



Behaviour of Market Arrivals and Prices of Wheat in Selected Markets of Uttar Pradesh

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ABSTRACT

Background: Wheat is essential for both food and nutrition security, comprising a significant portion of the consumption basket. Therefore, any significant fluctuations in the price of this staple food can impact the overall economic outlook. The study examined the wholesale markets of Uttar Pradesh over a sixteen-year period, focusing on wheat crops from January 2008 to December 2023.

Methods: Monthly wheat arrivals and model price was collected from Agmarknet. A twelve-month moving average was utilized to examine the seasonal patterns in wheat arrivals and prices.

Result: Wheat arrived in the market in large quantities during the post-harvest season, when farmers were paid less. It clearly indicated that prices and arrivals had a negatively relation and seasonality exist in the market. The price indices were above average (>100) during the lean season (October to December, January to March) and below average (<100) after the harvesting season (April to July), as higher arrivals dropped the prices during such period. The maximum value of the coefficient of variation for wheat was witnessed in Aligarh (26%) market, followed by Basti (25%) and Agra (25%). The seasonal index for prices was high in off season which reveals that there was lack of storage facilities and the production during these months was very low. This study recommended enhancing infrastructure, storage and post-harvest techniques to increase the arrivals of these commodities and ensure year-round availability, thereby minimizing prices.

Key words: ASPV, CV, IPR, Market arrival, Seasonality, Wheat.

INTRODUCTION

Wheat is a major food crop consumed by approximately 2.5 billion people worldwide and remains a crucial staple for many countries. India is the second-largest producer of wheat after China, with an annual production of 107.74 million tonnes in 2022 (FAO, 2024). Uttar Pradesh state was the highest wheat production (33.95 MT) followed by Madhya Pradesh (22.42 MT), Punjab (14.82 MT) and Haryana (10.45 MT) (Anonymous, 2022). The area under wheat cultivation has consistently increased in recent decades due to a significant rise in the minimum support price and government procurement efforts (Ramdas *et al.*, 2012). Price fluctuations around a well-established trend typically reflect market fundamentals and pose minimal risk, unpredictable and large price variations create uncertainty for all stakeholders in the value chain. Agricultural markets are known for such uncertain price movements (Yeasin *et al.*, 2023). The poor, who allocate a large portion of their income to food and smallholders, who depend on agriculture for their livelihood, are especially susceptible to high price volatility (Shekhar *et al.*, 2018). Consequently, volatility in agricultural prices significantly impacts the food and nutrition security of these vulnerable populations. The escalating global prices of food grains and increased volatility in recent years have become a significant concern for developing countries like India. (Ceballos *et al.*, 2017).

Market arrivals are defined in this study as the point at which farmers finally sell their produce. Price is the amount

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that a customer pays or is expected to pay for the monetary value of a product's features in exchange for the anticipated or delivered utility (Gandhi, 1985). Farmers' income is negatively impacted by this variation in the price of agricultural products, which leads to instability in farm investments and lower crop yield (Sarkar and Bera, 2012). The rise of agriculture overall and various sectors of the rural economy in particular, has made efficient marketing of agricultural commodities even more crucial (Kachroo

et al., 2021). Throughout time, space and form, pricing signals direct and control decisions about production, consumption and marketing (Kohls and Uhl, 1980).

Not only producers but also consumers and government agencies require price information to formulate effective policies. Government agencies use such data to frame policies aimed at stabilizing prices, either by directly controlling supply and demand or indirectly through taxation, subsidies and export-import duties (Mathur, 2001). Therefore, the study aims to determine the seasonality of regional wheat market prices to understand the behavioral patterns of wheat arrivals and prices. Variations in market arrivals are a major factor in the state's food grain price instability (Kumare *et al.*, 2022). Understanding price variations over time is crucial for developing solutions that effectively reduce food grain commodity price volatility (Meera and Sharma, 2017). Uttar Pradesh has been selected for this study due to its significant contribution to national wheat production, holding a 31.77 per cent share. Wheat procurement was 5063 ('000 tonne) during 2012-13 and after that decreased and reached at 336 ('000 tonne) in 2022-23 (Anonymous, 2022). So, the present study has been undertaken with the following specific objectives delineated as follows: (a) To examine the wheat prices and market arrivals over the long run in three distinct markets and (b) To research the wheat price and market arrivals' seasonal patterns.

MATERIALS AND METHODS

Time series data of monthly duration for the prices of wheat were collected from the portal of Agmarknet (agmarknet.gov.in) from January, 2008 to December, 2023 for the study period under consideration. Three regional market from Uttar Pradesh state were selected on the basis of highest triennium arrivals of wheat in the market for the last three years from 2021 to 2023. The model prices were chosen for the analysis. Agra, Basti and Aligarh markets were selected from Uttar Pradesh as a regional market.

Seasonal variation

Due to the cyclical nature of agricultural commodities, it is necessary to continuously monitor seasonal fluctuations in prices in order to make informed economic decisions. (Cariappa *et al.*, 2020). The most commonly used method to compute seasonal variations is the seasonality moving average method which was taken into account. The seasonal indices were determined using the 12 month ratio to the moving average method to quantify the seasonal changes in prices. By following procedure, the seasonal indices were determined.

1. Create a series of moving totals for the next 12 months.
2. Create a set of 12-month moving averages: Divide the 12-month moving totals by 12. This will create a set of 12-month moving averages.
3. Create a set of moving averages with a centring period of 12 months. In this stage, two consecutive 12-month

moving average pairs are averaged and the values between each pair are entered. The first and latest six months' corresponding moving averages are absent.

4. Calculate the percentage of each initial value to the matching centred moving average. The percentage of the moving average shows the combined indices of the irregular and seasonal components.
5. Removing the irregular component is the next step.
6. Set up monthly arrays representing the moving average percentage.
7. The average index for every month is then determined.
8. The sum of these averages must be increased to 1200 by making the necessary adjustments. This can be accomplished by calculating the correction factor and multiplying the monthly average by it.

The correction factor (K) is worked out as follows:

$$K = \frac{1200}{S}$$

Where,

K = Correction factor.

S = Sum of averages indices for 12 months, multiply.

K = The percentage of moving average for each month to obtain the seasonal indices.

Using the following formula, the degree of variation in seasonal indices was calculated using the coefficient of Average Seasonal Price Variation (ASPV), the Intra-year Price Rise (IPR) and the Coefficient of Variation (CV):

$$IPR = \left[\frac{HSPI - LSPI}{LPSI} \right] \times 100 \quad \dots(1)$$

$$ASPV = \left[\frac{HSPI - LSPI}{(HSPI + LSPI) / 2} \right] \times 100 \quad \dots(2)$$

$$CV = \left[\frac{\sigma}{\bar{X}} \right] \times 100 \quad \dots(3)$$

$$IPR = \frac{P_t}{P_0} \times 100 \quad \dots(4)$$

Where,

LSPI = Lowest seasonal price index.

HSPI = Highest seasonal price index.

Seasonal price index for wheat was calculated by using the following equation.

$$S = \frac{O}{M} \times 100 \quad \dots(5)$$

Where,

S = Seasonal index.

M = Twelve month centered moving average.

O = Original time series data.

RESULTS AND DISCUSSION

Seasonal variations are recurring patterns occurring at regular intervals each year, originating within the year. These variations in prices are distorted by factors such as

commodity perishability, seasonality in consumption, production concentration, storage costs and infrastructure. Thus, it is crucial for organizations to identify and measure these variations to better plan for pricing.

Compute the seasonal index to make well-informed economic decisions on agricultural commodity prices, since pricing behaviour is impacted by the production season. Table 1 and Table 2, respectively, provide the seasonal indices of wheat arrivals and prices in the chosen market places. To find long-term seasonal fluctuations in wheat arrivals and prices, monthly seasonal indices were computed. The findings demonstrated that there is seasonality in prices and arrivals in every market that was chosen.

In order to examine the trends in wheat arrivals and prices over the course of the year, 12-month moving averages were utilised to calculate seasonal indices. Table 1 displays the seasonal indices of market-wise arrivals of wheat in Agra, Basti and Aligarh markets of Uttar Pradesh. The findings indicated the presence of seasonality in all

the markets, with major arrivals recorded from April to July, as shown in Fig 1. Slight variations between the selected markets revealed the trends in market arrivals.

The results of Table 1 revealed the seasonal indices of wheat crop arrivals, broken down by market, in the chosen Uttar Pradesh markets. The findings showed that seasonality exists in every market. Fig 3 shows the seasonal index of monthly wholesale prices and arrivals of wheat in Agra market. Higher indices of market arrivals of wheat were noticed immediately after harvest, reaching 98.89 during April and peaking in May (134.13) in the Agra market and they found, arrival remained low during October to March and the lowest being in the month of February (79.99). Fig 4 shows the seasonal index of monthly wholesale prices and arrivals of wheat in Basti market. The Basti market showed the lowest arrivals in October (33.16) while peaking in May (303.14). The second highest was observed in June (236.81). The arrivals of Aligarh market are presented in Fig 5. The Aligarh market witnessed the lowest arrivals in January (54.55). Arrivals peaked in May (232.35) in the Aligarh market and decreased to 71.35 in September. Due to the fact that most farmers sold their grain as soon as it was harvested, the market was overflowing with wheat products from March to June. Higher market arrivals were prominent from April to July in the selected markets. The lowest arrivals were observed from December to February in all markets. This results are also supporting by Mahalle *et al.*, (2015), Thakur (2021) and Udhayan *et al.*, (2023). The wheat arrival seasonal index peaked in May for all Uttar Pradesh markets, whereas Bahraich and Ghazipur markets saw its lowest index in February (Horo *et al.*, 2016).

The estimated results of seasonal indices of prices of wheat in the selected markets of India are presented in Table 2 and Fig 2. The result clearly indicates the existence of seasonality in prices of wheat in the selected markets. Lower prices were observed during the month of April to June in different markets of Uttar Pradesh as there is excess of supply of wheat during these period. The higher price indices were observed during lean season due to lower arrivals from October to February in selected markets monthly seasonal indices were calculated to ascertain the long-run seasonal variations in arrivals. Thus, to analyze the pattern of wheat arrivals and prices during different months of the year, seasonal indices were computed using 12-month moving averages.

Fig 3 shows that February month witnessed highest seasonal price indices (105.27), followed by January (104.10) and December (101.96) in Agra market. The highest seasonal price indices were reported during February (103.28), followed by January (102.71) in Basti market (Fig 4). Price indices was higher during January (105.71) and February (105.35) in Aligarh market (Fig 5). Least price indices were observed during July month (95.36). The price indices were above average (>100) during the lean season (November to December, January to March) and below average (<100) after the harvesting

Table 1: Seasonal indices of monthly arrivals of wheat in selected regional markets of Uttar Pradesh (January, 2008 to December, 2023).

Month	Agra	Basti	Aligarh
Jan	84.78	34.48	54.55
Feb	79.99	36.49	68.07
Mar	89.09	42.98	65.20
Apr	98.89	145.56	141.73
May	134.13	303.14	232.35
Jun	126.79	236.81	163.31
Jul	113.15	117.81	117.53
Aug	104.23	118.88	80.79
Sep	96.24	56.53	71.35
Oct	92.72	33.16	75.46
Nov	91.97	37.49	67.71
Dec	88.00	36.67	61.96

Table 2: Seasonal indices of monthly wholesale prices of wheat in selected regional markets (January, 2008 to December, 2023).

Month	Agra	Basti	Aligarh
Jan	104.10	102.71	105.71
Feb	105.27	103.28	105.35
Mar	101.64	101.46	102.22
Apr	97.38	99.12	98.06
May	97.58	99.29	97.78
Jun	97.78	99.33	97.57
Jul	96.79	97.18	95.36
Aug	98.65	97.02	96.77
Sep	99.14	98.14	97.91
Oct	98.65	100.08	98.55
Nov	101.06	101.36	102.00
Dec	101.96	101.03	102.72

season (April to July), as higher arrivals dropped the prices during such period. The prices were found to be highest during the crop season (November March) as it is the production phase and thus the supply will be less in the market corroborating the findings of Horo *et al.*, (2016) and Darekar and Reddy (2018).

Majority farmers in India are small and marginal. So, they always had a financial problem and hence they sold

their agriculture produce immediately after harvesting. Bulk wheat production during the season makes prices down. So in peak season farmer received less price compared to lean season. Thus the majority of the produce was sold soon after the harvest probably for want of cash or lack of storage facilities. However, farmers who are financially sound can store for longer time to look forward for advantageous period and higher prices (Meera and Sharma, 2017). In the selected markets, the price trend often revealed major seasonal variations. Higher price indices were recorded before the harvesting period in the selected markets due to very low arrivals, while the lowest price indices were observed after a post-harvest period.

Different measurements of intra-year price fluctuations were used to establish the extents of seasonal price variation. The intra-year price increase (IPR), average

Table 3: Intra year price rise in selected regional markets of Uttar Pradesh (2008 to 2023).

Markets	IPR	ASPV	CV %
Agra	8.70	8.39	25
Basti	6.06	6.25	25
Aligarh	9.79	10.30	26

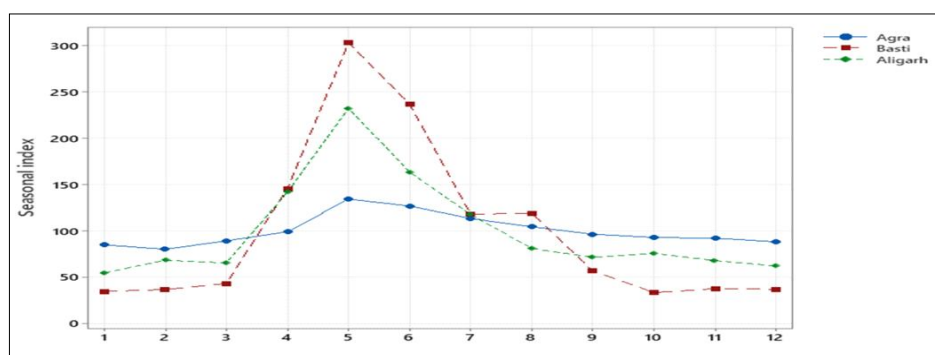


Fig 1: Seasonal index of wholesale monthly arrivals of wheat in selected regional markets of UP, January 2008 to December 2023.

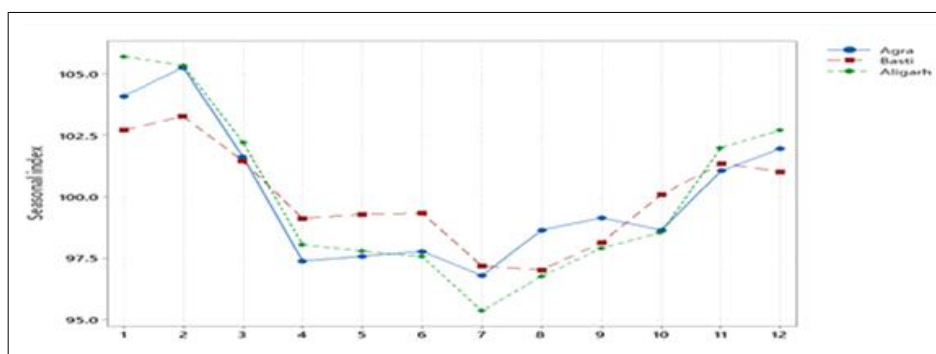


Fig 2: Seasonal index of wholesale monthly prices of wheat in selected regional markets of UP, January 2008 to December 2023.

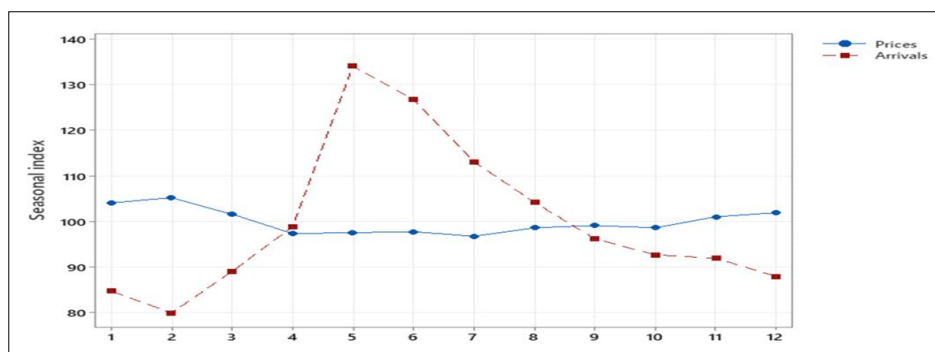


Fig 3: Seasonal index of wholesale monthly prices and arrivals of wheat in Agra market, January 2008 to December 2023.

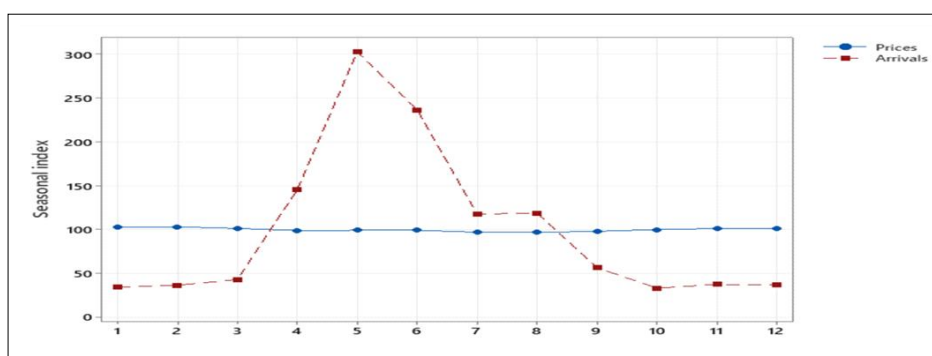


Fig 4: Seasonal index of wholesale monthly prices and arrivals of wheat in Basti market, January 2008 to December 2023.

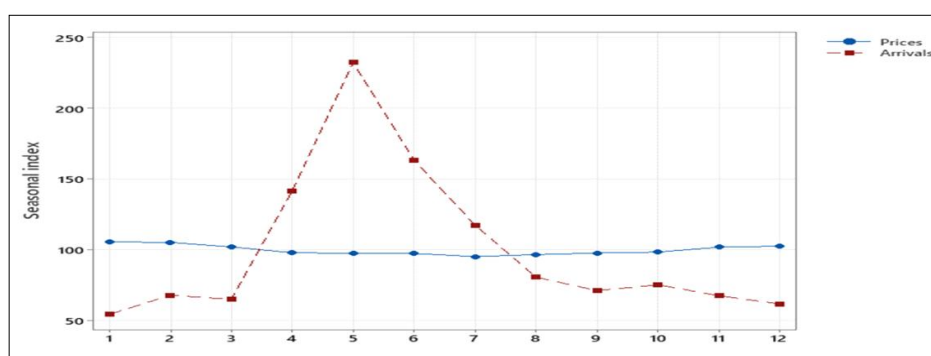


Fig 5: Seasonal index of wholesale monthly prices and arrivals of wheat in Aligarh market, January 2008 to December 2023.

seasonal price variation (ASPV) and coefficient of variation (CV) were the three techniques utilised in this study to quantify intra-year price fluctuations. The coefficient of average seasonal price index change was utilised to quantify the extent of variations in wheat seasonal indices. Table 3 displays the acquired results.

The maximum coefficient of Average Seasonal Price Variation (ASPV) was registered in Aligarh (10.30%) and the minimum in the Basti market (6.25%). The variation between the lowest and highest intra-year price rise aligned between the lowest (6.06%) in the Basti market to the highest (9.79%) in the Aligarh market for wheat. The market in Aligarh had the highest coefficient of variation for wheat (26%), followed by those in Basti and Agra (25%), as shown in Table 3. As the coefficient of variation increased, the degree of stability of prices decreased. The estimate of IPR and ASVP plays an important role in taking agri business decisions right from production, consumption and trade (Mahalle *et al.* 2015). In the chosen market, the wheat crop showed comparatively more stability. The price is heavily influenced by market stock levels, demand and the fluctuation of new product arrivals. By aligning supply to market demands during the high seasonal price index period, producers can secure better pricing by keeping these swings in demand in mind.

CONCLUSION

The present study was conducted in market arrivals and prices of wheat for Agra, Basti and Aligarh market of Uttar

Pradesh. The analysis and results of this study concluded that seasonality significantly impacts wheat prices, particularly during the peak season when post-harvest arrivals are high. Wheat arrivals in the market tend to surge immediately after the harvest, leading to distress sales. Therefore, it's crucial to provide credit facilities to farmers, enabling them to meet their financial needs during this period and sell their produce when market prices peak. The price indices were above average (>100) during the lean season (October to December, January to March) and below average (<100) after the harvesting season (April to July) because higher arrivals lead to price drops during this period. A reverse relationship between prices and arrivals was observed for wheat in Agra, Basti and Aligarh market. The study suggested improving storage and infrastructure facilities to ensure year-round disposal of commodities. Enhancing storage facilities by improving warehouse structures and storage chambers would help increase farmers' retention capacity and reduce post-harvest losses. The seasonality of wheat prices and arrivals is crucial for stakeholders in the wheat market, including farmers, traders and policymakers. By anticipating these seasonal patterns, they can make more informed decisions regarding production, storage, marketing and trading strategies to optimize their outcomes.

Conflict of interest

The authors declare that they have no conflict of interest.

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