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RESEARCH NOTE

Lockdown Impact on Wholesale Prices and Market Arrivals of Potato in Punjab: An Analysis

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ABSTRACT

The study uses the fixed effect panel model to examine the impact of the Covid-19 pandemic on market arrivals and wholesale prices of potato in Punjab. We found that the wholesale prices of potato increased over different phases of the lockdown due to decrease in supply. However, after a sharp increase in potato prices in April, there was a decline due to the easing of restrictions during subsequent phases of the lockdown. In addition, during the lockdown, the arrivals were negatively affected due to the restrictions on inter and intra-state movements. However, improving market infrastructure and strengthening linkages with the market intermediaries may increase markets' resilience to such disruptions.

Keywords: Arrival, COVID-19, Potato, Wholesale prices

JEL classification : C23, O13, Q02

I

INTRODUCTION

The initial wave of the COVID-19 pandemic, in early 2020, severely disrupted different supply chains of agricultural commodities, especially those of perishables (Ali and Khan, 2020; Galanakis, 2020; Singh and Neog, 2020; Kundu, 2020; Varshney *et al.*, 2020; Richards and Rickard, 2020; and Harris *et al.*, 2020). In general, the market arrivals declined and caused a sharp price increase. Potato is an important vegetable crop of Punjab due to its potential to be sold as potato seed. Furthermore, the reason behind the selection of this particular crop is that the state ranks sixth in India in terms of area (4.63 per cent) and production (5.22 per cent); its productivity is much higher than that of the major potato-producing states of India. Currently, it is cultivated on one lakh hectares (the largest for vegetables in Punjab) during 2021 (PAU, 2022). As there were severe disruptions in the supply chains of potato due to the COVID-19 pandemic, these may adversely affect the future area and production potato in Punjab. The reduction in area under the crop will adversely affect the farmers' income and efforts towards crop diversification in Punjab. The disruptions in supply chains caused farm-level crop losses and distressed sales with considerable income losses to the farmers. A series of studies conducted by Mahajan and Tomar, 2020; Narayanan and Saha, 2020; Bhosale, 2020; Katsushi *et al.*, 2020; Rawal and Verma, 2020; Lowe *et al.*, 2020 highlighted the serious long-term consequences of the pandemic on farmers' income. Our study aimed at examining the effect of rising costs of production and supply chain disruptions due to the COVID-19 pandemic on potato

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prices across the state. Undeniably the potato markets have recovered significantly with the easing of lockdown restrictions. However, the recovery is not yet complete, as the long-term consequences on this crop are still unknown. Our study discusses the behaviour of wholesale price and arrival of potato during different lockdown phases in Punjab and impact thereof, as major disruptions in potato supply chains were induced by Covid-19 pandemic.

Supply chains including arrivals and prices of various agricultural commodities were impacted differently in India as well as in Punjab during this period. Some studies (Rawal *et al.*, 2020; Vatta *et al.*, 2021; Ceballos *et al.*, 2021; Vatta *et al.*, 2022) have already highlighted that the supply chains of major food grains such as paddy and wheat were disrupted to the minimum because of large scale government intervention well established market network and introduction of token scheme during procurement (Vatta *et al.*, 2022; Government of Punjab, 2020). However, the markets for fruits and vegetables were disrupted significantly (Tripathi *et al.*, 2023). Some preliminary field work by the author (Vatta, 2020) estimated that the farmers lost more than 400 crores in vegetables and more than 40 crores in fruits during the lockdown period with resulting disruptions in supply chains. It further needs to be mentioned that supply chains for some commodities have returned towards their normal equilibrium more quickly, the others have not. In this regard, the present study was designed to examine the impact of pandemic on wholesale and retail price of potato in Punjab.

It will add significant value to the research literature on the impact of some unforeseen disruptions in agri-value chains. Apart from Covid-19 pandemic, many events such as Russia-Ukraine war, immediate earthquake disruptions in Syria and Turkey may have similar impacts on the value chains though on a smaller scale. A study like the present one can help in similar analysis of the markets and identification of most relevant policy interventions to mitigate the adverse impacts of the pandemic. The outline of this paper is structured as follows. Section II describes the data collected and methodology used in fulfilling the objectives of the study. The results obtained are reported and discussed in Section III. Section IV concludes the study by summarising the findings and also suggest some suitable policy measures.

II

DATABASE AND METHODOLOGY

To accomplish the objectives of the study, the data on market arrivals and wholesale prices of potatoes for five major potato markets of Punjab were extracted from the Government of India's agriculture market information portal (agmarknet.gov.in). The daily data for January to September were converted into weekly data for three years (2019-2021). The Union government imposed the lockdown on 24th March 2020, which lasted till May 31, 2020, and the unlock phase persisted from June 1, 2020, to June 30, 2020. To examine the impact of the COVID-

19 pandemic on the arrival and prices of the potato crop, the study has covered different phases of lockdown, including unlock phase 1.0 and unlock phase 11.0.

Analytical Tools

Model A: Fixed Effect Panel Model

A panel data of 675 observations (weekly data of five markets for three years) is constructed and used to assess the impact of the COVID-19 pandemic on the arrival and prices of the potato crop. The model included six dummy variables for Phase I, II, III, and IV of the lockdowns announced by the Government of India to capture time effects. The first lockdown spanned 21 days from 25 March 2020 to 14 April 2020, where nearly everything was shut down except “essential services”. The second lockdown started on 15 April 2020 and continued till 3 May 2020, with conditional relaxations for regions where the Covid-19 spread had been contained. Then, with additional respites, phase three of the lockdown was from 4 May 2020 to 17 May 2020, and the fourth phase was from 18 May 2020 to 31 May 2020.

The study also considered the Unlock phase 1.0, from June 1, 2020, to June 30, 2020, as the first phase of the reopening. We have also considered unlock 11.0 phase during the year 2021, the reason behind creating a dummy to check and compare the density of impact created in the subsequent year, i.e., 2021. We have controlled for the unobservable mandi-level fixed effects. This captures whether prices, arrivals, and the severity of a pandemic differ due to unobservable factors at market levels, such as institutional or cultural factors that are unchanged in our study period.

The fixed effect panel model to see the impact of the COVID-19 pandemic on arrival is specified as

$$\ln(\text{Arrival}) = \alpha_x + \alpha_y + \sum_{i=1}^6 \beta_i \text{Phase}^t + \varepsilon_{xy}$$

Where

$\ln(\text{Arrival})$ = log of total arrival of the potato in tonnes for different markets

α_x = Week fixed effect

α_y = Market fixed effect

The fixed effect panel model to see the impact of the COVID-19 pandemic on arrival is specified as

$$\ln(\text{Price}) = \alpha_x + \alpha_y + \sum_{i=1}^6 \beta_i \text{Phase}^t + \varepsilon_{xy}$$

Where

$\ln(\text{Price})$ = log of the price of potato in Rs./qtl for different markets

α_x = Week fixed effect

α_y = Market fixed effect

We include a dummy variable for the five phases to estimate the separate effects for each lockdown phase. For example, Phaseⁱ is a dummy variable equal to one for March 25, 2020, to April 14, 2020, equal to zero otherwise, and so on.

III

RESULTS AND DISCUSSION

The Government of India announced a countrywide lockdown, severely disrupting the market operations. The state government and different market officials however put their efforts into recovering and restoring the market operations so that the market functionaries could run their businesses smoothly. To minimize large gatherings of people in one area and guarantee the government's social distancing, the concerned authority took immediate steps to properly regulate the markets even though they also established temporary markets for smooth market operations. This study analyses the five major potato markets in Punjab regarding their prices and arrival in the APMC mandies across the state during lockdown phases, including Unlock phases 1.0 and 11.0, capturing the impact of lockdown and its performance during this period.

Wholesale Prices and the Arrival of Potato During Different Lockdown Phases in Punjab

The phase-wise average wholesale prices and market arrivals of potato during the lockdown have been compared with those during the previous year (Table 1). The average wholesale price of the potato was comparatively lower before the lockdown; however, the wholesale prices rose with lockdown restrictions. The wholesale price of potato during the first phase of the lockdown was Rs. 1202 per quintal, though it was Rs 401 per quintal during the same period in 2019. While comparing the lockdown period with the corresponding period of last year, the market arrival of potato also declined from 582 tonnes to 226 tonnes (first phase of lockdown particularly). Subsequently, the prices surged. While comparing the before and after COVID-19 lockdown periods for all the phases of lockdown, the arrivals of potato declined by more than 40 per cent. In the phases, the wholesale prices of potato varied between Rs. 1202 to Rs. 1413 per quintal. The highest prices prevailed in phase III, and the lowest during the first phase of the lockdown. The average wholesale prices of potato during various phases of the lockdown showed an increasing trend until the third phase, from Rs. 1202 to Rs. 1413 per quintal. The prices declined after the third phase as the state government adopted proactive measures to restore the supply of agricultural commodities.

During the initial lockdown period, the prices increased due to market disruption and the panic created by the pandemic, and such a trend continued till the third phase. The wholesale prices declined during the later phases. During the Unlock phase 1.0, when the government took the initiative to restore the supply, the market

arrivals were at par with the normal 2021. However, the prices increased due to reasons other than lower arrivals. During Unlock phase 11.0 with lower restrictions during the year 2021, the price trend shifted downward. During this period, the wholesale prices were identical to the normal year.

TABLE 1: WHOLESALE PRICES AND ARRIVAL OF POTATO DURING DIFFERENT LOCKDOWN PHASES DURING THE COVID PANDEMIC IN PUNJAB

Lockdown phases (1)	Statistics (2)	Prices (Rs/q)			Arrival (tonne)		
		Before (3)	During (4)	t-stat (5)	Before (6)	During (7)	t-stat (8)
Phase I	Mean	401	1202		582	226	
	SD	140	280	-17.94**	482	240	4.18**
	CV (per cent)	34.6	23.5		86.4	107.7	
Phase II	Mean	558	1396		433	207	
	SD	216	342	-12.71**	295	208	3.85**
	CV (per cent)	39.2	24.4		66.2	98.4	
Phase III	Mean	653	1413		323	221	
	SD	176	328	-9.70**	267	209	-0.10 ^{NS}
	CV (per cent)	26.9	23.2		87.2	95.9	
Phase IV	Mean	696	1295		243	166	
	SD	169	369	-8.14**	97	109	-0.19 ^{NS}
	CV (per cent)	24.2	28.6		39.7	65.0	
Unlock Phase 1.0	Mean	764	1330		220	229	
	SD	174	367	-13.67**	181	166	-0.35 ^{NS}
	CV (per cent)	22.8	27.6		85.4	73.0	
Unlock Phase 11.0 ^s	Mean	480	476		553	211	
	SD	198	164	-0.21 ^{NS}	389	312	3.67***
	CV (per cent)	41.0	34.4		67.3	96.9	

** Indicates that the figures are statistically significant at a 5 per cent level

^sComparison of year 2021 with 2019 (after and before COVID)

Figure 1 shows the daily prices of potato during the lockdown and unlock phases of COVID year 2020 and normal year 2019. The gap in potato prices during the initial period widened throughout the lockdown. It signifies that the prices of potatoes were relatively high in 2020. It may be due to storage which prevents a glut

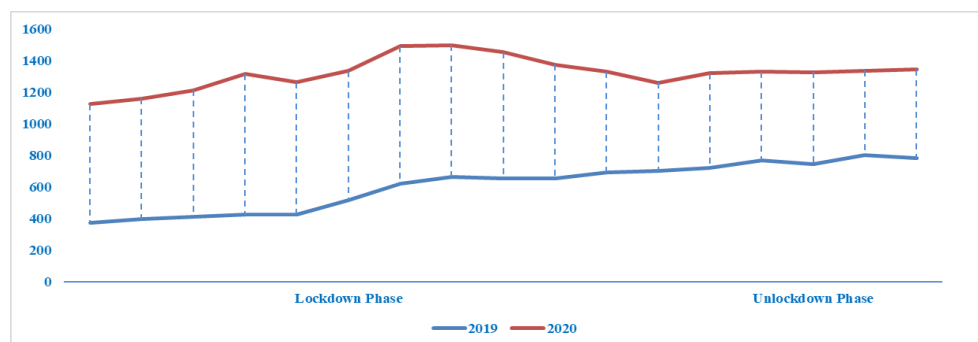


Figure 1: Wholesale Price of Potato.

or shortage in supply. Afterwards, the gap was reduced, and during the unlock phases of COVID-19, it showed only a moderate decline. The price stability was associated with its perennial nature as the crop is available throughout the year due to its better storage facilities. As a result, the market arrival of potato has sharply declined. It gradually disappeared with inadequate volume during 2020; however, during 2019, the market arrival was relatively high, as shown in Figure 2.

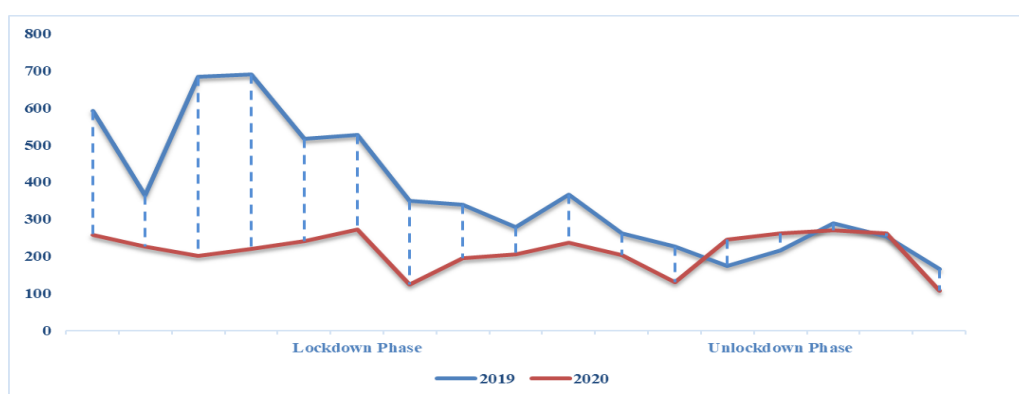


Figure 2: Market Arrival of Potato

Panel Unit Root Tests

Before analyzing the impact of lockdown, it is crucial to check whether the dependent variable Y_t is non-stationary, bringing in autocorrelation. We have utilized the panel unit root tests, i.e., Levin-Lin-Chu (Levin *et al.*, 2002); Im, Pesaran, and Shin (Im *et al.*, 2003); and the Fisher-type tests for stationarity, and our null hypotheses were rejected for almost all the series (Table 2). In other words, data are stationary for market arrival and wholesale prices of potato.

TABLE 2: VARIOUS TESTS TO CHECK THE STATIONARITY IN THE DATA

Unit Root Test		Hypothesis	Potato	
(1)	(2)		Arrival	Prices
		(3)	(4)	(5)
Levin-Lin-Chu	Unadjusted t	H_0 : Panels contain unit root	-9.240	-6.376
	Adjusted T	H_1 : Panels are stationary	-6.776	-2.438
Im-Pesaran-Shin	p-value		0.000	0.000
	z-t-tilde-bar	H_0 : All panels contain unit roots	-9.211	-4.599
Fisher-Type	p-value	H_1 : Some panels are stationary	0.000	0.000
	Chi-sq (pm)	H_0 : All panels contain unit roots	27.381	6.546
	P-value	H_1 : At least one panel is stationary	0.000	0.000

Impact of Lockdown on Prices and Arrival

The results in Table 3 show the lockdown impact of covid on arrival and wholesale prices of potato in Punjab. We have considered 2019 before the lockdown

period, and 2020 is the affected year. We have taken the wholesale price and arrival of potato from January to September of 2019 and the same for 2020. The coefficient of potato prices is positive means the pandemic has significantly influenced the prices during all the phases of the lockdown. In simple words, we can say that the prices were skyrocketing due to excess demand. During the initial lockdown period, the impact was highly positive and significant as the supply chains were abruptly disrupted due to the suspension of all economic activities.

TABLE 3: LOCKDOWN IMPACT OF COVID ON MARKET ARRIVAL AND WHOLESALE PRICE OF POTATO IN PUNJAB

Phases (1)	Ln(arrival)		Ln(prices)	
	Coefficient (2)	t-value (3)	Coefficient (4)	t-value (5)
Phase I (March 25, 2020, to April 14, 2020)	-0.56*** (0.219)	-2.55	0.59*** (0.010)	5.68
Phase II (April 15, 2020 to May 03, 2020)	-0.54*** (0.219)	-2.46	0.73*** (0.110)	7.09
Phase III (May 04, 2020 to May 17, 2020)	-0.39* (0.308)	-1.26	0.75*** (0.145)	5.16
Phase IV (May 18, 2020 to May 31, 2020)	-0.53* (0.308)	-1.72	0.65*** (0.145)	4.47
Unlock Phase 1.0 (June 01, 2020, to June 30, 2020)	-0.26 ^{NS} (0.197)	-1.32	0.68*** (0.093)	7.31
Unlock Phase 11.0 (April 01, 2021, to April 30, 2021)	-0.01 ^{NS} (0.197)	-0.06	-0.36*** (0.093)	-3.91
Constant	5.32*** (0.040)	130.88	6.48*** (0.019)	338.26
Observations	675	675	675	675
Sample Period	2019-21	2019-21	2019-21	2019-21
Year Fixed Effects	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes
Market Fixed Effects	Yes	Yes	Yes	Yes

Notes: Figures in parentheses are the standard error of the respective values; *** and ** represent significance at 1 and 5 per cent, respectively; NS: Non-significant.

On the other hand, potato arrival was negatively impacted. In addition, when we compare all the phases of the lockdown, we found it very interesting from the analysis that the impact was mitigated with the relaxation of lockdown guidelines as it was severe since its onset. In a nutshell, we can conclude that a strong negative effect on arrival influenced prices. The impact accumulated until the third phase of the lockdown in the case of wholesale prices; however, in the case of the market arrival, the effect slowed down during subsequent phases of lockdown. In this study, we have given a dummy for the period from April 1, 2021, to April 30, 2021, in Unlock Phase 11.0 to see the impact. The results show that the coefficient of prices during this period of Unlock phase is negatively significant, which signifies that the prices declined during this unlock phase 11.0. This decline in the wholesale prices of potato may be due to the fewer restrictions on the movements compared to other lockdown phases. The government measures helped in smoothening the supply, which enhanced market arrivals across the mandis during this period. The development of the COVID

pandemic adversely affected the market arrivals in Punjab, Rajasthan, and Madhya Pradesh, while the effect was positive in the case of Uttar Pradesh. The results are similar to that of Katsushi *et al.*, 2020.

IV

CONCLUSIONS AND POLICY IMPLICATIONS

The spread of COVID-19 crippled all economic activities across the globe, resulting in demand and supply disequilibrium. In this study, we took into account the interactions among the constituent changes in wholesale prices and potato market arrivals due to the covid-19 pandemic and concluded that supply chain disruptions had abruptly affected the demand-supply scenario of potato in the state. The arrival of potato crop has significantly reduced by more than 40 per cent during the lockdown period compared to before the lockdown period of the Covid-19 pandemic. Among the phases, the arrival was substantially more affected during Phase I, which raised prices during the same period. However, during the second year of lockdown, i.e., 2021(Unlock 11.0), a general negative influence is noted on the potato market arrival in the first lockdown phase though it is not significant. Still, the effect of lockdown on market arrival is not statistically significant in the unlock phase as there were no major restrictions. To tide over such short-run disruptions in the supply chain, market infrastructure and linkages should be strengthened so that the market can bear such small shocks occurring in the economy. This will not happen overnight and necessitate sustained focus and investment by considering the lockdowns necessary in such cases. This target of infrastructure development cannot be achieved in days or weeks. It would require continuous focus and novel ways of interacting with market intermediaries.

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