Monetary policy during Negative Output Gap periods in India in the First Quarter of the 21st Century

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Abstract

This article reviews the conduct of monetary policy in India during periods of slow growth in the first quarter of the 21st century. Using standard univariate filtering techniques, the article first identifies periods of slow growth, i.e., periods of negative output gap. It then uses the inflation rate and other supporting indicators to determine whether these periods were demand or supply constrained. The article then reviews the conduct of monetary policy during each of these episodes. An important takeaway is that monetary policy in the Indian context is very complex. Taylor type rules or even rules linking monetary policy stance to binding demand or supply constraints are by themselves inadequate for the conduct of monetary policy. They need to be combined with discretion and judgements based on comprehensive, detailed assessments of economic conditions. The article also reviews time lags and effectiveness in the transmission of monetary policy during both the Multiple Indicator Regime and the Inflation Targeting regime, particularly with reference to the interest rate channel. We find that transmission occurs with a time lag of 2-3 quarters, however it remains incomplete.

[1]The views expressed in this article are personal. The authors are respectively Chairman, Centre for Developing Studies, and Research Fellow, National Institute of Public Finance and Policy. Our greatest intellectual debt in writing this article is to Radhika Pandey, who was a key member of our team as we conceptualized this article and started our work on it. Very sadly, she passed away before the work could be completed. We are also indebted to Shri Janak Raj, who shared his practitioners' insights as a central banker and gave us his comments on a presentation of some of this material at a seminar at NIPFP held on 25th April 2025. However, we alone are responsible for any errors that remain.

1. Introduction

Central banks the world over use the output gap as an indicator of the state of the economy. A negative output gap[2], defined as the shortfall of actual output compared to potential or full capacity output, is taken as an indicator of slow growth. The long-term trend output is taken as a proxy measure of potential output. Part 2 discusses the methods used, the data and the periods of slow growth identified during the 21st century. Such periods of slow growth can be due to demand or supply constraints, each possibly requiring a different policy intervention. Identification of these binding constraints are discussed in part 3. Part 4 discusses the monetary policy response in each of these episodes. On the transmission front, we focus on the interest rate channel which is generally recognized as the most effective channel for monetary policy transmission in India.[3] We do this in part 5, taking into account both the lending and deposit rates of commercial banks. Finally, part 6 concludes with some closing remarks.

2. Episodes of slow growth in India in the 21st century

We use quarterly real Gross Domestic Product (GDP) from 1999 Q2 to 2025 Q1 to identify periods of negative output gap.[4] The first step is to adjust the series for seasonal fluctuations. A framework for seasonally adjusted series is not provided by the official statistical agency. We have adjusted the series seasonally using the X-13-ARIMA-SEATS seasonal adjustment program. The implementation of the seasonal adjustment procedures is done using the R package *seasonal*.[5]

There are several methods available for estimating output gaps. In this article we have used univariate filters to decompose the time series into its trend and cyclical components. To extract the cyclical component, the business cycles literature mostly use either the Hodrick-Prescott (HP) filter or the category of band-pass filters such as those proposed by Baxter and King (BK) or Christiano-Fitzgerald (CF).[6]

We apply the HP filter to separate the trend and the cyclical components of the seasonally adjusted quarterly real GDP series. We also use the CF filter to assess the sensitivity of the trend-cycle extraction to the choice of the filter. The band-pass filters eliminate the slow-moving trend components and high frequency components while retaining the intermediate frequencies, which are the business cycle fluctuations. Using the band-pass filters requires specification of the business cycle frequencies. We have used the National Bureau of Economic Research (NBER) definition of 8–32 quarters to extract the cyclical component.[7] We preferred the CF band-pass filter to the BK filter because the latter results in loss of data at the beginning and at the end of the GDP series.

Figure 1 juxtaposes the trend component of GDP to the seasonally adjusted real GDP. The periods where the seasonally adjusted real output is lower than the trend output are the negative output gap periods. Put differently, these are the periods when the cyclical component is negative.

[2] In this article, the phrases 'negative output gap' and 'slow growth' are used interchangeably.

[3] Acharya (2017), B. Bhoi et al. (2016), Khundrakpam and Jain (2012).

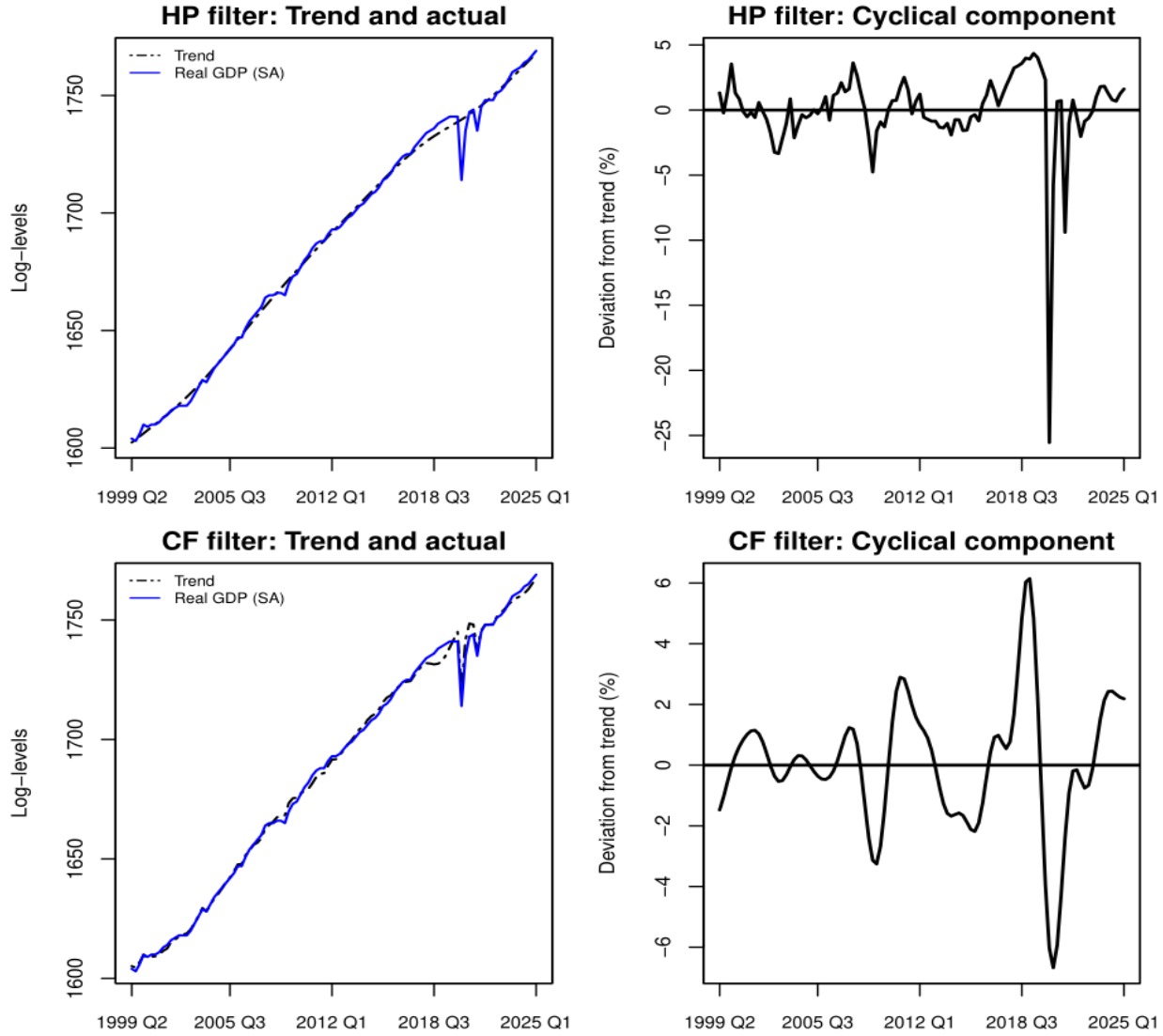
[4] Quarters pertain to the calendar year.

[5] Sax and Eddelbuettel (2018).

[6] Hodrick-Prescott (1997), Baxter and King (1999), Christiano and Fitzgerald (2003)

[7] Pandey et al. (2017).

Figure 1. Trend and cyclical components from the two filters



Source: Authors' estimates.

Note: Figure 1 plots the trend and the seasonally adjusted real GDP in log-levels along with a plot for the cyclical components using the HP and CF filter.

Table 1 shows the quarters of negative output gap identified using the HP and the CF filter. The third column shows the quarters identified as negative output gaps by both the filters. We have studied periods consisting of two or more contiguous negative output gap quarters. These include the early 2000s (2002 Q3 - 2003 Q3), the period following the global financial crisis (2008 Q4 - 2009 Q4), the period corresponding to the taper tantrum episode (2013 Q1 - 2015 Q4), the two COVID periods (2020 Q2 - 2020 Q3 & 2021 Q2 - 2021 Q3) and the period following the invasion of Ukraine by Russia (2022 Q1 - 2023 Q1). The periods of negative output gap identified in our study are similar to those identified in some earlier studies.[8]

[8] B.K. Bhoi and H.K. Behera (2016), Patra, H. Behera and John (2021), Reserve Bank of India (2023).

Table 1. Negative output gap quarters obtained using HP and CF filters

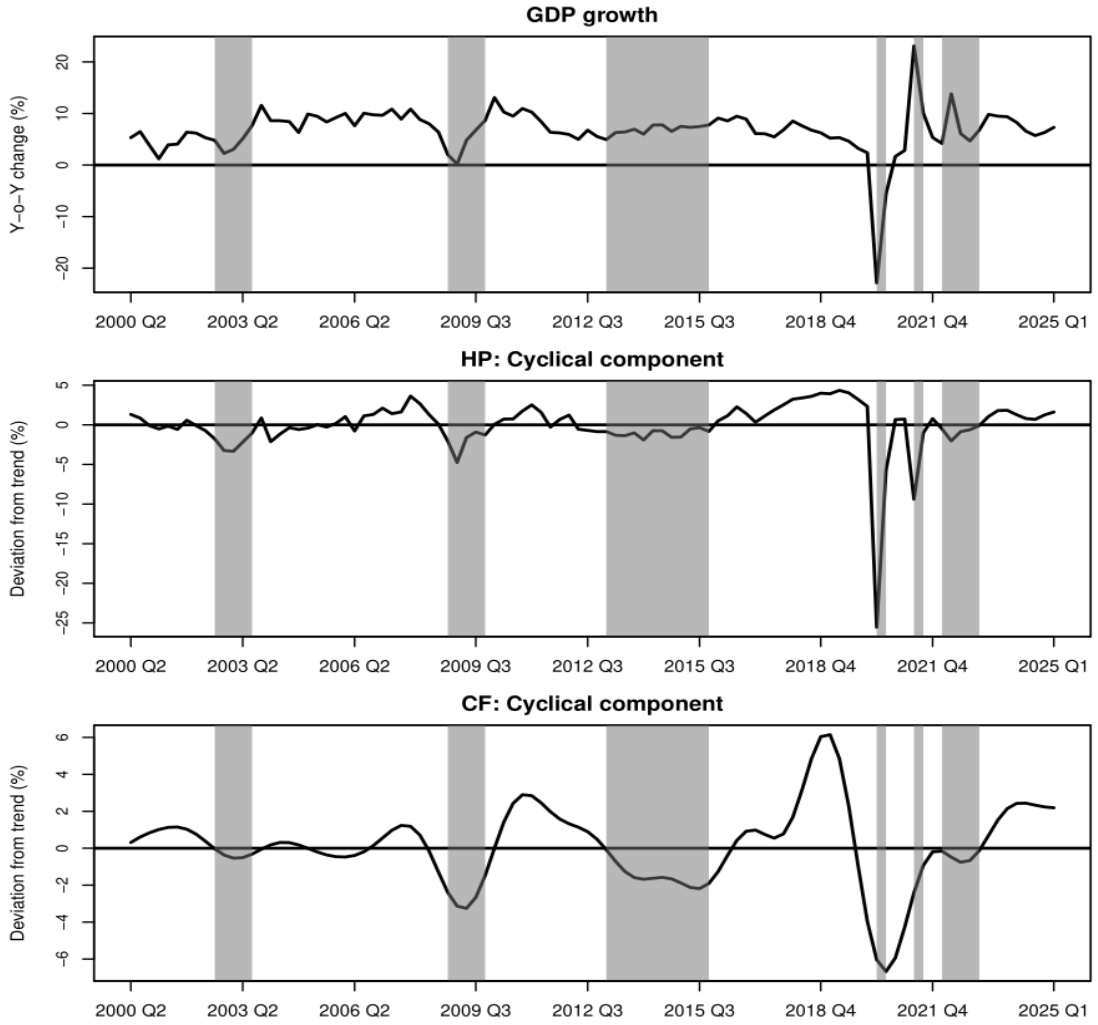
HP filter	CF Filter	Common quarters
1999 Q3	1999 Q2	1999 Q3
2000 Q4	1999 Q3	**2002 Q3**
2001 Q1	1999 Q4	**2002 Q4**
2001 Q2	2000 Q1	**2003 Q1**
2001 Q3	2002 Q3	**2003 Q2**
2002 Q1	2002 Q4	**2003 Q3**
2002 Q2	2003 Q1	2005 Q1
2002 Q3	2003 Q2	2005 Q3
2002 Q4	2003 Q3	2006 Q2
2003 Q1	2003 Q4	**2008 Q4**
2003 Q2	2005 Q1	**2009 Q1**
2003 Q3	2005 Q2	**2009 Q2**
2004 Q1	2005 Q3	**2009 Q3**
2004 Q2	2005 Q4	**2009 Q4**
2004 Q3	2006 Q1	**2013 Q1**
2004 Q4	2006 Q2	**2013 Q2**
2005 Q1	2006 Q3	**2013 Q3**
2005 Q3	2008 Q2	**2013 Q4**
2006 Q2	2008 Q3	**2014 Q1**
2008 Q4	2008 Q4	**2014 Q2**
2009 Q1	2009 Q1	**2014 Q3**
2009 Q2	2009 Q2	**2014 Q4**
2009 Q3	2009 Q3	**2015 Q1**
2009 Q4	2009 Q4	**2015 Q2**
2011 Q3	2013 Q1	**2015 Q3**
2012 Q2	2013 Q2	**2015 Q4**
2012 Q3	2013 Q3	**2020 Q2**
2012 Q4	2013 Q4	**2020 Q3**
2013 Q1	2014 Q1	**2021 Q2**
2013 Q2	2014 Q2	**2021 Q3**
2013 Q3	2014 Q3	**2022 Q1**
2013 Q4	2014 Q4	**2022 Q2**
2014 Q1	2015 Q1	**2022 Q3**
2014 Q2	2015 Q2	**2022 Q4**
2014 Q3	2015 Q3	**2023 Q1**
2014 Q4	2015 Q4	
2015 Q1	2016 Q1	
2015 Q2	2016 Q2	
2015 Q3	2019 Q4	
2015 Q4	2020 Q1	
2020 Q2	2020 Q2	
2020 Q3	2020 Q3	
2021 Q2	2020 Q4	
2021 Q3	2021 Q1	
2022 Q1	2021 Q2	
2022 Q2	2021 Q3	
2022 Q3	2021 Q4	
2022 Q4	2022 Q1	
2023 Q1	2022 Q2	
	2022 Q3	
	2022 Q4	
	2023 Q1	

Source: Authors' estimates.

Note: Table 1 shows the negative output gap quarters identified using the two filters. It also lists the set of quarters identified in common by both the filters.

It is instructive to compare the identified periods of negative output gap with the trajectory of the year-on-year growth in real GDP (seasonally adjusted). Figure 2 shows the close correspondence between the periods of slow growth and the negative output gap periods.

Figure 2. Real GDP growth and cyclical component during negative output gap periods



Source: Ministry of Statistics and Program Implementation (MOSPI), and Authors' estimates

Note: The gray bars indicate negative output gap periods while the line graphs indicate the year-on-year growth rate of real GDP and the HP and CF cyclical components.

3. Identifying binding constraints during periods of slow growth

In a market economy, positive and negative output gaps typically reflect different phases of the business cycle, which are driven by changes in the state of aggregate demand relative to capacity output. When demand runs ahead of capacity output we have a positive output gap. The economy heats up and inflation may rise while the level of unemployment declines. Conversely, when aggregate demand lags behind trend output, we get a negative output gap. Economic growth slows down as producers adjust production levels to match the level of demand. In other words, a typical business cycle of positive and negative output gaps is driven by changes in the state of aggregate demand. However, sometimes the impact of supply side shocks may be superimposed on the business cycle. In particular, a negative output gap period can be due to a demand constraint, a downturn of aggregate demand in a normal business cycle. Alternatively, it can be due to a supply constraint arising from a negative supply shock, e.g, shortfall in food production due to monsoon failure or reduction in oil supply following a cut back in production by the global oil cartel. The required monetary policy response may thus vary depending on the nature of the constraint. Hence, an

assessment of monetary policy during a period of slow growth requires identification of the binding constraint underlying the slowdown in growth.

To identify the binding constraint in each negative output gap period we go beyond the headline inflation and look at the trajectories of sub-indices of Wholesale Price Index (WPI) and Consumer Price Index (CPI). The idea here is to use changes in inflation rates of these sub-indices as indicators of binding demand or supply constraints. Thus, if a slow growth period is accompanied by rising inflation of supply constraint indicators such as the prices of food or 'fuel and light', we take that as indicative of growth being constrained by a negative supply shock. If a negative output gap is accompanied by declining inflation of demand constraint indicators such as the prices of non-food manufactures or CPI core inflation, excluding food and fuel, we take that as indicative of growth being constrained by a negative demand shock. These sub-indices are listed in Table 2.

Table 2. Inflation series used for identification of drivers of negative output gap

Indicators	Sub-indices	Time span
WPI	Primary article	2000 Q1 till 2025 Q1
	Non-food manufactured products	2000 Q1 till 2025 Q1
	Fuel & power	2000 Q1 till 2025 Q1
CPI[9]	Food	2012 Q1 till 2025 Q1
	Fuel & Light	2012 Q1 till 2025 Q1
	Core	2012 Q1 till 2025 Q1

The WPI inflation rate for primary articles and 'fuel & power' have been used along with the CPI inflation rate for food and 'fuel & light' as indicators of binding supply side constraints. To identify binding demand side constraints, we have used the WPI (core) inflation rate for non-food manufactured products and CPI (core) inflation rate excluding food and fuel.[10]

Using core indices enables us to separate short-term or temporary price spikes from persistent underlying inflation trends. As the trend is largely influenced by aggregate demand, core price indices serve as useful indicators to capture the underlying demand condition in an economy.[11]

It should be noted parenthetically that prolonged periods of elevated core inflation will eventually get reflected in elevated headline inflation because high core inflation implies that inflationary pressures are broad based in the economy. Thus, if core inflation is elevated headline inflation stays elevated. Also, unless prices of non-core items like food and fuel persistently pull in a different direction, headline inflation and core inflation are likely to converge.[12]

We use the inflation trajectories in Figure 3 along with the following thumb rules to determine the binding constraints:

[9] Data for CPI sub-indices is only available from 2011 onwards. Thus, the inflation rates start from 2012.

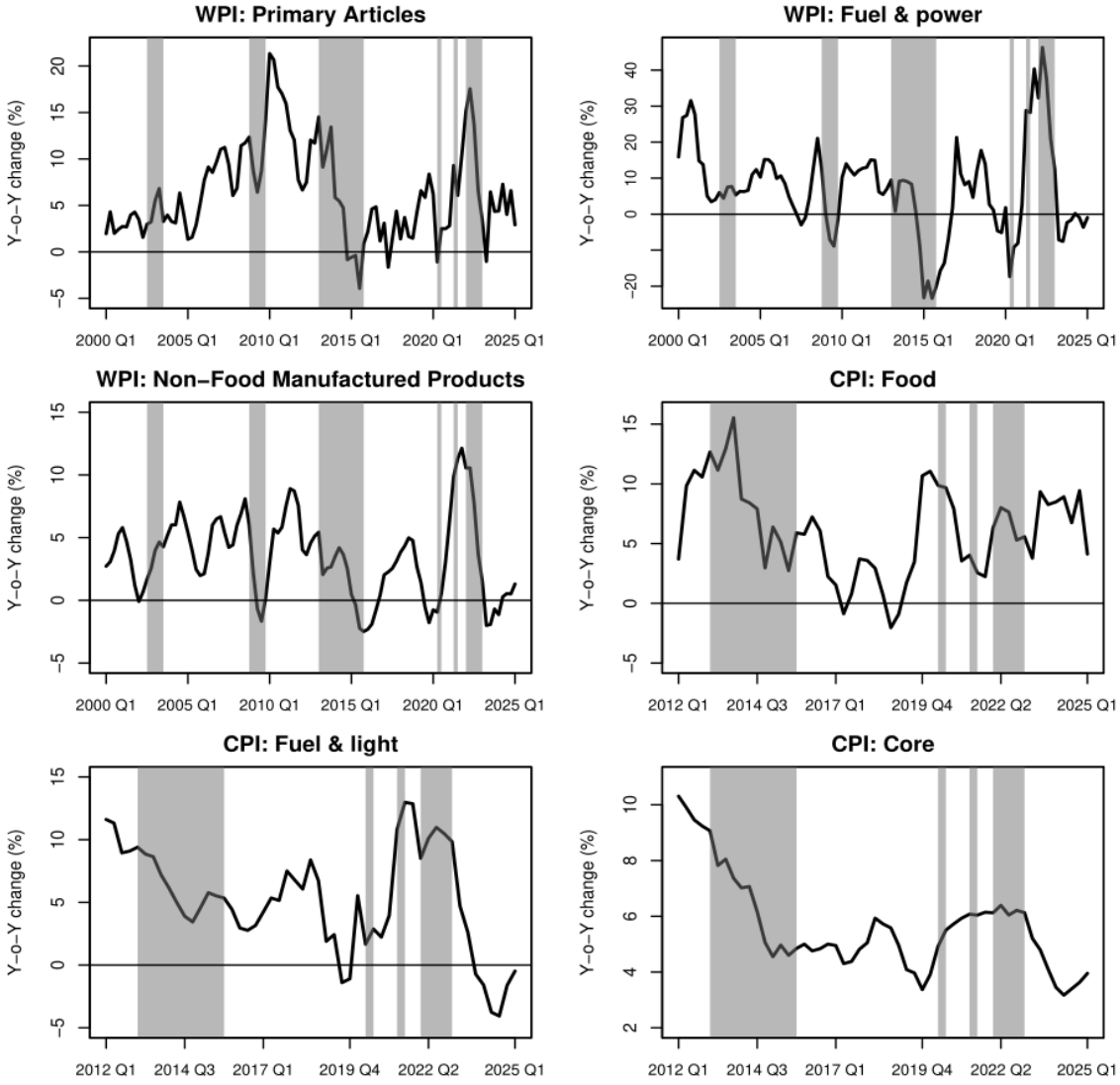
[10] The WPI non-food manufactured product series has been computed as the weighted average of non-food components of WPI manufactured products.

[11] Johnson (1999), Raj and Misra (2011).

[12] Mishkin (2007).

- An increase in inflation of both supply and demand constraint sub-indicators indicates a binding *supply constraint period*.
- A decrease in inflation of both supply and demand constraint sub-indicators indicates a binding *demand constraint period*.
- A negative output gap period in which inflation of supply constraint sub-indicators is rising while the inflation rate of demand constraint sub-indicators is moderating indicates a *mixed period in which one part of the economy is supply constrained while another part is demand constrained*.[13] It is also possible that one sub-period within the full negative output gap period has a binding supply constraint while another sub-period is demand constrained. This can happen because the same negative output gap period may cover several rounds of high frequency inflation estimates.

Figure 3. Inflation sub-indices to identify binding constraints



Source: MOSPI and Authors' calculation

Note: Figure 3 juxtaposes the Y-o-Y growth rate of WPI and CPI sub-indices along with the negative output gap periods

[13] For instance, a shortfall in food output due to poor monsoons may lead to a supply constrained spike in food prices. The income effect of this may then adversely impact the demand for non-food products and a demand constrained moderation of non-food price inflation.

The identified constraints driving each negative output gap period are presented in Table 3. Supply constrained periods are: 2002 Q3 - 2003 Q3, Q3-Q4 of 2009, Q2-Q3 of 2020, Q2-Q3 of 2021, and 2022 Q1 - 2023 Q1. Demand side constrained periods are: 2008 Q4 - 2009 Q2, Q1-Q4 of 2014, and Q1-Q4 of 2015. The period Q1-Q4 of 2013 is an outlier, a mixed period when both demand and supply constraints were binding.

Table 3. Identification of demand and supply constrained periods

	WPI			CPI			
Negative output gap periods	Primary article	Non-food Manufactured products	Fuel & Power	Food	Fuel & Light	Core	Constraint
2002Q3 till 2003Q3	⇑	⇑	⇑				Supply
2008Q4 till 2009 Q2	⇓	⇓	⇓				Demand
Q3-Q4 of 2009	⇑	⇑	⇓				Supply
Q1-Q4 of 2013	⇑	⇓	⇑	⇑	⇓	⇓	Demand and Supply
Q1-Q4 of 2014	⇓	⇓	⇓	⇓	⇓	⇓	Demand
Q1-Q4 of 2015	⇓	⇓	⇓	⇓	⇓	⇓	Demand
Q2-Q3 of 2020	⇑	⇑	⇓	⇑	⇑	⇑	Supply
Q2-Q3 of 2021	⇓	⇑	⇑	⇓	⇑	⇑	Supply
2022 Q1 till 2023 Q1	⇓	⇑	⇓	⇑	⇑	⇑	Supply

Source: Authors' calculation.

Note: During the Multiple Indicator Regime up to 2016, the trajectory of the sub-indices inflation rates are shown as up and down arrows. During the inflation targeting regime post 2016, the up and down arrows of the sub-indices indicate whether the inflation rate was above or below the 6% upper bound of the target inflation band.

4. Monetary policy response during episodes of slow growth

The text book Taylor rule suggests that during periods of negative output gap short term interest rates should be lowered (Taylor, 1993). However, the negative gap can be due to either a binding demand or supply constraint as we have explained above, which might require different monetary policy responses.

In a demand constrained situation interest rates may have to be reduced to stimulate demand.[14] When the supply constraint is binding a central bank can 'look through' the constraint and not respond since its intervention tools are suitable for stimulating demand and not for restoring supply. However, if there are fears of second round effects, that an inflation spike triggered by a negative supply shock in one sector can spill over across broad segments of the economy due to inflationary expectations, the central bank may have to tighten monetary policy. This is especially relevant for emerging market economies where food accounts for a large share of consumption expenditure and food prices have a strong impact on inflation expectations.[15]

However, even in this situation the response may not be straight forward. The demand for necessities like food is inelastic and a spike in headline inflation will shift consumption demand in favour of necessities, possibly leading to a demand constraint

[14] Fagan (2021).

[15] Anand, Ding and Tulin (2014), Bandera et al. (2023), John, D. Kumar, and Patra (2022).

in other sectors thereby requiring an expansionary monetary policy intervention. In the Indian context, monetary policy is made even more complex by the RBI also having to manage the exchange rate, not to set its level but to avoid excessive volatility in exchange rate movements. Navigating its way between inflation and growth along with management of exchange rate movements – the 'trilemma' as it is sometimes called – thus makes the conduct of monetary policy extremely challenging for the RBI. There can be no straight forward rule that monetary policy should be expansionary if the negative gap is demand constrained and it can 'look through' or be tightened when there is a supply constrained negative output gap. Rules need to be combined with discretion and judgement.

This has indeed been the RBI's actual practice. Tables 4 and 7 show the response of monetary policy during times of negative output gap, under the two policy regimes, i.e., Multiple Indicator regime (MIR) and Inflation Targeting regime (ITR). In neither regime do we see any straightforward association between the nature of the binding constraint and the RBI's monetary policy stance. Sometimes the required course of action was very clear. In other times it was not. There are episodes of binding supply constraints when monetary policy was eased not tightened while there are also episodes of binding demand constraints when monetary policy was tightened.

Table 4. Monetary policy during negative output gap periods under Multiple Indicator Regime

Negative output gap period	Constraint driving negative output gap	Monetary Policy response	Cash Reserve Ratio (CRR)	Repo rate	Reverse Repo Rate	Bank Rate	Marginal Standing Facility (MSF)
2002Q3 - 2003Q3	Supply	Easing	Reduced from 5% in 2002 Q3 to 4.5% in 2003 Q3 (50 basis points)	Reduced from 7.75% in 2002 Q3 to 6% in 2003 Q3 (175 basis points)	Reduced from 5.75% in 2002 Q3 to 4.5% in 2003 Q3 (125 basis points)	Reduced from 6.5% in 2002 Q3 to 6% in 2003 Q3 (50 basis points)	
2008Q4 - 2009Q2	Demand	Easing	Reduced from 9% in 2008 Q3 to 5% in 2009 Q2 (400 basis points)	Reduced from 9% in 2008 Q3 to 4.75% in 2009 Q2 (425 basis points)	Reduced from 6% in 2008 Q3 to 3.25% in 2009 Q2 (275 basis points)	Kept unchanged at 6%.	
Q3-Q4 of 2009	Supply	Status quo	Unchanged at 5%	Unchanged at 4.75%	Unchanged at 3.25%	Kept unchanged at 6%.	
Q1-Q2 of 2013	Demand & Supply	Easing	Reduced from 4.25% in 2012 Q4 to 4% in 2013 Q2 (25 basis points)	Reduced from 8% in 2012 Q4 to 7.25% in 2013 Q2 (75 basis points)	Reduced from 7% in 2012 Q4 to 6.25% in 2013 Q2 (75 basis points)		Reduced from 9% in 2012 Q4 to 8.25% in 2013 Q2 (75 basis points)
2013 Q3	Demand & Supply	Tightening	Kept unchanged at 4%	Increased to 7.5% (25 basis points)	Increased to 6.5% (25 basis points)		Increased to 9.5% (125 basis points)
2013 Q4	Demand & Supply	Tightening	Kept unchanged at 4%	Increased to 7.75% (25 basis points)	Increased to 6.75% (25 basis points)		Reduced to 8.75% (75 basis points)
Q1-Q4 of 2014	Demand	Tightening and then Status quo	Kept unchanged at 4%	Increased to 8% in 2014 Q1, and kept unchanged throughout the year (25 basis points)	Increased to 7% In 2014 Q1, and kept unchanged throughout the year (25 basis points)		Increased to 9% in 2014 Q1, and kept unchanged throughout the year (25 basis points)
Q1-Q4 of 2015	Demand	Easing	Kept unchanged at 4%	Reduced to 6.75% in 2015 Q4 (125 basis points)	Reduced to 5.75% in 2015 Q4 (125 basis points)		Reduced to 7.75% in 2015 Q4 (125 basis points)

Source: RBI

Note: Table 4 shows monetary policy response under the Multiple Indicator Approach during negative output gap periods along with the constraints driving them.

We discuss three episodes here during the MIR. One in which there was a very clear demand constraint which called for a strong expansionary monetary policy. A second episode when inflation was triggered by a binding supply constraint but the RBI opted to pursue an expansionary monetary policy. A third episode, particularly interesting, when a demand constraint and a supply constraint were both binding within the same negative output gap period.

Episode 1 The 2008 Q4 - 2009 Q2 period, when the collapse of Lehman Brothers in September 2008 triggered the Global Financial Crisis (GFC) is a classic example of when a severe demand constraint driven negative output gap called for a strong expansionary monetary policy response. The domestic economy had already been slowing down and the GFC deepened the slow down further.[16] The impact of GFC on India was mainly felt through three channels - financial markets (banking sector, equity markets, etc.), trade flows (primarily sharp decline in the demand for Indian exports) and the exchange rate. The challenge was exacerbated by a liquidity crunch in the global financial markets. It led to a shift in credit demand of Indian corporations and banks from external sources to domestic banks. As a result, banking system liquidity came under stress, along with Indian banks becoming increasingly risk averse following the GFC. With the economy already slowing down, bank credit also slowed down.[17] Responding to this exceptionally challenging situation, the central bank radically eased monetary policy, with a 425 basis point cut in the Repo rate, followed by a 400 basis point cut in CRR and 275 basis point cut in reverse repo rate.

Episode 2 In the 2002 Q3 - 2003 Q3 period, the Indian economy was experiencing severe drought conditions. It was the first instance of an all-India drought since 1987.[18] The South-west monsoon precipitation was 21 percent below normal.[19] There was a shortfall of around 24.83 billion tons in Kharif food-grain production, while Rabi production fell by 13.25 billion tons[20] (See Table 5). The negative food supply shock triggered a food price driven inflation spike. But the central bank responded by lowering the Repo and Reverse Repo rates by 175 and 125 basis points respectively to stimulate demand. The CRR and bank rate were also reduced by 50 basis points each. The RBI assessed that the food price inflation was transitory and the demand constraint it had generated by shifting demand away from non-necessities required a monetary policy intervention to stimulate demand.

[16] Reserve Bank of India (2009), Reserve Bank of India (2010).

[17] R. Kumar and Vashisht (2009).

[18] Department of Agriculture and co-operation (2003).

[19] At this time, the central government stepped in to address the consequences associated with the drought condition. It set up a task force for this. The task force used a food-for-work program that was employed under the special component of Sampoorna Grameen Rozgar Yojana. Apart from this, a few other measures were taken in the form of interest waivers on loans taken by farmers, etc.

[20] Reserve Bank of India (2003), Reserve Bank of India (2004).

Table 5. Rainfall & Food-grain Production: 2000-01 to 2024-25

	South-West Monsoon (India, % deviation from normal)	Kharif foodgrain production (in billion tonnes)	Rabi foodgrain production (in billion tonnes)
2000-01	-10.47	101.77	95.05
2001-02	-9.02	111.76	101.09
2002-03	**-22.06**	**86.92**	**87.85**
2003-04	1.25	116.61	96.58
2004-05	-11.41	102.96	95.40
2005-06	-1.37	109.47	99.14
2006-07	4	110.20	107.09
2007-08	8.62	120.46	110.32
2008-09	0.01	117.68	116.79
2009-10	**-21.38**	**103.53**	**114.58**
2010-11	1.95	120.81	123.67
2011-12	1.61	131.23	128.05
2012-13	-7.14	128.07	129.05
2013-14	5.69	128.69	136.35
2014-15	-11.86	128.07	123.96
2015-16	-13.71	125.09	126.45
2016-17	-2.6	138.33	136.78
2017-18	-4.69	140.47	144.55
2018-19	-9.4	141.52	143.69
2019-20	10.36	143.81	153.69
2020-21	9.18	150.58	160.17
2021-22	-0.69	155.36	160.25
2022-23	6.47	155.71	173.98
2023-24	-5.41	155.77	176.53
2024-25	7.75	168.07	185.89

Source: Indian Meteorological Department (IMD), Ministry of Earth Sciences, and Directorate of Economic & Statistics (DES), Ministry of Agriculture and Farmers Welfare.
Note: Table 5 shows the supply side factors like South-West Monsoon, along with production of foodgrains during Rabi and Kharif seasons. The figures in red highlight the periods during which agricultural supply constraint prevailed.

Similarly, during the supply constrained period 2009 Q3-Q4, both kharif and Rabi production declined, with the fall in Kharif production being more pronounced (Table 5). This led to a food price driven spike in inflation. However, the RBI assessed that the price spike was transitory and opted to maintain the status quo on rates instead of tightening monetary policy.

Episode 3 The period 2013-2015 is the longest and most interesting negative output gap period, when the RBI had to cope with a trilemma. The focus of monetary policy during this period saw a clear shift from growth support to rupee defense in 2013, then to fighting inflation in 2014 and back to supporting growth in 2015. In the first half of 2013 the Repo, Reverse Repo and Marginal Standing Facility (MSF) rates were each reduced by 75 basis points while the CRR was reduced by 25 basis points. This was undertaken to address the broad based slow-down GDP growth alongside moderating inflationary pressures.[21] But by the second half of 2013 the focus of monetary policy shifted to rupee defense following a radical shift in the Federal Open Market Committee's (FOMC) policy stance. In May 2013 Federal Reserve Chair Ben Bernanke

[21] Reserve Bank of India (2013a).

announced in his testimony to Congress that the FOMC might soon start to slow down its bond purchases. This immediately triggered the 'Taper Tantrum' with a surge in the US 10-year bond yield. This in turn led to a wave of capital flight from emerging economies. India was one of the countries most affected due to its then prevailing 'twin deficits' problem and high dependence on foreign capital inflows. The capital outflows resulted in rapid rupee depreciation. In response, the RBI in collaboration with the central government announced a series of measures to ease the depreciation pressure on the rupee (see Table 6).[22] There was severe tightening of monetary policy though investment demand was already weak at the time.

Table 6: Monetary Policy Actions to cope with Taper Tantrum

Dates	Measures Undertaken
15th July 2013[23]	Monetary policy tightening: a) Under the Liquidity Adjustment Facility (LAF), Marginal Standing Facility (MSF) rate was raised by 300 basis points above the policy repo rate to 10.25 percent. b) Bank rate was re-calibrated to 10.25 percent. c) Fund allocation under the LAF was limited to 1 percent of the Net Demand and Time Liabilities (NDTL) subject to an overall cap of Rs 750 billion. d) The Reserve Bank conducted Open Market Sales of Government of India (GoI) Securities on July 18, 2013, to tighten liquidity further.
23rd July 2013[24]	Monetary policy tightening Money available to a bank under LAF was restricted further to 0.5% of that bank's NDTL. Of the required CRR, banks were asked to maintain a minimum of 99 percent of CRR on all days. This meant an increase of 70 percent from earlier average daily requirements.
8th August 2013[25]	Liquidity tightening measure: RBI announced the decision to auction GoI Cash Management Bills for a notified amount of Rs. 220 billion once every week, to further tighten liquidity.

By the end of the year the special measures taken to defend the rupee were reversed and focus then shifted to addressing high inflation. Policy rates were raised further in January 2014 and maintained at that level throughout the year. As inflationary pressures ebbed in 2015, RBI shifted its focus back to stimulating domestic demand and reviving growth.

A similar lack of any simple association between the binding constraint and RBI's monetary policy response is also evident during the output gap periods under the ITR (Table 7). During the first COVID period (Q2-Q3 of 2020), RBI chose to support economic growth by lowering policy interest rates. It decided that supply constraints at

[22] Reserve Bank of India (2013b).
[23] Reserve Bank of India (2013c).
[24] Reserve Bank of India (2013d).
[25] Reserve Bank of India (2013e).

this point in time were transitory and that it was more urgent to restore demand to contain the damage brought on by the pandemic. During the second COVID period (Q2-Q3 of 2021 period) its assessment was similar and RBI maintained status quo on the rates.[26]

Table 7. Monetary Policy during Negative Output Gap periods under Inflation Targeting Regime

Negative output gap period	Constraint driving negative output gap	Monetary policy response	CRR	Repo Rate	Reverse Repo	Standing Deposit Facility (SDF)	MSF
Q2-Q3 of 2020	Supply	Easing	Reduced from 4% in 2020 Q1 to 3% in 2020 Q2 and held constant thereafter (100 basis points)	Reduced from 4.4% in 2020 Q1 to 4% in 2020 Q2 and held constant thereafter (40 basis points)	Reduced from 4% in 2020 Q1 to 3.35% in 2020 Q2 and held constant thereafter (65 basis points)		Reduced from 4.65% in 2020 Q1 to 4.25% in 2020 Q2 and held constant thereafter (40 basis points)
Q2-Q3 of 2021	Supply	Status quo	Increased back to 4% (100 basis points)	Kept unchanged at 4%	Kept unchanged at 3.35%		Kept unchanged at 4.25%
2022 Q1- 2023 Q1	Supply	Tightening	Increased from 4% in 2022 Q1 to 4.5% in 2022 Q2 and held constant thereafter (50 basis points)	Increased from 4% in 2022 Q1 to 6.5% in 2023 Q1 (250 basis points)	Kept unchanged at 3.35%	Increased from 4.65% in 2022 Q2 to 6.25% in 2023 Q1 (160 basis points)	Increased from 4.25% in 2022 Q1 to 6.75% in 2023 Q1 (250 basis points)

Source: RBI.
Note: Table 7 shows monetary policy response under the Inflation Targeting during negative output gap periods along with the constraints driving them.

In Q1 of 2022, RBI still maintained status quo on the policy rates, to ensure broad-based recovery in domestic economic activity.[27] However, from May 2022 onwards, RBI started tightening monetary policy as it felt that the prevailing supply constraint conditions could spill over into second-round effects and broad based inflation.[28] Increased global geopolitical tensions due to the Russia-Ukraine war and sanctions on Russia were expected to accentuate the existing supply disruptions that were already a concern due to the COVID pandemic. The war led to a surge in international prices of food, commodities and crude oil, which was reflected in input prices. As a result, the headline inflation surged and remained elevated above the 6 per cent upper limit of the inflation tolerance band throughout the period.[29] Inflationary pressures were also a result of the dollar index soaring to a two-decade high, which fed into imported inflation.[30] Thus, the negative output gap was supply constrained throughout this period but the RBI policy stance shifted from monetary policy easing to maintenance of status quo to monetary policy tightening as its assessment of the nature and severity of the supply constraint evolved.

5. Monetary policy transmission and the interest rate channel

The available evidence indicates that in India there is a transmission time lag of 2-3

[26] Reserve Bank of India (2020), Reserve Bank of India (2021).
[27] Reserve Bank of India (2022b).
[28] Reserve Bank of India (2022e).
[29] Reserve Bank of India (2022c,d).
[30] Reserve Bank of India (2022a).

quarters between monetary policy actions and their impact on output.[31] Our analysis indicates that it usually takes almost a year for the output gap to close after policy action is initiated:

- **2002 Q3 till 2003 Q3:** Policy action was initiated in 2002 Q4, the output gap closed in 2003 Q4.
- **2008 Q4 till 2009 Q4:** Policy action was initiated in 2008 Q4, output gap closed in 2010 Q1.
- **2013 Q1 till 2015 Q4:** Policy action **(**rate reduction) was initiated in 2013 Q1. The central bank reversed course and increased the interest rates in 2013 Q3. Status quo was maintained till the end of 2014 Q4.
  The stance was again reversed and eased during 2015 Q1 and the output gap closed by 2016 Q1.
- **Q2-Q3 of 2020:** Policy action initiated in 2020 Q1, output gap closed in 2020 Q4.
- **Q2-Q3 of 2021:** No policy action was initiated because the central bank felt that the gap was transient. The gap indeed closed in Q3 of 2021.
- **2022 Q1 till 2023 Q1:** Policy action was initiated in 2022 Q2 and the output gap closed in 2023 Q2.

Transmission of monetary policy requires a smooth transmission mechanism. Typically, changes in monetary policy are transmitted through five channels:[32]

1. **Interest rate channel:** In this channel changes in monetary policy are first transmitted to short-term interest rates like call money rate, etc., and then long-term interest rates like yield on government securities, bank lending and deposit rates, etc. These then influence the spending and investment decisions of economic agents.[33]
2. **Credit channel:** This channel works in tandem with the interest rate channel, mainly through bank lending and bank balance sheets, i.e., the cost of borrowing and its impact on aggregate demand.[34]
3. **Exchange rate channel:** Changes in policy rate lead to either an appreciation or depreciation of the exchange rate. A decrease in policy rate raises the demand for foreign exchange and causes the exchange rate to depreciate, which switches aggregate expenditure in favor of domestic thereby increasing domestic production. The reverse would occur if the policy rate is raised.
4. **Asset price channel:** Lowering of interest rates implies an increase in asset prices. The resulting positive wealth effect in turn raises aggregate demand.
5. **Expectations channel:** Central bank's monetary policy actions, particularly interest rate changes, affect the expectations and decisions of economic agents which in turn impacts levels of output, employment and inflation.

These channels operate simultaneously. However, their functioning depends on several factors including:

- Active liquidity management by the central
- A well-capitalised and healthy banking system.

[31] Acharya (2017).

[32] C. Singh et al. (2023).

[33] Acharya (2020).

[34] Bernanke and Gertler (1995).

- Responsiveness of bank asset-liability structures to policy rate changes
- Mismatch between administered and market interest rates
- Effective communication of monetary policy decisions.

In India, the existing literature indicates that the interest rate channel is the most effective,[35] followed by the credit channel. In this article we focus on the effectiveness of monetary policy transmission through the interest rate channel in addressing the negative output gap.

Interest rate channel: Commercial bank lending rates are typically a sum of the benchmark interest rate along with the spread or borrower specific charges. Benchmark interest rates are computed using RBI's prescribed methodology and are required to change in line with the policy rate, or repo rate. Commercial banks have the discretion to determine the spread to be charged to each customer, depending on the customer's credit and risk profile.

Over the years, RBI has refined the system of benchmark interest rates. With each subsequent revision, RBI has tried to improve transparency and transmission efficiency while providing greater flexibility to banks in setting their lending rates.[36] The different benchmark rate systems implemented by RBI over the years have included the *Prime Lending Rate (PLR; 1994), Benchmark Prime Lending Rate (BPLR; 2003), Base rate (2010)*, *Marginal cost of funds-lending rate (MCLR; 2016)* and the *External Benchmark Lending rate (EBLR; 2019)*.

All the benchmarks prior to EBLR, were internal benchmarks. This implied that parts of the methodology prescribed by the RBI for benchmark rate systems were under the control of the banks, such as cost of funds, etc. Hence, banks held discretionary powers to adjust the benchmark rate as per the requirements of the banks. As a result, benchmarks varied across banks. These anomalies were addressed in 2019 through the introduction of EBLR. Under the EBLR system, banks are required to link their floating rate loans (retail, personal, Micro & Small Enterprises) to either RBI repo rate or any other benchmark rates published by Financial Benchmarks India Private Limited (FBIL) such as 91-day treasury bill rate, etc. This has enhanced the transparency of setting benchmark rates. As of March 2025, almost 61.6% of total loans of the Scheduled Commercial Banks are linked to EBLR, while around 34.9% are still linked to MCLR.[37]

The trajectory of the benchmark rate movements for all the banks follows the direction of the policy rate, however the transmission remains partial as shown in Table 8.[38] For instance, in the 2008 Q4 to 2009 Q4 period the policy rates were reduced by more than 200 basis points but the reduction in the benchmark rate was much less. Similarly, in the post 2015 period all policy rates were reduced by 125 basis points but the benchmark rates declined only by 35 to 55 basis points, with maximum reduction occurring in the case of public sector banks.[39] During the ITR, especially in the 2020

[35] Acharya (2017), B. Bhoi et al. (2016), Khundrakpam and Jain (2012). See also Bhattacharya, Patnaik and Shah (2010); Raghuvanshi and Ahmad (2024), Sharma (2020); Singh B & I Pattanaik (2012); Ahmed, Binici and Turunen (2022); 2012) and Goyal and Parab (2021).

[36] *Report of the Internal Study Group to Review the Working of the Marginal Cost of Funds Based Lending Rate system (2017).*

[37] Reserve Bank of India (2025).

[38] EBLR is not covered in this analysis due to lack of data.

[39] We only look at the 2015 period in the entire negative output gap period of 2013-2015, since RBI

negative output gap period, much of the policy rate cut of 40 basis points was transmitted by commercial banks, especially the public and private sector banks. However, during the 2022 period of negative output gap, the transmission was relatively weak.

Table 8. Transmission towards benchmark lending rate

Negative output gap periods	Constraint driving the negative output gap	Policy rate	PLR/BPLR (Max)	Base Rate (Median)			MCLR (Median)		
				Public sector banks	Private sector banks	Foreign banks	Public sector bank	Private sector bank	Foreign banks
2002 Q3 - 2003 Q3	Supply	Reduction Repo - 175 basis points Reverse repo - 125 basis points CRR - 50 basis points Bank rate - 50 basis points	Reduced from 12% in 2002 Q3 to 11.5% in 2003 Q3 (50 basis points)						
2008 Q4 - 2009 Q2	Demand	Reduction Repo - 425 basis points Reverse repo - 275 basis points CRR - 400 basis points Bank rate - unchanged	Reduced from 14% in 2008 Q3 to 12.25% in 2009 Q2 (175 basis points)						
Q3-Q4 of 2009	Supply	Status quo	Further reduced to 12% (25 basis points)						
Q1-Q4 2015	Demand	125 basis point cu in all the policy rates		Reduced from 10.25% in 2015 Q1 to 9.7% in 2015 Q4 (55 basis points)	Reduced from 10.75% in 2015 Q1 to 10.25% in 2015 Q4 (50 basis points)	Reduced from 9.55% in 2015 Q1 to 9.20% in 2015 Q4 (35 basis points)			
Q2-Q3 2020	Supply	40 basis points reduction in repo rate					Reduced from 7.63% in 2020 Q2 to 7.35% in 2020 Q3 (28 basis points)	Reduced from 8.95% in 2020 Q2 to 8.65% in 2020 Q3 (30 basis points)	Reduced from 6.6% in 2020 Q2 to 6.4% in 2020 Q3 (20 basis points)
Q2-Q3 2021	Supply	Status quo					No change held constant at 7.3%	Reduced from 8.3% in 2021 Q2 to 8.23% in 2021 Q3 (7 basis points)	Reduced from 5.83% in 2021 Q2 to 5.75% in 2021 Q3 (8 basis points)
2022 Q1 - 2023 Q1	Supply	Repo rate increased by 250 basis points					Increased from 7.25% in 2022 Q1 to 8.53% in 2023 Q1 (128 basis points)	Increased from 8.35% in 2022 Q1 to 9.3% in 2023 Q1 (95 basis points)	Increased from 6.17% in 2022 Q1 to 8.02% in 2023 Q1 (185 basis points)

Source: RBI

Note: Table 8 shows changes in benchmark lending and policy rates during each negative output gap along with the constraints driving the periods.

started addressing the negative output gap in 2015 only.

Incomplete transmission is also evident in the case of actual lending rates (See Table 9) represented by Weighted Average Lending rate (WALR). For instance, during the 2020 Q2-Q3 period when the repo rate was reduced by 40 basis points, WALR on fresh loans for public and private sector banks declined by only 16 and 9 basis points, respectively.

Table 9: Transmission to WALR on outstanding and new loans

Negative output gap periods	Constraint driving negative output gap	Policy rate	WALR (Average) (Percent per annum)					
			Outstanding loans			Fresh Loans		
			Public sector banks	Private sector banks	Foreign banks	Public sector banks	Private sector banks	Foreign banks
Q1-Q4 2015	Demand	125 basis point cut in all the policy rates	Reduced from 11.66% in 2015 Q1 to 11.18% in 2015 Q4 (48 basis points)	Reduced from 12.37% in 2015 Q1 to 11.84% in 2015 Q4 (53 basis points)	Reduced from 11.88% in 2015 Q1 to 11.36% in 2015 Q4 (52 basis points)	Reduced from 11.02% in 2015 Q1 to 10.57% in 2015 Q4 (45 basis points)	Reduced from 11.84% in 2015 Q1 to 11.32% in 2015 Q4 (52 basis points)	Reduced from 10.59% in 2015 Q1 to 9.72% in 2015 Q4 (87 basis points)
Q2-Q3 2020	Supply	40 basis points reduction	Reduced from 9.13% in 2020 Q2 to 8.94% in 2020 Q3 (19 basis points)	Reduced from 10.79% in 2020 Q2 to 10.62% in 2020 Q3 (17 basis points)	Reduced from 9.32% in 2020 Q2 to 9.06% in 2020 Q3 (26 basis points)	Reduced from 8.18% in 2020 Q2 to 8.02% in 2020 Q3 (16 basis points)	Reduced from 8.95% in 2020 Q2 to 8.86% in 2020 Q3 (9 basis points)	Reduced from 7.37% in 2020 Q2 to 7.02% in 2020 Q3 (35 basis points)
Q2-Q3 2021	Supply	Status quo	Reduced from 8.53% in 2021 Q2 to 8.47% in 2021 Q3 (6 basis points)	Reduced from 10.02% in 2021 Q2 to 9.88% in 2021 Q3 (14 basis points)	Reduced from 8.07% in 2021 Q2 to 7.96% in 2021 Q3 (11 basis points)	Reduced from 7.65% in 2021 Q2 to 7.47% in 2021 Q3 (18 basis points)	Increased from 8.45% in 2021 Q2 to 8.82% in 2021 Q3 (37 basis points)	Increased from 5.79% in 2021 Q2 to 5.99% in 2021 Q3 (20 basis points)
2022 Q1- 2023 Q1	Supply	Policy repo rate increased by 250 basis points	Increased from 8.28% in 2022 Q1 to 9.06% in 2023 Q1 (78 basis points)	Increased from 9.71% in 2022 Q1 to 10.6% in 2023 Q1 (89 basis points)	Increased from 7.78% in 2022 Q1 to 9.35% in 2023 Q1 (157 basis points)	Increased from 7.11% in 2022 Q1 to 8.53% in 2023 Q1 (142 basis points)	Increased from 8.78% in 2022 Q1 to 9.89% in 2023 Q1 (111 basis points)	Increased from 6.04% in 2022 Q1 to 8.93% in 2023 Q1 (289 basis points)

Source: RBI

Note: Table 9 shows changes in WALR and policy rates during each negative output gap along with the constraints driving the period

It is also important to consider the effectiveness of transmission for bank deposit rates. Bank deposits are the cheapest source of finance which banks use for lending. Thus, incomplete transmission of policy rate reduction to deposit rates implies that cost of funds for banks will not decline adequately, thereby adversely impacting the net interest margins of banks. In such a scenario, banks tend to delay the transmission to lending rates, which in turn hinders the effectiveness of monetary policy.

Table 10 presents the changes in bank deposit rates, particularly the Weighted Average Domestic Term Deposit Rate (WADTDR). In each negative output gap period, the transmission to deposit rate seems to be higher than the transmission to lending rates during the ITR. For instance, the transmission of policy rates changes to outstanding deposits during the first COVID period was almost complete across banking sectors. This was also true during the 2022 negative output gap period, especially with regard to the transmission to deposit rates for new deposits.

The asymmetric transmission of monetary policy on the deposit and lending side

implies a widening margin between deposit and lending rates. This is a matter of concern. It raises a question about how RBI can strengthen transmission on the lending side.

Table 10: Bank deposit rates

Negative output gap period	Constraint driving negative output gap	Policy rate	WADTDR (Average) (Percent per annum)					
			Outstanding deposits			Fresh deposits		
			Public Sector Banks	Private Sector Banks	Foreign Banks	Public Sector Banks	Private Sector Banks	Foreign Banks
Q1-Q4 2015	Demand	125 basis point cut in all the policy rates	Reduced from 8.63% in 2015 Q1 to 7.89% in 2015 Q4 (74 basis points)	Reduced from 8.66% in 2015 Q1 to 8.02% in 2015 Q4 (64 basis points)	Reduced from 7.45% in 2015 Q1 to 6.6% in 2015 Q4 (85 basis points)			
Q2-Q3 2020	Supply	40 basis points reduction	Reduced from 6.09% in 2020 Q2 to 5.87% in 2020 Q3 (22 basis points)	Reduced from 6.24% in 2020 Q2 to 5.93 in 2020 Q3 (31 basis points)	Reduced from 4.38% in 2020 Q2 to 3.66% in 2020 Q3 (72 basis points)			
Q2-Q3 2021	Supply	Status quo	Reduced from 5.27% in 2021 Q2 to 5.15% in 2021 Q3 (12 basis points)	Reduced from 5.44% in 2021 Q2 to 5.3% in 2021 Q3 (14 basis points)	Increased from 3.18% in 2021 Q2 to 3.22% in 2021 Q3 (4 basis points)	Reduced from 4.19% in 2021 Q2 to 4.02% in 2021 Q3 (17 basis points)	Reduced from 4.28% in 2021 Q2 to 4.26% in 2021 Q3 (2 basis points)	Increased from 2.67% in 2020 Q2 to 2.72% in 2021 Q3 (5 basis points)
2022 Q1- 2023 Q1	Demand & Supply	Policy repo rate increased by 250 basis points	Increased from 5.11% in 2022 Q1 to 6.02% in 2023 Q1 (91 basis points)	Increased from 5.15% in 2022 Q1 to 6.18% in 2023 Q1 (103 basis points)	Increased from 3.29% in 2022 Q1 to 5.59% in 2023 Q1 (230 basis points)	Increased from 4.24% in 2022 Q1 to 6.68% in 2023 Q1 (244 basis points)	Increased from 4.36% in 2022 Q1 to 6.42% in 2023 Q1 (206 basis points)	Increased from 2.90% in 2022 Q1 to 5.38% in 2023 Q1 (248 basis points)

Source: RBI.

Note: Table 10 shows changes in WADTDR and policy rates during each negative output gap period along with the constraints driving them.

6. Some concluding remarks

This article has reviewed the conduct of monetary policy in India during periods of slow growth over the past quarter century. Taylor type rules such as reducing interest rates to eliminate negative output gaps are too simple because the gap can be due as much to an adverse supply shock as a cyclical demand constraint. Indeed, this has often been the case in India during the past 25 years. Different constraints may require different interventions.

However, there is also no straight forward relationship between the binding constraint, demand or supply, and monetary policy intervention. If there are concerns about a second-round inflationary effect of a negative supply shock due to expectations, this may call for monetary policy tightening. But if inflation of prices of low elasticity necessities is expected to shift aggregate demand away from other goods and services, this may call for an expansionary policy. Also, the same negative output gap period may be attributable to changing binding constraints during different sub-periods of the gap.

Further, monetary policy is made even more complex in India where navigating between inflation and growth, even in the Inflation Targeting regime, has had to be combined with interventions to contain excessive exchange rate volatility. Thus, rules have to be combined with discretion and judgement, based on comprehensive and intensive scrutiny of the overall economic situation.

We find that typically it takes about a year for a policy intervention to eliminate a negative supply gap, with a transmission lag of 2-3 quarters. This is a fairly robust pattern across both the Multiple Indicator Regime and Inflation Targeting Regime.

An important concern is the asymmetry between effectiveness of monetary policy transmission for deposit and lending rates. The RBI needs to consider why the effectiveness of transmission on the lending side has not improved despite its many policy initiatives undertaken over the years.

References

Acharya, Viral V. (2017). *Monetary transmission in India: Why is it import- ant and why hasn't it worked well?* BIS website: https://www.bis.org/review/r171123f.pdf.

– (2020). "Improving Monetary Transmission Through the Banking Chan- nel: The Case for External Benchmarks in Bank Loans". In: *Vikalpa* 45.1, pp. 32–41. url: https://journals.sagepub.com/doi/full/10.1177/0256090920917492.

Ahmed, Mr. Faisal, Mahir Binici and Mr. Jarkko Turunen (Oct. 2022). *Monetary Policy Communication and Financial Markets in India*. IMF Working Papers 2022/209. International Monetary Fund. url: https://www.imf.org/en/Publications/WP/Issues/2022/10/28/Monetary-Policy-Communication-and-Financial-Markets-in-India-525085.

Anand, Rahul, Ding Ding and Volodymyr Tulin (2014). *Food inflation in India: The role for monetary policy*. IMF working paper. International Monetary Fund. url: https://www.imf .org /external/pubs /ft/wp/2014/wp14178.pdf.

Bandera, Nicolo et al. (2023). *Monetary policy in the face of supply shocks: The role of inflation expectations*. Tech. rep. European Central Bank. url: https://www.ecb.europa.eu/press/conferences/ecbforum/shared/pdf/2023/Tenreyro_paper.pdf.

Baxter, M. and R.G. King (1999). "Measuring business cycles: Approximate band-pass filters for economic time series". In: *Review of Economics and Statistics* 81.4, pp. 575–593. issn: 0034-6535.

Bernanke, Ben S. and Mark Gertler (Dec. 1995). "Inside the Black Box: The Credit Channel of Monetary Policy Transmission". In: *Journal of Eco- nomic Perspectives* 9.4, pp. 27–48. url: https://www.aeaweb.org/articles?id=10.1257/jep.9.4.27.

Bhattacharya, Rudrani, Ila Patnaik and Ajay Shah (Jan. 2010). *Monetary policy transmission in an emerging market setting*. Working Papers. Inter- national Monetary Fund. url: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Monetary-Policy-Transmission-in-an-Emerging-Market-Setting-24555.

Bhoi, Barendra et al. (June 2016). "Effectiveness of alternative channels of monetary policy transmission: some evidence for India". In: *Macroeconomics and Finance in Emerging Market Economies* 10, pp. 1–20. url: https://www.researchgate.net/publication/303850809_Effectiveness_of_alternative_channels_of_monetary_policy_transmission_some_evidence_for_India.

Bhoi, Barendra Kumar and Harendra Kumar Behera (2016). "India's potential output revisited". In: *Journal of Quantitative Economics* 15, pp. 101–120. url: https://link.springer.com/article/10.1007/s40953-016-0040-9#citeas.

Christiano, L.J. and T.J. Fitzgerald (2003). "The band pass filter". In: *International Economic Review* 44.2, pp. 435–465.

Drought situation in the country (Dec. 2003). Standing committee on agriculture 45. Department of Agriculture and co-operation. url: https://eparlib.nic.in/bitstream/123456789/66093/1/13_Agriculture_45.pdf.

External Benchmark Based Lending (2019). Reserve Bank of India: https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=11677&Mode=0.

Fagan, Doreen (2021). *Understanding potential GDP and the output gap*. Federal Reserve Bank of St.Louis: https://www.stlouisfed.org/open-vault/2021/august/understanding-potential-gdp-and-output-gap.

Goyal, Ashima and Prashant Parab (Apr. 2021). *Effectiveness of expectations channel of monetary policy transmission: Evidence from India*. Working Papers 2021-011. Indira Gandhi Institute of Development Research, Mumbai, India. url: http://www.igidr.ac.in/pdf/publication/WP-2021-011.pdf.

Hodrick, Robert J and Edward C Prescott (Feb. 1997). "Postwar U.S. Business Cycles: An Empirical Investigation". In: *Journal of Money, Credit and Banking* 29.1, pp. 1–16. url: http://ideas.repec.org/a/mcb/jmoncb/ v29y1997i1p1-16.html.

Hofman, Boris, Cristina Manea and Benoit Mojon (Dec. 2004). *Targeted taylor rules: some evidence and theory*. BIS working paper 1234. Bank for International Settlements. url: https://www.bis.org/publ/work1234.htm.

John, Joice, Deepak Kumar and Michael Debabrata Patra (2022). *Monetary policy: Confronting supply-driven inflation*. RBI bulletin. Reserve Bank of India. url: https://rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=21138.

Johnson, Marianne (1999). *Core Inflation: A measure of inflation for policy purposes*. BIS working paper. Bank for International Settlements. url: https://www.bis.org/publ/bisp05d.pdf.

Khundrakpam, Jeevan Kumar and Rajeev Jain (June 2012). *Monetary Policy Transmission in India: A Peep Inside the Black Box*. Working Paper. Reserve Bank of India. url: https://www.rbi.org.in/scripts/PublicationsView.aspx?id=14326.

Kumar, Rajiv and Pankaj Vashisht (Nov. 2009). *The Global Economic Crisis: Impact on India and Policy Responses*. ADBI Working Papers 164. Asian Development Bank Institute. url: https://www.adb.org/sites/default/files/publication/156019/adbi-wp164.pdf

Kuttner, Kenneth K. (1994). "Estimating potential output as a latent vari- able". In: *Journal of Business & Economic Statistics* 12. url: https://www.jstor.org/stable/1392092.

Mishkin, Frederic S. (Oct. 2007). *Headline versus Core Inflation in the Con- duct of Monetary Policy*. url: https://www.federalreserve.gov/newsevents/speech/mishkin20071020a.htm.

Radhika Pandey, Ila Patnaik, Ajay Shah; Dating business cycles in India. *Indian*

Growth and Development Review 10 April 2017; 10 (1): 32–61. Url : https://www.emerald.com/igdr/article-abstract/10/1/32/108959/Dating-business-cycles-in-India?redirectedFrom=fulltext

Pandit, B. L. and Pankaj Vashisht (May 2011). *Monetary policy and credit demand in India and some EMEs*. Working Paper 256. url: https://icrier.org/pdf/Working_Paper_256.pdf.

Patra, Michael Debabrata, Harendra Behera and Joice John (Nov. 2021). *Is the Phillips Curve in India dead, inert and stirring to life or alive and well?* Tech. rep. url: https://rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=20629.

Planas, Christophe, Alessandro Rossi and Gabriele Fiorentini (2008). "Bayesian Analysis of the Output Gap". In: *Journal of Business & Economic Statistics* 26. url: https://www.jstor.org/stable/27638958.

Raghuvanshi, Abhay Pratap and Wasim Ahmad (2024). "Inflation targeting and monetary policy response in India". In: *Journal of Asian Economics* 95, p. 101822. issn: 1049-0078. url: https://www.sciencedirect.com/science/article/pii/S1049007824001179.

Raj, Janak and Sangita Misra (2011). *Measure of core inflation in India - An empirical evaluation*. RBI occasional paper 3. Reserve Bank of India. url: https://rbidocs.rbi.org.in/rdocs/Content/PDFs/2ARTIMCO100114.pdf.

Report of the Internal Study Group to Review the Working of the Marginal Cost of Funds Based Lending Rate System (Oct. 2017). Report. Reserve Bank of India. url: https://www.rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=878#CH3.

Reserve Bank of India (August 2025). *Lending and deposit rates of scheduled Commercial Banks.* RBI website : https://www.rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=61123

Reserve Bank of India (April 2003). *Macroeconomic and Monetary Developments in 2002-03*. RBI website: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/35998.pdf.

– (May 2004). *Macroeconomic and Monetary Developments in 2003-04*. RBI website: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/53375.pdf.

– (Apr. 2009). *Macroeconomic and Monetary Developments in 2008-09*. RBI website: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/MMDAPRFull2004.pdf.

Sax C, Eddelbuettel D (2018). "Seasonal Adjustment by X-13ARIMA-SEATS in R." *Journal of Statistical Software*, **87**(11), 1–17. Url: https://cran.r-project.org/web/packages/seasonal/index.html

Reserve Bank of India (Apr. 2010). *Macroeconomic and Monetary Developments in 2009-10*. RBI website: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/MMDAP190410F.pdf.

– (July 2013a). *First Quarter Review of Monetary Policy 2013-14 Statement by Dr. D. Subbarao, Governor, Reserve Bank of India*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=29192.

– (Jan. 2013b). *Third Quarter Review of Monetary Policy 2012-13 - State- ment by Dr. D. Subbarao, Governor, Reserve Bank of India*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=28038.

– (July 2013c). *RBI announces measures to address exchange rate volatility.* RBI website: https://website.rbi.org.in/web/rbi/-/press-releases/rbi-announces-measures-to-address-exchange-rate-volatility-29086

– (July 2013d). *RBI announces additional measures to address exchange market volatility*. RBI website: https://website.rbi.org.in/web/rbi/-/press-releases/rbi-announces-additional-measures-to-address-exchange-market-volatility-29140

– (August 2013e). *RBI's further measures to address volatility in Forex market: To auction 22000 crore GOI cash management bills every Monday.* RBI website: https://website.rbi.org.in/web/rbi/-/press-releases/rbi-s-further-measures-to-address-volatility-in-forex-market-to-auction-%60-lt-span-gt-22-000-crore-goi-cash-management-bills-every-monday-29275

– (Apr. 2015). *Monetary Policy Report*. RBI website: https://rbi.org.in/Scripts/PublicationsView.aspx?id=16216.

– (Oct. 2020). *Monetary Policy Report - October 2020*. RBI website: https://rbi.org.in/Scripts/PublicationsView.aspx?id=19980.

– (Oct. 2021). *Monetary Policy Report - October 2021*. RBI website: https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=20647.

– (Aug. 2022a). *Minutes of the Monetary Policy Committee Meeting, Au- gust 3 to 5, 2022*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=54236.

– (Feb. 2022b). *Minutes of the Monetary Policy Committee Meeting, February 8 to 10, 2022*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=53319.

– (June 2022c). *Minutes of the Monetary Policy Committee Meeting, June 6 to 8, 2022*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=53904.

– (May 2022d). *Minutes of the Monetary Policy Committee Meeting, May 2 and 4, 2022*. RBI website: https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=53728.

– (Sept. 2022e). *Monetary Policy Report*. Tech. rep. Url:https://website.rbi.org.in/web/rbi/-/publications/monetary-policy-report-september-2022-21343

– (Aug. 2023). *State of the Economy*. Tech. rep. url: https://rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=21991.

Sharma, Bhavish (2020). "Monetary policy and exchange rate pass-through in India". In: *Theoretical and Applied Economics*. url: https://store.ectap.ro/articole/1508.pdf.

Singh, Bhupal and Sitikantha Pattanaik (2012). "Monetary Policy and Asset Price Interactions in India: Should Financial Stability Concerns from Asset Prices be Addressed Through Monetary Policy?" In: *Journal of Economic Integration* 27.1, pp. 167–194. url: http: // www.jstor.org/stable/41473736

.

Singh, Charan et al. (2023). *A project draft on: Policy interest rates, market rates, inflation and economic growth*. Tech. rep. Foundation for Economic Growth and Welfare. url: https://www.niti.gov.in/sites/default/files/2023-03/A%20Project%20Draft%20On%20%E2%80%9CPolicy%20Interest%20Rates%2C%20Market%20Rates%2C%20Inflation%20and%20Economic%20Growth%E2%80%9D.pdf.

Taylor, John B. (1993). "Discretion versus policy rules in practice". In: *Carnegie-Rochester Conference Series on Public Policy* 39, pp. 195–214.
Url: https://www.sciencedirect.com/science/article/pii/016722319390009L.

The output gap and its role in monetary policy decision-making (Mar. 2003).
Report. Reserve Bank of New Zealand. Url: https://www.rbnz.govt.nz/-/media/project/sites/rbnz/files/publications/bulletins/2003/2003mar66-1citutwaddle.pdf

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