

ERSA Research Brief

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Estimating a Phillips Curve for South Africa: A Bounded Random Walk Approach¹

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Introduction

The Phillips curve depicts the relationship between current inflation and past inflation, expected inflation, and economic activity. This relationship is essential particularly for central banks with a dual mandate of stabilising inflation and maintaining the economy at full employment. Many attempts at both estimating the Phillips curve assume a constant relationship between inflation and unemployment over time.

However, this interpretation of the Phillips curve can be too restrictive for several reasons. The change in inflation dynamics may be attributed to structural changes in the economy such as a fall in energy prices, a rising share of services in the economy, a change in wage rigidity, and the role of globalisation. These changes will in turn alter the Phillips curve and may have important implications for the conduct of monetary policy. For example, a flattening of the Phillips requires a more aggressive monetary policy stance to control inflation. Then, the cost of stabilising inflation is a substantial fall in output relative to its full potential. Which means the so-called sacrifice ratio is very large.

This Economic Note takes these challenges into account and estimates a Phillips curve for South Africa in a flexible framework which allows the relationship between inflation and real activity to change over time. Besides the slope of the Phillips curve, inflation persistence, which represents the degree to which current inflation depends on past inflation, varies too. In addition, we estimate the inflation target, the target bands, and the non-accelerating inflation rate of unemployment (NAIRU). Given that South Africa is an open economy with a flexible exchange rate, it is appropriate to control for supply shocks such as import prices or the exchange rate. We implicitly account for these factors by allowing for variation in the variance of the error term of the estimated equation.

Inflation Target, Target Bands and NAIRU

Figure 1 represents inflation together with the implicit inflation target and the estimated target bands. Interestingly the estimated band, between 3.25% and 6.41%, is consistent with the official target of 3 to

6%. The estimated inflation target (π^*) is relatively constant with a mean of 5.12%, and maximum and minimum values of 5.25% and 5.03%, respectively. These results are consistent with an implicit target of financial analysts of 5.51%, estimated by Kabundi, Schaling, and Some⁵ Note that these authors use a different sample, from 2000 to 2013. Unlike these authors, this study allows the estimation of the target band.

¹ The views expressed in this paper are those of the author(s) and do not necessarily represent those of the South African Reserve Bank or South African Reserve Bank Policy. We are grateful to Chris Loewald for comments and suggestions.

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⁵ Kabundi A, Schaling E, and Some, M (2015), "Monetary Policy and Heterogeneous Inflation Expectations in South Africa," *Economic Modelling*, 45: 109-117

Figure 1: Inflation, Implicit Inflation Target and Implicit Target Bands

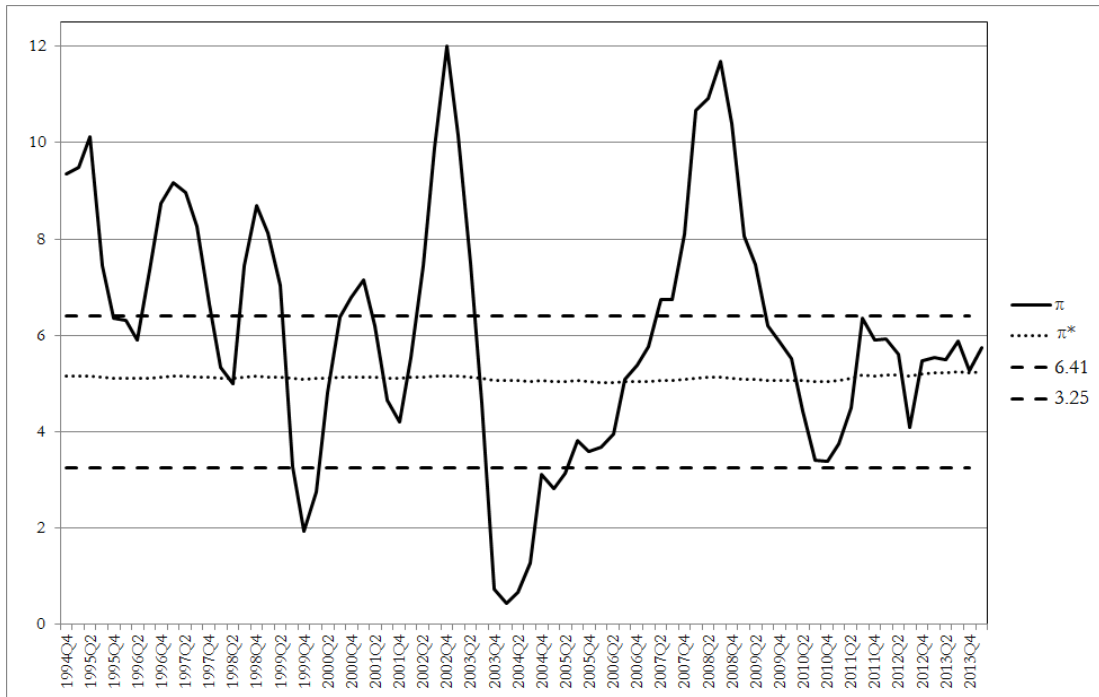
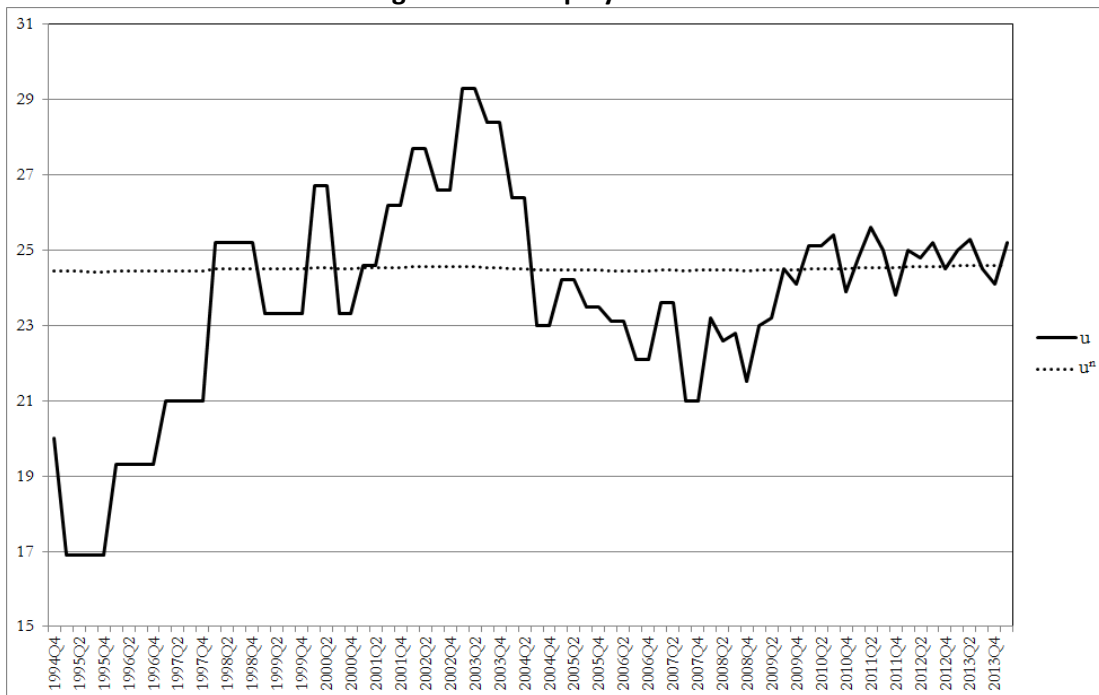


Figure 2: Unemployment and NAIRU



Similarly, the estimated NAIRU (u^n) in Figure 2 is relatively .at throughout the entire sample period, around 24.5%. Previous work suggests that the NAIRU for South Africa is about 25%. Figure 2 shows that the unemployment rate was lower than the NAIRU from 1994 to 1998. This period corresponds to rising economic activity in South Africa. Then unemployment stabilises somewhat around the NAIRU from 1998Q2 to 2001Q1. From 2001Q2 the unemployment rate rises markedly way above the NAIRU and stays high for approximately three years. During this period the economy was weak with a negative output gap. And from 2004Q3 until the recent .financial crisis the economy was at an expansionary stage and hence it created more jobs. Consequently unemployment decreased below the NAIRU for about .five years. The

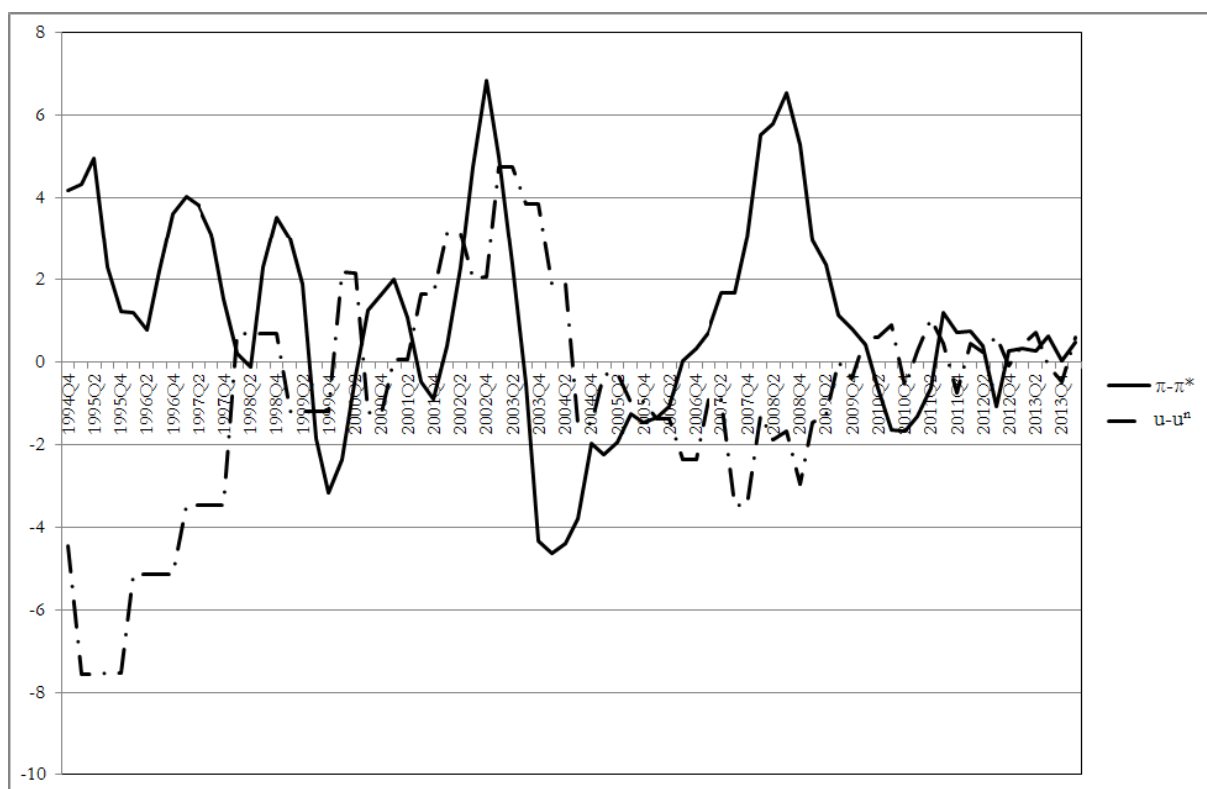
financial crisis pushed the South African economy into recession in 2009 which at same juncture exerted pressure on unemployment which rose back to the level of the NAIRU and it has remained stable ever since. The stability of unemployment around the NAIRU is consistent with a relatively constant inflation rate at the target level towards the end of the sample. The persistently high level of unemployment at the end of the sample closely mimics weak economic activity in South Africa since the financial crisis.

Inflation Gap and Unemployment Gap

In order to get some perspective on the Phillips curve in South Africa, in Figure 3, we show the relationship between the inflation gap (or deviation of inflation from its target) and the unemployment gap (or deviation of unemployment from the NAIRU). The Phillips curve relationship involves the inflation gap and the unemployment gap and not necessarily the levels. From Figure 4 we can see the changing nature of the relationship between the two gaps for the period 1994-2014. There is evidence of a negative relationship between the two variables at the beginning of the sample, that is, from 1994Q4 to 1998Q1.

The relationship is blurred from 1998Q2 to 2001Q3, which in turn is followed by a positive relationship between the two gaps. This result suggests that during this period of 1998Q2 - 2001Q3, the South African economy experienced stagflation whereby a high inflation gap was explained by other factors than the unemployment gap. Note that, the domestic currency (Rand) depreciated significantly in 1998Q2 - 2001Q3. This may explain a rise in inflation while at the same time the economy was subdued. The negative relationship between the two variables re-emerges in 2004 and remains in existence although weakens somewhat towards the end the sample.

Figure 3: Inflation Gap and Unemployment Gap

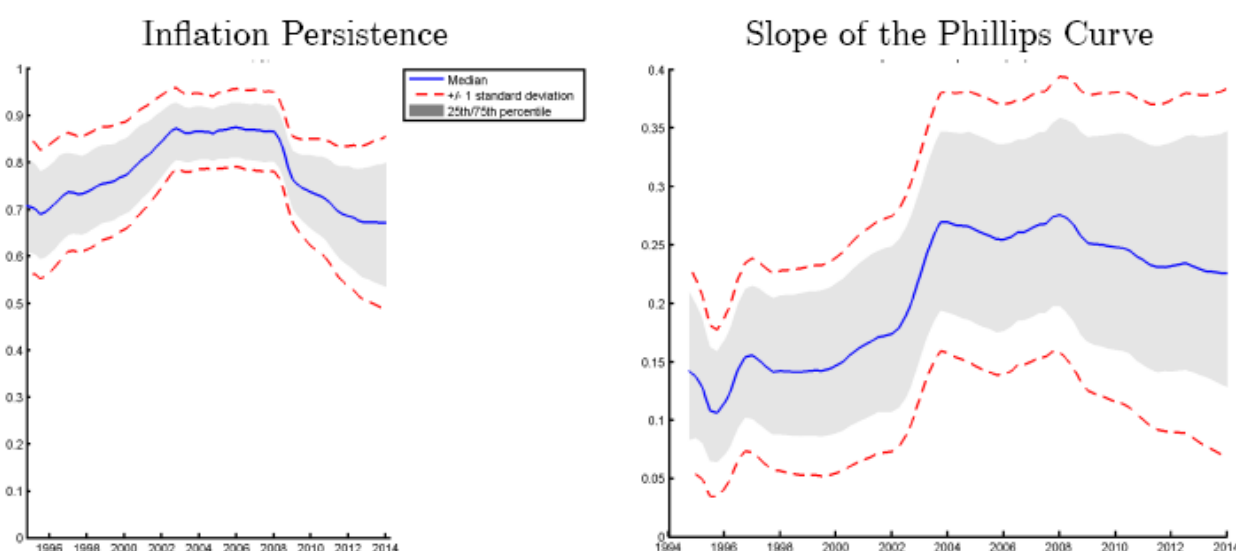


Importantly, the inflation gap seems more persistent than the unemployment gap. In addition, the inflation gap follows a long cycle with large amplitude from 2001 to 2008. Even if the 2001-2002 cycles displays a large amplitude of 6.85%, it is short and lasts only a year. However, the 2002-2008 cycles is both long and with a large amplitude, reaching a minimum of -4.63%. This cycle lasts four years and peaks in 2008Q3 at 6.55%. The next section provides an in-depth analysis of the dynamic nature of the Phillips curve, but also the persistence of the inflation gap.

Parameter Estimates of the Phillips Curve

Now, we present the results of the parameter estimates. In Figure 5 we present the estimates of inflation persistence and the slope of the Phillips Curve. These two parameters are critical for the dynamics of inflation. The inflation persistence captures the impact of inflation expectations on inflation whereas the slope captures the degree of the response of inflation to excess demand factors and the extent of the short run trade-off faced by policy makers. The more anchored inflation expectations are to the central Bank's target level the smaller the persistence in inflation and the smaller the effect of inflation expectations on inflation. In this case agents are mainly forward looking. As shown in Figure 5 our estimates suggest that the persistence parameter evolves over time and has increased from 1994 to 2001, remained high from 2001 to 2008, and eventually declined after around 2008. This indicates that inflation expectations in South Africa have been relatively more anchored and stable since 2008. As mentioned earlier, the SARB's implicit target estimates are consistent with financial market analysts inflation expectations. Thus, this result would suggest that financial analysts inflation expectations have been relatively more anchored than those of the price setters (unions and businesses). Moreover, the financial crisis in 2008 followed by the recession in 2009 in South Africa opens the question of whether this behaviour of inflation expectations is the result of "good policy or good luck". In fact, on the one hand, a decline in persistence parameter denotes an increase in policy credibility. On the other hand, independently of policy credibility, the global recession was marked by low levels of inflation around the world and agents may have expected these levels to persist over the near future.

Figure 4: Inflation Persistence and Slope Parameters Estimates



Although at lower levels, the slope parameter has increased from 1994 to the mid 2000s and since then exhibits a slight downward trend. The decline in the slope parameter means that inflation has become less responsive to demand side factors. It suggests that the importance of unemployment as a driver of the inflation process has decreased.

The implication for disinflation policy is that the sacrifice ratio, which captures the increase in unemployment above the natural rate due to each percentage point decline in inflation, has increased. The results favour a policy which focuses on anchoring inflation expectations rather than trying to exploit any trade-off between inflation and unemployment. Note that this pattern of the slope parameter is in line with the findings in most advanced economies whereby the slope of the Phillips curve has significantly flattened particularly after the great recession.

Conclusion

In this study we have estimated a Phillips curve for South Africa using a flexible framework which allows for change in the relationship between inflation and unemployment over time. Our results indicate that the slope of the Phillips curve has flattened since the mid-2000s - particularly after the Great Recession - which is in line with the findings in most advanced countries. In addition, we find that our estimated inflation target band from 3.25 to 6.41% is slightly higher than the official SARB target bounds of 3-6% band per the inflation targeting regime that has been in existence in South Africa since 2000. The estimated target is relatively constant with a mean of 5.12%. As it lies closer to the upper bound than the lower bound of the official target band this may be indicative of some accommodation of cost-push shocks.

With respect to the degree to the extent of which inflation expectations are anchored to the target our results indicate that the credibility of the SARB decreased from 1994 to 2001, remained constant from 2001 to 2008, and eventually increased around 2008.