Monetary Policy, Models and Forecasts in the South African Reserve Bank

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 Monetary policy framework in SA: Inflation targeting
 Current monetary policy considerations
 Models used in the Reserve Bank
 Forecasting Process

Monetary policy framework in SA: Inflation targeting

The role of monetary policy

Growing consensus regarding the role of monetary policy

- Pursuit of price stability: main medium- to long-run goal of monetary policy.
- Focus on price stability resulted in greater emphasis on central bank independence.
- There is a fair amount of agreement on goals, but there is variation on choice of operational or intermediate targets that guide the implementation of policy.

South Africa's pre-inflation targeting monetary policies





Money supply targets Money supply guidelines within the framework of the "eclectic approach". No explicit inflation target. M3 the key intermediate target. Hitting the M3 target was more the exception than the rule. Inflation targeting

Monetary Aggregate Targeting

- Assumes stable and predictable money demand function
- Advantage is that monetary aggregates are easily measurable and observable.
- Target broader definition of money supply (M3)
- With financial liberalisation, stable relationship broke down.
- Increased non-resident participation
- Gradual relaxation of exchange controls
- Extended banking services (financial deepening)

Money Supply Growth and Inflation



The eclectic approach

- Included focus on a broad range of intermediate targets
- Bank credit extension, overall liquidity in the banking sector
- Yield curve and interest rates
- Exchange rate, balance of payments and reserves
- Prices of financial assets
- Inflation

Problems encountered

- Objective of monetary policy was unclear
- The emphasis seemed to change frequently
- No clear accountability
- Informal inflation target 1-5 %
- No specified time frame
- High degree of real interest rate variability



- Inflation targeting offered improved policy focus, policy co-ordination, transparency and accountability.
- Unlike monetary targets, inflation is a final rather than an intermediate goal.

Greater emphasis also placed on:

Improving analysis of the transmission mechanism

- Developing better forecasting models
- Improved accountability, transparency and communication

Inflation targeting in South Africa

- Inflation target is set by National Treasury in consultation with the Reserve Bank.
- Price index chosen is the headline CPI excluding mortgage interest cost (CPIX).
- New target measure to be announced shortly Total CPI. Home owners cost to be measured differently:
 - measure of owner's equivalent rent replaces mortgage interest cost
- No specific sanction or obligation if target is missed. Governor reports quarterly to Parliament, where any target misses would be explained.
- Makes provision for an explanation clause (previously escape clause)

Inflation targeting in South Africa (continued)

- Decisions made by Monetary Policy Committee, meeting over two days every two months.
- Decision-making by consensus
- Minutes not released but detailed statement after each MPC meeting.
- SARB also issues an inflation report (Monetary Policy Review) twice a year.
- Inflation forecast is published in the form of a fan chart
- Monetary Policy Forums held twice a year in 9 centers around the country.

Inflation targeting in South Africa (continued)

- Initial inflation target was for 3-6% for the calender year 2002. Later targets for 2003 and 2004 were set at 3-6% and 3-5% respectively.
- CPIX inflation was on an upward path when the IT regime was introduced (at 7 %), peaked at 8,2% in August 2000 and then fell below 6% in September and October 2001.
- Late 2001: currency depreciated by about 37 per cent.

Inflation targeting in South Africa (continued)

- CPIX inflation in 2002 averaged 9,3% (Peaked at 11,3%). Repo rate raised by 400 basis points in four steps.
- Target modified from 3-5 per cent in 2004 to 3-6 per cent.
- Key issue: pass-through effect of exchange rate changes on prices.
- Initially pass-through had been unexpectedly low.
 When the depreciation accelerated, inflation picked up quickly.
- Currency recovered during 2002-3, helped reverse the upward inflation trend.



Annual average percentage change



Inflation targeting in South Africa (continued)

- In November 2003 the target was changed from a calendar year average to a continuous one.
- The CPIX inflation rate moved into the target range in September 2003 and has remained there until March 2007.
- This allowed for a reduction of interest rates of 500 basis points from June 2003 to April 2005.
- CPIX inflation rate out of target range since April 2007 and stands at 13.6% in August 2008
- Repo rate increased from 7% in April 2005 to 12% in June 2008

Inflation forecast for 2009

- The inflation forecast for 2009 will be influenced by a rebasing (2008=100) and reweighting exercise
- The household income and expenditure survey is used to determine the new weights
- The old CPI series was based on the International Trade Classification (ITC) while the new series is based on the Classification of Individual Consumption by Purpose (COICOP).
- Lower weights for current (2008) high-inflation items like food, petrol and electricity
- The impact of rebasing: Over time a substitution bias creeps into a fixed-weight methodology where high inflation items have higher effective weights over time.
- Expectations of a downward bias of up to 3 percentage points in the January 2009 CPI figures expected

Consumer price index, CPIX(mu)

Per cent



Contributions to CPIX inflation

Percentage change over twelve months* and percentage points

(2008)	Mar	Apr	May	Jun	Jul	Aug
Total*	10,1	10,4	10,9	11,6	13,0	13,6
Food	4,4	4,5	4,7	5,1	5,1	5,3
Housing	0,9	0,9	0,9	0,9	0,9	0,9
Medical care & health expenses	0,5	0,5	0,5	0,6	0,6	0,5
Transport	2,1	2,1	2,3	2,6	3,2	3,1
Education	0,4	0,4	0,4	0,4	0,4	0,4
Fuel & power	0,4	0,4	0,4	0,4	1,1	1,3
Other	1,4	1,6	1,7	1,6	1,7	2,1

Current monetary policy considerations

Policy considerations

- Increasing inflation rate and a lower economic growth rate
- Second round effects form supply side shocks
- Increasing inflation expectations
- Salary and wage negotiations
- Unemployment problem
- Widening of the deficit on the current account of the balance of payments
- Depreciating currency
- Change in political environment
- Anticipated slowdown in world economic growth

Increasing inflation rate and a lower economic growth rate

Real GDP growth shows signs of slower growth



Seasonally adjusted annualised rates

Short term indicators point towards a lower economic growth rate

New passenger car sales



Second round effects form supply side shocks

- Supply shocks emanating from oil price and food prices an international phenomenon
- How should monetary policy react to exogenous supply side shocks?
- Measuring of second round effects difficult
 - Visible in the price increases from other products
 - Increase in inflation expectations
 - Increase in salary and wage negotiation settlements

Increasing inflation expectations



Salary and wage negotiations

Nominal remuneration per worker



Unemployment rate

UNEMPLOYMENT RATE

Percentage



Widening of the deficit on the current account of the balance of payments

Ratio of Current account as % of GDP



Depreciating currency

Nominal effective exchange rate of the Rand



Change in political environment

- Replacement of the president of the country
- New cabinet ministers and other leaders
- Trade Unions and Communist Party have a different view on monetary policy framework
- Greater emphasis on economic growth, employment creation and poverty alleviation

Models used in the SA Reserve Bank

Monetary policy framework and modelling

- Econometric modelling is a challenging and ever changing environment
- Modelling and forecasting are closely linked to the monetary policy framework in place
- Other requirements and needs also have an impact on model specification in South Africa:
 - Rescheduling of foreign debt
 - Government budget estimates
 - Money supply guidelines
 - Macroeconomic plan GEAR
- Availability and quality of data

Modelling in a inflation targeting framework

- Formal inflation targeting framework announced on 23 February 2000 in SA
- Move from a big model to smaller core model
- Improving analysis of the transmission mechanism
- Main emphasis of model shift to inflation forecasting
- Achievement of inflation target becomes primary objective of monetary policy

Technical assistance and advice

- Technical assistance and advice in the development of the inflation-forecasting models received from:
- Bank of England
- Bank of Canada
- Reserve Bank of Australia
- Bank of Israel
- Riksbank Sweden
- Czech National Bank

Single or multiple modelling route

Current SARB approach:

- To follow a pluralistic approach: not one model for all occasions, but a suite of models
- To follow a pragmatic approach: supplement model output with surveys, value judgements, etc.
- The multiple modelling route provides the advantage of comparing results of the various models
- Some models might depict early warning signs of inflationary pressure before others
- Bank of England approach
Models developed and used by the SARB

- Core model
- Small-scale model
- Phillips-curve model
- Vector auto-regressive (VAR) model
- Auto-regressive integrated moving-average (ARIMA) model
- Disaggregated inflation model
- QPM model
- DSGE model

Core model

- Keep relatively small: 63 equations of which 25 are structural equations
- Focus on inflation and other key economic variables impacting on inflation
- Economic theory determines long-run relationship between variables
- No long-run trade-off between inflation and output
- Short-run dynamics to explain short-term fluctuations in variables

Flow chart of the price formation process



Small-scale model

- Highly aggregated: 5 equations
- Equations estimated for
 - Policy reaction function
 - Philips curve
 - Terms of trade
 - IS curve
 - Import prices
- Easier to experiment with different behavioural equations
- Limitations in use of model
- Compare results of the core model

Phillips-curve model

- Single equation model
- Useful to describe the determinants of inflation and for inflation forecasting
- Original concept relates to wage inflation and unemployment, but modern versions relate to price inflation and output gaps
- Cross-check forecasts derived from core model

Vector auto-regressive (VAR) model

- Dynamic interaction between a set of variables
- Do not require strong theoretical assumptions model is rather based on actual trends in data
- Useful over short time horizons
- Impulse responses describe reaction of variables on exogenous shocks

Auto-regressive integrated moving-average (ARIMA) model

Single equation model

- Model a single variable in terms of an auto-regressive component and a moving-average component
- Easy to estimate and solve the model
- No strong theoretical assumptions
- Useful over shorter time horizons
- Disadvantage : ARIMA models cannot show a turning point as it is based on historical figures (or trends of the past)

CPIX: Monthly average changes

CDIX (mu)																
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													Rebasing & Re	weighting		
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2009	2010	AVE	AVE*
JAN	0.96	1.01	1.15	1.17	1.74	0.99	1.11	0.46	0.73	1.00	1.20	<u>1.03</u>	<u>0.79</u>	<u>0.75</u>	0.98	0.98
FEB	0.24	0.11	0.31	0.29	0.54	-0.08	0.55	0.08	0.22	-0.10	0.40	<u>0.30</u>	<u>0.29</u>	<u>0.25</u>	0.24	0.22
MAR	0.83	0.78	0.93	0.77	1.07	1.06	0.62	1.06	0.43	1.00	1.60	<u>0.90</u>	<u>0.65</u>	<u>0.60</u>	0.90	0.62
APR	1.06	0.88	1.23	0.48	1.06	0.32	0.31	0.52	0.43	1.20	1.60	<u>0.70</u>	<u>0.60</u>	<u>0.60</u>	0.84	0.54
MAY	0.47	0.44	0.61	0.47	0.70	0.00	0.08	0.22	0.57	0.60	1.10	<u>0.41</u>	<u>0.35</u>	<u>0.30</u>	0.46	0.27
JUN	0.46	0.54	0.50	0.38	0.96	-0.32	0.23	-0.22	0.50	0.50	1.10	<u>0.48</u>	<u>0.45</u>	<u>0.40</u>	0.41	0.25
JUL	0.92	0.86	0.90	0.94	0.86	1.05	0.31	1.04	1.07	1.10	2.50	<u>1.34</u>	<u>1.20</u>	<u>1.40</u>	1.06	0.99
AUG	0.46	0.21	0.40	0.00	0.68	0.40	-0.15	0.37	0.49	0.30	0.90	<u>0.50</u>	<u>0.58</u>	<u>0.25</u>	0.36	0.32
SEP	0.68	0.53	0.49	0.28	1.10	0.24	0.31	0.22	0.28	0.10	<u>0.15</u>	<u>0.37</u>	<u>0.30</u>	<u>0.35</u>	0.42	0.34
OCT	0.45	0.43	0.39	0.46	0.92	0.00	0.46	0.22	0.14	0.70	<u>0.40</u>	<u>0.30</u>	<u>0.30</u>	<u>0.25</u>	0.42	0.37
NOV	0.23	0.42	0.10	0.46	0.50	0.24	0.61	-0.07	-0.07	0.50	<u>0.30</u>	<u>0.34</u>	<u>0.25</u>	<u>0.18</u>	0.30	0.20
DEC	0.34	0.42	0.39	0.64	0.17	0.08	-0.23	0.07	0.10	0.70	<u>0.30</u>	0.30	<u>0.25</u>	<u>0.15</u>	0.28	0.26
AVE	0.59	0.55	0.62	0.53	0.86	0.33	0.35	0.33	0.41	0.63	0.96	0.58	0.50	0.46	0.56	0.45

LET AVE* EQUAL THE AVERAGE EXCLUDING THE HIGHEST AND LOWEST OUTCOMES IN THOSE MONTHS.

Disaggregated inflation model

- Model the components of CPI independently
- Use weights of the CPI index
- Uses monthly data
- Possible to identify sources of inflation
- Components are modelled mainly as a function of unit labour costs, import prices and the output gap
- Obtain an estimate of administered price inflation exogenous assumption

Administered Prices

- Contribute 20.01% to total CPIX
- Components of Administered Prices
 - Fuel and Power 3.89%
 Water 1.81%
 Petrol and Diesel 5.08%
 Public Transport 0.34%
 Communication 3.11%
 Education 2.97%
 - Municipality Tariffs 2.28%
 - University boarding fees 0.16%
 - Medical Services 0.11%
 - TV Licences 0.26%

Disaggregated inflation model: CPIX(mu) and CPIX(mu) petrol



Disaggregated inflation model: CPIX(mu) and CPIX(mu) food



Disaggregated inflation model: CPIX(mu) and CPIX(mu) electricity



Disaggregated inflation model: CPIX(mu) and CPIX(mu) excluding food, electricity and petrol



	2004	2005	2006	2007	2008	2009	2010
CPIX(mu)	4 ¹ / ₄	4	4 ½	6½	10¾ 11½	73/4 71/4	NA 5¾
CPIX(mu) excluding food, electricity and petrol	43⁄4	3 ³⁄₄	3	4 ¹ / ₂	6	51/4 53/4	NA 5½

QPM model

- Provides a tool that tells a consistent story with regard to the economic interpretation and impact of economic shocks on the economy.
- A tool to trace the key channels through which the shock impacts on the economy.
- Assess the implications for future inflationary pressures
- Able to recommend an interest rate response that ensures inflation returns back to the target after a period of time.
- The parameters of the QPM model are normally calibrated.
- The model also needs to reflect the policymaker's views of the monetary policy transmission mechanism.

DSGE model

- DSGE models rely heavily on economic theory and are based on micro foundations or principals.
- These foundations would typically include economic agents such as households that maximise their utility under certain budget constraints, firms that maximise their profits subjected to technological constraints.
- Most of the parameters are pre-specified or calibrated.
- DSGE models normally include a number of policy variables to reflect the main channels of the monetary policy transmission mechanism and have a well defined steady state.
- More advanced techniques such as Bayesian estimation or maximum likelihood estimation techniques have increasingly been used to estimate some of the model parameters.
- DSGE models also make provision for the inclusion of forward looking expectations.

The transmission mechanism

 To be successful in conducting monetary policy, the monetary authorities must have an accurate assessment of the timing and effect of their policies on the economy, thus requiring an understanding of the mechanisms through which monetary policy effects the economy"

(Mishkin, 1995).

- Describes how monetary policy affects output and inflation
 - Through which channels does this happen?

The transmission mechanism

- The lags with which monetary policy acts are long and variable (Friedman)
- Our knowledge of the transmission mechanism is imperfect.
- Estimating the transmission mechanism is difficult. (Mahadeva and Sinclair, 2001)
 - Lack of reliable data
 - Unforeseeable changes in the structure of the economy
 - Separating cause from effect in the data

Monetary Policy Transmission Mechanism



Requirements for Policy Models

- More attention to economic theoretical soundness and internal consistency than to the statistical fit of an equation
- The level of aggregation is often determined by theory and the diverse behaviour of groups of economic groups rather than by predictive ability
- The primary emphasis in validating the model is on the responses to exogenous shocks. Conforming to theoretical suppositions are valued higher than forecast accuracy.

Forecasting process



Monetary policy and forecasts

- Regardless of the monetary policy framework, a policymaker must have a view of the future because of the existence of transmission lags.
- Forecasts even more important in an inflation targeting framework.
- "Implicit in any monetary policy action or inaction is an expectation of how the future will unfold, that is, a forecast. There is no way to avoid making a forecast, explicitly or implicitly."
 - Alan Greenspan, 1994

MPC or staff forecast?

- No clear agreement if forecast is a MPC or staff forecast
- Different involvement from MPCs with regard to model structure and forecast
- Staff forecast provides a benchmark for policy decisions
- Bank of England : MPC forecast
- US Federal Reserve: Staff forecast
- Reserve Bank of New Zealand: Published under the name of the governor
- **SA Reserve Bank: MPC forecast**

Role of forecasts

Forecasts is not the overriding consideration in monetary policy decision making:

In an ever-changing economy, no single model can possibly assimilate in a comprehensive way all the factors that matter for policy. Forming judgements about those factors, and their implications for policy, is the job of the Committee, not something that can be abdicated to models or even modellers. But economic models are indispensable tools in that process." - Bank of England

Forecasting process in the Bank

- Intensive process spanning over several weeks 6 times a year : from data collection to final discussion at MPC meeting
- Collection and analysis of all relevant information on international and domestic economy
- Initial assumptions and forecast by technical staff and sectoral experts in the Bank
- Comments and suggestions by senior staff
- Final assumptions by members of the MPC
- Preparation of forecast with all the models and cross checking
- Discuss forecast, risks and uncertainties at MPC meeting
- Publish the inflation forecast in the MPR twice a year

Schematic illustration of the forecasting process in the Bank



Interest rate assumption

- Baseline forecast with fixed repo rate
- Alternative forecast for the MPC with "market expectations" repo rate
- Run alternative forecasts with Taylor-type policy reaction functions
- Other alternative forecasts specified by MPC

Use Fan charts to communicate forecasts

- Many central banks use fan charts to present the forecast for inflation and GDP growth
- No point forecast has much chance of matching actual outcome
- To convey a more accurate representation of the assessment of medium-term inflationary pressures
- Concentrate the discussion on uncertainty & risks around the forecast
- Indicates probabilities, NOT upper & lower bounds for inflation

Inflation rate excluding interest rates on mortgage bonds, CPIX(mu):





CPIX inflation forecasts



Individual Reuters CPIX(mu) forecasts

Per cent



Communication of policy decisions and inflation forecasts

BIS survey of 35 central banks communication policies

Communications of monetary policy decisions and inflation forecasts						
	Percentage of					
	central banks					
Policy statement with reason for decision	92					
Minutes of the policy committee meeting	35					
Reports and bulletins with assessments of economic						
conditions	100					
Publication of staff forecast	23					
Publication of official central bank forecast	58					

Future model developments

- Incorporate forward looking expectations in more models
- Further research into exchange rate pass through
- Using QPM and DSGE model in forecasting process

Assessment and conclusion



Assessment and conclusion

- The monetary policy environment remains particularly challenging.
- While South Africa has unique challenges, other inflationtargeting countries are also having to deal with similar significant food and oil-price shocks.
- International financial market volatility and uncertainty have not subsided
- Against this background, many inflation-targeting countries have found it increasingly difficult to remain within their target ranges.
- The challenge for these countries, including South Africa, is to ensure that inflation returns to within the inflation target range within a reasonable period of time.

Assessment and conclusion

- The economy has been responding to the previous monetary policy actions taken by the MPC, and household consumption expenditure is moderating.
- However, inflation expectations have increased and are no longer clearly anchored within the inflation target range
- Monetary policy will remain committed to bringing inflation back to within the target range over a reasonable time horizon.
Thank you