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Seasonality and Volatility in arrivals and prices of maize in major market of Western Maharashtra

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Abstract
The present study aims to examine the seasonality and volatility in arrivals and prices among the selected maize markets in Western Maharashtra. For the present study, the time series data on monthly average arrivals and prices of maize for the period from 2012 to 2021 were collected from MSAMB, Pune for respective markets *viz.,* Lasalgaon, Dhule and Nandurbar. The result of present study shows that the clear pattern of maximum and minimum arrivals and prices in all three markets, with the peak arrivals of maize seen from October to January and the maximum prices seen from June to September. The intra-year and inter year estimates of variation revealed that variations in arrivals were greater than variations in maize prices in selected market of Western Maharashtra. There was no cycle in any selected markets were observed.

Keywords: Seasonality, Volatility, Western, *Zea mays* L.

Introduction
Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. It is cultivated on nearly 150 m ha in about 160 countries having wider diversity of soil, climate, biodiversity and management practices that contributes 36 per cent (782 mt) in the global grain production. The United States of America is the largest producer of maize contributes nearly 35 per cent of the total production in the world and maize is the driver of the US economy. The USA has highest productivity (> 11.13 t ha^{-1}) which is double than the global average (5.92 t ha^{-1}). Whereas, the average productivity in India is 3.24 t ha^{-1}.

Maize is the third most important cereal crop in India after rice and wheat and is grown in a wide range of environments, extending from extreme semi-arid to sub-humid and humid region which predominantly occupies 82 per cent of the area under cultivation in the *kharif* season. It accounts for around 10 per cent of total food grain production in the country. The Indian maize sector has several opportunities in all its sub- sectors like seed, non-seed inputs, farm mechanization, processed foods, industrial products, market-related infrastructure, storage, processing etc.

Maharashtra was ranked 3rd in area under maize and rank 2nd under maize production among different maize producing states in the year 2020-21. Maize is grown in almost all the districts of all the region of Maharashtra. But, Western Maharashtra and Marathwada are major maize producing region of Maharashtra. Nashik has highest area under maize followed by Aurangabad, Dhule, Ahmednagar and Jalgaon and in production, Nashik is at the top followed by Dhule, Aurangabad, Ahmednagar, Jalgaon and Jalna.

Materials and Methods
For the present study the major markets of maize in Maharashtra namely Lasalgaon, Dhule and Nandurbar were selected. The time series data on monthly average arrivals and prices of maize for the period from 2012 to 2021 were collected from MSAMB, Pune for respective markets and used for present study.

1. **Seasonal indices of arrivals and prices of maize:** To estimate the seasonal variations in arrivals and prices, seasonal indices were calculated by employing twelve months ratio to moving average method.
2. **Variation in arrivals and prices:** To estimate both intra-year and inter-year in arrivals and prices was studied by following Formula.

C.V. (%) = (SD/ Mean) x 100

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3. Cyclical Indices: The residual method of estimating cyclical movement in time series was used for estimating cyclical indices, after eliminating the seasonal variations and trend components.

Result and Discussion: For analyse seasonal fluctuations, the seasonal indices of monthly average maize prices for a Lasalgaon, Dhule and Nandurbar markets were estimated, which are presented in Table 1.

Table 1: Seasonal indices of arrivals and prices of maize in Western Maharashtra (2012-21)

Month	Lasalgaon		Dhule		Nandurbar	
	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices
January	237.51	95.95	145.11	96.98	139.87	102.99
February	122.6	95.87	65.29	96.33	58.08	101.82
March	75.13	95.76	32.83	99.4	30.92	99.77
April	49.49	97.8	102.02	97.71	94.34	97.87
May	43.12	96.22	173.59	96.19	158.63	95.49
June	18.84	102.22	40.83	103.99	24.71	101.04
July	4.56	109.14	17.81	109.87	2.18	103.94
August	2.17	109.5	4.85	111.56	0.93	98.28
September	2.74	108.51	5.64	107.7	4.83	100.99
October	63.58	98.18	146.35	87.43	152.22	88.05
November	268.93	93.7	236.61	92.63	268.55	100.99
December	311.34	97.15	229.07	100.21	264.74	108.77
Total	1200	1200	1200	1200	1200	1200

From Table 1 it is observed that in selected markets, the maize arrivals indices were higher than the maize price indices. In addition, there was a clear pattern of maximum and minimum arrivals and prices in all three markets, with the peak arrivals of maize seen from October to January and the maximum prices seen from June to September, with a few exceptions in Nandurbar market. The higher prices attributed to less arrivals of Maize in the markets.

Table 2: Intra-year coefficient of variations in arrivals and prices of maize in Western Maharashtra (2012-2021) (per cent)

Month	Lasalgaon		Dhule		Nandurbar	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
January	40.74	17.82	92.09	16.62	60.35	14.51
February	62.6	18.35	89.79	17.21	50.52	17.63
March	83.82	16.80	62.89	18.2	46.6	16.7
April	82.33	21.34	67.25	21.6	48.51	19.81
May	91.37	20.77	69.50	21.86	38.41	19.58
June	190.32	18.09	85.02	19.91	136.93	17.77
July	130.71	19.72	239.86	19.86	178.01	20.79
August	80.11	18.61	205.43	20.55	115.03	17.83
September	135.32	18.70	104.14	21.67	75.7	22.57
October	89.29	18.03	89.09	21.78	60.45	18.75
November	55.52	15.04	45.35	14.25	28.92	14.87
December	31.48	17.87	93.39	16.33	39.91	16.14
Mean	89.47	18.43	103.65	19.15	73.28	18.08

Table 2 revealed that, the intra-year variability among the months in the Lasalgaon market over a ten-year period (2012-2021) showed that, the variation in case of arrivals ranged from 31.48 (December) to 190.32 (June) per cent and in case of prices ranged from 15.04 (November) to 21.34 (April) per cent, respectively. In the Dhule market, in case of arrivals and prices the magnitude of variation increased from 45.35 (November) to 239.89 (July) per cent and 14.25 per cent (November) respectively. While the arrivals varied in the Nandurbar market from 28.92 per cent in November to 178.01 per cent in July, and prices varied from 14.51 per cent in January to 22.57 per cent in September, respectively.

Table 3: Inter-year coefficients of variations in arrivals and prices of maize in Western Maharashtra (2012-2021) (per cent)

Year	Lasalgaon		Dhule		Nandurbar	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
2012	143.4	10.14	121.35	11.14	116.4	10.1
2013	109.62	10.57	127.22	13.22	101.82	9.99
2014	123.88	7.7	101.54	9.04	115.8	7.61
2015	129.5	7.59	84.8	10.05	97.93	9.63
2016	202.82	11.27	124.43	14.67	108.13	8.5
2017	129.28	8.66	112.2	9.24	103.34	12.97
2018	89.66	12.86	95.08	11.77	100.66	15.01
2019	174.11	9.3	197.25	12.85	145.48	7.85
2020	85.72	13.24	62.72	13.12	89.32	15.93
2021	120.45	10.89	93.27	11.47	124.62	8.99
Mean	130.84	10.22	111.99	11.66	110.35	10.66

From the table 3, inter year variability noticed selected market, in case of Lasalgaon market lowest variations in maize arrivals (85.72%) in 2020 and the highest variations (202.82%) in 2016. In the Lasalgaon market, the range of price variation was 7.59 per cent in 2015 to 13.24 per cent in 2020. For the Dhule market, the coefficients of variation in arrivals and prices were 62.72 per cent in 2020 to 197.25 per cent in 2019 and 9.04 per cent in 2014 to 14.67 per cent in 2016, respectively. In case of Nandurbar market, the arrivals of maize varied in the range of 89.32 per cent in 2019 to 145.48 per cent in 2019. In contrast, the annual variation in the per quantal price of maize was found to range from 7.61 per cent in 2019 to 15.93 per cent in 2020.

Cyclical variation

Table 4: Cyclical variation in arrivals and prices of maize in selected market

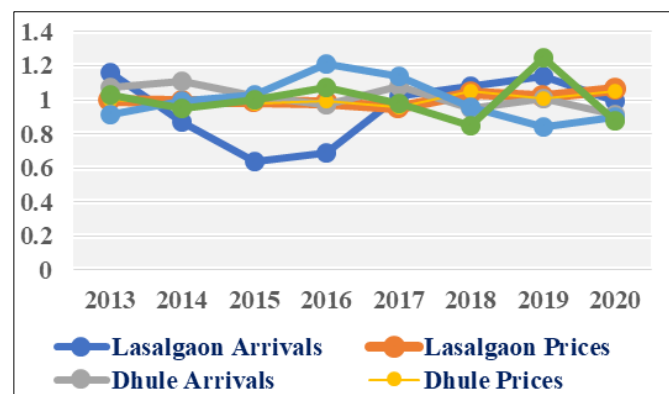| Month	Lasalgaon		Dhule		Nandurbar	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
2013	1.16	1.00	1.07	1.01	0.91	1.03
2014	0.87	0.99	1.11	0.98	0.99	0.95
2015	0.64	0.99	1.02	0.98	1.03	1
2016	0.69	0.98	0.97	0.99	1.21	1.07
2017	1.02	0.95	1.08	0.96	1.14	0.98
2018	1.08	1.04	0.95	1.05	0.96	0.85
2019	1.14	1.02	1.01	1.01	0.84	1.25
2020	0.99	1.06	0.91	1.05	0.9	0.88

Fig 1: Cyclical variation in arrivals and prices of maize

The cyclical indices were estimated for the period 2012-2021 and presented in Table 4. It could be seen from the figures that there was no cycle were observed in any selected markets. From the table 4 it is noticed that, the higher prices recorded during the year 2013 and 2019. Prices increased as a result of lower production brought on by unfavourable weather. Prices increased as a result of lower production brought on by unfavourable weather.

Conclusions
1. The seasonal indices of maize arrivals in selected markets were highest from October to February and the prices were higher from June to September with few exceptions. The higher prices attributed to less arrivals of maize in the markets.
2. The estimates of intra-year and inter-year variation revealed that, the variations in arrivals were greater than variations in maize prices in selected market.
3. The cycles in the selected market for both arrivals and

prices were found to be uneven. Thereby it implied that there was fluctuation in arrivals and prices of maize in the selected market.

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