Agricultural Supply Chains during the COVID-19 Lockdown

A Study of Market Arrivals of Seven Key Food Commodities in India

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COVID-19 lockdown and disruption of food supply chains

The sudden announcement of a national lockdown to contain the spread of COVID-19 has resulted in a severe disruption of food supply chains. The lockdown was announced without any preparation, and nothing was mentioned about excluding agricultural production and marketing operations from the purview of the lockdown when the Prime Minister first announced these restrictions. Once the lockdown was announced, governments scrambled to keep the supply chains functioning. Agricultural mandis are where food supply chains start and it soon became clear that agricultural mandis had to function for ensuring supply of food commodities even in the short- and medium-term. On March 27, the third day of the lockdown, government announced that the agricultural marketing operations were exempted from lockdown restrictions.

In this article, we present quantitative evidence from 1331 mandis to show that, over the first three weeks of the COVID-19 lockdown, a large number of agricultural markets were not operational, and in those markets that were operational, arrivals of key agricultural commodities fell very sharply. A disruption of 21 days in being able to sell their crops would have resulted in massive losses to farmers, in particular, to producers of perishable crops.

Data

The article uses data on daily arrivals and prices from Agmarknet (`http://www.agmarknet.gov.in/`), a database of the Directorate of Marketing & Inspection (DMI), Ministry of Agriculture and Farmers Welfare, which covers over three thousand mandis nationally. We use data for seven key commodities that are harvested in this season. The commodities covered in our analysis are wheat, chickpea (chana), mustard, potato, onion, tomato and cauliflower. Wheat is the most important cereal crop of the rabi (winter) season. Similarly, chickpea is the most important pulse crop and mustard the most import oilseed crop of the rabi season. Potato, onion, tomato and cauliflower are among the most important vegetable crops.

We have compiled daily data for March 15-April 14 for 2017, 2018, 2019 and 2020 for all the mandis in which these commodities were sold. For 2020, this includes the 21 day period of the first phase of the lockdown. The dataset covers a total of 2055 mandis from 18 States. Of these 1331 mandis reported some data between March 15, 2020 and April 14, 2020. We are considering only these mandis in our analysis. That is, mandis that were not reporting any data since March 15, 2020 have been excluded from the last three years as well to avoid any over-estimation of the decline in mandi operations between the earlier years and 2020. If some mandis were not reporting data since March 15, 2020 either because they were already closed or because they stopped reporting data for some administrative reasons, these have been excluded from the entire analysis.

This exclusion results in an under-estimation of the supply in the previous years as mandis on which information of arrivals are excluded. In particular, mandis that

We are grateful to comments by Jayati Ghosh and Abhijit Sen. This work could not have been done without the support of Jyotirmoy Bhattacharya in compiling the data set. Amit Dhiman and Pawan helped by identifying gaps in the data set and plugging them. The usual disclaimer applies.

are seasonal, and would have operated in the period of the lockdown as they did in previous years during this period, are excluded from the analysis.

Our final dataset includes mandis from 20 States of India. Number of mandis covered in each State are presented in Table 1. While this is a broad coverage, inclusion of mandis is determined by availability of information on the Agmarknet website. It may be noted that no data were available for Bihar and Tamil Nadu. Table 2 provides information on number of mandis from different States that were dropped from the analysis because they did not report any arrivals since March 15, 2020. It may be noted that almost all the mandis of Maharashtra were dropped from the analysis because they were not reporting data to the Agmarknet database from before the lockdown. Data from a number of mandis from wheat growing states such as Punjab, Haryana, Rajasthan, Madhya Pradesh and Chhattisgarh were also dropped because of the same reason. It is likely that many of these mandis have seasonal operations and were yet to start functioning when the lockdown was announced. Their exclusion results in under-estimating the extent of decline in Mandi operations but we chose to exclude this to avoid the criticism that we might be overstating the problem by including mandis that were not functional since before the lockdown.

Table 1: Number of mandis from different States covered in the dataset

	State	2017	2018	2019	2020
1	Andhra Pradesh	11	0	11	8
2	Chhattisgarh	21	23	25	27
3	Gujarat	94	95	108	36
4	Haryana	52	69	65	65
5	Himachal Pradesh	13	18	20	12
6	Jammu and Kashmir	5	4	4	8
7	Jharkhand	1	1	1	1
8	Karnataka	66	69	72	85
9	Kerala	67	66	67	49
10	Madhya Pradesh	232	234	254	54
11	Maharashtra	1	1	1	1
12	Nagaland	1	3	4	2
13	Odisha	55	61	64	46
14	Punjab	103	101	99	74
15	Rajasthan	120	125	126	57
16	Telangana	13	12	15	6
17	Tripura	17	20	18	26
18	Uttar Pradesh	159	228	231	223
19	Uttrakhand	17	17	17	8
20	West Bengal	67	66	67	57

Table 2: Number of mandis from different States for which data from 2017–2019 were excluded because of lack of availability of information since March 15, 2020

	State	2017	2018	2019
1	Andaman and Nicobar	2	0	1
2	Andhra Pradesh	27	0	3
3	Arunachal Pradesh	0	1	0
4	Assam	19	15	8
5	Bihar	1	1	0
6	Chandigarh	1	1	1
7	Chhattisgarh	19	27	25
8	Goa	0	1	1
9	Gujarat	31	18	17
10	Haryana	23	30	22
11	Himachal Pradesh	0	1	4
12	Jammu and Kashmir	2	2	2
13	Jharkhand	24	19	4
14	Karnataka	5	6	6
15	Kerala	6	7	4
16	Madhya Pradesh	15	16	19
17	Maharashtra	231	226	235
18	Manipur	5	5	5
19	Meghalaya	8	8	7
20	Mizoram	0	2	1
21	NCT of Delhi	5	5	5
22	Nagaland	1	1	1
23	Odisha	22	24	10
24	Pondicherry	0	0	1
25	Punjab	86	59	24
26	Rajasthan	22	22	20
27	Tamil Nadu	1	0	0
28	Telangana	14	18	10
29	Tripura	2	1	0
30	Uttar Pradesh	4	20	17
31	Uttrakhand	4	4	3
32	West Bengal	7	7	6

How many mandis were functional during the lockdown?

The data we have compiled for the mandis from across the country show that a large number of mandis remained non-functional throughout the three-week period. Figure 1 shows that a large number of mandis did not have arrivals of wheat, chickpea and mustard throughout the 21 day period. For example, wheat was sold in only 264 mandis during the period of lockdown in 2020 while in the same 21-day period in 2019, wheat was sold in 688 mandis. During the 21-day period of the first phase of the lockdown, chickpea was sold in only 174 mandis and mustard was sold in only 152 mandis.

The situation was somewhat better in case of perishable crops though not all mandis where these crops were sold were functional during the period of the lockdown. In comparison with last year, the number of mandis buying potato and onion fell by 70, the number of mandis buying tomato fell by 48, and the number of mandis where cauliflower was traded fell by 25.

Table 3 shows that a number of mandis where both grain and perishables were marketed in 2019 were only dealing with perishables during the lockdown. Of the 325 mandis where both grain and perishables were marketed between March 25 and April 14, 2019, only perishables were marketed in 100 mandis during the period of the lockdown. On the other hand, of the 449 mandis in which only grain was marketed during this period in 2019, 326 were non-functional during the period of the lockdown.

This suggests that, given the limited capacity to function during the lockdown, a large number of mandis limited their operations to only perishable commodities.

Of all the States covered in the data set, the problem of non-functional mandis was most severe in Madhya Pradesh, where only 43 out of 259 mandis were functional during the lockdown. Similarly, Only 57 out of 132 mandis in Rajasthan and only 34 out of 113 mandis in Gujarat were functional during the lockdown (Table 4).

Figure 1: Number of mandis reporting arrivals on at least one day during the Phase-I of the national lockdown

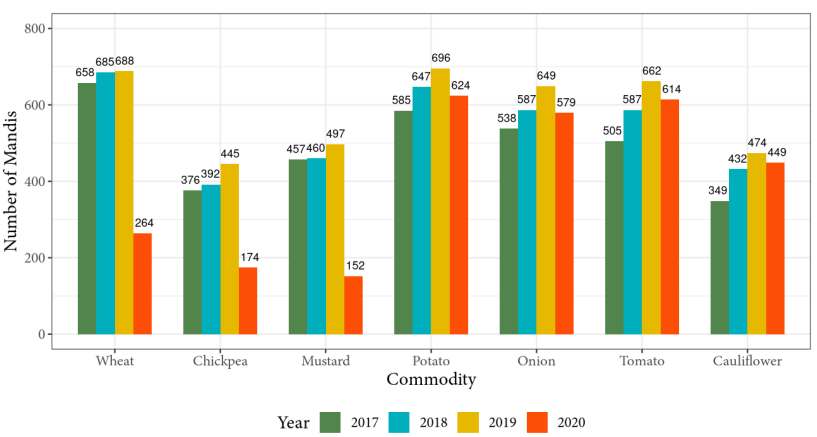


Table 3: Number of mandis selling grains (wheat, chickpea and mustard) and perishables (potato, onion, tomato and cauliflower) between March 25 and April 14 in 2019 and 2020

In 2019, mandis selling	In 2020, mandis selling				
	Grain and perishables	Grain only	Perishables only	Non-functional	Total
Grain and perishables	177	3	100	45	325
Grain only	13	97	13	326	449
Perishables only	12	0	351	116	479
Non-functional	3	21	33	15	72
Total	205	121	497	502	1325

Table 4: Number of mandis that were operational between March 25 and April 14, 2019 and 2020, by State, India

State	Mandis functional during lockdown	Mandis covered in data set
Andhra Pradesh	7	10
Chattisgarh	27	28
Gujarat	34	113
Haryana	65	72
Himachal Pradesh	12	21
Jammu and Kashmir	8	8
Karnataka	83	91
Kerala	49	67
Madhya Pradesh	43	259
Maharashtra	1	1
Nagaland	2	4
Odisha	46	65
Punjab	74	104
Rajasthan	57	132
Telangana	6	16
Tripura	26	27
Uttar Pradesh	223	234
Uttrakhand	8	17
West Bengal	57	68

Quantity of crop produce marketed during the lockdown

What do the data on actual arrivals show?

Figure 2 shows that only 1.32 lakh tonnes of wheat was sold in the mandis during the period of the lockdown. This was only about 6 per cent of the total amount of wheat sold in the same 21-day period in 2019, and only 3.4 per cent of the total amount of wheat sold in the mandis in this period in 2017. Compared to the quantity sold in 2019, the arrivals in 2020 were also only 6 per cent for chickpea and 4 per cent for mustard.

Given that a large number of mandis shifted their focus to perishables, the situation in respect of these commodities was a little better. However, even in these crops, a significant drop in arrivals is seen. The drop in arrivals was very large for onions (70 per cent) and potato (59 per cent). In case of tomato, arrivals during the period of lockdown were 26 per cent less than the arrivals in the same period last year. The shortfall was lowest (11 per cent) in case of cauliflower.

While the extent of decline in quantity of arrivals was less in perishables than in grain, it must be noted that, even with this level of decline in marketing, a considerable amount of perishables would have remained unsold with farmers. Given high degree of perishability of these products, the losses on account of inability to sell the produce for a prolonged period may have been substantial.

Figure 3 presents cumulative daily arrivals. To account for weekly holidays, in this Figure, comparison is made between the same days of the same week of the year, starting from Saturday of 10th week of the year (which was on March 17, 2019 and March 15, 2020) to Wednesday of the 15th week of the year (which was on April 16, 2019 and April 14, 2020). The figure shows that the daily arrivals for all the crops except chickpea and potato were higher in the pre-lockdown period in 2020 than in the corresponding period in 2019. A clear deceleration is seen in arrivals of all crops after Saturday of the 11th week (March 21) in the current year.

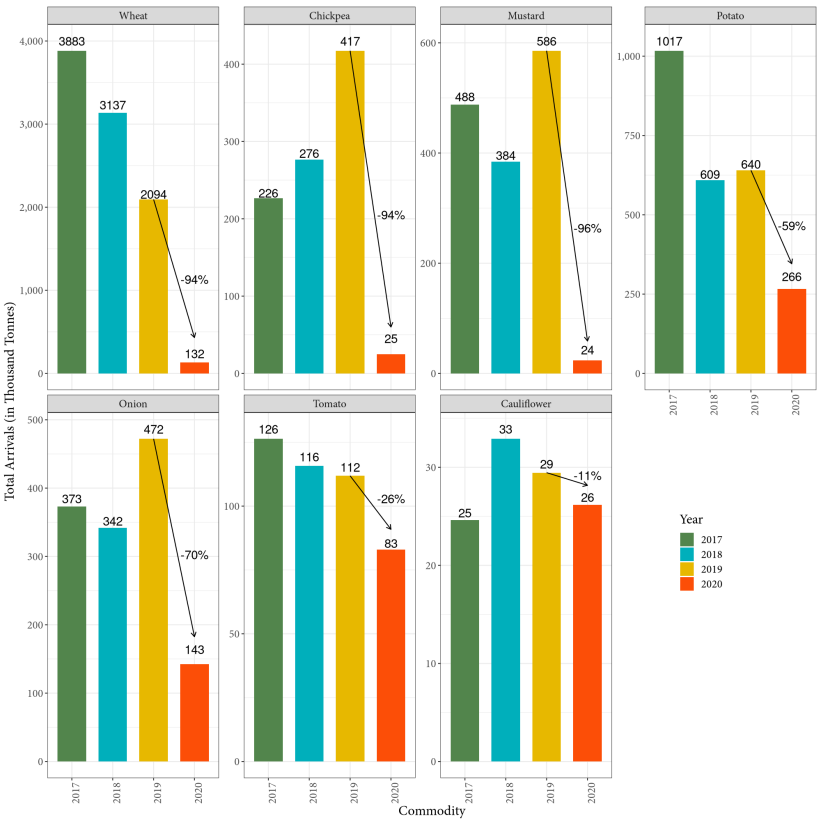
In comparison with other crops, quantity of production and sales of cauliflower are small. Even in 2019, the total arrivals of cauliflower during the 21-day period was only about 29 thousand tonnes. This should be kept in mind while interpreting the trends for cauliflower which show that arrivals picked up towards the end of the first phase of the lockdown period, and by the end of the first phase, the cumulative arrivals were just a little lower than the total arrivals during this period last year.

In all the major crops, particularly for grains but also for potato, onion and tomato, the gap between arrivals last year and arrivals this year continued to steadily increase throughout the period of the lockdown.

Figure 4 shows the percentage decline in the quantity of arrivals in the March 25 to April 14 period between 2019 and 2020 for States for which a substantial number of mandis are covered in the database. The table shows that, barring a few exceptions, the arrivals of all commodities declined in most of the States. If we look at States which had substantial arrivals of these crops, the only significant exception is Karnataka, where a significant increase in arrivals of tomato are recorded. In case of cauliflower, UP saw a positive growth, but since the total quantity of arrivals is very small even for UP, this is not really very significant.

In Figure 5 we have marked individual mandis on the map, classifying the mandis by the extent of drop they had in the volume of arrivals. Mandis that did not have any arrivals during the period of the lockdown but had some arrivals in

Figure 2: Total arrivals of key food commodities in mandis, March 25-April 14, 2017-2020 (Thousand tonnes)



the same period last year are marked in blue. Mandis that did not have any arrivals of a commodity during this period either this year or last year are marked in grey.

In case of grains, one finds that a large number of mandis did not report any arrivals of produce though wheat, chickpea and mustard were traded in these mandis during the same period last year. These mandis, marked in blue, are seen to dominate in Madhya Pradesh, Gujarat and Rajasthan. In Uttar Pradesh, Chhattisgarh and Karnataka, although some mandis were reporting grain arrivals, a dominance of red, reflecting very low arrivals, is seen in all these cases. It is noteworthy that wheat harvesting has been delayed in Haryana and Punjab because of longer winter as well as the lockdown. However, in these two states, harvesting was delayed last year as well. As a result, one finds that, in case of wheat, mandis in Haryana and Punjab are marked in grey (no arrivals this year or last year). This is a very important point because it may be argued that very low arrivals of wheat during the period of the lockdown is a result of delayed harvest in northern India. This is not true because harvest in northern India was delayed last year as well. In fact, as can be seen in Figure 1, the total arrivals of wheat between March 25 and April 14 last year was only 48 per cent of the arrivals during the same period in 2018. This suggests that the low levels of wheat arrivals this year is not because of delayed

Figure 3: Cumulative arrivals from saturday of 10th week of the year to wednesday of the 15th week of the year, key agricultural commodities marketed during the period of the lockdown

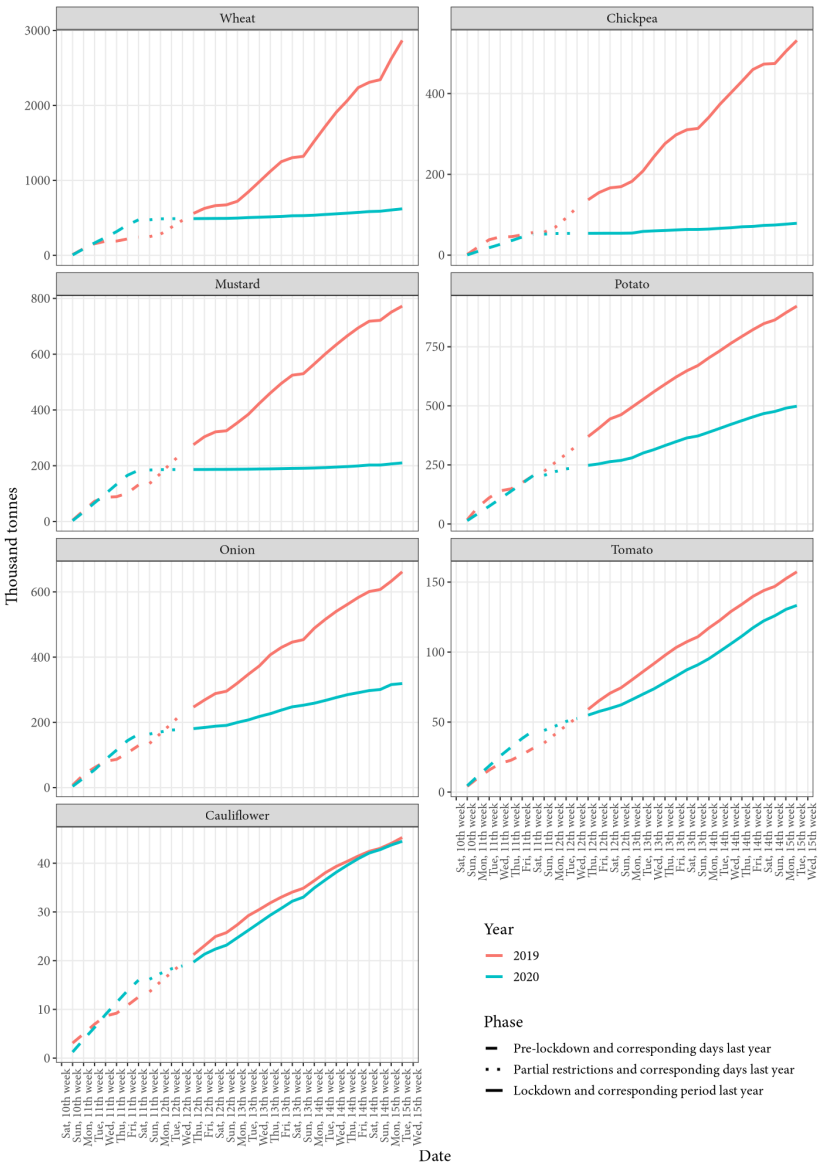
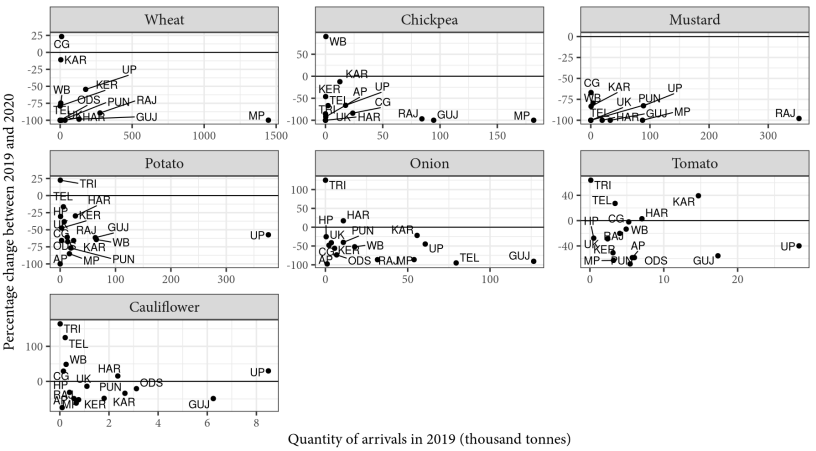


Figure 4: Quantity of arrivals in 2019 and percentage change in arrivals between 2019 and 2020, March 25 and April 14, by State



harvest but because of non-functioning mandis across central India where wheat is normally harvested before it is harvested in Punjab and Haryana.

In case of potato, onion and tomato, the maps show a dominance of red dots, representing low arrivals, across all the states. Although these commodities were being traded in the mandis, the quantity of arrivals was very low.

Impact on mandi prices

The data on prices shows an increase in volatility of prices of most commodities during the period of the lockdown (Figure 6). For wheat, chickpea, onion, cauliflower and tomato, prices fell after an initial jump and have seen considerable volatility. For onion, the declining trend in mandi prices seems to have continued after the lockdown except for a brief upward spurt initially. On the other hand, for mustard and potato, prices jumped and then have hovered around the increased level.

Apart from mustard and potato, one does not see a significant tendency of an increase in mandi prices as a result of decline in quantity of arrivals. In case of wheat, this is not surprising because large (over 25 million tonnes) of public stocks of wheat held by the Food Corporation of India have been putting a downward pressure on the prices of wheat. Given the large quantity of public stocks, it was clear that there would not be any shortage of wheat at least in the short-run despite low levels of market arrivals.

Figure 5: Change in quantity of arrivals between the lockdown period and the same dates in 2019 in mandis across India, key agricultural commodities marketed during the period of the lockdown

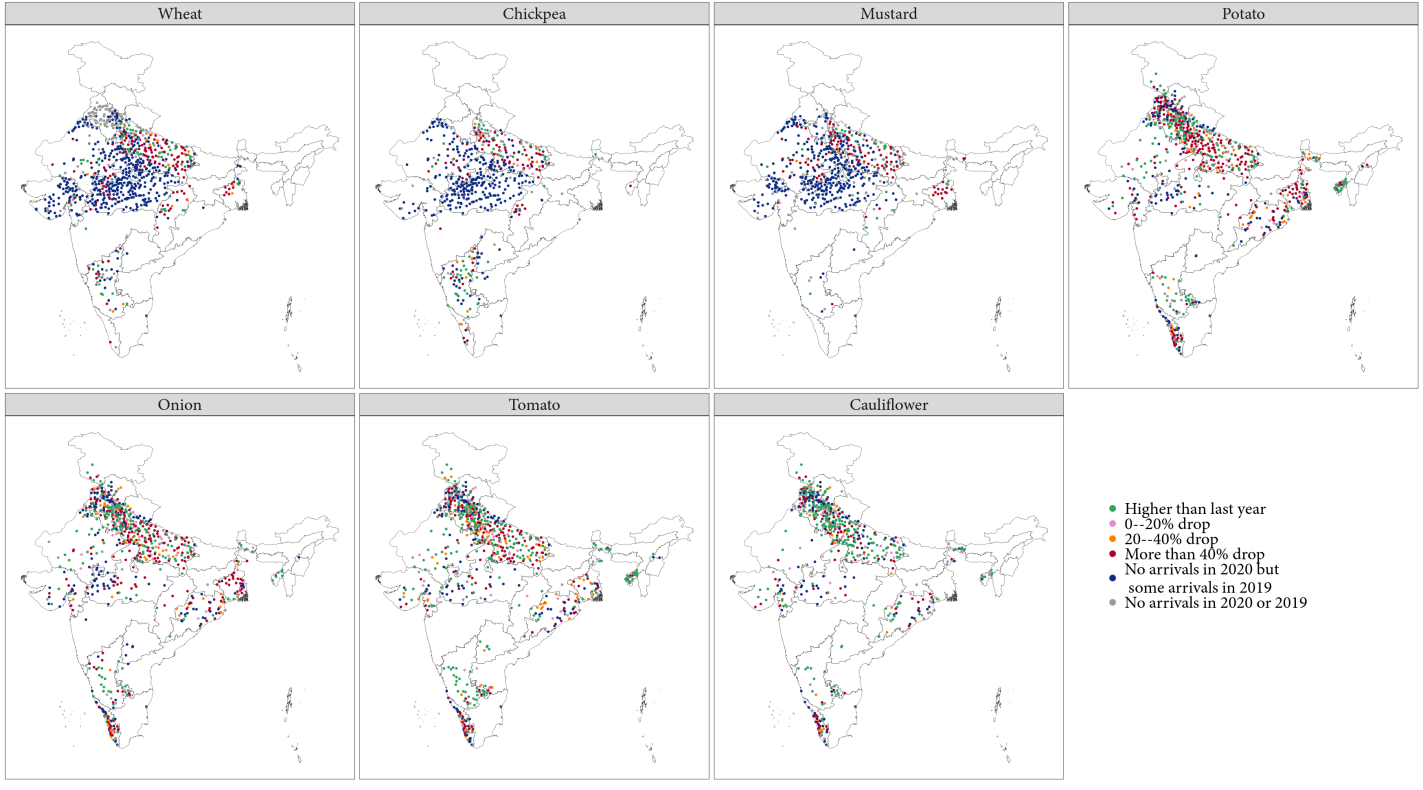
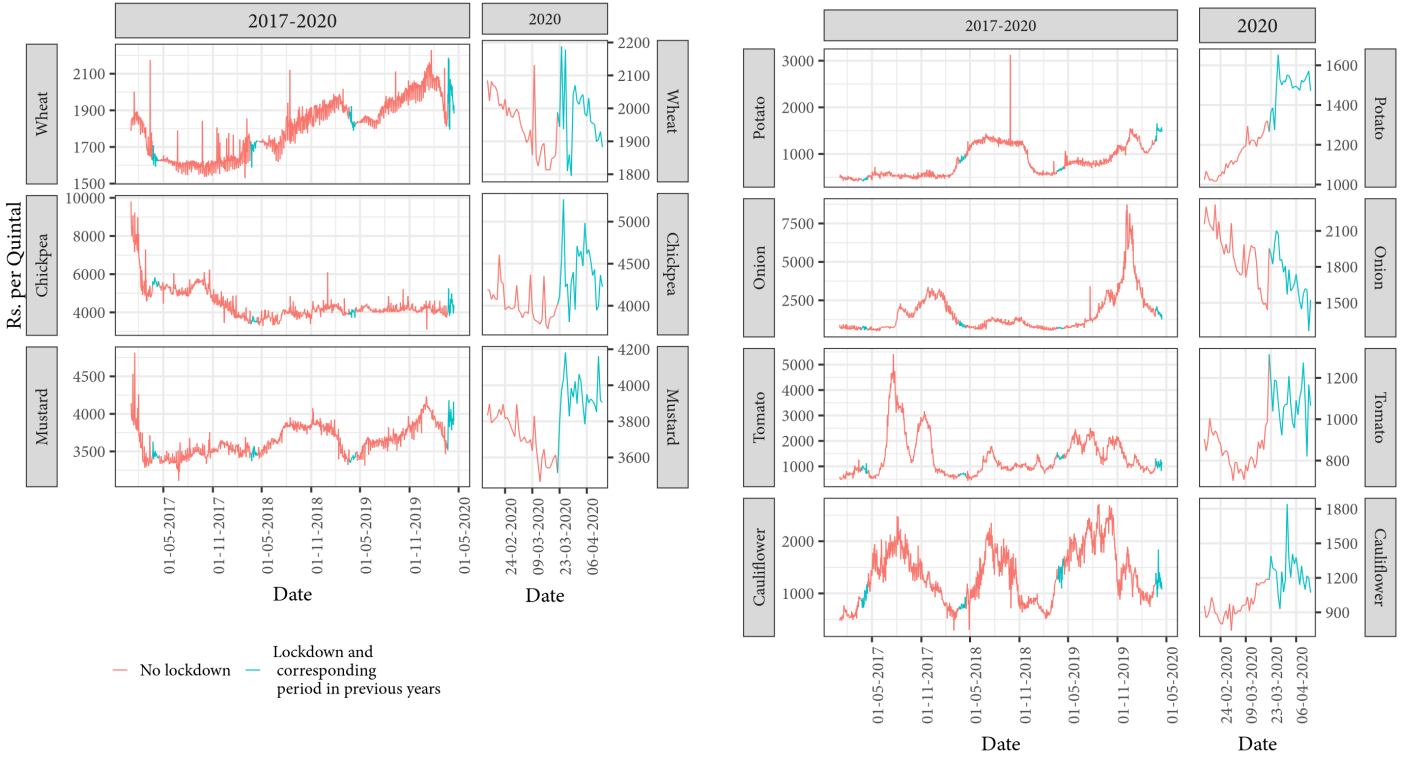


Figure 6: Daily average mandi prices (nominal) of different commodities, 2017–2020



Notes:

1. The figure shows average prices across mandis weighted by the quantity of arrivals.
2. For each commodity, the figure shows trends of average prices between 2017 and 2020, and a magnified view of the trends after February 15, 2020.

However, the fact that prices have not seen any significant jump even for vegetables like tomato, onion and cauliflowers suggests that the traders were not willing to offer higher prices despite the fact that the supply had fallen drastically. This is likely to have been because of downstream disruptions in the supply chain and depressed demand (because of loss of incomes and employment for a large proportion of households).

Concluding remarks

This article is the first quantitative assessment of the functioning of agricultural markets during the COVID-19 lockdown. The sudden imposition of the lockdown, with very little preparation or planning, has impacted agriculture and the food systems in many different ways. Of these, the disruption in functioning of the agricultural markets has been one of the most significant. Given the agro-climatic variations across the country, agricultural production was in different stages in different parts of the country when the lockdown was enforced. In northern and central India, rabi crops were being harvested or were about to be harvested. In other areas, winter crops had already been harvested and summer (*zaid/boro)* crops, which are short-duration bridge crops between rabi harvest and kharif sowing, were being sown or were about to be sown. It is clear that the government had made no advance preparations to ensure that the supply chains, especially of essential food items, continued to function. It was only on March 27th, three days after the national lockdown and 5 days after the first round of restrictions (starting with *janta* curfew) were enforced, that the government announced exemption of agricultural mandis from the restrictions of the lockdown.

The article uses data on daily arrivals and prices for seven key rabi crops from 2055 mandis across the country to show that the lockdown resulted in a massive contraction in the amount of crop produce that was sold in the mandis. There is no doubt that the lack of prior preparation to ensure continued functioning of agricultural markets during the COVID-19 lockdown has caused immense distress to the peasantry.

The evidence presented in this article strongly suggests that, although the government exempted agricultural mandis from lockdown restrictions on March 27th, in absence of complementary measures to ensure availability of labour, facilitate safe transportation of produce from villages to the mandis and taking measures to ensure safety of those involved in transportation and marketing, these administrative decisions have been completely ineffective.

Agricultural mandis in India have very low levels of mechanisation. Operations such as loading and unloading, cleaning, sorting and packaging of the produce are all done manually. Migrant workers and rural workers from nearby villages constitute the main workforce involved in these operations. The announcement of a prolonged lockdown forced hundreds of thousands of migrant workers to use whatever means were available, including walking hundreds of kilometers, to return to their villages. Local workers, who commuted to the towns to work in mandis, were also unable to do so because of the lockdown. As a result, even though mandis were allowed to function, severe labour shortage thwarted any such possibility.

Taking crop produce to the mandi requires considerably mobilisation of labour by the farmers as well. In case of highly perishable crops, the crop has to be harvested/picked just before it is to be taken to the market. Even for other crops,

in many such cases, harvesting and post-harvest operations (such as threshing and winnowing) were not done before the lockdown. Inevitably, farmers need to load the produce onto the carts or tractor trolleys before it can be taken to the mandis. All these operations are labour intensive and require a number of workers to assemble to work together. With the lockdown in place, most farmers would have been either unable to carry out these tasks or, at best, would have managed to do them at a snail's pace. This is likely to be another factor why the marketing operations continued to be hampered.

Our data show that, in comparison with the same period last year, only 6 per cent of the wheat was sold during the 21 days of the first phase of the lockdown. The situation was similar in case of chickpea and mustard. The data shows clearly that, functioning under severe constraints, mandis were forced to focus on perishables and did not have capacity for marketing of grain. The focus on these crops may also have been dictated by the fact that, while India has large stocks of wheat, disruption in supply of vegetables, which constitute a more important item in the consumption basket of middle-income and affluent households in urban areas than they do in the consumption baskets of the poor, may have a higher political cost.

Although the extent of the decline in arrivals varied across crops, it was very large for all the seven crops covered in this study. It is noteworthy that, while arrivals of wheat and mustard, the two most important rabi crops, were higher than last year in the pre-lockdown period, the arrivals slowed down very sharply after the lockdown was imposed.

The daily data show that, for a number of crops, arrivals in the pre-lockdown period were higher than in the corresponding period last year. For all the crops covered in this study, one finds a distinct deceleration in arrivals after restrictions were imposed. In all the major crops, the gap between arrivals last year and arrivals this year continued to widen throughout the 21 day period of the first phase of the lockdown.

The sudden announcement of a national lockdown to contain the spread of COVID-19 has resulted in a severe disruption of food supply chains. The lockdown was announced without any preparation, and nothing was mentioned about excluding agricultural production and marketing operations from the purview of the lockdown when the Prime Minister first announced these restrictions. Once the lockdown was announced, governments scrambled to keep the supply chains functioning. On March 27, the third day of the lockdown, government announced that the agricultural marketing operations were exempted from lockdown restrictions.

This study presents quantitative evidence from 1331 mandis to show that, over the first three weeks of the COVID-19 lockdown, a large number of agricultural markets were not operational, and in those markets that were operational, arrivals of key agricultural commodities fell very sharply. A disruption of 21 days in being able to sell their crops would have resulted in massive losses to farmers, in particular, to producers of perishable crops.

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agricultural markets, supply chains, agricultural marketing, COVID-19, lockdown, India

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