Term Premium Estimation for South Africa

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Abstract:

This paper decomposes South African sovereign yields into expectations of future average short-term rates and a term premium. We estimate that the term premium in South African sovereign bonds is lower than after the onset of the COVID pandemic, but still meaningfully higher than its historical average. We also show that the steepening of South Africa's curve over recent years can be explained by an increase in the term premium.

Keywords: term premium; yield curve; Nelson-Siegel-Svensson.

JEL Classification: E43; E58; G12.

Introduction

The sovereign yield curve describes the cost to the government of borrowing for various lengths of time. This note shows that not only has South Africa's yield curve been very steep but it has also steepened significantly over recent years. Yet there has been relatively little research into why South Africa's yield curve has been so steep[1].

To explain why South Africa's sovereign yield curve is so steep, this paper presents estimates of the South African term premium and market-implied neutral interest rate. The term premium is the difference between the nominal sovereign bond yield and the average expected short rates over a specific horizon. The term premium is a catch-all for sovereign bond market liquidity risk, sovereign credit risk, and inflation uncertainty. As a result, term premia estimates are useful for policy analysis as they allow expectations of future monetary policy rates to be calculated, allow for assessments of liquidity and sovereign risk embedded in bond market prices, and the assessment of the transmission of risk shocks to the economy. We show that the steepening of South Africa's curve over recent years can be explained by an increase in the term premium.

1. Estimation Approach

We estimate sovereign yield curves for South Africa and apply a term structure model to decompose sovereign yields into expectations of future average short-term rates and a term premium. We estimate sovereign yield curves using the approach of Nelson-Siegel-Svensson (Nelson and Siegel 1987, Svensson 1994) over a range of maturities (3-month to 10-year maturities):

$$r(m) = \beta_1 + \beta_2\left(\frac{1-\exp\left(\frac{-m}{\tau_1}\right)}{\frac{m}{\tau_1}}\right) + \beta_3\left(\frac{1-\exp\left(\frac{-m}{\tau_1}\right)}{\frac{m}{\tau_1}} - \exp\left(\frac{-m}{\tau_1}\right)\right) + \beta_4\left(\frac{1-\exp\left(\frac{-m}{\tau_2}\right)}{\frac{m}{\tau_2}} - exp\left(\frac{-m}{\tau_2}\right)\right) \quad (1)$$

where: $r(m)$ is a range of daily zero-coupon rates at different maturities m from Bloomberg, based on four estimated factors describing the level (β_1), slope (β_2) and curvature (β_3 and β_4) of the sovereign yield curve, and the τ parameters capturing the shape of the function used to fit the curve.

[1]There are papers that consider the determinants of South Africa's high interest rates, such as (Fedderke 2020) who suggests yield spreads reflect public debt dynamics, (Soobyah and Steenkamp 2020b) who show that the yield curve embeds very high expected short rates, and (Reid 2009) who extracts inflation expectations from the bond market.

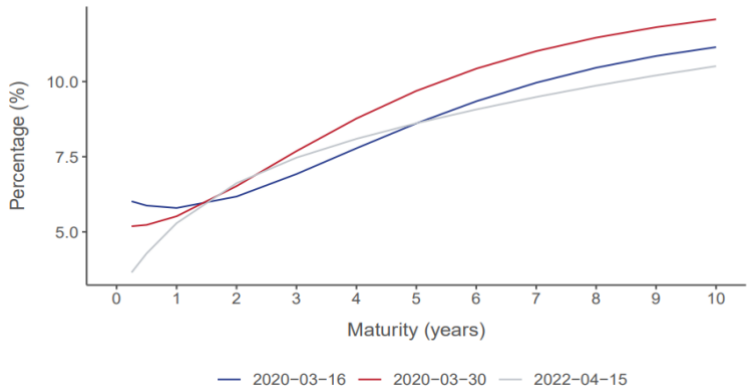
We impose restrictions on the parameters to ensure a good fit of daily and monthly yield curves and to ensure stability and interpretability of the parameter estimates.[2] Our approach balances scalability, economic interpretability, curve fit, and computational efficiency. Our model assumes that the yield curve level estimate for each day/month is positive, with specific upper bounds, and further restrictions following the recommendations of (Wahlstrom *et al*. 2022) to minimize the error between the fitted yield curves and the observed market yields using an adaptive nonlinear least-squares algorithm. To estimate the optimal parameters to best fit the yield curve, we set the initial values for optimization for each day/month as follows: β_1 based on the observed long-term rate, β_2 as the relevant observed yield curve slope, β_3 and β_4 at zero, and τ_1 and τ_2 at one.

Thereafter, we use the information for the fitted yield curves to estimate the affine term structure model of (Adrian *et al.* 2013) to decompose yields into term premium and rate expectations components. The model estimates principal components of the term structure, calculates holding-period excess returns and uses this information to estimate implied risk-neutral curves *(i.e.*, rates at which investors would not require compensation for risk, which are obtained by setting the risk premium parameters to zero) to compare to empirical yield curves. We estimate term premia at a daily and monthly frequency but present results at a monthly frequency.

2. Estimates

The onset of the COVID-19 pandemic saw a meaningful steepening of the South African yield curve (Figure 1). The short end of the curve fell as the market expected monetary policy to ease over the short term, while the long end shifted up on higher sovereign and market risk on account of the higher market volatility and expected negative impact of the pandemic and economic lockdowns on the economy and fiscal position. The surprise monetary policy cut on the 14th of April, 2020 saw the short end of the curve shift lower, but the long end also shifted down, as the cut boosted confidence and the risk premium embedded in long rates fell.

Figure 1. Fitted yield curves on selected dates



The term premium presented here is the difference between the nominal 10-year sovereign bond yield and the average expected short rates over that horizon and captures sovereign bond market liquidity risk, sovereign credit risk, and inflation uncertainty.

Figure 2 shows that average short-rate expectations embedded in the 10-year yield have fallen somewhat over the last two decades but remain high by international standards. However, in line with the international literature, we find that term premium changes are the dominant driver of long-yield dynamics. The South African term premium spiked dramatically during the Global Financial Crisis of 2008-9, as well as with the onset of the COVID-19 pandemic (Figure 3). Our estimate of the term premium embedded in 10-year South African sovereign bonds has been positive for most of the last 20 years.[3] This, in part, reflects the steepness of the South African

[2] Particularly at a daily frequency, the South African yield curve exhibits unusual variations at specific short- and medium-term maturities. Possible explanations include limited issuance of short maturity government bonds, limited trading of high-quality liquid assets owing to Basel III regulatory requirements, and a National Treasury switch auction programme that switches out bonds maturing within one to two years into longer-term bonds to manage sovereign refinancing risk. Limited available reference bonds likely limits price discovery and therefore affects the representativeness of short maturity generic reference rates, while the switches likely distort the shortend of the South African yield curve by encouraging hoarding of switch-eligible bonds.

[3] Our term premium estimates are similar to those of (Soobyah and Steenkamp 2020), but we restrict the parameters from the Nelson-Siegel-Svenson model to prevent erratic and economically inappropriate parameter estimates and to enhance the yield curve fit relative to the approach taken in (Soobyah and Steenkamp 2020).

yield curve, with long-term rates usually a lot higher than short-term interest rates (as can be observed from Figure 1). A positive, and large, term premium implies the existence of large inflation, liquidity, and credit risk premia in South Africa. The slope of the sovereign curve has become much steeper with the onset of the COVID pandemic, with the initial easing of monetary policy and as liquidity premia and credit risk embedded in government long bonds increased.

Figure 2. Implied short rate expectations embedded in 10-year South African government bond yields

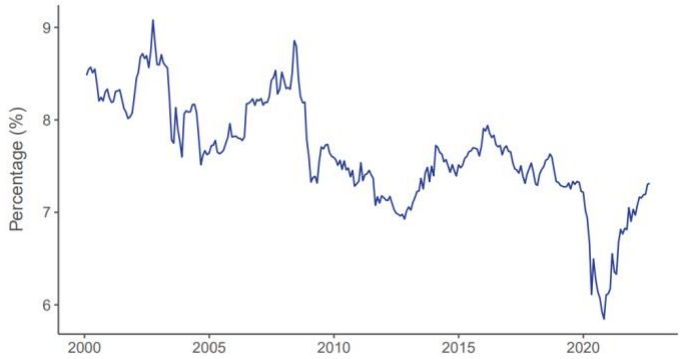


Figure 3. 10-Year Term Premium Estimate

Conclusion

South Africa's sovereign yield curve is one of the steepest in the world (Erasmus and Steenkamp 2022). Our estimates suggest that South Africa's yield curve embeds high average expected short-term interest rates as well as a large term premium. The results also suggest that the significant steepening of the South African yield curve over recent years has also reflected an increase in the sovereign term premium. It is likely that the higher sovereign term premium reflects an increase in inflation and credit premia associated with a worsening outlook for the government's fiscal position. This is a major policy concern since a high term premium likely is represent a drag on South Africa's growth prospects (Soobyah and Steenkamp 2020). This highlights the importance of developing frameworks to explain South Africa's high average interest rates and high term premium.

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