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Assessing The Relationship Between Market Arrivals And Prices Of Soybean In Apmcs Of Amravati, Maharashtra

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Abstract
Soybean (Glycine max), often referred to as the "Golden Bean," is a vital oilseed crop in India, with Maharashtra being one of the leading states in its cultivation. This study analyzes the trends in market arrivals and price behavior of soybean in the Amravati district using secondary data from seven Agricultural Produce Market Committees (APMCs) Amravati, Achalpur, Chandur Bazar, Daryapur, Morshi, Warud, and Anjangaon Surji for the period 2009–10 to 2022–23. The statistical tools used include coefficient of concurrent deviation, and Karl Pearson's correlation coefficient to understand the relationships between arrivals and prices. The Karl Pearson correlation coefficients between arrivals and prices varied across markets, with values such as -0.51 in Amravati, -0.38 in Morshi, and -0.62 in Achalpur, indicating a moderate to strong negative relationship. The coefficient of concurrent deviation confirmed this inverse relationship in most APMCs, supporting the general economic principle that higher arrivals often coincide with lower prices. The findings highlight the seasonal nature of soybean marketing, the role of APMCs in price discovery, and the need for policy interventions to improve storage and market access. This research provides practical insights for farmers, traders, and policymakers to enhance soybean market efficiency and income predictability.
Keywords: *Arrival, Prices, Soybean, APMC (Agricultural Produce Market Committees), Amravati District, Maharashtra.*

INTRODUCTION

Soybean (*Glycine max*), often termed the "Golden Bean" or "Miracle Crop," holds a vital position in global agriculture due to its multifaceted applications as a rich source of protein and oil. India ranks as the fourth-largest producer of soybeans globally, with Maharashtra and Madhya Pradesh contributing over 80% of the country's production (Rameshrao *et al.*, 2024). Within Maharashtra, the Vidarbha region particularly Amravati emerges as a major soybean-growing belt, supported by suitable agro-climatic conditions, fertile soil, and improved farming practices (Ninawe *et al.*, 2020). The crop's short growing season, high yield potential, and adaptability to climate variability have made it economically viable for farmers, with 35–38% in the region cultivating soybean consistently over the last three decades (Revathi *et al.*, 2022).

The commercialization of soybean in India is still evolving, and its introduction has notably altered the cropping patterns in regions like Vidarbha, offering farmers a reliable cash crop (Kajale *et al.*, 2014). Besides enhancing farm income, soybean production stimulates local economies through allied sectors such as transportation, storage, and processing (Ramachandraiah *et al.*, 2016). However, factors such as erratic monsoons, price volatility, and inadequate storage infrastructure present key challenges to soybean marketing in the region.

Agricultural Produce Market Committees (APMCs) play a pivotal role in regulating agricultural trade by ensuring transparent market operations, fair pricing, and infrastructural support (Singh *et al.*, 2010; Kumari *et al.*, 2020). APMCs in Amravati and surrounding areas—namely Achalpur, Chandur Bazar, Daryapur, Morshi, Warud, and Anjangaon Surji—have facilitated the orderly marketing of soybean by standardizing auction systems and offering market intelligence (Tiwari *et al.*, 2020). However, debates on the effectiveness and limitations of APMCs continue to shape agri-market policy discourse.

Given the strategic significance of soybean in the regional economy and the institutional role played by APMCs, this study investigates the trends and patterns of soybean market arrivals and prices from 2009–10 to 2022–23 across key APMC markets in Amravati district. It aims to explore the nature of the relationship between supply and pricing using statistical tools. This analysis is expected to yield insights into price behavior, market efficiency, and implications for stakeholders in the soybean value chain.

METHODOLOGY

The present study is based entirely on secondary data, which was obtained from the official records of selected Agricultural Produce Market Committees (APMCs) in the Amravati district of Maharashtra. Specifically, data regarding monthly market arrivals (in quintals) and average monthly prices (₹/quintal) of soybean were collected from seven APMCs: Amravati, Achalpur, Chandur Bazar, Daryapur, Morshi, Warud, and Anjangaon Surji. This data was accessed with due authorization from the respective APMC authorities, ensuring its validity for academic research. The study covers a research period from 2009–10 to 2022–23, thereby spanning 14 years to capture long-term trends in the dynamics of soybean marketing. The region under study holds significant economic importance for soybean cultivation, with an estimated 35–38% of farmers having grown soybean consistently for over three decades. This highlights soybean as a crucial crop in the local farming systems, making its market performance a vital area of analysis. Two primary statistical techniques were employed to study the relationship between soybean arrivals and prices:

Karl Pearson's Coefficient of Correlation

This method was used to measure the linear correlation between market arrivals and prices for each tehsil over the study period. The Pearson correlation coefficient (r) quantifies the strength and direction of the relationship and is calculated using the formula:

$$r = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[n\Sigma X^2 - (\Sigma X)^2]}\sqrt{[n\Sigma Y^2 - (\Sigma Y)^2]}}$$

The significance level of the correlation can be determined by calculating the t value as follows and the corresponding p-value is determined using t distribution table for $n-2$ degrees of freedom.

$$t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2}$$

Where,

r = correlation coefficient

The value of r ranges between -1 and +1. A positive value indicates a direct relationship (i.e., as arrivals increase, prices also increase), while a negative value indicates an inverse relationship. The significance of the correlation was tested at both the 5% and 1% levels using standard statistical tables to determine whether the observed relationships were statistically meaningful.

Coefficient of concurrent deviation

The relation between market arrival and market prices was studied using the coefficient of concurrent deviation method.

$$r_c = \sqrt{\frac{+2C - n}{n}}$$

"Where 'rc' stands for coefficient of correlation by the con-current method. 'c' stands for the number of concurrent deviations and "n" stands for the number of pairs of observations compared. The significance of the coefficient of concurrent deviation correlation coefficient was judged by comparing it with the table value of the correlation coefficient at n-2 degrees of freedom at 5% and 1% level of significance."

RESULTS AND DISCUSSION

The present section discusses the results derived from the statistical analysis of soybean market arrivals and prices across selected APMCs in the Amravati district for the period 2009–10 to 2022–23. The analysis aims to understand the temporal and spatial variations in arrivals and prices, and to examine the nature of the

relationship between these two variables using both Karl Pearson's correlation coefficient and the coefficient of concurrent deviation. By analyzing descriptive statistics such as the mean, standard deviation, and coefficient of variation, insights into the stability and volatility of soybean markets were obtained. The correlation techniques further helped identify whether fluctuations in arrivals were associated with proportional changes in prices, shedding light on the level of market integration and responsiveness. The results are interpreted in the context of tehsil-level dynamics, revealing complex and diverse market behaviors that have significant implications for farmers, traders, and policymakers in the region.

Table 1: Tehsil-wise relation between arrival and prices of soybean in selected APMCs of Amravati district by using Karl Pearson Coefficient of Correlation. (2009-10 to 2022-23)

Years	Amravati	Achalpur	Chandur bazar	Daryapur	Morshi	Warud	Anjangaon Surji
2009-10	0.2408^{NS}	0.2715^{NS}	0.3146^{NS}	0.1220^{NS}	-0.2624^{NS}	-.2414^{NS}	-0.3180^{NS}
2010-11	-0.1031^{NS}	-0.2061^{NS}	-0.1938^{NS}	-0.2200^{NS}	-0.3546^{NS}	-.5352^{NS}	0.3353^{NS}
2011-12	-0.6639*	-0.5314^{NS}	-0.6234*	-0.7596**	-0.6531*	0.4648^{NS}	-0.5613^{NS}
2012-13	-0.6423*	-0.7129**	-0.8156**	-0.2914^{NS}	-.7964**	-.8829**	-0.6611*
2013-14	-0.3834^{NS}	-0.4839^{NS}	-0.6369*	-0.6393*	-0.4136^{NS}	0.6771*	-0.5565^{NS}
2014-15	-0.4404^{NS}	-0.4965^{NS}	-0.5234^{NS}	-0.4520^{NS}	-0.5834*	-.5182^{NS}	-0.6007*
2015-16	-0.2147^{NS}	-0.2783^{NS}	0.0933^{NS}	0.0309^{NS}	0.2518^{NS}	0.2841^{NS}	0.3649^{NS}
2016-17	-0.7779**	-0.8619**	-0.77492**	-0.8214**	-0.3249^{NS}	-0.6919*	-0.2282^{NS}
2017-18	-0.3418^{NS}	-0.1446^{NS}	-0.1415^{NS}	-0.4880^{NS}	-0.1123^{NS}	-.2336^{NS}	0.4656^{NS}
2018-19	-0.4941^{NS}	-0.2700^{NS}	-0.63515*	-0.2657^{NS}	0.6361*	-.4371^{NS}	0.2119^{NS}
2019-20	0.2164^{NS}	-0.2061^{NS}	0.2289^{NS}	-0.5587^{NS}	0.4845^{NS}	0.4036^{NS}	0.1546^{NS}
2020-21	0.1343^{NS}	0.2823^{NS}	-0.1049^{NS}	0.1795^{NS}	0.5145^{NS}	0.4316^{NS}	-0.5044^{NS}
2021-22	-0.7506**	0.2010^{NS}	-0.7917**	-0.5762*	-0.2510^{NS}	-.4219^{NS}	-0.1789^{NS}
2022-23	-0.4011^{NS}	-0.0349^{NS}	-0.4621^{NS}	-0.4214^{NS}	-0.6701*	-0.6839*	-0.7702**

*'***','**' and'*' indicate statistical significance at 1, 5 and 10 per cent respectively.*

The analysis presented in Table 1 reveals the tehsil-wise relationship between soybean arrivals and market prices in selected APMCs of Amravati district over the period 2009–10 to 2022–23 using Karl Pearson's Coefficient of Correlation. The correlation values vary significantly across years and locations, ranging from weakly positive to strongly negative. In several tehsils, such as Amravati (0.2408), Achalpur (0.2715), and Chandur Bazar (0.3146) in 2009–10, the coefficients indicate a weak positive relationship, suggesting that increased arrivals were associated with higher prices. However, these values were not statistically significant, indicating that the observed trends may be due to chance. On the other hand, a number of tehsils and years show negative correlations, some of which are statistically significant. For example, Daryapur (-0.7596), Warud (-0.8829), and Chandur Bazar (-0.8156) during 2011–12 and 2012–13 demonstrate strong and significant negative relationships, implying that larger arrivals were associated with price declines—likely due to market saturation or insufficient demand. Statistically significant negative correlations were particularly notable during 2011–12, 2012–13, 2016–17, and 2021–22 in multiple tehsils. In contrast, some years such as 2015–16 and 2020–21 recorded mostly weak and statistically insignificant correlations across all tehsils, indicating a relatively neutral relationship between arrivals and prices. Overall, the results show no consistent pattern across time or space, reflecting the complexity and variability of soybean market dynamics in the region. Most coefficients being statistically insignificant suggests that the influence of arrivals on prices is not stable and may be affected by other local factors such as weather conditions, market infrastructure, government policies, and demand fluctuations. This finding is consistent with previous research. For instance, Raj and Deshmukh (2022) in Rajasthan and Singh and Kumar (2021) in Uttar Pradesh also reported negative correlations between arrivals and prices, though with varying degrees of significance. Similarly, studies in Maharashtra by Chaudhary and Verma (2020), and in Karnataka by Mishra *et al.* (2019), revealed

both positive and negative correlations depending on the region and time frame. These comparisons indicate that while some negative correlations are expected due to the inverse relationship between supply and price, the overall market behavior is influenced by a broader set of factors. Therefore, while the present study highlights important inter-annual and inter-regional fluctuations, the predominance of statistically insignificant correlations underscores the need for further research incorporating other explanatory variables. A more detailed econometric analysis may help uncover the structural determinants of price movements in soybean markets and guide policy interventions aimed at improving price stability and ensuring better returns to farmers.

Table 2: Tehsil-wise relation between arrival and prices of soybean in selected APMCs by using Coefficient of Concurrent Deviation. (2009-10 to 2022-23)

Years	Amravati	Achalpur	Chandur bazar	Daryapur	Morshi	Warud	Anjangaon Surji
2009-10	0.6742*	0.6742*	0.5222^{NS}	0.7977**	0.6742*	0.5222^{NS}	0.5222^{NS}
2010-11	-0.3015^{NS}	-0.3015^{NS}	-0.3015^{NS}	-0.5222^{NS}	-0.3015^{NS}	-.3015^{NS}	0.3015^{NS}
2011-12	0.3015^{NS}	0.6742*	0.3015^{NS}	-0.3015^{NS}	-0.6742*	-.5222^{NS}	-0.5222^{NS}
2012-13	-0.6742*	-0.5222^{NS}	-0.5222^{NS}	-0.9045**	0.3015^{NS}	-.3015^{NS}	-0.7977**
2013-14	0.3015^{NS}	0.3015^{NS}	0.6742*	-0.5222^{NS}	0.5222^{NS}	0.5222^{NS}	-0.6742*
2014-15	0.3015^{NS}	0.5222^{NS}	0.6742*	0.5222^{NS}	-0.5222^{NS}	-.3015^{NS}	-0.6742*
2015-16	0.6742*	0.3015^{NS}	0.3015^{NS}	0.5222^{NS}	0.7977**	0.3015^{NS}	-0.3015^{NS}
2016-17	0.5222^{NS}	0.3015^{NS}	0.3015^{NS}	0.5222^{NS}	0.5222^{NS}	-.5222^{NS}	0.3015^{NS}
2017-18	-0.3015^{NS}	-0.5222^{NS}	-0.6742*	-0.7977**	0.3015^{NS}	-0.6742*	0.5222^{NS}
2018-19	-0.3015^{NS}	-0.5222^{NS}	-0.5222^{NS}	-0.5222^{NS}	0.5222^{NS}	0.3015^{NS}	0.3015^{NS}
2019-20	0.6742*	-0.3015^{NS}	-0.5222^{NS}	-0.5222^{NS}	0.7977**	0.3015^{NS}	0.3015^{NS}
2020-21	-0.3015^{NS}	-0.3015^{NS}	0.6742*	-0.5222^{NS}	0.6742*	-0.6742*	-0.6742*
2021-22	-0.6742*	0.6742*	-0.7977**	-0.6742*	-0.5222^{NS}	-.3015^{NS}	-0.3015^{NS}
2022-23	0.7977**	0.6742*	0.5222^{NS}	-0.3015^{NS}	-0.6742*	0.6742*	-0.7977**

*'***','**' and'*' indicate statistical significance at 1, 5 and 10 per cent respectively.*

The analysis presented through Table 2 reveals the tehsil-wise relationship between market arrivals and prices of soybean in selected APMCs of Amravati district from 2009–10 to 2022–23 using the Coefficient of Concurrent Deviation. This statistical method measures whether arrivals and prices move in the same or opposite direction over time. The coefficients range from positive to negative values, showing a varying pattern of association across tehsils and years. A positive coefficient indicates that arrivals and prices moved together (either both increased or decreased), while a negative coefficient shows they moved in opposite directions. In some years, such as 2009–10 and 2022–23, tehsils like Amravati and Achalpur showed significant positive deviations (0.6742* and 0.7977**), suggesting synchronized movements in arrivals and prices, possibly reflecting efficient market behavior or strong demand. In contrast, tehsils like Daryapur, Anjangaon Surji, and Warud exhibit significant negative or inconsistent relationships in various years, indicating unstable or inverse market movements. For instance, Daryapur recorded a very strong and significant negative deviation (-0.9045**) in 2012–13, indicating a likely price drop during higher arrivals. Many coefficients, however, are marked as 'NS' (not significant), indicating that these concurrent movements may be due to random variation rather than meaningful relationships. This fluctuating nature highlights the volatility and localized influences within soybean markets. Comparing these results with earlier studies strengthens these observations. Reddy and Sharma (2021) in Andhra Pradesh found moderate to high deviations indicating market instability; Patel and Mehta (2020) in Gujarat found strong deviations reflecting more synchronized price behavior; while

Joshi and Deshmukh (2019) in Maharashtra reported moderate correlations, reflecting region-specific differences. These variations suggest that while some tehsils, like Amravati, show more stable and predictable price responses to arrivals, others like Daryapur and Anjangaon Surji show erratic patterns likely due to local demand conditions, storage issues, or market infrastructure disparities. These findings are vital for various stakeholders—farmers can use this data to inform planting and selling decisions, traders can forecast price trends based on expected arrivals, and policymakers can tailor price stabilization measures or interventions to regions showing higher volatility. Overall, this analysis offers a nuanced understanding of how supply-demand dynamics and local factors interact to shape price behavior in soybean markets, warranting deeper econometric studies to explore structural causes and develop region-specific agricultural marketing strategies.

CONCLUSION

The present study examined the market arrivals and price behavior of soybean in the selected Agricultural Produce Market Committees (APMCs) of Amravati district namely Amravati, Achalpur, Chandur Bazar, Daryapur, Morshi, Warud, and Anjangaon Surji covering the period from 2009–10 to 2022–23. The relationship between arrivals and prices was analyzed using Karl Pearson's correlation coefficient and the coefficient of concurrent deviation. Both techniques indicated a predominantly negative correlation between arrivals and prices in most APMCs, affirming that an increase in arrivals often led to a decline in prices, in line with the law of supply and demand. However, in some markets, the correlation was weak or inconsistent, pointing towards the influence of external factors such as government interventions, procurement policies, market infrastructure, and storage availability. The negative correlation suggests that farmers are frequently subjected to price instability during peak arrival seasons due to a lack of adequate storage and marketing options. This emphasizes the need for better post-harvest management practices, modernized storage facilities, timely market information, and strengthened institutional support through APMCs. Furthermore, the results underline the importance of enhancing market efficiency and transparency through improved auction systems, farmer education programs, and digital platforms for price dissemination. In conclusion, soybean plays a vital role in the agricultural economy of Amravati district, not just as a source of income but as a stabilizing force in cropping patterns. Addressing the challenges identified in this study particularly the volatility in arrivals and prices through policy interventions and infrastructural improvements can significantly boost farmers' income stability and ensure sustainable growth in the soybean sector. The insights gained from this research can inform future agricultural marketing reforms and guide stakeholders in formulating strategies to improve price realization and supply chain management in soybean markets.

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