

Logistics Availability and India's July 2023 Tomato Price Shock-A Descriptive Case Study of Supply Chain Amplification and Policy Response

Author: Zoyana Wadhwa

Affiliation: Economics Department | The Lawrence School Sanawar | Grade 12 | Solan, India

Email: zoyanawadhwa@gmail.com

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ABSTRACT

India's tomato price shock of July 2023 illustrates how disruptions in perishable-food supply can produce large and rapid inflationary effects. This study examines how logistics interacted with seasonal availability, weather-related crop stress, market organisation and government intervention during the episode. It uses a structured descriptive case-study method and triangulates dated government releases, Reserve Bank of India analysis and peer-reviewed research on tomato value chains and post-harvest loss. The evidence shows that the shock cannot be attributed to transport distance alone. Tomato CPI inflation reached 202.1 per cent year on year in July 2023, while the all-India average retail price reached INR 109.5 per kilogram. Official evidence identified lean-season conditions, adverse weather, crop damage and temporary supply-chain disruption as concurrent pressures. Logistics amplified these pressures by shaping how quickly alternative supply could be assembled, transported and distributed to deficit markets. The government response, which procured tomatoes from several producing states and sold them in high-price consumption centres, further demonstrates the policy importance of effective availability rather than simple geographic distance. The study concludes that resilient perishable-food systems require better availability monitoring, diversified sourcing, reduced handling losses and rapid distribution capacity. Because the analysis uses secondary evidence and no counterfactual, it does not estimate the independent causal effect of logistics or the intervention.

Keywords tomato prices; food inflation; logistics; perishable supply chains; post-harvest loss; India

JEL classifications E31; Q11; Q18; R41

1 INTRODUCTION

Perishable-food prices can move sharply when production shocks coincide with weak storage, handling or transport. Tomatoes are especially exposed because they have a short marketing life, are produced in geographically dispersed clusters and pass through several stages before reaching urban consumers. A disruption that reduces crop availability can therefore be intensified by delays, damage and the time required to redirect supply from another region.

The July 2023 tomato shock was economically significant. A Reserve Bank of India study reports that tomato CPI inflation reached 202.1 per cent year on year in July, the all-India average retail price was INR 109.5 per kilogram, and tomato accounted for 18.9 per cent of measured inflation across the 299 commodities in the CPI basket (Roy et al., 2024). The RBI also described the episode as an exceptional tomato shock that spilled into other vegetable prices and helped lift headline inflation to a 15-month high (Reserve Bank of India, 2023).

A simple cost-of-distance explanation is nevertheless inadequate. Distance is only one possible input into the cost and reliability of supply. Prices may also reflect crop availability, rainfall, disease, road and vehicle quality, loading practices, route substitution, wholesale operations, local demand and retail losses. The same number of kilometres can have different economic consequences under different supply-chain conditions.

This study asks: How did logistics interact with seasonal availability, weather-related supply constraints and market organisation during India's July 2023 tomato price shock, and what did the policy response reveal about managing perishable-food inflation? It argues that logistics acted primarily as an amplification and adjustment mechanism. The initial shock arose from restricted availability and adverse production conditions; logistics then influenced how much usable supply reached deficit markets and how quickly alternative sources could respond.

2 LITERATURE AND ANALYTICAL FRAMEWORK

2.1 Perishability and Supply Chain Frictions

A tomato's retail price incorporates more than farm-gate value. Assembly, sorting, packaging, loading, transportation, wholesale activity, retailing and physical losses all affect the amount paid by the consumer. Mohan et al. (2023) identify harvesting, storage, packaging, loading, unloading and transportation as stages at which inefficiency can generate post-harvest losses. Their study emphasises temperature-controlled storage and coordination among supply-chain participants as potential responses, while also showing that storage decisions must be understood as part of the wider chain rather than as an isolated infrastructure problem.

Evidence from the Azadpur wholesale market similarly shifts attention from kilometres alone to the organisation of distribution. Negi and Anand (2018) find that labour charges and operational factors are prominent contributors to supply-chain inefficiency. The implication is that spatial movement affects prices through a bundle of costs and risks: time, handling, market coordination, product damage and the reliability of alternative routes.

Loss measurement also requires care. The WRI India tomato-chain study cites the national NABCONS estimate of 11.61 per cent post-harvest loss for tomatoes, but its Madhya Pradesh fieldwork identifies farm and retail as critical loss points and stresses that infrastructure and practice differ across the chain (Lamba et al., 2024). A national percentage therefore cannot be applied mechanically to a particular city or consignment.

2.2 Availability and Price Volatility

The strongest empirical evidence places effective availability at the centre of tomato-price formation. Roy et al. (2024) construct monthly supply-demand balance sheets and estimate an autoregressive distributed lag model for 2012-2022. Their long-run coefficient on the tomato availability-to-usage ratio is -0.721, indicating an inverse relationship between availability and the tomato CPI after accounting for rainfall and agrochemical prices. The rainfall indicator is positive and statistically significant. These results do not estimate the July 2023 episode itself, but they provide a tested framework for interpreting it.

Kumar (2024) reaches a compatible conclusion through a descriptive examination of the 2023 shock. The study connects the surge to low returns from the preceding crop, high temperatures, pest pressure, heavy rainfall and transport bottlenecks. Both studies imply that logistics should be analysed in interaction with production and availability, not as a stand-alone cause.

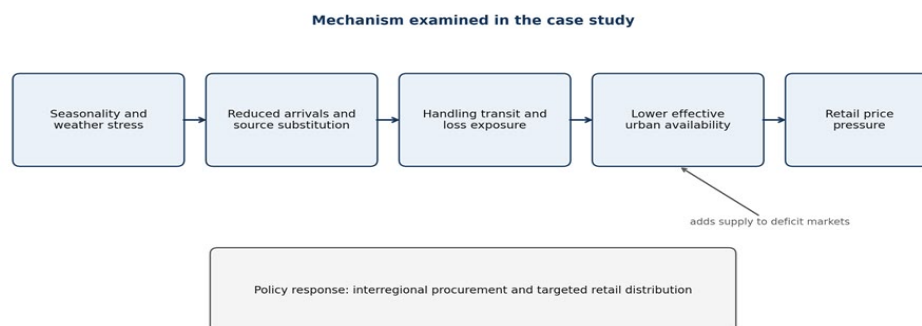


Figure 1: Analytical framework for the July 2023 tomato price shock

Source: Author's synthesis based on Press Information Bureau (2023a, 2023b, 2023c), Mohan et al. (2023) and Roy et al. (2024).

3 RESEARCH DESIGN

The paper uses a structured descriptive case-study design. The event window begins with the Government of India's procurement direction on 12 July 2023 and continues through the reduction of the administered retail price to INR 70 per kilogram from 20 July. Later research is used to interpret the event, but not to create retrospective city-level observations that were unavailable in the contemporaneous record.

Sources were selected using three criteria. First, event facts such as dates, procurement locations, sale prices and quantities had to come from dated government releases. Second, national price and production statistics had to come from the RBI or another public institution. Third, claims about post-harvest loss and market inefficiency had to be supported by peer-reviewed research or an identified institutional working paper. Table 1 shows how each source enters the analysis.

Table 1: Evidence base and analytical use

Evidence source	Scope	Use in this study
Press Information Bureau 12 July 2023	Contemporaneous government diagnosis	Seasonality, weather, source regions and procurement direction
Press Information Bureau 16 and 19 July 2023	Intervention implementation	Administered prices, locations and quantity procured
Reserve Bank of India 2023	Macroeconomic assessment	Inflation significance and supply-chain policy interpretation
Roy et al. 2024	National data and econometric analysis	Price magnitude, production structure, value-chain margins and availability mechanism
Mohan et al. 2023	Peer-reviewed tomato supply-chain study	Post-harvest operations, storage and coordination mechanisms
Lamba et al. 2024	Institutional working paper and field study	Loss estimate and critical points in the tomato chain
Kumar 2024 and Negi and Anand 2018	Descriptive and wholesale-market studies	Multiple causes and wholesale-market frictions

The analysis triangulates evidence across four mechanisms: seasonal and weather-related availability; reconfiguration of supply origins; handling and distribution frictions; and the government's attempt to augment supply in high-price markets. It does not estimate a regression, a correlation between distance and price, or the causal effect of the intervention. Those questions require a city-level panel with consistent daily prices, verified shipment origins, arrivals, route conditions and a credible counterfactual.

4 FINDING

4.1 Scale and Seasonal Context

The shock occurred in a structurally seasonal market. India produced 20.4 million metric tonnes of tomato in 2022-23, but six major producing states accounted for 57 per cent of output and 67 per cent of production came from the rabi season (Roy et al., 2024). Production concentration and staggered harvesting make urban supply dependent on which regional crop is active at a given time.

The government's 12 July assessment described July-August as a lean production period and identified the monsoon as an additional distribution challenge that increased transit losses. It also cited temporary supply-chain disruption and crop damage from adverse weather as drivers of sudden price spikes (Press Information Bureau, 2023a). The national statistics are consistent with an exceptional availability shock: tomato CPI inflation rose to 202.1 per cent year on year in July 2023 (Roy et al., 2024).

4.2 Supply Origins and Route Substitution

The contemporaneous supply map was dynamic. On 12 July, tomatoes entering Gujarat, Madhya Pradesh and some other states were reported to come largely from Maharashtra, including Satara, Narayangaon and Nashik. Delhi-NCR, however, was receiving tomatoes mainly from Himachal Pradesh and some quantity from Kolar in Karnataka. New arrivals from Nashik were expected later (Press Information Bureau, 2023a).

This evidence matters because it rules out a fixed one-hub-per-city model. When the active production region changes, the route, travel time, handling intensity and exposure to disruption also change. A straight-line or road distance from a chosen production centre is therefore not a valid measure of the logistics actually embodied in a city's observed price unless shipment origin and timing are independently verified.

4.3 Logistics as an Amplifier

Three findings support an amplification mechanism. First, tomatoes lose marketable quantity and quality through multiple operations, so disruption affects effective supply as well as transport cost (Mohan et al., 2023). Second, the national post-harvest loss estimate of 11.61 per cent shows that material losses exist even under ordinary conditions, while field evidence indicates that loss points vary by stage and location (Lamba et al., 2024). Third, wholesale inefficiency is tied to labour and operations, not solely to fuel or distance (Negi & Anand, 2018).

The value-chain distribution reported by Roy et al. (2024) reinforces this interpretation. Their Delhi calculation estimates that farmers received 33.5 per cent of the consumer price. Trader mark-ups included transport, mandi fees, commission and loading and unloading, while retailers bore substantial perishability and wastage risk. The consumer-farm spread therefore combines costs, margins and physical risk. It cannot be assigned to distance without transaction-level data.

4.4 Policy Response

The intervention reveals how policymakers interpreted the immediate problem. The Department of Consumer Affairs directed NAFED and NCCF to procure tomatoes from mandis in Andhra Pradesh, Karnataka and Maharashtra and distribute them in major consumption centres with unusually high prices. The response did not attempt to shorten a single route. It assembled supply from several regions and redirected it towards deficit markets.

Table 2: Government tomato-market intervention in July 2023

Date	Action or observation	Economic interpretation
12 July	NAFED and NCCF directed to procure from Andhra Pradesh, Karnataka and Maharashtra for high-price consumption centres	Diversified procurement to augment effective supply
14 July	Subsidised retail sales began in Delhi-NCR at INR 90 per kilogram	Targeted last-mile distribution in a high-price market
16 July	Administered selling price reduced to INR 80 per kilogram after review of more than 500 points	Intervention adjusted as wholesale conditions changed
18 July	Cumulative procurement reached 391 metric tonnes	Evidence of interregional physical mobilisation
20 July	Administered selling price reduced to INR 70 per kilogram	Further consumer relief during a declining price trend

Sources: Press Information Bureau (2023a, 2023b, 2023c). The listed prices were administered intervention prices, not citywide market averages.

The sequence is consistent with a supply-augmentation strategy, but it does not by itself establish that the intervention caused the subsequent decline in market prices. Harvest arrivals, weather and private-market adjustment were changing at the same time. The evidence supports a narrower conclusion: the state treated procurement speed, source diversification and distribution capacity as operational tools for managing a perishable-food shock.

5 DISCUSSION

5.1 From Distance to Effective Availability

The case supports replacing the idea of a simple price of distance with the broader concept of effective availability. Effective availability is the quantity of marketable produce that reaches a consumption centre at the required time. It depends on production, active source regions, transit reliability, handling quality, spoilage and market coordination. Distance matters when it changes these variables, but kilometres alone do not identify the mechanism.

This interpretation aligns with the RBI's empirical result that the availability-to-usage ratio is inversely related to tomato prices (Roy et al., 2024). It also explains why the 2023 response relied on simultaneous procurement and distribution. When local or customary supply weakens, resilience depends on the ability to identify another source, move produce quickly and limit deterioration before retail sale.

5.2 Policy Implications

The first priority is better availability and intelligence. Daily retail prices are useful, but policymakers also need timely information on mandi arrivals, crop conditions, active source regions and shipment constraints. A balance-sheet approach, similar to that developed by Roy et al. (2024), can help distinguish an emerging physical shortage from a local distribution problem and can improve the timing of intervention.

Second, source diversification should be planned before a crisis. The July intervention drew from three producing states and targeted several consumption centres. Maintaining verified seasonal maps of production clusters, transport capacity and alternative routes would reduce the time needed to mobilise replacement supply.

Third, investment should target measured loss points. Reusable crates, grading, pack-house operations, rapid loading, temperature management and better coordination may each be appropriate in different parts of the chain. The evidence does not justify using aggregate cold-storage capacity as a universal proxy for resilience. Infrastructure decisions should be based on commodity suitability, location-specific loss data and the economics of operation.

Finally, emergency retail operations should publish clear triggers, quantities, locations and exit conditions. The July press releases provide a useful dated record, but future evaluation would improve if government agencies also released machine-readable procurement and sales data. That would allow researchers to separate the effects of public distribution from harvest recovery and private-market responses.

6 LIMITATIONS

This study has four limitations. It relies on secondary evidence and does not observe individual consignments, transaction prices or physical losses. The event sources provide an official account of the intervention and may not capture every local market condition. Administered sale prices cannot be compared directly with citywide retail averages. Finally, the absence of a counterfactual means that the study cannot estimate how prices would have evolved without government procurement.

The findings should therefore be read as a mechanism-based interpretation of one episode. A causal extension would require daily city-market prices, mandi arrivals, rainfall and crop-damage measures, verified origin-destination flows, transport times and intervention intensity across treated and comparison markets.

7 CONCLUSION

India's July 2023 tomato shock was not simply the price of distance. It was a rapid fall in effective availability produced by lean-season conditions, adverse weather, crop damage and temporary supply-chain disruption. Logistics influenced the severity of the shock because perishability, handling, route substitution and market operations determined how much usable produce reached consumers and how quickly supply could adjust.

The government's response supports this interpretation. Procurement from several producing states and distribution in high-price centres treated logistics as a means of restoring availability, not as an isolated transport-cost problem. The policy lesson is accordingly specific: better monitoring, diversified sourcing, lower handling losses and rapid distribution can make perishable-food systems more resilient, but their effects must be evaluated with transparent market and shipment data.

DATA AVAILABILITY AND ETHICS STATEMENT

The study uses only publicly available secondary sources listed in the references and reproducibility ledger. It involved no human participants, personal data or original survey collection. No proprietary dataset was created.

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APPENDIX A REPRODUCIBILITY LEDGER

The ledger identifies the precise source location for every quantitative or event-level claim used in the paper.

Claim or indicator	Value or evidence	Source location
Tomato CPI inflation July 2023	202.1 per cent year on year	Roy et al. 2024 Chart 16 and Section II
All-India average retail price July 2023	INR 109.5 per kilogram	Roy et al. 2024 Section II
Contribution to measured inflation	18.9 per cent across 299 CPI commodities	Roy et al. 2024 Section II
Tomato production 2022-23	20.4 million metric tonnes	Roy et al. 2024 Chart 3
Production concentration	Six major states produced 57 per cent	Roy et al. 2024 Chart 5
Rabi production share	67 per cent	Roy et al. 2024 Section II and tomato value-chain discussion
Availability model	Long-run coefficient -0.721; rainfall indicator positive and significant	Roy et al. 2024 Table 6
Farmer share in Delhi consumer price	33.5 per cent	Roy et al. 2024 Chart 18
National tomato post-harvest loss	11.61 per cent	Lamba et al. 2024 citing NABCONS 2022
Delhi-NCR supply origins	Mainly Himachal Pradesh with some Kolar supply	Press Information Bureau 12 July 2023
Intervention quantity	391 metric tonnes procured through 18 July	Press Information Bureau 19 July 2023
Administered sale-price sequence	INR 90 then INR 80 from 16 July and INR 70 from 20 July	Press Information Bureau 16 and 19 July 2023