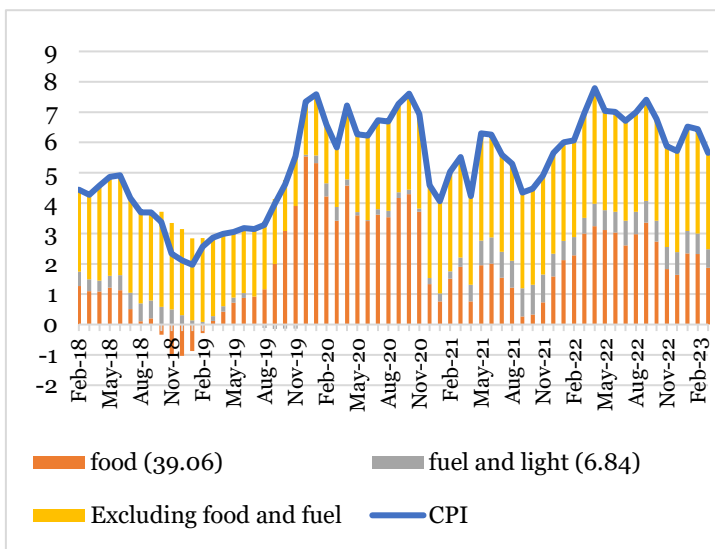


I. Inflation and Food Inflation

The higher share of food and beverages in CPI complicates the task of inflation targeting by RBI under the flexible inflation targeting (FIT) framework, wherein inflation target is defined as 4 % with a tolerance band of ± 2 % around the target (Bhanu Pratap, Abhishek Ranjan, Vimal Kishore and Binod B. Bhoi).

The high volatility in food inflation coupled with the high weight of the food group in the CPI basket has resulted in significant contributions of food inflation to overall inflation during episodes of food price spikes. **Share of food inflation in headline inflation was almost 67% in November 2013, 62% in July 2016, 75% in December 2019 (just before the pandemic) and well above 50% throughout 2020 (Figure 1). Since then, the contribution of food inflation to overall inflation has been well below its weightage (39.06).**

Figure 1: Drivers of headline inflation



Source: Calculated by NABARD based on data released by MOSPI, GoI

Note: Value in parentheses are weight of each component in CPI

Factors behind higher food inflation

Several factors play significant role in enhanced food inflation. **Demand-side factors such as those related to the changing structure of demand** away from cereals toward high-value items such as livestock products (Mishra & Roy 2016).

Supply-side factors such as changes in production and productivity also play its role. On the supply side, the performance of the agricultural sector in India has been below its potential.

Long-term policies such as the cereal-centric focus of the government through a system of producer support prices and maintenance of buffer stocks.

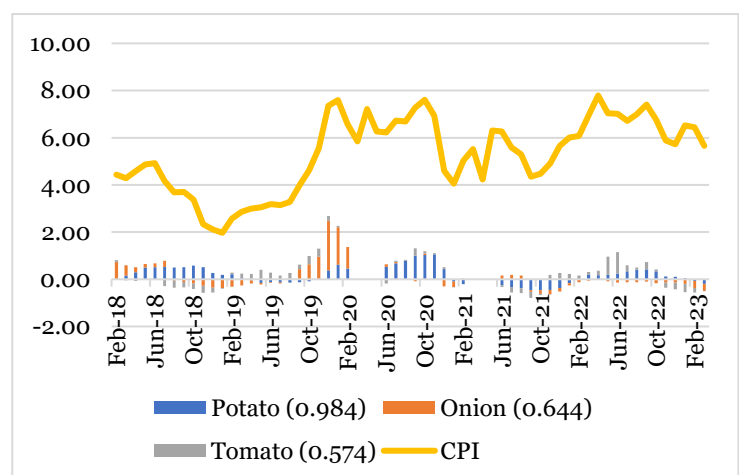
In addition to long-term structural factors and policies, **short-term factors also contribute to inflation.** These include (1) short-term shocks, such as negative shocks from natural disasters like droughts and floods, and positive income shocks, such as rural employment guarantee schemes; (2) domestic policy interventions such as revisions to minimum support prices; (3) trade policy responses such as easing export restrictions; and (4) movements in international commodity prices (Mishra & Roy 2016).

II. Inflation, Food Inflation and TOP Inflation

The food and beverages component has a weight of 45.86 in the combined CPI with a relatively higher weight in CPI-Rural (54.18) as compared to CPI-Urban (36.29). This component comprises of 12 sub-components with cereals and products (9.67) having the highest weight followed by milk and products (6.61) and vegetables (6.04).

The weightage of vegetables in the overall index is only 6.04 with the weightage of TOP being 2.20. Even with such a low weightage, the contribution of TOP to the overall CPI has higher in many months and in negative territory in some months. **The share of TOP in CPI was 29% in the month of January 2020 and -18% in the month of September 2021 (Figure 2).** This points clearly towards high volatility in the inflation of TOP.

Figure 2: Contribution of TOP to Headline Inflation



Source: Calculated by NABARD based on data released by MOSPI, GoI

Note: Value in parentheses are weight of each component in CPI

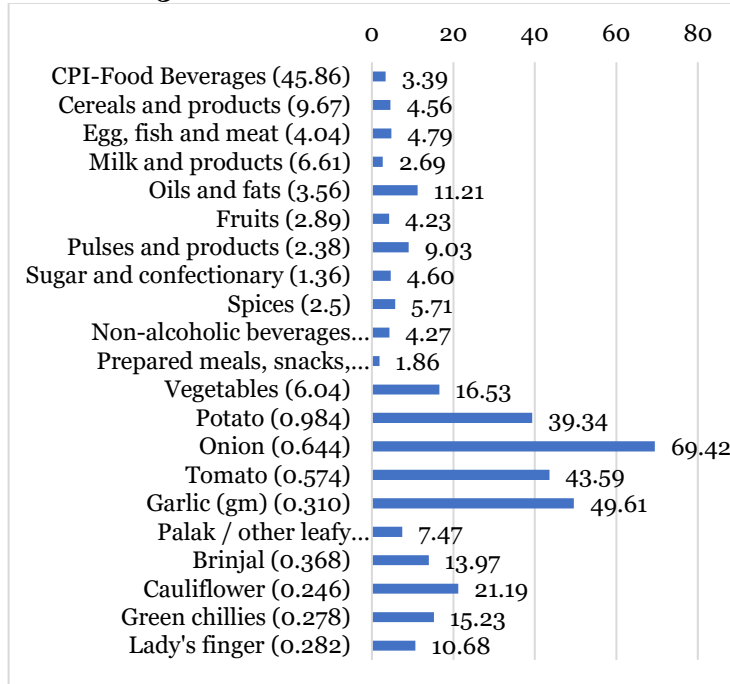
III. Food Inflation and Price Volatility of TOP Commodities

Food and beverages segment has higher price volatility and persistent cob-web phenomenon especially recurrent supply shocks in the case of few crops renders inflation targeting more difficult. Specifically in the case of TOP

commodities, wherein, supply glut and shortage has been causing price fluctuations. High price volatility in TOP, in comparison to other vegetables and components of food inflation has been observed (Figure 3).

This is often caused by crop damages on account of the vagaries of nature (excess or deficient rainfall and other extreme weather events) lead to production shortfalls, leading high headline inflation.

Figure 3: Inflation volatility from March 2018 to March 2023



Source: Calculated by NABARD based on data released by MOSPI, GoI
 Note: Volatility has been calculated by using standard deviation formula on inflation data

Regional concentration of production of TOP and consumption throughout the country has also led to extreme volatility in prices. The need to transport these perishable commodities from surplus to deficient regions escalates the costs further. Andhra Pradesh, Madhya Pradesh and Karnataka supply their tomato produce to the northern states. Onions are mainly sourced from Maharashtra, Madhya Pradesh and Karnataka. Potato is mainly grown in the Indo-Gangetic plains of northern India with Uttar Pradesh, West Bengal and Bihar being the three largest states, and must be transported to the southern parts of the country (Ashok Gulati, Kavery Ganguly, Harsh Wardhan).

Let's dissect the reasons for volatility in each of TOP commodities:

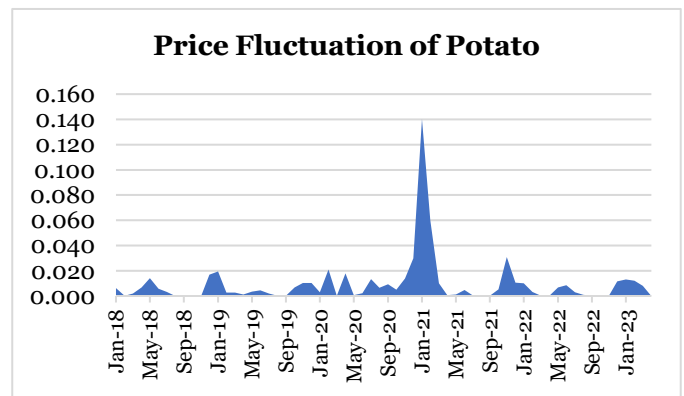
i. Volatility in Potato

Potato is the least volatile among the TOP crops mainly because it has higher processing-to-production share (7%) as compared to onion (3.0%) and tomato (1.0%) (Gulati

2019). **To ascertain a better indicator of volatility, historical volatility has been calculated for the period from January 2018 to April 2023.** It is an indicator of the extent to which a price may diverge from its average in a given period. Hence, increased price fluctuation results in a higher historical volatility value. It is a better indicator of volatility than standard deviation or variance.

As per the historical volatility, tomato (0.21) has higher volatility than onion (0.19) and potato (0.10). Historical volatility has been presented in graphical form for potato in figure 4.

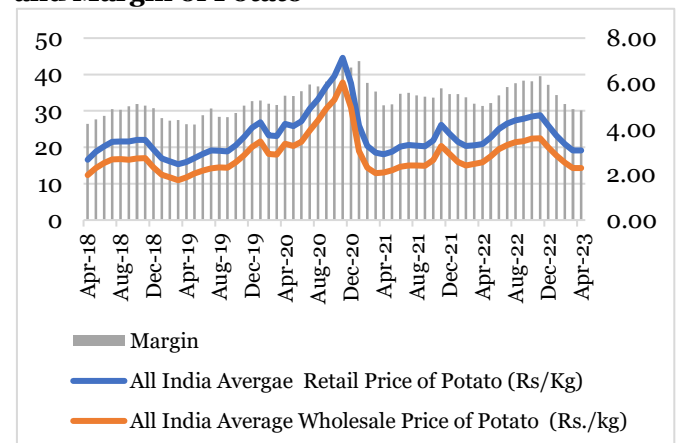
Figure 4: Historical Price Volatility of Potato



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

Usually, potato crop witnesses increase in price volatility between November to January as prices go up in the month of October-November and come down in December-January as new crops arrived at the market (Figure 4 and 5). Prices normally start rising from June onward and are firm till October. Prices start coming down from November as fresh crop from Punjab starts coming in markets and in few regions, stock of rabi crop is still available in cold storages.

Figure 5: All India Average Retail, Wholesale Prices and Margin of Potato



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

After Punjab, fresh crop from Uttar Pradesh followed by West Bengal, Bihar and Gujarat starts coming into the

market. Fresh crop is available in the market till May and after that cold store, potato is consumed.

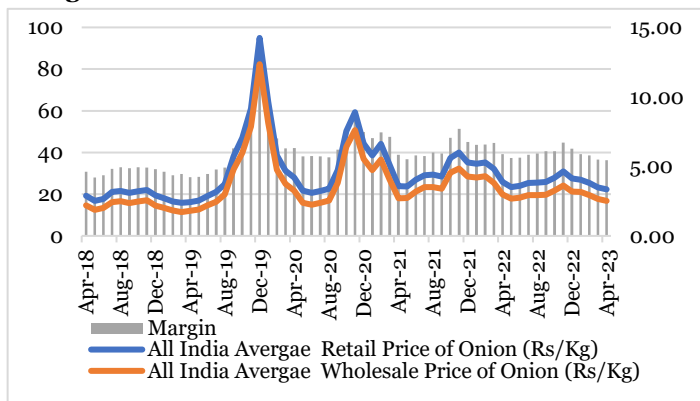
Table 1: Potato Storage in Major Producing States (In Lakh MT) in 2018-19

States	Potato Storage Capacity	Potato Stored	Capacity Utilized (%)
Uttar Pradesh	154.55	129.82	84
West Bengal	70.62	57.91	82
Bihar	11.85	8.03	67.78
Punjab	19.66	14.4	73.27
Gujarat	28.75	25.7	89.38
Total-above states	285.43	235.86	82.63

ii. Volatility in Onion

On the contrary, price volatility of the onion is the highest among the TOP crops as per normal standard deviation and second highest as per historical volatility. There exists a strong seasonal pattern in prices in all the markets; these being lower during April–May and higher during September–November (figure 6). Almost a similar pattern prevails for market arrivals (Pratap Birthal, Akanksha Negi and P.K. Joshi, 2018).

Figure 6: All India Average Retail, Wholesale Prices and Margin of Onion



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

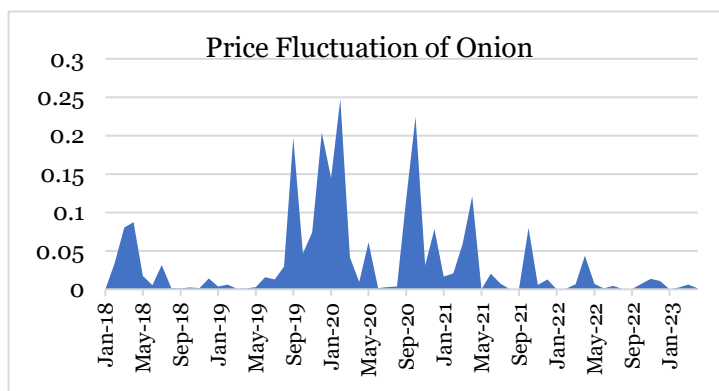
Onions are mainly sourced from Maharashtra, Madhya Pradesh and Karnataka with **Maharashtra alone contributing to 30% to the total production**. Since their production is concentrated in a few western and southern states, any shortfall in production or changes in market dynamics there are likely to cause ripples in onion markets across the country.

Seasonal Concentration: Two-thirds of the total onion production comes from Rabi or winter crop. Another 23% comes from Kharif crop, and the rest from late Kharif crop which arrives from mid-December until late February. The lower onion prices during summers and the higher prices toward the latter months of the year are probably due to seasonality in production (Pratap Birthal, Akanksha Negi and

P.K Joshi, 2018) (Figure 7).

Another important reason of price volatility in onion is the production cycle. The uncertainty arises whenever there is negative uncertainty regarding Kharif crops (i.e., damage or delay in arrivals). If there is significant damage to the Kharif crop due to uncertain monsoon, it increases the burden of supply on the stored Rabi crop. Production of onion in Rabi season or late Kharif season crop are comparatively more manageable.

Figure 7: Historical Price Volatility of Onion



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

Inelastic demand: Demand for onions is price inelastic, and even a small shortfall in their production seems to create an opportunity for supply chain participants to resort to anti-competitive practices, such as hoardings for an expected price rise, that exacerbates the price effects of reduced supplies (Birthal, Negi and Joshi, 2018).

Hoarding and Lack of Storage: Storage capacity for onion is much lesser than the potato in major producing states, like Uttar Pradesh (largest producer of potato) has 154 lakh tonnes storage capacity of potato while Maharashtra (largest producer of onion) has just 47 lakh tonnes storage of onion (Table 2).

Low storage capacity negatively impacts the buffer and leads to jump in price during slack production year.

Table 2: Storage Capacity of Onion in Maharashtra and MP (In lakh tonnes)

State	2018	2017	2016
Maharashtra	46.70	44.15	36.10
Madhya Pradesh	10.86	11.04	16.51

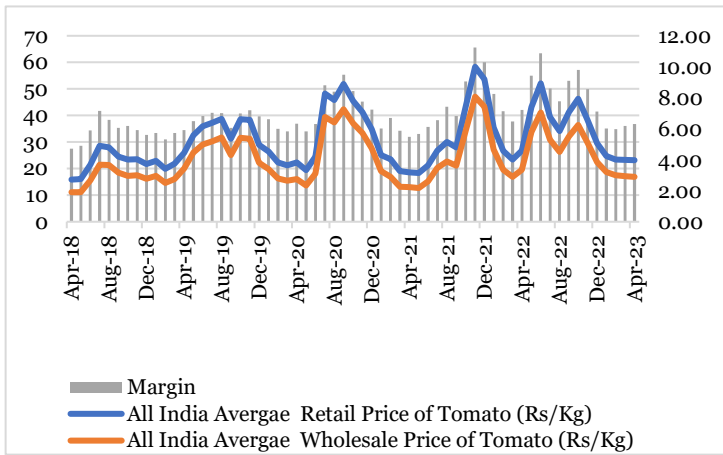
iii. Volatility in Tomato

As per the historical volatility, Tomato is most volatile out of all three TOP commodities. Although produced throughout the year, tomato's production is regionally concentrated in states of Andhra Pradesh, Madhya Pradesh, Karnataka, Odisha and Gujarat, accounting for 47%

of the total production of the country in 2021-22 (MoA&FW, 2022).

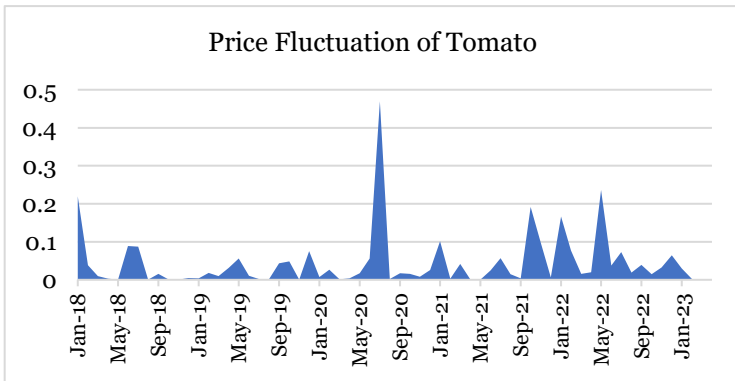
Seasonality: Tomato prices are highest during the period of July to August as this period is the lean production period. December to March is the period when tomato prices are trading at their lowest (Figure 8 and 9). Among the TOP, higher perishability of tomato renders it highly volatile. Unlike onion and potato, tomato cannot be stored for long, hence keeping tomato in the processed form as buffer stock is the way to tame tomato inflation.

Figure 8: All India Average Retail, Wholesale Prices and Margin of Tomato



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

Figure 9: Historical Price Volatility of Tomato



Source: NABARD estimate based on data from Department of Consumer Affairs (Price Monitoring Division)

A well pronounced cyclical phenomenon has also been witnessed in the case of tomatoes, i.e., a clear case of price-production cobweb with same situation arising every alternate year. In 2021, tomato had negative inflation with tomato wholesale prices touching as low as ₹2-3 per kg. The steep decline in tomato prices resulted in huge losses for the small and marginal farmers such that many of them could not afford to cultivate the crop in the following months. Due to low price realisation, farmers planted lesser area under tomatoes last year and shifted towards crops like soya, cotton and corn. As tomato is a short duration crop, the impact of

supply shortages got transferred to prices in the next 2-3 months (Tomato Tremors Harsh Wardhan and Ranjana Roy).

IV. How can food inflation be tamed?

In the short run, the measures to control inflation may include ensuring adequate quantity of the commodities in the market through steps such as export bans, encouraging imports, checking hoarding, etc. However, in the long run, the remedy to food inflation is developing robust value chains.

Agri Value Chain and Its Benefits

A value chain is characterised by a market-focussed collaboration of a set of enterprises working together to produce, process and market products and services in an effective and efficient manner. The set of actors conduct a linked sequence of activities and act in an inter-dependent complimentary way within the value-chain.

A well-functioning agri value-chain integrates small holder farmers with other key actors and higher order processes. This facilitates access to quality farm inputs, technology, quality standards, hassle free credit, access to processing and market link, etc.

How Can Organized Agri Value Chains Help Control Food Inflation?

- **Reducing Volatility in Prices**

The agricultural value chain can play a significant role in curbing volatility in TOP commodities by ensuring a steady and efficient supply of these commodities to the market.

Organized value chains can better manage volatility in produce and the associated movement in prices. This is especially true for perishables. This hold especially true for tomatoes in the context of cyclical phenomenon discussed earlier. **The real solution to tomato inflation lies in linking tomato value chains to processing of at least 10% of tomato production into tomato paste and puree during bumper years** and using them when fresh tomato prices spike.

- **Reducing the number of intermediaries**

Through organized value chains led by anchors such as FPOs, supermarket chains/food retail companies, etc., farmers can experience better price realisation by minimizing the share of middlemen.

The lower the number of intermediaries in the value chain, less could be the mark-up over the base product which would help bring down the final price, thereby having a favourable impact on food inflation.

NABARD had sanctioned a study by ICRIER titled 'Agricultural Value Chains in India-Ensuring Competitiveness, Inclusiveness, Sustainability, Scalability, and Improved Finance' which provided **recommendations specific to each of the TOP crops**. These are as follows:

a) Tomato Value Chain

- i. Private companies have done well in introducing different varieties of hybrid and disease-resistant seeds. **Strong intellectual property rights (IPR) regime** is essential for private companies for incentive to further invest in seed research.
- ii. Indian tomato yields are very low as compared to yields in European countries. There is a need for large scale adoption of poly houses to enhance the yield of Indian tomatoes. As polyhouse construction is capital intensive, government can subsidise such investments.
- iii. **Precision farming** that allows farmers to improve their farming practices and harvest safe and quality produce, need to be encouraged and incentivized.
- iv. FPOs can be encouraged to **setup small scale processing plants** to produce tomato pulp and puree to supply to large scale ketchup manufacturing plants.
- v. **Aggregation facilities for tomatoes** should be done at farm-level itself with assaying, sorting, and grading based on size, colour and texture and packaging with tinker proof bar codes for easy traceability.

b) Onion Value Chain

- i. Even though cold storages can reduce post-harvest losses by 5%, these are not popular in India. Hence, there is need to invest in the creation of scientific **dry storages for onions**, especially, in Madhya Pradesh, which has a huge infrastructure gap and has no policy to increase farm level storage.
- ii. An **aggressive expansion of the area under onion** with focus on states of Bihar, Odisha, Assam, and Chhattisgarh, will help cater to demand in **east and north-east India**, Nepal, and Bangladesh.

Leveraging private investment to expand onion value chains in new geographies, and strengthening processing and marketing segments within these value chains can provide diversified income opportunities for the farmers.

- iii. There should be an **overhaul of India's onion trade policy**. Instead of imposing minimum export price as and when onion price starts rising, government should instead allow imports. The minimum export price policy for onion not only affects India's image as a credible exporter, but also deprives onion farmers the benefit of higher prices in the international market.
- iv. FPOs can play an effective role in promoting collective farming of onions marketed as fresh as well as dehydrated. Direct marketing linkages and/or contract farming will allow farmers to benefit from economies of scale and fair price realization.

c) Potato Value Chain

- i. **Inadequate investments in research of table and processing varieties of potato in India** needs to be addressed to overcome the issues related to yield stagnation due to varietal reasons; threat of widespread viral and pest borne diseases; excessive use of agrochemicals; among others.
- ii. **FPOs can enable farmers to access organized markets for agri inputs as well as create awareness among them about the right farm practices.**

For instance, farmers can be linked to entities like Mahindra-HZPC, which can provide access to high-quality seed. Finance can be made available to farmers through these FPOs, which can help farmers take care of their agri credit requirements and address issues related to default to a large extent.

- iii. **Cold storage plays an important role in the potato value chain.** However, the cold storage infrastructure deficit and spatial mismatch needs to be corrected. For example, Bihar with a 14% share in potato production, accounts for only 4% of the total cold storage capacity.

There is an urgent need to setup cold storage facilities in Nalanda, and other potato producing districts in the state. Financial incentives for setting up of energy-efficient, cold storages would help in reducing operational cost.

Conclusion

TOP commodities have higher inflation volatility in comparison to other commodities. Especially tomato have higher historical price volatility than potato and onion. This owes to the perishable nature of the tomato. The regional concentration of the onion production to few states. Potato is least volatile due to better storage capacity available.

The organised agri value chain can play a crucial role in curbing inflation of TOP by improving productivity, storage and transportation, market linkages, diversification, and innovation. By working together, stakeholders in the agri value chain can help ensure a steady and efficient supply of TOP, leading to more stable and affordable prices for consumers.

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