Variations of Wholesale Price of Wheat in Different States of India under COVID-19 Pandemic

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Abstract

The present study investigates the impact of COVID-19 and restrictions imposed on wheat in different agricultural markets of India. The COVID-19 pandemic has had a significant impact on various sectors worldwide, including the food market. In India, the wheat crop harvest coincided with the lockdown imposed to control the spread of the virus. Monthly wholesale price data of seven states viz. Chhattisgarh, Uttar Pradesh, Madhya Pradesh, West Bengal, and Maharashtra were exercised from agricultural marketing portal of India. We compared monthly prices of April, May and June across 2019, 2020 and 2021. Linear piecewise regression was used to understand the impact COVID-19 on market whole sale price during different phases. The result revealed that wheat prices were at minimum support price in most of the states. Time series analysis showed the immediate impact of lockdown on decreased monthly wholesale price in all the states. Price risk was calculated using Cuddy Della Valle instability index (CDVI). Maharashtra showed the highest average monthly whole sale price and maximum price risk. The findings suggest that the agricultural markets have demonstrated a significant level of resilience in coping with the adverse effects of the COVID-19 pandemic. This is attributed to the provision of adequate policy support that has helped to mitigate the impact of the pandemic on the sector.

Key words: COVID-19; Whole sale Price; Wheat; Agricultural commodity; Price risk.

AMS Subject Classifications: 62K05, 05B05

1. Introduction

Undoubtedly, the COVID-19 pandemic and the subsequent nationwide lockdown enforced in March 2020 have caused a significant economic impact, affecting every sector of the economy, including the agricultural sector and its related markets. The agricultural industry in India, unlike many other countries, is a crucial source of livelihood, accounting for 60% of all rural employment (Varshney *et al.*, 2023). Therefore, it has been severely impacted by the pandemic, just like other sectors of the economy. The greatest current global problem the world has faced since World War II is the COVID-19 pandemic. It has been impacting

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life and the economy across the world since December 2019. It has brought a threatening challenge to the Indian economy and society. The COVID-19 has affected all walks of life (Cariappa *et al.*, 2021). A nationwide lockdown of 21days was declared by the government of India with an aim to restrict the spread of Coronavirus. The effort of India to contain the spread of Coronavirus has been applauded worldwide (Varshney *et al.*, 2021). It stalled the economy across all enterprises, including agriculture. Consequently, the agricultural value chain during the initial phase of the lockdown faced a huge economic shock. This led to a serious detrimental effect on the health of the rural Indian economy. Agricultural marketing channel was also affected in a way. Unlike different countries across the globe, agricultural enterprises in India account for single largest source of employment generation with more than 60 percent of the population directly depending on agriculture.

Agriculture and allied sectors carry immense importance to the rural economy of India. It contributes nearly one-sixth to the Indian national income and provides employment to nearly 50% of the workforce. It is vital for ensuring food security of the nation and also influences the growth of secondary and tertiary sector of the economy through its forward and backward linkages. The COVID-19 pandemic has occurred at a time when the global and Indian economic growth was already expected to decelerate (NABARD 2020). The economic implications of the novel Coronavirus (COVID-19) pandemic have brought the agricultural sector into sharp focus and heightened its responsibility to feed and employ thousands who might have lost livelihoods. At this time when most sectors of the economy are reported to be under significant stress, the agricultural sector continues to be promising and cushioning the economy. The most important factor of the lockdown was the total breakdown in supply chain both at global and Indian scale. There was a decline in global exports of agricultural goods. During the lockdown there was no proper management of sowing, harvesting and marketing of crops. There were different restrictions: (a) disruptions in procurement of food grain by different agencies; (b) disruptions in assembling of harvests from farms by traders; (c) paucity of farm workers for harvesting of rabi crops; (d) unavailability of truck drivers; (e) barriers in the transport of commodities; (f) inadequate operations of APMC mandis and (g) closures in the retail markets.

In the present context we make effort to access the impact of spread of COVID-19 and lockdown on the wholesale price of wheat across different states of India (Rawal and Verma, 2020). The impact on the price may be conceptualised as combined effect of response from consumers, wholesalers and retailers through stakeholders. Price and quantities traded of different agricultural commodities whose harvesting begin from late march is very crucial to the liquidity of farmer and how their lives are being affected by the pandemic. Several researchers across the globe believe that the empirical evidence of COVID-19 pandemic on food and agricultural market is still evolving with time (Sendhil *et al.*, 2013). For example, Mahajan and Tomar (2020) reported that there was a decline of 10% in the accessibility of various commodity through online mode during the initial phase of lockdown (Ramakumar, 2020). They have also reported a decline of about 20% in market arrival of vegetable and fruits in few cities during lockdown months (March and April). The major reason for the decline in arrival of fruits and vegetables is disruption supply chain in agriculture market (Sharma *et al.*, 2021). A sharp increase in the retail and wholesale prices for various commodities including pulses and edible oils was witnessed immediately after the lockdown (Narayanan and Saha, 2020). They reported that movement restrictions were the prime reason and contributed in increased prices. We have taken 5 different states: Uttar Pradesh,

Madhya Pradesh, Gujarat, Maharashtra. We have focused are study on agricultural commodities. The present paper is organised in four sections. The first section presents a short description of COVID-19 pandemic and its impact on agriculture, few recent studies related to COVID-19 impact on agricultural commodity. The second section describes the data used and methodology applied in present study. The third section presents the result and analysis. The fourth section discusses the result and fifth section ends with conclusion.

2.   Data and methodology

2.1.   Average monthly wholesale price

Data used for the present research were assessed from Agriculture Marketing Information portal (Source: https://agmarknet.gov.in) of Indian government, which provide commodity wise state wise monthly average wholesale price. It is the price at which the grain markets or mandis sell wheat to the wholesalers, who in turn sell it to retailers or food processing industries. The wholesale price of wheat is influenced by various factors such as demand and supply, production, transportation costs, and government policies. It is an important indicator of the overall performance of the wheat market in India. The study period includes January 2019 to June 2021. In the entire study period first wave and second phase of COVID-19 disrupted the agricultural marketing chain which entirely affected the consumer behaviour and price of different agricultural commodities. For the entire study period wheat wholesale price data for 5 states (Chhattisgarh, Gujarat, Madhya Pradesh, Uttar Pradesh and Rajasthan) were analysed.

3.   COVID-19 events in India

Lockdown during COVID-19 has impacted agriculture marketing chain in different ways in different phases of lockdown, which started from the end of march 2020. Table 2 represents the Descriptive statistics of monthly average whole sale price. To analyse the impact of COVID-19 lockdown on the wholesale price of agricultural commodities categorisation of period is very important. The different phases of the lockdown along with the activities exempted during each period is summarised in Table 1.

Table 1: Lockdown and unlock timelines and activities allowed

Lockdown	Duration	Activities allowed
Phase-1	25th March to 14th April 2020	Nearly all activities were suspended
Phase-2	15th April to 3rd May 2020	Allowed agricultural activities starting 20th April 2020
Phase-3	4th May to 17th May 2020	Lockdown in Green, Orange and Red zones
Phase-4	18th May to 31st May 2020	Movement allowed with some conditions across districts and states.
Unlock 1	1st June to 30th June	Reopening phase with an economic focus.

Source: Ministry of Home Affairs, Govt. of India

4.   Methodology

The price variation during the lockdown period and normal year has been analysed using piecewise linear regression tool. This analysis is used if the data follows different linear trend over different time segment. The piecewise linear regression can be conceptualised as follows:

$$y(x) = n_1 \beta_1 (x - b_1), \qquad b_1 < x \le b_2$$
$$n_2 + \beta_2 (x - b_2), \qquad b_2 < x \le b_3$$
$$n_n + \beta_{nb} (x - b_{nb-1}), \qquad b_{nb-1} < x \le b_{nb}$$

Where b_1 is the x location of first break point, b_2 is the x location of second break point, and so forth until the last break point bnb for nb number of break points.

4.1.   Price risk

Cuddy Della Valle instability index (CDVI) (Cuddy and Valle, 1978), represented the modified form of coefficient of variation which capture the price risk. CDVI has been used in this study to analyse the risk in monthly wholesale price for before and after lockdown period. It can be computed as follows:

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

where, CV is coefficient of variation and R^2 is coefficient of determination.

4.2.   Percentage change

We used PC to analyse the impact of lockdown on wholesale price of wheat. It is a simple mathematical concept that represents the degree of change over time. The value of percentage change is positive then there is a increase in percentage of that unit over time, while negative value shows a depicts a decrease in percentage over time. It can be calculated using the following formula:

$$\%change = \frac{(\text{price during lockdown-price before lockdown})}{(\text{price before lockdown})} \text{x}100$$

5.   Results and discussion

5.1.   Monthly wholesale price

The monthly time series wholesale price data of wheat for all six states are represented in Figure 1. The wholesale price witnessed decrease after March 2020 for all the states. Maharashtra showed highest wholesale price after Lockdown, while Chhattisgarh showed the least wholesale price trend.

5.2.   Descriptive statistics

The descriptive statistics of monthly average whole sale price is summarised in Table 2. The mean monthly wholesale price before lockdown was higher than that of after lockdown
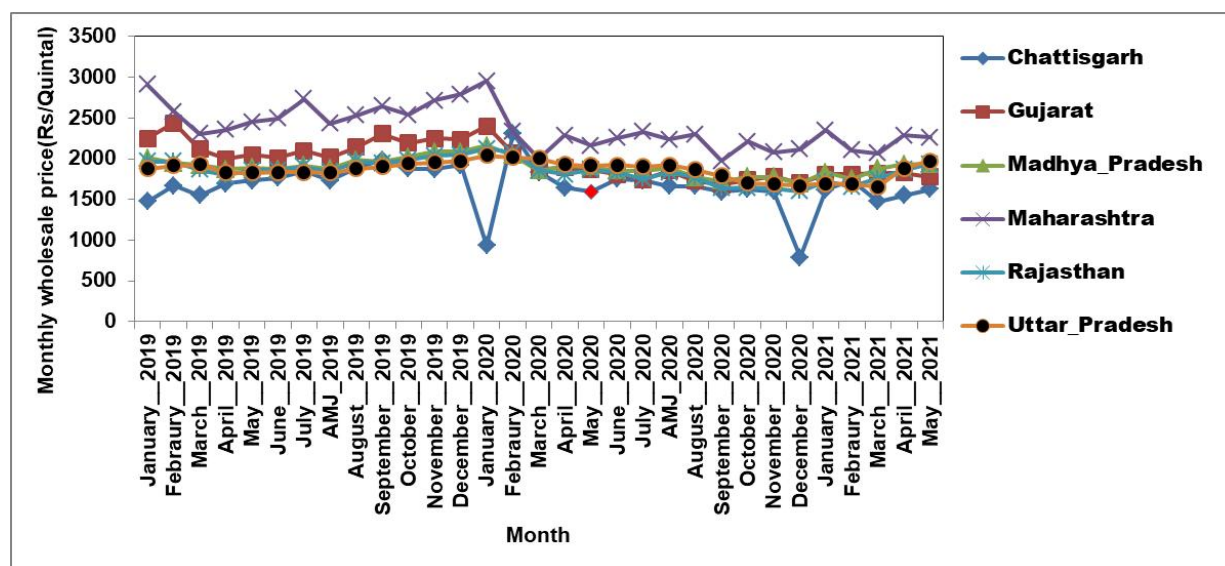
Figure 1: Time series variation of average monthly wholesale price of wheat

for all the states. The highest average monthly whole sale price was found for Maharashtra among different states. Chhattisgarh showed least whole sale price among six states after lockdown. Different states showed different statistics trend in India. In the present study difference in monthly whole sale price for different region is attributed to disruption in supply chain management in different region due to COVID-19 pandemic.

Table 2: Descriptive statistics of monthly average whole sale price

	Lock-down	Chhatt-isgarh	Gujarat	Madhya Pradesh	Mahara-shtra	Rajasthan	Uttar Pradesh
Mean	Before	1769.94	2161.94	1956.85	2576.21	1925.53	1886.45
	After	1596.54	1856.46	1863.10	2248.81	1803.69	1873.65
Maximum	Before	1981.83	2438.54	2088.29	2908.84	2047.86	1975.11
	After	2314.00	2399.09	2163.06	2951.27	2125.06	2039.25
Minimum	Before	1476.88	2000.36	1868.54	2305.86	1793.75	1826.45
	After	788.90	1680.44	1695.45	1969.46	1602.00	1672.04
Sd	Before	147.45	131.60	76.81	176.54	78.36	52.47
	After	378.76	192.65	127.98	242.78	160.32	124.80
Skewness	Before	-0.611	0.572	0.545	0.320	-0.051	0.227
	After	-0.779	2.12	1.101	2.08	0.769	-0.536
Kurtosis	Before	-0.191	-0.142	-0.890	-0.548	-1.021	-1.396
	After	2.030	5.161	1.41	6.18	0.196	-0.922

5.3. Price risk

The price risk was analysed before and after COVID-19 is presented in Figure 2. All states except Uttar Pradesh showed higher price risk after COVID-19. Maharashtra showed highest price risk, while Uttar Pradesh showed least price risk among different states.
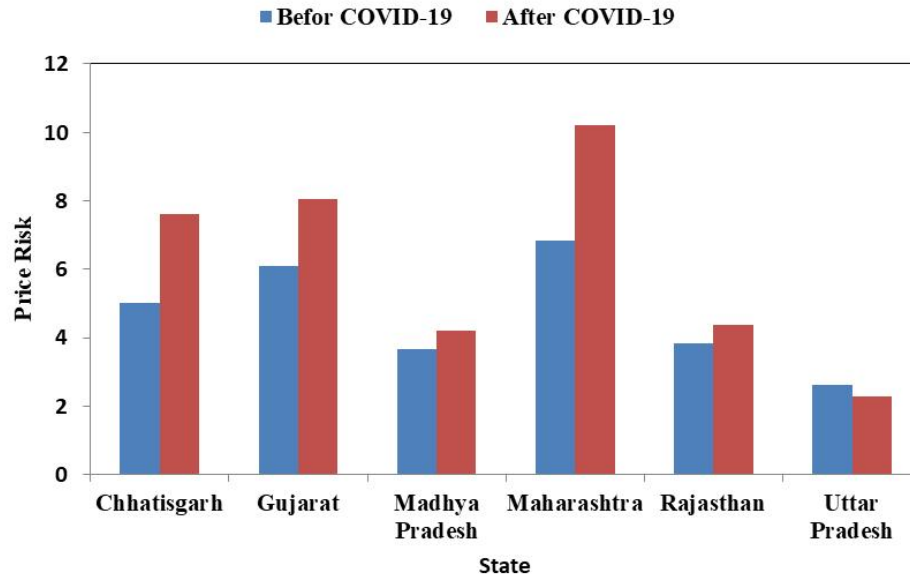
Figure 2: Price risk before and after lockdown

5.4.   Percent change (%)

To understand the impact of lockdown on average whole sale price, we have calculated percent change for all states. The percent change analysis is presented in Figure 3. The result revealed that all states showed percent decrease in average monthly whole sale price compared to normal year 2019. Gujarat showed highest percentage decrease in average monthly wholesale price, while Uttar Pradesh showed least percent decrease among different states considered in the present study.
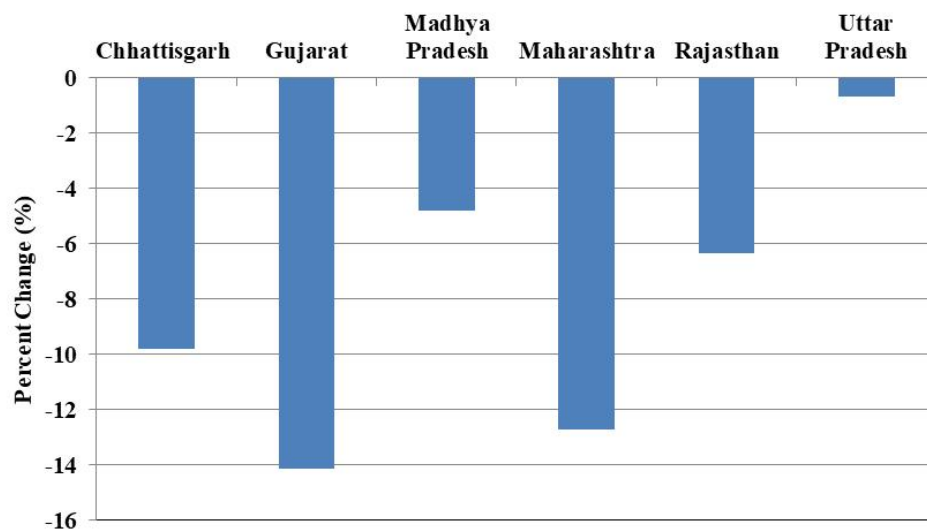

Figure 3: Percent change analysis of different states

6.   Conclusion

In the present study an attempt was made to capture the impact of COVID-19 on average monthly whole sale price of wheat across different state in India. Time series analysis showed the immediate impact of lockdown on decreased monthly wholesale price in all the states. Price risk was calculated using Cuddy Della Valle instability index (CDVI) also that there was increase in price risk after lockdown across all the states, except Uttar Pradesh. Measures taken by Government of India after lockdown has been reflected in increase in monthly wholesale price of wheat in post lockdown months. The percentage change analysis showed clear impact of lockdown on average monthly wholesale price of wheat in comparison to normal year (2019).

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