RBI's Quarterly Projection Model 2.0

Indian economy entered a new era with the adoption of Flexible Inflation Targeting (FIT) as a monetary policy framework in 2016 as per recommendations of the Urjit Patel Committee report. This was a paradigm shift from the erstwhile multiple indicator approach of monetary policy. The inflation target was set for a period of five years and was scheduled to be reviewed on 31st March 2021 for suitable changes if deemed necessary by the government. The central government has maintained the terms of flexible inflation targeting framework for the next five years i.e. from 2021 to 2026 with the nominal anchor of the headline CPI inflation at 4%, and the tolerance band at +/- 2% around the nominal anchor, which translates to 2% and 6%, respectively.

The Reserve Bank of India's (RBI) recent publications cite the credibility acquired during the period from 2016-2019, wherein this framework ensured that inflation remained fairly within the tolerance band. Flexible Inflation Targeting (FIT) is also known as Inflation Forecast Targeting (IFT) and the analysis and decomposition of the pre and post FIT periods has been done by the RBI offering a clear insight into the workings and impact of the new monetary policy framework. The observation of the post FIT period was that favorable supply shocks aided the disinflation during the most part of the 2016-2019 time period. Favorable supply shocks in food and fuel were aided by mostly benign external factors like US treasuries, Fed policy rates and prudent domestic fiscal policy.

Effective policy making requires clear and reliable projections of the major macroeconomic variables that the central bank deems important for the adherence to rational responses which would be beneficial to the economy. Also required is an insight into how policy variables are affecting the targeted macroeconomic variables like inflation and growth in the medium term. To generate forecasts for policy making, the RBI uses a modelling framework called the Forecast and Policy Analysis System (FPAS). The FPAS is a suite of models, designed to track the vast and multiple channels of macroeconomic variables and also variables affecting these target variables. Amongst the various models is the RBI's Quarterly Projection Model (QPM), which is a forward looking, open economy, calibrated, New Keynesian Model gap model. In simple words, these terms are:

- Forward looking means projecting the future trajectory of the variable;
- Open economy means international trade and finance are an essential factor in measurement;

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- Calibrated means as precise a measurement as possible of the model parameters; and
- New Keynesian Model refers to equations calibrating aggregate demand, aggregate supply and a rule for the central bank's main policy tool i.e. the policy Repo rate in the case of the Reserve Bank of India.

To enrich the model's analytics and to capture the interactions between the four major sectors i.e. monetary-fiscal-external and real, the model structure has been expanded, and the parameters of the model have been recalibrated using pre-COVID-19 data (up to Q4:2019). In terms of structure, the Quarterly Projection Model 2.0 incorporates the following:

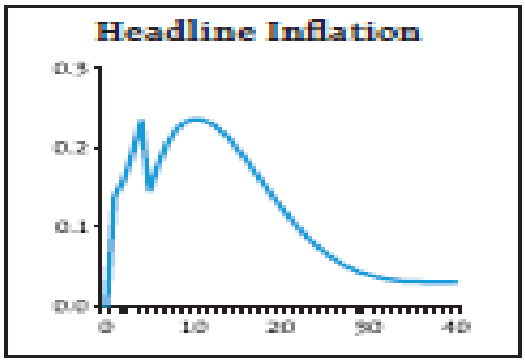
- Fiscal-Monetary Dynamics;
- Disaggregated Fuel Pricing (oil price, exchange rate and fuel taxes);
- Balance of Payments and Exchange Rate Interactions.

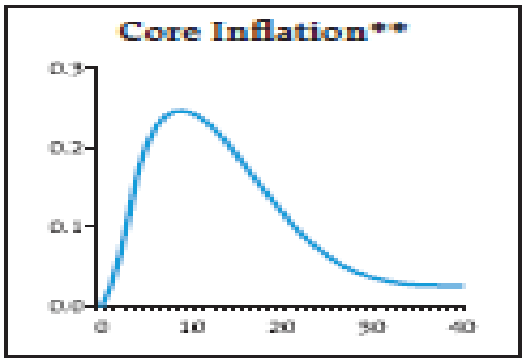
Since the Quarterly Projection Model intends to produce forward looking trajectories of several macroeconomic variables it is classified into various segments or blocks for example the fuel block or the fiscal block. A brief description of what each major block contains is presented below:

- The Fiscal Block in QPM 2.0 decomposes the primary deficit into structural (cyclically adjusted) and cyclical components. This implies that shocks to the structural component impacting through aggregate demand and country risk premia are adequately captured. Monetary policy affects the fiscal balance through the interest rate channel (Cost of Borrowing).
- The Fuel Block decomposes the domestic crude oil price into international crude oil price + VAT + Excise Duty; Liquefied Petroleum Gas (LPG) and kerosene prices are market determined but with a lagged pass-through and electricity prices are determined by the State Government.
- The external sector is covered by the Balance-of-Payments block and incorporates determinants of current and capital accounts and their interaction with the exchange rate management guided by the objective of containing excess volatility in the currency markets.

As per the model's properties, these features are best represented through the Impulse Response Functions (IRFs) which quantify the response of key macroeconomic variables to exogenous shocks. The independent variable (X axis) in the quantification is generally

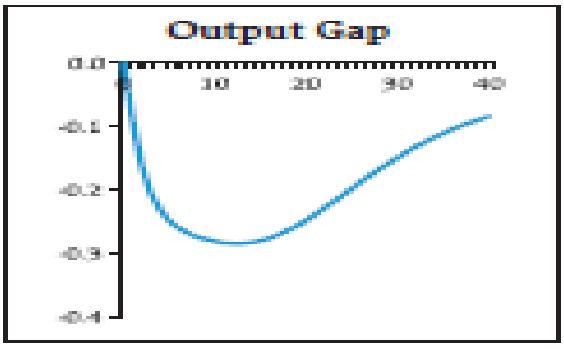
time. A real-world example would be tracking the reaction of the variables like headline inflation (on the Y axis) in response to a fuel price hike. For every Rs.10/Liter hike in the price of petrol due to a fuel tax hike would result in a spike of 25 basis points in the headline inflation. The effects of a fuel tax hike on headline inflation are measured through an impulse response function as can be seen in the chart below:





Source: Monetary Policy Report RBI

Similarly for the assessment of the effect of a fuel tax hike of Rs.10/litre in the petrol price on the output gap, the chart below shows the response of the output gap to the same. The trajectory of the response carries the output gap to decline by around 30 basis points initially up to the first 10 quarters, due to the weakening demand and creation of excess capacity due to an adverse price shock, and then recovering closer to the pre-shock levels by the end of the time period of 40 quarters or 10 years.



Source: Monetary Policy Report RBI

The independent variable in the charts is time on the X axis and the dependent variable on the Y axis is the change in terms of percentage points. The effects of the exogenous shock are then simulated in the model to generate a medium term and a long term

forecast which would converge to the long term target of the variable i.e. Headline Inflation. The original work on which the FPAS is based[1] states that

In situations where the actual rate of inflation differs from the long-run target, monetary policy would generally have to make a choice of appropriate response. The approach may be more or less rapid, depending on policymakers' preferences regarding the short-run output-inflation trade-off. It might involve an asymptotic approach or a planned overshoot. Often out of the available options, the central bank will implement the one that "looks best," i.e., the one that reflects its judgment as to the best outcome.

This applies to any gap between actual inflation and the long-run target. To provide a typical example, consider how the IFT would work following a sudden drop in the world price of oil. The Projection Team (PT) of the central bank would take into account its ramifications on all external variables, e.g., the level of demand in trading partners, and then, using the model, simulate the impact on the domestic economy. The baseline forecast, using the standard policy response of the model, would imply an interest rate path that, over the medium term, returns inflation to its long-run target rate, while taking into account the trade-off between the costs of inflation being away from target and the costs of output gap. Other policy responses might also be simulated to provide policymakers with a menu of options. In each case, there would be an entire time profile of short-term interest rates. The PT might also provide forecasts based on a couple of scenarios in which very different assumptions are used for the oil price, or, for that matter, other exogenous variables.

Quarterly Projection Model 2.0 & Macroeconomic projections

The recent Monetary Policy Report which was published alongside the Monetary Policy Statement gives a table of the various indicators and their respective values assumed in October 2020 and in April 2021. The baseline projections are made by assuming certain levels for various indicators as given below:

Baseline Assumptions For Projections		
Indicator	**MPR 2020**	**MPR 2021**
Crude Oil (Indian Basket)	USD 40/bbl during H2:2020-21	USD 64/bbl during 2021-22
Exchange Rate	Rs.73.6/USD during H2:2020-21	Rs.72.6/USD during 2021-22
Monsoon	9% above Long Period Average	Normal for 2021

[1] Quarterly Projection Model For India –Key Elements and Properties Benes et al- WP/17/33-IMF Working Paper

Global Growth	-4.5% in 2020 and 5.4% in 2021	5.5% in 2021, 4.2% in 2022
Fiscal Deficit (% of GDP)	Given the COVID-19 impact on activity, revenues and expenditures and factoring in the additional borrowings announced, fiscal deficits are expected to be significantly higher	To remain within BE 2021-22. Centre 6.8% Combined 10.8
Domestic Macroeconomic/ Structural Policies during the forecast period	No Major Change	No Major Change

Source: Monetary Policy Report, April 2021 (RBI)

The Monetary Policy Report states that looking at the initial conditions signals from forward looking surveys forecasting the headline CPI and estimates from structural and other time series models, CPI inflation is projected to average 5.20% in H1:2021-22 and 4.40% and 5.10% in Q3 and Q4 of 2021-22 respectively. The 50% confidence interval for headline CPI is 3.30%-6.90% and the 70% confidence interval for CPI headline inflation is 2.40-7.80%. Similarly, baseline projections for the year 2022-23 project headline inflation to move within a range of 4.50%-4.80% assuming there is normal monsoon, a normalization of supply chains on the back of a successful vaccine roll out and no major policy shocks or exogenous shocks. The major upside risks to headline enumerated by the RBI are:

1. Supply chain disruptions persisting for a longer period;
2. Rise in global crude oil prices;
3. Rise in prices of other commodities than what is general assumed in the baseline;
4. Stronger pass-through of input costs amidst improvement in demand conditions and return of pricing power; and
5. Persistent structural demand-supply imbalances in key food items such as pulses, edible oils and fats, and eggs, meat and fish could also keep inflation elevated.

Down side risks to inflation are mostly associated with weaker than expected global and domestic demand in the face of another wave of infections, fall in global crude oil prices, and an early normalization of supply chains. A good rabi crop and efficient food supply management might keep food prices soft.

Similarly for growth, the outlook has been modelled taking into account its own baseline assumptions, forwards looking survey indicators and model forecasts. Real GDP growth is projected to pick up from -8% in 2020-21 to 10.50% 2021-22 with quarterly readings of 26.20% in Q1, 8.30% in Q2, 5.40% in Q3, and 6.20% in Q4, with risks evenly balanced. Assuming a normal monsoon and no major policy or exogenous shocks, 2022-23 should see a real GDP growth of 6.80%, and the RBI estimates the quarterly growth rates to move in the range of 6.20%-7.30%.

An inflation targeting central bank has to have reasonable clarity in the forward trajectory of key macroeconomic variables or at least to have the responses of the policy mapped out to the various scenarios, which have been assigned probabilities for the formulation of optimal monetary policy. Central banks around the world following FIT with "price stability" as one of the goals, profit immensely from a workhorse model of projecting the key macroeconomic variables like GDP growth and inflation for the near to medium term. In the RBI's case the projections are usually published for the period of two years or of eight quarters and the projections undergo changes as and when the underlying assumptions about the variables in the box given above undergo change. The projections are published at a six monthly interval. The first bi-monthly policy has given guidance from the RBI for entire 2021-22. The next Monetary Policy Report (MPR) shall be published in October encapsulating the new forecasts of the macroeconomic variables crucial for the formulation of monetary policy.

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