Hierdie artikel handel oor die omvang en grootte van die verdringingseffek in Suid-Afrika binne die konteks van die huidige wêreldwye finansiële krisis, en hoe ’n aantal lande staatsbesteding verhoog het om die effek daarvan te versag, hoewel dit uiteindelik op ’n groot begrotingstekort uitgeloop het. Die omvang van die verdringing van private belegging in Suid-Afrika word geëvalueer binne die konteks van die leenfondsteorie van die rentekoers. Die koïntegrasievektor-autoregressive outoregressietegniek word gebruik om beperkings te identifiseer, gevolg deur die volledige Fisher-effek. Daar word verskillende aannames vir prysverwagtings in die artikel gedoen, waarvan die hoofbevinding – dat ’n begrotingstekort langs longtermynrentekoerse laat styg – die bestaan van die verdringingseffek in Suid-Afrika staaf. Nog ’n belangrike bevinding is dat die model wat gebruik is, insiggewend is oor die aard van die begrip “rentekoersstruktuur” in Suid-Afrika.

Senaganwa

Sengwalwa se se nyakišiša bokgole le kgato ya ditlamorado tše di šitišiša katleho ya sepetho sa Afrika Borwa ka seemo sa ditaba sa khuduego ya moragorago ya lefasekakarešo ya ditšehelete moo dinaga tše ntši di t_habelago go koketšego ya ditshenyegelo tša mmušo, se o se dirago gore go be le tlhaoelo ye kgolo ya peankanjo ya ditšehelete, go fokotša ditlamorado tša khuduego ya ditšehelete. Bokgole bja tšhitišo ya peletšo ya praebete ka Afrika Borwa bo lekolwa ka seemo sa teori ya ditšehelete tšeo di adimišegago ya seelo sa tsvala. Tshenini ya bogolo bjo bo tsenelanago e dirišwa moo dithibile tša go hlatsha di latelago ditlamorado tša go tlala tša Fisher. Dikakanjo tša go fapanä tša ditetelo tša theko di dirwa ka go pampiri ye. Se o se fihleletšwe go kare ga pampiri sa gore hlaelo ya tekanyetšo ya ditšehelete e oketša tsvala ya lebaka le le telele se thekga go bagona ga ditlamorado tša tšhitišo ka Afrika Borwa. Se sengwe gape se boholkoa se se fihleletšwego ka go pampiri ye ke gore motlolo wo o dirišišišwego ke wa go sedimoša sebopego sa paka ya seelo sa tsvala ka Afrika Borwa.

Isiqephu

Budget deficit, long-term interest rates and crowding-out effect in South Africa

ABSTRACT
This paper investigates the extent and the degree of the crowding-out effect in South Africa in the context of the current global financial crisis, to mitigate which a number of countries have resorted to increasing government expenditure, resulting in high budget deficit. The extent of the crowding out of private investment in South Africa is assessed in the context of the loanable-funds theory of interest rate. The cointegrating vector autoregressive technique is used to identify restrictions, followed by the full Fisher effect. Different assumptions for price expectations are made in the paper, the main finding of which—that budget deficit increases long-term interest rates—supports the existence of the crowding-out effect in South Africa. Another important finding is that the model used is informative of the nature of the term 'structure of interest rate' in South Africa.
Introduction

One of the most important issues in public finance is whether an increase in budget deficit has an adverse effect on private investment. This phenomenon is dubbed the ‘crowding-out effect’. The extent of the phenomenon necessitates investigation into the current global financial crisis, which has led a number of governments to increase expenditure considerably, with a resultant high budget deficit. For example, in South Africa the projection of the budget deficit has increased to 3.8 per cent of GDP in the 2009-10 fiscal year, from a budget surplus of 1.1 per cent of GDP in the previous fiscal year. The evidence and the extent of the crowding-out effect can result in the failure of any fiscal stimulus put in place by a government. The intended increase in government investment may reduce private investment by the same magnitude, and has a neutral effect on output growth.

The crowding-out effect is essentially measured by the relationship between budget deficit and interest rate. Chopin et al. (1997) show that if a positive relationship exists between the government budget deficits and interest rates, then higher deficits would crowd out private spending and slow down economic growth. In contrast, if deficit financing has no effect on interest rates, then deficit spending may instead promote economic growth.

However, the important concern remains as to which of the interest rates between the short- and long-term ones is relevant in explaining the crowding-out effect. To address such concern, Taylor (1995) shows that there is a _priori_ evidence that for long-term decisions, such as investing in plant and equipment, the long-term interest rate should be a variable of greater interest. Furthermore, empirical evidence suggests that, in South Africa, private investment is more sensitive to long-term than to short-term interest rates (Le Roux & Ismail, 2004). Moreover, on the relationship between interest rate and fiscal policy, Kiani (2009) shows that the long-term interest rates are dominated, amongst other phenomena, by budgetary conditions. This leads to an inference that the crowding-out effect accords with the relationship between the government budget deficit and long-term interest rate.

The change in the long-term interest rate as a result of government budgetary conditions should also have an implication for the short-term structure of the interest rate, and shows the ability of the fiscus to twist the yield curve. While monetary authority can control short-term interest, it cannot control the yield curve or all interest rates for different maturities. If this paper finds that government budgetary conditions influence the long-term rate in South Africa, this should indicate the ability of a fiscal-monetary policy mix to control the yield curve. The control of the yield curve is important in the current context of a global economic downturn. Twisting the yield curve downward should provide incentive for more investment expenditure and probable economic growth and recovery.

This paper assesses the relationship between the long-term interest rate and budget deficit in the context of the loanable-funds theory of interest rates, which states that the interest rate is determined in terms of the demand and supply of funds available for lending (Cebula, 1988). Because governments borrow, mostly in the capital market and to finance a budget deficit, their borrowing leads to an increase in the demand for loanable funds and the reduction of available loanable funds to finance private investment. Thus, the increase in the demand for loans, as a result of government borrowing, leads to an increase in the price of loan (interest rate) and a likely decrease in private investment.

This paper is structured as follows: section 2 reviews the literature on the relationship between interest rate and budget deficit in the context of crowding-out effect; section 3 presents the methodology for assessing the relationship between interest rate and budget deficit; section 4 discusses the results of the empirical analysis; and section 5 concludes the paper.

**Literature review**

The relationship between the budget deficit and interest rate, and thus its implications for the crowding-out effect, can be described under different theoretical models. The standard Hicksian IS-LM model shows that the increase in government
spending that results in budget deficit shifts the IS curve to the right, resulting in an increase in interest rate. In this framework it is often assumed that for the crowding-out effect to occur, the LM curve should be perfectly inelastic (constant money supply). With a vertical LM curve, the expansionary fiscal action will result in an increase in interest rate but will fail to stimulate economic activity, as the total income will remain constant. The resulting zero government spending multiplier means that increased government demand crowds out the same amount of private demand. However, Friedman (1972) shows that the slope of the LM curve is irrelevant to the crowding-out effect. For the author, an expansionary fiscal policy might first be reflected in an increase in output, but the financing of the deficit (tax- or debt-financed expenditure) would set in motion contracting forces that could offset the initial increase in output.

David and Scadding (1974) use the IS-LM framework to show that an extra dollar of government deficit displaces a dollar of private investment expenditure. For the authors, a tax-financed expenditure has a displacement effect on private consumption that offsets the increase in government spending. Given this reality, fiscal actions have no effect on the IS curve and aggregate demand. With the Keynesian assumption of liquidity trap, represented by an elastic LM curve, it is assumed that expansionary fiscal policy should result in the right increase of the IS curve and an increase in total output. This shows that in terms of Keynesian economics, a crowding-out effect may not occur.

Another important theoretical model from which the relationship between the budget deficit and interest rate, and thus the crowding-out effect, can be described is the Ricardian Equivalence Proposition (REP). Barro (1974), in support of the Ricardian Equivalence Proposition (REP), shows that if households are fully rational and take the welfare of their descendants into account in formulating their consumption and savings patterns, decrease in taxes (that results in budget deficit) today would be balanced by an offsetting of increases in private saving tomorrow. In particular, households would recognise that the reduction in taxes today would increase future tax liabilities and therefore negate the tax cut. Thus, the implication of the REP is that an increase in the budget deficit is neutral on national saving and interest rate. Likewise, an increase in government expenditure, according to the REP, will decrease private consumption and increase private saving (Feldstein & Elmendorf, 1990). The consequence of the REP is that an increase in government expenditure is offset by a decrease in private consumption and results in a neutral effect in the total demand and output.

In the context of the REP, the neutral response of national saving, as a consequence of expansionary fiscal policy, will result in an unchanged real interest rate. For example, Evan (1987) has found no evidence that interest rates are related to current, past or expected future budget deficit over the period between June 1908 and March 1984 in the United States (US), as the REP posits.

The relationship between interest rate and budget deficit can also be described under the loanable-funds theory, according to which interest rate is determined in terms of the demand and supply of funds available for lending (Cebula, 1988). Because the decision to invest (demand for funds) and the decision to save (supply of funds) are long-term decisions, the loanable-funds theory provides a framework by which to determine the level of long-term interest rate, given the interaction between the demand and supply. Moreover, the loanable-funds framework is so fundamental that the implication of other theories, such as the REP, can be inferred from this framework. For example, Kiani (2009) shows that if agents are Ricardian, the increase in the demand for funds as a consequence of government budget deficit is offset by the increase in private saving (supply of funds), leaving the long-term interest rate unchanged.

Different functional forms are used to represent the relationship between the budget deficit and long-term interest rate within the context of the loanable-funds theory. Sargent (1969) provides a model for interest rate determination where the nominal bond rate (the long-term interest rate) is a function of anticipated inflation, budget deficit, changes in real money supply and income. In the functional form proposed by Sargent, changes
in the real money supply capture the impact of monetary policy actions. Mehra (1994) modified Sargent’s model by replacing money supply with the federal funds rate to represent the instrument of monetary policy. Using co-integration regression, Mehra (1994) finds that the bond rate is positively correlated with inflation and the budget deficit in the long run. However, the authors show that if the co-integration regression is re-estimated under the restriction that the bond rate adjusts one-for-one with inflation, the long-run relationship between the bond rate and budget deficits weakens. For Mehra, those results indicate that the positive effect of the budget deficit on the bond rate found in the study is suspect.

Cebula (1999) applied an open-economy loanable-funds model to assess whether a long-term relationship existed between budget deficits and long-term interest rates in the United Kingdom (UK) in the period from 1972 to 1991, and found that there was. In Cebula’s model, the nominal long-term interest rate is a function of the expected future inflation, ex ante real short-term interest rate, the percent change in real gross domestic product (GDP), the real net capital flow and the real net borrowing by the central government. Kiani (2009) investigated whether the emergence of high inflation rates after 1965 in the US and large budget deficits after the 1980s caused the financial market agents to become more sensitive to the outlook for inflation and budget deficits. The study evaluated the impact of budget deficits on long-term interest rates within the context of the loanable-funds theory. The author suggested a model for long-term interest rate determination where it is a function of an ex-ante real short-term interest rate, expected inflation, a variable representing economic activity (represented by output gap) and budget deficits. Kiani (1999) showed that there was a link between budget deficits and the slope of the yield curve in the US between 1962 and 2005, a result which indicates that economic agents are becoming more sensitive to the outlook of budget deficits in the US.

To the best of our knowledge, there is no study that analyses the relationship between the long-term interest rate and the budget deficit in South Africa in the context of the loanable-funds theory. Nonetheless, Akinboade (2004) uses the London school method and Granger-causality test to determine the relationship between the budget deficits and interest rates. The author finds that budget deficits do not influence interest rates in South Africa. Uwilingiye and Gupta (2007) verify the claim made by Akinboade (2004), using Granger causality and co-integration analysis. The authors focus on the relationship between the short-term interest rate and budget deficits, and find that the causal relationship depends on the periodicity of the data.

Data analysis and methodology

The empirical tests carried out in this paper are aligned with the loanable-funds model proposed by Mehra (1994), according to which the long-term interest rate is a function of the short-term interest rate, expected inflation, real deficit and income. Contrary to Mehra’s model, that uses the real short-term interest rate to represent the effect of monetary policy in the long-term interest rate, the loanable-funds model proposed in this paper makes use of the nominal short-term interest rate. With the nominal short-term interest rate as a determinant of the long-term interest rate, the loanable-funds framework proposed here will also be interpreted as a term structure model. It is important to note that the presence or absence of the link between the short- and long-term interest rate can establish whether the expectation or market segmentation theory of the term structure holds in a given environment (Baye & Jansen, 1995). In addition, the loanable model makes use of the different assumptions with regards to inflation expectations. The paper makes use of the assumptions of backward, Martingale and forward (perfect foresight) expectation models to represent expected inflation. In as far as backward inflation expectations are concerned, it is assumed that $E_t(P_{t+1})=P_{t+1}$, where expectation at time $t$ of the price to prevail at time $t+1$ is the price at time $t+1$. With discrete-time Martingale price expectation, $E_t(P_{t+1})=P_t$. Under the assumption of forward perfect expectation, it is assumed that $E_t(P_{t+1})=P_{t+1}$. 


The method used to test for cointegration and estimate the cointegrating vector is the vector autoregressive (VAR) maximum likelihood technique outlined by Johansen and Juselius (1990). Letting the vector \( X_t = \left[ iL_t, iS_t, bud_t, E_t, r_t \right] \), where \( iL_t, iS_t, bud_t, E_t, r_t \) represent the nominal long-term interest rate, nominal short-term interest, ratio of government budget deficit by GDP, expected price and real GDP, respectively, the VAR system is represented as:

\[
X_t = \mu + \sum_{i=1}^{n-1} \Pi_i X_{t-i} + \epsilon_t
\]

Where \( \Pi \) is a \( n \times n \) matrix of parameters, \( \mu \) is a constant term and \( \epsilon_t \sim iid(0, \Omega) \). The VAR system of Expression (1) can be rewritten as a vector error correction model (VECM) in the form of Expression (2):

\[
\Delta X_t = \mu + \Pi \Delta X_{t-1} + \sum_{i=1}^{n-1} \Gamma_i \Delta X_{t-i} + \epsilon_t
\]

where \( \Gamma_i \) is the parameter of short-term coefficients and \( \Delta \) is an expression for first difference series. The rank of \( \Pi, r \), determines how many linear combinations of \( Z_t \) are stationary. With \( r \) cointegrating vectors, one can factorise \( \Pi \) as \( \Pi = \alpha \beta' \), where both \( \alpha \) and \( \beta \) are \( (N \times r) \) matrices, and \( \beta \) contains the cointegrating vectors and \( \alpha \) the adjustment parameter. The rank of \( \Pi \) is assessed on the basis of two tests on the characteristic roots of \( \Pi \). The first test, known as the Max-eigenvalue test, tests the null hypothesis of cointegrating vectors against the alternative hypothesis that there are cointegrating vectors. The second test, the trace statistic, tests the null hypothesis that the number of cointegrating vectors is less than or equal to \( r \).

This paper applies restrictions to the cointegration vector to identify the Fisher effect in the cointegration relationship. According to the Fisher effect, there should be a one-for-one relationship between the nominal interest rate and the expected price. This paper estimates the cointegrating vector under the restriction that the long-term interest rate adjusts one-for-one with expected inflation in the long run.

### Empirical analysis and results

#### Empirical Analysis

This paper makes use of yearly data from 1960 to 2007 to assess the relationship between the long-term interest rate and budget deficits within the framework of multivariate cointegration. Darrat (1989) shows that it is appropriate to analyse the budget deficits with yearly data as they are determined on an annual basis by the fiscal authority. Table 1 (below) shows the variables used for model specification. All the variables are sourced from the I-Net Bridge database.

#### Table 1: Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y_t )</td>
<td>The log of real GDP at market price</td>
</tr>
<tr>
<td>( Ep_t )</td>
<td>Expected inflation</td>
</tr>
<tr>
<td>( iS_t )</td>
<td>Prime overdraft rate</td>
</tr>
<tr>
<td>( iL_t )</td>
<td>RSA- yield on 10-year government bond</td>
</tr>
<tr>
<td>( bud_t )</td>
<td>Ratio budget deficit by GDP</td>
</tr>
</tbody>
</table>

Table 2 presents the results of the stationarity test of all the time series data. The paper employs the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) methodology for testing the null hypothesis of stationarity for the time series data. The KPSS methodology for the test of stationarity of the data series is considered to be more powerful than other tests, such as the Augmented Dickey-Fuller (ADF) methodology in small samples (Delong et al., 1989; Lee & Schmidt, 1996).

#### Table 2: the KPSS stationarity test of different series

<table>
<thead>
<tr>
<th>Variables</th>
<th>LM-stat: level</th>
<th>LM-stat: first difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y_t )</td>
<td>0.883977</td>
<td>0.372599</td>
</tr>
<tr>
<td>( Ep_t )</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>( iS_t )</td>
<td>0.582930</td>
<td>0.263638</td>
</tr>
<tr>
<td>( bud_t )</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>( iL_t )</td>
<td>0.463511</td>
<td>0.353099</td>
</tr>
</tbody>
</table>

KPSS is the Kwiatkowski-Phillips-Schmidt-Shin test for which the null hypothesis is that the series is stationary. The stationarity tests for \( y_t, iS_t \) and \( iL_t \) are conducted by including
the intercept. The 5% level asymptotical critical value of 0.463000 is used for the three series. The KPSS stationarity tests for $E_{pt}$ and $bud_t$ are inconclusive. We use other tests of stationarity that confirm that the series are I(1).

The results of the stationarity test show that all the series are I(1). This paves the way for the application of the Johansen’s cointegration test to assess the relationship between the different variables of interest.

To test the number of co-integration relations, we set up an initial VAR and included a constant and a dummy variable as deterministic terms that take the value of zero before 1995 and unit afterward. Tswamuno (2007) shows that the South African government lifted all control on non-resident investors in March 1995, allowing them full access to the Johannesburg Security Exchange (JSE) and the South African Bond Exchange (SABE). This move resulted in a massive increase in bond purchases, which in turn has had an effect on the yield on government bonds.

The lag length of the VAR process, $p = 1$, was selected using the Hannan-Quinn (HQ) information criteria. The LM-test, not reported here, indicated that there is no serial correlation in the VAR residual when the lag length of one is selected. The results of the trace and Max-eigenvalue tests of cointegration are reported in Table 3 and Table 4:

### Table 3: Trace test for co-integration

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>Trace Statistic</th>
<th>Critical Value (5%)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>r 0</td>
<td>88.31245*</td>
<td>69.81889</td>
<td>0.0008</td>
</tr>
<tr>
<td>r 1</td>
<td>44.85505</td>
<td>47.85613</td>
<td>0.0931</td>
</tr>
<tr>
<td>r 2</td>
<td>27.80017</td>
<td>29.79707</td>
<td>0.0835</td>
</tr>
<tr>
<td>r 4</td>
<td>11.79216</td>
<td>15.49471</td>
<td>0.1672</td>
</tr>
</tbody>
</table>

Trace test indicates 1 co-integration equations at 5% level

* Denotes rejection of the null hypothesis at 5% level

### Table 4: Maximum eigenvalue test for co-integration

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>Maximum eigen stat</th>
<th>Critical value (5%)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>r 0</td>
<td>43.45740*</td>
<td>33.87687</td>
<td>0.0027</td>
</tr>
<tr>
<td>r 1</td>
<td>17.05489</td>
<td>27.58434</td>
<td>0.5252</td>
</tr>
<tr>
<td>r 2</td>
<td>16.00801</td>
<td>21.13162</td>
<td>0.2244</td>
</tr>
<tr>
<td>r 3</td>
<td>11.79202</td>
<td>14.26460</td>
<td>0.1187</td>
</tr>
</tbody>
</table>

Maximum eigenvalue test indicates 1 cointegrating equations at 5% level

* Denotes rejection at 5% level

The results of the co-integration tests point to the existence of one cointegrating equation. To provide a theoretical meaning to the estimated cointegration vector, restrictions are imposed where it is assumed a one-for-one relationship between the nominal long-term interest rate and the expected price. This restriction corresponds to the Fisher effect. It is worth noting that this paper assesses the relationship between the long-term interest rate and budget deficits under three different assumptions of price expectations. The three assumptions are the forward-looking perfect foresight, where $E_t (P_{is,t}) = P_{is,t}$. The second assumption refers to the backward looking foresight, where $E_t (P_{is,t}) = P_{r,t}$. The third assumption assumes Martingale foresight where $E_t (P_{is,t}) = P_t$.

Table 5 (below) provides the results of the likelihood ratio (LR) test to assess whether the Fisher effect restrictions are binding for the cointegrating equation when the assumption of backward foresight for price expectation is considered. Also in Table 5, the results of the restricted cointegrating coefficients are reported:

### Table 5: Test and results of the restriction on the cointegrating equation

$H_0: \beta_2 = 1, \beta_5 = -1 \quad \chi^2(1) = 1.85[0.173]$

<table>
<thead>
<tr>
<th>$y_t$</th>
<th>$E_{pt}$</th>
<th>$bud_t$</th>
<th>$iS_t$</th>
<th>$iL_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.757</td>
<td>1</td>
<td>0.603</td>
<td>1.357</td>
<td>-1</td>
</tr>
<tr>
<td>(2.58488)</td>
<td>(3.423)</td>
<td>(14.49)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[] denotes the probability values. () denotes the t-statistics. $E_{pt}$ is price expectation formulated under backward-looking assumption.

The test of long-run homogeneity between $iL_t$ and $E_{pt}$ in the cointegrating relation with $x_t = (v_t, E_{pt}, bud_t, iS_t, iL_t)$ shows that the null hypothesis $H_0$ can be accepted with a $p$ value of 0.173. Moreover, these restrictions are binding when the rank of the co-integration is one. The results reported in Table 5 show that there is a positive relationship between budget deficits and long-term interest where the change in budget deficit by GDP by 1% will lead to the change in the long-term interest rate by 0.63%. Furthermore, these results indicate that there
A positive relationship exists between short-term and long-term interest rates. These results are statistically significant.

Table 6 (below) shows the results of the likelihood ratio test when the Fisher effect is tested in the cointegrating relation with \( x' = (y_t, \ E_{pt}, \ bud_t, \ iS_t, \ iL_t) \), where \( E_{pt} \) denotes price expectation under the assumption of Martingale foresight. Also in Table 6, the results of the restricted cointegrating coefficients are reported.

**Table 6: Test and results of the Fisher effect restriction on the cointegrating equation**

\[
H_0 : \beta_2 = 1, \ \beta_5 = -1 \quad \chi^2(1) = 0.894[0.344]
\]

<table>
<thead>
<tr>
<th>( y_t )</th>
<th>( E_{pt} )</th>
<th>( bud_t )</th>
<th>( iS_t )</th>
<th>( iL_t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.667</td>
<td>1</td>
<td>0.614</td>
<td>1.3802</td>
<td>-1</td>
</tr>
<tr>
<td>(2.300)</td>
<td>(2.980)</td>
<td>(13.05)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[] denotes the probability values and () denotes the t-statistics. \( E_{pt} \) is price expectation formulated under Martingale assumption.

The results in Table 6 show that the null hypothesis \( H_0 \) is accepted with a p-value of 0.344. This indicates that the Fisher effect restriction applied to the cointegrating relation with \( x' = (y_t, \ E_{pt}, \ bud_t, \ iS_t, \ iL_t) \) is binding when there is one cointegrating relation between the variables in the \( X' \) vector. The results reported in Table 6 show a positive relationship between the long-term interest rate and budget deficit. A 1% change in the budget deficit by GDP leads to 0.61% in the long-term interest rate.

Table 7 (below) shows the results of the LR test for the Fisher effect restriction applied to the co-integration relation in the vector \( x' = (y_t, \ E_{pt}, \ bud_t, \ iS_t, \ iL_t) \). The results of the estimated cointegrating vector, when the Fisher effect restriction is applied, are also provided in Table 7:

**Table 7: Test and results of the Fisher effect restriction on the cointegrating equation**

\[
H_0 : \beta_2 = 1, \ \beta_5 = -1 \quad \chi^2(1) = 7.298[0.0069]
\]

<table>
<thead>
<tr>
<th>( y_t )</th>
<th>( E_{pt} )</th>
<th>( bud_t )</th>
<th>( iS_t )</th>
<th>( iL_t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.727</td>
<td>1</td>
<td>0.439</td>
<td>1.370</td>
<td>-1</td>
</tr>
<tr>
<td>(2.043)</td>
<td>(1.819)</td>
<td>(10.41)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[] denotes the probability values and () denotes the t-statistics. \( E_{pt} \) is price expectation formulated under forward-looking perfect foresight assumption.

The results of the LR test in Table 7 show that the null hypothesis \( H_0 \) of the Fisher effect restriction is rejected. Moreover, the positive relationship between the long-term interest rate and budget deficit is not statistically significant at 1% level of significance, as in the previous cases of Martingale and backward-looking assumptions of price expectation. These results indicate that under the assumption of forward-looking perfect foresight, budget deficits do not affect the long-term interest rate. Nonetheless, as in the previous cases, the positive relationship between the short-term and long-term interest rates is observed when the forward-looking assumption is considered for price expectation.

On assessing whether budget deficits affect the long-term interest rate, an over-identifying restriction is considered where budget deficits are restricted to zero in the cointegrating vector \( x' = (y_t, \ E_{pt}, \ bud_t, \ iS_t, \ iL_t) \). The results reported in Table 8 show that the LR test does not reject the imposed restriction at 1% level of significance, and budget deficits do not impact on the long-term interest rate:

**Table 8: Test and results of the zero restriction on budget deficits**

\[
H_0 : \beta_3 = 0, \ \beta_5 = 1 \quad \chi^2(1) = 3.12[0.077]
\]

<table>
<thead>
<tr>
<th>( y_t )</th>
<th>( E_{pt} )</th>
<th>( bud_t )</th>
<th>( iS_t )</th>
<th>( iL_t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.45</td>
<td>-3.55</td>
<td>0.000</td>
<td>-1.205</td>
<td>1</td>
</tr>
<tr>
<td>(0.2309)</td>
<td>(-2.77)</td>
<td>(0.000)</td>
<td>(-10.31)</td>
<td></td>
</tr>
</tbody>
</table>

[] denotes the probability values and () denotes the t-statistics. \( E_{pt} \) is price expectation formulated under forward-looking assumption.

\[ \] The positive relationship exists between \( bud_t \) and \( iL_t \) when the latter is endogenised. This is in line with the loanable-funds theory.
The positive relationship between the short-term and long-term interest rate is again supported with the results reported in Table 8.

**Discussion of results**

The results of the empirical analysis indicate that under the backward-looking and Martingale assumptions for price expectation, the increase in budget deficits leads to an increase in the long-term interest rate. Nonetheless, under forward-looking assumptions for price expectation, the increase in budget deficit is neutral insofar as the change in the long-term interest rate is concerned. The positive relationship between the long-term interest rate and budget deficit indicates that an increase in the budget deficits translates into an increase in the long-term interest in South Africa. This finding should be expected, as in South Africa the bulk of the deficit is financed from private borrowing in the form of bonds issued (Akinboade, 2004). The higher supply of bonds by the government results in a decrease in their price and an increase in the yield. The increase in the long-term interest rate will persist so long as there is no compensation on the part of private economic agents in the form of an increase in the supply for loan or savings. Nonetheless, when private economic agents have a perfect foresight (for price expectation) and bequest motives, they can anticipate the increase in future tax, as a result of a present deficit, by increasing their savings. Thus, the high interest rate, as a result of budget deficit, will be compensated for by a decrease in the interest rate as a result of the increase in saving. This indicates the neutral effect of budget deficits on the long-term interest rates as observed under the assumption of perfect foresight for price expectation.

This finding supports the REP, which attributes the neutral effect of fiscal stimulus on real interest rate to the offsetting effect of fiscal policy action by private individuals. As in this paper, Barro (1974) showed that this offsetting effect by the private sector of the budget deficit occurs when individuals are fully rational in their expectations.

While it is evident, under Martingale and the backward inflation expectation model, that budget deficit will result in an increase in the long-term interest rate, and thus a decrease in private investment, a crowding-out effect can still be identified under the assumption of perfect foresight for price expectation. In as far as the neutral effect of the budget deficit on interest rate is concerned, it can be deduced under the loanable-funds framework that if private investors have perfect foresight of price expectation they will anticipate the inflationary effect of fiscal expansion by reducing their demand for investment. Thus, the increase in the demand for loanable funds, as a result of expansionary fiscal policy, will be compensated for by the decrease in the demand for loans, and in turn a decrease in the demand for private investment. This result proves that the loanable-funds model is an important framework in which to explain the effect of the budget deficits on interest rates.

Another important finding in this paper is the observed positive relationship between the short-term and long-term interest rate. This finding is supported under all the three assumptions for price expectation. This result should indicate that the expectation theory of the term structure of interest rates holds in South Africa. It also shows that monetary authority in South Africa is capable of influencing not only the short-term but also the long-term interest rates which would indicate that the monetary transmission mechanism is effective in South Africa.

Furthermore, the findings of this paper underlines the importance of monetary-fiscal policy mix in affecting the long-term interest rate and, thus, the yield curve. Considering the positive effect of the short-term interest rate (monetary policy tool) and budget deficit (fiscal policy tool) on the long-term interest rate, the combined action of the monetary and fiscal authority can play an important role in twisting the yield curve. For example, if short-term interest rates are higher and the yield curve is increasing, fiscal authority can choose to run a budget surplus to decrease long-term interest rates. Such a twist of the yield curve is important for future investment and economic growth expectations.

**Conclusion**

In the wake of efforts by governments to stimulate their economy with the aid of expansionary fiscal policy in order
to redress the current global downturn, this paper has assessed the long-term effect of increasing budget deficits on long-term interest rates in South Africa. In as far as the evidence suggests that, in South Africa, private investment is more sensitive to long-term than short-term interest rates (Le Roux & Ismail, 2004), this paper uses the relationship between budget deficit and long-term interest rate to infer the crowding-out effect in South Africa. The paper uses the cointegrating vector autoregressive method to the loanable-funds model specification. Different assumptions for estimating price expectation, as an important variable in the loanable-funds model, are applied in the paper. The findings are that if Martingale and backward-looking assumptions for price expectation are applied, the increase in budget deficits leads to an increase in the long-term interest rate. Nonetheless, under a forward-looking assumption for price expectation, the increase in budget deficit is neutral insofar as the change in the long-term interest rate is concerned. These results support the existence of the crowding-out effect in South Africa.

Another important finding of this paper is the observed positive relationship between the short-term and long-term interest rates. This result indicates that the expectation theory of the term structure of interest rate holds in South Africa, and that monetary authority in the country is capable of influencing not only the short-term but also the long-term interest rates. As said earlier, this finding should indicate that the monetary transmission mechanism is effective in South Africa. Lastly, the finding of this paper underlines the importance of monetary-fiscal policy mix in affecting the long-term interest rate and thus, the yield curve. For further research, a non-linear model should be considered to deal with the asymmetric effect of the budget deficits in the context of the loanable-funds model.
References


