistically significant negative correlation was observed between arrivals and prices of Tomato in the Nagpur markets except for kalmeshwar market which shows positive correlation.*

Keywords— ***Tomato, Trend, Arrival, Price, Seasonal indices, Variability, APMC.***

I. INTRODUCTION AND OBJECTIVES

A well functioning Agriculture Market is crucial for farmers to plan, produce, and market their crop effectively. Under the X FY plan, the scheme aims to expand it's coverage to an additional 2000 agricultural markets, bringing the total to 9300 markets. By the end of the plan, 37% of the country's 7300 wholesale markets (27350 markets) will have online facilities. Tomato is the second most prominent vegetable crop, after potato, in terms of cultivation, and also leads the market in canned vegetable production.It scientifically classified as lycopersicon esculentum Mil and a member of the Solanaceae family, originated in Tropical America and was introduced to other regions in the 16th century, becoming widely popular within the last ninety years **.** And recognized as a highly productive and protective food, providing ample amounts of Vitamin A and C and Minerals such as Iron and Phosphorous. Global Tomato production was approximately 189 million metric tones. Andhra Pradesh led India in Tomato production, contributing 20.2% to the national total. Tomato cultivation in Maharashtra is prominent in several regions, including Narayangaon near Pune, Nashik, beed and Pusegaon. Price volatility in agricultural commodities is a pervasive phenomenon primarily attributed to seasonal fluctuations, biological characteristics of crops and significant dependence on climatic conditions. Variability in Tomato prices are a major determinant of income instability for the cultivator. Understanding the relationship between arrivals and prices is essential for analyzing price volatility over time. Pricing signals play a crucial role in influence production,

consumption, and marketing strategies across time, form, and location, promoting an examination of the growth trends. Considering the above context the objectives of this study can be outlined as follows.

1)To analyze the market trends in Tomato arrivals and prices in selected markets of Nagpur District.

2)To measure the variability in arrivals and prices.

3)To examine the seasonal fluctuations in market arrivals and prices.

4)To investigate the correlation between Tomato arrivals and prices.

II. MATERIALS AND METHODS

The study relies on existing secondary data collected over a 10 year period from (2014 -2023). The data on monthly arrival and prices for Tomato was derived from the major markets specially Kalamna, Kalmeshwar and Kamthi situated within the District Nagpur and the website (www.agmarknet.nic.in). The selection of these markets was based on geographical location and the quantity of produce handled.

Analytical Tools:-

The study's objectives and the nature of the data collected guided the selection of statistical analysis methods.

A) Estimation of Compound Growth Rates:-

The exponential growth function was applied to analyze the growth of arrivals and prices.

$Y = ab^t$ ---------- (1)

Where,

Y = Depended variable for which growth rate is to be estimated

a = Intercept (constant)

b = Regression coefficient

t = Time variable

This equation is calculated following the transformation of (1) as shown below.

Log Y = Log a + Log b ---------- (2)

Then the relationship is used to calculate the percent annual compound growth rate.

CGR = [Antilog (log (b)) – 1] x 100 ---------- (3)

The significance of regression coefficient was tested using student's t-test.

B) Coefficient of Variation: -

The variability in arrivals and prices of Tomato crop at major APMC's in Nagpur District was analyzed using the below given formula.

CV = SD/Mean × 100

Where,

CV = Coefficient of Variation

SD = Standard Deviation

C) Seasonal indices:-

Seasonal indices were calculated by Moving Average Method**.**

$$SI = \frac{\text{Monthly avg. of arrival and prices}}{\text{avg. of monthly avg.}} X100$$

Where,

SI = Seasonal indices

avg. = average

D) Correlation Coefficient:-

The correlation method is applied to study the relationship between arrivals and prices.

$$rxy = \frac{nxy - \Sigma x \, \Sigma y}{\sqrt{[n\Sigma x^2 - (x^2).[n\Sigma y^2 - (y^2)]}}$$

Where,

r = correlations

x = x variables

y = y variables

COV(x, y) = covariance between x and y

n = number of pairs of score

Σxy = sum of the pairs of x and y

III. RESULTS AND DISCUSSION

3.1 Growth and Variability in arrival and prices of Tomato at major APMC's in Nagpur District:-

Trend analysis illustrates the magnitude and direction of variation over a period of time. The examination of variability in monthly arrivals and prices reveals the effectiveness of the marketing system in managing market supply. Table No.1 Represent, in Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur the compound growth rate in arrival of Tomato was 0.38 i.e positive and non-significant and for prices 8.17 i.e positive and non-significant. In kalmeshwar APMC, Nagpur the compound growth rate in arrival of Tomato was 32.36*** i.e positive

and significant at 1 percent and for prices 4.76* i.e positive and significant at 10 percent. In kamthi APMC, Nagpur the compound growth rate in arrival of Tomato was 10.83*** i.e positive and significant at 5 percent and for prices 4.74* i.e positive and significant at 10 percent. The highest CV of arrival was 82.04 of Tomato in Agriculture Produce Market Committee, kamthi, Nagpur and in prices 86.30 in Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur. And the lowest CV of arrival was 62.84 of Tomato in Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur and in prices 80.20 in Agriculture Produce Market Committee, Kamthi, Nagpur.

Table No. 1 Compound Growth Rate and Coefficient of Variation of arrival and prices of Tomato in major APMC's of Nagpur District

Sr.No.	Name of Markets	CGR		CV	
		Arrival	Prices	Arrival	Prices
1.	Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur	0.38	8.17	62.87	86.30
2.	Kalmeshwar APMC, Nagpur	32.36***	4.76*	70.49	83.32
3.	Kamthi APMC, Nagpur	10.83**	4.74*	82.04	80.20

* = Significant at 10 percent (table T value is 1.833 for decades and 1.729 for whole period)
** = Significant at 5 percent (table T value is 2.262 for decades and 2.093 for whole period)
*** = Significant at 1 percent (table T value is 3.250 for decades and 2.861 for whole period)

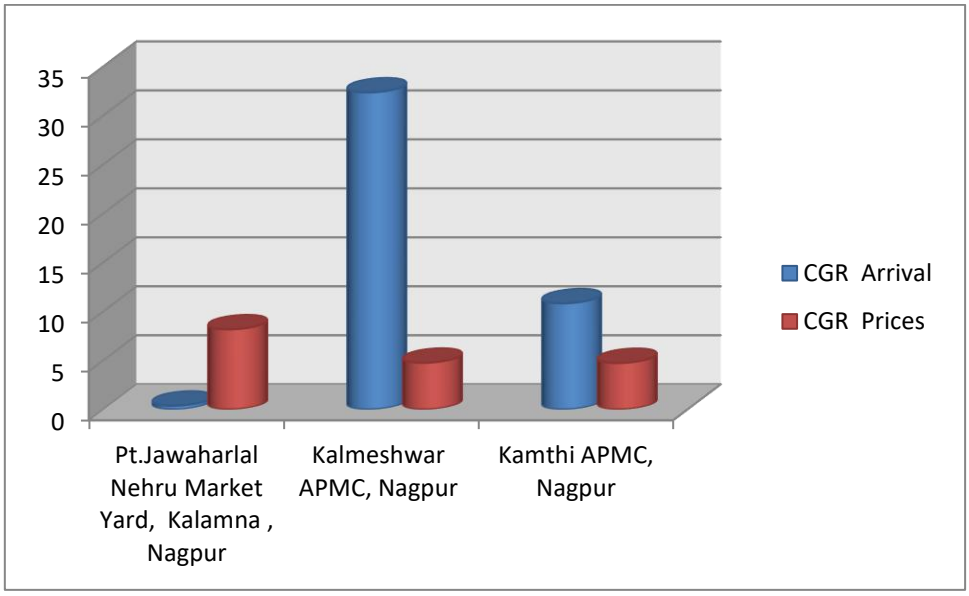

Fig.1. Compound Growth Rate of arrival and prices of Tomato

3.2 Seasonal indices in arrival and prices of Tomato:-

Seasonal fluctuations in prices and arrivals are driven by variations in produce available and demand across different seasons, exhibiting an inverse relationship between supply and demand. Table No. 2 Represents that maximum arrival was 117 for the month of December and for prices 176 in the month of October and minimum arrival was 79 for the month of April and for prices 48 in the month of March of Tomato in Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur. For Kalmeshwar APMC, Nagpur the maximum arrival was 138 for the month of March and for prices 214 in the month of July and minimum arrival was 76 for the month of May and for prices 34 in the month of March of Tomato. For Kamthi APMC, Nagpur the maximum arrival was 139 for the month of December and for prices 222 in the month of July and minimum arrival was 71 for the month of July and for prices 36 in the month of March of Tomato.

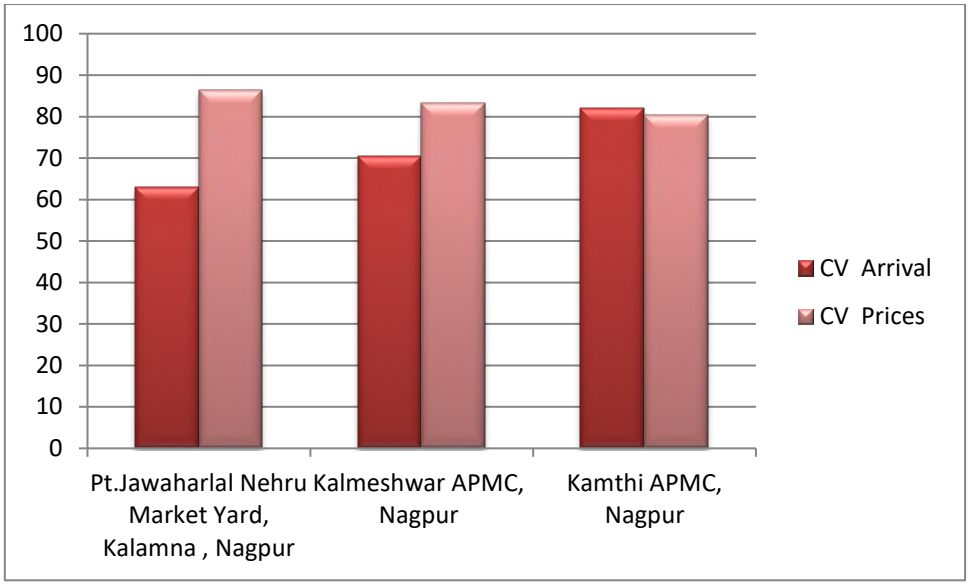

Fig.2. Variability in arrival and prices of Tomato

Table No. 2 Seasonal Indices of arrivals and prices of Tomato in major APMC's of Nagpur District from (2014-2023)

Months	Pt. Jawaharlal Nehru Market Yard, Nagpur (2014-2023)		Kalmeshwar APMC, Nagpur (2014-2023)		Kamthi APMC, Nagpur (2014-2023)	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
January	114	63	108	38	127	49
February	103	60	102	37	105	42
March	105	48	138	34	119	36
April	79	54	78	51	119	47
May	88	90	76	92	92	87
June	91	119	90	130	87	137
July	99	138	83	214	71	222
August	101	111	93	186	72	149
September	97	120	98	111	83	102
October	99	176	97	121	89	126
November	102	133	105	120	90	137
December	117	80	126	60	139	61

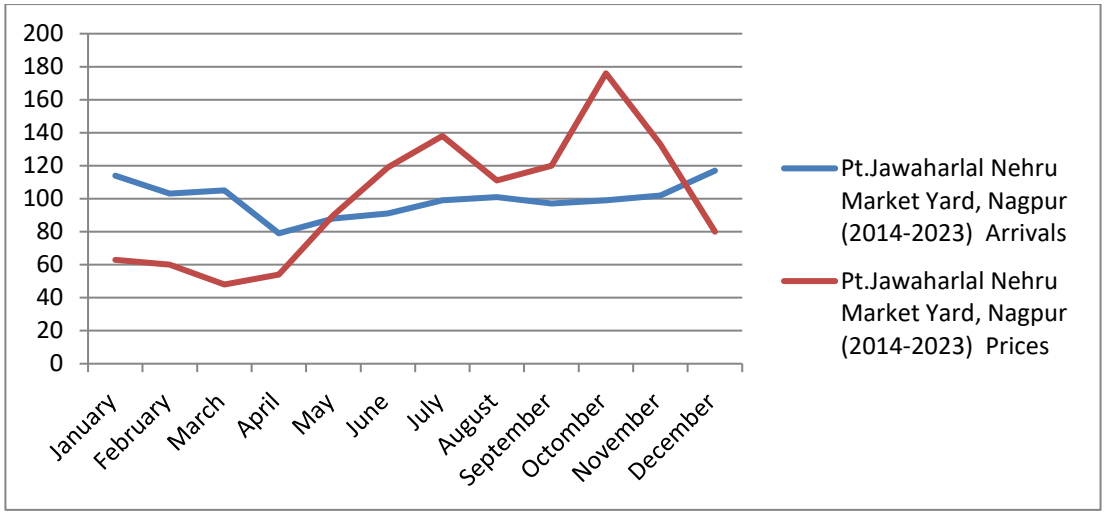

Fig.3. Seasonal indices in arrival and prices of Tomato at Kalamna APMC, Nagpur.

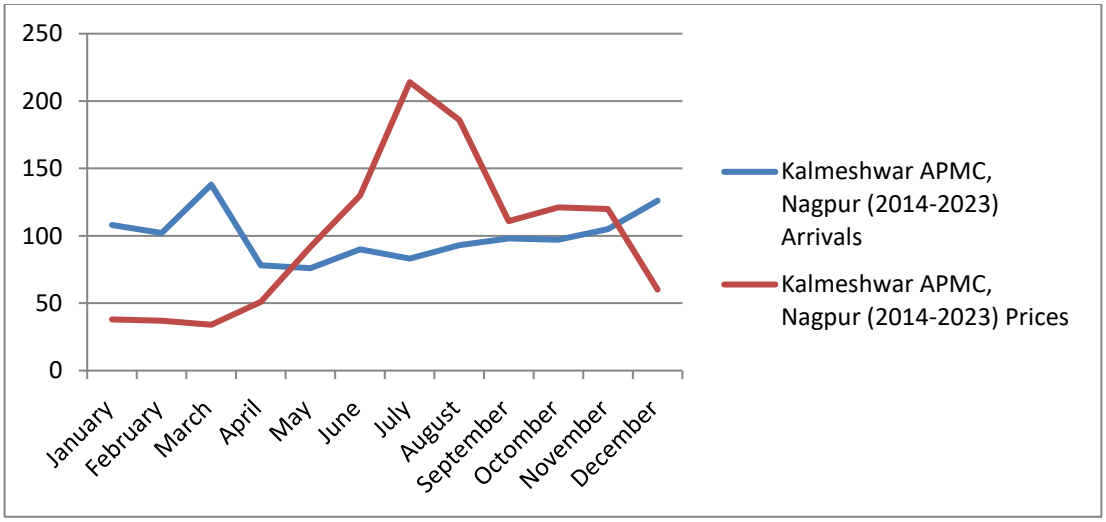

Fig.4. Seasonal indices in arrival and prices of Tomato at Kalmeshwar APMC, Nagpur.

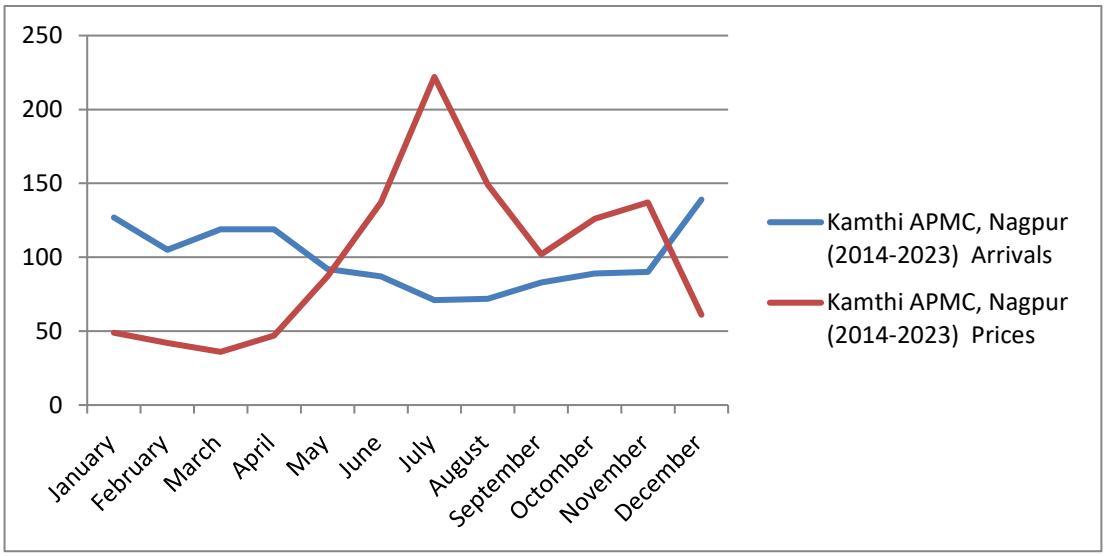

Fig.5. Seasonal indices in arrival and prices of Tomato at Kamthi APMC, Nagpur

4.3 Relationship between arrival and prices of Tomato of selected APMC's in Nagpur District:-

Vegetable prices are significantly influenced by market arrivals. The degree of relationship between market arrivals and prices was investigated through correlation coefficient calculation. Table No.3 Represents that the highest correlattion is - 0.40 is negative and significant at 10 percent level in the month of May in Pt. Jawaharlal Nehru Market Yard, kalamna, Nagpur. In kalmeshwar APMC, Nagpur the highest correlation is 0.51 is positive and significant at 5 percent level in the month of February. And in Kamthi APMC, Nagpur the highest correlation is -0.51 is negative and significant at 5 percent level in the month of December for Tomato.

Table No. 3 Correlation Between arrival and prices of Tomato for selected APMC

Months	Pt. Jawaharlal Nehru Market Yard, Nagpur (2014-2023)	Kalmeshwar APMC, Nagpur (2014-2023)	Kamthi APMC, Nagpur (2014-2023)
January	-0.23	0.17	-0.35*
February	0.18	0.51**	0.19
March	0.24	-0.19	0.11
April	-0.39*	0.18	-0.16
May	-0.40*	-0.03	-0.03
June	0.34*	0.27	0.42*
July	0.32	0.15	0.07
August	0.08	-0.23	0.40*
September	-0.29	0.19	0.08
October	-0.22	0.32	-0.20
November	0.10	0.35*	-0.09
December	0.11	0.15	-0.51**

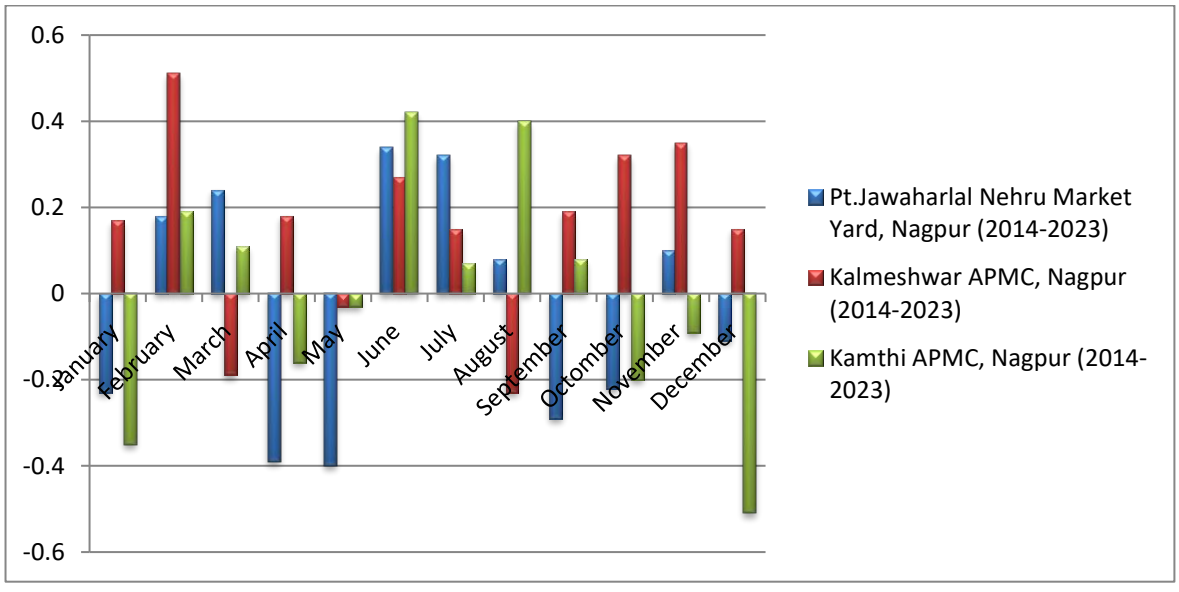

Fig.6. Relationship between Tomato arrival and prices at selected APMC's in Nagpur District

IV. CONCLUSION

An analysis of market arrivals and prices of Tomato in three Nagpur District markets reveals a positive trend in arrivals across all markets, although statistical significance was only observed in two markets, excluding Kalamna market. A significant and positive trend in current prices was observed across all markets, with the exception of kalamna market, where the trend was found to be non-

significant. Kamthi APMC, Nagpur recorded the highest variability in Tomato arrival, while Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur saw the highest price variability. In contrast, Pt. Jawaharlal Nehru market Yard, Kalamna, Nagpur had the lowest variability in Tomato arrival, and Kamthi APMC, Nagpur had the lowest price variable. The maximum seasonal Indices for Tomato arrivals and prices occurred in December and October at Pt. Jawaharlal Nehru Market Yard, Kalamna, Nagpur. March and July at kalmeshwar APMC, Nagpur and December and July at kamthi APMC, Nagpur. The correlation analysis revealed a negative correlation at 10 percent significance in Pt. Jawaharlal Nehru Market Yard, kalamna, Nagpur . A positive correlation at 5 percent significance in kalmeshwar APMC, Nagpur. And a negative correlation at 5 percent significance in kamthi APMC, Nagpur.

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