Economic Research Southern Africa

The South African sovereign term premium and its drivers

Discussion Document 15

NOVEMBER 2022

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Matthew Simmonds

Director

The South African sovereign term premium and its drivers

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Abstract

South Africa's sovereign yield curve is one of the steepest among large emerging markets. Our estimates suggest that this can be explained by an increase in the term premium embedded in long rates. We argue that a higher term premium reflects a deterioration in market perceptions of South African credit risk and South Africa's relatively high macroeconomic volatility. A higher term premium implies that interest rates in South Africa have been less reactive to domestic monetary policy than they might have been if South Africa had a stronger fiscal position, a lower inflation target or lower macroeconomic volatility overall.

1. Introduction

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. Term premia estimates are very useful as they allow expectations of future monetary policy rates (as well as the economy's neutral rate) to be calculated, allow for assessments of liquidity and sovereign risk embedded in bond market prices, and the transmission of risk shocks to the economy. Soobyah and Steenkamp (2020b) estimate, for example, that term premium shocks tend to be associated with weaker economic activity in South Africa, and tend to require an offsetting monetary policy response to stabilise the macroeconomy.

We estimate sovereign yield curves using the approach of Nelson-Siegel-Svensson (Nelson and Siegel 1987 and Svensson 1994) over a range of maturities (3 month to 10 year maturities):

$$r(m) = \beta_1 + \beta_2 \frac{(1 - \exp(\frac{-m}{T_1})}{\frac{m}{T_1}} + \beta_3 \frac{(1 - \exp(\frac{-m}{T_1})}{\frac{m}{T_1}} \exp(\frac{-m}{T_1} + \beta_4 \frac{(1 - \exp(\frac{-m}{T_2})}{\frac{m}{T_2}} \exp(\frac{-m}{T_2}{}_n$$

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. We impose restrictions on the parameters to ensure good fit of daily and monthly yield curves, and ensure stability and interpretability of the parameter estimates.[1]

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 daily and monthly

[1] 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 short-end of the South African yield curve by encouraging hoarding of switch-eligible bonds. 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 minimise 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 optimisation for each day/month as follows: β_0 based on the observed long-term rate, β_1 as the relevant observed yield curve slope, β_2 and β_3 at zero, and τ_1 and τ_2 at low positive values calibrated differently for different sovereigns.

frequency for a range of sovereign yield curves but focus this note on a South African application.

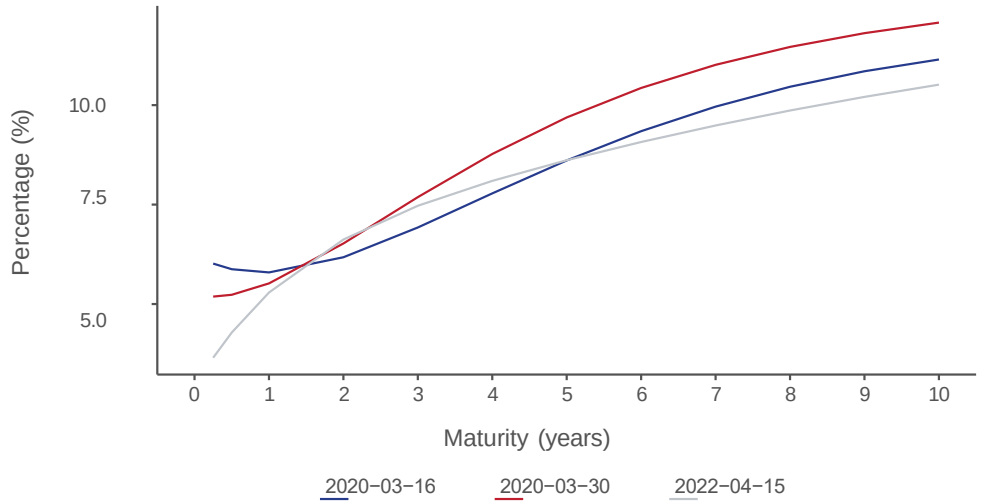
2. Estimates

The sovereign yield curve describes the cost to the government of borrowing for various lengths of time. The slope of the South African yield curve has generally been positive (Figure 1), reflecting uncertainty over future economic growth and inflation that mean that investors need to be compensated to lock-in their funds in long-term investments.[2] As a result, the yield curve can be used to assess market expectations of the outlook for the economy - such as the expected level of short term interest rates, market-implied inflation expectations and risks around economic growth, inflation variability, sovereign credit risk or general macroeconomic risk.

The onset of the COVID-19 pandemic saw a meaningful steepening of the South African yield curve. The short end of the curve fell as the market expected monetary policy easing 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 14 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.

[2] Notably, the South African curve briefly inverted after the onset of the Global Financial Crisis and during the COVID-19 pandemic in response to concerns over possible recession and expectations of monetary policy easing.

Figure 1: Fitted yield curves on selected dates



The term premium is the difference between the nominal 10-year sovereign bond yield and 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 10-year yield have fallen over the last two decades. 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 yield curve, with long-term rates usually a lot higher than short-term interest rates (Figure 4).[4] A positive, and large, term premium implies that the existence of large inflation 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.

[3] Our term premium estimate is similar to that of Soobyah and Steenkamp (2020b), 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 (2020b).

[4] The term spread is the 10 year generic government yield less the 3 month Treasury bill rate. Bloomberg's South African Treasury-bill rate backdated using the SARB's 91-day tender rate.

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

Figure 3: 10 Year Term Premium Estimate

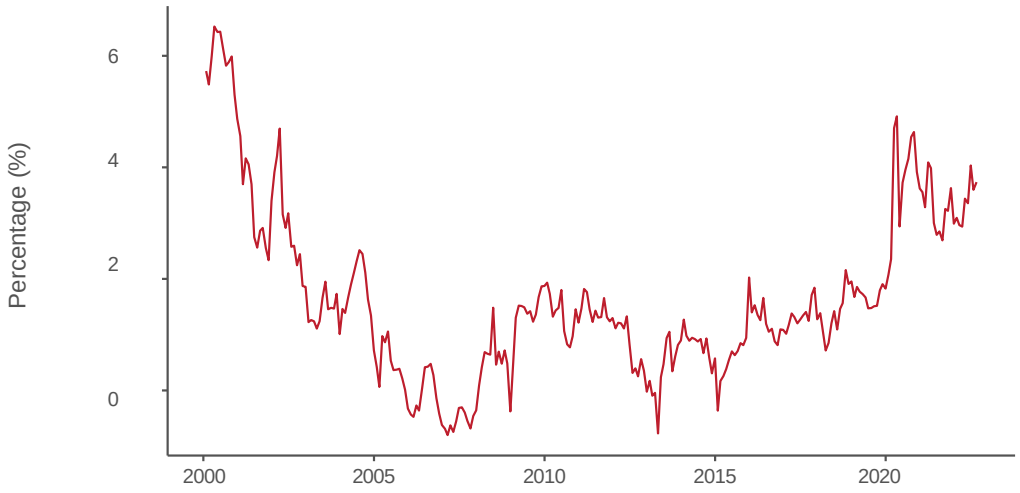
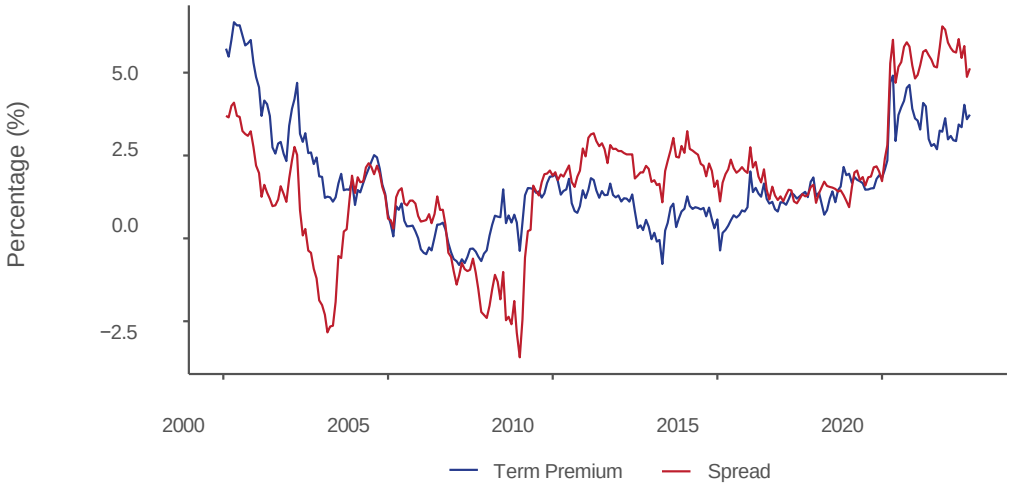


Figure 4: The South African term spread and 10-year term premium



The South African term premium embedded in long rates is significantly higher than in the United States (Figure 5). The US term premium briefly turned positive in 2021 as the US economy recovered from the pandemic and inflationary pressures re-appeared after years of low inflation. Despite expectations of higher short term interest rates in the US, the US term premium is currently estimated to be negative as long yields have not risen as much as in other parts of the world. We estimate that the South Africa's term premium is currently higher than in Brazil, Mexico and Turkey (Figure 6).

Figure 5: Term premium embedded in 10-year government bond yields (South Africa and United States)

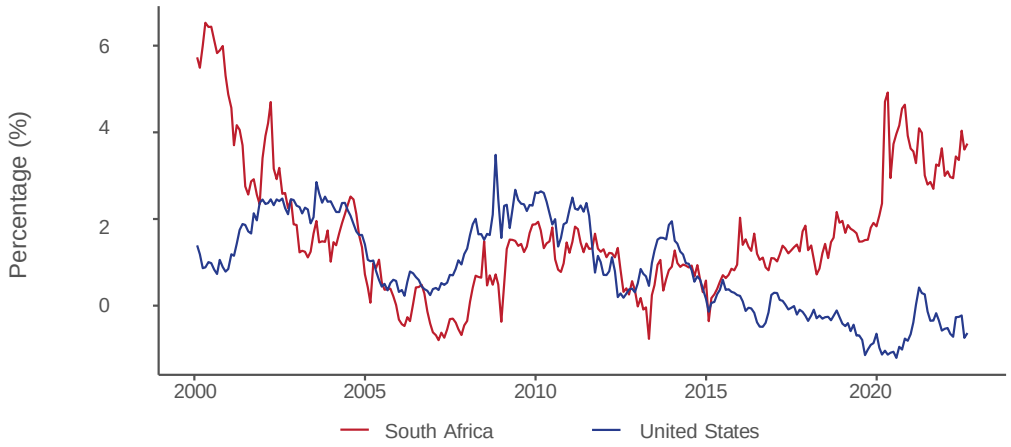
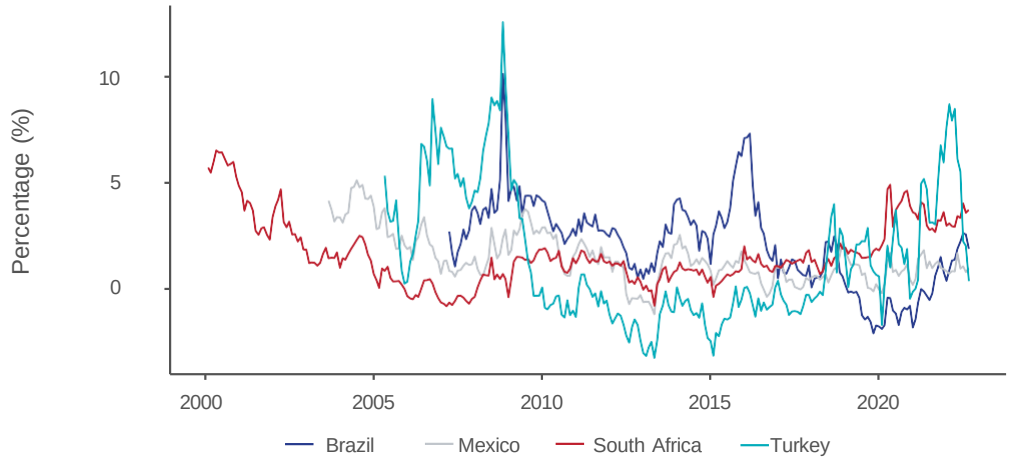


Figure 6: Term premium embedded in 10-year government bond yields



The neutral real interest rate is a useful concept for assessing the stance of monetary policy. Our preferred neutral rate estimate uses our estimated 5 and 10 year risk neutral rates to calculate implied an 5-year, 5-year forward interest rate (indicative of where 5

year interest rates are expected to be 5 years hence, Figure 7). We also plot term premium-adjusted 1y5y and 5y1y forward expectations to capture short- and medium-term neutral concepts. The decline in the estimated neutral rates until 2021 is consistent with the well-documented downward drift in global equilibrium interest rates. However, the decline in our estimated measures is much lower than in major advanced economies (see for example comparable estimates from Callaghan 2019 for New Zealand or Aguilar et al. 2022 for Mexico). As we argue below, this reflects persistently higher inflation and credit risk premia, among other factors. Our model suggests that monetary policy became extremely accommodative following the COVID-19 related repo cuts, with the repo rate falling well below the neutral rate and current inflation. The South African Reserve Bank (SARB) began to tighten monetary policy in December 2021 as economic slack created by the economic lockdown began to dissipate and inflationary pressures built up. Our estimates suggest that the market-implied neutral rate began rising well ahead of policy tightening. The long-term nominal neutral interest rate embedded in the sovereign yield curve in South Africa is currently estimated to be around 7.5 percent, which is also close to our medium-term measure.

Figure 7: Estimated neutral rate

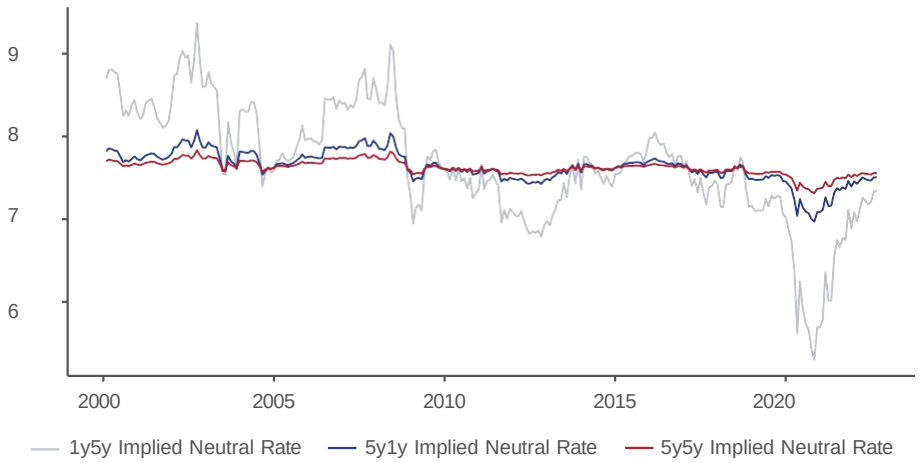
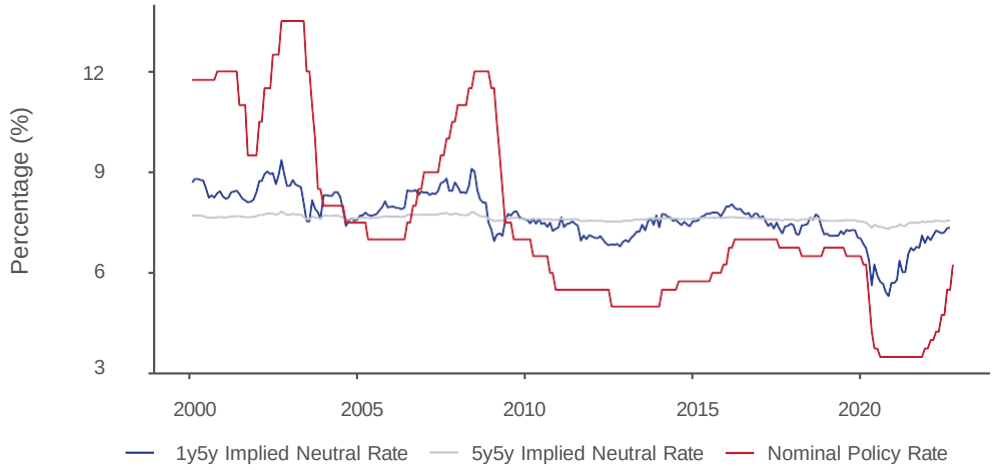


Figure 8 plots the nominal repo rate against two of our estimated neutral rates. The SARB's neutral estimate (at around 7% nominal currently) suggests around 75 basis points of further tightening is required to shift to a neutral policy stance over the projection period (i.e. to return interest rates to a level consistent with inflation at the

inflation target over the medium term).[5] Our model suggests that the market expects a greater degree of tightening would be required than assumed by the SARB, in line with current market expectations inferred from forward rate agreements.[6]

Figure 8: Estimated neutral rate and nominal policy rate



This also implies that South Africa has a neutral interest rate that exceeds its economic growth rate (r∗ nominal neutral compared with nominal growth g). The implication is that government debt tends to rise when borrowing costs are higher than economic growth.[7] Our estimates suggest that sovereign risk is being expressed in long rates. A high sovereign risk premium therefore means that South Africa has a steeper yield curve than it would otherwise have. In this way, the government's weak fiscal position and South Africa's uncertain political and economic outlook weigh on growth.

3. What drives the South African term premium?

To assess which macroeconomic factors can explain movements in the South African term premium, we combine simple models of the term premium using Bayesian model averaging to weight up ordinary least square models drawing on subsets of the

[5] See https://codera.co.za/neutral-rate-estimates-from-sarb/ for a summary of SARB's historical neutral estimates.

[6] See Soobyah and Steenkamp (2021) for a discussion of the extraction of market expectations of monetary policy using market rates in South Africa.

[7] It is important to note that this also reflects a low and declining potential growth rate. Since democracy, Havemann and Hollander (2022) calculate that r (defined there as average nominal sovereign rates) have exceeded g briefly in the 1990s and again between 2012-20, when borrowing added to debt and caused the government debt-to-GDP ratio to rise meaningfully. See https://codera.co.za/a-long-history-of-r-vs-g-in-sa/for a summary.

considered indicators and their lags based on their ability to explain the term premium (see Botha et al. 2021 for a summary of the approach used). We consider a large number of potential economic drivers of the term premium, including:

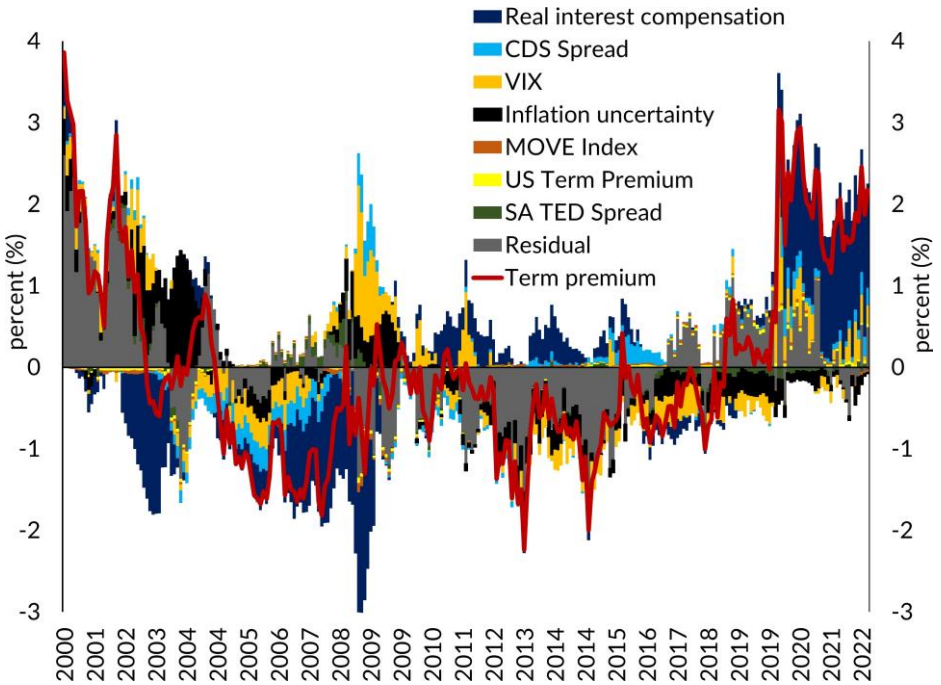
- inflation uncertainty (proxied using the one year rolling standard deviation of inflation for South Africa)
- global risk aversion (proxied using the Chicago Board Options Exchange Volatility Index (VIX))
- global expected bond market volatility (proxied using the Merrill Lynch Option Volatility Expectations (MOVE) index)
- liquidity in the South African money market (proxied using the South African TED spread, calculated as the difference between the rate banks lend to each other and the Government's short-term borrowing costs)
- market perception of South African sovereign risk (proxied using 5-year Credit Default Swap (CDS) spread on South African government debt)
- the US term premium as estimated using the approach of Adrian et al. (2013) and published by Bloomberg
- and real long-term interest compensation (proxied using the slope of the yield curve, as 10-year rates less 3 month Treasury bill rates).

The South African term premium is influenced by the domestic macroeconomic outlook and global financial market volatility. Figure 9 plots the estimated contributions of different economic and financial variables to the explained level of the term premium. The top explanatory factor for the term premium is our real compensation proxy. This is likely because our measure is an amalgam of a real risk premium reflecting the compensation investors require to bear risk associated with uncertain future short-term real interest rates, sovereign credit risk and an inflation risk premium. Risk perceptions (as captured by CDS spreads) help to explain a small additional proportion of the increase in the term premium over the last three years.[8] While the VIX can explain some of the dynamics of the South African term premium over the last decade, other global

[8] As argued in Soobyah and Steenkamp (2020a) CDS spreads do not accurately capture South African-specific sovereign risk and further work could develop better proxies of South African sovereign credit risk.

factors (represented by the MOVE index and the US term premium) have very limited explanatory power.[9] Whereas the TED spread has generally been positive in the US, it has been largely negative in South Africa over the last 7 years on account of elevated sovereign risk. Surprisingly, the SA TED spread (our long-term proxy for credit and liquidity risk in the South African money market) explains little of the variation in the term premium.[10]

Figure 9: Contributions to explaining the term premium embedded in 10-year government bond yields (demeaned)



4. Conclusion

South Africa's sovereign yield curve is one of the steepest among large emerging markets.[11] Our estimates suggest this reflects a large term premium. Our modelling

[9] We excluded market-implied expectations of inflation based on breakeven inflation as such data are only available from 2012 onwards. Unfortunately, we do not have a sovereign inflation linker curve available with which to assess the extent to which the term premium reflects inflation uncertainty. This is something that could also be explored in future extensions of this work. We also excluded measures of capacity pressures as their association with the term premium for South Africa are low at a monthly frequency, though they have a mildly counter-cyclical relationship with the term premium at a quarterly frequency.

[10] Alternative market liquidity measures have a stronger association with the term premium but are not shown on account of a relatively short available sample. For an estimate of the historical market liquidity premium in the South African money market see https://codera.co.za/ market-liquidity-in-south-africa/. Domestic equity market volatility (measured using the JSE South African Volatility Index) also has a strong correlation with the term premium but is excluded here on account of a short available sample.

[11] See https://codera.co.za/comparative-yield-curve-slopes/.

results suggest that a higher term premium usually coincides with deterioration in market perceptions of South African credit risk and macroeconomic volatility. As demonstrated by Soobyah and Steenkamp (2020b), a higher term premium tends to weigh on economic growth. A higher term premium also implies that interest rates in South Africa have been less reactive to domestic monetary policy than they might have been if South Africa had a stronger fiscal position, a lower inflation target or lower macroeconomic volatility overall.

References

Adrian, T., R. Crump, and E. Moench (2013). Pricing the term structure with linear regressions. Journal of Financial Economics (110/1).

Aguilar, A., M. Diego-Fernandez, R. Elizondo, and J. Roldan-Pena (2022, January). Term premium dynamics and its determinants: the Mexican case. BIS Working Papers 993, Bank for International Settlements.

Botha, B., T. Olds, G. Reid, D. Steenkamp, and R. van Jaarsveld (2021, December). Nowcasting South African gross domestic product using a suite of statistical models. South African Journal of Economics 89 (4), 526–554.

Callaghan, M. (2019, March). Expectations and the term premium in New Zealand long-term interest rates. Reserve Bank of New Zealand Analytical Notes series AN2019/02, Reserve Bank of New Zealand.

Havemann, R. and H. Hollander (2022). Fiscal policy in times of fiscal stress: Or what to do when r>g. Working Paper 2022-52, World Institute for Development Economic Research.

Nelson, C. R. and A. F. Siegel (1987). Parsimonious modelling of yield curves. The Journal of Business 60 (4), 473–489.

Soobyah, L. and D. Steenkamp (2020a, June). A measure of South African risk. Occasional Bulletin of Economic Notes 10009, South African Reserve Bank.

Soobyah, L. and D. Steenkamp (2020b, June). Term premium and rate expectation estimates from the South African yield curve. Working Papers 9998, South African Reserve Bank.

Soobyah, L. and D. Steenkamp (2021, October). Has publication of a repo path provided guidance? Occasional Bulletin of Economic Notes 11019, South African Reserve Bank.

Svensson, L. (1994). Estimating and interpreting forward interest rates: Sweden 1992 - 1994. NBER Working Papers 4871, National Bureau of Economic Research, Inc.

Wahlstrom, R. R., F. Paraschiv, and M. Schurle (2022, March). A Comparative Analysis of Parsimonious Yield Curve Models with Focus on the Nelson-Siegel, Svensson and Bliss Versions. Computational Economics 59 (3), 967–1004.

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