India's Agricultural Commodity Market Integration

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Abstract

It has been recorded how well certain Indian domestic markets for agricultural goods now integrate. It was discovered that different commodities had varied levels of integration and variable rates of price transmission. In comparison to other perishable goods, cereals like rice and wheat shown superior integration. Both the wholesale and retail markets for wheat and rice were integrated throughout the long and short terms. Because there are no trade restrictions on the domestic trade of grammes in India, grammes also shown stronger market integration. Due to inadequate market institutions and infrastructure, a lack of local supplier rivalry, and insufficient market infrastructure, India's domestic apple markets were not properly integrated. Other fruit markets, such as those for banana and pineapple, also shown a lack of integration. Domestic potato markets were weakly integrated as compared to onion markets, which were more integrated. It was discovered that the price and information transfer between the futures and spot markets of various agricultural commodities was efficient. In the cases of chickpea, wheat, and maize, the spot and futures were merged, although barley's were not. Wheat and maize markets showed greater price discovery efficiency.

Keywords: Agricultural Commodities, Market Integration, Price Discovery, And Price Transmission

INTRODUCTION

The one that would provide the most advantages to all the participants in the marketing

chain is a well-organized and effective marketing system. An effective marketing system must have flawless market integration and complete pricing transfer. This kind of marketing system would quickly adapt pricing fluctuations and exclude arbitrage that is not profitable. It's possible that India's current agricultural marketing system's structure makes it difficult to increase marketing effectiveness. Improvements in the market integration of agricultural commodities in India are hampered by inadequate infrastructure and a lack of information distribution.

If the price difference between two markets for a homogeneous good is equal to the transfer costs associated with transporting that good between them, that market is said to be geographically integrated. Information on the spatial market integration would provide suggestions on market performance generally, including competitiveness, arbitrage efficacy, and pricing efficiency. The market integration studies may provide details on market performance needed for macroeconomic modelling and policy formation. Additionally, manufacturers' marketing choices would be misled by price signals sent by non-integrated marketplaces, leading to ineffective product movement.

Here, an effort is made to determine the level of market integration among the domestic markets of the main agricultural commodities in India, taking into account the importance of the data emerging from research on market integration. To get a comprehensive picture, the authors combine their own estimates with data from market integration studies undertaken by renowned experts in India. This research will aid in understanding how successful price policy is because if all agricultural markets are not connected at the national level, a national price policy would not be appropriate.

The pricing information for the agricultural products taken into consideration in the

research is collected on a monthly basis from India's main marketplaces. The price series span for various commodities varies depending on the data's availability, and it consists mostly of information from the last fifteen years. The Augmented Dickey-Fuller (ADF) test was used to determine the stationarity of each price series, and those that were integrated to order one were eligible for the Johansen co-integration test. The maximal eigen value test and the trace test were used to determine the number of co-integrating equations. The coefficients of the co-integrating equations and Granger causality were used to determine the long-run link between the market pairings.

Market integration for food grains

It was discovered that the domestic rice markets were interconnected throughout the long and short terms. However, the causation between the markets is not necessarily one-way.

It was also discovered that some of the geographically well-separated wholesale markets were merged, however the market pairings displayed variations in the pace of adjustment (Table 1). Mumbai and Kolkata, Delhi and Chennai, Hyderabad and Chennai, and their respective wholesale markets, were all connected. The long-term convergence of wholesale prices in various markets is indicated by the negative coefficient of the speed of adjustment for various pairings of markets. In the instance of Chennai-Hyderabad, 22% of the deviation from long-run equilibrium will be rectified each month.

In the cases of Chennai-Delhi and Kolkata-Mumbai, where the adjustment speed is 13% and 7%, respectively, it is slower than this.Over time, there was an equilibrium connection between wheat wholesale market prices. The western region's Mumbai market and the southern regions' Bengaluru and Hyderabad markets were discovered to be connected with Delhi's market. However, the direction of causation from Delhi to

Mumbai, Bengaluru, and Hyderabad was unidirectional. The wholesale marketplaces in the southern area displayed unidirectional causation and integration.

With price signals going from Bengaluru and Hyderabad to Chennai, the markets in Bengaluru, Hyderabad, and Chennai were integrated (Acharya et al., 2012).\

Table 1. Speed of adjustment and causality among the domestic rice and wheat market pairs

Market pair	*Coefficient of speed of adjustment*	*Direction of price transmission*
Horizontal price transmission among rice wholesale markets		
Chennai-Hyderabad	-0.21	Bi-directional
Chennai-Delhi	-0.12	Bi-directional
Kolkata-Mumbai	-0.07	Mumbai to Kolkata
Horizontal price transmission among wheat wholesale markets		
Chennai-Bengaluru	-0.11	Banagaluru to Chennai
Bengaluru-Delhi	-0.13	Delhi to Bengaluru
Chennai-Hyderabad	-0.15	Hyderabad to Chennai
Hyderabad-Delhi	-0.10	Delhi to Hyderabad
Mumbai-Delhi	-0.14	Delhi to Mumbai

Source: Acharya et al., 2012.

Using the Johansen cointegration test, the co-integration of significant maize markets was investigated. The market pairings chosen seemed to have a cointegrating link, according to the trace test and maximal eigen value test. The prices of maize in various marketplaces have a clear positive association with one another. The cointegrating vector demonstrated that a 1% increase in price at the Delhi market causes a 0.29% increase in pricing at the Dohad market (Table 2). According to the Granger causality test, the

changes in the Dohad market are statistically caused by the Delhi market. The price of the Kanpur market increases by 1.35 and 2.24 percent for every one percent rise in the price of the Gokak and Kolkata markets, respectively.

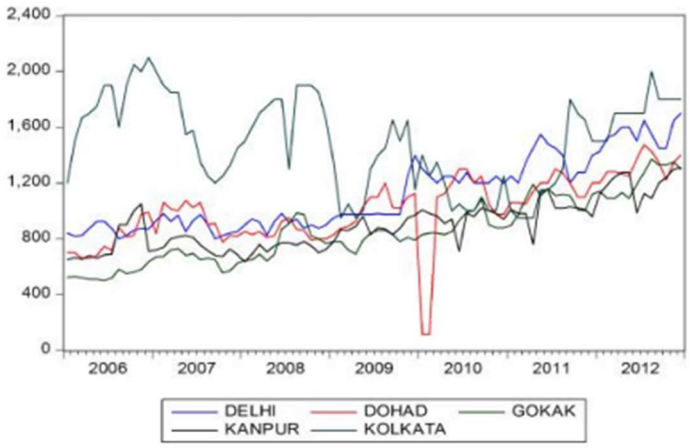

Fig. 1. Monthly price of maize (2006-12) in major domestic markets (Rs. /Qtl)

Table 2. Integration of maize markets

Market pairs	*Long-run coefficients*	*Causality*
Delhi-Dohad	-0.29	Delhi to Dohad
Gokak-Kanpur	-1.35	Gokak to Kanpur
Kolkata-Kanpur	-2.24	Kolkata to Kanpur

Gram's market integration has improved as a consequence of the domestic market system now in place in India. At the national and regional levels, it was discovered that the gramme markets were entirely interconnected. The western, northern, and eastern parts of

India's gramme markets were all merged. These markets also showed evidence of interregional market integration. However, the length of time needed for price shocks to dissipate varied between locations. Price shocks will subside at the national level in ten months, compared to five months for the western and northern areas and fifteen months for the eastern region. The main reason for the stronger market integration of gramme at the national and regional levels in India may be the lack of limitations on its domestic commerce (Sekhar, 2012).

Market integration for edible oils

India's major domestic marketplaces for edible oils and oilseeds are interconnected because prices on these markets fluctuate in tandem with variations in supply and demand. The Augmented Dickey-Fuller and Phillips-Perron tests showed that the prices of oilseed and edible oil in the chosen domestic marketplaces were integrated of order one. The Schwarz information criterion recommended a lag duration of one for all the series as the ideal value. The Johansen co-integration test findings showed that there was at least one co-integrating link between the primary markets for mustard oilseed and groundnut and its oil. When it came to the markets for mustard oil, there was no co-integrating link.

For every 1% rise in groundnut pricing in the Rajkot market, there is a 0.97 % increase in the price in the Hyderabad market (Table 3). In order to preserve the long-term equilibrium with the Rajkot pricing, the Hyderabad price adjusts itself by 25% in the short run. In the instance of groundnut edible oil, the short-term pricing at the markets in Chennai and Jaipur are adjusted by 22% and 16%, respectively, in order to preserve the long-term equilibrium. In this pair, a 1% change in any one market's price results in a

0.88% change in the price of the other market. To maintain equilibrium with the Delhi market, the price at the Hingna market is adjusted by 31% (Sundaramoorthy et al., 2014).

Table 3. Long-run coefficients of error correction model for oilseed and edible oil markets

Commodity	*Market pair*	*Long-run coefficients*	*Causality*
Groundnut oilseed	Hyderabad-Rajkot	-0.97	Rajkot to Hyderabad
Groundnut edible oil	Chennai-Jaipur	-0.88	Bi-directional
Mustard oilseed	Delhi-Hingna	-1.18	Delhi to Hingna

Integration of Markets for Fruit and Veggies

India's local apple markets seem to be not very well integrated. The pricing in other local marketplaces have not changed as a result of the Delhi market, which handles more than 70% of India's domestic apple production. India's geographical pricing disparities are a result of a lack of local supplier competition, poor market institutions, and insufficient market infrastructure. The results of the pairwise test for co-integration using the Phillips-Perron test for the apple market pairings of Bengaluru-Mumbai, Kolkata-Mumbai, Mumbai-Kolkata, Bengaluru-Kolkata, and Kolkata-Bengaluru (Table 4) showed that the prices in these pairs were cointegrated. barely the prices in Mumbai and Delhi were cointegrated, and the degree of importance was barely 5%. Despite the markets' integration, there was a delay in the transmission of prices between them.

The Bengaluru and Kolkata markets modify their pricing to changes in the Mumbai markets over the course of more than two weeks. Therefore, infrastructural investments are required, and institutions to increase market efficiency should be conceptualised, in

order to strengthen the market integration across local apple markets (Deodhar, 2005).

Table 4. Pairwise co-integration of apple markets

Dependent variable	*Independent variable*	*Phillips-Perron Test*
Bengaluru	Mumbai	-5.0577*
	Kolkata	-6.0628*
	Delhi	-3.6218
Mumbai	Bengaluru	-3.7663
	Kolkata	-5.7100*
	Delhi	-2.5926
Kolkata	Bengaluru	-4.5672*
	Mumbai	-5.5744*
	Delhi	-2.2124
Delhi	Bengaluru	-3.5841
	Mumbai	-3.7807**
	Kolkata	-3.7162

According to Kar, et al.'s (2004) research on the integration of the apple market, prices in Delhi and Mumbai are linked to Bengaluru and Kolkata market lag prices. The rates in Chennai, Kolkata, and Chandigarh marketplaces are also connected with those in Delhi, Mumbai, and other cities. All other market combinations taken into consideration for the research were unable to establish the presence of any kind of integration.

It was discovered that India's domestic marketplaces for pineapple and bananas were not well integrated. Delhi and Hyderabad market prices were impacted by changes in the Benagaluru market's banana pricing. However, none of the main markets' prices were affected by the markets in Delhi, Mumbai, or Hyderabad.

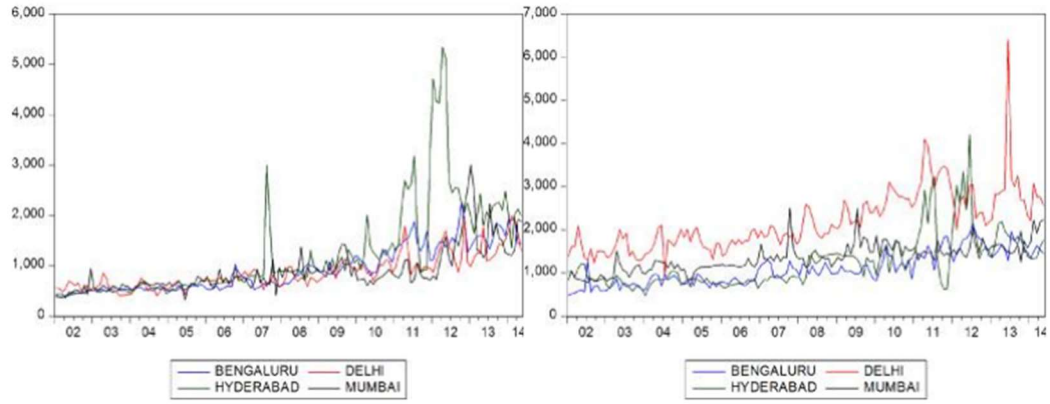

Fig 2. Monthly price of Banana and Pineapple (2002-14) in major domestic markets (`/Quintal)

The Delhi and Hyderabad markets saw price increases of 2.76 and 0.66 percent and 0.66 percent, respectively, in response to a 1% increase in the price of bananas in the Benagaluru market. The only market pair that showed cointegration in the pineapple market study was Bengaluru and Delhi, with the causation extending from Bengaluru to Delhi.

Table 5. Banana market integration

Market pairs	*Long-run coefficients*	*Causality*
Bengaluru-Delhi	-2.76	Bengaluru to Delhi
Bengaluru-Hyderabad	-0.66	Bengaluru to Hyderabad

At the national level, India's domestic potato markets were not integrated.

Even marketplaces that were not physically far apart from one another could not communicate via price signals. The findings of the correlation coefficients of potato price revealed that the close markets, where there is little danger of rotting during transit, were not integrated. The main potato market is in Delhi, and during the months of October and December, prices at regional marketplaces varied the most from those in Delhi. Poor market integration for potatoes in India is mostly the result of flaws and bottlenecks in the marketing infrastructure (Rana et al., 2003).

However, several of the marketplaces in West Bengal displayed market integration.

The lag pricing of the Behrampura and Siliguri marketplaces is integrated with significant West Bengal markets like Kolkata and Howrah. Similar to how Siliguri, Malda, and Behrampur pricing were linked to Kolkata and Howrah lag prices.

According to Roy (2010), the potato price in the market in Kolkata and the lag price in Howrah are related. These outcomes are a consequence of the close proximity of the marketplaces and the superior infrastructure and communication facilities present in that specific area.

Table 6. Correlation coefficient in monthly wholesale prices of onion (1999-2011)

	Ahmedabad	***Bengaluru***	***Mumbai***	***Kolkata***	***Delhi***
Ahmedabad	1	0.871	0.285	0.908	0.819
Bengaluru		1	0.863	0.898	0.796
Mumbai			1	0.84	0.774
Kolkata				1	0.84
Delhi					1

The zero order correlation matrix reveals the integration of the main domestic onion markets. The only market pair that was not integrated among the ones chosen was the Ahmedabad-Mumbai market pair. varying pairs of integration have varying integration amplitudes. Thus, variables present in marketplaces other than this one were used to determine the pricing of onions in one market in addition to arrivals in that market. In India's domestic onion markets, the price signals were efficiently transmitted (Reddy et al. 2012). Major onion markets in West Bengal exhibited comparable conduct to that of the potato market when it came to interdependence. The marketplaces of Kolkata, Howrah, Behrampur, and Siliguri were combined. The strongest relationship among all the combinations was that between the price in Kolkata and the lag price in Howrah (Roy, 2010).

Integration of Spot and Futures Markets

In India, the prices of agricultural commodities in the futures and spot markets often showed a significant positive co-movement. The results of the Johansen's co-integration test showed that the futures and spot markets for barley, wheat, and maize were not integrated. Additionally, these markets had robust information exchange, and price transmission proved successful. Markets for wheat and maize shown greater price discovery efficiency. Wheat and maize were the two commodities where the futures market dominated price discovery, and both commodities had a larger percentage of contracts that contributed to price discovery than the other commodities (Sendhil et al., 2013).

Conclusion

It has been recorded how well certain Indian domestic markets for agricultural goods now

integrate. It was discovered that different commodities had varied levels of integration and variable rates of price transmission. In comparison to other perishable goods, cereals like rice and wheat shown superior integration. Both the wholesale and retail markets for wheat and rice were integrated throughout the long and short terms. However, the causation might be either unidirectional or bidirectional. Because there are no trade restrictions on the domestic trade of grammes in India, grammes also shown stronger market integration. Due to inadequate market institutions and infrastructure, a lack of local supplier rivalry, and insufficient market infrastructure, India's domestic apple markets were not properly integrated. Even among those of the domestic apple markets that were integrated, the price transmission moved relatively slowly. Fruit markets, such as those for banana and pineapple, also displayed a lack of integration. Domestic potato markets were weakly integrated as compared to onion markets, which were more integrated. It was discovered that the price and information transfer between the futures and spot markets of various agricultural commodities was efficient. In the cases of chickpea, wheat, and maize, the spot and futures were merged, although barley's were not. Markets for wheat and maize shown greater price discovery efficiency.

The results of the research have shown the country's agricultural markets' level of integration. It emphasises the need for legislative initiatives on the part of the government to enhance domestic market integration so that farmers and consumers would both benefit. Some potential policy actions include: • Implementing a policy to increase investment in market infrastructure and information systems for agricultural commodities. Markets need to have superior transportation, cold storage, grading, and packaging capabilities, particularly for perishable goods. Why Markets where pricing

tends to depart from the long-run equilibrium based on the direction of price transmission should be given priority. • The function of commodities markets should be reviewed in light of maintaining market intelligence, information flow, and openness in market operations. • Farmers' ability to respond to price signals from the markets should be increased in order to decrease the volatility in arrivals, and the margin money needed to engage in futures trading should be reduced.

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