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Dynamics of market arrivals and market prices of maize in major APMCs in Udaipur district of Rajasthan

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Abstract

The present study analysed the dynamics of market arrivals and market prices of maize in two major APMCs of Udaipur district of Rajasthan over a period of 10 years (2015-16 to 2024-25). The analytical tools employed were Compound Annual Growth Rate (CAGR), Coefficient of Variation, Cuddy-Della Valle Instability Index, and Pearson's Correlation Coefficient. Results revealed that while Krishi Upaj Mandi Samiti, Fatehnagar showed a positive but statistically insignificant growth in maize arrivals, Krishi Upaj Mandi Samiti (Grain), Udaipur recorded a significant decline. Prices showed significant positive growth in both markets. Instability was higher in market arrivals than in market prices. A strong negative correlation was observed between market arrivals and market prices in Krishi Upaj Mandi Samiti (Grain), Udaipur, whereas a weak positive correlation existed in Krishi Upaj Mandi Samiti, Fatehnagar.

Keywords: Maize, market arrivals, market prices, growth rate, instability index, correlation

Introduction

In India, maize is the third most important food crop mainly grown during kharif season. The crop has a crop duration ranging from 90-120 days depending on the region and season. It is referred to as the "Queen of Cereals", "Contingent crop", "Miracle crop", and "Emerging Industrial crop." The crop is believed to have originated from Central Mexico in America. Maize holds significant importance as it provides feed, food, and fodder and also plays a vital role in industrial applications. Maize starch, an excellent source of carbohydrates, is a highly versatile industrial raw material and finds extensive applications in numerous industrial products such as starch, protein, oil, food, alcoholic beverages, cosmetics, bio-fuel, textile, pharmaceutical, gum, package and paper industries. Additionally, maize offers a variety of uses, including popcorn, sweet corn, high amylase corn, baby corn, corn cob, and quality protein maize. It is also used in a variety of products ranging from toothpaste, detergents, paper to dyes, soaps, artificial sweeteners like fructose, food containers, plastic food packaging, medicine, vitamin tablets, candies and so on. India ranked fifth in terms of global production, contributing 3.06 percent of total production with a quantum of 38.09 million tonnes in 2023. Maize occupies an area of 208 million hectare globally, wherein India ranks fourth with an area of 10.74 million hectares under maize production. In India, Rajasthan has sixth position in area and ninth position in production among all the maize producing states in the country. The crop is being cultivated in 0.88 million hectares of area with total production of 2.17 million tonnes and productivity of 2464 kg per hectare in Rajasthan in 2023- 2024. Udaipur ranks third in terms of production of maize in the state with an area, production and productivity of 0.15 million hectares, 0.27 million tonnes and 1780 kg per hectare, respectively in the year 2022-23. The soil and the climatic conditions of Rajasthan are found suitable for cultivation of maize in kharif season. The market arrivals and market prices of maize had changed over the years in Rajasthan.

Therefore, it becomes necessary to estimate the growth rates and factors responsible for changing scenario for maize market arrivals and market prices in Rajasthan. The present study estimated growth rates, variability and correlation coefficient between market arrivals and market prices.

The paper is divided in three sections. It begins with examinations of growth rate in market arrivals and market prices of maize in Udaipur district of Rajasthan. Secondly, it includes finding the variability in market arrivals and market prices of maize in leading APMCs of Udaipur district of Rajasthan by estimating Coefficient of Variation and Cuddy Della Vella Index. Thirdly, to calculate the Correlation Coefficient between market arrivals and market prices.

There are many studies such as Gohain *et al.* (2018) [3], Dhende *et al.* (2020) [2], Thakur *et al.* (2022) [11], Udhayan *et al.* (2023) [12] and Singh and Deshmukh (2024) [10] have presented work on growth rate, variability and correlation coefficient between market arrivals and prices for various crops. The present study has been conducted to answer the research questions whether there was significant growth in market arrivals and market prices of maize in Udaipur District of Rajasthan over the period as well as to find the correlation coefficient between market arrivals and market prices.

Materials and Methodology

The leading APMC Markets in Udaipur district having the highest arrivals of maize were selected for the study viz., Krishi Upaj Mandi Samiti (Grain), Udaipur and Krishi Upaj Mandi Samiti, Fatehnagar with market arrivals of 2.96 thousand tonnes and 30.75 thousand tonnes respectively in 2024-25. Krishi Upaj Mandi Samiti (Grain), Udaipur, and Krishi Upaj Mandi Samiti, Fatehnagar, are Agricultural Produce Market Committee (APMC) regulated markets. The study was mainly based on secondary data and information also was gathered from visit to Krishi Upaj Mandi Samiti (Grain), Udaipur and Krishi Upaj Mandi Samiti, Fatehnagar. For the proposed study, time series data for a period of 10 years, from 2015-16 to 2024-25 was used.

Estimation of Growth Rate

The compound annual growth rates of market arrivals and market prices of maize were estimated by using following exponential model.

$$Y = AB^t$$

$$\log Y = \log A + t \log B$$

Where, Y is the market price or market arrivals of maize crop, t is the time variable, B is the regression coefficient, and A is the intercept

Then, the percent compound annual growth rate 'r' were computed by using the following formula.

$$CAGR(r) = [\text{Antilog}(\log b) - 1] \times 100$$

Where, r is the compound annual growth rate

The significance of estimated coefficients was tested by using 't' test.

$$t = \frac{b}{S.E(d)}$$

Where, b is the estimated coefficient of model and S. E (d) is the standard error of the estimated coefficient.

Instability Analysis

To measure the instability in market arrivals and market prices variability was assessed using the Coefficient of

Variation (CV) and the Cuddy-Della Valle instability index. It was assumed that if the range of instability for Cuddy Della Valle Instability Index is greater than 30 percent, it was considered high instability, if it was between 15 and 30 percent, it was considered moderate instability and if it was less than 15 percent, it was considered low instability.

Coefficient of variation: The coefficient of variation (CV) was calculated by using the following formula

$$CV = \frac{\sigma}{\bar{X}} \times 100$$

Where, $\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$, CV is the Coefficient of variation, σ is the standard deviation, $\bar{X}$ is the arithmetic mean, X is the market arrivals or market prices, and n is the number of observations

Cuddy Della Valle Instability Index: The instability index of Cuddy-Della Valle Index was analysed using the formula:

$$CDVI = CV \sqrt{1 - R^2}$$

Where, CV is the Coefficient of variation (in %) while R^2 is the Adjusted coefficient of multiple determination calculated by time trend regression and adjusted by the number of degrees of freedom.

Measurement of Correlation Coefficient: Correlation coefficient was analysed to know the relationship between market arrivals and prices of maize.

$$\text{Correlation Coefficient (r)} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2 \sum (Y_i - \bar{Y})^2}}$$

Where, r is the correlation coefficient between market arrivals and market prices of maize, X_i is the quantity of maize market arrivals (in Q), $\bar{X}$ is the average quantity of maize market arrivals (in Q), Y_i is the price of maize (in ₹/Q), and $\bar{Y}$ is the average price of maize (in ₹/Q).

Results and Discussion

The compound annual growth rate in maize market arrivals and prices in Krishi Upaj Mandi Samiti (Grain), Udaipur was calculated and illustrated in Table 1 and Figure 1. The market arrivals of maize in 2015-16 was 18.48 thousand tonnes which decreased to 2.96 thousand tonnes in 2024-25. A significant negative growth rate (-18.49%) during period 2015-16 to 2024-25 was registered in the market prices of maize. This reduction in market arrivals of maize in Krishi Upaj Mandi Samiti (Grain), Udaipur was due to farmers directly selling the produce to private wholesalers and traders. The market price of maize in 2015-16 was ₹1468 per quintal which increased to ₹2461 per quintal in 2024-25. A significant growth rate (5.06%) during period 2015-16 to 2024-25 was registered in the prices of maize. The reason behind positive growth rate in prices might be due to an increase in MSP from ₹1325 per quintal to ₹ 2225 per quintal in 2024-25.

Table 1: Compound Annual Growth Rate in Prices of Maize in Krishi Upaj Mandi Samiti (Grain), Udaipur

Particulars	Market arrivals (in 000' tonnes)	Market Price (in ₹/Q)
Base year (2015-16)	18.48	1468
Latest year (2024-25)	2.96	2461
No. of observation	10.00	10.00
CAGR (%)	-18.49*	5.06*

* Significant at 1% level of significance

The results of growth rate in prices were found to be consistent with findings of Gohain *et al.* (2018) ^[3] who found negative growth rate in market arrivals and positive growth rate of prices for maize in agricultural markets of Punjab during 1970-71 to 2016-17.

The compound annual growth rate in maize market arrivals and market prices in Krishi Upaj Mandi Samiti, Fatehnagar were calculated and depicted in Table 2 and Figure 1. The market arrival of maize in 2015-16 was 15.54 thousand tonnes which increased to 30.75 thousand tonnes in 2024-25. The compound annual growth rate for market arrivals was 8.82 percent during the period 2015-16 to 2024-25 though it was insignificant. The reason behind positive growth rate in market arrivals of maize may include better price realization, increased procurement by government agencies, expansion in market infrastructure, and rising demand from processing and poultry industries, which may have encouraged farmers to bring more produce. The market price of maize in 2015-16

was ₹1470 per quintal which increased to ₹2230 per quintal in 2024-25. A significant growth rate (1.99%) during period 2015-16 to 2024-25 was registered in the market prices of maize. The results of growth rate in market arrivals and market prices were found to be consistent with findings of Navsare *et al.* (2018) ^[7] as they found positive growth rate of market arrivals and market prices of sorghum in APMCs of Ahmednager district during 2005-06 to 2016-17.

Table 2: Compound Annual Growth Rate in Market Arrivals and Market Prices of Maize in Krishi Upaj Mandi Samiti, Fatehnagar

Particulars	Market arrivals (000' tonnes)	Market Price (₹/Quintal)
Base year (2015-16)	15.54	1470
Latest year (2024-25)	30.75	2230
No. of observation	10.00	10.00
CAGR (%)	8.82	1.99**

** Significant at 5% level of significance

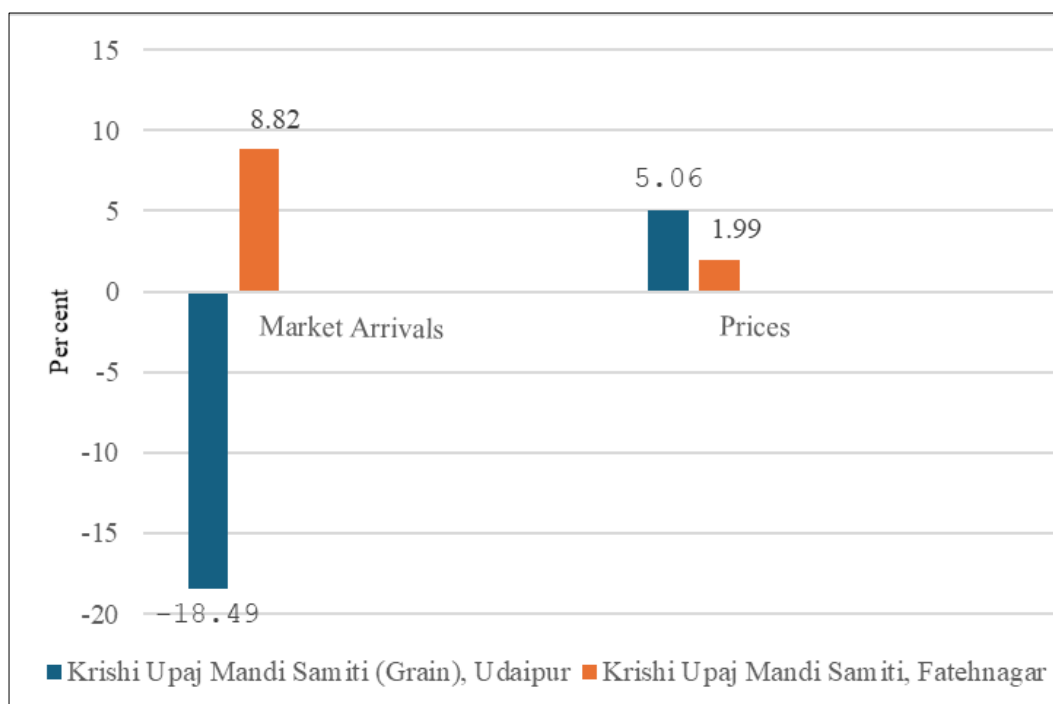


Fig 1: Compound Annual Growth Rate in Market Arrivals and Market Prices of Maize in Krishi Upaj Mandi Samiti

Instability in terms of coefficient of variation was calculated from 2015-16 to 2024-25 and presented in Table 3 and Figure 2. The results of coefficient of variation showed that Krishi Upaj Mandi Samiti, Fatehnagar showed high instability in market arrivals (43.69%) as compared to market prices (20.42%). Krishi Upaj Mandi Samiti (Grain), Udaipur showed

high instability (50.87%) in market arrivals as compared to prices (18.41%). The study conducted by Chaudhary and Sharma (2022) ^[1] was found consistent with the present findings that co-efficient of variation of market arrivals was higher than prices in pearl millet in Jaipur, Alwar and Barmer districts of Rajasthan for the period 2010-11 to 2020-21.

Table 3: Instability in Market Prices and Market Arrivals of Maize in Krishi Upaj Mandi Samiti using Coefficient of Variation

Particulars	Instability in Market Prices (%)	Instability in Market Arrivals (%)
Krishi Upaj Grain Mandi, Udaipur	18.41	50.87
Krishi Upaj Mandi, Fatehnagar	20.42	43.69

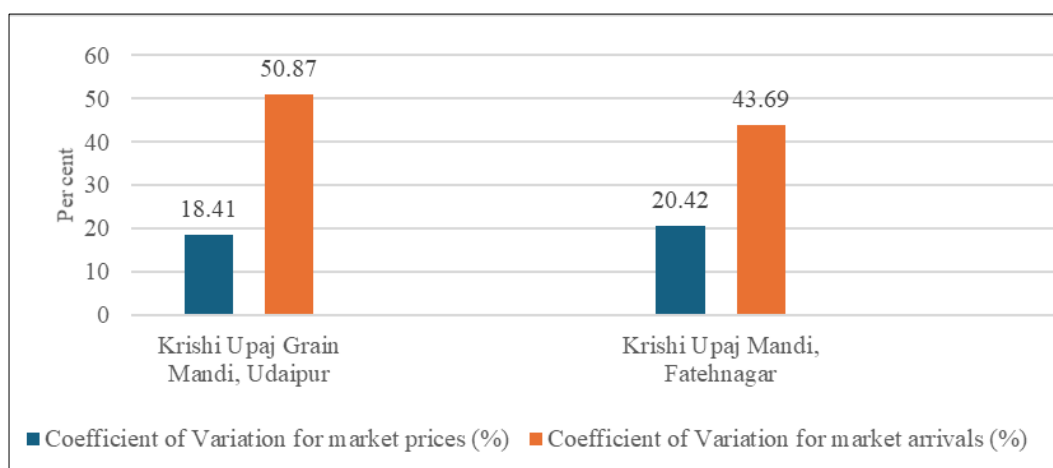


Fig 2: Instability based on Coefficient of Variation

Instability in terms of Cuddy Della Valle Index was calculated from 2015-16 to 2024-25 and presented in Table 4 and Figure 3. The results of Cuddy Della Valle index showed that Krishi Upaj Mandi Samiti, Fatehnagar showed high instability in market arrivals (37.87%) as compared to prices (16.41%). Krishi Upaj Mandi Samiti (Grain), Udaipur showed

higher moderate instability (23.57%) in market arrivals as compared to prices (10.77%). The study conducted by Kolageri and Banakar (2018) ^[4] was found consistent with the findings that Cuddy Della Valle index of market arrivals was higher than prices for maize in Vijayapura market of Karnataka for a period of fifteen years.

Table 4: Instability in Market Arrivals and Market Prices of Maize in Krishi Upaj Mandi Samiti using Cuddy Della Valle index

Particulars	Cuddy Della Valle index in prices (%)	Cuddy Della Valle index in market arrivals (%)
Krishi Upaj Grain Mandi, Udaipur	10.77	23.57
Krishi Upaj Mandi, Fatehnagar	16.41	37.87

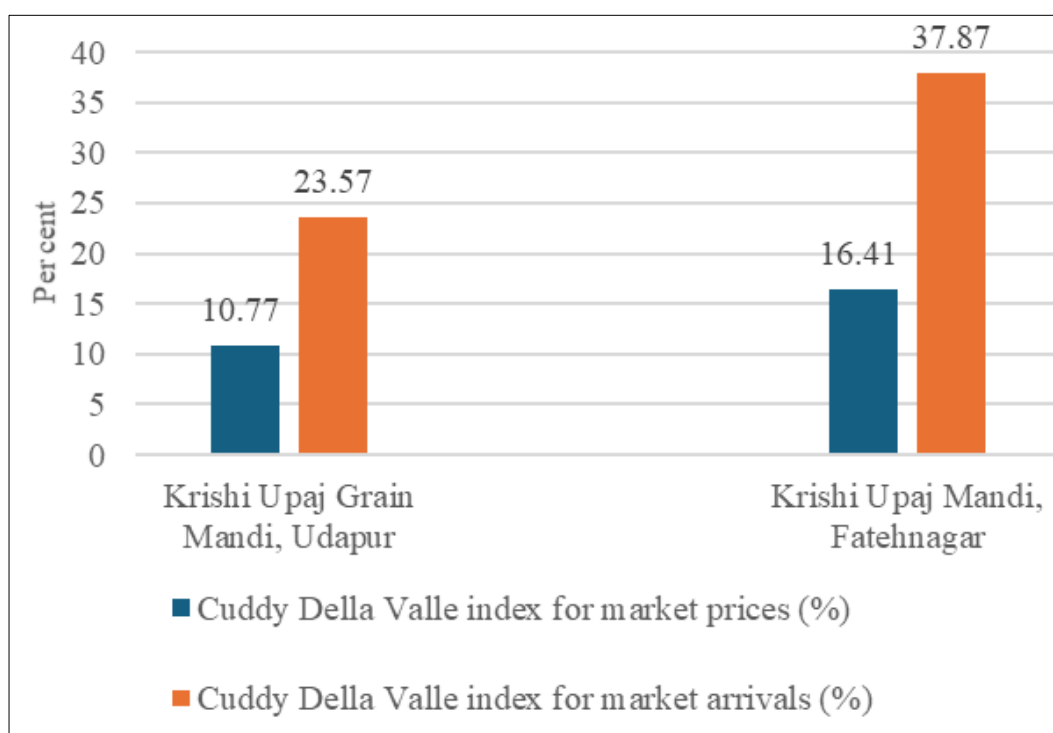


Fig 3: Instability based on Cuddy Della Valle Index

Thus, it can be inferred that market arrivals of maize were more instable than market prices in both the APMCs. The relationship between market arrivals and market prices of maize from 2015-16 to 2024-25 was analysed and presented in Table 5 for Krishi Upaj Mandi Samiti (Grain), Udaipur and Krishi Upaj Mandi Samiti, Fatehnagar. The correlation coefficient (r) for Krishi Upaj Mandi Samiti (Grain), Udaipur was found to be -0.86, indicating a strong negative linear relationship though it was non-significant with a P-value of

0.41. The correlation coefficient (r) for Krishi Upaj Mandi, Fatehnagar was found to be 0.07, indicating a weak positive linear relationship though it was non-significant with a P-value of 0.84. These findings are consistent with the results of study conducted by Sharma (2024) ^[9]. His thesis concluded that there was a negative correlation between market arrivals and prices for wheat, whereas a positive correlation was observed between market arrivals and market prices for maize in Udaipur District of Rajasthan.

Table 5: Correlation between Market Arrivals and Market Prices of Maize in Krishi Upaj Mandi Samiti

Particulars	Correlation Coefficient
Krishi Upaj Mandi Samiti (Grain), Udaipur	-0.86
Krishi Upaj Mandi Samiti, Fatehnagar	0.07

Conclusion

The study concluded Krishi Upaj Mandi Samiti, Fatehnagar showed an increase in arrivals and moderate price growth whereas Krishi Upaj Mandi Samiti (Grain), Udaipur reflected a substantial decline in arrivals with notable price growth. The instability in market arrivals was higher than instability in market prices. The correlation coefficient was negative and statistically insignificant for Krishi Upaj Mandi Samiti (Grain), Udaipur. This was likely due to the imposition of mandi tax, which may have discouraged farmers from bringing their produce to the regulated markets. In contrast, Krishi Upaj Mandi Samiti, Fatehnagar exhibited a weak positive correlation though insignificant.

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