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Stellenbosch Economic Working Papers: 09/09

KEYWORDS: SOUTH AFRICA, INFLATION EXPECTATIONS, MONETARY POLICY TRANSMISSION MECHANISM, IMPLIED FORWARD RATES, TERM STRUCTURE OF INTEREST RATES
JEL: E43, E44, E52, E58

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A WORKING PAPER OF THE DEPARTMENT OF ECONOMICS AND THE
BUREAU FOR ECONOMIC RESEARCH AT THE UNIVERSITY OF STELLENBOSCH

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ABSTRACT

The inflation expectations channel of the transmission mechanism is generally recognised as crucial for the implementation of modern monetary policy. This paper briefly reviews the practices commonly employed for measuring inflation expectations in South Africa and offers an additional method, which is market based. The methodologies of Nelson and Siegel (1987) and Svensson (1994) are applied to determine implied nominal and real forward interest rates. The difference between the nominal and real forward rates (called inflation compensation) on a particular day is then used as a proxy for the market's inflation expectations. This measure should not be viewed as a substitute for other measures of inflation expectations, but should rather supplement these in order to offer an additional insight.

Keywords: South Africa, Inflation expectations, Monetary policy transmission mechanism, Implied forward rates, Term structure of interest rates

JEL codes: E43, E44, E52, E58

[1] Note: This paper is also available as ERSA Working Paper 127.

[2] The author acknowledges financial support for this project from ERSA. The author also wishes to thank Prof Stan Du Plessis for his guidance during the completion of the author's Master's thesis, of which this paper is a product.

1. INTRODUCTION

The South African inflation targeting regime is facing its greatest challenge since its implementation in 2000, and the state of the inflation expectations of the population are central to the defence of the regime. Modern monetary authorities are increasingly relying on the expectations channel of the transmission mechanism to implement monetary policy, and inflation targeting is used as a framework to manage these expectations. Therefore, the measurement of inflation expectations is crucial to empirical work that attempts to understand the transmission of monetary policy and improve its efficiency, and it is central to the debate surrounding the appropriateness of inflation targeting in the South African context.

Some of the methods currently used as measures of inflation expectations will be presented in section 2, followed in section 3 by a discussion of the merits of 'inflation compensation' (the difference between the nominal and real forward rates) as a measure. The term structure of interest rates, which is represented graphically by the yield curve, is recognised to contain information about the inflation expectations of the financial markets. The difficulty lies in disentangling the information about inflation expectations contained in the yield curve from the other information, including expected real future interest rates and risk premia.

Calculating the implied forward rates necessary to determine forward inflation compensation is also a challenge. The method proposed in this paper for calculating these forward rates will be explained in section 4, and then the actual extraction of the South African implied forward rates using the parametric methodologies of Nelson and Siegel (1987) and Svensson (1994) will be demonstrated in section 5. The South African inflation compensation series finally extracted will be analysed in section 6.

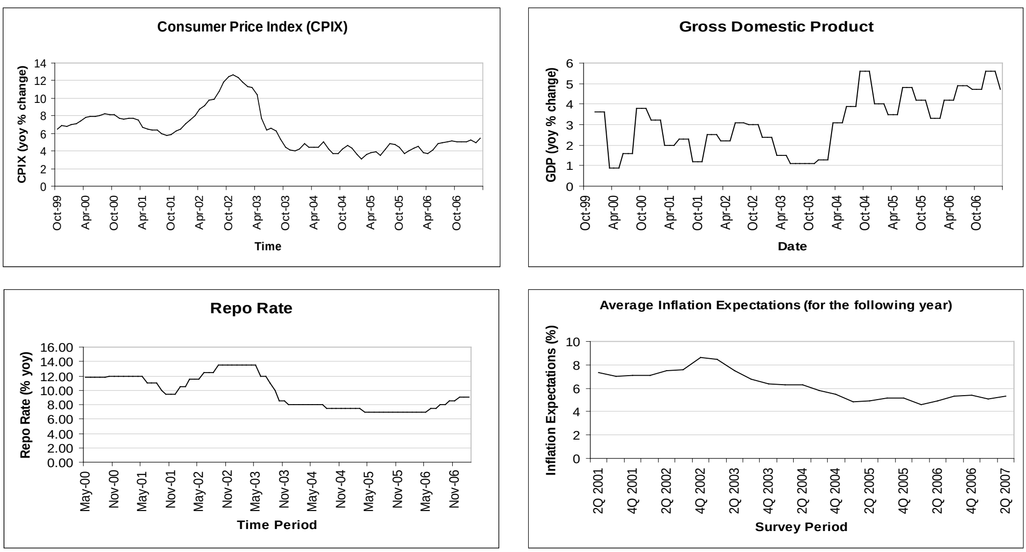
2. MEASURES OF SOUTH AFRICAN INFLATION EXPECTATIONS

The SARB's (South African Reserve Bank's) mandate is 'to protect the value of the currency of the Republic in the interest of balanced and sustainable growth in the Republic' (South African Reserve Bank Act 90 of 1989, amended: 3). In line with received wisdom about the goals of monetary policy (Walsh, 2003) and the vital role of managing private sector expectations, the SARB aims to anchor inflation expectations in order to minimise output costs, while pursuing *low* and *stable* inflation. Through increased transparency and credibility, the central bank can enhance the predictability of its actions and encourage the transmission of changes in the monetary authority's interest rate along the yield curve to long-term interest rates, which influence the majority of economic decisions.

According to Aron and Muellbauer (2006) the move to inflation targeting has enhanced the credibility and efficiency of monetary policy in South Africa, and delivered 'reasonable predictability' (2006: abstract). There is no one perfect or conclusive method for measuring these concepts, but a number of measures can be used to give us an indication of the degree of success of monetary policy in anchoring inflation expectations in order to achieve the goals of low and stable prices, and sustainable economic growth.

Visual inspection of graphical representations of the evolution of various macroeconomic indicators can offer some valuable insights.

Figure 1: Macroeconomic Trends



Sources: CPIX and GDP data from Stats SA
Inflation expectations data from the BER
The repo rate from the SARB

Figure I shows that over the period 2002 to mid-2007, CPIX inflation and inflation expectations decreased in South Africa, while GDP growth rose and the repo rate was lowered. In 2002 repo rate was raised in an attempt to contain sharp increases in inflation and inflation expectations, and output decreased. More recently, GDP was able to rise strongly with limited increases in inflation and inflation expectations. Although these trends are the kinds that successful monetary policy would wish to achieve, they could merely be what Aron and Muellbauer (2006) call a 'lucky accident'.

The measurement of inflation expectations and credibility of the central bank are areas of active research in the hope of more rigorously evaluating the degree to which modern monetary policy succeeds in influencing interest rates (especially at longer horizons). In the November 2006 Monetary Policy Review, three measures of inflation expectations in South Africa were identified – the inflation expectations surveys of the Bureau of Economic Research (BER), the Reuters survey of long-term forecasts for the South African Economy, and breakeven inflation expectations. Firstly, the BER conducts a survey of the inflation expectations among financial analysts, business executives, trade unions and households on a quarterly basis, which has added valuable insight by evaluating the expectations of these different groups separately (Kershoff and Smit (2001), Kershoff (2000)).

The second measure of inflation expectations referred to in the Monetary Policy Review was the Reuters Survey. In this survey a panel of professional economists are asked monthly for their forecast of the quarter-end values of a set of economic indicators[3]. This is a useful way of testing the robustness of the one component of the BER survey (the financial analysts).

The third indicator of inflation expectations referred to was the breakeven inflation rates (the difference between the yields on nominal and inflation-indexed bonds of similar maturities). Establishing a market-based measure of inflation expectations is appealing from the point of view that the data would be more accurate and available at a high frequency (Svensson and Söderlind, 1997). Based on the Fisher equation, bond yields are recognised as containing information about inflation expectations. The Fisher equation, below, decomposes the nominal interest rate into inflation expectations and the real interest rate (Söderlind, 1995).

$$i_t = r_t + \pi_t^e \tag{1}$$

where i_t = nominal interest rate

r_t = real interest rate

$\pi^e{}_t$ = inflation expectations

[3] For three months economists forecast the same upcoming quarter end, so their forecast horizon shortens progressively.

It is now quite common to extract 'breakeven inflation' as a proxy for the inflation expectations of the market[4]. The forward inflation compensation measure presented in the following section is an extension of this market-based measure.

3. FORWARD INFLATION COMPENSATION AS A MEASURE OF INFLATION EXPECTATIONS[5]

It is widely recognised that the yield curve (the term structure of interest rates) contains information about the market's expectations of the path of future inflation, together with information about the expected path of future real interest rates and risk premia. Based on the Fisher equation (equation 1), inflation expectations can be extracted by finding the difference between nominal and real interest rates. In addition, the capital asset pricing model recognises that together with information about inflation expectations, at a long horizon, the yield curve also contains information about the real interest rate and risk premia. It would be ideal to isolate the expected inflation by identifying the real interest rates and the risk premia and removing their influences as well, but this is not simple in practice.

Studies using the term structure of interest rates[6] often assume that the expectations hypothesis holds – 'the *n*-period interest rate equals an average of the current short-term rate and the future short-term rates expected to hold over the *n*-period horizon' (Walsh, 2003: 489), or that the term premia are negligible and treated as if it were zero. This is a contentious issue with many conflicting findings (See Berk (1998) and Walsh (2003)for a summary of some of these conflicting empirical findings). Svensson (1994) argues that forward interest rates may still act as indicators of inflation expectations because the risk premia that have been estimated have been small and they vary at low frequencies, so analysis of shifts in the yield curves at daily frequencies remain informative about changes in high frequency inflation expectations. Very little of the change in the slow moving risk premia could be attributed to one day, so this would theoretically be responsible for little of the variation of the interest rate on a single day. In conclusion, although this measure is a useful indicator of the market's inflation expectations, it is inadvisable to rely solely on the forward curve information to assess market inflation expectations (Svensson, 1994).

The yield curve, spot rate (zero-coupon) curve and forward rate curves are different representations of the same term structure information, based on the same underlying financial instruments (Coleman, 1998), but they present this information in different

[4] Some of the banks in South Africa are currently developing interest swap rates, which will offer an alternative measure of inflation expectations in future. However, these have only been trading for a short period, so the series is not yet long enough to be a used for much robust econometric evaluation.

[5] Terminology used by Gürkaynack, Sack and Swanson, 2005.

[6] The term structure of interest rates (usually illustrated by a yield curve) describes the relationship between interest rates and term to maturity.

forms which are useful for different purposes. Svensson (1994) proposed the use of forward interest rates as a measure of market expectations because they represent the expected short-term interest rate for a future period of time along the time path of interest rates, and it is easier to separate short, medium and long-term expected interest rates. The one-year forward rate, ending in ten years' time, is the short-term forward rate between years nine and ten. He compares the relationship between the yield curve and the forward interest rate curve to that between the average and marginal cost curves. A point on the yield curve at a long horizon represents an average of all the expected changes in the components up till that point, whereas the forward interest rate at that horizon reflects only the marginal or short-term interest rate at that horizon. It is therefore easier to interpret expected future short-term interest rates (and inflation expectations as a component of this) by tracking the evolution of forward interest rates over time.

If it is possible to determine both the real and nominal forward interest rates, forward inflation compensation (the difference between nominal and real forward rates) can be determined, which will provide a measure of inflation expectations (albeit an imprecise measure in the sense that it does not account for the size of the risk premia). For example the one year forward inflation compensation, ending in ten year's time would provide a proxy for inflation expectations between end of year nine and the end of year ten.

$$\text{Fwd inflation compensation (9-10)} = \text{nom fwd rate (9-10)} - \text{real fwd rate (9-10)} \quad (2)$$

The determination of this forward inflation compensation measure therefore requires nominal and real forward rates. Forward rate agreements are explicit forward rates, determined by market trading, but in South Africa they are only available for shorter time horizons[7], and so they do not offer an indication of short-term interest rates over the long-term future, which is of particular interest in judging whether inflation expectations are well anchored[8]. Instead implied forward rates must be extracted from yield curve data.

[7] A range of FRAs traded in South Africa, from 1x4 month to 12x24 month FRAs, where a 1 x 4 month FRA is a 3 month interest rate in 1 months' time.

[8] Expectations are well 'anchored' if they are strongly influenced by the nominal anchor (e.g. the inflation target) rather than being buffeted by current economic developments.

4. EXTRACTING IMPLIED FORWARD RATES

The implied forward rate could be calculated from the price of a zero-coupon bond, based on the following relationship (Anderson and Sleath, 2001):

$$B(\tau) = \exp\left[-\int_0^{\tau} f(m)dm \right] \tag{3}$$

where $B(\tau)$ is the price of a τ-maturity zero-coupon bond

$f(m)$ is the 'instantaneous' forward rate (the rate for which the 'difference between settlement time and maturity time approaches zero' (Bank for International Settlements, 2005: v))

However, zero-coupon bond prices are usually not freely available from the market for a full range of maturities along the curve (where they are available they are usually for horizons under one year). Instead, the zero-coupon price must in turn be extracted from the prices of the available (observable) coupon-bearing bonds, where the bond price and the price of the zero-coupon bond are related in the following manner (Anderson and Sleath, 2001):

$$P(c_i, \tau_i, i = 1,\ldots,n) = \sum_{i=1}^{n-1} c_i B(\tau_i) \tag{4}$$

where P is the price of the observable coupon-bearing bond

c_i is the coupon payment

τ_i is the maturity of the bond

n is the number of coupon payments outstanding

B is the price of a zero-coupon bond

Therefore, using equations (3) and (4) above, it is possible to determine the forward rate from the price of observable coupon-bearing bonds. The prices of the coupon bonds, the coupon rates and the time to maturity of the bonds are used to determine the price of the zero-coupon bond (equation (4)). Then the price of the zero-coupon bond can be used to calculate the instantaneous forward rates (equation (3)).

The next challenge is that these bonds are not available for every maturity along the curve i.e. the calculation above determines the forward rate at a single point in time. A method is required to interpolate and trace the full curve. The approaches available to determine the zero-coupon and forward rate curves implied by the bond data can broadly be divided into parametric methods and spline-based methods. Both these approaches determine a set of parameters to describe the entire zero-coupon and forward rate curve implied by the bond data, but the two methods by which they achieve this each offers different advantages.

Three criteria are used to compare the relative advantages of the different approaches to determining the functional form and estimation of these parameters (Anderson and Sleath, 2001). Ideally, the curve should be *flexible* enough to capture the changes in the interest rates at different horizons (especially at the short-end, where there tends to be greater curvature), but should not excessively compromise *smoothness* by insisting on passing through every data point. The *stability* of the forward rate curve should also not be excessively influenced by the minor adjustments of a single (or a small number of) bond data points.

By using a simple function, with few parameters to estimate, the parametric models offer a parsimonious, simple and robust method of estimating forward rates. They tend to offer a smoother curve with less flexibility, although the inclusion of additional terms in the functional form can increase their flexibility.

By contrast, spline-based methods determine a segmented curve, where the individual segments are represented by cubic polynomials which are joined at knot points. The parameters of these segments are restricted to maintain a continuous curve, but they do allow a greater level of flexibility as they are able to move more independently. For the purposes of monetary policy an unconstrained spline can compromise smoothness excessively as it becomes increasingly flexible, therefore modified versions (such as the Fisher, Nychk and Zervos (1995) or the variable roughness penalty parameter (Waggoner, 1997) methods) are more commonly used for this purpose.

In this paper, the parametric models of Nelson and Siegel (1987), and the extension of the Nelson-Siegel model by Svensson (1994) are used. According to Svensson (1994), the simple parametric model of Nelson and Siegel (together with Svensson's extension) offers sufficient precision for the purposes of monetary policy. This is also widely used by central banks internationally (Bank of International Settlements, 2005), so adopting the same is useful for comparative purposes.

Using maximum likelihood, the deviation of the squared yield errors or price errors (the difference between the observed and estimated yields or prices) is minimised in order to estimate the parameters of the model that represents the yield curve (Svensson, 1994, Anderson and Sleath, 2001). Svensson (1994) argues that it is more appropriate to minimise the yield errors in this case as communication about monetary policy relies on interest rates, and prices are less sensitive to changes in yields at the short end of the curve, which can result in large yield errors.

Nelson and Siegel (1987) used a relatively simple functional form to estimate a parsimonious forward rate curve.

$$f(m;\beta) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \frac{m}{\tau_1} \exp\left(-\frac{m}{\tau_1}\right) \tag{5}$$

where f is the instantaneous forward rate curve

β is the vector of parameters to be estimated

m is the time to maturity

τ is the scale parameter that causes the exponential terms to decay to zero (Fabozzi and Mann, 2005).

The first term captures the horizontal asymptote of the curve (the level) and the second term is an exponential function that increases or decreases monotonically (depending on the sign of the coefficient) towards zero as the time to maturity approaches infinity (the slope of the curve). The third term determines the hump or U-shape of the curve (the curvature), depending on whether the coefficient is positive or negative (Diebold and Li, 2006, Söderlind and Svensson, 1996).

Svensson (1994) extended Nelson and Siegel's function by adding an additional term, which increased the flexibility of the model.

$$f(m;\beta) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \frac{m}{\tau_1} \exp\left(-\frac{m}{\tau_1}\right) + \beta_3 \frac{m}{\tau_2} \exp\left(-\frac{m}{\tau_2}\right) \tag{6}$$

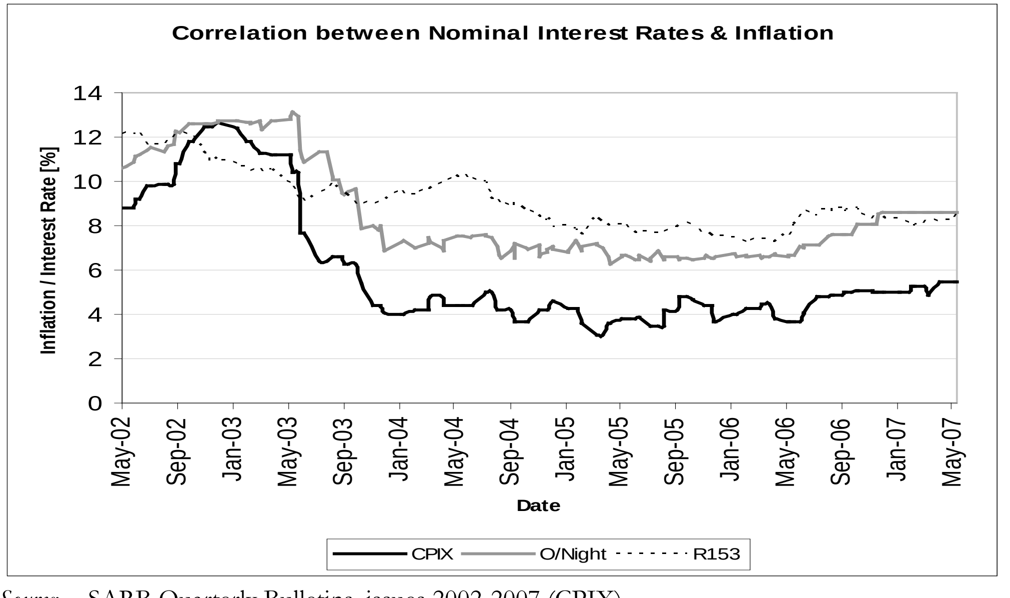
Both the nominal and real implied forward rate curves had to be calculated in order to determine the forward inflation compensation (the difference between the nominal and real forward interest rates).

5. IMPLIED FORWARD RATES FOR SOUTH AFRICA

South Africa does not have many inflation-linked (real) bonds. Neither real forward interest rates, nor the real zero-coupon curve were available for South Africa. Many researchers facing this problem have made the assumption that the real interest rates far in the future are constant, and therefore all the variations in the long term nominal interest rates are due to changes in inflation expectations (Walsh, 2003). Empirical evaluations of the markets have widely, but not unanimously, indicated that at longer horizons, real interest rates are far more stable and the movement in nominal interest rates tends to reflect mainly changes in inflation expectations (Walsh (2003), Ang, Bekaert, and Wei (2007)). Ang, Bekaert and Wei (2007) find that 80% of the variation in the nominal interest rate in the US at the 20-quarter horizon is due to the variation in inflation compensation (inflation premium and expected inflation), and inflation expectations are responsible for most of the nominal rate spread.

Figure II shows a strong correlation between the overnight interest rate and CPIX in South Africa. The correlation between CPIX and the R153 (a nominal government bond maturing on 31 Aug 2010) is not as strong but is certainly not unrelated. During the period where inflation peaked, the R153 dropped below CPIX, which corresponds with other measures of inflation expectations which show that inflation expectations lay below actual inflation during this period.

Figure II:



Source: SARB Quarterly Bulletins, issues 2002-2007 (CPIX)
SARB (overnight rate)
BESA (R153)

Although there does appear to be reason to believe that the real interest rates are relatively constant far into the future, this kind of assumption is rarely made with confidence, especially when investigating a developing country, because most of the assumptions are based on studies of more developed countries.

In fact, Mitchell-Innes et al (2007) argue that in a credible monetary policy regime, where expected inflation is relatively constant (well anchored), it is the real interest rate that will drive the nominal interest rates. Mitchell-Innes et al (2007) empirically analysed the relationship between expected inflation and nominal interest rates in South Africa between 2000 and 2005 (they tested whether the Fisher hypothesis holds for that period). Their study distinguishes between the long term and short term Fisher effects, thereby investigating the strength of the relationship between inflation expectations and nominal interest rates in the short and long terms. They did not find a statistically significant short term Fisher effect, but a weak form of the long term Fisher effect. These results imply that, in the short term, the real interest rate is not constant (is strongly influenced by monetary policy), and although in the long term inflation expectations do influence nominal interest rates, the long term real interest rate is still not constant.

Instead of assuming a constant real interest rate far into the future, in this study Svensson's extended version of the Nelson and Siegel methodology (Svensson, 1994), represented by equation 6 above, was adopted to calculate implied forward rates from bond data[9] [10]. To determine the forward interest rate on a particular day, the yields to maturity, time to maturity and coupons of a set of bonds, recorded by the markets on that day, are required as inputs. From these a zero-coupon yield curve (spot rate curve) and a forward rate curve for that day can be estimated.

For the nominal forward rate curves, between four and seven nominal government bonds[11] were available concurrently over the sample period. The SARB overnight rate and the 91-day, 182-day and 273-day Treasury Bills were added as inputs to help define the curves at the short end. Figure III is a typical example of the nominal curves plotted by the programme. The estimated yield to maturity is represented by the dots and the

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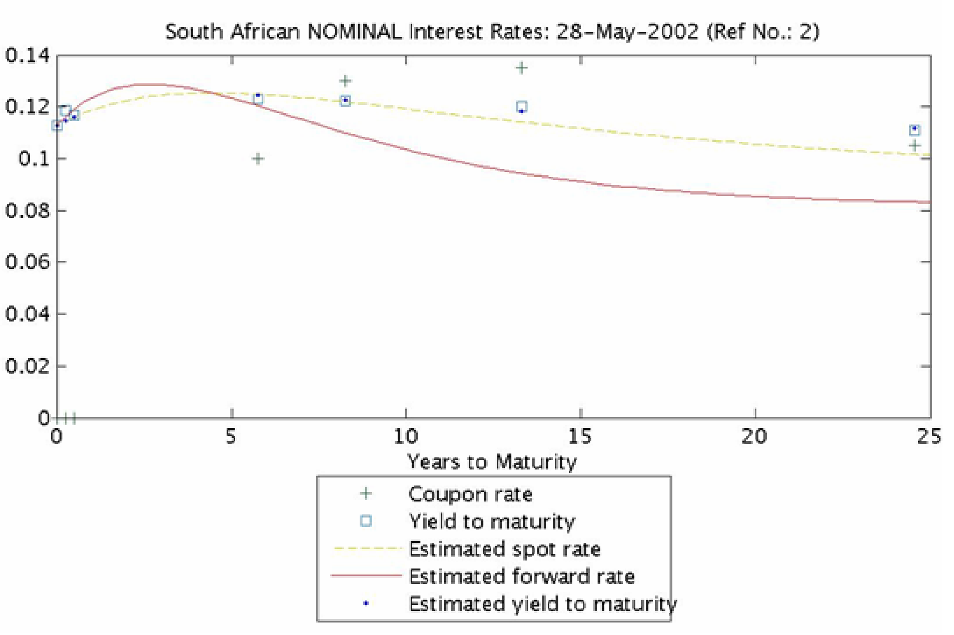
[9] After an article by Svensson and Söderlind (1997), Söderlind made the Matlab code for Svensson's method available on his website.

[10] Zero-coupon yield curves with a high degree of precision are available for nominal bonds from the Bond Exchange of South Africa (BESA, 2004). Despite this, the method proposed by Svensson (1994) was used to determine both real and nominal forward rates, because only the nominal rates were available from the BESA, and further extensions of the dataset would have meant periodically requesting further data from the exchange. According to Svensson (1994), his method is adequately precise for the purposes of monetary policy.

[11] The R194, R153, R201, R157, R203, R204 and R186, maturing in February 2007/2008/2009, August 2009/2010/2011, December 2014, September 2014/2015/2016, September 2017, December 2018 and December 2025/2026/2027.

observed yield to maturity by the squares, so where the dot lies within the square the squared yield error is small.

Figure III:



Source: Results calculated for SA data, using Matlab programme by Söderlind.

For real forward rate curves, three inflation-indexed government bonds were available concurrently from 26 April 2002. A fourth was added from 15 August 2003[12]. The SARB overnight rate and the three Treasury Bills were adjusted for inflation expectations and used to trace the short ends of the curves. The Reuters Econometer forecasts of inflation were used to adjust these short-term instruments, because it is a measure of the inflation expectations of the financial market 'audience' in particular, and the survey does include the markets' forecasts one, two and three quarters ahead, so these can be appropriately matched with the horizons of the three Treasury Bills.

A series of these weekly forward rate curves (using the interest rates recorded on Fridays when Treasury Bills are auctioned) is useful to observe the changes in inflation expectations of the markets over time. The sample period was May 2002 to June 2008, limited by the date from which sufficient inflation-indexed bonds were available. Of the 334 weekly observations, approximately 4% of the real curves were excluded from the regression analysis due to the inability of the algorithm to find stable parameter values for

[12] The R198, R189, R197 and R 202, maturing in March 2008, March 2013, December 2023 and December 2033.

these curves. There is concern about the liquidity of the inflation-indexed government bonds. Around a quarter of the observations lost were from 2006, where a sharp increase in the demand for these bonds was not met by supply, and real yields were distorted (BESA, 2006). About half of the lost observations were from the end of 2007 and 2008 when the demand for inflation-indexed bonds was likely to have increased again. Had this been included, the algorithm would have struggled to minimise the large yield errors and plot the curve.

However, the rest of the curves seem reasonable. As predicted by the literature, most of these real forward rate curves were flat at the longer horizons. On visual inspection, the interest rate at which these curves settled also did not fluctuate wildly from observation to observation. Over the entire period, the stable, longer-term portion of the curves varied around 2% to 5%.

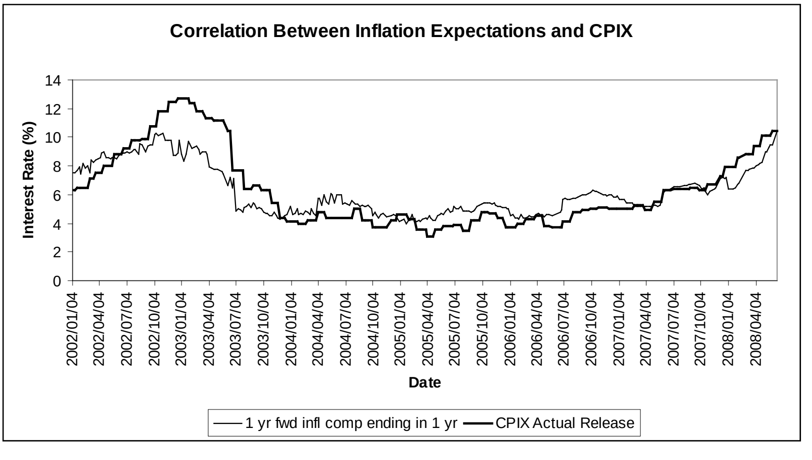
Finally, the forward inflation compensation could be calculated for each day by finding the difference between the nominal and real forward rates on that day. For example, the one-year forward inflation compensation (inflation expectations) for the one year period between four and five years is calculated by subtracting the one-year real forward rate, ending in five years, from the one-year nominal forward rate, ending in five years.

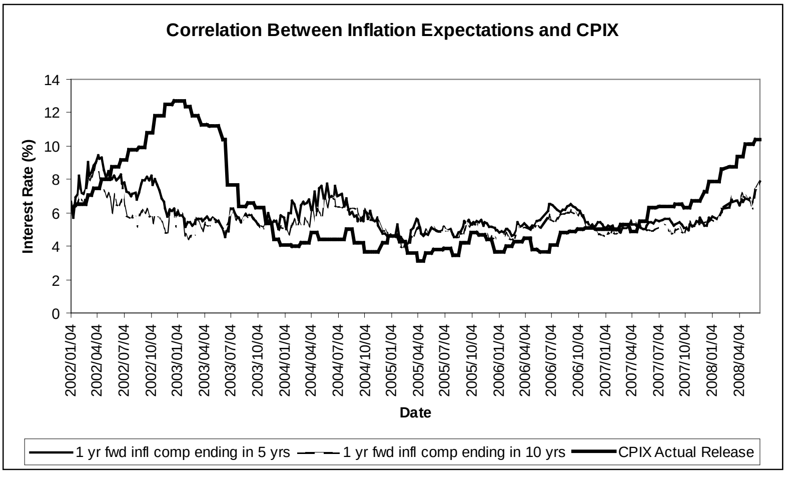
$$\text{Infl Comp (4-5years)} = \text{Nom Fwd Rate (4-5years)} - \text{Real Fwd Rate (4-5years)} \qquad (7)$$

6. ANALYSING THE SOUTH AFRICAN IMPLIED FORWARD RATES

An analysis of the forward inflation compensation measure extracted in the previous subsection seems appropriate at this point in order to provide insight into the nature of the series created and to consider whether the series is congruent with what we already believe about inflation expectations.

Figure IV:





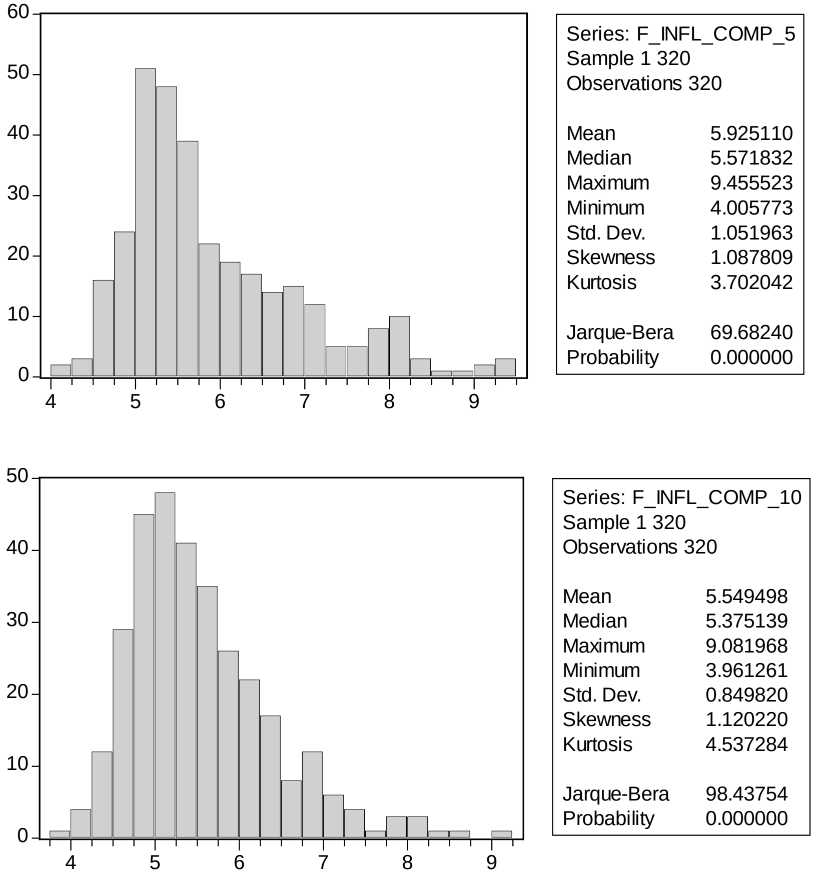
Sources: Data from the SARB

Own calculations

Figure IV depicts the correlation between the consumer price index and the forward inflation compensation series ending in one year, five years' time and ten years' time. The figure depicts that inflation compensation at the one year horizon lay below actual inflation, while it increased sharply around the end of 2002, and then declined to within the inflation targeting band until mid-2007. More crucially, inflation compensation at the five and ten year horizons seems to suggest that even in the 2002/2003 period of high inflation, the markets did expect inflation to move back toward the target band in the future. Most striking is the fact that inflation compensation at the ten-year horizon is already anchored within the target band by mid-2002. With regards to the recent period of inflation, the inflation compensation again suggests that the markets expect inflation to progressively move back towards the target band.

The histograms in figure V represent the distribution of forward inflation compensation over the sample period. Forward inflation compensation ending in five years' time (the first histogram) centres around a median of 5,57% and varies between a minimum of 4,01% and a maximum of 9,45%, and has a standard deviation of 1,05. In comparison, the forward inflation compensation ending in ten years' time is slightly better anchored. It centres around median of 5,38%, and the observations are bunched a little tighter around this median, with a minimum of 3,96%, a maximum of 9,08%, and a standard deviation of 0.84. The portion of the observations that fall below 6% (the upper target band) also increases from 64% for the forward inflation compensation ending in 5 years' time to 75% for the forward inflation compensation ending in 10 years' time.

Figure V:



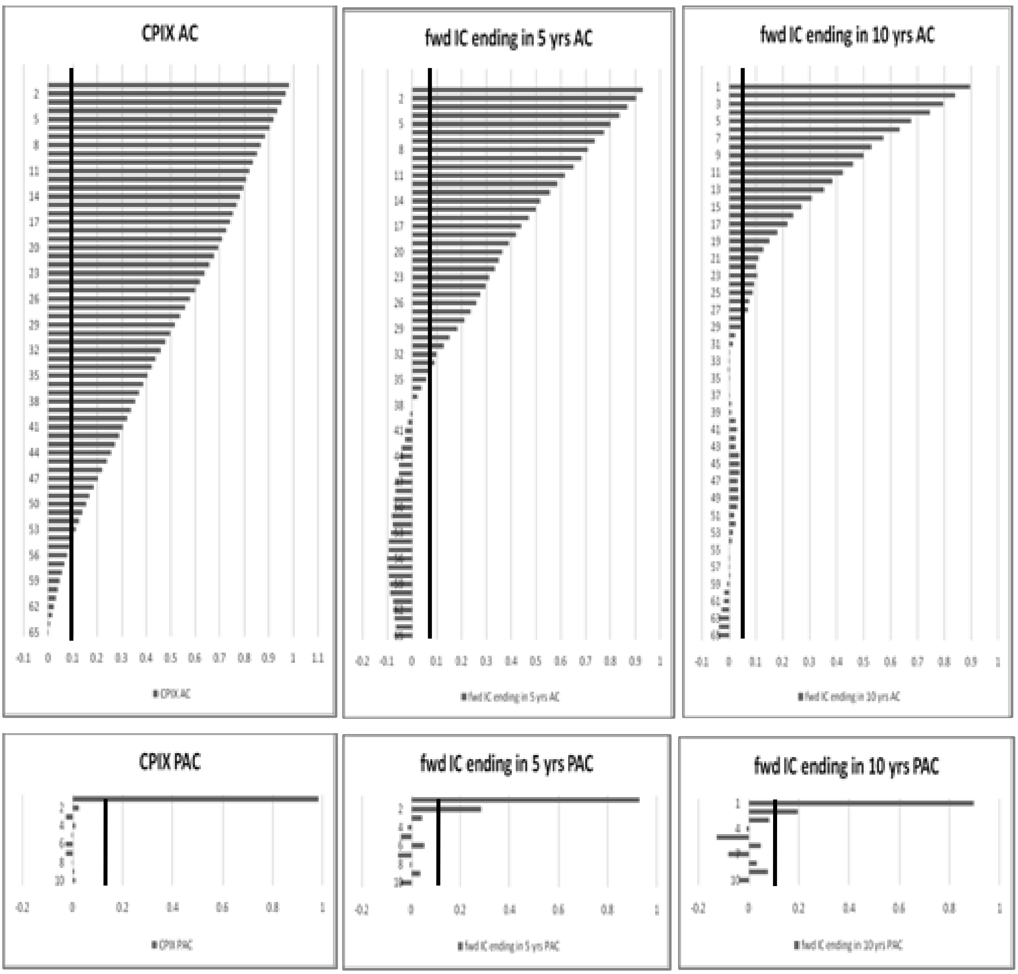
It is interesting that the inflation expectations settle not far below 6% (the upper band of the inflation target). This, together with the fact that inflation averaged 6,45% between March 2000 and June 2008 (SARB, 2008), supports the warning by Du Plessis (2005) that specifying a 3%-6% range would cause a hardening of the upper band of the target range[13].

The autocorrelation and partial autocorrelation coefficients for CPIX and forward inflation compensation in Figure VI demonstrate the persistence of these measures. These three series were determined at weekly intervals (the day of the week on which the Treasury Bills are auctioned), so the lags can be interpreted as the number of weeks that the autocorrelation persists. The CPIX series reflects strong persistence as expected (autocorrelation takes 64 weeks to die out). The solid black line shows the 5% level of significance, so the autocorrelation is significant until the 55th week. The forward

[13] Thank you to an anonymous referee for bringing this to my attention.

inflation compensation ending in five years' and ten years' time each illustrate progressively lower levels of persistence. The forward inflation compensation ending in five years time dies out after 37 weeks (significant at the 5% level until the 32nd week), and the autocorrelation coefficient of forward inflation compensation ending in ten years time dies out after 31 weeks (significant at the 5% level until the 23rd week) .

Figure VI:



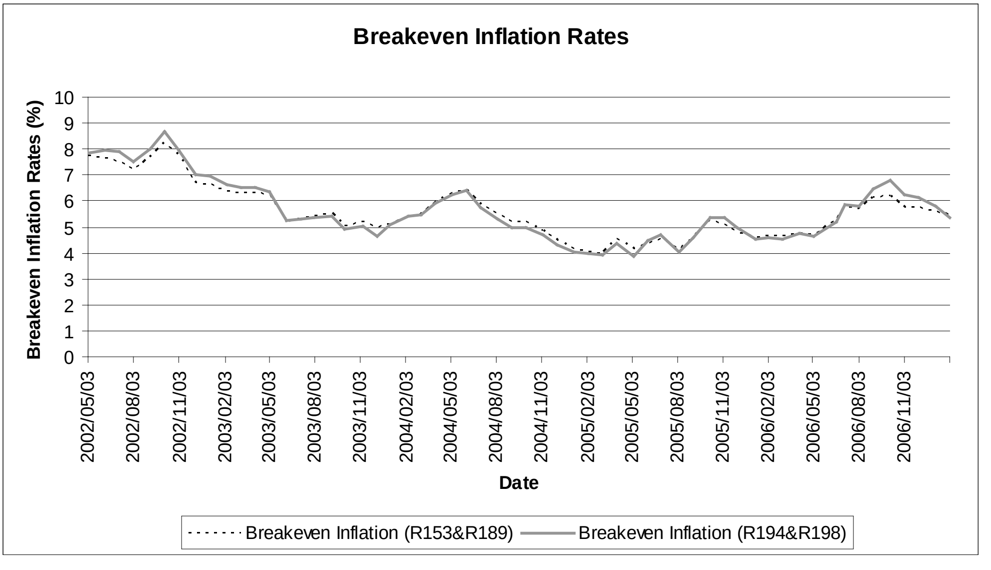
Note: The above figures show the autocorrelation and partial autocorrelation of CPIX and inflation compensation ending in 5 and 10 years time. The solid black line denotes the 5% level of signifincace. Lags that do not at least extend to meet this line are not significnat at the 5% level.

7. RISK PREMIA AND INDEXATION LAG

The nominal interest rate captures a range of risk premia, with the liquidity risk and inflation risk premia having the greatest influence in this case (Sack (2002), Söderlind (1995), Aron and Muellbauer (2006)). An advantage of using government bonds is that the credit risk is very low (Svensson and Söderlind, 1997). The South African government bond market is sophisticated and has recently been rated the sixth most liquid in the world by the Bank for International Settlements (Bonorchis, 2007).

Aron and Muellbauer (2006) warn that even if liquidity is constant, as the period to maturity of the bond decreases, the inflation risk decreases, which will especially distort our evaluation of inflation expectations over the long-term. Casual inspection of the trends in the spreads between the nominal and real bonds does reveal a slight downward trend, but again this is a variable that changes at a low frequency.

FigureVII:



Source: Bond yield data provided by BESA

As discussed above, the magnitude of the risk premia and their impact on measures of inflation expectations is highly contentious. In this study the assumption has been made that the risk premia are not large or that they do not change substantially at a daily frequency. Further research which attempts to measure these risk premia would add valuable insight and improve the precision of this inflation compensation series.

In addition, the last 3 months of the inflation indexed bonds in South Africa is in fact not indexed for inflation (National Treasury, 2000) due to the fact that the CPIX data is released with a lag and is unavailable when the bond matures. This is called the indexation lag and has not been adjusted for in this study. Shen (1995) acknowledges that the indexation lag reduces the accuracy of the inflation indexed bonds, but argues that its impact is relatively small, particularly at horizons longer than two years. He argues that the indexation lag could be as short as 3 months if coupon payments are made semi-annually (as is the case in South Africa), so that the fraction of the bond that is not indexed for inflation gets progressively as the horizon of the bond increases. However, this is clearly an area that also warrants further research.

8. CONCLUSION

The expectations channel of the transmission mechanism is central to the implementation of modern monetary policy. A brief review of the current methods used in South Africa to monitor inflation expectations was followed by the presentation of inflation compensation as a new measure which could offer further insight. The lack of forward rate instruments with long maturities traded in the markets meant that implied forward rates had to be calculated. The various methods of extracting implied forward rates from traded bond data were discussed, and the practical calculation of these rates for the South African market was presented.

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