

Inflation Targeting in India: An Interim Assessment

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Flow of presentation

- Overview—Research question, key findings
- History of the monetary policy framework in India
- Data
- Empirical Findings
- Caveats and Limitations
- Suggestion for future

Overview

Inflation Targeting (IT) framework in India

India adopted IT in September 2016.

- Government and the Reserve Bank of India (RBI) signed the IT framework in February 2015
- The RBI act was amended in May 2016
- First monetary policy committee (MPC) meeting in October 2016

Key features of the framework

- Headline consumer price inflation to be targeted (vs core, or WPI)
- Inflation target 4 percent within a band of 2-6 percent
- A 6 member MPC set up for 4 years, to hold at least 4 meetings a year
- Repo rate is the key policy rate

Has the IT framework worked well?

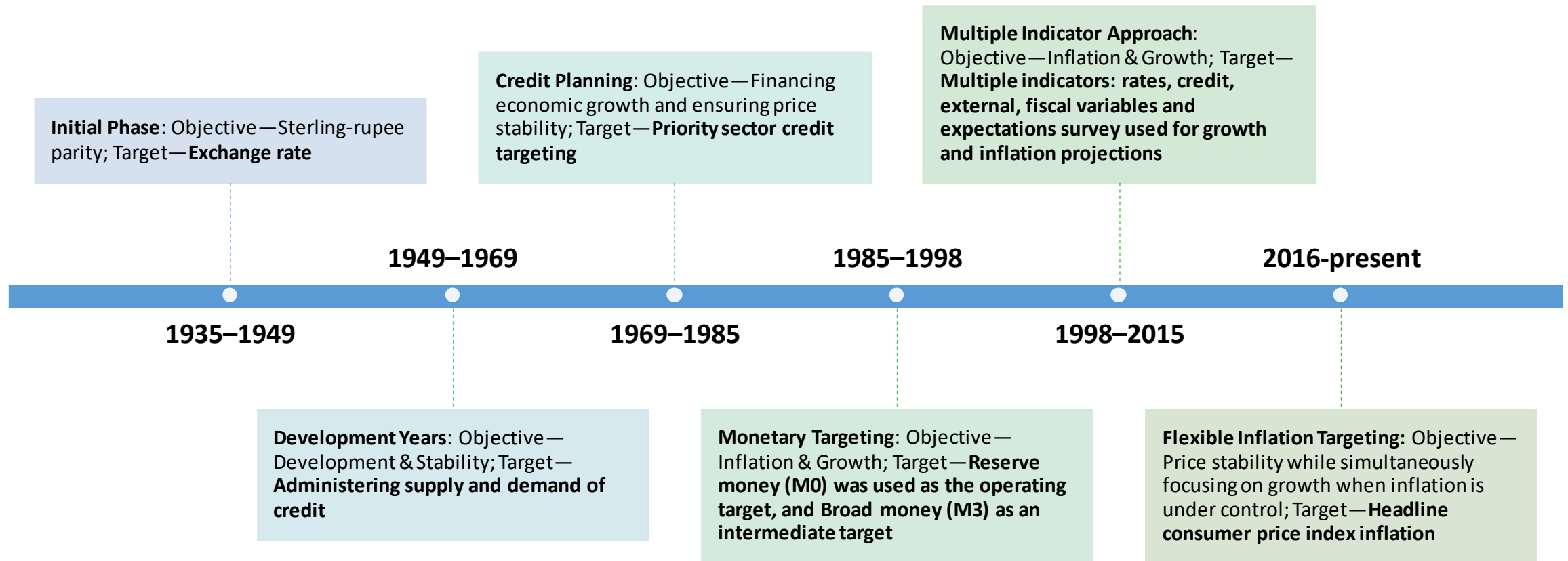
- Analyze the properties of different inflation series and **ask whether there is a strong case for targeting core inflation**
- Estimate the reaction function to check
 - **whether the RBI has become more hawkish** since the introduction of IT regime
 - if the RBI neglects changes in output gap while setting policy
- **Whether inflation expectations have become better anchored**
- **Comparing economic outcomes pre and post IT**
- Ask if the IT is well placed to respond to the COVID-19 shock

Findings

- **Inflation expectations** have become **better anchored**.
- A range of financial variables appear to be **less volatile**.
- The RBI is not obsessed with inflation; contrary to some criticisms, it **responds to output fluctuations**.
- In fact, it **responds less to inflation than before**, which we take as evidence of greater anti-inflation credibility.
- Rather than looking through food-price inflation (and focusing on core), we find that **food-price inflation can spill over into core inflation**, potentially de-anchoring expectations; by implication, the RBI should respond to it.
- We suggest that as a credible IT central bank, the **RBI has had more room to respond to Covid-19**, loosening despite the fact that inflation was already running at the top of its target range.

Timeline of the monetary framework in India

History of the monetary policy framework in India



Data

Data

- CPI headline is available from 2012. Before that CPI industrial worker. We construct CPI headline time series by combining the two.
- WPI series is available throughout. Has a lower weight of food, and a larger weight of manufacturing (and wholesale/producer prices).
- RBI “monitored” WPI before 2014. For the reaction function we construct the inflation series as: WPI before 2014; CPI from 2014.
- In most cases, analysis starts from Q2 1997 as the quarterly GDP growth rate series is available from thereon. We restrict our analysis until the end of 2019 to avoid the impact of COVID-19 on our results.

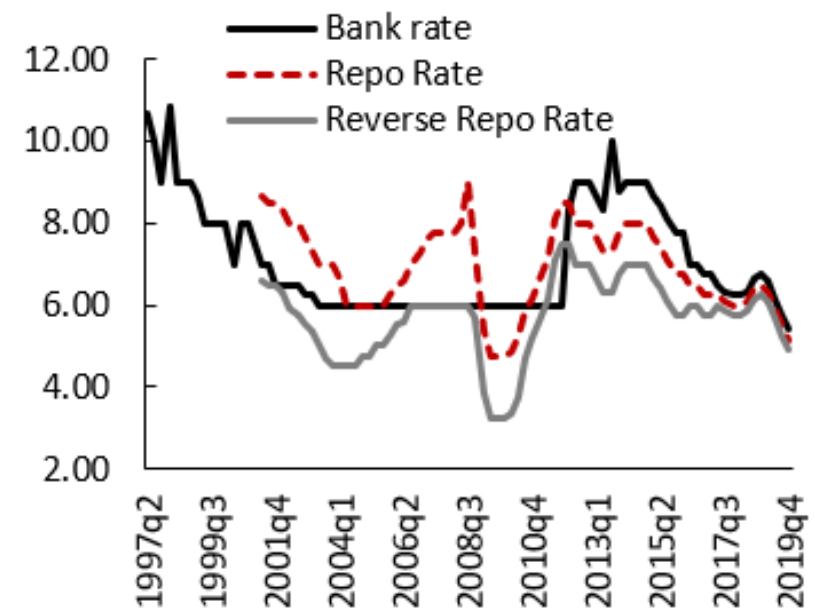
Data

Effective policy rates

	Instrument	Duration	
		Month	Quarter (cal. year)
Effective Policy rate	Bank rate	Jan1996 - Feb2002	1996q1 - 2002q1
	Reverse repo rate	Mar2002 - June2006	2002q2 - 2006q2
	Repo rate	July2006 - Nov2008	2006q3 - 2008q4
	Reverse repo rate	Dec2008 - May2010	2009q1 - 2010q2
	Repo rate	June2010 - present	2010q3 - present

Source: Based on information in Patra and Kapur (2013).

Bank rate, the repo rate, and the reverse repo rate



Source: RBI, CEIC

Empirical Findings

Target Headline or Core Inflation?

- We note that
 - (i) **Food inflation is not more persistent than core inflation**
 - (ii) **Food feeds into core inflation; not the other way round**
- Granger causality tests show that food-price inflation Granger causes core inflation.
- This inclines us against the standard textbook view that the CB can safely look through volatile food-price fluctuations, which we find spills over to core inflation.
- Rather, **we conclude that food-price inflation should be included in the price index targeted by the RBI.**

Granger Causality Wald tests (VAR model)

Dependent Variable (y)	Explanatory Variable (x)	F	df	df_r	Prob > F	Does x granger cause y?
Lag length 2						
Food Inflation	Core Inflation	2.4129	2	81	0.096	No
Core Inflation	Food Inflation	3.4081	2	81	0.0379	Yes
Lag length 4						
Food Inflation	Core Inflation	3.3246	4	73	0.0147	Yes
Core Inflation	Food Inflation	3.3435	4	73	0.0143	Yes
Lag length 8						
Food Inflation	Core Inflation	0.69824	8	61	0.6917	No
Core Inflation	Food Inflation	2.9597	8	61	0.0073	Yes

Note: Granger causality is based on 5% significance level; "No" indicates that we fail to reject the null hypothesis: x does not granger cause y.

To analyze the stability of various outcome variables....

- ...we estimate equations of the form:

$$y_t = \alpha_0 + \alpha_1 IT_t + \alpha_2 GFC_t + \alpha_3 \text{Post GFC}_t + \epsilon_t^y$$

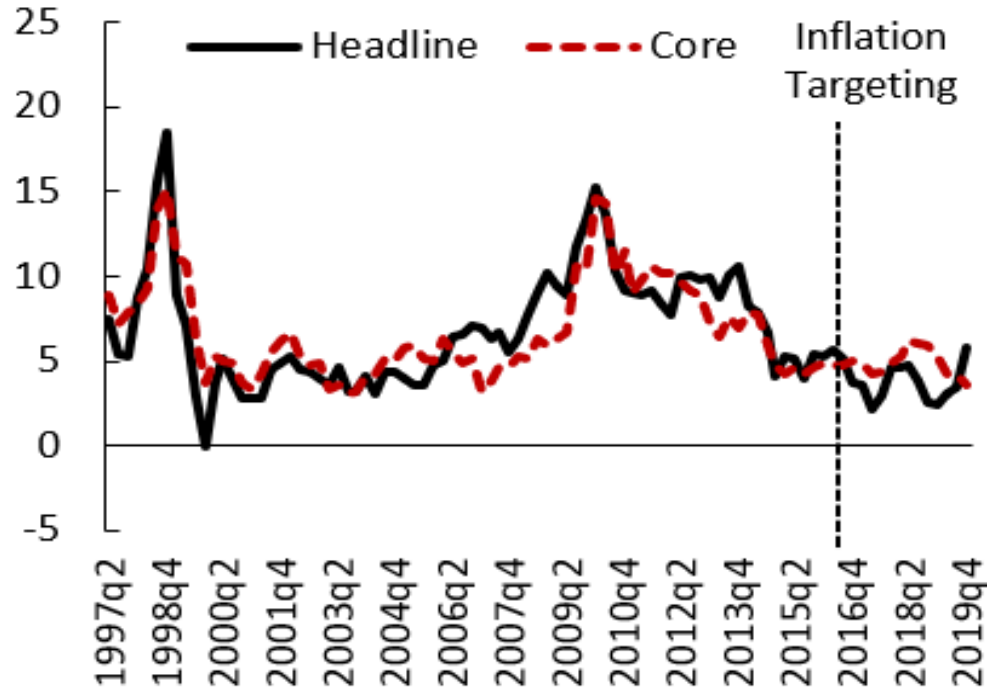
- Where
 - y is the outcome,
 - IT is a post-2016 Q3 dummy,
 - GFC is a 2008 Q3-2009 Q1 dummy,
 - Post GFC is a post 2009Q1 dummy, and
 - The coefficient of interest is α_1

This simple framework suggests that with the shift to IT:

- Inflation has fallen and has become less volatile

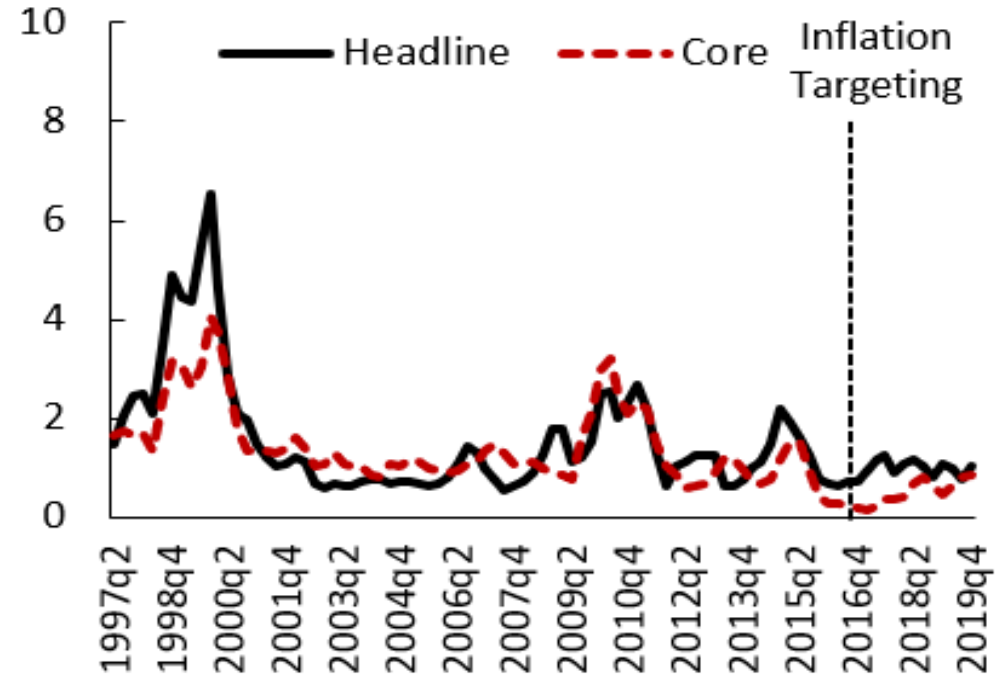
Consumer Price Inflation

Percent



Consumer Price Inflation Volatility

Standard Deviation (Percent)



Source: CEIC, Author's Calculations

Note: Inflation volatility is computed as 15-month rolling standard deviation of monthly inflation series which is then averaged at quarterly frequency.

This simple framework suggests that with the shift to IT:

Inflation volatility under IT

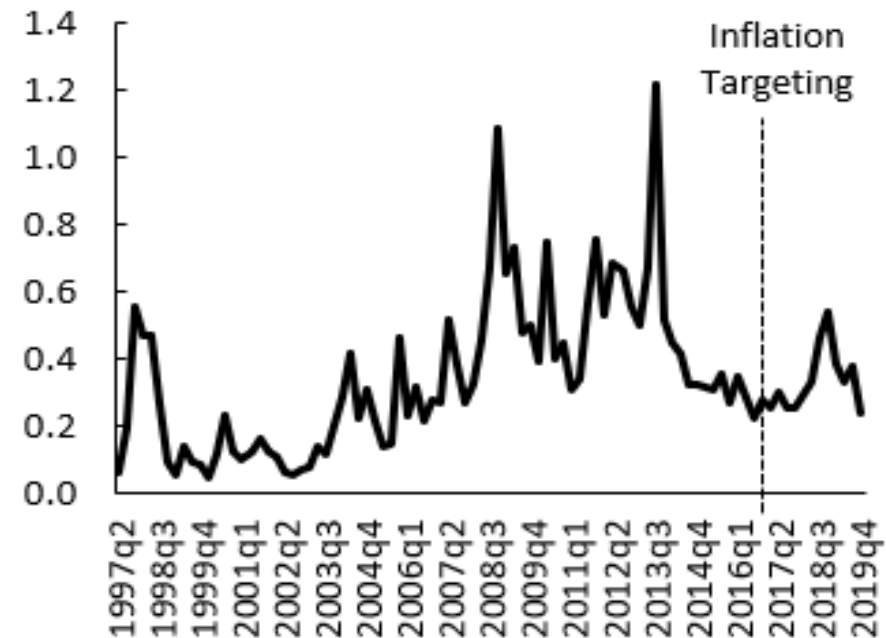
	Volatility of CPI Inflation			Volatility of WPI Inflation		
	Headline	Core	Food	Headline	Primary articles	Manufacturing
Inflation Targeting	-0.42*** (3.32)	-0.80*** (5.01)	-0.28 (1.26)	-0.48* (1.69)	-0.99*** (3.92)	-0.41** (2.17)
Global Financial Crisis Dummy	-0.12 (0.43)	-0.65*** (5.15)	-0.31 (0.73)	1.65*** (18.80)	0.33 (1.34)	0.62*** (9.95)
Post Global Financial Crisis Dummy	-0.31 (1.23)	-0.27 (1.44)	-0.13 (0.36)	0.80*** (3.12)	0.59* (1.84)	0.42*** (2.86)
Constant	1.71*** (7.53)	1.57*** (13.03)	2.73*** (8.37)	1.26*** (22.43)	2.69*** (11.49)	1.09*** (18.38)
Observations	91	91	91	91	91	91
Adjusted R ²	0.02	0.19	-0.03	0.19	0.04	0.11

Note: Robust t statistics in parentheses; *, **, ***, indicate significance at 10, 5 and 1 percent respectively.

This simple framework suggests that with the shift to IT:

- No impact on external variables (exchange rate trends, reserve movements, or portfolio capital flows).
- With one exception: **the exchange rate has become significantly less volatile.**
- (As have equity prices and the call money rate.)
- You can see from the figure how the decline in exchange rate volatility is due mainly from avoiding major spikes.

Exchange rate volatility



Source: CEIC, Authors' calculations

Note: We measure exchange rate volatility by the standard deviation of percentage changes in daily value of the rupee to dollar exchange rate.

And on the real side...

- Output has become significantly less volatile.
- No change in growth (as proxied by industrial production) or various components of the general government budget.

Industrial production and government expenditure

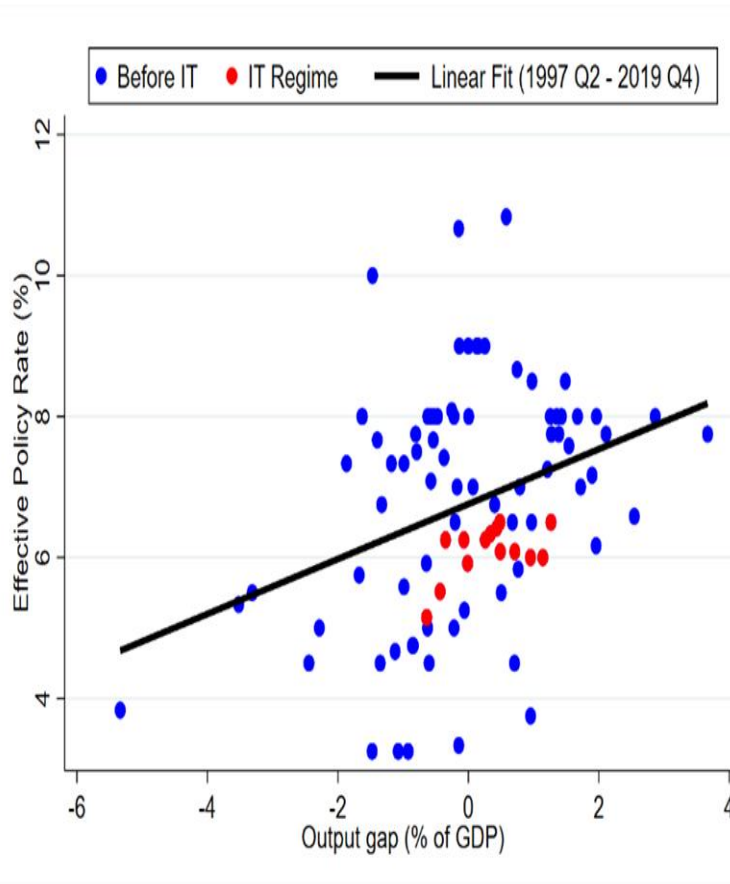
	Index of Industrial Production (% change)	Volatility of Index of Industrial Production	Total government Expenditure (% change)	Revenue Expenditure (% change)	Capital Expenditure (% change)	Interest Payments (% change)
Inflation Targeting	-0.88 (1.02)	-0.99*** (3.36)	-1.58 (0.42)	-1.43 (0.44)	9.31 (0.41)	-5.45 (1.39)
Global Financial Crisis Dummy	-6.98** (2.15)	3.28*** (5.60)	23.95** (2.42)	26.23** (2.27)	-6.80 (0.42)	2.52 (0.30)
Post Global Financial Crisis Dummy	-3.68*** (4.24)	1.22*** (4.17)	-0.90 (0.30)	-2.63 (1.11)	-0.55 (0.03)	2.08 (0.63)
Constant	7.85*** (13.11)	2.19*** (17.49)	12.54*** (5.39)	13.61*** (8.66)	22.35 (1.52)	11.60*** (4.95)
Observations	91	91	87	87	87	87
Adjusted R^2	0.24	0.33	0.08	0.19	-0.03	-0.02

Note: Robust t statistics in parentheses; *, **, ***, indicate significance at 10, 5 and 1 percent respectively.

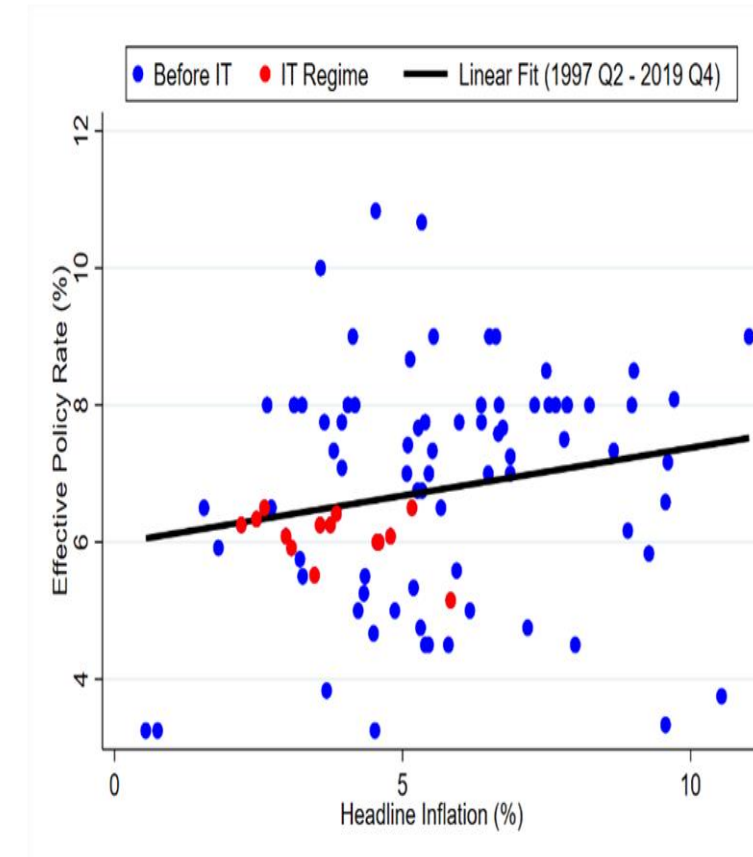
An explanation for this last finding is that...

- The RBI responds to output fluctuations as well as inflation—acts as a “flexible inflation targeter.”
- We find no change in its responsiveness to the output gap post IT.
- But we do find a smaller reaction to inflation movements.
- Which we interpret as greater anti-inflation credibility post-IT.
 - Note that extensive sensitivity tests confirm the robustness of these findings.

A: Output gap and Effective policy rate



B: Inflation and Effective policy rate



Consistent with this interpretation

- We find some evidence that **inflation expectations have become better anchored post-IT.**
- We regress expected inflation q quarters ahead on current inflation.
- No change for households. But for professional forecasters, the response is significantly less post-IT.

Do shocks to current inflation affect inflation expectations?

	Households' Expectations		Professional Forecasters' Expectations			
	1-quarter ahead	1-year ahead	1-quarter ahead	2-quarter ahead	3-quarter ahead	4-quarter ahead
CPI Inflation	0.40 ^{***} (3.17)	0.41 ^{***} (3.09)	0.70 ^{***} (10.26)	0.50 ^{***} (5.74)	0.30 ^{***} (3.56)	0.13 (1.23)
Inflation Targeting	1.18 (0.91)	0.42 (0.29)	0.50 (0.62)	0.34 (0.39)	-0.06 (0.08)	-0.43 (0.42)
CPI Inflation × Inflation Targeting	-0.08 (0.48)	0.05 (0.20)	-0.32* (1.95)	-0.35** (2.31)	-0.36 ^{***} (2.83)	-0.42 ^{***} (3.57)
Constant	6.50 ^{***} (5.34)	7.10 ^{***} (5.71)	2.31 ^{***} (3.80)	3.52 ^{***} (4.86)	4.83 ^{***} (7.15)	6.06 ^{***} (6.12)
Observations	54	54	45	45	45	30
Adjusted R^2	0.12	0.15	0.87	0.72	0.62	0.45

Note: Robust t statistics in parentheses; *, **, ***, indicate significance at 10, 5 and 1 percent respectively.

And further consistent with better anchoring

- Lesser tendency for expected inflation to feed through to actual inflation.
 - For professional forecasters.
 - But here also for households.
- Model specification

$$\pi_t = \beta_0 + \underbrace{\beta_1 \pi_{t-1}}_{\text{persistence}} + \underbrace{\beta_2 E_{t-1} \pi_t}_{\text{expectations}} + \underbrace{\beta_3 \text{output gap}_t}_{\text{supply side shock}} + \epsilon_t$$

Do inflation expectations feed into actual inflation?

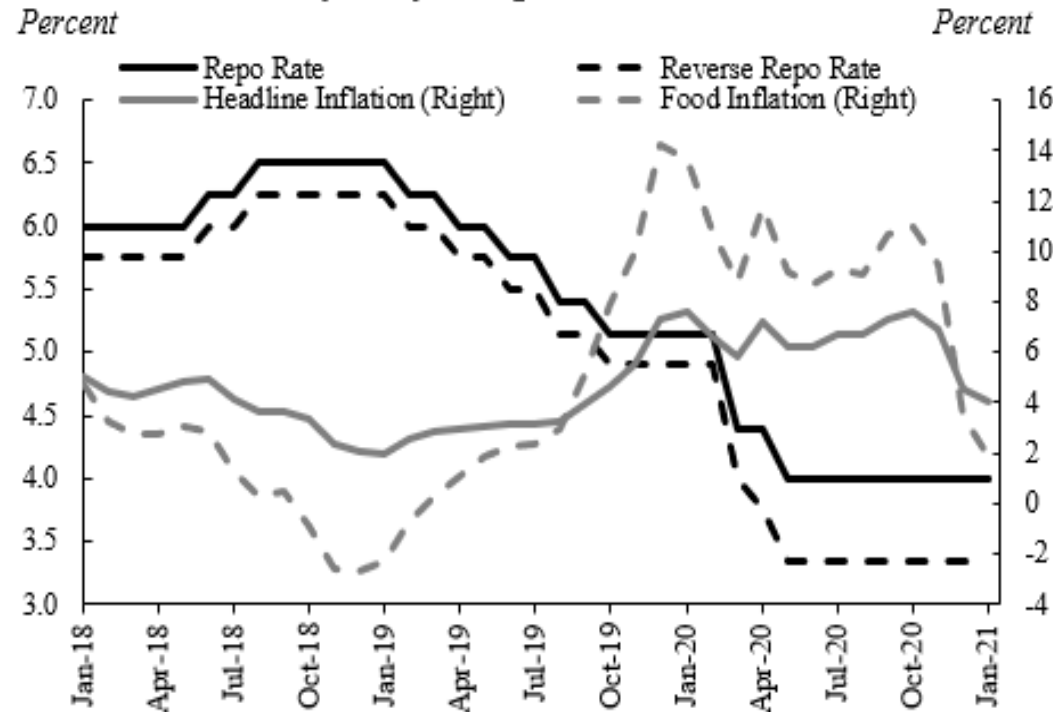
	Dependent Variable: CPI Inflation (%)			
	Households' Expectations		Professional Forecasters' Expectations	
Lagged Inflation	0.90*** (8.36)	0.90*** (8.46)	0.62*** (4.46)	0.61*** (4.38)
Inflation Expectations	-0.10 (1.14)	-0.11 (1.34)	0.39** (2.66)	0.41** (2.66)
Inflation Targeting	6.14* (1.79)	5.85 (1.64)	2.77 (1.51)	2.75 (1.48)
Inflation Expectations × Inflation Targeting	-0.75** (2.09)	-0.71* (1.90)	-0.73** (2.09)	-0.70* (1.97)
Output gap (% of GDP)		-0.12 (0.93)		-0.09 (0.81)
Constant	1.72** (2.04)	1.91** (2.25)	0.13 (0.14)	0.03 (0.04)
Observations	53	53	44	44
Adjusted R ²	0.84	0.84	0.86	0.86

Note: Robust t statistics in parentheses; *, **, ***, indicate significance at 10, 5 and 1 percent respectively.

Better anchoring means more ability to respond to exceptional shocks

- Covid-19 being a case in point.
 - Despite the fact that inflation was running toward the top of the target range.
 - Despite the fact that the lockdown, as a negative supply shock, might be thought to be inflationary.
 - (Food prices rose by 9% in May.)
 - CPI rose by 7.2%, 6.3% and 6.1% in April, May and June.

Inflation and Monetary Policy during the Pandemic



Source: RBI, CEIC

IT has provided room for maneuver more generally for IT CBs

- IT Central banks have cut by more.

Policy response to Covid-19 by IT and non-IT central banks

	IT	Non-IT	India
# of countries	27	43	
Average policy rate at end 2019	4.70	5.27	5.15
Average policy rate change between December 2019 and May 2020 (percentage points)	-1.31	-0.90	-1.15
Average inflation rate during 2019	3.13	3.19	3.7

Source: Haver, authors' calculations. Inflation is the monthly average during 2019. Policy rate is as of the end 2019; the change in policy rate is between end May 2020, and end December 2019 levels.

This is true even controlling for inflation and using a variety of IVs...

Change in Policy Rate during the COVID Crisis

Dependent Variable	Change in Policy Rate		
	I	II	III
Inflation Targeting dummy	-0.41 (1.57)	-0.48** (2.04)	-0.47* (1.96)
Policy rate at end 2019		-0.12*** (2.82)	-0.09* (1.97)
Inflation at end 2019			-0.06 (0.94)
Constant	-0.90*** (5.74)	-0.25 (1.18)	-0.23 (1.02)
Observations	70	70	70
Adjusted R^2	0.02	0.23	0.22

Note: Robust t statistics in parentheses; *, **, ***, indicate significance at 10, 5 and 1 percent respectively.

Note: IT frameworks are not assigned randomly, of course. The literature suggests several approaches to instrumenting IT status. Virtually all of them produced negative coefficients on the IT specification in the table above, although significant levels varied. The coefficient in question was significantly less than zero when the instrumental variable was real GDP in 2010 U.S. dollars (on the grounds that larger economies adopt IT while smaller ones prefer to peg the exchange rate), the World Bank measure of voice and accountability (on the grounds that IT tends to be adopted in countries with a culture of transparency), and regulatory quality (on the grounds that IT requires administrative capacity that is common to monetary policy and other forms of regulation).

Caveats and Limitations

- Four years is not a long enough period
- Change of governorship and deputy governorship even during the short period of 4 years
- While India moved to IT officially from 2016, it had started moving closer to it from 2014
- Covid-19 is still evolving, and it's premature to analyze the flexibility of IT

Suggestions for future

- **If it ain't broke, don't fix it**
- The inflation target and band seem fine.
- As does the focus on headline inflation
- Household expectations of inflation can be further analyzed
- The IT framework seems to have an inbuilt escape clause due to its “flexible” nature.

Appendix

Responsiveness to output gap has been higher than inflation...

Estimation of Monetary Policy Reaction Function

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation	0.33 ^{***} (4.15)	0.30 ^{***} (3.70)	0.19 ^{**} (2.56)	0.26 ^{***} (3.01)	0.11 ^{***} (3.79)	0.10 ^{***} (3.22)	0.09 ^{***} (3.45)	0.09 ^{***} (3.27)
Output gap (% of GDP)		0.37 ^{***} (5.24)	0.56 ^{***} (4.20)	0.53 ^{***} (4.14)		0.19 ^{***} (3.07)	0.22 ^{***} (3.79)	0.21 ^{***} (3.65)
Lagged Effective Policy rate					0.86 ^{***} (19.30)	0.82 ^{***} (17.59)	0.85 ^{***} (19.27)	0.85 ^{***} (20.31)
Constant	4.81 ^{***} (10.48)	4.99 ^{***} (11.36)	5.74 ^{***} (14.91)	5.36 ^{***} (11.80)	0.27 (0.93)	0.59 ^{**} (1.98)	0.49 [*] (1.87)	0.45 [*] (1.77)
Observations	87	87	87	87	87	87	87	87
Adjusted R^2	0.00	0.12	0.12	0.09	0.86	0.89	0.89	0.89

Robust t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' Calculations

Note: We present results from the GMM estimation of the reaction function. In columns (1), (2), (5) and (6), inflation is instrumented by its four lags while output gap is treated as exogenous; in columns (3) and (7), output gap is instrumented by its four lags while inflation is treated as exogenous; and in columns (4) and (8), output gap and inflation are both assumed to be endogenous and are instrumented by four lags of inflation & output gap.

Finally, we did extensive tests for asymmetries

- We check if the weights on the output gap and inflation are different in periods when these variables take on unusually high or low values but do not find evidence of such threshold effects.
- Specifically, we define dummies for very high values of inflation as when it exceeds 9 percent; for a very large output gap as when it exceeds 1.5; for very low levels of inflation as when inflation is below 3 percent, and for a low output gap as when it is below -1.5.
- The cutoffs have been selected at about top 10 or bottom 10 percent of the observations for inflation and the output gap. We include one of these dummy variables at a time in the regressions.
- The only coefficient that is significant at 10 percent level is for a high output gap. This coefficient is negative, indicating that at very high GDP growth rate (and output gap), the policy rate does not increase proportionately. .