Policy brief — June 2026

Rain, shine and rising prices: climate-related drivers of food inflation in India

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Summary

- Food and beverages account for approximately 37% of India's Consumer Price Index (CPI) basket. This is one of the highest shares in any major economy. As India is predominantly self-sufficient in food production, sudden disruption to domestic supply transmits directly and forcefully into headline inflation and household welfare in a way that cannot be smoothed over through trade.
- Climate extremes in India are intensifying rapidly: 2024 was the hottest year on record, heatwaves in the agricultural heartland are growing longer and more severe, and the spatial distribution of monsoons is increasingly erratic.
- Higher food inflation in India has led researchers at the Reserve Bank of India to characterise it as an endemic structural feature of India's inflation environment rather than a temporary disturbance.
- Our statistical analysis of the impacts of extreme changes (or 'shocks') in temperature and precipitation on food, fuel and headline inflation indicates that the effects are both larger and more persistent than aggregate assessments would suggest.
- Temperature shocks are the dominant driver of food inflation in India, generating price increases that peak at around 0.6 percentage points, according to our analysis. These increases remain statistically significant for up to nine months. These effects are larger, more persistent and more geographically varied than conventional monetary policy frameworks assume.
- The effects of climate-driven food price pressures go beyond the food component of the CPI basket. Temperature shocks produce a delayed but persistent rise in core inflation that is concentrated in urban markets and continues for up to 12 months. As shocks occur in quicker succession, the window for prices to normalise narrows, increasing the cumulative probability of pass-through into core inflation and the need to revise inflation expectations upwards.
- Central banks in climate-vulnerable economies may find themselves managing a structural inflation environment with tools designed for a cyclical one. These findings from India offer a critical reference point for the global conversation about how to address this issue.

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Introduction

Climate change is increasingly recognised as a source of significant macroeconomic risk. A growing body of literature shows that physical climate-related risks affect growth, inflation and other economic variables.

This policy brief examines the mechanisms through which physical climate impacts transmit into rises in food prices at the subnational level in India, and then into headline and core inflation. The brief draws on analysis at the state level to capture heterogeneity that national aggregates obscure. We combine satellite climate data with granular price series at the subnational level to examine the persistence and transmission dynamics of extreme changes in temperature and precipitation (known as 'climate shocks') across food inflation, headline inflation and core Consumer Price Index (CPI) inflation. Using rural and urban disaggregations, we quantify the relationship between extreme temperatures, deviations in rainfall patterns and measurable price outcomes, with the aim of anticipating these effects and integrating them into monetary and fiscal policy planning and responses.

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How climate change affects food inflation

Food inflation is particularly sensitive to climate change because agricultural production and distribution are directly exposed to physical risks. Unlike the prices of many manufactured goods, food prices, especially for perishables, respond quickly to disruptions in growing conditions, harvest timing, storage and transport. There is evidence that heat stress lowers crop productivity, excess rainfall damages standing crops, and floods and storms interrupt supply chains. These effects amplify price volatility for commodities such as fruit, vegetables, meat and dairy products (Kotz et al., 2024). Climate shocks also lead to wastage and post-harvest losses, further constraining effective supply.

As climate change makes these shocks more frequent and intense, spikes in food prices may become not only larger but also more persistent. There is growing evidence of these effects, and an increasingly prevailing view that climate change is reshaping the structure of food inflation rather than merely causing temporary disturbances (ibid.). This global pattern provides an important backdrop for understanding country-specific inflation dynamics, especially in emerging economies like India, where food items take up a large share of the inflation basket.

Climate change also threatens aggregate price stability. Persistent sharp spikes in food prices can spill over into core inflation when they shift inflation expectations, creating second-round effects through rising input costs and wage pressures. In the case of India, where food has a strong influence on the CPI, the relationship between food inflation and headline and core inflation is clear and pronounced; sudden cost spikes (or shocks) tend to pass through more strongly into inflation expectations and wage dynamics in emerging market settings (Gopinath, 2025). This makes climate change a structural risk to overall price stability rather than a sectoral or agricultural concern alone.

"Persistent sharp spikes in food prices can spill over into core inflation when they shift inflation expectations."

India's exposure to climate-related volatility in food prices

Food and beverages make up around 37% of India's CPI basket, one of the highest shares globally. By comparison, food's share of the CPI basket is around 17% in China, 23% in Mexico and 18% in South Africa (CEIC, 2026). Moreover, India largely meets its food needs through domestic production rather than imports. This implies that any domestically driven disturbance in food prices will transmit strongly into headline inflation and affect household welfare.

Historically, food price spikes in India have been considered volatile but transitory, often attributed to crop-specific or seasonal shocks that fade with the next harvest (Reserve Bank of India [RBI], 2023). However, recent evidence challenges this view. Kohli (2025) shows that the peaks of food price volatility are more frequent. This pattern is increasingly linked to climate variability rather than isolated sectoral issues. Accordingly, food inflation can no longer be treated as a peripheral or temporary component of inflation in India; instead, it plays a central role in shaping macroeconomic outcomes.

Moreover, India has experienced a marked rise in the number of heatwave days, episodes of extreme precipitation, floods, droughts and unseasonal rainfall over the past decade. In 2024, the country experienced its warmest year since records began in 1901 (India Meteorological Department, 2024). Average temperatures in India have risen by approximately 0.89°C relative to 1901–1930, with warming accelerating in recent decades (Dhara et al., 2025). Heatwaves in the Indo-Gangetic plains – India's agricultural heartland – have grown longer and more severe. Monsoon rainfall patterns have also become increasingly erratic, even where aggregate annual rainfall appears normal. The 2024 monsoon season brought the heaviest rainfall since 2020 overall, but the spatial and temporal concentration of the rainfall produced both localised droughts and floods, varying across regions (Narayanan and Behera, 2025).

Importantly, physical risks vary across the country: heat stress disproportionately affects northern and central states, excess rainfall and flooding are more likely to occur in eastern and coastal regions, and there is a higher chance of drought in parts of western and southern India. These regional differences matter because crop production is spatially concentrated. Therefore, climate shocks in a few key crop-producing states can spill over to create nationwide price effects, especially for perishable goods such as tomatoes, onions, potatoes and dairy products. As climate change intensifies, these geographically uneven shocks increasingly translate into repeated and overlapping food price pressures.

Climate shocks reach consumers through several distinct but mutually reinforcing channels. Higher temperatures and erratic rainfall reduce crop yields, shorten growing periods and intensify pest pressures, leading to volatile food prices, especially for perishables that cannot be stored or substituted (Dilip and Kundu, 2020). Extreme weather can also damage transport and storage infrastructure, leading to an increase in supply chain costs that is passed on to consumers (Khalfaoui et al., 2024). Climate change also raises input costs by increasing energy demand, water scarcity and pesticide use, compounding direct yield losses (Mutale et al., 2025). When domestic production is affected by climate shocks, governments may respond by implementing export

"India has experienced a marked rise in the number of heatwave days, episodes of extreme precipitation, floods, droughts and unseasonal rainfall."

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restrictions to protect food security, tightening global supply and transmitting price pressures internationally.

Why the conventional framework is under strain

Conventional monetary policy on food price shocks rests on the assumption that price spikes are temporary and should be 'looked through'; i.e. supply disruptions are self-correcting and do not require a policy response. However, climate change increasingly challenges this assumption. The assertion that a bad harvest will be followed by a good one – and that prices will have an opportunity to normalise before the next disruption – only holds when climate shocks are infrequent, idiosyncratic and short-lived. Climate change erodes all three of these conditions simultaneously by increasing the frequency of shocks, extending their duration and producing widespread, simultaneous failures across crops and regions.

The empirical record in India reflects this shift. Average food inflation in the country has increased when comparing the period 2016–2020 to the 2020s. This trend has been primarily attributed to climate change. Recent research by staff at the Reserve Bank of India (RBI) characterises food inflation as having transformed from an episodic problem into an endemic one, which has prompted a shift in inflation expectations (Patra et al., 2024). In more than half of the period between June 2020 and June 2024, India experienced food inflation of more than 6% – exceeding the RBI's tolerance band of 4% (±2) (RBI, 2026). Data from the Ministry of Statistics and Programme Implementation (2026) shows that food price inflation is more volatile than core inflation, with larger and more frequent spikes at the national and subnational levels that have direct impacts on headline inflation figures (see Figure 1). These dynamics mark a departure from previous patterns in which food price spikes were short-lived, sector-specific and localised.

Photo: Adobe Stock

Figure 1. Overall inflation and state-level variability, 2013–2025

Notes: Max(states) and Min(states) refer to the maximum and minimum inflation rates across the states for the specific month. Source: Authors' calculations using data from the Ministry of Statistics and Programme Implementation (2026).

The consequences of these new dynamics extend beyond food prices themselves. When food inflation is persistent and broad-based, it risks feeding into core prices via second-round effects – through wage pressures, rising input costs and upward revisions to inflation expectations. As Kotz et al. (2024) note, persistent upward pressure on inflation from rising temperatures "would have important implications for monetary policy, as it would render the identification of drivers of inflation more difficult when relying on traditionally used models". India could experience climate-induced inflationary pressures of 1–3 percentage points (ppts) by 2035, according to one projection (Trivedi and Jena, 2024). While this estimate is not an official policy projection, it points to a growing constraint on the RBI's ability to meet its 4% (±2%) inflation target.

"Temperature and precipitation shocks generate statistically significant food price pressures, but they occur through different channels and on different timelines."

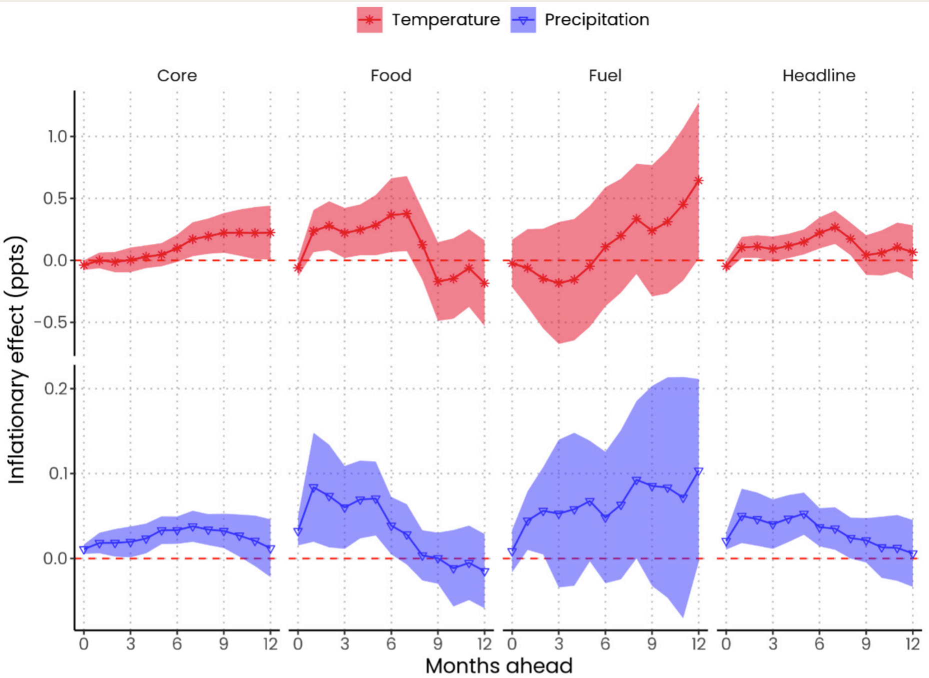
Research findings

Temperature shocks

Both temperature and precipitation shocks generate statistically significant food price pressures, but they occur through different channels and on different timelines. Temperature shocks have a larger and more sustained effect.

Figure 2 shows the estimated effects of a temperature shock on each price level, tracking the impact of the shock from the month it occurred and for up to one year afterwards.

Figure 2. Estimated inflationary effects in India of climate shocks on the Consumer Price Index and its components



Source: Authors' calculations using data from the Ministry of Statistics and Programme Implementation (2026) and the Copernicus Climate Change Service (C3S, 2017).
Note: Temperature shocks are standardised with respect to the month-specific mean and standard deviation. Precipitation shocks measure total rainfall deviation from the month-specific mean and standard deviation. The inflationary effect is relative to the month before the shock.

Food prices rise almost immediately after a temperature shock, increasing by 0.23 ppts in the first month and continuing to climb. The effect peaks at 0.38 ppts after seven months. However, this inflationary pressure dissipates relatively quickly: by month eight, the effect will have diminished significantly; by month ten, prices will return to baseline levels. This pattern likely reflects the direct impact of extreme heat on agricultural yields and productivity, which disrupts food supply in the short term and has an immediate impact on flexible price items such as food. These effects gradually fade once supply and distribution recover, consistent with existing evidence (Faccia et al., 2021; Kabundi et al., 2022).

Unlike food prices, core CPI prices show no significant response to temperature shocks during the first six months. By month seven, however, core prices have risen by 0.17ppt, before climbing to around 0.22 ppts after nine months. Crucially, this effect does not fade: it persists through the full year of observation. This delayed but sustained response is consistent with existing evidence of the delayed pass-through effects of commodity price shocks on core prices.

Precipitation shocks

Precipitation effects are mediated by channels other than agricultural productivity. Excessive precipitation can trigger flooding events and other natural disasters, which quickly destroy farmland, crops and physical capital. In addition, they disrupt supply chains and damage infrastructure, restricting access to food in ways that could increase inflation. This contrasts with the effect of temperature shocks, which may have a less direct and short-lived impact on food production by, for example, reducing yields or affecting labour productivity (Ehlers et al., 2025). This could explain why core inflation reacts to precipitation shocks almost immediately, but remains unresponsive to temperature shocks for six months.

> "Core inflation reacts to precipitation shocks almost immediately, but remains unresponsive to temperature shocks for six months."

Core inflation increases shortly after a precipitation shock, reaching 0.03 ppts after six months and peaking after seven months (as shown in Figure 2). The effect remains statistically significant for nine months before beginning to fade. By the end of the 12-month period this study covers, prices have reverted to their original level. This quicker transmission likely reflects the broader economic disruption caused by excessive rain and flooding. The muted effects are consistent with the previously observed impact of excessive rainfall and floods on inflation via demand-side effects (see Ficarra and Mari, 2025).

The inflationary effects of precipitation shocks on food follow a similar pattern to core inflation. Food prices initially surge by up to 0.08 ppts, but the effect gradually dissipates to 0.03 ppts by month six, before essentially disappearing by month seven. This pattern suggests that while excessive rainfall disrupts harvests and food supply in the short term, markets adjust over the medium term. In contrast, the rise in food prices following a temperature shock peaks after seven months. This is consistent with global evidence. Kotz et al. (2024) find that excessively wet conditions cause an uptick in food and headline prices over 12 months, and that the effects of more extreme short-lived precipitation events (that cause floods) are quicker to decline. Similarly, Kabundi et al. (2022) find that floods have more geographically concentrated effects on, for example, the price of crops grown in a flood zone. These negative supply-side effects could be partly offset by increased precipitation in surrounding areas, resulting in greater supply and reduced food inflation.

Headline inflation reflects the combined dynamics of food and core prices, but the speed and duration of effects differ markedly between temperature and precipitation shocks. Because food and core inflation together account for over 93% of India's CPI basket, headline inflation mirrors their combined movements. Temperature shocks have a more gradual but larger effect on headline inflation, which peaks at 0.27 ppts by month seven, before fading entirely by month nine as food inflation subsides. Precipitation shocks, by contrast, have an almost immediate but more modest and short-lived effect: headline inflation gradually grows to around 0.03–0.05 ppts in the first six months before declining rapidly to zero by month nine. In both cases, the trajectory of headline inflation broadly tracks the easing of food price pressures. Nonetheless, for temperature shocks, the persistence of core inflation means that underlying price dynamics continue to shift even after the headline effect has dissipated.

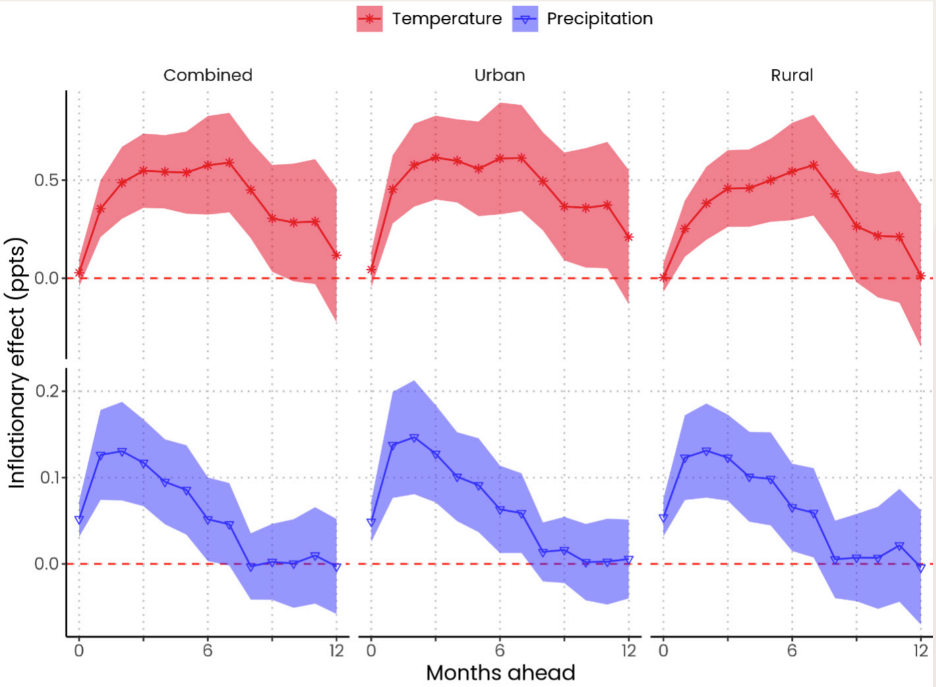
"Temperature shocks generate faster initial responses in urban markets than in rural areas."

Geographical differences

The combined CPI in India applies different weights to urban and rural areas, the distribution of which varies across states. This aggregation could mask important differences between the ways in which climate shocks affect prices in distinct geographical settings.

Temperature shocks generate faster initial responses in urban markets than in rural areas: in an urban context, food prices rise by 0.29 ppts in the first month. This reflects the tendency of urban retailers and wholesalers to reprice quickly in response to news of supply disruptions (see Figure 3).

Figure 3. Estimated inflationary effects in India of climate shocks on food baskets



Source: Authors' calculations using data from the Ministry of Statistics and Programme Implementation (2026) and the Copernicus Climate Change Service (C3S, 2017).
Note: Temperature shocks are standardised with respect to the month-specific mean and standard deviation. Precipitation shocks measure total rainfall deviation from the month-specific mean and standard deviation. The inflationary effect is relative to the month before the shock.

Rural food prices respond more slowly, but the eventual peak is larger: rural food inflation reaches 0.49 ppts by month seven, compared with 0.33 ppts in urban areas in the same time period. Rural prices also tend to normalise more quickly once the next harvest arrives, while rises in urban prices are more persistent, due to more rigid price-setting mechanisms in services and manufactured goods.

The delayed response of core inflation to temperature shocks comes primarily from urban areas, where core prices only begin rising in month six, increasing by 0.13 ppts in that month. The effect continues to accelerate, reaching 0.30 ppts by month 11 and stabilising at 0.29 ppts after one year. As with the combined CPI, urban core inflation remains elevated after 12 months. Rural core inflation also increases after six months, but the effects are not statistically significant. This urban/rural difference is, to our knowledge, a novel finding in the growing literature on climate and inflation at the sub-national level. Previously, staff at the RBI have observed that rural core prices show no statistically significant inflationary response to temperature shocks (Dilip and Kundu, 2020). Labour mobility and adaptation play a crucial role in mitigating and coping with the impact of temperature shocks in India, potentially dampening the pass-through to rural prices (Neog, 2022).

Unlike temperature changes, precipitation shocks trigger an immediate but muted core inflation response in both urban and rural settings. Rural core inflation rises more quickly than urban core inflation. Rural core inflation also peaks higher, at 0.06 ppts by month eight, but fades to statistical insignificance by month nine. Urban core inflation peaks at a more modest 0.03 ppts by month seven but persists somewhat longer, before gradually fading and fully stabilising after one year.

These findings could be explained by excessive rainfall and flooding striking rural areas first and most directly, translating into immediate local price increases before propagating through the supply chain to urban markets (Ehlers et al., 2025). The higher but less persistent impact of precipitation shocks on rural core prices could reflect the localised nature of these shocks. In contrast, propagation effects take longer to pass through urban supply chains. Extreme precipitation and flooding also dampen demand, which partly offsets supply-side disruptions and could explain the muted overall effect.

> "Urban and rural food prices respond strongly to precipitation shocks but normalise quickly."

Urban and rural food prices respond strongly to precipitation shocks but normalise quickly. Both rise to around 0.09 ppts in the first month and remain elevated in the first six months, before fading rapidly. By month seven, neither is statistically significant. This swift normalisation reflects the short-lived nature of precipitation-driven supply disruptions and their partly offsetting demand-side effects, as is consistent with existing evidence (Kotz et al., 2024; Kabundi et al., 2022).

Headline inflation rises in both urban and rural areas following temperature and precipitation shocks, but with differences in scale and persistence. Temperature shocks generate larger and more sustained effects, as urban headline inflation rises quickly and peaks at 0.23 ppts by month seven, remaining elevated at 0.14–0.20 ppts thereafter. Rural headline inflation responds more slowly but peaks higher, at 0.31 ppts in month seven, before fading in month eight. Precipitation shocks, by contrast, produce a modest and short-lived response: the rise in urban headline inflation reaches 0.04–0.05 ppts between month four and month six, while the rise in rural headline inflation peaks at 0.07 ppts in month five. In both cases, precipitation-driven headline effects fade after month six and return to zero by month nine, reflecting transitory price rises caused by rainfall compared with temperature shocks.

One explanation for the delayed and persistent effects in urban areas could be that urban CPI baskets are more dependent on food services or manufactured goods, whose prices are set through mechanisms that adjust with a persistent lag. Urban food markets could be more exposed to temperature shocks than their rural counterparts are because they are more labour-intensive and, therefore, more susceptible to heat-driven productivity losses. The difference between urban and rural food inflation effects may align with the structure of India's food supply chain. Urban consumers purchase food primarily from retail markets, mandis (wholesale marketplaces) and, increasingly, e-commerce platforms, all of which are quick to adjust their prices in response to news of crop damage or supply disruptions. Rural consumers are far closer to the point of production and may initially rely on stocks from their own production before turning to local – often informal – markets. Furthermore, prices in rural areas may adjust more quickly when supply shocks are offset by the next season's production.[1]

What does this research mean for policymakers in India?

Our findings point to the need to reframe India's monetary and fiscal policy. The burden of price stability must increasingly be shared across different institutions, levels of government and policy domains.

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Implications for the Reserve Bank of India

Integration of climate-related risks. Given that climate shocks may increasingly have a persistent impact on inflation, policy frameworks need to explicitly account for climate-related risks by incorporating climate variables, weather indicators and regional supply conditions into inflation projections. A crucial step would be to accelerate the RBI's ongoing efforts to integrate climate considerations into its inflation-forecasting macro-models, strengthening its capacity to anticipate and forecast persistent inflationary effects caused by the impact of temperature and precipitation shocks on food inflation.

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[1] India has up to three cropping seasons: the Kharif (summer/monsoon season, with harvesting in September and October), the Rabi (winter season, with harvesting in March and April) and the Zaid (short summer season, with harvesting in March, April, May and June).

Inflation targeting. The persistent core inflation effects documented above could imply that there are second-round inflationary effects, particularly in urban settings, where food prices are more dependent on services and manufacturing. The RBI already has a tolerance band that allows it to look through transitory price rises and limit action, but could consider stronger action and enhanced communication if disturbances persist. Temporarily extending its monetary policy horizon when climate indicators signal elevated supply-side risk is also an option (Barmes et al., 2024), but only if doing so does not risk de-anchoring inflation expectations (e.g. if the government is already taking action to smooth out shocks). Alternatively, the RBI could ensure that uncertainty bands in fan charts vary across quarters, in line with cropping cycles and the India Meteorological Department's monsoon predictions.[2]

Insurance and social protection. Expanding insurance mechanisms or integrating climate-related risks into existing schemes to cover agricultural losses at scale would reduce the fiscal burden of ad hoc disaster relief. The RBI could complement such efforts by explicitly incorporating climate resilience into its Priority Sector Lending framework, aiming to direct concessional credit towards adaptation investment. The Insurance Regulatory and Development Authority could continue its efforts to expand India's insurance market by, for instance, reducing regulatory burdens for innovative parametric insurance products.

Implications for the central government and state governments

Coordination. Effective price stability in a warming world requires active coordination between monetary, fiscal and agricultural policy. Climate-induced inflation extends part of the burden of price stability beyond the central bank, as supply-side shocks driven by climate volatility cannot be resolved with monetary tools alone. Central and state governments can establish clearer protocols for timing interventions (such as buffer stock releases, export restrictions and disaster relief) in line with the RBI's inflation management objectives, especially when predictions from the India Meteorological Department signal elevated climate-related risks.

Data infrastructure. It was possible for this research to identify state-level heterogeneity by reviewing satellite climate data and granular subnational price series in combination with one another. Improving real-time data-sharing between the RBI, Ministry of Agriculture, state governments and the Department of Consumer Affairs would reduce the delay between a climate shock occurring and policymakers receiving the information needed to respond, thereby reducing the uncertainty and volatility that impacts food prices through more timely influence on agents' behaviour and expectations.

Supply chain resilience. The probability and magnitude of price spikes could be directly lowered through investments in climate-resilient infrastructure, drought- and heat-resistant seed varieties, storage and refrigerated storage and transport, farmer advisory services that use climate and weather data, and early-warning systems that send out alerts before extreme climate events. These investments would be especially effective in heat-exposed and cereal-producing Indian states. In this context, agricultural adaptation to climate change is a form of inflation stabilisation, not just rural development.

"Agricultural adaptation to climate change is a form of inflation stabilisation, not just rural development."

[2] Fan charts are a visual tool that central banks use to show the range of possible future paths for inflation. The wider the 'fan', the greater the uncertainty. Currently, these uncertainty ranges tend to be similar across the year. The RBI could widen these ranges during seasons when harvests or monsoons are likely to cause bigger swings in food prices, and narrow them during more stable periods, thereby helping the bank's forecasts reflect India's agricultural calendar.

Conclusion

The RBI has already begun to recognise the macroeconomic significance of climate-driven inflation. Ongoing efforts to integrate climate considerations into forecasting models and the establishment of the Climate Risk Information System (CRIS) signal that the institution is moving in the right direction. The recommendations in this policy brief are intended to support and accelerate that shift by providing an empirical foundation for changes to forecasting frameworks, communication and the inflation-targeting architecture that the RBI is already beginning to consider. These changes need to be complemented by fiscal efforts at the central and state government levels, as outlined above.

The broader challenge, however, extends well beyond India. The country is increasingly exposed to climate change as a large emerging market in which food makes up an unusually high share of the CPI and is largely domestically produced. This means that the RBI faces an early and acute case of a growing problem for central banks across the world. More frequent, more intense and increasingly widespread climate shocks challenge a long-standing assumption about inflation targeting: that supply shocks are temporary, idiosyncratic and short-lived. Central banks in climate-vulnerable economies may find themselves managing a structural inflation environment with tools designed for a cyclical one. India's experience offers a critical reference point for this global conversation.

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Note
A forthcoming CETEx working paper will examine the transmission channels discussed in this policy brief in greater depth, using more granular market data and providing more detail about the specific food components driving inflation dynamics, disaggregated state-level evidence and the robustness of the methodology.

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Authors' declaration
The authors declare no conflict of interest in the preparation of this report. The views in this report are those of the authors and do not necessarily represent those of the host institutions or their funders. Any errors and omissions remain those of the authors.

AI use statement
The authors used Gemini for refining a satellite data extraction algorithm, and Claude for processing inflation data. These tools were used only for editing the code that computes climate shocks and wrangles the database for estimating the regressions. All outputs were reviewed and, where necessary, corrected by the authors, who remain fully responsible for the content of the publication.

Code availability
A replication package can be provided upon request to Juan-Pablo Martinez at j.martinez8@lse.ac.uk.

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