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Long-term yield bonds and future inflation in South Africa: a vector error-correction analysis

by G R Wesso

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Long-term bond yields and future inflation in South Africa: a vector error-correction analysis

by G R Wesso[1]

It is widely believed that bond yields contain useful information about expected inflation. This article takes the Fisher hypothesis as a long run relationship. Evidence is provided on the predictive content of the bond yield for future inflation, using cointegration and error-correction modelling techniques. South African quarterly data from 1985 to 1999 are used, and the results indicate that long-term bond yield movements are largely driven by expected inflation. An increase in expected inflation therefore leads to a steepening in the yield curve, but the results show that a steeper yield curve does not necessarily signal a rise in actual future inflation. The findings support the idea that steep long-term yield movements can therefore be interpreted as partly indicative of shifts in the credibility of the central bank's commitment to low inflation.

Key words: *Monetary policy, future inflation, bond yield, cointegration, vector error-correction.*

Introduction

In recent years, central banks in many countries have increasingly focused on the goal of price stability. In pursuing this goal, central banks need information about the degree of inflationary pressures in the economy, and a natural place to look for this information is the term structure of interest rates, or the yield curve.

The term structure of interest rates has long been of interest to monetary policy makers and their advisers. The market determines different yields on investments of different maturities; of considerable importance is the gap between interest rates on short-dated investments and those with longer maturities. If these interest rates are plotted against unexpired maturity, the result is the yield curve, and of importance is its slope (which is the difference between nominal interest rates on longer-dated bonds and shorter-dated securities).

The transmission of monetary policy is conventionally viewed as running from short-term interest rates managed by central banks to the longer-term rates that influence aggregate demand. A central bank's influence over longer-term interest rates comes from the fact that the market determines these as the average expected level of short-term rates over the relevant horizon (abstracting from a term and default risk premium). Working in the other direction, the long-term bond yield contains a premium for expected inflation, and thus serves as an indicator of the credibility of a central bank's commitment to low inflation. That alone merits the attention of central bankers to significant bond yield movements.

A related but separate issue is the extent to which bond yields actually have proven to be a good forecaster of future inflation trends. Accurate projections of inflation are a key element in the conduct of monetary policy, and it is useful to extract the information content of the yield curve. In 1998, when the slope of the South African yield curve was inverted, some analysts argued that the curve was signalling a sharp slowdown in economic activity. Towards the end of 1999, when the yield curve was positive and steep, some economists were predicting a significant acceleration in economic activity. It is sometimes difficult to read unambiguous signals from these changes in the shape of the yield curve. In this regard, the Governor of the South African Reserve Bank, Mr T T Mboweni (1999), pointed out that one should keep in

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mind that expected inflation is only one factor determining nominal interest rates. An increase in expected inflation should lead to a steepening of the yield curve, but a steeper yield curve does not necessarily signal a rise in expected inflation.

This paper relies essentially on the expectations theory in which long-term interest rates are affected by long-term inflationary expectations (which in turn are affected by the commitment of the central bank to price stability). Based on this approach, the four variables used in the analysis are the nominal yield on 10-year South African government bonds, inflation (excluding changes in food and energy prices), the nominal securities repurchase rate of the Reserve Bank, and the output gap, indicating the extent of capacity utilisation in the economy. Theoretically, other determinants might also explain the term structure. An important one is short run movements in the real interest rate that affect the bond yield, without a change in expected inflation.

In this study, the Fisher (1930) relation between the inflation rate and the nominal bond yield is empirically investigated, using cointegration and error-correction modelling techniques. The objective is to extract from the yield curve information about future inflation. The methodology is based on the Johansen procedure to determine the existence of a cointegration relationship. Using South African data from the first quarter of 1985 to the second quarter of 1999, this article attempts to extend the existing literature by presenting a more rigorous econometric analysis of the information about future inflation contained in the term structure of interest rates. The cointegration relationship is estimated and tested over all four variables implied by the approach developed by Mehra (1998) instead of employing the usual bivariate approach used in other studies.

Prior research

It is widely believed that bond yields contain useful information about expected inflation. Many have empirically investigated this issue by examining whether the slope of the term structure has any predictive content in forecasting future inflation. That research, however, has produced diverse results. In a series of papers, Mishkin (1990, 1991) and Jorian and Mishkin (1991) report evidence indicating the slope has predictive content at long horizons, but not at short horizons. By contrast, Engsted (1995) investigated whether the difference between the long-term rate and the lagged inflation rate would predict future inflation. He found that although this difference helped predict future inflation for a number of countries, it did not do so for the United States.

The empirical evidence on the topic of cointegration in this regard is mixed. Mishkin (1992) used the two-step approach proposed by Engle and Granger (1987) and found only tentative support for cointegration. Also, the multi-country results presented by Engsted (1995) did not provide a consistent picture of the long run relationship between the two variables. However, Crowder and Hoffman (1996) as well as Wallace and Warner (1993) who used the multivariate approach of Johansen (1988) concluded that a long run relationship between inflation and interest rates cannot be rejected. The same conclusion was reached by Evans and Lewis (1995) who used a modified least-squares estimator and observed cointegration in their data. Mehra (1998) concluded that in the long run, permanent movements in actual inflation have been associated with permanent movements in the bond yield. He also examined whether the predictive content of the bond yield had changed over time, and found conflicting results for the various subperiods. Consequently, the question whether these variables are cointegrated is still moot.

Movements in bond yields since 1985

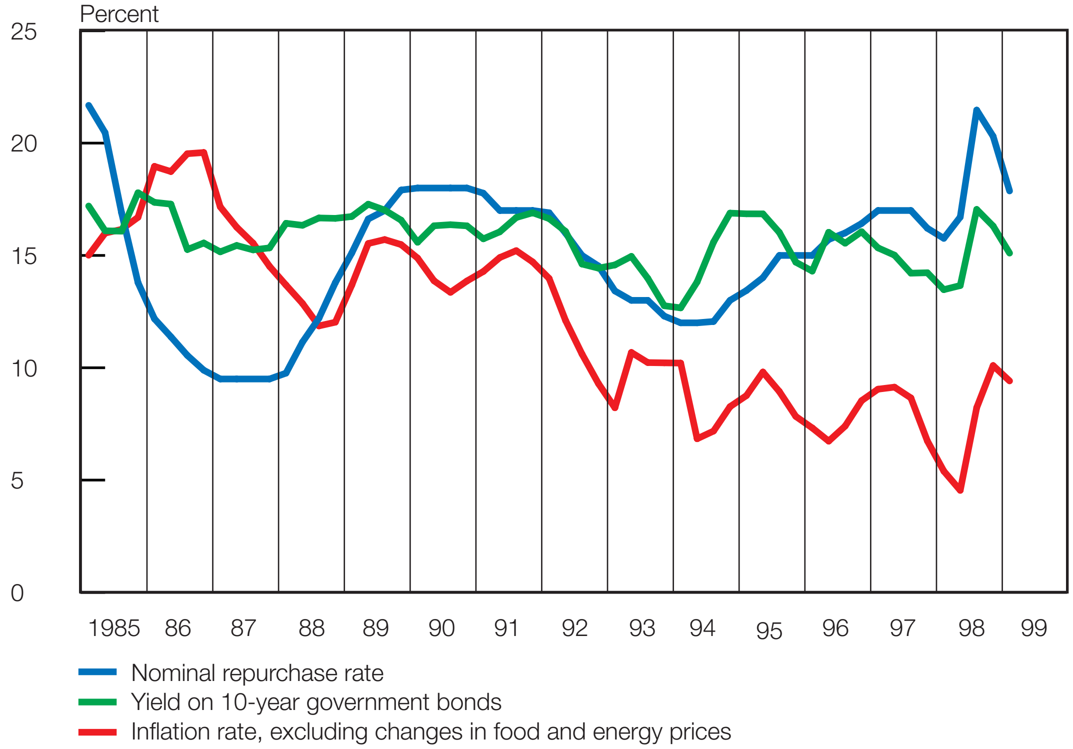
In South Africa, bond prices and *ex post* real returns became increasingly variable during the period of high and fluctuating inflation and inflation expectations after 1985. The variability of returns was due in part to the increased range of short-term rates that the central bank influenced in its attempt to bring rising inflation under control. When inflation moved above 18 per cent per year in 1986, long-term bond yields were almost double and bond prices were about half of what they had been in the mid-1970s.

Since 1993, the shape of the South African yield curve has been subject to fairly significant changes. After the 1993 yield curve normalisation, the yield on long-term government bonds, which had already fallen from 17 per cent to 14 per cent, fell another 200 basis points to around 12 per cent in January 1994. From mid-April to August 1998, when South Africa was affected by the global crisis in emerging markets, the slope of the yield curve was negative; it changed from a slight to a fairly steep inversion. Tight monetary conditions caused yields on short-dated bonds to rise more than yields on long-dated bonds. The overall level of the curve rose, reflecting heightened uncertainties about the future direction of financial policies, nervousness about investment in emerging markets and an upward adjustment of expectations about future inflation. The financial markets gradually settled down in the last three months of 1998 and yields declined when monetary conditions eased as the exchange rate of the rand stabilised. From March 1999, short-term yields declined to levels below those of long-term yields and the yield curve assumed a positive slope which subsequently steepened.

The graph illustrates these movements in the yield on 10-year government bonds (*BR*), the inflation rate, excluding changes in food and energy prices (*PX*), and the nominal repurchase rate (*REPO*[2]) of the Reserve Bank.

2 The repo rate has been used as a proxy for the Bank rate since March 1998

The bond yield, repo rate and inflation rate



This graph indicates that inflation declined to about 7 per cent by 1996, and since then has declined to a lower level in 1999. Long-term bond yields continued to be sensitive to new information that indicated potentially higher future inflation and likely central bank action on short-term rates to head it off.

Time lags between changes in inflation and bond yields

One of the most important lessons learned by central bankers in recent decades is that credibility for low inflation is the foundation of effective monetary policy. The Reserve Bank has gained credibility since the early 1990s by consistently taking policy actions to hold inflation in check. Experience shows that the guiding principle for monetary policy is to pre-empt rising inflation. The go-stop policy experience of the 1970s and 1980s taught that waiting until the public acknowledged that inflation was a problem, would mean waiting for too long. At that point the higher inflation would become entrenched and would have to be counteracted by corrective policy actions more likely to depress economic activity (see Goodfriend, 1998).

It is generally recognised that a pre-emptive monetary policy strategy should be directed at combating inflation rather than influencing short run changes in unemployment. That puts a premium on a forward-looking indicator, especially one that embodies a direct measure of inflation expectations, such as long-term bond yields. Goodfriend (1998) points out that the bond yield has not been a particularly good forecaster of changes in trend inflation, and so it certainly needs to be used in conjunction with other economic indicators. Yet there is evidence that the long-term nominal bond yield moves primarily as a result of inflation expectations. Steep bond yield movements ought to be taken as evidence of worsening or improving the credibility of fighting inflation, as the case may be, and taken into account in making decisions on short-term policy.

It is difficult for policy makers to know when, and how much, to change short-term interest rates in order to curb inflation or to resist a recession. In practice a central bank moves short-term rates in steps so that it can observe the consequences of its actions and assess sequentially the need for each incremental rate change. Policy makers know that it takes some months for the economy to feel the effects of a given change in rates. As tightening proceeds, for example, central bankers become more cautious about taking further actions for fear of overdoing it and creating a recession. Of course, the converse risk is that excessive caution might allow inflation to rise.

If a central bank has credibility as an inflation fighter, then markets may guess correctly that an initial increase in the short-term rate is likely to be followed by further increases. The expected future path of short-term rates will immediately be built into the term structure of interest rates (see Dahlquist and Lars, 1996).

Empirical investigation

Data sources

The empirical work examines, among other things, the dynamic interaction between the bond yield and the inflation rate. It uses quarterly data that span the period 1985 to 1999. The economic variables that enter the analysis are the yield on long-term government bonds, the actual inflation rate, the repurchase rate, and the output gap that measures the utilisation of productive resources. The bond yield is the nominal yield on 10-year South African government bonds (*BR*). Inflation is measured by changes in the consumer price index, excluding changes in food and energy prices (*PX*). The indicator of the monetary policy stance is the nominal repurchase rate (*REPO*), and the output gap (*GAP*) is the natural log of real GDP minus the natural log of potential GDP.[3]

3 The potential GDP was estimated using Cobb-Douglas production function and Hodrick-Prescott (1997) filter technique on the technology variable

Cointegration analysis and vector error-correction modelling

A group of non-stationary time series is cointegrated if some of them have a linear combination that is stationary; that is, the combination does not have a stochastic trend. The linear combination is called the cointegrating equation. Its normal interpretation is as a long run equilibrium relationship. One can test hypotheses about cointegration within a framework established by Johansen (1991).

The vector error-correction (VEC) model is a restricted vector autoregression (VAR) designed for use with nonstationary series that are known to be cointegrated. The VEC specification restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short run dynamics. Estimation of a VEC model proceeds by first determining one or more cointegrating equations using the Johansen (1991) procedure. The first difference of each endogenous variable is then regressed on a one-period lag of the cointegrating equation(s) and the lagged first differences of all of the endogenous variables in the system.

The specification of exogenous intercepts and trends should be made by choosing from a set of assumptions provided in the Johansen (1991) procedure. In this study it is assumed that the data have a linear deterministic trend and an intercept (but no trend) in the cointegrating equation. This choice is based on the proposition that long run equilibrium conditions (such as the relationship between the bond yield and the inflation rate) probably do not have trends. In choosing a final VEC model of the data, one should be guided by both economic theory and statistical criteria. The normalised cointegrating equations should confirm one's beliefs about long run relationships among the variables.

In the Fisher relation for interest rates, the bond yield is related to expectations of future inflation and the real interest rate. If one assumes that those expectations can be proxied by distributed lags on current and past values of actual inflation and other fundamental economic determinants, then the Fisher relation implies the following regression for the bond yield (*BR*) at time *t*:

$$BR_t = a + \sum_{s=0}^{k} b_s \, PX_{t-s} + \sum_{s=0}^{k} c_s \, X_{t-s} + u_t \qquad (1)$$

where PX_t is the actual inflation rate as defined above, X_t is the vector containing other economic determinants of the real rate (such as *GAP* and *REPO*), and u_t is the disturbance term. The presence of the disturbance term reflects the assumption that distributed lags on actual values of economic determinants may be good proxies for their anticipated values in the long run but not necessarily in the short run.

If levels of the empirical measures of these economic determinants, including the bond yield, are unit root nonstationary, then the bond yield may be cointegrated with these variables as in Engle and Granger (1987).

Under those assumptions, Equation 1 can be formulated as:

$$BR_t = d_0 + d_1 PX_t + d_2 X_t + e_t \tag{2}$$

Equation 2 is the cointegration regression. The coefficients that appear on PX_t and X_t measure the long run responses of the bond yield to inflation and other real rate determinants, respectively. The question whether the bond yield incorporates expectations of future inflation is investigated by testing whether the bond yield is cointegrated with the actual inflation rate. The analysis therefore views the positive relationship between the bond yield and actual inflation as a long run phenomenon.

If the bond yield rises above its long run equilibrium value, then either the bond yield should fall or the economic determinants, including inflation, should adjust in the direction needed to correct the disequilibrium, or both. These short run dynamic adjustments are examined by building a vector error-correction model that consists of short run inflation and bond yield equations. The behaviour of the error-correction variable, defined below, provides information about the ways that the bond yield and inflation adjust in the short run. Therefore, if the error-correction term is positive and statistically significant in the short run inflation equation, then that evidence can be interpreted to mean that the bond yield signals future inflation. The cointegrating relations are defined as:

$$BR_t = a_0 + a_1 PX_t + u_{1t} \tag{3}$$

$$REPO_t = b_0 + b_1 PX_t + u_{2t} \tag{4}$$

where the u_1 and u_2 are stationary disturbance terms. Equation 4 can be interpreted as a policy reaction function. The behaviour of the error-correction term $u_{1t} = BR_t - a_0 - a_1 PX_t$ is examined in the short run equations of the form:

$$\Delta BR_t = b_0 + \sum_{s=1}^{k1} b_{1s}\, \Delta BR_{t-s} + \sum_{s=1}^{k2} b_{2s}\, \Delta PX_{t-s} + \sum_{s=1}^{k3} b_{3s}\, \Delta REPO_{t-s} + \sum_{s=1}^{k4} b_{4s}\, GAP_{t-s} + \lambda_1 u_{1\,t-1} + \delta_1 u_{2\,t-1} \tag{5}$$

and

$$\Delta PX_t = c_0 + \sum_{s=1}^{k1} c_{1s}\, \Delta BR_{t-s} + \sum_{s=1}^{k2} c_{2s}\, \Delta PX_{t-s} + \sum_{s=1}^{k3} c_{3s}\, \Delta REPO_{t-s} + \sum_{s=1}^{k4} c_{4s}\, GAP_{t-s} + \lambda_2 u_{1\,t-1} + \delta_2 u_{2\,t-1} \tag{6}$$

where all variables are defined as before. The short run equations include first differences of the bond yield, inflation, the repo rate and level of the output gap. The last two variables do not enter the long run bond yield in Equation 3. Equations 5 and 6 include an approximation of the real bond yield (u_1), and the current stance of short run monetary policy measured by an approximation of the real repo rate (u_2). These variables capture the short run impacts that monetary policy and the state of the economy have on the bond yield and the inflation rate, respectively. The parameters of interest are λ_1, λ_2, and the expected signs of these parameters for the error-correction term (u) are positive for ΔP and negative for ΔBR. Thus, if λ_2 is positive and statistically significant, then a rise in the real bond yield ($u_{1\,t} = BR_t - a_0 - a_1 PX_t$) signals higher inflation, whereas a rise in the difference between the repo rate and the inflation rate is expected to have a negative effect on the inflation rate. If the coefficients that appear on the real bond yield and the real repo rate are equal in size but opposite in sign, it suggests that increases in the real bond yield accompanied by equivalent increases in the real repo rate have had no effect on actual future inflation rates. The presence of cointegration between BR_t and PX_t implies further that either $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, or both.

Results

Cointegration and error-correction modelling involves four steps. First, determine the stationarity properties of the empirical measures of economic determinants suggested above. Second, test for the presence of cointegrating relationships in the system. Third, estimate the cointegrating regression and calculate the residuals. Fourth, construct the short run error-correction equations. All tests were conducted at a 5 per cent level of significance.

The lag structure has an impact on the short run dynamics of the model. The number of lags in the unrestricted VAR was selected by using the procedure given in Hall (1994), and a combination of criteria such as the Schwarz Bayes' information criteria, the Akaike criteria and likelihood ratio tests of model reduction (see Lutkepohl (1993). The concept of Granger (1969) causality tells us that the information content of lagged endogenous variables has to be taken into account before one can determine the predictive quality of other (explanatory) variables. Otherwise, spurious results might emerge. Granger's tests of causality were therefore used to determine whether short run changes in the bond yield have an impact on inflation. The causality can go the other way: increases in inflation could cause an increase in the bond yield. The results are reported in Table 1.

A Wald-F test has been computed, and if the null hypothesis cannot be rejected, the conclusion is that the data do not show causality. The test does, however, indicate a bi-directional causality between price and government bond yield differences. But tests of causality combined with tests on the cointegrating vectors are necessary to understand the dynamics of the model.

Table 1 Pairwise Granger causality test

Pairwise Granger causality test
Sample: 1985:1 1999:2
Lags: 2

Null hypothesis:	Observations	F-statistic	Probability
D(*PX*) does not Granger Cause *D*(*BR*)	55	3,22893	0,04799
D(*BR*) does not Granger Cause *D*(PX)		3,37999	0,04199

D = first-level differences

4 The sentivitity of results to some changes in specification was examined, but qualitatively they produce similar results

A variable X_t is considered unit root nonstationary if the hypothesis that X_t has a unit root is not rejected by the augmented Dickey-Fuller (Dickey and Fuller, 1979) test. Table 2 shows the test results for determining whether the rest of the variables have a unit root. No trend or intercept was used in the test equation, and the number of lagged differences in the test equation equals 1. As can be seen, the ADF statistic that tests the null hypothesis that a particular variable has a unit root is small for *BR*, *PX*, and *REPO*, which indicates that these variables have a unit root and are therefore nonstationary in levels, but I(1) stationary when differenced once. The output gap variable is taken in level form in the analysis.[4]

Table 2 ADF test for unit root in variables

Variable	ADF test statistic	5 per cent critical value	Order of integration, I(d)
BR	-0,425	-1,946	
D(BR)	-6,059	-1,946	I(1)
PX	-1,182	-1,946	
D(PX)	-5,086	-1,946	I(1)
REPO	-1,169	-1,946	
D(REPO)	-4,025	-1,946	I(1)
GAP	-2,484	-1,946	I(0)

D = first-level differences

The test used for cointegration is the one proposed in Johansen (1991). Table 3 presents test statistics for determining the number of cointegrating equations (CE) in the system (*BR, PX, REPO, GAP*). Trace and maximum eigenvalue statistics presented in this table indicate that there are two cointegrating relations in the system. Structural changes in the economy and political factors can also have an impact on the bond yield and inflation expectations. Controlling for structural breaks is essential as the predictive content of the term structure can change over time. A dummy variable (*DUMREP*, 1998:3=1) was therefore used in the analysis to capture the effect of the Southeast Asian crisis during 1998.

Table 3 Estimates of restricted cointegrating vectors

Sample: 1985:1 1999:2
Included observations: 51
Test assumption: Linear deterministic trend in the data
Series: *BR REPO PX*
Exogenous series: *GAP(-1 TO -6) DUMREP*
Lags interval: 1 to 6

Eigenvalue	Likelihood ratio	5 per cent critical value	1 per cent critical value	Hypothesised No. of CE(s)
0,519217	61,52474	29,68	35,65	None **
0,377499	24,17546	15,41	20,04	At most 1 **
1,89E-05	0,00097	3,76	6,65	At most 2

*(**) denotes rejection of the hypothesis at a 5 per cent (1per cent) significance level

L.R. test indicates 2 cointegrating equation(s) at 5 per cent significance level

Table 4 presents estimates of the cointegrating relationship found in the system. The error-correction coefficients (*t*-values in parentheses) for the long run and short run equations 3-6 appear in this table. Since $\lambda_1 \neq 0$ it implies that BR_t and PX_t are cointegrated.

Table 4 Summary of results from error-correction equations

Estimation period: 1985:1 to 1999:2		
Cointegration equations: $u_{1t-1} = BR_{t-1}$ - 13.3- $0.20PX_{t-1}$; $u_{2t-1} = REPO_{t-1}$ - 13.6 - $0.11PX_{t-1}$		
	Error-correction regression coefficients	
Variables	ΔBR_t equation	ΔPX_t equation
Real bond yield, u_{1t-1}	-0,62* (= λ_1) (-2,06)	0,69 (= λ_2) (1,65)
Real repo rate, u_{2t-1}	-0,08 (= δ_1) (-1,11)	-0,19* (= δ_2) (-4,92)

Notes: The coefficients reported are from error-correction regressions that include the bond yield (*BR*), the inflation rate (*PX*), the nominal repo rate (*REPO*), and the output gap (*GAP*) (see Equations 3-6 in the text, and the results in Appendix 1, for more details). In addition, the model has two error-correction variables (u_{1t-1} and u_{2t-1}). Parentheses contain *t*-statistics for the error-correction variable (u_{t-1}).* denotes rejection of the hypothesis at a 5 per cent significance level

These tables indicate that the error-correction coefficient (λ_1) is negative and statistically significant in the bond yield equation (ΔBR), while in the inflation equation (ΔPX), λ_2 is positive, but not statistically different from zero at a 5 per cent level of significance. Because of this, a rise in the real bond yield ($u_{1t} = BR_t - a_0 - a_1 P_t$) does not signal higher actual inflation. These results therefore mean that the long-term nominal bond yield moves primarily as a result of inflation expectations, but a steeper yield curve does not necessarily signal a rise in actual future inflation. On the other hand, the coefficient that appears on the real repo rate variable of the inflation rate equation is negative and statistically significant. This is consistent with the presence of policy-induced movements in the real component of the repo rate and their subsequent negative effects on future inflation rates. It indicates further that the Reserve Bank was geared towards reducing inflation over the sample period. The dummy variable (*DUMREP*) used to capture the effect of the Southeast Asian crisis appears significantly in both the error correction equations, indicating a structural shift in the data during 1998:3 (see Appendix 1).

Concluding remarks

This article builds on the long run properties of the Fisher hypothesis. The findings show that the bond yield is cointegrated with the inflation rate over the 1985:1 to 1999:2 period, which indicates that in the long run, permanent movements in actual inflation have been associated with permanent movements in the long-term bond yield. It indicates further that long-term bond yield movements are driven by expected inflation. The results support the idea that steep long-term yield movements can be partly interpreted as indicative of shifts in the credibility of the central bank's commitment to low inflation. However, the real bond yield does not help predict one-quarter-ahead changes in the rate of inflation. Since inflation is a nonstationary process, the results also imply that the real bond yield has no predictive content for long-horizon forecasts of future inflation.

Since the early 1990s the Reserve Bank has adhered to a disinflationary policy in order to reduce trend inflation and contain inflationary expectations. This behaviour may provide an explanation for the deterioration in the predictive content of the bond yield for actual future inflation. To the extent that rising long run inflationary expectations evidenced by the rise in the bond yield were triggered by news of anticipated demand growth, the Reserve Bank may have calmed those expectations by raising the interest rate at which overnight central bank funds were provided to banks. The induced tightening of monetary policy may have reduced inflationary expectations by reducing actual or anticipated demand growth, thereby preventing any increase in actual inflation. Given such behaviour, observed increases in the bond yield do not necessarily indicate that actual inflation is going to accelerate in the near term.

However, a few limitations in the study are worth mentioning. Firstly, it uses lagged inflation rates as a proxy for inflation expectations. One of the greatest difficulties facing all central banks is getting a reliable measure of inflation expectations.

Secondly, the regression coefficients might also be sensitive to the relative variability of expected future inflation changes and real term structures[5]. Any change in the monetary policy framework in South Africa is likely to change the correlation and relative variability of expected future inflation changes and term structure slopes, thus causing the regression coefficients to change in the inflation-forecasting equation. Therefore, the forecasting ability of the term structure for the path of future inflation could change dramatically, making the term structure a poor guide for monetary policy. It seems reasonable to assume that changes in a policy regime will cause changes in the parameters of the behavioural relationship (see the Lucas (1976) critique).

5 See Wesso (1995) for an extensive discussion on varying coefficients in econometric models

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Appendix 1

Error-correction regression results

Sample (adjusted): 1986:4 1999:2
Included observations: 51 after adjusting endpoints
Standard errors and *t*-statistics in parentheses

Error Correction:	*D(BR)*	*D(PX)*
CointEq1	-0,619025	0,690115
	(0,30083)	(0,41861)
	(-2,05771)	(1,64859)
CointEq2	-0,082540	-0,195461
	(0,07441)	(0,03971)
	(-1,10925)	(-4,92170)
D(BR(-1))	0,480711	-0,318596
	(0,24933)	(0,34694)
	(1,92804)	(-0,91831)
D(BR(-2)	0,489648	-0,309298
	(0,24315)	(0,33834)
	(2,01379)	(-0,91416)
D(BR(-3))	0,114607	-0,447540
	(0,24714)	(0,34389)
	(0,46374)	(-1,30140)
D(BR(-4))	0,270383	-0,223517
	(0,20804)	(0,28949)
	(1,29967)	(-0,77211)
D(BR(-5))	0,284586	-0,378930
	(0,21234)	(0,29547)
	(1,34023)	(-1,28245)
D(BR(-6))	0,360058	-0,015411
	(0,18549)	(0,25811)
	(1,94109)	(-0,05971)
D(REPO(-1))	-0,346273	-0,234864
	(0,22014)	(0,30632)
	(-1,57298)	(-0,76672)
D(REPO(-2))	-0,365745	0,054323
	(0,21042)	(0,29279)
	(-1,73820)	(0,18553)
D(REPO(-3))	0,160208	-0,449935
	(0,22747)	(0,31653)
	(0,70429)	(-1,42146)
D(REPO(-4))	0,036519	0,220931
	(0,36963)	(0,51434)
	(0,09880)	(0,42954)
D(REPO(-5))	-0,299343	-0,296399
	(0,31781)	(0,44224)
	(-0,94188)	(-0,67022)
D(REPO(-6))	0,636253	0,081795
	(0,25978)	(0,36149)
	(2,44917)	(0,22627)
D(PX(-1))	0,133765	0,403034
	(0,16586)	(0,23079)
	(0,80650)	(1,74630)
D(PX(-2))	-0,099411	-0,345016
	(0,18127)	(0,25224)
	(-0,54842)	(-1,36783)
D(PX(-3))	-0,087500	0,259614
	(0,14355)	(0,19975)
	(-0,60956)	(1,29973)
D(PX(-4))	-0,420038	-0,706399
	(0,13934)	(0,19389)
	(-3,01451)	(-3,64329)
D(PX(-5))	0,292723	0,174442
	(0,16390)	(0,22807)
	(1,78600)	(0,76488)
D(PX(-6))	0,121738	-0,301469
	(0,17306)	(0,24081)
	(0,70346)	(-1,25190)
C	0,071601	-0,431086
	(0,13585)	(0,18903)
	(0,52707)	(-2,28050)
GAP(-1)	6,592724	37,58158
	(18,9266)	(26,3364)
	(0,34833)	(1,42698)
GAP(-2)	-13,75139	-47,36100
	(32,7032)	(45,5066)
	(-0,42049)	(-1,04075)
GAP(-3)	69,02598	55,08871
	(32,1011)	(44,6688)
	(2,15027)	(1,23327)
GAP(-4)	-21,74523	-3,234590
	(29,3496)	(40,8401)
	(-0,74090)	(-0,07920)
GAP(-5)	-5,951068	15,04569
	(25,3274)	(35,2432)
	(-0,23497)	(0,42691)
GAP(-6)	-24,33822	-14,23497
	(19,1998)	(26,7166)
	(-1,26763)	(-0,53281)
DUMREP	3,712006	4,294384
	(0,90472)	(1,25893)
	(4,10292)	(3,41115)
R-squared	0,773084	0,782017
Adj. R-squared	0,506704	0,526124
Sum sq. resids	8,698912	16,84360
S.E. equation	0,614991	0,855763
F-statistic	2,902190	3,056028
Log likelihood	-27,26586	-44,11556
Akaike AIC	2,167289	2,828061
Schwarz SC	3,227899	3,888671
Mean dependent	-0,007457	-0,227883
S.D. dependent	0,875619	1,243143

Determinant Residual Covariance	0,002256
Log Likelihood	-61,69897
Akaike Information Criteria	5,948979
Schwarz Criteria	9,358083

D = first-level differences