AfDB
AFRICAN DEVELOPMENT BANK GROUP

Africa Economic Brief

Chief Economist Complex | AEB Volume 4, Issue 7, 2013

## Outline





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# An empirical investigation of the Taylor curve in South Africa: A Non-technical note and Policy brief

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## 1 | Introduction

Against the backdrop of heightened uncertainty and anaemic growth following the financial crisis and the ongoing euro area sovereign debt crisis, expectations about the role that monetary policy should play trying to stimulate growth have been raised. At the same time, the domestic economy has been subject to a number of severe supply-side shocks and the output gap remains negative and wide. Inflation has breached the upper limit (6 per cent) of the target band, albeit for short periods, and the forecast remains persistent towards the upper limit of the target range. Inflation expectations remain marginally above the target band at 6,1 per cent until 2015. The Monetary Policy Committee (MPC) has been facing tough choices as it tries to support the hesitant recovery and bring inflation to well within the target range.[2]

In light of the above, there is a need to understand the correlation between the volatility of output and inflation as stated in the central bank loss function with regard to economic growth performance. This typically involves a model that represents the dynamics of the economy fairly well and the specification of a loss function that represents the social costs of deviations of inflation from the inflation target and deviations of growth from its long-run rate or potential output.

This trade-off between the volatilities of inflation and output is known as the Taylor curve. Taylor (1979) also refers to the Taylor curve as a second-order Phillips curve in which there is a permanent trade-off between the variance of inflation and the variance of the output gap. The trade-off arises because monetary policy cannot simultaneously offset both types of variabilities. However, any change in inflation must be persistent, given that it is this property of persistence that results in a si-

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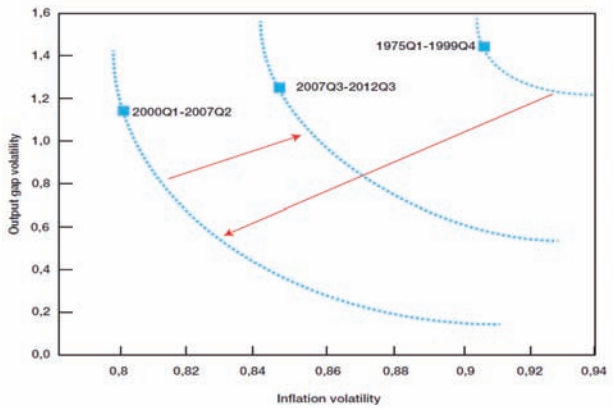
[2] The objectives of monetary policy as given through the inflation-targeting framework by the Minister of Finance state that primary objective is to ensure that CPI inflation remains within the 3 to 6 per cent inflation band, but it also makes clear that, in so doing, the MPC should be mindful of the implications of its policy actions on growth.

tuation where the variability of the inflation rate can be lowered only at the expense of greater variability in output (Chatterjee, 2002).

Our aim is to empirically estimate the relationship between output volatility and inflation volatility without the need to assume that the economy is always operating on the Taylor curve. To this end, first, we investigate whether the Taylor curve has shifted over time. Second, to assess the nature of the departures from the Taylor curve, we look at the structural (demand and supply) shocks to the conditional volatilities of inflation and the output gap. Third, we assess the optimality of monetary policy by applying the Taylor principle.[3] Thereafter, assuming a constant Taylor curve, we plot the estimated relative degrees of the South African Reserve Bank's (SARB or the Bank) preferences over time, irrespective of whether the policy settings were optimal or sub-optimal.

To achieve the objectives stated above, we used the framework in Olson et al. (2012) which implements a multivariate Garch model discussed in Engle and Kroner (1995). We modified the mean equation to include the effects of openness captured by the exchange rate.

**Figure 1** Shifts in South African Taylor curves




Source: Authors' calculations

## 2 | Key findings of the study and policy implications

- The results for the relationship between the Taylor curve and macroeconomic performance show that in most periods a negative relationship holds, indicating a negative trade-off between inflation and output-gap conditional volatilities. We also find that periods of positive trade-off seem to be followed by a slowdown in economic growth. The implication is that, periods of sub-optimal monetary policy may have adverse effects on economic growth.
- There is evidence of the negative trade-off in the later parts of the 1990s prior to the formal adoption of inflation targeting, confirming that the trade-off between output and inflation volatility started before the formal implementation of the framework.
- The average volatilities for the period 1975Q1 to 1999Q4 show the contrasting performance relative to those observed in the period 2000Q1 to 2007Q3. In this context, the Taylor curve shifted inwards from 1975Q1–1999Q4 to 2000Q1–2007Q2 shown by curves in Figure 1.
- The Taylor curve has shifted outwards for the period 2007Q3 to 2012Q3 from 2000Q1 to 2007Q2 as shown in Figure 1. The causes of this outward shift could be a series of large unanticipated shocks (of which the global financial crisis has been relatively persistent in nature) that have hit the economy and the change in the structure of the economy – hence the coefficients of the output-inflation variability have changed. From the results, these shocks have heightened macroeconomic instability and have contributed to the volatilities of output and inflation moving in the same direction.
- Furthermore, in Table 1, the results indicate that macroeconomic performance is superior in periods in which the Taylor curve relationship holds and a more negative tradeoff (correlation), that is, 2000Q1–2007Q2 has lowest volatilities in both inflation and the output gap and highest average economic growth than other periods. While causality remained an area of debate, it was clearly evident that inflation targeting was at least consistent with economic stability.
- The results of the assessment of structural shocks show that the effects of demand and supply shocks on the volatilities of inflation and output gap are transitory. Since the responses of conditional variances to demand and supply

[3] The Taylor principle states that all being equal, monetary policy authorities should respond to a persistent increase by raising nominal short-term interest rates by more than the increase in inflation so that the real rate rises sufficiently to bring inflation down.

shocks are not persistent, the results imply that departures or deviations from the Taylor curve should be short-lived if the central bank operates efficiently.

- To illustrate how the Bank's preference in terms of the stabilisation of inflation relative to output has evolved over the sample period, we assume a constant Taylor curve and plot the estimated relative degrees of preferences over time, irrespective whether the policy settings were optimal or sub-optimal.
- The results, shown in Figure 2, show that monetary policy regimes over the sample period lie on the left side of the 45 degree line. These indicate that the Bank placed more weight on inflation than the output-gap for all the sub-samples analysed.
- However, the degree to which different policy regimes have managed to stabilise the variances in inflation and the output gap has varied noticeably over the years, with the regime pre-inflation targeting (1975Q1–1999Q4) clearly lying on the upper part of the Taylor curve. The estimates for the inflation-targeting framework including the sub-sample for the current period (2007Q3–2012Q3) characterised by the persistent financial crisis and the supply shocks lie towards point B.
- Relative to other sub-samples, the 2000Q1–2007Q2 subsample seems to indicate a higher degree a monetary policy conduct which has managed to execute the mandate of flexible inflation targeting reasonably well. That is, the period 2000Q1–2007Q2 characterises a more flexible inflation-targeting approach than both1975–1999 and 1975–2012 periods.

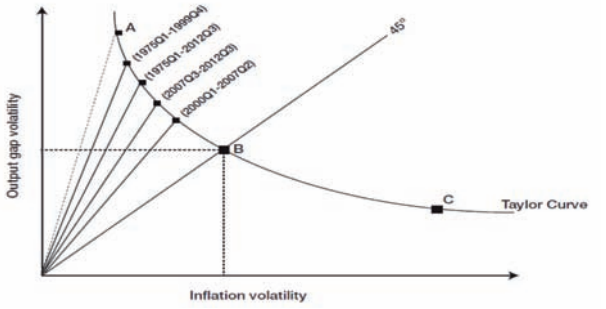
**Table 1 Average volatilities, trade off and economic growth**

| Periods | Inflation volatility | Output gap volatility | Correlation | GDP growth |
|---|---|---|---|---|
| 1975Q1–1999Q4 | 0,930 | 1,431 | -0,153 | 1,985 |
| **2000Q1–2007Q2** | **0,791** | **1,153** | **-0,306** | **4,286** |
| 2007Q3–2012Q3 | 0,832 | 1,238 | -0,079 | 2,352 |
| 1975Q1–2012Q3 | 0,888 | 1,348 | -0,175 | 2,493 |

Note: Bold shows the period with lowest volatilities and higher average economic growth
Source: Authors' calculations

- We conclude that given the statutory mandate of price stability while taking into account the negative effects on output, the Bank seems to have reasonably adjusted policy settings in response to two gaps, namely the deviation of inflation from the target and the deviation of output from the potential in a balanced way.

**Figure 2 Locations of different policy regimes on constant Taylor curve**




Note. Adapted from Levieuge and Lucotte (2012)
Source: Authors' calculations

## 3 | Policy implications

- The shift to the inflation-targeting regime minimised the inflation volatilities and managed to achieve price stability, alternatively the conduct of policy managed to minimise both anticipated and unanticipated deviations in inflation. However, the results of the shifts in the Taylor curve since the onset of the financial crisis suggest that policymakers should aim at reducing the volatility in inflation and growth with the intention of stabilising it around the levels associated with those around the origin.
- Given that these volatility measures capture both anticipated and unanticipated deviations, the anticipated volatility deviations can be discounted or hedged by economic agents, whereas the unanticipated component affects investment and spending decision-making by economic agents. Therefore, policymakers should try to minimise the unanticipated volatility component as it adversely affects economic growth performance.
- Moreover, optimal monetary policy is shown by movement along the Taylor curve rather than in its shifts away from the origin. The Taylor curve shifts towards the origin are beneficial, as this is the position where the least level of the variance is experienced, and it would be desirable for the

curve to remain at the origin, so that policymakers can move along the curve to enforce the trade-offs and price and growth stability.

- Of great concern is that periods of positive trade-off tend to be followed by a slowdown in economic growth. That is, when both volatilities move in the same direction, economic growth tends to slowdown. The positive trade-off, in less stricter terms, implies shifts rather than movements along the efficient frontier curve. The implication is that periods of positive trade-offs indicate sub-optimal monetary policy settings and these may adversely impact economic growth performance. In addition, shifts away from the origin can also be associated with welfare costs given the fact that they imply increased inflation variability, which might have negative implications for the purchasing power of economic agents. This affects planning and investment decisions, such as projected returns.
- Overall, policymakers face a choice towards not minimising both inflation and output volatilities as represented by the curve shifting way out from the origin, however, this is not ideal as it involves weakened trade-offs and anemic economic growth rate relatively to other periods where the volatilities are highly minimised.

## 4 | Further areas of research

This study has the following limitations which warrant further extensions and areas for research:

- It is argued that monetary policy paid insufficient attention to the potential impact of the build-up of financial vulnerabilities prior to the financial crisis and that the events following the financial crisis, demonstrated that financial shocks are costly as their effects are often too rapid for policy easily to offset. Moreover, they affect potential output and in turn create a trade-off between output and inflation. We acknowledge that a specification that takes into account some form of financial vulnerabilities might give a more accurate indication of the position of the 'Minsky-Taylor' curve[4] – hence better policy options open to policy makers consistent with the expanded mandate of financial stability. This is therefore identified as an area for further investigation in extensions of this study.
- Moreover, we are cognisant of fact that the paper does quantify the welfare effects of the shifts in, and along, the Taylor curve or the policymakers' preferences for inflation stability over output stability or vice versa.