ON SOVEREIGN RISK AND THE FINANCIAL SYSTEM IN SOUTH AFRICA

by

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Declaration

"I hereby declare that this is my own unaided work, the substance of or any part of which has not been submitted in the past nor will be submitted in the future for a degree to any university, and that the information contained herein has not been obtained during my employment or working under the aegis of any other person or organisation other than this university.

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Abstract

Local-currency government bonds have emerged as the predominant source of financing for emerging-market sovereigns. While the development of these markets has enhanced the resilience of emerging markets to external shocks, it has also introduced new vulnerabilities. Among these, sovereign default risk on local currency-denominated debt is becoming increasingly relevant as the indebtedness of emerging-market governments such as South Africa's increases, especially after the Covid-related fiscal shocks of 2020. As such, there has been growing interest in the impact of government debt and sovereign risk on the financial system. However, much of the work analysing sovereign default risk in emerging markets still relies on measures that are based on their foreign-currency denominated debt, despite the dominance of local-currency bond issuance.

In this thesis, I explore local currency sovereign risk and its influence on the financial system in South Africa. Using a local-currency measure of sovereign risk, I explore three specific questions. First, I examine the role of sovereign and exchange rate risk as drivers of changes in nominal government bond yields in South Africa. Second, I consider the impact of government bond holdings and sovereign risk on emerging-market bank valuations and performance. Lastly, I analyse interactions between fiscal and monetary policy, first in a panel of emerging markets and then in South Africa specifically.

The findings of my thesis have implications for emerging markets in general. I find that increases in sovereign risk have adverse impacts on government borrowing costs, the banking system, bondholders, and the monetary authority. Furthermore, the spillovers that the financial system experiences from sovereign risk are largely a function of the level of exposure to sovereign debt.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AE	- advanced economy
BCBS	- Basel Committee on Banking Supervision
BER	- bilateral exchange rate
CDS	- credit default swap
CIP	- covered interest parity
CPI	- consumer price index
EM	- emerging market
EMBI+	- Emerging Market Bond Index Plus
Fed	- US Federal Reserve
FGLS	- feasible generalised least squares
FTPL	- fiscal theory of the price level
FX	- exchange rate
GDP	- gross domestic product
GFC	- global financial crisis
IMF	- International Monetary Fund
IRF	- impulse-response function
LCCS	- local currency credit spread
LLP	- local linear projection
OLS	- ordinary least squares
PE	- price/equity
QE	- quantitative easing
REER	- real effective exchange rate
ROA	- return on assets
ROE	- return on equity
SARB	- South African Reserve Bank
US	- United States
USD	- United States Dollar

UST	- United States Treasury
VAR	- vector autoregression
ZARUSD	- South African Rand/United Staes Dollar

1 Introduction[1]

[1] Some excerpts of this PhD thesis have been published in working papers and economic notes. Results from Chapter 2 have been published in Mamburu (2022) while portions of Chapter 4 have been published in Soobyah et al. (2023). These portions are my contributions to the co-authored working paper and as such are my own original work.

Government bonds play a central role in the functioning of a financial system. The safety of government securities and their liquidity advantage relative to other domestic assets, and their role in prudential regulation as well as central bank operations means that the majority of participants in the domestic financial market have some exposure to the sovereign. Sovereign[2] bond markets also tend to account for a sizeable share of capital inflows for an emerging market (EM) economy such as South Africa. Therefore, the emergence of any considerable risk or vulnerability in the local government bond market may result in significant spillovers to the domestic financial system and have implications for capital flows as well.

In recent years, South African fiscal policy has resulted in a steady rise in sovereign risk following growing concerns about the deterioration of the fiscal position and the sustainability of government debt[3]. The global financial market shock on the advent of the Covid-19 pandemic in early 2020 saw increases in sovereign risk and considerable capital outflows from EMs, which affected the functioning of financial markets and highlighted the influential role of the government debt market in the financial system. Fiscal positions deteriorated notably as governments increased debt issuance to finance deficits related to policy responses to the pandemic and contractions in economic activity, and this remained the case after market conditions normalised. This in turn resulted in persistently higher sovereign risk and increased exposure of the domestic financial system to sovereign debt in economies such as South Africa, making the question of the impact of sovereign risk on the financial system more pertinent.

In this thesis, I explore local currency sovereign risk and its influence on the financial system in South Africa. First, I follow Du and Schreger (2016) and derive a local-currency measure of sovereign risk that is appropriate for evaluating the default risk on South Africa's predominantly local currency-denominated sovereign debt. I employ this measure in an empirical analysis of the role of sovereign risk and exchange rate risk as drivers of changes in nominal bond yields. Second, I use the same

[2] I define sovereign debt as debt issued by the central government.
[3] See Mamburu (2024) for a discussion of the deterioration of the South African fiscal position.

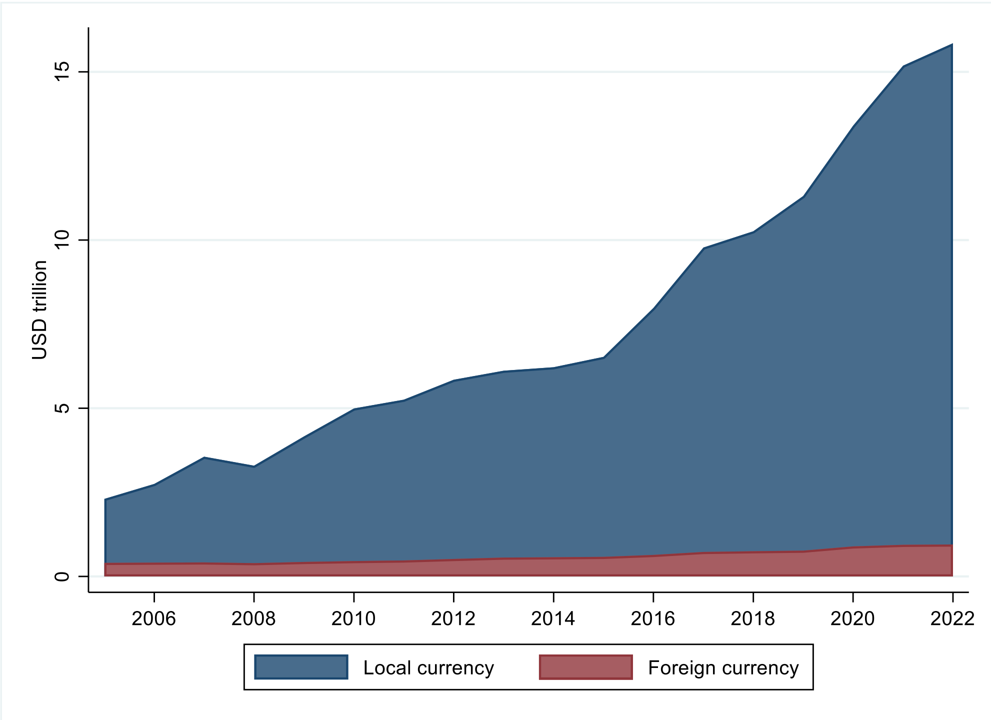
measure of local currency sovereign risk to explore the impact of sovereign risk on EM banks through their holdings of government bonds. Finally, I consider the impact of fiscal policy and sovereign risk on the conduct of monetary policy in a panel of EMs and in South Africa specifically.

1.1 Local currency sovereign debt and default risk

Historically, financial crises in EMs have often been associated with a country's external obligations. One of the main vulnerabilities of EM financial systems that has contributed to previous crises has been 'original sin', defined by Eichengreen et al. (1999) as the inability of a country to borrow abroad in its currency. When a country's debt obligations are in foreign currency, a real exchange rate depreciation increases its debt servicing costs in terms of its home currency, which can render its debt service burden unsustainable and lead to default as happened in the Asian crisis (Corsetti et al., 1999).

From the mid-1990s, EMs steadily developed their local currency bond markets with the intention of enhancing financial stability by reducing their vulnerabilities to such external shocks, as shown in Figure 1.1. However, the change in the currency composition of EM debt also introduced a new set of vulnerabilities for these economies. As discussed by Hofmann et al. (2020), this is because EMs typically have a smaller domestic institutional investor base, such that their debt markets rely more on foreign investor participation, regardless of the currency in which debt issuances are denominated. If foreign portfolio investors evaluate their returns in hard currency such as the US Dollar (USD) then unhedged positions will make their holdings of EM local-currency bonds more sensitive to measures of risk. This reinforces exchange rate depreciations and rises in bond spreads in times of financial turmoil, with real impacts on the functioning of EM financial markets (Korinek, 2011). Carstens and Shin (2019) refer to this shift in currency mismatches from the borrower to lender's balance sheet as 'original sin redux'. The vulnerability of different economies to original sin redux is likely to vary, depending on their exposure to foreign investors. For instance, Ebeke and Lu (2015) find that foreign investor participation in local currency bond markets contributes to higher yield volatility. Bertaut et al. (2024) also find that duration risk on local-currency sovereign bonds can work to transmit external financial conditions to the domestic EM economy through its interaction with exchange rate risk.

Figure 1.1: EM sovereign debt currency composition



Source: Bank of International Settlements

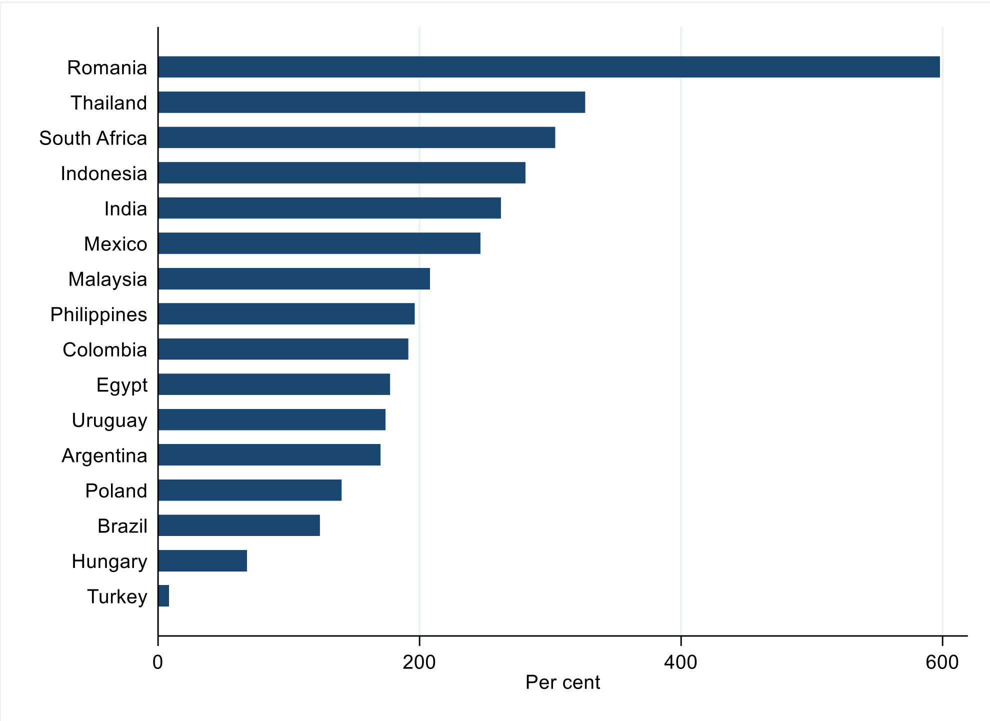
Another possible reason why the development of local currency bond markets was expected to make EMs more resilient was that the transition from foreign to local currency sovereign debt issuance was expected to eliminate the problem of sovereign default risk. The literature on sovereign debt has often assumed that a government cannot default on its local currency debt, as it can simply inflate the nominal value of its debt burden away (Reinhart & Rogoff, 2011). This assumption of negligible default risk underpins the designation of local currency sovereign bonds as the 'safe' assets for the purpose of prudential regulation (Nouy, 2012).

However, some scholars have recently argued that the assumption that governments do not default on their local currency debt is extreme, as there may be circumstances where it would be optimal for a government to default on its debt rather than inflate it away, as in Russia's default in 1998. For instance, Reinhart and Rogoff (2011) catalogue historical episodes of default on domestic debt by advanced economies and EMs showing that the assumption that governments always honour their domestic obligations is unwarranted. The restructuring of Ghana's local currency government debt following a default on its external debt in 2022 reiterated the difficulty of confining default risk to external debt when a sovereign's debt burden is predominantly denominated in its own currency.

The recent literature has therefore paid more attention to the impact of sovereign default on the financial system (see Gennaioli et al. (2013), Boz et al. (2014) for example) and the economy more broadly (Popov & van Horen, 2013). This strand of the literature, however, is limited in that it either observes discrete events of government default as opposed to more continuous measures of default risk, or focuses on the euro-area sovereign debt crisis, which as a monetary union has more complex institutional arrangements affecting a government's probability of default. Nevertheless, this work has shown that sovereign risk is not negligible and the treatment of government bonds as risk-free can have material consequences for the soundness of the financial system (D'Erasmo et al., 2019).

The challenges regarding the risks embedded in sovereign debt are increasingly relevant for the South African financial system. In the years since the Global Financial Crisis (GFC), the growth in South Africa's stock of sovereign debt has outpaced that of most of its peers, as shown in Figure 1.2. While increasing debt-service costs have become a central issue for borrowers everywhere since the beginning of the post-Covid monetary policy tightening cycle, a rising debt-service burden and its implications for fiscal sustainability preceded pandemic-related developments in South Africa (Mamburu, 2024). This deterioration, coupled with the diminishing role of foreign investors in the local government bond markets, has driven an intensification in the nexus between the financial sector and the sovereign, with implications for banks, investors and the central bank which must conduct monetary policy against this backdrop.

Figure 1.2: Change in total sovereign debt by country, 2009 to 2023



Source: International Monetary Fund

1.2 Research objectives and key findings

The main objective of this research is to build on the existing international literature on sovereign debt by exploring the influence of sovereign risk on the domestic financial system in South Africa. The analysis focuses on the post-GFC era, from 2008 to 2022, when local currency government bond issuance increased among EMs amid increased global investor demand. In particular, it will consider three specific research topics:

1. The impact of local-currency sovereign risk and exchange rate risk on South African government nominal bond yields
2. The effect of local currency sovereign risk on bank valuations and balance sheets
3. The interaction between fiscal policy and monetary policy in South Africa

In this study, I make several findings that contribute to the literature on sovereign risk, EM government bonds and the financial system. First, I demonstrate that the local currency credit spread as proposed by Du and Schreger (2016) is a good measure of South African sovereign risk that compares favourably to market-based measures of credit risk. In terms of bond markets, I contribute to the literature on the interaction between exchange-rate and sovereign risk by showing that a significant covariance exists between the two, with time-varying impacts on nominal bond yields. Furthermore, I find evidence consistent with the existing literature that global factors are more significant drivers of changes in nominal yields than local factors, particularly since 2020.

Beyond the impact of sovereign risk on the bond market, this study also provides insights on the impact of sovereign risk on parts of the financial system. I find that among EMs, bank demand for government bonds is a function of demand for liquidity and the availability of central bank funding, while sovereign risk is a driver of demand among banks with higher exposure to sovereign debt. I find that higher sovereign risk is associated with lower bank returns and lower lending activity among less-capitalised banks.

Finally, I also show that sovereign risk has an impact on the conduct of monetary policy. The macroeconomic impact of government debt management and the threat of fiscal dominance are topical and much debated. While I find no evidence of the emergence of fiscal dominance among inflation-targeting EMs since the GFC, I do find that the bilateral exchange rate with respect to the USD is a significant factor in the monetary policy reaction functions of the economies considered. Building on this, I show that for South Africa, the bilateral exchange rate weakens following a sovereign risk shock. Therefore, fiscal policy affects the monetary policy stance through the effect of sovereign risk.

1.3 Thesis structure

The structure of the study is as follows. In Chapter 2, I estimate the local currency credit spread and use it in an empirical analysis of the impact of exchange rate and sovereign risk on changes in South African government nominal yields. In Chapter 3, I employ panel data analysis to consider the impact of sovereign risk on EM bank returns, valuations and lending activity. Chapter 4 focuses on how sovereign risk affects the conduct of monetary policy by analysing interactions between fiscal and monetary policy for a sample of EMs and South Africa specifically. Chapter 5 concludes the study.

2 Local-currency sovereign risk on South African government bonds: The role of sovereign and exchange rate risk as drivers of changes in nominal bond yields[4]

[4] Some results from this chapter have been published in Mamburu (2022).

2.1 Introduction

Local-currency bond issuance has become a dominant source of financing for many EMs in response to the financial crises these economies experienced in the 20th century. In the post-GFC era of ultra-low developed-market interest rates, EM local-currency bond markets have become a more important destination for international-investor portfolio flows as well as a more integral component of the global financial system. Despite these developments, however, the market's pricing of EM sovereign default risk is still derived from the foreign-currency denominated component of these borrowers' debt portfolios. Much empirical analysis on EM bond markets and sovereign risk is also based on foreign-currency based measures of default risk.

In this chapter, I set out to address the role of sovereign risk in local currency-denominated debt, and examine how it can drive changes in nominal yields on government bonds. I calculate the local-currency credit spread developed by Du and Schreger (2016) for South Africa, which was not included in their original study, for the period between January 2008 and October 2022. I compare this measure to market-based measures of credit risk, namely the credit default swap (CDS) spread and JP Morgan Emerging Market Bond Index Plus (EMBI+) spread, and find that the Du-Schreger risk spread is a good measure of local-currency credit risk for South Africa during the period under review, with the added advantage of being less responsive to external developments that are not directly related to domestic fiscal risk. The results here are compared with those of Soobyah and Steenkamp (2020) who use the CDS spread to extract a domestic measure of the sovereign risk premium.

With the availability of a local currency-based measure of sovereign risk, I can observe whether changes in nominal yields are driven by domestic factors or more closely associated with external conditions, and how these relationships change over time. I apply the local-currency credit spread in an empirical analysis of the role of sovereign and exchange rate (FX) risk as drivers of changes in South African nominal bond yields. I find that relative to domestic factors such as the South African Rand (ZARUSD) and the local-currency credit spread, global factors such as the USD and CDS spreads are more significant drivers of changes in nominal bond yields, particularly since 2020. I also find sovereign and FX risk exhibit a significant covariance that has a time-varying impact on nominal yields. Thus, while the pre-2020 increase in nominal yields was more closely associated with increases in local-currency sovereign risk amid a deteriorating fiscal position, the post-2020 increase in yields been driven by global financial conditions. Furthermore, there is a significant interaction between sovereign and FX risk in local-currency sovereign debt that warrants further research.

These results have implications for EM sovereign debt issuers as well as investors in that they highlight the vulnerability of EM local-currency sovereign debt to external shocks. While appropriate fiscal policy could have contained the upward trend in South African nominal yields prior to 2020, changes in nominal yields since 2020 were more associated with global factors beyond domestic policymakers' control. Similarly, the returns of investors in EM local-currency bonds are affected by external conditions including the USD, even for domestic investors whose positions are local-currency funded. An understanding of these dynamics is useful for an understanding of conditions in the sovereign bond market in general.

2.2 Measuring local-currency sovereign risk

The emergence of local-currency bond markets as the main source of financing among EMs has enhanced the resilience of these economies by reducing the currency mismatch between their fiscal revenues and debt service obligations. However, this growing market has also introduced a new set of vulnerabilities for sovereign borrowers as they still rely on financing by foreign investors are thus exposed to sharp changes in FX markets (Carstens & Shin, 2019). Furthermore, history has shown that sovereign default risk is not a negligible concern among EM borrowers, contrary to historical expectations that sovereigns could not explicitly default on debt denominated in their own currency (Reinhart & Rogoff, 2011). Therefore, an understanding of sovereign risk on local-currency debt and how it drives changes in the bond market is important.

Also relevant are the measures used to observe sovereign risk. While a few studies such as Amstad et al. (2020) use ratings assigned by major credit rating agencies as a measure of credit quality, most analyses rely on market-based credit risk spreads or indices such as the CDS spread or the EMBI+. These measures of sovereign default risk are based on the default risk on USD-denominated bonds. While the benchmark CDS spread is based on the cost of insuring against a borrower's default over a 5-year horizon, the EMBI+ measure is the yield spread of a basket of USD-denominated debt issued by the borrower over US Treasuries (USTs). The drawback with these market-based measures is that they are indicators of the risk of default on foreign-currency denominated debt, whereas an increasing share of the sovereign debt burden among EMs is local-currency denominated (Anderson et al., 2010).

To the extent that local- and foreign-currency sovereign risks are different, these measures may be unsuitable indicators of sovereign risk in certain contexts. Indeed, Amstad et al. (2020) find that the drivers of sovereign risk differ depending on the currency denomination of the debt. They find that a sovereign's local-currency denominated debt is mostly affected by domestic factors such as inflation and banks' holdings of government debt, while foreign-currency denominated debt is more affected by external indicators such as foreign reserve accumulation, exchange rate volatility and the sovereign's proportion of debt denominated in foreign currency. Furthermore, risk measures based on foreign-currency denominated debt may also be more sensitive to external developments that affect exchange rate markets. For instance, Longstaff et al. (2011) decompose CDS spreads into different premia and demonstrate that CDS spreads are driven more by global market factors and investment flows than country-specific fundamentals.

To address the shortcomings associated with CDS and index spreads as measures of sovereign risk, Du and Schreger (2016) (Du-Schreger) introduce a local-currency credit risk spread for sovereigns which captures the credit risk component of local-currency denominated debt. They estimate this local-currency sovereign risk spread for a sample of ten countries between 2005 and 2014 using the yield on a country's sovereign benchmark bond and the UST yield of similar maturity. The measure is found to be lower than the country's foreign-currency credit risk spread, and less correlated with global risk factors and the credit spreads of other countries. This local currency credit risk spread provides a more appropriate measure to assess the impact of changes in sovereign risk on other macroeconomic variables in EMs when sovereign debt is largely local-currency denominated.

2.3 Estimating the local currency credit spread

Du-Schreger use the covered interest parity (CIP) condition to develop a measure of local currency credit risk for a sample of EM countries, where the base country is the US. The CIP condition can be stated as

$$y_{nt}^{SA} = y_{nt}^{US} + \rho_{t,t+n} + x_{t,t+n}^{SA-US} \tag{2.1}$$

Here, y_{nt}^{SA} and y_{nt}^{US} are the nominal n-year interest rates for South Africa and the US respectively at time t, $\rho_{t,t+n}$ is the n-year FX forward premium from time t, and $x_{t,t+n}^{SA-US}$ is the CIP deviation when the condition does not hold. Du-Schreger interpret this CIP deviation among EMs as a measure of local currency credit risk for that country relative to the US, which is taken to be free of credit risk.

Du et al. (2018) demonstrate that such deviations from the CIP condition have been common in the post-GFC period. In the literature (see, for example, Schmitt-Grohé et al., 2022), a deviation from the CIP condition is also derived alternatively from relative interest rates and exchange rates:

$$CIP\ deviation = (1 + i_t) - (1 + i_t^*)\frac{F_t}{\varepsilon_t} \tag{2.2}$$

Where i_t is the domestic interest rate, i_t^* is the foreign interest rate, F_t is the forward rate and ε_t is the exchange rate.

I follow Du-Schreger and interpret the CIP deviation as the local currency credit risk premium. I replicate their premium for South Africa, which was not in the original study but available from the study's updated data appendix. I estimate it at a daily frequency for the period January 2008 to October 2022. In line with Du-Schreger, I use a benchmark tenor of five years.

While the updated data appendix includes the credit spread for South Africa from January 2008, I choose to replicate the spread using their methodology rather than using the spreads available in the appendix for two reasons. First, I do the replication exercise as a simple cross-check of the methodology described in the original Du-Schreger (2016) study. This exercise is also beneficial in that it provides insight regarding how the different components in the credit spread contribute to certain peculiarities in the credit spread. Second, some of the data appendix's descriptions of the instruments used in the credit spread construction are quite vague, potentially resulting in differences between the measure derived by Du-Schreger and a replication; I therefore construct a credit spread to provide certainty about which instruments are used for each component of the spread.

The local currency credit spread (LCCS) can be stated as

$$s_{nt}^{LCCS} = y_{nt}^{LC} - y_{nt}^{*LC} = y_{nt}^{LC} - (y_{nt}^{*\$} + \rho_{nt}) \tag{2.3}$$

Where y_{nt}^{LC} is the zero-coupon yield on the n-year local currency nominal sovereign bond, y_{nt}^{*LC} is the n-year local currency nominal risk-free rate and $y_{nt}^{*\$}$ is the zero-coupon yield on the n-year nominal UST bond. The n-year local currency risk-free rate is defined as the sum of the zero-coupon nominal UST yield and the n-year forward premium, that is

$$y_{nt}^{*LC} = y_{nt}^{*\$} + \rho_{nt} \tag{2.4}$$

I note that the forward premium is the normalised difference between the forward and spot exchange rate for a given tenor, that is

$$\rho_{t,t+n} = \frac{1}{n}(f_{t,t+n} - s_t)$$

(2.5)

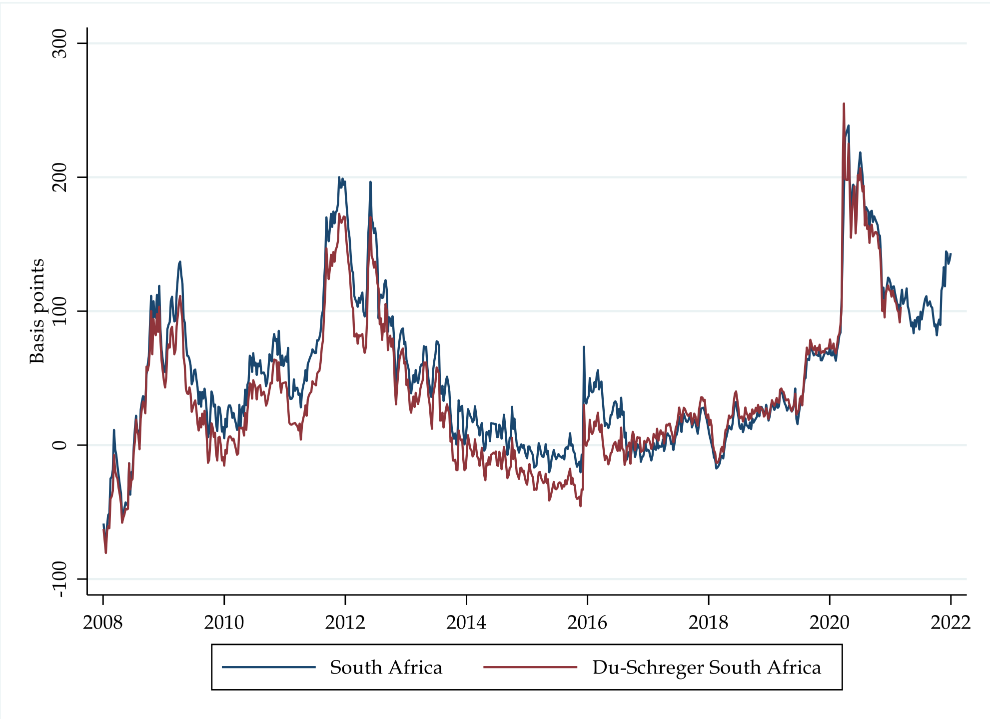
However, given that the FX forward market is generally illiquid past the 1-year tenor, there may be mispricing errors in the forward premium of longer maturities owing to the lack of liquidity in that market. To allow for this, I follow market convention as in Du et al. (2018) and calculate the 5-year forward premium as

$$\rho_t = IRS_t^{ZAR} + CCB_t^{ZAR-USD} - IRS_t^{USD}$$

(2.6)

Where IRS_t^{ZAR} is the 5-year ZARUSD fixed-for-float interest rate swap, $CCB_t^{ZAR-USD}$ is the 5-year ZAR-USD cross-currency basis swap, and IRS_t^{USD} is the 5-year USD fixed-for-float interest rate swap. I use Bloomberg data for the zero-coupon sovereign yields and swap rates.

Figure 2.1: LCCS estimates with Du-Schreger measure

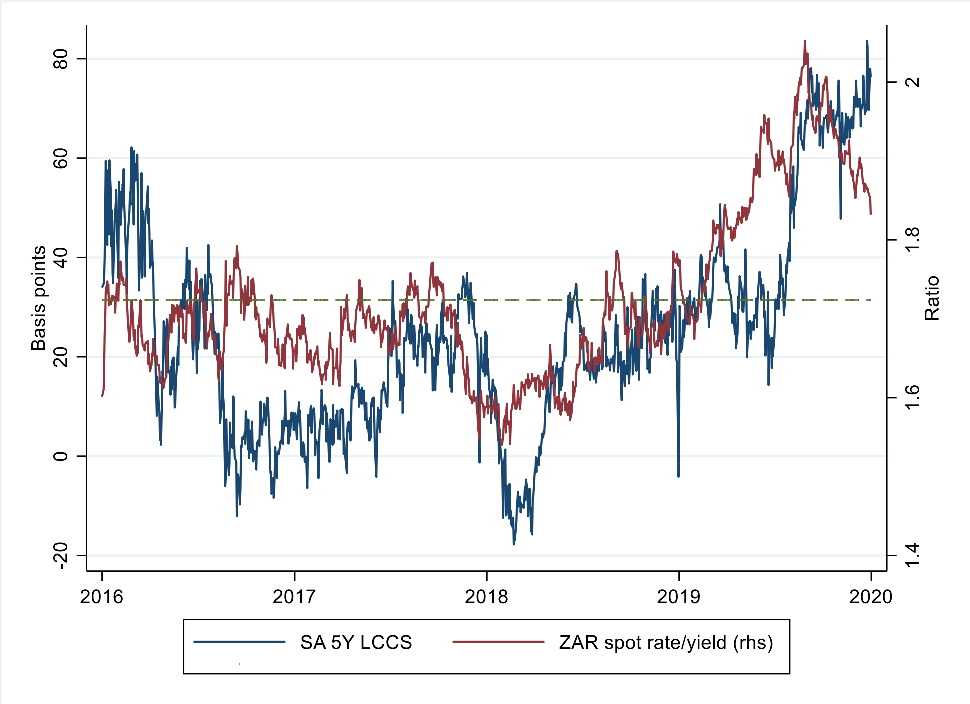


Source: authors' calculations, Du-Schreger (2021)

Figure 2.1 depicts the local currency credit spread I estimate as well as the measure as calculated by Du-Schreger in their updated data appendix. My estimate appears to approximate the Du-Schreger measure well, with very similar levels and strong co-movement between the two series throughout the period under review. There are a few divergences where my estimate spikes relative the Du-Schreger measure; this is explained by spikes in the underlying data, i.e. in the South African interest rate swap or the zero-coupon yield. Notably, the co-movement between the two series remains intact even during periods of market stress, as in the Covid-19 induced market shock of early 2020. Therefore, to the extent that the Du-Schreger estimate is a good proxy for the local currency credit risk of an EM, my replicated measure is also robust.

The LCCS appears to be a good measure of local-currency sovereign risk for South Africa. In particular, the LCCS reflects a downward trend in the pricing of sovereign risk from 2012 when South Africa was first included in the World Government Bond Index and foreign investors started increasing their exposure to South African government bonds. It also reflects the steady upward trend in sovereign risk from late 2015, when fiscal risk became a dominant concern among investors in South African government bonds. Moreover, the trend of the LCCS broadly tracks the South African financial cycle during the period under review (Farrell & Kemp, 2020), in line with the expectation that risk premia would increase amid tightening domestic financial conditions. The LCCS therefore captures domestic fiscal developments that would be relevant to the sovereign risk of local-currency denominated debt during the period under review.

Figure 2.2: South Africa's LCCS and ratio of spot FX rate to sovereign yield



Source: author's calculations, Bloomberg Finance LP

One important consequence of extending the sample period in this study relative to that of Du-Schreger is the greater variance in levels observed of the LCCS. Specifically, I note that the LCCS can be negative, particularly in periods when the EM's spot exchange rate is strong and thus low relative to the local currency nominal yield. For instance, Figure 2.2 shows that the LCCS was negative when the ratio of the spot exchange rate to the 5-year zero coupon yield was lower than the average for the period. A negative credit risk premium for an EM is difficult to interpret and is not addressed in Du-Schreger (2016). Given this challenge, using changes in the LCCS to analyse the evolution of the sovereign risk spread over time as opposed to its level would arguably be more reasonable[5].

2.4 Comparing the LCCS with market measures of sovereign risk

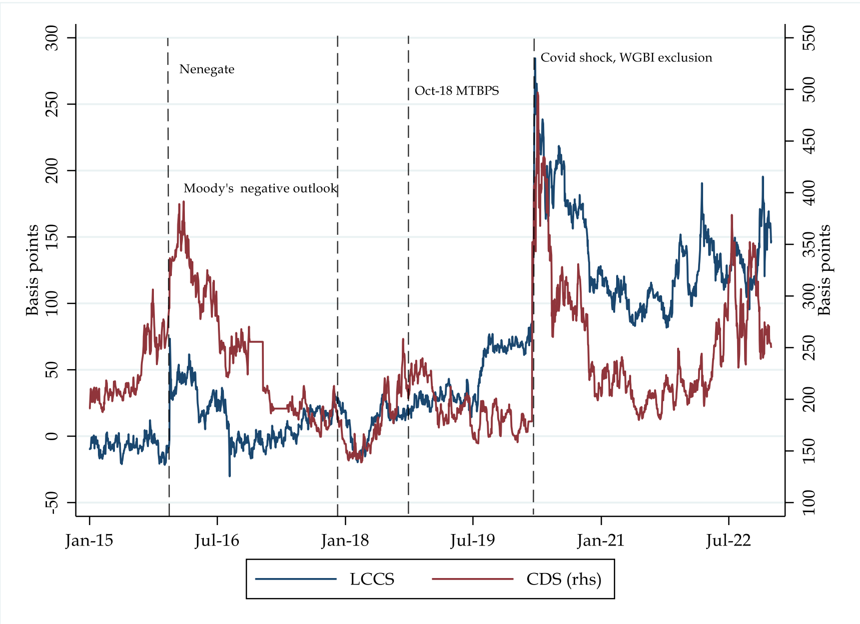
Having established that this study's LCCS is a good replication of Du-Schreger and also a good measure of local-currency sovereign risk, I now consider how local-

[5] For analyses where negative values are more prohibitive, there are modifications that can be made to achieve a strictly positive data series. For instance, in their multi-country study of financial conditions, Adrian et al. (2018) standardise financial conditions indices by adding a country-common positive constant for the indices to have strictly positive values, allowing them to use log values for the indices.

currency credit risk compares with market-based measures of sovereign risk. Given that market measures of sovereign risk are still based on foreign-currency denominated debt despite the growth of EM local-currency bond markets, I compare my LCCS estimate to widely-observed foreign-currency measures of sovereign risk, specifically the CDS spread and the EMBI+ spread.

As noted in Du-Schreger, a key difference between the LCCS on one hand and both the CDS spread and the EMBI+ spread on the other is that the latter are measures of default risk on USD-denominated debt, which Amstad et al. (2020) show has different default drivers than local-currency-denominated debt, whereas the LCCS measures the credit risk on local-currency denominated debt. Furthermore, there is evidence that CDS spreads reflect global rather than domestic factors to a large extent (Longstaff et al., 2011). Despite the potential significance of this key difference, my LCCS estimate should broadly move in line with both the CDS spread and EMBI+ spread on domestic or global developments that would affect the willingness or ability of the sovereign to service its debt. For instance, developments that may reduce fiscal revenues or increase debt service costs as a proportion of fiscal revenues would erode the capacity of the sovereign to fulfil its debt obligations, regardless of currency of denomination.

Figure 2.3: LCCS estimates with market spreads



Sources: author's calculations, Bloomberg Finance LP

Figure 2.3 shows the co-movement of the LCCS with the CDS spread and EMBI+ spread, respectively. I focus on the period January 2015 to December 2021 where sovereign risk underwent significant changes in response to several fiscal and political events that had a notable impact on financial markets. Notably, the range of the CDS and EMBI+ spreads are 139 to 497 basis points and 186 to 712 basis points respectively, while the LCCS has a lower range of -30 to 285 basis points. This is as expected, as the risk of default by a sovereign in its own currency would be lower than the default risk on foreign-currency denominated debt, as also found in Du-Schreger. Additionally, as illustrated by the highlighting of key developments during the period under review, the LCCS reflects these developments in the expected manner, such as the gradual increase in the risk spread following the downgrade in South Africa's rating outlook to negative by the credit rating agency Moody's in November 2017.

The LCCS generally exhibits the same trend as both measures, though the correlation differs between the CDS and EMBI+ spread. The LCCS spikes in line with large increases in both the CDS and EMBI+ spread, with the degree of volatility more comparable to the EMBI+ spread than the CDS spread. In particular, the rise in sovereign risk following the ousting of the Minister of Finance in December 2015 ("Nenegate") as measured by the LCCS was more consistent with the increase in the

EMBI+ spread, while the CDS spread rose to a larger extent and remained elevated for longer[6]. The partial post-Covid shock recovery in the LCCS from its peak in late March 2020 is also more in line with the EMBI+ which also remained higher than its pre-Covid levels, as opposed to the CDS spread which broadly recovered to pre-Covid levels. This partial recovery in the LCCS is in line with the deterioration in South Africa's fiscal metrics following the onset of the Covid-19 pandemic, including an increase in the government debt burden and a steeper sovereign yield curve.

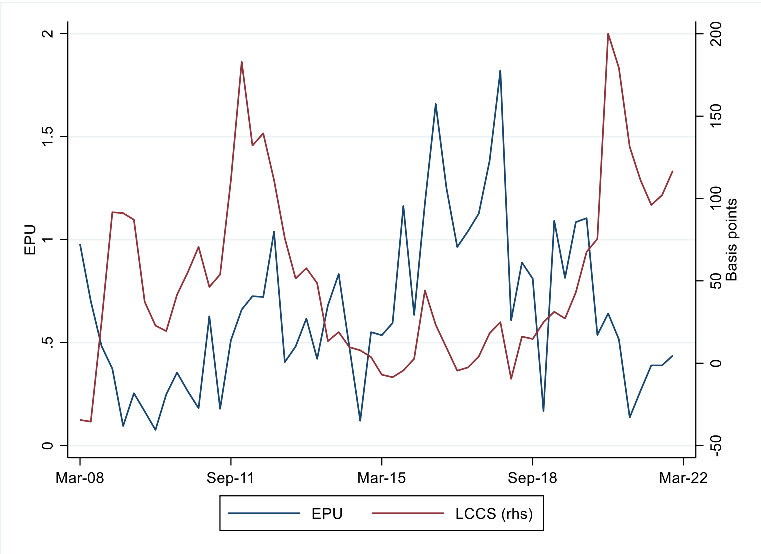
While the CDS and EMBI+ spreads exhibit strong co-movement with the LCCS on domestic developments directly affecting sovereign risk, there are some notable instances when these market-based measures diverge from the LCCS. Both the CDS and EMBI+ spreads surge in September 2015, a period during which EMs sold off amid growing risk aversion following China's devaluation of the Renminbi and growing concerns about that country's economic outlook. By contrast, the LCCS remains steady during the period and only surges in December 2015. The CDS and EMBI+ spreads diverge again from the LCCS in early August 2018. During this period, there were no notable developments that would affect the sovereign's willingness or ability to service its debt, however global risk sentiment had turned against EMs as Turkey's currency crisis worsened. Thus, while South Africa's market-based measures of sovereign risk are also driven by global developments that are not directly linked to fiscal risk, the LCCS is less responsive to such developments and is therefore a more appropriate measure of domestic sovereign risk. For these reasons, the LCCS is a more appropriate measure of credit risk on local-currency debt than market-based measures.

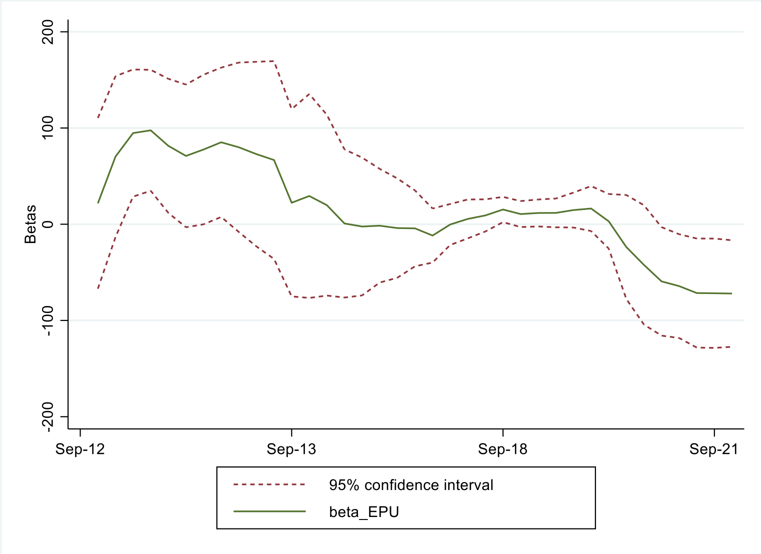
I also consider the co-movement of the LCCS with measures of fiscal policy that are not market-based. The Economic Policy Uncertainty (EPU) index, first developed for the US (Baker et al., 2016), reflects the frequency of mentions of words associated with regulatory, fiscal and monetary policies in leading newspapers. It also reflects major political developments such as presidential elections and the 9/11 terror attacks for

[6] The increased sovereign risk following Nenegate is also consistent with higher measures of systemic risk among South Africa's largest banks during this period (Chatterjee & Sing, 2021)

the US. I obtain the index for South Africa from FRED (Ahir et al., 2025), available at a quarterly frequency. I run rolling windows bivariate regressions to observe the relationship between the LCCS estimates and EPU index over time, where the dependent variable is the LCCS and each window is 20 quarters. The relationship between the LCCS and EPU index is positive initially, but has changed over time, becoming negative by the end of the review period (Figure 2.4). In the latter period where the relationship is negative, the LCCS is elevated and volatile amid a post-Covid deterioration in the fiscal position, while the EPU index is falling and arguably not reflecting developments in the sovereign risk profile. The significance of the beta estimates also change over time, going from statistically significant to insignificant by the end of the sample period.

Figure 2.4: LCCS estimates with the South African EPU index





Source: author's calculations, FRED

2.5 Application of the LCCS: an analysis of cousin risks

The local currency risk spread allows me to examine the role of sovereign risk as a driver of changes in bond yields. Crucially, it also allows me to explore the interaction between sovereign risk and an important risk that is relevant for investors in EM local currency bond market but not for hard-currency bondholders, namely FX risk.

FX risk exposure is an important consideration for global investors as it affects their expected returns from holding EM local currency bonds. In their decomposition of nominal Mexican government bond yields, Domowitz et al. (1998) define the nominal currency risk premium as the compensation investors require to hold peso-denominated bonds rather than USD-denominated bonds, exposing themselves to real FX risk and the additional inflation risk associated with EM economies. Gadanecz et al. (2018) define FX risk as the expected depreciation and volatility of the exchange rate, and find that higher implied FX volatility is associated with higher EM local currency bond yields.

How does the FX rate affect sovereign bond yields? Hofmann et al. (2022) propose a portfolio choice model that captures the impact of FX movements on the risk-taking capacity of global investors, where a USD depreciation increases risk capacity and induces investors to increase their holdings of EM local-currency bonds. Because global investors are assumed to evaluate portfolio gains and losses in USD, a broad-based USD appreciation is expected to have a larger impact on a given EM local currency bond market than the equivalent percentage change in the bilateral FX rate. Indeed, they find empirical evidence that a USD appreciation leads to EM bond outflows and wider yield spreads, with a broad-based USD appreciation having a more pronounced impact than a similar change in the bilateral exchange rate (BER).

FX risk is also significant as a driver of EM bond yields due to its potential co-variance with sovereign risk. FX risk may have an amplifying effect on sovereign credit risk as FX movements might affect a sovereign's willingness or ability to service its debt, whether the debt is local- or foreign-currency denominated. Garcia and Lowenkron (2004) analyse the co-movement between currency and country risk premia among EMs, which they refer to as "cousin risks", and find a positive correlation between the two such that increasing country risk is associated with increasing currency risk. Similarly, Della Corte et al. (2022) show that CDS spreads are associated with excess currency returns for a group of countries, providing evidence of a positive co-variance between sovereign and currency risk.

However, no study has considered the existence of a cousin-risk phenomenon using local-currency credit spreads yet. Indeed, Della Corte et al. (2022) note that much of the covariance between CDS spreads and currency returns is determined by the global component of CDS spreads and not local components, such that there is currently no evidence in the literature of a relationship between FX and sovereign risk on local currency-denominated debt.

In this section, I use the LCCS to empirically assess the role of sovereign risk as well as the cousin-risk phenomenon in South African nominal bond yields. As a point of departure, I consider Hofmann et al. (2022) who model bond spreads as follows:

$$s_{i,t+h} - s_{i,t-1} = \alpha_{h,i} + \rho_h(L)\Delta s_{i,t-1} + \beta_h \Delta BER^s_{i,t} + \delta_h \Delta USD^s_t + \Gamma Z_{i,t-1} + \eta_{i,t+h} \tag{2.7}$$

where L is the lag operator, $\Delta BER^s_{i,t}$ is the change in the BER, ΔUSD^s_t is the is the change in an index of a basket of major nominal exchange rates against the USD and $Z_{i,t-1}$ is a set of macroeconomic control variables including the Vix index and domestic and US short-term interest rates

This approach can be adapted to specify a model for the change in the South African nominal bond yield, with the inclusion of a sovereign risk proxy as an explanatory variable. After confirming that all variables in the data set are stationary either as levels or first differences, I follow a general-to-specific approach to determine my model specification, including the number of lags required to mitigate serial correlation. I model the change in the nominal bond yield expressed in basis points as

$$\Delta y_t = \alpha + \rho(L)\Delta y_{t-1} + \beta_1 \Delta LCCS_t + \delta_1 \Delta ZAR_t + \delta_2 \Delta USD_t + \Gamma Z_{t-1} + \theta_1 LCCS_t . ZAR_t + \eta_t \tag{2.8}$$

$$\Delta y_t = \alpha + \rho(L)\Delta y_{t-1} + \beta_2 \Delta CDS_t + \delta_1 \Delta ZAR_t + \delta_2 \Delta USD_t + \Gamma Z_{t-1} + \theta_2 CDS_t . USD_t + \eta_t \tag{2.9}$$

where $\Delta LCCS_t$ is the change in the local currency credit spread expressed in basis points, ΔZAR_t is the change in the logged BER expressed as rands per dollar, ΔCDS_t is the change in the South African 5-year CDS spread and ΔUSD_t is the change in the USD index. I also include interaction terms between the sovereign risk and FX variables in each equation to observe the potential presence of a cousin risk phenomenon. The vector Z_{t-1} includes the lagged domestic and US short-term interest rates and the Vix index. L includes three lags and I also include two lags for each sovereign risk and FX variable to mitigate serial correlation. I use robust standard errors to account for potential heteroscedasticity in the standard errors.

I use the R186 to observe changes in the nominal benchmark yield. In contrast to the zero-coupon yield used in the construction of the LCCS, the yield on the R186 is that of an actively traded bond reflecting actual dynamics between the drivers of bond prices[7]. I select October 2022 as the end of the period of analysis as the R186 falls below five years to maturity after 2022, while the bond also became increasingly driven by interest rate expectations amid the monetary policy tightening cycle as the shortest-

[7] The R186 was referenced as the South African nominal benchmark bond throughout the period of analysis. For instance, see Johannesburg Securities Exchange (2014) and South African Reserve Bank (2020).

dated actively traded bond on the sovereign yield curve. Therefore, the role of other components of the R186 yield relevant to this analysis, such as sovereign risk, likely diminished.

Given empirical work that finds a significant relationship between local currency yields and foreign based-measures of sovereign risk such as CDS spreads (e.g. Gadanecz et al, 2018) as well as Hofmann et al. (2022)'s finding regarding the significance of the USD as a driver of EM local currency yield spreads, it is interesting to compare the role of local and foreign currency credit spreads as drivers of the change in the bond yield, as well as to compare the role of the BER and the USD for the South African case in particular. Estimating both equations 2.8 and 2.9 will allow me to not only undertake such comparisons, but to also analyse whether the covariance of sovereign and FX risk depends on the proxy used to observe sovereign risk and FX movements.

Aside from fundamental drivers of changes in nominal yields, liquidity risk premia can also affect bond pricing, especially relative prices between different bonds (See, for instance, Andreasen and Christensen (2020) and Favero et al. (2010)). The role of liquidity risk in bond pricing becomes even more significant following a liquidity shock during a period of market stress (See Vayanos (2004) and Acharya et al. (2013)). However, given the demonstrated effectiveness of the LCCS as an indicator of sovereign risk, especially following a domestic sovereign shock, I follow the literature and use the above model under the assumption that the liquidity risk premium is included in the residual term (Gürkaynak et al. (2007)).

2.6 Regression results

Table 2.1 presents the first set of regression results based on variations of equations 2.7 and 2.8, where the dependent variable is the change in the local currency bond yield. The regressions are run using daily data from the beginning of January 2015 to the end of October 2022.

As expected, the co-efficient on both sovereign risk premia proxies are consistently positive and highly statistically significant, such that an increase in market perceptions of sovereign credit risk is associated with an increase in the yield. A 10 basis-point (bp) increase in local-currency sovereign risk is associated with a 1.6 to 2.3 bp rise in the bond yield, while a 10 bp increase in the CDS spread is associated with an increase in the bond yield of up to 3.5 bps. Notably, I find that default risk based on offshore debt, proxied by the CDS spread, has a consistently larger impact on changes in the nominal yield than local-currency default risk.

To more directly compare the relative impact of local- and foreign-currency default risk in a "horse-race" setup, I also consider specifications that include both the LCCS and CDS variables. To address the potential multicollinearity that might arise from including both measures of sovereign risk, which are likely highly correlated, I follow Hoffmann et al. (2016) and use orthogonalised versions of these variables as controls. That is, I extract the residuals from regressing the CDS variable on the LCCS to obtain the component of the CDS that is unrelated to the LCCS – this is the orthogonalised CDS. I then use the orthogonalised CDS as the control variable in a regression where the LCCS is the sovereign risk variable of interest, and I use the orthogonalised LCCS in a regression where the CDS is the variable of interest. While both coefficients of interest are larger once orthogonalised variables are included as control variables, the coefficient on the CDS variable remains larger than the LCCS coefficient.

Given the empirical evidence that CDS spreads consist more of a global component than the domestic sovereign risk component (Longstaff et al., 2011), the consistently larger size of the CDS coefficient relative to the LCCS coefficient might suggest that changes in the domestic sovereign yield are more sensitive to global risk factors than domestic sovereign risk. In line with this, the coefficient on the Vix index, a variable meant to control for global risk appetite, is significant in the LCCS model specification but becomes insignificant when the CDS is included in the regression. I also note that the coefficient on the Vix index is consistently small, even in those specifications where it is significant, while the R^2 on the regressions excluding the CDS spread are notably smaller than those including this regressor, suggesting that the Vix index is an inefficient proxy for global risk appetite.

To address this potential impact of global factors, I include specifications which control for the global component of EM CDS spreads, such that the CDS variable more directly reflects the domestic component of the foreign-currency default risk measure. Specifically, I extract the principal components of the CDS spreads of six EMs[8] for the period under review. The first principial component accounts for 80 percent of the variation in CDS spreads, reflecting a high level of commonality among EM CDS spreads. When I include the first component as a control variable, the coefficients on the CDS variable remain consistently significant. While they become more comparable in size to the LCCS coefficients, the CDS variable remains a bigger driver of local-currency nominal yields than the LCCS.

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[8] The EMs used in the principal-component analysis include Brazil, Chile, Colombia, Indonesia, Mexico and South Africa. The group of EM peers includes no European countries as the liquid CDS contracts for these countries are for their Euro-denominated debt rather than USD-denominated debt.

Table 2.1: Initial regression results

	(1a)	(1b)	(1c)	(1d)	(1e)	(2a)	(2b)	(2c)	(2d)	(2e)	(3a)	(3b)	(3c)	(3d)	(3e)
LC yield (t-1)	-2.60 ***	-2.45 ***	-2.97 ***	-2.89 ***	-3.04 ***	-2.33 ***	-2.55 ***	-2.68 ***	-2.66 ***	-2.79 ***	-2.78 ***	-2.53 ***	-3.05 ***	-2.95 ***	-3.09 ***
	(0.44)	(0.46)	(0.49)	(0.49)	(0.49)	(0.48)	(0.49)	(0.50)	(0.52)	(0.52)	(0.45)	(0.47)	(0.49)	(0.50)	(0.50)
LCCS (diff)	0.16 ***			0.21 ***		0.23 ***			0.26 ***		0.17 ***			0.21 ***	
	(0.03)			(0.03)		(0.03)			(0.03)		(0.03)			(0.03)	
CDS (diff)		0.33 ***	0.19 ***		0.26 ***		0.47 ***	0.27 ***		0.35 ***		0.34 ***	0.19 ***		0.26 ***
		(0.02)	(0.03)		(0.03)		(0.02)	(0.03)		(0.04)		(0.02)	(0.03)		(0.03)
ln ZARUSD (diff)	-4.21 ***	-3.14 ***	-2.94 ***	-2.91 ***	-2.92 ***						-5.35 ***	-3.95 ***	-3.72 ***	-3.68 ***	-3.68 ***
	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)						(0.20)	(0.22)	(0.22)	(0.22)	(0.22)
ln USD (diff)						6.30 ***	3.72 ***	3.02 ***	2.99 ***	3.06 ***	7.63 ***	5.29 ***	4.55 ***	4.54 ***	4.61 ***
						(0.47)	(0.45)	(0.45)	(0.44)	(0.45)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)
Vix (t-1)	0.08 ***	0.04	0.03	0.03	0.03	0.07 **	0.02	0.00	-0.01	-0.01	0.09 ***	0.04	0.03	0.04	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
US Libor (t-1)	0.05	-0.13	0.01	0.13	0.21	0.06	0.01	0.35	0.44	0.52 *	0.06	-0.23	0.07	0.17	0.24
	(0.23)	(0.26)	(0.26)	(0.26)	(0.26)	(0.25)	(0.25)	(0.29)	(0.29)	(0.29)	(0.23)	(0.27)	(0.28)	(0.28)	(0.28)
SA Jibar (t-1)	0.50	1.10 ***	1.08 ***	0.70 **	0.62 *	0.36	0.89 ***	0.69 ***	0.49	0.39	0.45	1.08 ***	1.15 ***	0.74 **	0.66 *
	(0.33)	(0.26)	(0.26)	(0.33)	(0.33)	(0.37)	(0.23)	(0.23)	(0.36)	(0.36)	(0.34)	(0.27)	(0.27)	(0.35)	(0.35)
CDS*PC1 (diff)			6.33 ***	10.08 ***	6.51 ***			8.70 ***	14.16 ***	8.84 ***			6.75 ***	10.57 ***	6.88 ***
			(1.08)	(0.73)	(1.07)			(1.14)	(0.72)	(1.13)			(1.09)	(0.72)	(1.08)
CDS_orth (diff)				0.18 ***					0.26 ***					0.18 ***	
				(0.03)					(0.03)					(0.03)	
LCCS_orth (diff)					0.17 ***					0.20 ***					0.17 ***
					(0.03)					(0.03)					(0.03)
N	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
R^2	0.34	0.38	0.4	0.41	0.41	0.17	0.3	0.32	0.34	0.34	0.33	0.38	0.39	0.41	0.41

Standardised beta coefficients; Standard errors in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

In terms of FX drivers, I find that the ZARUSD has a consistently strong and highly statistically significant impact on changes in the bond yield, such that a 1 percent appreciation of the ZARUSD is associated with a 2.9 to 4.2 basis-point decrease in the nominal yield. Consistent with Hofmann et al. (2022)'s finding regarding the USD, changes in the USD index are found to have a larger association with movements in the bond yield relative to the bilateral FX rate, with a 1 percent appreciation in the USD associated with a 3 to 6.3 bp increase in the nominal yield. However, I find that the coefficients on the sovereign risk variables become much larger in specifications that use the USD as a proxy for FX risk, while these specifications also have lower R^2 values, suggesting that the USD variable insufficiently controls for FX effects on bond yields.

To directly compare the impact of the bilateral and broad-based measures of FX risk, I also construct orthogonalised ZARUSD and USD variables. When I include both orthogonalised variables in a joint regression, the sovereign risk coefficients and R^2 values are comparable in size to those in the ZARUSD specifications. I confirm the finding that changes in the broad-based USD are a bigger driver of changes in the domestic bond yield than the BER. Furthermore, the impact of both the ZARUSD and the USD on changes in the nominal yield is larger, such that a 1% appreciation of the ZARUSD is associated with a 3.7 to 5.4 bp decrease in the nominal yield while a 1% appreciation of the USD is associated with a rise in the nominal yield of up to 7.6 bps.

Taken together, the findings regarding both sovereign risk and FX drivers suggest that global factors are bigger drivers of changes in South African local-currency bond yields than domestic factors. That is, market-based measures of default risk on offshore debt have a stronger association with the evolution of the nominal yield than a local-currency credit spread which is less affected by global factors, while changes in broad-based USD strength are also more significant for bond yields than changes in the ZARUSD. This is the case even when market risk aversion (the Vix index) and the common component in EM CDS spreads are controlled for.

While the choice of FX proxy affects the size of the sovereign risk coefficients, it is notable that the choice of sovereign risk proxy also affects the size of the FX variable coefficients. In particular, specifications which use the LCCS as the only proxy for sovereign risk (columns 1a and 3a) show a larger impact of a ZARUSD appreciation on the nominal yield than those which include the CDS variable. The absolute value of the ZARUSD coefficient declines further when the EM CDS first principal component is controlled for. Even in those regressions where only the USD is used as a FX proxy, the use of the LCCS as a sovereign risk measure results in the FX variable having a larger impact on the nominal yield (columns 2a and 3a). By contrast, FX proxy coefficients do not vary much in regressions with the CDS as the variable of interest when the LCCS and EM CDS principal component are included. This suggests that there is some interaction between the sovereign risk and FX variables, a cousin risk phenomenon, that varies depending on whether domestic variables i.e. the LCCS and ZARUSD or more global variables i.e. the CDS and USD are observed.

In order to explore the covariance between sovereign and FX risk, I run another set of regressions including interaction terms as in equations 2.7 and 2.8 above, reported in Table 2.2. In these regressions I jointly include the ZARUSD and USD in all regressions as the consistency of the ZARUSD coefficients in Table 2.1 suggest these variables are independent of each other. The LCCS and CDS coefficients remain statistically significant and of comparable size to the baseline regressions when I include the interaction terms for sovereign and FX risk. The impact of the ZARUSD and USD variables on changes in the nominal yield are also robust to the inclusion of interaction terms. The direction and degree of impact suggested by the interaction terms, however, are unexpected. The interactions between the ZARUSD and both the LCCS and CDS variables are positive and all significant at least at the 10% level, such that sovereign risk is associated with a larger increase in the nominal yield when the ZARUSD is appreciating. The interaction terms are larger than the level LCCS and CDS coefficients, respectively, suggesting that when the ZARUSD depreciates by 1% then LCCS and CDS cushion the increase in the nominal yield by 1.2 – 2.1. bps and 0.4 – 0.9 bps, respectively. Thus, contrary to mechanisms such as the original sin redux as described by Hofmann et al. (2016), sovereign and FX risk are found not to amplify but to partially offset each other. Notably, this cushioning effect of sovereign risk on the ZARUSD is more pronounced with regard to the LCCS than CDS.

In line with the interaction between the domestic proxies, i.e. the ZARUSD and LCCS, the interaction between the global proxies for sovereign and FX risk, i.e. USD and CDS is also larger and statistically significant, while the LCCS-USD interaction is not. Contrary to the unexpected signs of the ZARUSD interactions, the CDS-USD interaction carries the expected positive sign such that sovereign risk is associated with a larger increase in the nominal yield when the USD is appreciating. This compounding effect is consistent with Hofmann et al. (2022)'s risk taking channel, in which a broad-based appreciation of the USD reduces the risk-taking capacity of global investors and widens risk spreads. As with the LCCS-ZARUSD interaction, this cousin-risk phenomenon is economically large, such that an increase in the CDS spread is associated with a 2.3 – 2.5 bp larger increase in the nominal yield when the USD appreciates by 1%.

The relative sizes of the interaction terms confirm the finding regarding the relative impact of domestic and global factors in driving changes in South African nominal bond yields. Just as the global proxies for sovereign and FX risk are consistently bigger drivers of changes in the nominal yield, so is the interaction between the global proxies relative to the domestic proxies. Interestingly, while the LCCS and the local currency unit exhibit a negative cousin-risk phenomenon such that changes in sovereign risk cushion the full impact of a ZARUSD depreciation on yields, the impact of a USD appreciation on yields is compounded by a further increase in the CDS spread. These findings demonstrate the usefulness of measures such as the LCCS which allow us to distinguish between domestic and global measures of risk embedded in local-currency nominal yields.

Several questions arise from the above findings regarding the role of domestic and global factors, as well as sovereign and FX risk respectively in the evolution of

Table: 2.2: Regression results with interaction terms

	(4a)	(4b)	(4c)	(4d)	(4e)	(5a)	(5b)	(5c)	(5d)	(5e)
LC yield (t-1)	-2.46 ***	-2.70 ***	-2.47 ***	-3.01 ***	-3.04 ***	-2.78 ***	-2.95 ***	-2.54 ***	-3.06 ***	-3.12 ***
	(0.44)	(0.49)	(0.46)	(0.49)	(0.50)	(0.45)	(0.50)	(0.47)	(0.49)	(0.50)
LCCS (diff)	0.36 ***	0.32 ***				0.17 ***	0.21 ***			
	(0.03)	(0.03)				(0.03)	(0.03)			
CDS (diff)			0.39 ***	0.25 ***	0.29 ***			0.34 ***	0.17 ***	0.24 ***
			(0.02)	(0.04)	(0.04)			(0.02)	(0.03)	(0.03)
ln ZARUSD (diff)	-4.85 ***	-3.61 ***	-3.83 ***	-3.68 ***	-3.67 ***	-5.35 ***	-3.68 ***	-3.98 ***	-3.76 ***	-3.72 ***
	(0.20)	(0.21)	(0.22)	(0.22)	(0.22)	(0.20)	(0.22)	(0.22)	(0.22)	(0.22)
ln USD (diff)	7.29 ***	4.75 ***	5.22 ***	4.60 ***	4.64 ***	7.57 ***	4.55 ***	5.34 ***	4.59 ***	4.66 ***
	(0.52)	(0.53)	(0.54)	(0.54)	(0.54)	(0.55)	(0.54)	(0.54)	(0.54)	(0.54)
ZARUSD*LCCS (diff)	2.46 ***	1.53 ***								
	(0.21)	(0.21)								
ZARUSD*CDS (diff)			1.55 ***	1.15 ***	0.64 **					
			(0.29)	(0.30)	(0.31)					
USD*LCCS (diff)						-0.39	0.03			
						(0.64)	(0.61)			
USD*CDS (diff)								1.61 *	2.33 **	2.53 ***
								(0.95)	(0.95)	(0.94)
Vix (t-1)	0.09 ***	0.04	0.04	0.03	0.04	0.09 ***	0.04	0.05	0.03	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
US Libor (t-1)	0.05	0.13	-0.23	0.06	0.22	0.06	0.17	-0.23	0.08	0.24
	(0.22)	(0.27)	(0.27)	(0.28)	(0.28)	(0.23)	(0.28)	(0.27)	(0.28)	(0.28)
SA Jibar (t-1)	0.43	0.68 **	1.05 ***	1.14 ***	0.64 *	0.45	0.74 **	1.08 ***	1.15 ***	0.69 **
	(0.33)	(0.34)	(0.26)	(0.27)	(0.35)	(0.34)	(0.35)	(0.27)	(0.27)	(0.35)
CDS*PC1 (diff)		9.27 ***		5.61 ***	6.21 ***		10.57 ***		7.08 ***	7.24 ***
		(0.74)		(1.12)	(1.12)		(0.72)		(1.09)	(1.08)
CDS_orth (diff)		0.13 ***					0.18 ***			
		(0.03)					(0.03)			
LCCS_orth (diff)					0.15 ***					0.17 ***
					(0.03)					(0.03)
N	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
R^2	0.37	0.42	0.39	0.4	0.41	0.33	0.41	0.38	0.39	0.41

Standardised beta coefficients; Standard errors in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

nominal bond yields. One might be whether the above results are consistent across the period of review considered, or whether they exhibit a time-varying nature. Such a question is made more relevant by the rapid appreciation of the USD in the post-Covid era amid heightened risk aversion in the immediate aftermath of the pandemic and subsequently in response to the US Federal Reserve (Fed)'s aggressive monetary policy tightening cycle.

To explore the potential time-variation of my results, I run the same regressions on two distinct subsamples, with sample 1 running from January 2015 to December 2019, and sample 2 running from January 2020 to October 2022 (Tables 2.3 to 2.6). Comparing the results of the two subsamples, I find that the impact of both sovereign and FX risk on nominal yields do indeed exhibit a time-varying nature. The coefficients on the sovereign risk variables are much larger in subsample 1, in the period before 2020, than in subsample 2 and the full sample. Indeed, while a 10 bp rise in the LCCS is associated with a 6 to 8 bp increase in the nominal yield and a 10 bp increase in the CDS spread with a rise in the nominal yield of up to 9 bps in subsample 1, both proxies of sovereign risk are statistically and economically insignificant drivers of nominal yield changes after 2019. Furthermore, in contrast with the findings from the full sample in which the CDS spread is consistently more significant for the nominal yield than the LCCS, the coefficient on the LCCS is at least equal to the CDS coefficient in the first subsample, such that local-currency sovereign risk is a more significant driver of nominal yield changes in this period than in the full sample.

Coefficients on the FX proxies, too, point to a variation in the relationship between FX drivers and nominal yields over time. Prior to 2020, changes in the ZARUSD had a larger impact on changes in nominal yields than in the subsequent period or the full review period; the ZARUSD coefficients for the better-specified models range from 3.1 to 4.1 bps in subsample 1 compared with 2.2 to 2.7 bps in subsample 2. The reverse is true of the USD, which became a larger driver of changes in domestic nominal yields in the second subsample.

Taken together, these findings suggest that the results from the full sample are driven largely by developments in the period starting in 2020 than in the full period under review. Specifically, local factors such as the LCCS and the BER were more important in explaining changes in nominal yields than global factors were during the earlier period, and their significance diminished after 2019 as global factors became more dominant factors. During this second period, the USD in particular has emerged as exhibiting the strongest association with evolutions in domestic nominal yields, while sovereign risk has become a less significant factor. Given the considerable strengthening of the USD in the post-Covid era amid heightened risk aversion and the subsequent aggressive monetary policy tightening undertaken by the Fed, the increased relevance of changes in the USD for EM local-currency bond markets makes sense.

I also consider whether the interaction between sovereign and FX risk exhibits time-varying characteristics. The results for subsample 1 have a notable difference from the full sample: while the LCCS-ZARUSD interaction in the full sample carried a positive sign, the LCCS-ZARUSD coefficient for subsample 1 is negative as might be expected, such that the impact of an increase in sovereign risk on changes in the nominal yield is compounded when the ZARUSD is also depreciating. The other interaction terms are not significant in this period, such that the cousin-risk phenomenon only manifests among the local factors. In subsample 2, the LCCS-ZARUSD interaction is strongly significant and large, driving the overall positive sign found in the full sample. While the significance of interactions with the USD for both the LCCS and CDS are statistically weaker than the full sample, these interactions are more significant than in subsample 1. Notably, the coefficients for the LCCS-USD interaction are negative in this period, suggesting that local-currency sovereign risk drives increases in the nominal yield less when the USD is appreciating. This is in line with this period's LCCS-ZARUSD interaction, supporting the finding that local-currency sovereign risk cushions the impact of FX changes.

Another question could be the extent to which the importance of global factors is affected by the degree of foreign-investor participation in an EM's bond market. Given that concepts such as original sin redux model the impact of FX risk and global risk sentiment on EM bond yields through the channel of the global investor's balance sheet, a crucial question would be whether global factors such as the USD and CDS spreads have the same impact on EMs with varying degrees of investor participation and thus hard-currency balance sheet funding of their local-currency bond markets. Such an exploration would be a fruitful avenue of further research.

2.7 Conclusion

Recent sharp increases in government debt burdens and the subsequent rapid tightening of global financial conditions has increased interest in EM sovereign default risk. The fact that major EMs now have most of their debt portfolios denominated in their local currencies means that a measure of a sovereign's risk of default should reflect this. This chapter assesses such a measure for South Africa, and shows that the Du-Schreger LCCS captures the evolution in key developments relevant to domestic sovereign risk, particularly regarding fiscal policy. The LCCS is also a more appropriate measure for South Africa than market-based measures of sovereign risk, as these foreign-currency based sovereign risk measures are shown to respond to external developments that are not directly related to domestic fiscal risk.

The LCCS is shown to be useful in an analysis of the drivers of domestic nominal yields in South Africa. Comparing domestic drivers such as the LCCS and the bilateral ZARUSD FX rate with global factors such as the CDS spread and the USD, global factors are shown to have become more significant drivers of changes in nominal yields since 2020, particularly the USD. There is also some evidence of covariance between sovereign and FX risk such that their interaction affects changes in nominal yields.

More broadly, as large EMs such as South Africa continue to rely more on their local-currency bond markets for their funding requirements as sovereign risk increases, such a measure of local-currency risk will become even more appropriate for understanding default risk among these issuers.

2.8 Annexure Chapter 2

Table 2.3: Initial regression results, 2015-2019

	(1a)	(1b)	(1c)	(1d)	(1e)	(2a)	(2b)	(2c)	(2d)	(2e)	(3a)	(3b)	(3c)	(3d)	(3e)
LC yield (t-1)	-1.61 ***	-2.33 ***	-2.31 ***	-2.21 ***	-2.18 ***	-1.06 *	-3.12 ***	-3.18 ***	-3.01 ***	-2.99 ***	-1.94 ***	-2.39 ***	-2.45 ***	-2.38 ***	-2.35 ***
	(0.54)	(0.63)	(0.64)	(0.59)	(0.59)	(0.55)	(0.70)	(0.70)	(0.65)	(0.65)	(0.55)	(0.64)	(0.65)	(0.60)	(0.60)
LCCS (diff)	0.58 ***			0.70 ***		0.75 ***			0.83 ***		0.59 ***			0.71 ***	
	(0.04)			(0.04)		(0.05)			(0.04)		(0.04)			(0.04)	
CDS (diff)		0.38 ***	0.46 ***		0.69 ***		0.68 ***	0.67 ***		0.92 ***		0.41 ***	0.47 ***		0.71 ***
		(0.03)	(0.04)		(0.04)		(0.03)	(0.05)		(0.05)		(0.03)	(0.04)		(0.04)
ln ZARUSD (diff)	-3.85 ***	-3.11 ***	-3.23 ***	-3.05 ***	-3.05 ***						-5.02 ***	-3.96 ***	-4.08 ***	-3.83 ***	-3.84 ***
	(0.15)	(0.17)	(0.18)	(0.17)	(0.17)						(0.19)	(0.23)	(0.23)	(0.21)	(0.21)
ln USD (diff)						4.54 ***	2.46 ***	2.45 ***	2.55 ***	2.55 ***	5.26 ***	3.83 ***	4.11 ***	4.12 ***	4.14 ***
						(0.40)	(0.47)	(0.48)	(0.45)	(0.45)	(0.52)	(0.55)	(0.56)	(0.52)	(0.52)
Vix (t-1)	-0.10 **	-0.12 **	-0.12 **	-0.13 ***	-0.13 ***	-0.12 ***	-0.19 ***	-0.21 ***	-0.21 ***	-0.21 ***	-0.09 **	-0.10 **	-0.11 **	-0.12 **	-0.12 **
	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
US Libor (t-1)	-0.11	0.36	0.41	0.4	0.4	-0.06	0.87 **	1.13 ***	1.05 ***	1.03 ***	-0.03	0.21	0.33	0.36	0.34
	(0.24)	(0.38)	(0.39)	(0.36)	(0.36)	(0.29)	(0.34)	(0.41)	(0.39)	(0.39)	(0.25)	(0.38)	(0.40)	(0.37)	(0.37)
SA Jibar (t-1)	0.28	0.67	0.68	0.58	0.6	-0.05	0.58	0.64	0.63	0.65	0.1	0.67	0.71	0.48	0.51
	(0.55)	(0.55)	(0.55)	(0.55)	(0.55)	(0.67)	(0.62)	(0.62)	(0.60)	(0.60)	(0.56)	(0.56)	(0.56)	(0.55)	(0.55)
CDS*PC1 (diff)			-4.21 ***	5.25 ***	-3.88 ***			0.01	13.47 ***	0.02			-3.39 **	6.43 ***	-3.27 **
			(1.46)	(1.04)	(1.36)			(1.62)	(1.05)	(1.51)			(1.49)	(1.04)	(1.39)
CDS_orth (diff)				0.42 ***					0.61 ***					0.44 ***	
				(0.04)					(0.04)					(0.04)	
LCCS_orth (diff)					0.55 ***					0.62 ***					0.55 ***
					(0.04)					(0.04)					(0.04)
N	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
R^2	0.5	0.47	0.47	0.55	0.55	0.26	0.34	0.34	0.44	0.44	0.48	0.46	0.46	0.54	0.54

Standardised beta coefficients; Standard errors in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.4: Initial regression results, 2020-2022

	(1a)	(1b)	(1c)	(1d)	(1e)	(2a)	(2b)	(2c)	(2d)	(2e)	(3a)	(3b)	(3c)	(3d)	(3e)
LC yield (t-1)	-3.33 ***	-3.73 ***	-6.20 ***	-5.32 ***	-5.95 ***	-3.56 ***	-3.89 ***	-4.98 ***	-3.90 ***	-4.47 ***	-4.97 ***	-5.71 ***	-6.44 ***	-5.38 ***	-5.98 ***
	(0.80)	(0.77)	(0.98)	(1.02)	(1.03)	(0.89)	(0.84)	(0.98)	(1.00)	(1.00)	(0.92)	(0.91)	(0.99)	(1.03)	(1.03)
LCCS (diff)	-0.01			-0.01		-0.01			-0.02		0.00			-0.02	
	(0.04)			(0.04)		(0.05)			(0.04)		(0.04)			(0.04)	
CDS (diff)		0.31 ***	0.01		0.01		0.34 ***	0.01		0.01		0.30 ***	0.01		0.01
		(0.03)	(0.05)		(0.05)		(0.03)	(0.05)		(0.05)		(0.03)	(0.05)		(0.05)
ln ZARUSD (diff)	-4.38 ***	-2.96 ***	-2.29 ***	-2.16 ***	-2.30 ***						-5.00 ***	-3.44 ***	-2.68 ***	-2.54 ***	-2.67 ***
	(0.35)	(0.37)	(0.37)	(0.36)	(0.37)						(0.45)	(0.48)	(0.47)	(0.46)	(0.46)
ln USD (diff)						9.54 ***	6.02 ***	4.35 ***	4.51 ***	4.80 ***	11.70 ***	7.84 ***	5.84 ***	5.92 ***	6.25 ***
						(0.87)	(0.91)	(0.89)	(0.87)	(0.89)	(1.07)	(1.12)	(1.11)	(1.09)	(1.11)
Vix (t-1)	0.28 ***	0.20 ***	0.13 **	0.15 ***	0.12 **	0.23 ***	0.17 ***	0.12 **	0.14 **	0.12 **	0.28 ***	0.19 ***	0.15 ***	0.17 ***	0.14 **
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
US Libor (t-1)	1.25 *	1.76 ***	0.5	0.34	0.2	-1.48	0.07	-0.1	-0.99	-1.41	-1.42	-0.6	-0.69	-1.21	-1.62 *
	(0.74)	(0.67)	(0.68)	(0.70)	(0.71)	(0.95)	(0.84)	(0.80)	(0.87)	(0.87)	(0.92)	(0.84)	(0.80)	(0.86)	(0.86)
SA Jibar (t-1)	-0.07	0.1	1.25 *	0.91	1.06	-0.1	0.2	0.91	0.08	0.08	-0.41	-0.01	0.63	0.05	0.05
	(0.70)	(0.67)	(0.71)	(0.72)	(0.73)	(0.71)	(0.68)	(0.74)	(0.77)	(0.78)	(0.69)	(0.67)	(0.73)	(0.76)	(0.77)
CDS*PC1 (diff)			13.45 ***	13.28 ***	13.58 ***			14.24 ***	13.96 ***	14.28 ***			13.30 ***	12.99 ***	13.42 ***
			(1.66)	(1.09)	(1.67)			(1.66)	(1.05)	(1.65)			(1.65)	(1.07)	(1.64)
CDS_orth (diff)				0.00					0.01					0.00	
				(0.05)					(0.05)					(0.05)	
LCCS_orth (diff)					0.03					0.01					0.02
					(0.04)					(0.04)					(0.04)
N	735	735	735	735	735	735	735	735	735	735	735	735	735	735	735
R^2	0.29	0.34	0.41	0.43	0.41	0.27	0.33	0.39	0.42	0.4	0.32	0.36	0.42	0.44	0.43

Standardised beta coefficients; Standard errors in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.5: Regression results with interaction terms, 2015-2019

	(4a)	(4b)	(4c)	(4d)	(4e)	(5a)	(5b)	(5c)	(5d)	(5e)
LC yield (t-1)	-1.88 ***	-2.35 ***	-2.38 ***	-2.46 ***	-2.33 ***	-1.94 ***	-2.37 ***	-2.39 ***	-2.44 ***	-2.34 ***
	(0.54)	(0.60)	(0.64)	(0.65)	(0.60)	(0.55)	(0.60)	(0.64)	(0.65)	(0.60)
LCCS (diff)	0.65 ***	0.73 ***				0.60 ***	0.70 ***			
	(0.04)	(0.04)				(0.04)	(0.04)			
CDS (diff)			0.41 ***	0.48 ***	0.69 ***			0.43 ***	0.51 ***	0.71 ***
			(0.03)	(0.05)	(0.05)			(0.04)	(0.05)	(0.05)
ln ZARUSD (diff)	-5.62 ***	-4.20 ***	-3.98 ***	-4.07 ***	-3.88 ***	-5.00 ***	-3.83 ***	-3.92 ***	-4.02 ***	-3.83 ***
	(0.23)	(0.26)	(0.23)	(0.23)	(0.22)	(0.19)	(0.21)	(0.23)	(0.23)	(0.22)
ln USD (diff)	5.21 ***	4.13 ***	3.86 ***	4.10 ***	4.20 ***	4.53 ***	4.80 ***	3.77 ***	4.07 ***	4.13 ***
	(0.52)	(0.52)	(0.56)	(0.56)	(0.52)	(0.78)	(0.75)	(0.55)	(56.11)	(0.52)
ZARUSD*LCCS (diff)	-1.73 ***	-0.93 **								
	(0.38)	(0.37)								
ZARUSD*CDS (diff)			0.17	-0.13	0.54					
			(0.46)	(0.48)	(0.45)					
USD*LCCS (diff)						-1.52	1.48			
						(1.22)	(1.18)			
USD*CDS (diff)								-1.39	-2.69 *	-0.33
								(1.53)	(1.59)	(1.49)
Vix (t-1)	-0.08 **	-0.12 **	-0.10 **	-0.11 **	-0.12 **	-0.08 **	-0.12 **	-0.10 **	-0.11 **	-0.12 **
	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
US Libor (t-1)	-0.05	0.35	0.21	0.33	0.34	-0.03	0.34	0.22	0.33	0.34
	(0.24)	(0.37)	(0.38)	(0.40)	(0.37)	(0.24)	(0.37)	(0.38)	(0.40)	(0.37)
SA Jibar (t-1)	0.09	0.46	0.67	0.71	0.50	0.11	0.47	0.67	0.71	0.50
	(0.56)	(0.55)	(0.56)	(0.56)	(0.55)	(0.56)	(0.55)	(0.56)	(0.56)	(0.55)
CDS*PC1 (diff)		6.24 ***		-3.49 **	-2.85 **		6.56 ***		-4.15 ***	-3.36 **
		(1.04)		(1.53)	(1.43)		(1.04)		(1.55)	(1.45)
CDS_orth (diff)		0.42 ***					0.45 ***			
		(0.04)					(0.04)			
LCCS_orth (diff)					0.56 ***					0.55 ***
					(0.04)					(0.04)
N	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
R^2	0.49	0.54	0.46	0.46	0.54	0.48	0.54	0.46	0.46	0.54

Standardised beta coefficients; Standard errors in parentheses
*** p < 0.01; ** p < 0.05; * p < 0.1.

Table 2.6: Regression results with interaction terms, 2020-2022

	(4a)	(4b)	(4c)	(4d)	(4e)	(5a)	(5b)	(5c)	(5d)	(5e)
LC yield (t-1)	-4.90 ***	-5.44 ***	-5.65 ***	-6.44 ***	-6.03 ***	-4.64 ***	-5.22 ***	-5.74 ***	-6.48 ***	-6.06 ***
	(0.88)	(1.03)	(0.89)	(1.00)	(1.03)	(0.92)	(1.03)	(0.91)	(0.99)	(1.03)
LCCS (diff)	0.46 ***	0.15 *				0.01	-0.01			
	(0.07)	(0.08)				(0.04)	(0.04)			
CDS (diff)			0.43 ***	0.01	-0.06			0.30 ***	0.00	0.01
			(0.04)	(0.08)	(0.09)			(0.03)	(0.05)	(0.05)
ln ZARUSD (diff)	-6.10 ***	-3.49 ***	-.306 ***	-2.68 ***	-2.69 ***	-5.08 ***	-2.64 ***	-3.50 ***	-2.74 ***	-2.73 ***
	(0.45)	(0.63)	(0.47)	(0.47)	(0.47)	(0.45)	(0.46)	(0.48)	(0.47)	(0.47)
ln USD (diff)	9.73 ***	6.33 ***	7.09 ***	5.83 ***	6.30 ***	13.14 ***	6.73 ***	7.93 ***	5.93 ***	6.32 ***
	(1.05)	(1.11)	(1.12)	(1.11)	(1.11)	(1.13)	(1.18)	(1.13)	(1.10)	(1.11)
ZARUSD*LCCS (diff)	3.73 ***	1.48 **								
	(0.43)	(0.65)								
ZARUSD*CDS (diff)			2.40 ***	0.04	-0.75					
			(0.49)	(0.62)	(0.80)					
USD*LCCS (diff)						-3.86 ***	-1.76 *			
						(1.04)	(0.97)			
USD*CDS (diff)								2.39 *	2.74 **	2.55 *
								(1.37)	(1.31)	(1.31)
Vix (t-1)	0.24 ***	0.17 ***	0.18 ***	0.15 ***	0.14 **	0.27 ***	0.17 ***	0.19 ***	0.15 ***	0.14 **
	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
US Libor (t-1)	-1.11	-1.2	-0.7	-0.69	-1.64 *	-1.25	-1.14	-0.58	-0.67	-1.56 *
	(0.88)	(0.86)	(0.83)	(0.80)	(0.86)	(0.91)	(0.86)	(0.84)	(0.80)	(0.86)
SA Jibar (t-1)	-0.4	0.08	-0.09	0.64	0.06	-0.52	-0.01	0.00	0.66	0.11
	(0.65)	(0.76)	(0.66)	(0.73)	(0.77)	(0.68)	(0.76)	(0.66)	(0.73)	(0.77)
CDS*PC1 (diff)		10.87 ***		13.21 ***	15.11 ***		12.62 ***		13.40 ***	13.51 ***
		(1.42)		(2.13)	(2.43)		(1.09)		(1.64)	(1.64)
CDS_orth (diff)		-0.08					0.00			
		(0.06)					(0.05)			
LCCS_orth (diff)					0.05					0.03
					(0.05)					(0.04)
N	735	735	735	735	735	735	735	735	735	735
R^2	0.38	0.44	0.38	0.42	0.43	0.33	0.44	0.36	0.42	0.43

Standardised beta coefficients; Standard errors in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

3 Local-currency sovereign risk and emerging-market banks: the impact of government debt exposure and sovereign risk on banks

3.1 Introduction

Local currency debt markets have become a dominant source of financing for major EM governments in recent years as these economies have sought to enhance their financial stability. Sovereign debt markets, in turn, play a central role in the functioning of their domestic financial systems, with a particularly close link to the banking system (often termed the sovereign-bank nexus). Consequently, changes in sovereign risk can spill over into the banking system and potentially affect bank balance sheets, bank valuations and banking activity.

EM banks have steadily increased their holdings of sovereign debt since 2016, with the trend accelerating in 2020 following the Covid-19 related fiscal shock (Deghi et al., 2022). At the same time that the sovereign exposure of banking systems intensified, the fiscal outlooks of EM governments also deteriorated, with adverse implications for the sovereign risk outlook. Given the theoretical two-way feedback loop between sovereigns and their banking systems, known as a "doom loop" or "deadly embrace" (Farhi and Tirole, 2018) or "diabolic loop" (Brunnermeier et al., 2016), these developments have prompted questions regarding the impact of sovereign risk on bank balance sheets and performance.

In this chapter, I consider the effect of sovereign risk on the banking system through the domestic banks' holdings of government debt on their balance sheets for a sample of 13 EMs including South Africa between 2008 and 2021. This sample includes 9 of the 10 countries in Du and Schreger (2016), as well as Chile, Malaysia, Russia and South Africa which were not in the original study. Within the two-way context of the sovereign-bank nexus, I impose directional causality in a bank-level fixed effects model to analyse the effect of a local-currency measure of sovereign risk on banks' holdings of government debt. I also analyse the impact of sovereign risk on bank returns, valuations and lending activity, and whether these relationships vary according to banks' exposure to sovereign debt. In doing so, the paper provides insights on spillovers from sovereign risk to banks, with implications for the real economy.

I find that EM banks' demand for government bonds during the period under review is driven by a demand for liquidity and the availability of central bank funding. I also find that banks with higher exposure to the sovereign tend to increase their holdings of government bonds in response to elevated sovereign risk. This finding is consistent with the experience of European banks during the Euro sovereign debt crisis and the secondary market theory in which domestic investors would increase their sovereign exposure in response to a crisis as their potential losses in the event of default would go beyond their direct losses on government debt (Brutti & Saure, 2013). In terms of the spillover from sovereigns to banks, I find that higher holdings of government bonds are associated with lower lending activity, while higher sovereign risk is associated with lower lending activity.

The chapter proceeds as follows. Section 3.2 provides context for the study by discussing the feedback loops between banks and sovereigns in EMs. In Section 3.3 I present the methodology used in the study. Section 3.4 considers the data I use, and section 3.5 discusses the results of the empirical analysis. Section 3.6 concludes.

3.2 The sovereign-bank nexus in emerging markets

3.2.1. The significance of sovereign debt in the banking system

The health of the sovereign debt market is central to the functioning of the broader financial system. Sovereign debt is used as a benchmark for private financial instruments and can encourage financial market development, for instance in its role as a store of liquidity (Holmström & Tirole, 1993). Furthermore, debt issued by the government is used as the 'safe' asset in the prudential regulation of financial institutions. As a result, prudential regulation assigns government bonds preferential treatment in the form of lower risk weights for banks' holdings of government bonds (Basel Committee on Banking Supervision (BCBS, 2010a), BCBS (2010b), BCBS (2013)).

Because of the central role of sovereign debt in prudential regulation, banks are significant holders of government debt instruments. EM banks are no different in this regard, as varying levels of the implementation of Basel standards since the GFC will have affected banks' incentives to hold sovereign debt. For its part, South Africa had fully implemented Basel III standards by 2015 (BCBS, 2015).

Using the case of Italian banks during the GFC and Euro sovereign debt crisis, Affinito et al. (2022) offer potential reasons why banks may increase their sovereign exposure at such times. Firstly, banks hold sovereign debt in compliance with capital requirements as government bonds are zero-risk weighted and thus improve a bank's capital ratio. Banks may thus increase their exposure to government debt in compliance with regulation, especially poorly capitalised banks. Secondly, sovereign debt functions as a store of liquidity and can be used as collateral for raising short-term funding, especially when the bank is facing liquidity strains and needs to raise secured funding in the wholesale market. As also argued by Acharya and Steffen (2015), banks may also increase their sovereign bond holdings to improve profitability through the carry trade hypothesis and as a response to bad loans. Lastly, the availability of low-cost funding from the central bank may increase demand for government bonds among banks.

The outcomes of banks are thus closely linked with sovereign debt. Brunnermeier et al. (2016) describe the sovereign-bank nexus in which a sovereign's decline in creditworthiness reduces the perceived solvency of domestic banks, which in turn lowers lending activity and increases the default risk of the sovereign. The government and banks are so entangled because governments have an incentive to bail out a domestic banking system in distress to curtail a banking crisis. Banks also hold a sizeable amount of government debt on their balance sheets, and the sovereign often acts a ceiling for the credit rating of its home banks with implications for banks' cost of borrowing (Committee on the Global Financial System (CFGS), 2011). Furthermore, a distressed banking system can adversely affect the real economy through reduced credit extension, which would affect the fiscal position through lower tax revenues (Brunnermeier et al., 2016), while sovereign distress can impair economic activity and in turn affect the quality of bank assets (Deghi et al., 2022).

The negative feedback loop between the sovereign and the banking system was demonstrated during the euro-area sovereign debt crisis, where banks with higher balance sheet exposures to distressed sovereign debt extended less credit (Popov & van Horen (2013), De Marco (2018)) and faced higher costs of borrowing (CFGS, 2011). Correa et al. (2014) find that sovereign credit rating downgrades have a strong adverse effect on the share price of domestic banks, especially those that are more likely to receive government support.

The literature has historically focused on the impact of actual sovereign default on the banking system (see Gennaioli et al. (2018) for example). Recently, research considering the effectiveness of prudential regulation has raised questions about the impact of sovereign risk on the banking system. For instance, D'Erasmo et al., (2019) model the impact of designating risky government debt as "safe" on the effectiveness of banking regulation. They argue that the failure of banking regulation to recognise sovereign risk may be responsible for excessive exposure to government debt among banks and for the banking crises that typically follow defaults on sovereign debt. Much of the literature in this respect has drawn from the experience of the Euro-area in the sovereign debt crisis, such that there remains a paucity of work focused on the impact of continuous measures of sovereign risk on EM banking systems.

While there is some literature on the interaction between sovereign risk and the South African banking system, it has tended to be limited in scope. Foggitt et al. (2017) analyse systemic risk across the South African banking sector, but find that that systemic risk is more dependent on external conditions than domestic factors, of which sovereign risk is an example. Makrelov et al. (2021) demonstrate evidence of a positive relationship between sovereign risk premia and capital buffers. There remains scant literature on the interaction between sovereign risk and bank lending activity and profitability. Furthermore, as is the case for EMs in general, previous empirical studies on South Africa have employed sovereign risk measures based on foreign currency-denominated debt. The significance of local-currency sovereign risk for banks and financial institutions more broadly, however, has only grown since the Covid-related fiscal shocks experienced by many EMs, with policy institutions paying increasing attention to the risks related to banks' exposure to sovereign debt (e.g. International Monetary Fund (IMF), 2022a).

3.2.2 *The evolution of EM banks' exposure to sovereign risk*

Banks in EMs may be inclined to have greater exposure to the sovereign than their advanced-economy (AE) counterparts. This is because EM banks can be expected to hold government bonds for the same reasons as AEs, while their structural characteristics such as lower financial sector development (Dell'Arricia et al., 2018) provide further reasons to hold government bonds. These characteristics may also increase the intensity of the feedback loop between the banking system and the sovereign and increase the sensitivity of banks to external shocks. Consistent with this, the IMF (2022) find significant spillover effects between sovereigns, banks and non-financial corporates in EMs, with the largest spillovers found from increases in sovereign risk to increases in bank default risk. Such risk spillovers may translate to higher bank funding costs, which may in turn be passed on to the real economy.

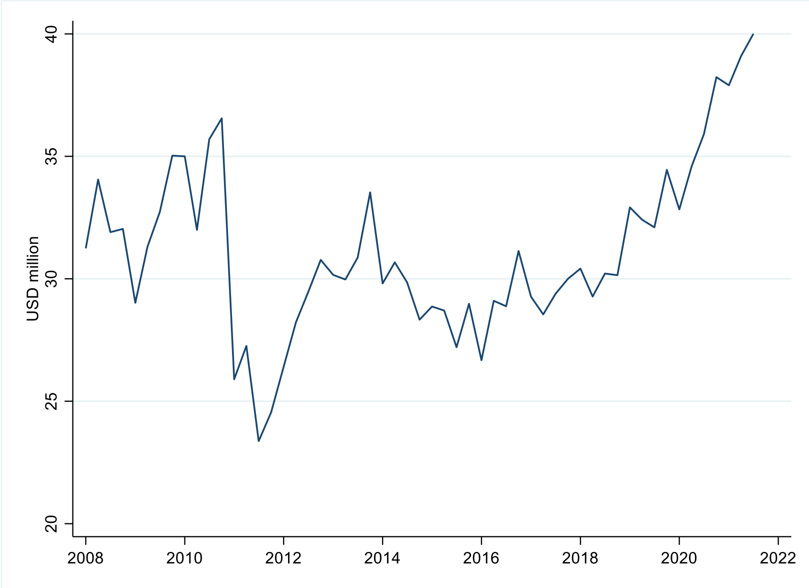
Figure 3.1: EM banks sovereign exposure

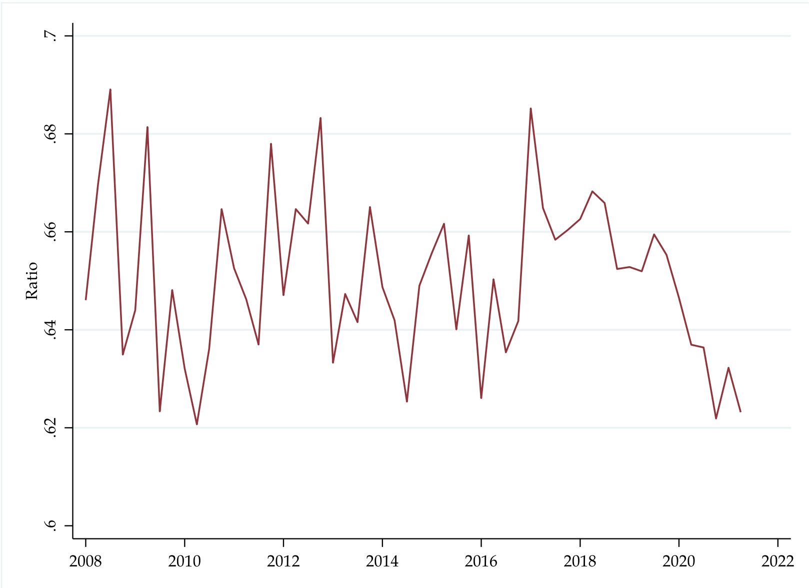
Source: IMF

Figure 3.1 illustrates aggregate bank holdings of government debt in USD (left) and the average as a share of the total government bond market (right) for the sample of EMs considered in this study since the GFC. EM banks' exposure to sovereign debt increased gradually in the period since the GFC, both in absolute terms and relative to other investors in EM local-currency government bond markets. The increase in sovereign exposure was in line with increased sovereign debt issuance among some EMs during this period as they took advantage of low global interest rates and increased demand from international investors searching for higher returns (Kose et al., 2019), which was partly absorbed by domestic banks.

The growth in government bond holdings was consistent with a general growth in EM bank balance sheets during this period, especially from 2016 (Figure 3.2). As Figure 3.2 shows, the increased exposure may also have been associated with a recomposition of bank balance sheets, as banks reduced the size of their lending books during the same period. Such a reallocation towards government bonds would be consistent with banks reducing their exposure to assets with higher risk weights in the prudential regulation, and towards "safe" sovereign assets.

Figure 3.2: EM median change in banks total assets and loan to assets

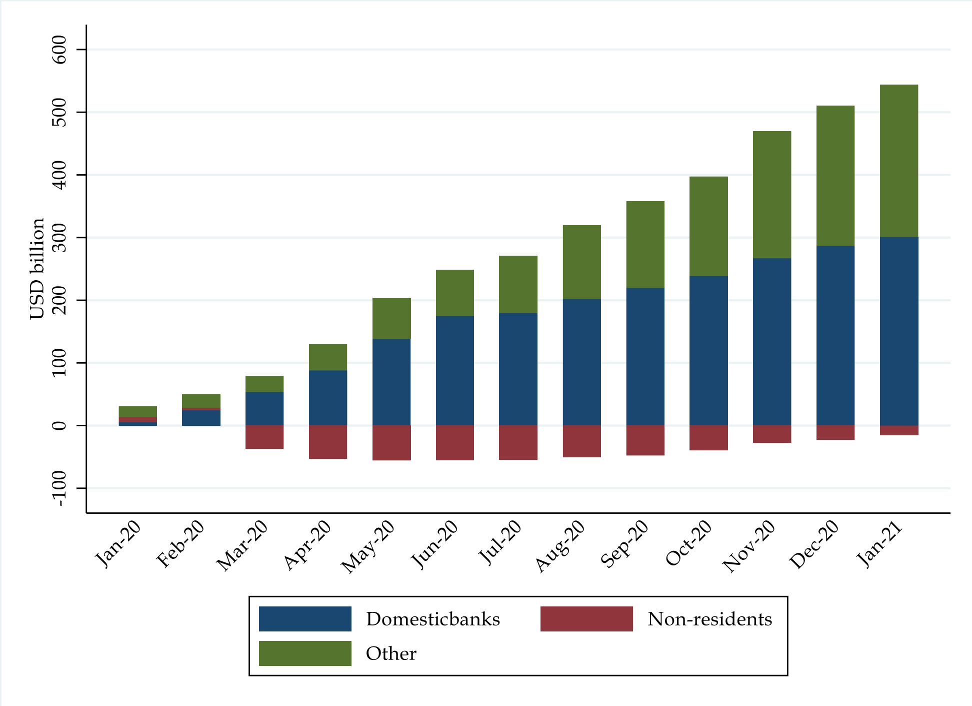




Source: IMF, Bloomberg

Following the onset of the Covid-19 pandemic in early 2020, sovereign debt issuance among EMs and AEs alike increased notably amid wider fiscal deficits driven by policy responses to the pandemic and the associated contraction in economic activity. Bank holdings of government bonds rose sharply during this period, with EM banks absorbing larger shares of the increased supply than their AE counterparts. Furthermore, the increased sovereign exposure among EM banks was also driven by a retrenchment by foreign investors from EM local currency bond markets during this time (Figure 3.3). As a result, government bond holdings among eleven major EMs increased by over USD300 billion in the year between January 2020 and January 2021 (IMF, 2021).

Figure 3.3: Change in sovereign debt holdings by investor type



Source: IMF

This intensification in the sovereign-bank nexus took place against a backdrop of deteriorating fiscal positions. The broad-based increase in sovereign debt burdens among EMs and fiscal deficits that persisted beyond 2020 reduced the fiscal space available to EM governments (Kose et al., 2021b). These economies were also expected to recover more moderately than their advanced counterparts on generally strong policy responses to the post-Covid inflation shock and slower rollouts of vaccines (IMF, 2021); the softening expectations for economic growth in turn impaired the fiscal outlook. The commencement of a global monetary policy tightening cycle in the latter part of 2021 increased refinancing risk for sovereign borrowers and raised debt service costs for those governments with floating-rate obligations or shorter-dated debt that needed to be rolled over. Together, these factors could be expected to increase sovereign default risk as they would inhibit governments' willingness or ability to service their debt. Given the spillovers between sovereigns and banks, this increase in sovereign risk could in turn have implications for EM banks.

There are separate bodies of literature analysing sovereign default and local currency bond markets in EMs, respectively, however local currency sovereign risk has not been considered as much. As a result, much of the discussion regarding default risk among EMs has featured measures of foreign-currency default risk in contrast with the now predominant share of local-currency denominated debt. This study contributes to the literature by using the local-currency credit spread as proposed by Du and Schreger (2016) to explore the impact of sovereign risk on banking systems. To my knowledge, this will be the first analysis of local currency sovereign risk and the banking system in South Africa. There is also a literature on banking systems and sovereign default risk. However, this literature either focuses on the impact of actual sovereign default, banking crises, or the experience of banks during the sovereign debt crisis in the euro-area, a monetary union in which the probability of default is higher as no individual member country has direct control over monetary policy and the exchange rate. This study will contribute empirical evidence on how a continuous, local-currency measure of sovereign risk affects the banking system.

3.3 Methodology

This paper is concerned with the impact of local currency sovereign risk on bank returns and bank activity. In particular, I explore three empirical questions:

1. How does sovereign risk affect banks' holdings of government debt?
2. Does sovereign risk affect bank returns? Does this effect vary by bank holdings of government debt?
3. Does sovereign risk affect the lending activity of banks? Does this effect vary by bank holdings of government debt?

Earlier empirical studies such as Gennaioli et al. (2018) have considered the impact of a discrete sovereign risk in the form of a sovereign default on banks, while others have used the experience of the Euro sovereign debt crisis to investigate the relationship between sovereign risk and banks (see Affinito et al. (2022) and Erce (2015) for instance) and the impact of sovereign risk on bank activity (for example, see Popov & van Horen (2013) and De Marco (2018)).

This study builds on this existing literature in two ways. First, the continuous nature of the LCCS as proposed by Du and Schreger (2016) allows this study to look at the impact of changes in sovereign risk over time as opposed to the impact of a discrete event such as default. Second, the inclusion of several countries with debt denominated in their local currencies provides evidence of how sovereign risk affects banks when the government issues debt in its own currency as opposed to a foreign currency or a single-currency union arrangement.

In line with the objective of exploring the above questions for a sample of major EMs, I follow a panel approach by using a bank-level fixed-effects model. Such a model allows me to observe the impact of changes in sovereign risk on individual bank outcomes over time. Hsiao (2007) notes the advantages of panel data modelling, including allowing for the exploration of dynamic and more complex relationships between variables, and controlling for omitted variables, which are relevant to the present analysis.

3.3.1. Sovereign risk and banks' demand for government debt

To address the first empirical question, I consider the role of sovereign risk in banks' demand for government debt. Banks hold sovereign debt on their balance sheets for a variety of reasons. I follow Affinito et al. (2022) and consider bank demand for government bonds as a function of capital requirements, liquidity management, risk-taking and the availability of central bank liquidity. I specify the following fixed-effects model:

$$\begin{aligned}\Delta Gov_{i,c,t} = \beta_0 + \beta_1.Capital_{i,c,t-1} + \beta_2.Liquidity_{i,c,t-1} + \beta_3.Risk_{c,t-1} \\ + \beta_4.CBLiquidity_{c,t-1} + \gamma_1 X_{c,t} + \mu_{i,c,t}\end{aligned} \tag{3.1}$$

Where $\Delta Gov_{i,c,t}$ is the change in bank i's holdings of government bonds. To observe the capital motive, I use the equity-to-total assets ratio and expect β_1 to be negative such that poorer capitalisation incentivises banks to increase their sovereign debt exposure. For the liquidity channel I use the ratio of customer deposits to total assets, where a larger ratio means the bank needs less short-term funding and in turn has lower demand for government bonds for use as collateral. Therefore, I expect β_2 to be negative[9]. For the risk-taking motive I use the sovereign's LCCS as a proxy, as an increase in sovereign risk would be associated with an increase in the sovereign yield and potentially higher return. I expect β_3 to be positive as greater sovereign risk would incentivise a risk-seeking bank to increase its exposure to the higher-yielding debt. Finally, for the availability of low-cost central bank funding, data on bank-level liabilities to the central bank are not available across all the countries included in this study. As a proxy, I use the central bank claims on domestic banks, normalised by domestic banks' total claims on the domestic sector, as sourced from the IMF's International Financial Statistics. I expect β_4 to be positive, such that an increase in central bank liquidity is associated with higher bank demand for government bonds.

I also include a set of country-level control variables $X_{c,t}$ including the year-on-year inflation rate and the fiscal balance to control for the volume of government bond issuance.

All balance sheet variables are lagged by one period in all regressions, while I observe the change in central bank claims and both the level and the change in LCCS. I use bank-level fixed effects with time dummies for each quarter to control for seasonal patterns. To account for potential within-country correlation of errors, I cluster my standard errors at the country level.

The time period covered in the analysis, between January 2008 and December 2021, featured several notable developments in global financial markets and changes in global risk sentiment. Such developments in global markets may have in turn resulted

[9] I note, however, that β_2 can also be negative if higher customer deposits result in excess liquidity, which is then invested in government bonds.

in the sensitivity of different variables to risk premia varying over the review period. To account for the potential time-varying role of the impact of sovereign risk on bank demand for government debt, I also run the above model over three distinct subsamples covering different time periods, namely 2008Q1 until the end of the Fed's Quantitative Easing (QE) 3 programme in 2013Q3; 2013Q4 until the end of the pre-Covid era in 2019Q4; and 2020Q1 until 2021Q4 in the Covid era.

3.3.2. Sovereign risk and bank returns

To preview the results of the previous section, these provide evidence that an increase in sovereign risk is associated with increasing holdings of sovereign bonds by banks. I now address the second empirical question by considering what impact these holdings of sovereign bonds have on banks' returns, particularly on bank price-earnings (PE) ratios and return on equity (ROE). That is, I consider how changes in sovereign risk affect banks' market valuation and profitability, and whether this impact varies depending on the magnitude of banks' exposure to sovereign debt.

Gennaioli et al. (2018) use the following model to estimate the impact of sovereign default on bank lending:

$$\Lambda_{i,c,t} = \gamma_0 + \gamma_1 . Gov + \gamma_2 . Def_{c,t-1} + \gamma_3 . Def_{c,t-1} . Gov_{i,c,t-1} + \gamma_4 . L_{i,c,t-1} \\ + \gamma_5 . Def_{c,t-1} . L_{i,c,t-1} + \mu_{i,c,t} \tag{3.2}$$

Where $\Lambda_{i,c,t}$ is the change in the loans to assets ratio of bank i in country c between years t − 1 and t, $Gov_{i,c,t-1}$ is a bank i's government bond holdings as a share of total assets, $Def_{c,t-1}$ is an indicator which takes the value 1 if country c is in default in time t-1 and $L_{i,c,t-1}$ is a bank's loan-to-asset ratio. I adapt this specification as follows:

$$y_{i,c,t} = \beta_0 + \beta_1 . Gov_{i,c,t-1} + \beta_2 . \Delta S_{c,t}^{LCCS} + \beta_3 . \Delta S_{c,t}^{LCCS} . Gov_{i,c,t-1} + \gamma_1 Z_{i,c,t} + \gamma_2 X_{c,t} \\ + \mu_{i,c,t} \tag{3.3}$$

Where $y_{i,c,t}$ is alternately bank i's PE ratio and ROE, $\Delta S_{c,t}^{LCCS}$ is the change in country c's local-currency risk spread, and $Z_{i,c,t}$ is bank-level characteristics including total assets as a proxy for bank size and the equity-to-total assets as a proxy for bank capitalisation. I also include $X_{c,t}$,a vector of macroeconomic control variables including country c's real gross domestic product (GDP) growth as a proxy for economic conditions and thus credit demand, year-on-year inflation and the monetary policy rate. I also include US year-on-year inflation and the Fed's effective fed funds rate to control for global macroeconomic and financial conditions. I use a fixed-effects model with time dummies for each quarter.

The coefficient β_1 reflects the impact of the previous period's holdings of government bonds on the pe ratio/return on equity; a negative sign would suggest that banks with higher government bond holdings have lower returns in the subsequent period. A positive sign on the coefficient β_2 would suggest that increases in sovereign risk are associated with higher bank returns. A β_3 on the interaction between government bond holdings and the change in the credit spread with the same sign as β_2 would suggest that higher holdings of government bonds compound the impact of changes in sovereign risk on bank returns.

Given that this analysis also covers the period between 2008Q1 and 2021Q4, the same concerns regarding the potential time-variation in the key relationships of interest are also relevant here. As such, I also run this model over the three subsamples described above to observe potential differences in the coefficients of interest over the distinct periods.

3.3.3. *Sovereign risk and bank activity*

To address the final empirical question, I consider the impact of changes in sovereign risk on banks' lending activity. Similar to the preceding analysis, I consider the following model:

$$y_{i,c,t} = \beta_0 + \beta_1.Gov_{i,c,t-1} + \beta_2.\Delta S_{c,t}^{LCCS} + \beta_3.\Delta S_{c,t}^{LCCS}.Gov_{i,c,t-1} + \gamma_1 Z_{i,c,t} + \mu_{i,c,t} \tag{3.4}$$

Here $y_{i,c,t}$ is bank i in country c's loan to total assets ratio in period t. A negative sign on the coefficient β_1 would suggest that banks with higher government bond holdings extend less credit in the subsequent period. Given that a bank's loan book and its holdings of government bonds are substitutable components of its total assets, I expect this coefficient to be negative. I also expect β_2 to be negative, such that an increase in sovereign risk is associated with lower lending activity. The coefficient β_3 on the interaction term is expected to be the same sign as β_2 such that the impact of changes in the credit spread on bank activity is compounded by the level of its government bond holdings. I also consider interaction terms between $\Delta S_{c,t}^{LCCS}$ and bank capitalisation to test whether the impact of sovereign risk on a bank's credit extension depends on how well-capitalised it is. Finally, as in the preceding analyses I use a fixed-effects model with time dummies, and I also run the regressions over the three subsamples.

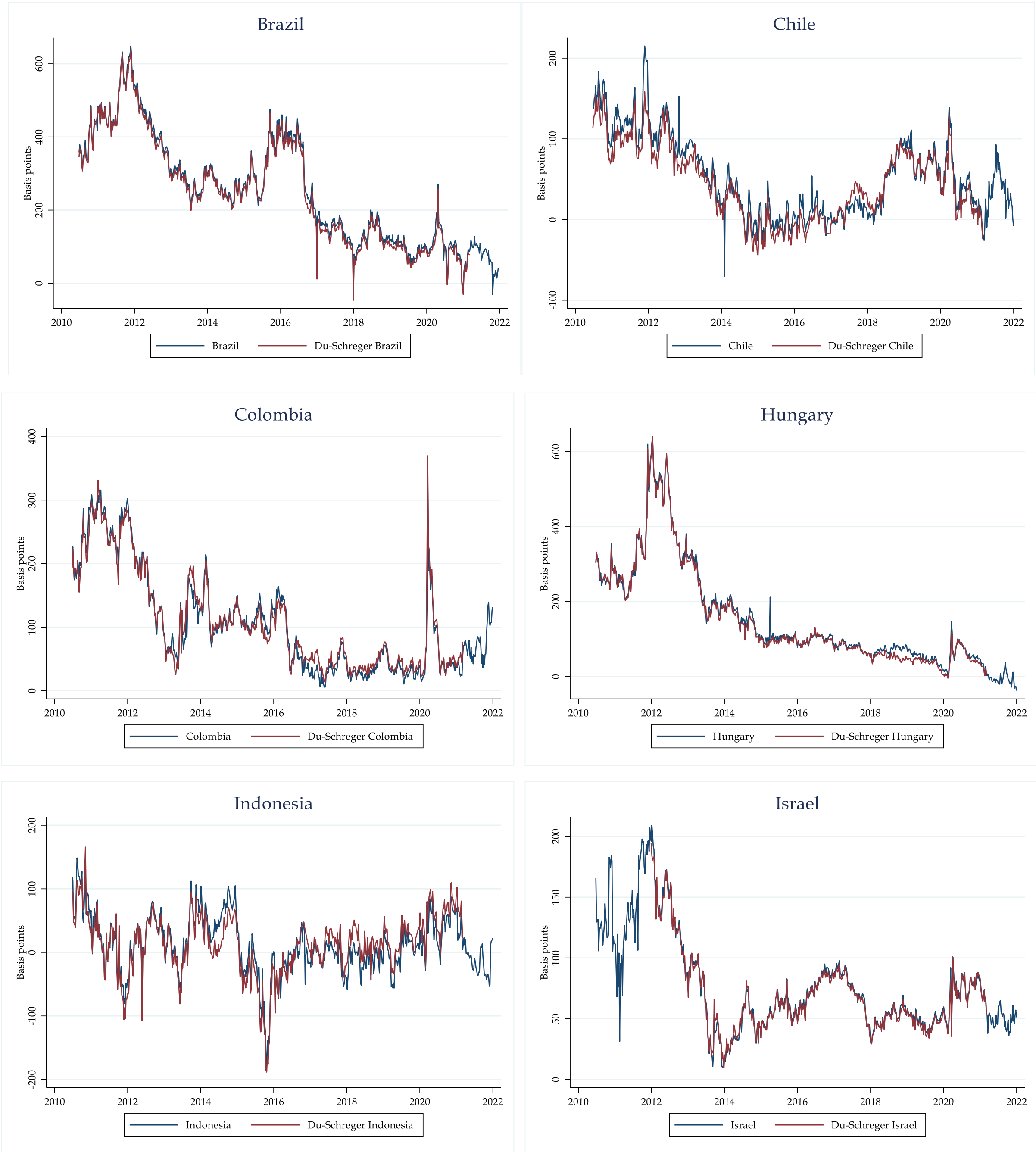
3.4 The data

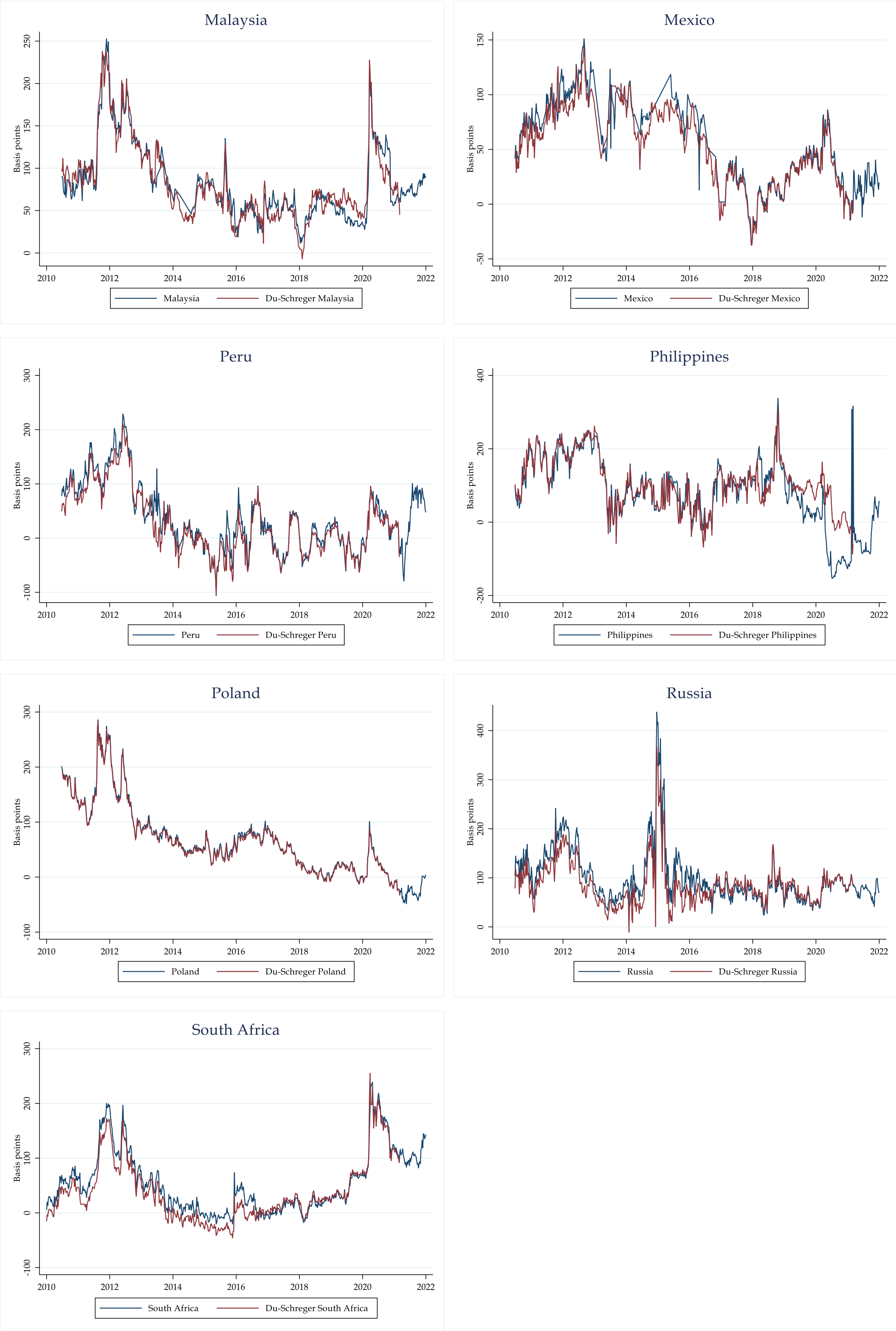
3.4.1. The local currency credit spread

To observe the impact of sovereign risk on balance sheets, I make use of a local currency-based measure as this is consistent with EMs' growing reliance on local-currency denominated debt for their financing. As discussed in Chapter 2, Du and Schreger (2016) propose a local currency credit spread which has been used increasingly in the literature (see, for instance, Avdjiev et al., 2019; Hesse & Miyajima, 2022).

I follow Du and Schreger (2016) and calculate the LCCS for nine of the 10 countries in their 2016 paper, as well as Chile, Malaysia, Russia and South Africa which were not in the original study. Due to data limitations for Turkey, I remove this country from the sample, leaving me with a sample of 13 EMs. I estimate the premium at a daily frequency for the period January 2008 to December 2021. However, where the necessary market data is unavailable, there are gaps in the time series for a given country. For instance, in the case of Brazil the time series only begins in June 2010 due to the lack of market data prior to that date. In line with Du-Schreger, I use a benchmark tenor of 5 years.

Figure 3.4: EM LCCS estimates with Du-Schreger measure




Malaysia
Basis points
Malaysia
Du-Schreger Malaysia
Mexico
Basis points
Mexico
Du-Schreger Mexico
Peru
Basis points
Peru
Du-Schreger Peru
Philippines
Basis points
Philippines
Du-Schreger Philippines
Poland
Basis points
Poland
Du-Schreger Poland
Russia
Basis points
Russia
Du-Schreger Russia
South Africa
Basis points
South Africa
Du-Schreger South Africa
2010 2012 2014 2016 2018 2020 2022

Source: author's calculations, Du-Schreger (2021)

3.4.2. *Constructing a bank-level panel*

In order to analyse the variation in bank balance sheets and valuations as well as sovereign risk, I construct a panel dataset consisting of 13 EMs and multiple banks in a given jurisdiction. The panel includes country-level variables such as the LCCS as described above, as well as bank-level variables that allow me to observe how banks in each country with varying levels of sovereign debt exposure and other characteristics, respond to a given change in sovereign risk, for instance. Furthermore, the panel also includes global variables to control for global financial conditions that may affect bank balance sheets, valuations and lending activity.

Bloomberg features market and financial statement data on publicly-listed entities, with improving data coverage the larger the entity and the more market-relevant the economy is. This makes Bloomberg a good source for data on publicly-listed banks in 12 of the EMs most important among investors in the asset class. I use Bloomberg to collect data for up to 10 of the largest banks trading in 2021 (by market capitalisation) in each country, at a quarterly frequency for the period 2008 – 2021. Most countries in the sample have fewer than 10 publicly-listed banks, so this constraint is only binding for Brazil, Indonesia, the Philippines and Poland. Since some of the banks trading in 2021 may have been listed after 2008, the panel is unbalanced with some banks missing data for some quarters. The result is an unbalanced panel of 180 banks.

While I use Bloomberg to source the financial data for 12 of the 13 EMs' banks, for South Africa the financial data for banks are sourced from the Prudential Authority while the market data are sourced from Bloomberg. This is because South African banks release financial statements, which are the source of Bloomberg data, annually rather than quarterly, and the only data available for these banks at a quarterly frequency are those which they submit to their prudential regulator. Since aggregating market data and the LCCS, which can be reasonably expected to have a considerable amount of intra-year variance, to an annual level is arguably less desirable for the objectives of this study, I proceed by using the regulatory data for South African banks, and Bloomberg data for the other EMs.

The financial data included in the panel include each bank's total assets, gross loans, holdings of government securities, common equity Tier 1, non-performing loans, and return on equity and assets. The financial data in absolute values, such as total assets, is standardised across the countries by expressing it in USD. This is augmented by market data, specifically each bank's price-to-equity and price-to-book ratio.

To complete the panel, I augment the bank-level data with country-level macroeconomic data. These variables will be the same for each bank in a given country for a given period. Firstly, I calculate a quarterly average LCCS for each country as the bank data is at a quarterly frequency. I include other macroeconomic variables that might affect banks' financial performance or the country's sovereign risk, such as the country's annual real GDP growth, the quarterly average monetary policy rate and the quarterly average year-on-year domestic inflation rate. As controls for global economic and financial conditions, I also include the US quarterly average policy rate and quarterly average year-on-year inflation rate. The macroeconomic data are all sourced from the IMF's International Financial Statistics.

3.5 Results

3.5.1. Sovereign risks and banks' demand for government debt

Table 3.1 shows the results of the determinants of banks' demand for government bonds where I use the level of the LCCS as a proxy for risk (see equation 3.1). Bank capitalisation as measured by the ratio of total equity to total assets is found to be an insignificant determinant for banks' accumulation of government bonds. While β_1 carries the expected negative sign, it is statistically insignificant across all specifications such that less capitalised banks do not accumulate more government bonds than better capitalised banks in order to satisfy capital requirements. The capital channel remains insignificant when the tier 1 capital ratio is used instead of total equity to total assets as a proxy for capitalisation. This is in line with EM banks' accumulation of sovereign debt from 2016 even as loans as a share of banks' total assets were declining, suggesting that EM banks' accumulation of government bonds is not for prudential purposes.

Table 3.1: Banks' demand for government bonds with level LCCS

	y = Change in government bonds to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-1.102***	-1.120***	-1.170***	-1.128***	-1.129***
	(0.0515)	(0.0517)	(0.0507)	(0.0586)	(0.0580)
Equity to assets (t-1)	-0.054	-0.040	-0.053	-0.064	-0.068
	(0.0367)	(0.0404)	(0.0400)	(0.0401)	(0.0390)
Deposits to assets (t-1)	-0.389**	-0.360**	-0.365**	-0.425**	-0.412**
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
LCCS	0.023	0.027	-0.059	0.031	0.087
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in central bank liquidity	0.094***	0.098***	0.097***	0.102***	0.099***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Total assets (t-1)		0.100	0.107	0.112	0.105
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation rate (y/y)		-0.019	-0.030	-0.023	-0.026
		(0.0005)	(0.0004)	(0.0004)	(0.0004)
Fiscal balance		-0.115**	-0.131**	-0.095**	-0.090*
		(0.0006)	(0.0006)	(0.0005)	(0.0005)
LCCS*Government bonds to assets			0.144**		
			(0.0001)		
Return on assets (t-1)				0.018	0.039*
				(0.0009)	(0.0006)
LCCS*Return on assets					-0.069
					(0.0000)
N	4415	4415	4415	4240	4240
R^2	0.147	0.151	0.154	0.145	0.146

This table presents coefficient estimates from equation 3.1. Standardised beta coefficients; standard errors in parentheses.

*** $p<0.01$; ** $p < 0.05$; * $p < 0.1$.

While the capital channel is insignificant, the demand for liquidity is found to be a significant driver of banks' demand for government bonds. The ratio of customer deposits to total assets is the proxy for liquidity, with a larger ratio implying the bank needs less short-term funding and in turn has lower demand for government bonds for use as collateral. The coefficient β_2 is significant across all specifications: banks buy government bonds for use as collateral in the short-term funding market and as a store of liquidity. This coefficient is negative as banks who obtain less funding from customer deposits increase their government bond holdings more in the subsequent period.

The impact of the risk-taking channel on banks' government bond net purchases, captured using the LCCS, is more nuanced. The level of sovereign risk is found to be insignificant across all specifications. The interaction term for the LCCS and government bond holdings, in the third specification, is statistically significant and positive, suggesting that banks that have higher levels of sovereign debt exposure increase their holdings government bond holdings at higher levels of sovereign risk. This finding is consistent with evidence of sovereign debt repatriation by domestic banks during the Euro sovereign debt crisis (Brutti & Saure, 2013). The coefficient on the lagged return on assets (ROA) variable, a proxy for bank profitability, in specifications (4) and (5) is insignificant, while the interaction term between ROA and the LCCS is significant with a negative sign, providing further evidence that the risk-taking channel is a more nuanced driver of banks' demand for government bonds. Specifically, less profitable banks can be expected to increase their exposure to sovereign debt at higher levels of sovereign risk.

There are several plausible explanations for the observed relationship between government bond holdings and sovereign risk. To the extent that sovereign risk is high during periods of market stress or an economic downturn, this may suggest that banks that hold higher proportions of government debt due to limited lending opportunities (Dell'Arricia et al., 2018) during normal times will be more likely to hold even more government debt during periods of sovereign or economic distress. Alternatively, the consistently positive and statistically significant coefficient on bank size as proxied by total asset suggests that larger banks accumulate more government debt relative to their balance sheets. Since larger banks are more likely to have market-making responsibilities in their respective government bond markets (Arnone & Iden, 2003), they would be more likely to absorb the supply of unwanted bonds in the secondary market[10]. Thus, in the event of a shock that would result in high sovereign risk spreads, such as during the Covid-related market stress of early 2020, these larger banks would increase their sovereign exposure as they absorb the selloff from other market participants. Similarly, as primary dealers (Arnone & Iden, 2003), larger banks would acquire government bonds in the primary market and may be constrained in the ability to sell these in the secondary bond market during periods of elevated sovereign risk.

Finally, I find that the availability of funding as proxied by central bank liquidity to domestic banks is consistently significant, with the expected positive sign on β_4: a greater availability of low-cost funding to banks is associated with greater accumulation of government bonds. Notably, since I already control for the collateral and liquidity demand of banks, this positive and significant relationship is not an instance of reverse causality in which banks increase their holdings of government bonds for the purpose of using them as collateral against central bank funding.

As a test of the robustness of these findings, I also run the same regressions but substitute the level of the LCCS with the change in the LCCS, as shown in Table 3.6 (Annexure Section 3). The size and sign of the other coefficients do not meaningfully change when I use the change in the LCCS rather than the level as an explanatory variable for the risk-taking channel. The coefficient on the sovereign risk variable itself is more significant (at the 1% level) when the change in the variable is used rather than the level, with the expected positive sign in all specifications. The interaction term between the change in the LCCS and holdings of government bonds is insignificant,

[10] Larger banks are also more likely to be designated as systemically important by prudential regulators, which would also affect their sovereign debt holdings.

such that banks with higher sovereign debt exposure are not significantly more responsive to changes in sovereign risk.

Taken together, these results suggest that banks accumulate government bonds in response to a demand for liquidity beyond the funding they secure from customer deposits, risk-taking incentives to increase profitability through exposure to high sovereign risk premia, and the availability of relatively low-cost central bank funding. Contrary to Affinito et al. (2019)'s findings regarding Italy, capital requirements are not found to be a significant driver of net government bond purchases among EM banks.

I note that the sensitivity of bank demand for government bonds to the different determinants may vary across time. To investigate this possibility, I consider the same specifications over three distinct subsamples covering different time periods and report the results in Tables 3.7 to 3.9 (Section 3.7). Interestingly, the liquidity channel is not a significant determinant of bank demand in any subsample, even though it is significant over the review period as a whole. The availability of central bank funding is significant in the first and second subsamples covering the period January 2008 to December 2019, but not in the third period covering January 2020 to December 2021: this is interesting given that a notable feature of the post-Covid shock era is increased liquidity provision by larger EM central banks in response to the global financial stress in March 2020. This suggests that the availability of central bank liquidity may have been a binding constraint to bank demand for government bonds in the earlier subsamples when EM central banks managed less abundant liquidity in the market, but became an insignificant driver as liquidity became more abundant in 2020.

In terms of the risk-taking channel, the LCCS behaves differently over the three subsamples. In the first period, prior to the Fed's QE3 programme, sovereign risk was an insignificant driver of banks' sovereign bond purchases. Notably, the fiscal balance control variable, which I include to control for the supply of government bonds, is also insignificant during this time. In the second period, between 2013Q4 and 2019Q4, the level of the LCCS is positive and economically and statistically significant, but the interaction with government bond holdings and the change in the LCCS are insignificant. This suggests that during this period, banks increased their holdings of government bonds at higher levels of sovereign risk, however banks with higher sovereign exposure did not respond more to changes in sovereign risk. In the third subsample, the level and change in the LCCS are both positive and significant at different levels.

A plausible explanation of these findings from the subsamples is that in the post-QE era, as international investors increased their demand for EM debt in the search for yield and thereby supported increased EM debt issuance, higher levels of sovereign risk have been a significant driver of banks' accumulation of sovereign debt as they seek to improve their profitability. Therefore, higher levels of sovereign risk are found to be associated with higher net purchases of government bonds by banks.

3.5.2. Sovereign risk and bank returns

Given the different determinants of banks' demand for sovereign bonds, the second question of interest is whether government bond holdings and sovereign risk affect the returns of banks' shareholders (see equation 3.3). In particular, I analyse whether sovereign risk affects banks' ROE and ROA as well as banks' valuations, and whether this impact depends on the level of government holdings on a given bank's balance sheet.

Table 3.2 reports the results of the impact of government bond holdings and sovereign risk on bank returns, where ROE is used as a proxy for returns. The level of government bond holdings has a negative coefficient but statistically insignificant coefficient: higher holdings of government bonds are not associated with lower ROE in the subsequent period. When looking at the subsamples, the effect is statistically significant in the second period, such that higher holdings of government bonds are associated with lower ROE in the subsequent period, while it is not significantly different from zero in other subsamples.

Table 3.2: Sovereign risk and bank return on equity

	y = Return on Equity			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.083	-0.083	-0.079	-0.079
	(4.1487)	(4.1487)	(4.5794)	(4.5794)
Total assets (t-1)	-0.240***	-0.240***	-0.224***	-0.224***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	-0.049*	-0.049*	-0.052*	-0.052*
	(3.0215)	(3.0215)	(3.1478)	(3.1478)
Change in LCCS (t-1)	-0.006	-0.006		
	(0.0012)	(0.0012)		
LCCS			-0.039	-0.039
			(0.0041)	(0.0041)
Change in LCCS*Government bonds to assets	0.009	0.009		
	(0.0104)	(0.0104)		
LCCS*Government bonds to assets			-0.022	-0.022
			(0.0123)	(0.0123)
Fiscal balance (t-1)	-0.035	-0.035	-0.034	-0.034
	(0.2185)	(0.2185)	(0.2201)	(0.2201)
Real GDP growth (t-1)	0.186**	0.186**	0.186**	0.186**
	(0.1526)	(0.1526)	(0.1478)	(0.1478)
Policy rate	0.012	0.012	0.031	0.031
	(0.1655)	(0.1655)	(0.1548)	(0.1548)
Inflation rate (y/y)	-0.054	-0.054	-0.058	-0.058
	(0.2042)	(0.2042)	(0.2006)	(0.2006)
US Inflation rate (y/y)	-0.076	0.168**	-0.086	0.166**
	(0.2926)	(0.3665)	(0.3141)	(0.3614)
Fed funds effective rate	0.413***		0.425***	
	(0.8530)		(0.8818)	
Change in Fed balance sheet		-0.072**		-0.077**
		(0.0000)		(0.0000)
N	4402	4402	4416	4416
R^2	0.242	0.242	0.246	0.246

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses.

*** p<0.01; ** p < 0.05; * p < 0.1.

The coefficient on the level of the LCCS is insignificant such that higher levels of sovereign risk are also not associated with lower ROE. Neither the change in LCCS nor the interaction between the level or change in LCCS and government bond holdings are significant, suggesting that the impact of sovereign risk on ROE is not transmitted through the banks' direct sovereign exposure on their balance sheet but through other channels. As reported in Table 3.3, the results are similar when I use ROA as the proxy for bank returns. Overall, bank profitability is found to be largely unrelated to either sovereign debt accumulation or sovereign risk.

Table 3.3: Sovereign risk and bank return on assets

	y = Return on Assets			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.025	-0.025	-0.013	-0.013
	(0.6038)	(0.6038)	(0.7228)	(0.7228)
Total assets (t-1)	-0.222***	-0.222***	-0.202***	-0.202***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.328***	0.328***	0.325***	0.325***
	(0.8179)	(0.8179)	(0.8477)	(0.8477)
Change in LCCS (t-1)	0.001	0.001		
	(0.0001)	(0.0001)		
LCCS			-0.036	-0.036
			(0.0004)	(0.0004)
Change in LCCS*Government bonds to assets	-0.002	-0.002		
	(0.0012)	(0.0012)		
LCCS*Government bonds to assets			-0.048	-0.048
			(0.0023)	(0.0023)
Fiscal balance (t-1)	-0.084	-0.084	-0.081	-0.081
	(0.0249)	(0.0249)	(0.0233)	(0.0233)
Real GDP growth (t-1)	0.121**	0.121**	0.119**	0.119**
	(0.0178)	(0.0178)	(0.0171)	(0.0171)
Policy rate	-0.016	-0.016	0.009	0.009
	(0.0159)	(0.0159)	(0.0137)	(0.0137)
Inflation rate (y/y)	-0.042	-0.042	-0.047	-0.047
	(0.0231)	(0.0231)	(0.0225)	(0.0225)
US Inflation rate (y/y)	-0.075*	0.088**	-0.085**	0.084**

	(0.0310)	(0.0318)	(0.0328)	(0.0298)
Fed funds effective rate	0.274***		0.285***	
	(0.0957)		(0.0945)	
Change in Fed balance sheet		-0.067**		-0.072**
		(0.0000)		(0.0000)
N	4407	4407	4421	4421
R^2	0.229	0.229	0.234	0.234

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Finally, Table 3.4 reports the results for the same regressions with bank valuation proxied by the PE ratio as the dependent variable. As with bank profitability, I find bank profitability to have an insignificant relationship with government bond holdings and sovereign risk in the full sample. While the coefficient on government bond holdings is consistent across the subsamples, there are differences in the significance of sovereign risk. In particular, I find that both of the level and change In sovereign risk are positive and statistically significant in the second period, such that higher levels of sovereign risk and larger increases in sovereign risk are both associated with a higher bank valuation. Notably, bank capitalisation as proxied by equity to assets is also weakly significant and positive during this period, and it is also the time when several jurisdictions were raising capital requirements.

Table 3.4: Sovereign risk and bank price-to-earnings ratio

	y = PE ratio			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.153	-0.153	-0.146	-0.146
	(160.5878)	(160.5878)	(160.7465)	(160.7465)
Total assets (t-1)	0.014	0.014	0.010	0.010
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.014	0.014	0.016	0.016
	(40.2562)	(40.2562)	(40.7746)	(40.7746)
Change in LCCS (t-1)	0.011	0.011		
	(0.0337)	(0.0337)		
LCCS			0.023	0.023
			(0.0206)	(0.0206)
Change in LCCS*Government bonds to assets	-0.010	-0.010		
	(0.1539)	(0.1539)		
LCCS*Government bonds to assets			-0.022	-0.022
			(0.0989)	(0.0989)
Fiscal balance (t-1)	-0.063	-0.063	-0.061	-0.061
	(2.7122)	(2.7122)	(2.7562)	(2.7562)
Real GDP growth (t-1)	0.035	0.035	0.034	0.034
	(2.1190)	(2.1190)	(2.1193)	(2.1193)
Policy rate	0.003	0.003	0.006	0.006
	(1.1501)	(1.1501)	(1.0804)	(1.0804)
Inflation rate (y/y)	-0.011	-0.011	-0.011	-0.011
	(2.9569)	(2.9569)	(2.9537)	(2.9537)
US Inflation rate (y/y)	-0.028	0.002	-0.024	0.001
	(4.1546)	(2.3833)	(4.0642)	(2.2439)
Fed funds effective rate	0.048		0.041	
	(6.2965)		(6.2588)	
Change in Fed balance sheet		-0.026		-0.022
		(0.0000)		(0.0000)
N	4279	4279	4293	4293
R^2	0.020	0.020	0.020	0.020

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** $p<0.01$; ** $p < 0.05$; * $p < 0.1$.

3.5.3. Sovereign risk and bank activity

The results presented so far show that higher levels of sovereign risk incentivise EM banks to accumulate more government debt on their balance sheets. Higher levels of sovereign risk have also had a varying impact on bank valuation over time. I now consider the impact of government debt and sovereign risk on banks' lending activity, with results shown in Table 3.5.

The coefficient on the change in government bond holdings is highly significant across all specifications and carries the expected negative sign: an increase in government bond holdings is associated with a decline in the loan book as a share of a bank's total assets. Such a relationship between the two variables could reflect banks increasing their holdings of government bonds in response to the risk-taking channel, allocating capital away from loans to customers and toward government bonds which have less default risk but still yield a return.

The coefficient on the change in LCCS offers evidence on the direct sensitivity of bank lending to changes in sovereign risk: this coefficient is only weakly significant in two specifications, with specification (3) carrying an unexpected positive sign suggesting that banks increase their lending activity when sovereign risk increases. In the different specifications I also include interaction terms for the change in LCCS, bank capitalisation as proxied by the tier 1 capital ratio, and the level of government bond holdings. Because the interaction term between the level of the LCCS and government bond holdings is statistically significant and larger than the LCCS coefficient, banks with higher levels of sovereign exposure actually increase their lending when sovereign risk increases. The LCCS terms taken together suggest that in general, an increase in sovereign risk leads to less bank lending. The lending activity of better-capitalised banks is not found to be more resilient to changes in sovereign risk.

Table 3.5: Sovereign risk and bank lending

	y = Loans to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-0.227**	-0.226**	-0.228**	-0.304***	-0.305***
	(0.0958)	(0.0968)	(0.0967)	(0.0717)	(0.0701)
Change in government bonds to assets	-0.050***	-0.050***	-0.050***	-0.055***	-0.055***
	(0.0635)	(0.0636)	(0.0639)	(0.0570)	(0.0570)
Equity to assets (t-1)	0.107	0.107	0.107	0.088	0.080
	(0.1878)	(0.1884)	(0.1866)	(0.1699)	(0.1937)
Total assets (t-1)	-0.035	-0.036	-0.033	0.006	0.010
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in LCCS		-0.013	0.034*		
		(0.0001)	(0.0000)		
LCCS				-0.209***	-0.240**
				(0.0001)	(0.0001)
Change in LCCS*Government bonds to assets	0.010	0.020			
	(0.0001)	(0.0002)			
Change in LCCS*Equity to assets			-0.031		
			(0.0005)		
LCCS*Government bonds to assets				0.260***	0.263***
				(0.0002)	(0.0002)
LCCS*Equity to assets					0.032
					(0.0008)
N	4133	4133	4133	4148	4148
R^2	0.106	0.106	0.106	0.157	0.158

This table presents coefficient estimates from equation 3.4. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

I also consider the same regressions on the three distinct subsamples used throughout this chapter. The findings on the relationship between the change in government bond holdings and lending activity is mostly consistent in the first and second subsamples and insignificant in the third subsample. Bank capitalisation is only significant in the third subsample, after the full phasing in of additional regulations in line with the Basel 3 framework in various jurisdictions. In third period, better-capitalised banks were more were more likely to lend.

In terms of sovereign risk, the change in the LCCS is consistently insignificant in the subsamples. The interaction between the LCCS and bank capitalisation is significant and positive in the first period, such that in specification (5), an increase in sovereign risk is associated with lower lending in general but higher lending among better-capitalised banks. As such, the impact of sovereign risk on bank lending activity is consistently shown to vary by bank capitalisation.

Given that the above results are average estimates for all EMs in the sample, the degree to which they are representative may differ across the economies. This may also be dependent on differences between the structures of the banking and financial systems. For instance, non-bank financial institutions play an important role in the South African financial system, with significant holdings of government debt among these institutions and a high degree of interconnectedness with the banking system (Hesse and Miyajima (2022), IMF (2022b)). This may affect the role of domestic banks as holders of sovereign bonds.

While domestic bank holdings of sovereign debt have increased in line with the growth of government debt issuance since the Covid 19-shock, the exposure of South African banks to sovereign debt remains moderate relative to EM peers (IMF, 2022a). Smaller banks' accumulation of sovereign debt as a share of total assets has outpaced the growth in these exposures among larger banks in South Africa as the domestic banking system has become increasingly concentrated (South African Reserve Bank (SARB), 2023).

3.6 Conclusion

The feedback loop between banks and governments in EMs has intensified following the increase in banks' sovereign debt exposure since 2016 and the acceleration in government bond accumulation since the Covid-19 pandemic. The outlook for potentially higher sovereign risk spreads among EMs on weaker fiscal positions makes the question of spillovers between banks and sovereigns a more pertinent issue for the health of EM banking systems going forward. This paper provides insights on the drivers of government bond accumulation among EM banks and some of the spillovers from governments to banks.

On the drivers of bank demand for government debt, the liquidity channel and availability of central bank funding are significant drivers of government bond accumulation. In terms of the risk-taking motive, I find that while sovereign risk on its own is not a significant driver of government bond demand, banks with greater exposure to sovereign debt increase their holdings of government bonds at high levels of sovereign risk.

In terms of the impact of sovereign risk on banks, I find that higher sovereign risk is associated with lower bank returns, especially among banks with greater sovereign exposure. While there is some evidence that increases in sovereign risk affect banks' lending activity, this effect is attenuated among better-capitalised banks. Furthermore, I find that higher holdings of government bonds are generally associated with lower bank returns and valuations. These spillovers may in turn have implications for the real economy.

3.7 Annexure Chapter 3

Table 3.6: Banks' demand for government bonds with change in LCCS

	y = Change in government bonds to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-1.103***	-1.121***	-1.123***	-1.129***	-1.129***
	(0.0533)	(0.0533)	(0.0532)	(0.0611)	(0.0611)
Equity to assets (t-1)	-0.06	-0.046	-0.046	-0.069	-0.069
	(0.0368)	(0.0403)	(0.0401)	(0.0404)	(0.0403)
Deposits to assets (t-1)	-0.386**	-0.358**	-0.359**	-0.421**	-0.421**
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Change in LCCS	0.039***	0.037***	0.049**	0.039***	0.034*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in central bank liquidity	0.101***	0.104***	0.104***	0.108***	0.108***
	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Total assets (t-1)		0.11	0.11	0.122	0.122
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation rate (y/y)		-0.016	-0.015	-0.02	-0.02
		(0.0005)	(0.0005)	(0.0005)	(0.0005)
Fiscal balance		-0.114**	-0.114**	-0.094**	-0.094**
		(0.0006)	(0.0005)	(0.0005)	(0.0005)
Change in LCCS*Government bonds to assets			-0.015		
			(0.0001)		
Return on assets (t-1)				0.01	0.01
				(0.001)	(0.001)
LCCS*Return on assets					0.006
					(0.0000)
N	4400	4400	4400	4226	4226
R^2	0.148	0.152	0.152	0.146	0.146

This table presents coefficient estimates from equation 3.1. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.7: Banks' demand for government bonds, 2008Q1 to 2013Q3

	y = Change in government bonds to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-1.598***	-1.615***	-1.628***	-1.657***	-1.659***
	(0.0510)	(0.0547)	(0.0539)	(0.0551)	(0.0548)
Equity to assets (t-1)	0.044	0.058	0.052	-0.051	-0.052
	(0.1162)	(0.1185)	(0.1209)	(0.1446)	(0.1444)
Deposits to assets (t-1)	-0.162	-0.157	-0.141	-0.226	-0.227
	(0.0004)	(0.0004)	(0.0004)	(0.0006)	(0.0006)
LCCS	-0.023	-0.017			
	(0.0000)	(0.0000)			
Change in LCCS			0.070***	0.051**	0.027
			(0.0000)	(0.0000)	(0.0000)
Change in central bank liquidity	0.073**	0.084**	0.104***	0.092***	0.094***
	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0006)
Total assets (t-1)		0.180	0.187	0.229	0.233
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation rate (y/y)		0.071	0.089	0.096	0.098
		(0.0016)	(0.0016)	(0.0016)	(0.0016)
Fiscal balance		-0.074	-0.077	-0.094	-0.093
		(0.0011)	(0.0011)	(0.0010)	(0.0010)
Change in LCCS*Government bonds to assets			-0.016		
			(0.0001)		
Return on Assets (t-1)				0.174	0.173
				(0.0047)	(0.0047)
Change in LCCS*Return on assets					0.029
					(0.0000)
N	1532	1532	1532	1445	1445
R^2	0.281	0.283	0.287	0.293	0.293

This table presents coefficient estimates from equation 3.1. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.8: Banks' demand for government bonds, 2013Q4 to 2019Q4

	y = Change in government bonds to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-1.410***	-1.448***	-1.432***	-1.183***	-1.176***
	(0.0736)	(0.0742)	(0.0749)	(0.0412)	(0.0394)
Equity to assets (t-1)	0.010	0.029	0.044	0.077	0.078
	(0.0599)	(0.0625)	(0.0579)	(0.0462)	(0.0451)
Deposits to assets (t-1)	-0.135	-0.072	-0.083	0.080	0.089
	(0.0003)	(0.0003)	(0.0003)	(0.0005)	(0.0004)
LCCS	0.150**	0.154*			
	(0.0000)	(0.0000)			
Change in LCCS			0.006	-0.006	0.034
			(0.0000)	(0.0000)	(0.0000)
Change in central bank liquidity	0.102***	0.107***	0.109***	0.126***	0.128***
	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Total assets (t-1)		0.214**	0.291**	0.209*	0.206*
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation rate (y/y)		-0.060	-0.012	-0.013	-0.013
		(0.0006)	(0.0008)	(0.0007)	(0.0007)
Fiscal balance		-0.143***	-0.148***	-0.124***	-0.126***
		(0.0008)	(0.0009)	(0.0007)	(0.0007)
Change in LCCS*Government bonds to assets			-0.008		
			(0.0001)		
Return on Assets (t-1)				-0.028	-0.034
				(0.0011)	(0.0011)
Change in LCCS*Return on assets					-0.049
					(0.0000)
N	2199	2199	2194	2112	2112
R^2	0.192	0.202	0.199	0.169	0.170

This table presents coefficient estimates from equation 3.1. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.9: Banks' demand for government bonds, 2020Q1 to 2021Q4

	y = Change in government bonds to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-2.502***	-2.571***	-2.551***	-2.455***	-2.472***
	(0.1103)	(0.1086)	(0.1114)	(0.1226)	(0.1250)
Equity to assets (t-1)	-0.142	-0.174	-0.254***	-0.333**	-0.332*
	(0.0743)	(0.0699)	(0.0531)	(0.0995)	(0.1023)
Deposits to assets (t-1)	-0.092	-0.183	-0.214	-0.243	-0.250
	(0.0008)	(0.0007)	(0.0007)	(0.0008)	(0.0008)
LCCS	0.174*	0.200*			
	(0.0000)	(0.0001)			
Change in LCCS			0.007	0.109***	0.177**
			(0.0000)	(0.0000)	(0.0001)
Change in central bank liquidity	0.017	0.016	0.020	0.023	0.021
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Total assets (t-1)		0.407*	0.302	0.310	0.331
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation rate (y/y)		-0.091	-0.075	-0.102	-0.110
		(0.0012)	(0.0012)	(0.0011)	(0.0011)
Fiscal balance		-0.026	-0.012	-0.018	-0.015
		(0.0006)	(0.0007)	(0.0008)	(0.0007)
Change in LCCS*Government bonds to assets			0.114**		
			(0.0002)		
Return on Assets (t-1)				0.121**	0.138**
				(0.0016)	(0.0016)
Change in LCCS*Return on assets					-0.087*
					(0.0000)
N	684	684	684	669	669
R^2	0.253	0.257	0.260	0.250	0.252

This table presents coefficient estimates from equation 3.1. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.10: Sovereign risk and bank return on equity, 2008Q1 to 2013Q3

	y = Return on Equity			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	0.013	0.013	-0.014	-0.014
	(4.6110)	(4.6110)	(4.2142)	(4.2142)
Total assets (t-1)	-0.491**	-0.491**	-0.406**	-0.406**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	-0.012	-0.012	-0.016	-0.016
	(2.2471)	(2.2471)	(2.1369)	(2.1369)
Change in LCCS (t-1)	-0.013	-0.013		
	(0.0011)	(0.0011)		
LCCS			-0.101	-0.101
			(0.0030)	(0.0030)
Change in LCCS*Government bonds to assets	0.027	0.027		
	(0.0110)	(0.0110)		
LCCS*Government bonds to assets			0.022	0.022
			(0.0177)	(0.0177)
Fiscal balance (t-1)	0.065	0.065	0.049	0.049
	(0.3843)	(0.3843)	(0.3782)	(0.3782)
Real GDP growth (t-1)	0.072	0.072	0.079	0.079
	(0.1946)	(0.1946)	(0.2007)	(0.2007)
Policy rate	0.005	0.005	0.037	0.037
	(0.4286)	(0.4286)	(0.4600)	(0.4600)
Inflation rate (y/y)	-0.195**	-0.195**	-0.200**	-0.200**
	(0.2772)	(0.2772)	(0.2861)	(0.2861)
US Inflation rate (y/y)	0.109*	0.211***	0.207***	0.102*
	(0.3090)	(0.3788)	(0.3753)	(0.3023)
Fed funds effective rate	0.106**			0.111**
	(0.7870)			(0.6999)
Change in Fed balance sheet		-0.013	-0.011	
		(0.0000)	(0.0000)	
N	1504	1504	1513	1513
R^2	0.161	0.161	0.171	0.171

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.11: Sovereign risk and bank return on equity, 2013Q4 to 2019Q4

	y = Return on Equity			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.110	-0.110	-0.081	-0.081
	(6.0324)	(6.0324)	(6.6291)	(6.6291)
Total assets (t-1)	0.018	0.018	0.034	0.034
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	-0.143	-0.143	-0.130	-0.130
	(13.6109)	(13.6109)	(13.5101)	(13.5101)
Change in LCCS (t-1)	0.012	0.012		
	(0.0038)	(0.0038)		
LCCS			-0.029	-0.029
			(0.0067)	(0.0067)
Change in LCCS*Government bonds to assets	-0.007	-0.007		
	(0.0130)	(0.0130)		
LCCS*Government bonds to assets			-0.073	-0.073
			(0.0306)	(0.0306)
Fiscal balance (t-1)	0.008	0.008	0.008	0.008
	(0.1785)	(0.1785)	(0.1708)	(0.1708)
Real GDP growth (t-1)	0.026	0.026	0.018	0.018
	(0.1984)	(0.1984)	(0.1874)	(0.1874)
Policy rate	-0.108	-0.108	-0.059	-0.059
	(0.2558)	(0.2558)	(0.2754)	(0.2754)
Inflation rate (y/y)	0.037	0.037	0.046	0.046
	(0.2769)	(0.2769)	(0.2882)	(0.2882)
US Inflation rate (y/y)	0.160**	-0.016	-0.013	0.150**
	(0.5360)	(0.2490)	(0.2268)	(0.4647)
Fed funds effective rate	-0.174***			-0.181***
	(0.3805)			(0.3474)
Change in Fed balance sheet		0.113***	0.119***	
		(0.0000)	(0.0000)	
N	2184	2184	2189	2189
R^2	0.077	0.077	0.081	0.081

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.12: Sovereign risk and bank return on equity, 2020Q1 to 2021Q4

	y = Return on Equity			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	0.032	0.032	0.049	0.049
	(6.1665)	(6.1665)	(5.4220)	(5.4220)
Total assets (t-1)	0.641***	0.641***	0.703***	0.703***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.291	0.291	0.302	0.302
	(44.1900)	(44.1900)	(45.4742)	(45.4742)
Change in LCCS (t-1)	-0.019	-0.019		
	(0.0108)	(0.0108)		
LCCS			0.081	0.081
			(0.0098)	(0.0098)
Change in LCCS*Government bonds to assets	0.052	0.052		
	(0.0551)	(0.0551)		
LCCS*Government bonds to assets			-0.043	-0.043
			(0.0451)	(0.0451)
Fiscal balance (t-1)	0.048	0.048	0.043	0.043
	(0.2674)	(0.2674)	(0.2828)	(0.2828)
Real GDP growth (t-1)	0.255**	0.255**	0.240**	0.240**
	(0.1283)	(0.1283)	(0.1251)	(0.1251)
Policy rate	0.133	0.133	0.127	0.127
	(0.5993)	(0.5993)	(0.6250)	(0.6250)
Inflation rate (y/y)	-0.041	-0.041	-0.053	-0.053
	(0.3046)	(0.3046)	(0.3083)	(0.3083)
US Inflation rate (y/y)	-0.104	-0.029	-0.028	-0.086
	(0.2265)	(0.3494)	(0.3596)	(0.2612)
Fed funds effective rate	-0.058			-0.045
	(1.2048)			(1.2861)
Change in Fed balance sheet		0.079	0.062	
		(0.0000)	(0.0000)	
N	714	714	714	714
R^2	0.188	0.188	0.186	0.186

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.13: Sovereign risk and bank return on assets, 2008Q1 to 2013Q3

	y = Return on Assets			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	0.059	0.059	0.035	0.035
	(0.5873)	(0.5873)	(0.5979)	(0.5979)
Total assets (t-1)	-0.279	-0.279	-0.212	-0.212
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.392***	0.392***	0.388***	0.388***
	(0.3449)	(0.3449)	(0.2873)	(0.2873)
Change in LCCS (t-1)	-0.011	-0.011		
	(0.0001)	(0.0001)		
LCCS			-0.092*	-0.092*
			(0.0004)	(0.0004)
Change in LCCS*Government bonds to assets	0.010	0.010		
	(0.0011)	(0.0011)		
LCCS*Government bonds to assets			0.019	0.019
			(0.0022)	(0.0022)
Fiscal balance (t-1)	0.039	0.039	0.043	0.043
	(0.0261)	(0.0261)	(0.0270)	(0.0270)
Real GDP growth (t-1)	0.040	0.040	0.057	0.057
	(0.0510)	(0.0510)	(0.0541)	(0.0541)
Policy rate	-0.176**	-0.176**	-0.177**	-0.177**
	(0.0370)	(0.0370)	(0.0378)	(0.0378)
Inflation rate (y/y)	0.082	0.129**	0.126**	0.074*
	(0.0435)	(0.0511)	(0.0477)	(0.0378)
US Inflation rate (y/y)	-0.031	-0.031	-0.038	-0.038
	(0.0656)	(0.0656)	(0.0640)	(0.0640)
Fed funds effective rate	0.049			0.054
	(0.1053)			(0.0974)
Change in Fed balance sheet		-0.008	-0.007	
		(0.0000)	(0.0000)	
N	1506	1506	1515	1515
R^2	0.273	0.273	0.278	0.278

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.14: Sovereign risk and bank return on assets, 2013Q4 to 2019Q4

	y = Return on Assets			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.057	-0.057	-0.041	-0.041
	(0.8827)	(0.8827)	(0.8481)	(0.8481)
Total assets (t-1)	-0.032	-0.032	-0.022	-0.022
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.061	0.061	0.075	0.075
	(2.3168)	(2.3168)	(2.3396)	(2.3396)
Change in LCCS (t-1)	0.029	0.029		
	(0.0006)	(0.0006)		
LCCS			0.011	0.011
			(0.0006)	(0.0006)
Change in LCCS*Government bonds to assets	-0.022	-0.022		
	(0.0022)	(0.0022)		
LCCS*Government bonds to assets			-0.052	-0.052
			(0.0023)	(0.0023)
Fiscal balance (t-1)	-0.006	-0.006	-0.005	-0.005
	(0.0170)	(0.0170)	(0.0161)	(0.0161)
Real GDP growth (t-1)	-0.118	-0.118	-0.097	-0.097
	(0.0282)	(0.0282)	(0.0315)	(0.0315)
Policy rate	0.019	0.019	0.021	0.021
	(0.0306)	(0.0306)	(0.0315)	(0.0315)
Inflation rate (y/y)	0.091**	-0.001	-0.007	0.076**
	(0.0507)	(0.0239)	(0.0299)	(0.0494)
US Inflation rate (y/y)	-0.008	-0.008	-0.009	-0.009
	(0.0207)	(0.0207)	(0.0221)	(0.0221)
Fed funds effective rate	-0.086**			-0.086**
	(0.0445)			(0.0437)
Change in Fed balance sheet		0.059***	0.054**	
		(0.0000)	(0.0000)	
N	2186	2186	2191	2191
R^2	0.055	0.055	0.057	0.057

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.15: Sovereign risk and bank return on assets, 2020Q1 to 2021Q4

	y = Return on Assets			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.048	-0.048	0.053	0.053
	(0.9653)	(0.9653)	(0.5918)	(0.5918)
Total assets (t-1)	0.387***	0.387***	0.451***	0.451***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.491	0.491	0.468	0.468
	(7.9952)	(7.9952)	(7.6010)	(7.6010)
Change in LCCS (t-1)	-0.014	-0.014		
	(0.0013)	(0.0013)		
LCCS			0.098	0.098
			(0.0014)	(0.0014)
Change in LCCS*Government bonds to assets	0.009	0.009		
	(0.0059)	(0.0059)		
LCCS*Government bonds to assets			-0.178	-0.178
			(0.0136)	(0.0136)
Fiscal balance (t-1)	0.001	0.001	0.006	0.006
	(0.0224)	(0.0224)	(0.0206)	(0.0206)
Real GDP growth (t-1)	0.221**	0.221**	0.210**	0.210**
	(0.0120)	(0.0120)	(0.0136)	(0.0136)
Policy rate	0.140	0.140	0.092	0.092
	(0.0652)	(0.0652)	(0.0578)	(0.0578)
Inflation rate (y/y)	-0.043	-0.043	-0.044	-0.044
	(0.0384)	(0.0384)	(0.0353)	(0.0353)
US Inflation rate (y/y)	-0.118	-0.091	-0.090	-0.113
	(0.0327)	(0.0419)	(0.0419)	(0.0396)
Fed funds effective rate	-0.021			-0.018
	(0.1108)			(0.1171)
Change in Fed balance sheet		0.029	0.024	
		(0.0000)	(0.0000)	
N	715	715	715	715
R^2	0.165	0.165	0.172	0.172

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.16: Sovereign risk and bank valuation, 2008Q1 to 2013Q3

	y = PE ratio			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.173	-0.173	-0.150	-0.150
	(125.6528)	(125.6528)	(106.2455)	(106.2455)
Total assets (t-1)	0.177	0.177	0.141	0.141
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.008	0.008	0.010	0.010
	(9.5298)	(9.5298)	(8.9243)	(8.9243)
Change in LCCS (t-1)	0.018	0.018		
	(0.0100)	(0.0100)		
LCCS			0.062	0.062
			(0.0389)	(0.0389)
Change in LCCS*Government bonds to assets	-0.014	-0.014		
	(0.0532)	(0.0532)		
LCCS*Government bonds to assets			-0.055	-0.055
			(0.1919)	(0.1919)
Fiscal balance (t-1)	-0.049	-0.049	-0.047	-0.047
	(2.4748)	(2.4748)	(2.4570)	(2.4570)
Real GDP growth (t-1)	0.070	0.070	0.069	0.069
	(1.4585)	(1.4585)	(1.4919)	(1.4919)
Policy rate	-0.012	-0.012	-0.016	-0.016
	(1.6482)	(1.6482)	(1.5680)	(1.5680)
Inflation rate (y/y)	-0.023	-0.023	-0.027	-0.027
	(0.6206)	(0.6206)	(0.7564)	(0.7564)
US Inflation rate (y/y)	-0.046*	-0.023	-0.018	-0.038*
	(1.3802)	(1.3562)	(1.2807)	(1.1088)
Fed funds effective rate	0.024			0.020
	(2.5249)			(2.2817)
Change in Fed balance sheet		-0.011	-0.009	
		(0.0000)	(0.0000)	
N	1458	1458	1467	1467
R^2	0.023	0.023	0.023	0.023

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.17: Sovereign risk and bank valuation, 2013Q4 to 2019Q4

	y = PE ratio			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	0.177	0.177	0.174	0.174
	(26.6434)	(26.6434)	(26.5419)	(26.5419)
Total assets (t-1)	0.126*	0.126*	0.108	0.108
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	0.634*	0.634*	0.630*	0.630*
	(192.2059)	(192.2059)	(192.9378)	(192.9378)
Change in LCCS (t-1)	0.031*	0.031*		
	(0.0177)	(0.0177)		
LCCS			0.120**	0.120**
			(0.0182)	(0.0182)
Change in LCCS*Government bonds to assets	-0.022	-0.022		
	(0.0555)	(0.0555)		
LCCS*Government bonds to assets			-0.059	-0.059
			(0.0547)	(0.0547)
Fiscal balance (t-1)	-0.014	-0.014	-0.008	-0.008
	(0.7949)	(0.7949)	(0.7902)	(0.7902)
Real GDP growth (t-1)	0.014	0.014	0.016	0.016
	(1.0581)	(1.0581)	(1.0842)	(1.0842)
Policy rate	-0.033	-0.033	-0.055	-0.055
	(0.4665)	(0.4665)	(0.3788)	(0.3788)
Inflation rate (y/y)	-0.005	-0.005	-0.015	-0.015
	(0.5427)	(0.5427)	(0.5589)	(0.5589)
US Inflation rate (y/y)	0.189	-0.009	-0.010	0.178
	(4.9024)	(1.3627)	(1.4293)	(4.9024)
Fed funds effective rate	-0.182			-0.170
	(3.8275)			(3.6345)
Change in Fed balance sheet		0.129	0.117	
		(0.0000)	(0.0000)	
N	2116	2116	2121	2121
R^2	0.068	0.068	0.069	0.069

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.18: Sovereign risk and bank valuation, 2020Q1 to 2021Q4

	y = PE ratio			
	(1)	(2)	(3)	(4)
Government bonds to assets (t-1)	-0.367	-0.367	-0.259	-0.259
	(1130.7825)	(1130.7825)	(922.5490)	(922.5490)
Total assets (t-1)	0.059	0.059	0.087	0.087
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Equity to assets (t-1)	-0.245	-0.245	-0.269	-0.269
	(2675.3855)	(2675.3855)	(2694.8529)	(2694.8529)
Change in LCCS (t-1)	-0.024	-0.024		
	(0.2945)	(0.2945)		
LCCS			0.045	0.045
			(0.2253)	(0.2253)
Change in LCCS*Government bonds to assets	0.003	0.003		
	(0.7139)	(0.7139)		
LCCS*Government bonds to assets			-0.178**	-0.178**
			(2.1702)	(2.1702)
Fiscal balance (t-1)	-0.069	-0.069	-0.058	-0.058
	(5.5653)	(5.5653)	(4.5405)	(4.5405)
Real GDP growth (t-1)	0.037	0.037	0.053	0.053
	(3.7957)	(3.7957)	(4.1791)	(4.1791)
Policy rate	-0.149	-0.149	-0.207	-0.207
	(17.8260)	(17.8260)	(23.2748)	(23.2748)
Inflation rate (y/y)	0.152	0.152	0.157	0.157
	(24.2580)	(24.2580)	(23.4971)	(23.4971)
US Inflation rate (y/y)	-0.054	-0.125	-0.127	-0.074
	(13.7583)	(18.9231)	(18.5368)	(16.3440)
Fed funds effective rate	0.054			0.040
	(35.2570)			(26.8909)
Change in Fed balance sheet		-0.073	-0.054	
		(0.0000)	(0.0000)	
N	705	705	705	705
R^2	0.031	0.031	0.037	0.037

This table presents coefficient estimates from equation 3.3. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.19: Sovereign risk and bank lending, 2008Q1 to 2013Q3

	y = Loans to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-0.145***	-0.158**	-0.162**	-0.215***	-0.222***
	(0.0507)	(0.0657)	(0.0654)	(0.0667)	(0.0673)
Change in government bonds to assets	-0.045**	-0.062***	-0.062***	-0.065***	-0.065***
	(0.0696)	(0.0409)	(0.0406)	(0.0382)	(0.0374)
Equity to assets (t-1)	0.090	0.087	0.086	0.067	0.008
	(0.2401)	(0.2700)	(0.2743)	(0.2627)	(0.2735)
Total assets (t-1)	-0.026	-0.016	-0.012	0.022	0.051
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in LCCS		-0.014	0.012		
		(0.0000)	(0.0001)		
LCCS				-0.097**	-0.282**
				(0.0000)	(0.0001)
Change in LCCS*Government bonds to assets		0.029			
		(0.0002)			
Change in LCCS*Equity to assets			-0.001		
			(0.0006)		
LCCS*Government bonds to assets				0.115**	0.129**
				(0.0002)	(0.0001)
LCCS*Equity to assets					0.195*
					(0.0007)
N	1448	1366	1366	1376	1376
R^2	0.088	0.111	0.109	0.121	0.134

This table presents coefficient estimates from equation 3.4. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.20: Sovereign risk and bank lending, 2013Q4 to 2019Q4

	y = Loans to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-0.259**	-0.250**	-0.249**	-0.299***	-0.305***
	(0.0998)	(0.0986)	(0.0980)	(0.0854)	(0.0817)
Change in government bonds to assets	-0.036**	-0.035**	-0.035**	-0.040***	-0.041***
	(0.0589)	(0.0578)	(0.0583)	(0.0459)	(0.0457)
Equity to assets (t-1)	-0.104	-0.108	-0.108	-0.114	-0.129
	(0.2621)	(0.2552)	(0.2554)	(0.2659)	(0.2570)
Total assets (t-1)	0.011	0.009	0.009	-0.055	-0.053
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in LCCS		0.016	0.015		
		(0.0001)	(0.0001)		
LCCS				0.090	-0.021
				(0.0001)	(0.0003)
Change in LCCS*Government bonds to assets		-0.003			
		(0.0002)			
Change in LCCS*Equity to assets			-0.000		
			(0.0011)		
LCCS*Government bonds to assets				0.075	0.098
				(0.0003)	(0.0004)
LCCS*Equity to assets					0.100
					(0.0013)
N	2110	2100	2100	2105	2105
R^2	0.058	0.057	0.057	0.106	0.109

This table presents coefficient estimates from equation 3.4. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

Table 3.21: Sovereign risk and bank lending, 2020Q1 to 2021Q4

	y = Loans to assets				
	(1)	(2)	(3)	(4)	(5)
Government bonds to assets (t-1)	-0.124	-0.119	-0.122	-0.047	-0.052
	(0.0901)	(0.0921)	(0.0905)	(0.0855)	(0.0814)
Change in government bonds to assets	-0.022**	-0.021**	-0.021**	-0.016	-0.016
	(0.0372)	(0.0349)	(0.0348)	(0.0473)	(0.0469)
Equity to assets (t-1)	0.252**	0.254**	0.255**	0.248**	0.238**
	(0.2601)	(0.2589)	(0.2553)	(0.2470)	(0.2549)
Total assets (t-1)	0.172***	0.181***	0.147**	0.275***	0.224***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Change in LCCS		0.013	-0.036		
		(0.0001)	(0.0002)		
LCCS				0.125***	0.054
				(0.0001)	(0.0002)
Change in LCCS*Government bonds to assets		-0.015			
		(0.0004)			
Change in LCCS*Equity to assets			0.039		
			(0.0016)		
LCCS*Government bonds to assets				-0.140***	-0.131***
				(0.0004)	(0.0004)
LCCS*Equity to assets					0.061
					(0.0015)
N	667	667	667	667	667
R^2	0.118	0.120	0.121	0.157	0.160

This table presents coefficient estimates from equation 3.4. Standardised beta coefficients; standard errors in parentheses

*** p<0.01; ** p < 0.05; * p < 0.1.

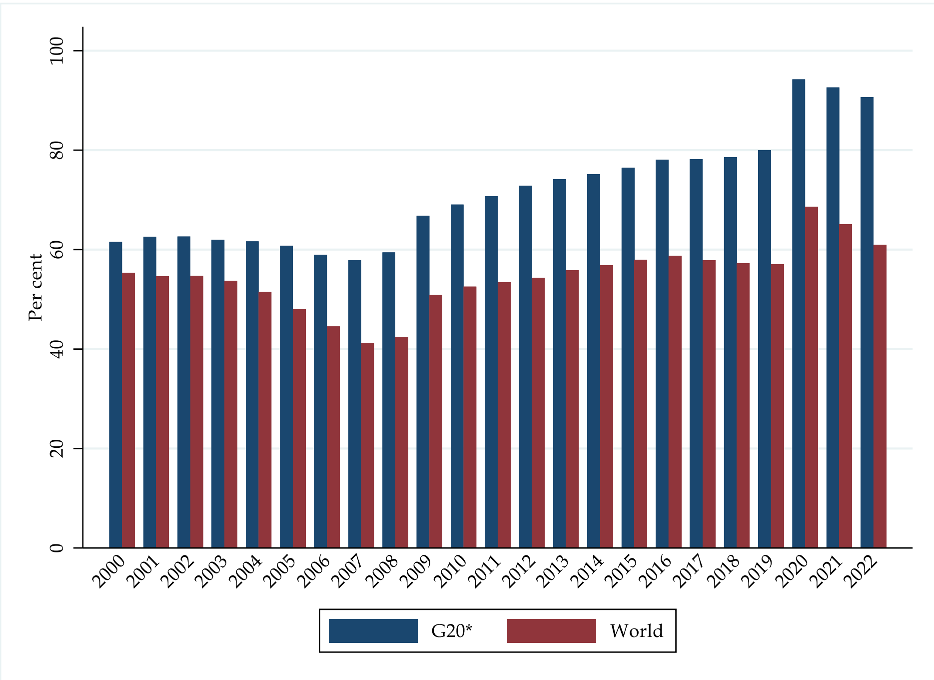
4 Interactions between fiscal and monetary policy in emerging-market economies: The South African case[11]

[11] Portions of this chapter have been published in Soobyah et al. (2023). These portions are my contributions to the co-authored working paper and as such are my own original work.

4.1 Introduction

Global developments in the 21st century have renewed interest in the interaction between fiscal and monetary policy. As Figure 4.1 shows, public debt has steadily increased since the GFC as an increase in global liquidity and ultra-low interest rates in advanced economies increased demand for emerging- and frontier-market debt among global investors in a search for returns (Kose at al., 2021a), allowing borrowers to issue more debt at favourable interest rates. Furthermore, policy responses to the Covid-19 pandemic posed a fiscal shock to governments, raising sovereign debt stocks to their highest levels since 1970 (Kose et al., 2021b).

Figure 4.1: Global public debt-to-GDP

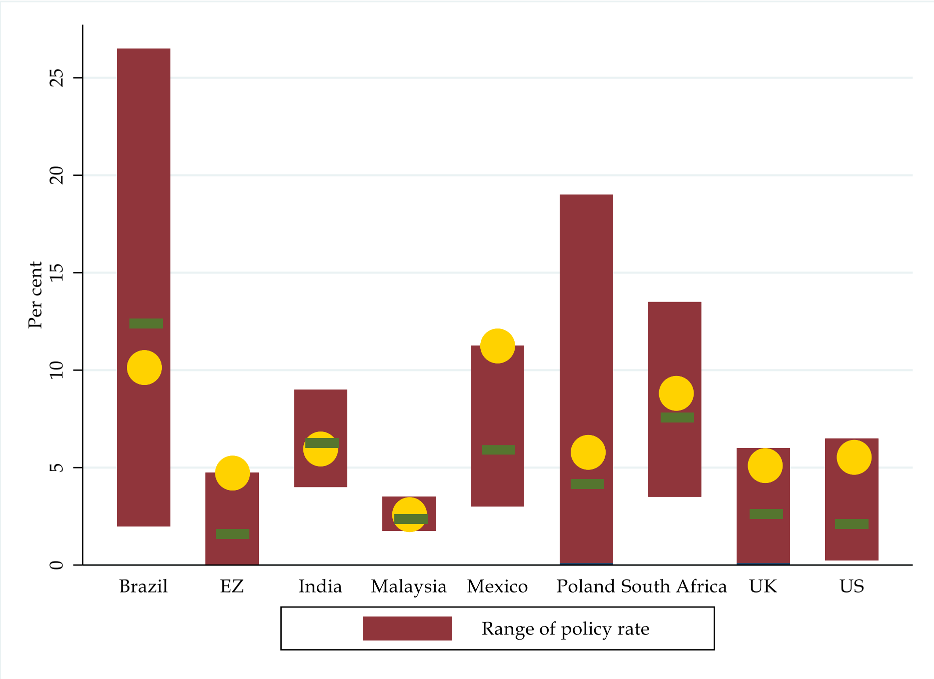


Source: IMF. *G20 excluding Mexico

Although outstanding sovereign debt was rising for years prior to the pandemic, the relatively low level of interest rates contained concerns about debt sustainability and the impact of sovereign debt levels on monetary policy. However, the post-pandemic global inflation shock has led to the highest nominal interest rates in a generation in many economies, as shown in Figure 4.2, and these issues have become more salient.

Particularly among sovereigns with shorter debt maturity profiles, there is a growing concern that debt-service costs might become unsustainable, especially if inflation remains elevated and necessitates tighter monetary policy for longer.

Figure 4.2: Selected policy rates between January 2000 and June 2024



Source: Bloomberg. The green markers represent the average policy rate for the period, while the yellow markers represent the policy rate at the end of June 2024.

In South Africa, public debt accumulation has been more pronounced than in many peer economies and the increase in debt-service costs preceded the pandemic. Debt sustainability and the fiscal outlook more broadly have therefore been a central focus for financial markets and those interested in domestic macroeconomic policy for a while. This has included the question of the impact of sovereign risk on domestic monetary policy, and the prospect of fiscal dominance in South Africa.

This chapter analyses the interaction between fiscal and monetary policy in EMs, with a particular focus on the South African context. First, I take the special case of fiscal dominance, a topic of strong interest in the literature, as a starting point and analyse the phenomenon among EMs since the GFC. Consistent with pre-GFC studies, I find that while the exchange rate is significant in the monetary policy reaction functions of inflation-targeting EM economies, there is no evidence of fiscal dominance among these economies during the period of interest. Second, I consider other ways beyond the narrow definition of fiscal dominance in which fiscal and monetary policy may affect each other by examining the interactions between variables that are relevant to fiscal and monetary policy in the South African context. Using impulse responses derived from the local projection approach of Jordá (2005), I show that the exchange rate, a significant driver of monetary policy among EMs, depreciates in response to sovereign-risk shocks, and this effect on the exchange rate is persistent. I also provide evidence that the monetary policy stance may remain persistently tighter following a sovereign risk shock compared with initial levels.

The chapter proceeds as follows: Section 4.2 provides a broad overview of the literature on fiscal-monetary policy interactions. Section 4.3 considers the special case of fiscal dominance by extending an earlier study by Zoli (2005) on fiscal dominance in EMs. Section 4.4 employs a local linear projection approach to examine interactions with monetary policy in South Africa. The chapter concludes with Section 4.5.

4.2 Literature review

4.2.1. The interaction between fiscal and monetary policy

The interaction between fiscal and monetary policy has resurged as a topic of interest in recent years, given the broad-based increase in fiscal spending since the onset of the Covid-19 pandemic and the post-Covid inflation shock. There are at least two key ways in which monetary and fiscal policy might be expected to influence one another. On one hand, monetary policy can affect fiscal policy through the impact of real interest rates: an increase real rates in response to inflationary pressures may affect debt sustainability (Leith & Wren-Lewis, 2000). On the other hand, fiscal policy can affect monetary policy through the impact of government spending on aggregate demand and real wages (Woodford, 2001). Dodge (2002) argues that significant spillovers also exist between the credibility of either policy, such that fiscal policy credibility can affect the credibility and effectiveness of monetary policy, and vice versa.

More generally, Leeper (1991) analyses the interaction between fiscal and monetary policy in a stochastic model. He defines “active” and “passive” fiscal policy according to the constraints faced by the authority: an active authority acts independently of the state of government debt and sets its policy instrument as it sees fit, whereas a passive authority responds to government debt shocks and sets its policy instrument to balance to government budget. For its part, monetary policy is also characterised as active or passive depending on its responsiveness to the fiscal position. When monetary policy is active and fiscal policy is passive, the central bank is unconstrained and can set the nominal interest rate to respond strongly to inflation while the government passively adjusts direct taxes to balance the budget. When monetary policy is passive and fiscal policy is active, the government does not sufficiently adjust direct taxes in response to a deficit shock and the central bank allows the money stock to grow to prevent an explosive path for real government debt. In Leeper’s model, both regimes where one authority is active and the other is passive result in a unique and stable equilibrium, while a regime in which both authorities are unresponsive to government debt leads to an unstable outcome with a potentially explosive government debt path.

4.2.2. The transmission channels of fiscal policy to monetary policy

The literature features various ways in which fiscal policy can affect monetary policy as outlined above. A notable strand of work along this line is the fiscal theory of the price level (FTPL), which views the price level as determined solely by the government’s total liabilities comprising of government debt and money supply. The real value of government liabilities is equal to the sum of expected primary government surpluses. Woodford (2001) describes a system in which fiscal policy can affect the price level through a wealth effect: given the relationship between the government budget balance and taxes, lower expected surpluses make households feel wealthier, increasing aggregate demand and raising the price level. Cochrane (2005) argues that nominal government liabilities are a residual claim to primary government surpluses similar to how stocks are a residual claim to a company's expected earnings. To address some criticisms of the FTPL, Cochrane (2005) develops a model with zero money demand where the central equilibrium condition that determines the price level is the relation between government liabilities and primary surpluses. He argues that a government can affect the price of nominal liabilities and thus the price level because it defines these liabilities in the same way a firm defines its stock and can undertake corporate actions which affect its share price. However, as noted by Bassetto (2008), the FTPL remains controversial, with detractors citing issues such as fundamental economic misspecification problems that have implications for the equilibria derived under the FTPL (Buiter, 2002).

Besides the government-liability channel proposed by the FTPL, fiscal policy might also affect monetary policy through sovereign risk. Arellano et al. (2020) expect sovereign default risk to be inflationary by raising inflation expectations in the economy, resulting in tighter monetary policy. Bonam and Lukkezen (2018) modify a standard New Keynesian model by introducing a sovereign risk premium that forms a wedge between the risk-free rate and the sovereign yield and is nonlinear in its relationship to government in that the risk premium increases in debt elasticity at higher levels of government debt. They show that in the presence of sovereign risk, a stable and unique equilibrium may not be possible when the government pursues a countercyclical fiscal policy, even if monetary policy is active and fiscal policy is passive. Therefore, the existence of sovereign risk increases the significance of the fiscal authority's commitment to managing debt dynamics, regardless of the stance of the central bank. Increases in sovereign risk are also associated with exchange rate depreciation (Della Corte et al., 2022), which may have implications for monetary policy in an EM setting (Devereaux et al., 2006).

Furthermore, in line with Dodge's (2002) argument about fiscal-monetary policy credibility spillovers, fiscal policy can also have an impact on inflation expectations. Using Brazil as a case study, Montes and de Hollanda Lima (2021) find that fiscal spending and credibility both have a significant impact on the size of the inflation risk premium, which would have consequences for monetary policy to the extent that the inflation risk premium is a reflection of the anchoring of inflation expectations and monetary policy credibility (Buraschi & Jiltsov, 2005).

While economic theory points to a positive relationship between government spending and price levels, the effect of fiscal multipliers and their drivers may result in different outcomes in the actual interaction between fiscal and monetary policy. Several scholars have found evidence for smaller fiscal multipliers among EMs (Hory, 2015) and that the composition of government spending affects its impact with investment spending having larger multipliers (Ilzetzki et al., 2012). Furthermore, there is also evidence that fiscal multipliers are negative when public debt is high (Nickel et al., 2014). In a country with a small or negative fiscal multiplier such as South Africa (Janse van Rensburg et al., 2022), government spending does not have a positive impact on aggregate demand and real wages, with implications for the impact on inflation and monetary policy.

4.2.3. Other factors relevant for transmission of monetary policy

For small, open economies such as EMs, there are other variables related to both fiscal and monetary policy that can affect the conduct and effectiveness of monetary policy. Following the GFC, there has been growing interest in the spillover of monetary policy from major economies such as the US and the impact of such spillovers on international financial conditions. Rey (2015) argues that because of financial globalisation, there is a global financial cycle in which financing conditions are set by the main world financing centres and transmitted to the rest of the world regardless of exchange rate regime.

In this strand of literature, financial conditions are transmitted through capital flows and asset prices that respond to monetary policy conditions in a centre economy such as the US. In Degasperi et al.'s (2023) financial transmission channel of monetary policy, a Fed rate hike is transmitted along the yield curve and reduces the prices of risk assets; they find that a contractionary US monetary policy shock is followed by a depreciation in foreign currencies against the USD and a reduction in global risk appetite and cross-border flows, supporting the existence of a global financial cycle. By contrast, Cerutti et al. (2017) find no evidence of a global financial cycle driving changes in capital flows. In Kalemli-Ozcan's (2019) study of US monetary policy and risk spillovers, changes in US monetary policy also impact emerging-market monetary policy through risk premia and capital flows, and the sensitivity of the EMs' capital flows drives their monetary policy response to changes in US monetary conditions.

4.2.4. Fiscal dominance as a special case of fiscal-monetary policy interaction

Fiscal dominance can be considered a particular form of interaction between fiscal and monetary policy that aligns with Leeper's (1991) active fiscal – passive monetary policy regime. In their seminal paper, Sargent and Wallace (1981) define a fiscal-dominant regime as one in which the fiscal authority independently sets its budgets and announces current and future deficits and surpluses. In this way, it determines the revenue that must be generated through bond sales and seignorage and it affects the conduct of monetary policy via the demand for government debt and its impact on inflation. They note that in a fiscal-dominant regime, if the primary deficit cannot be financed solely by bond sales, then the monetary authority is forced to create new money and tolerate higher inflation. In a monetary policy implementation framework such as South Africa's, this could manifest in the central bank maintaining more ample liquidity conditions in the market to enable banks to absorb the higher supply of government bonds implied by persistent fiscal deficits. Sargent and Wallace conclude that if primary fiscal deficits are exogenous, then tighter current monetary policy implies higher inflation in future as the fiscal authority will eventually face the limit on demand for its bonds.

Other scholars have since built on the Sargent-Wallace model of fiscal dominance beyond money aggregate-targeting frameworks. McCallum (1984) uses a theoretical model to argue that persistent primary fiscal deficits financed by bond issuance are inflationary. Zoli (2005) conceptualises the Sargent-Wallace theory as a question of whether primary balances as set by the fiscal authority are exogenous or responsive to current government liabilities. This study estimates the empirical relationship between fiscal and monetary policy for a group of EMs and finds no evidence of fiscal dominance in the sample countries. By contrast, Bajaro et al. (2025) use forward-looking Taylor rules and find evidence of fiscal dominance in a sample of countries over three decades, with stronger effects among EMs with inflation-targeting frameworks. Ahmed et al. (2021) consider the responsiveness of fiscal variables to interest rates as a form of fiscal dominance, and find some evidence of fiscal dominance among non-inflation targeting EMs. Unconventional monetary policies including large central bank purchases of sovereign debt have also prompted work on the spectre of fiscal dominance in advanced economies (Bordo & Levy, 2021).

Blanchard (2004) proposes yet another approach to the concept of fiscal dominance for a small, open economy which accounts for the impact of fiscal risk on monetary policy transmission. In his model, real interest rates affect sovereign risk and the exchange rate, which in turn affect inflation. If an increase in the real interest rate under inflation targeting also increases the probability of default on government debt, then it may make government debt less attractive and lead to a real depreciation of the exchange rate and higher inflation. In this case, inflation targeting would have perverse outcomes where monetary tightening leads to a real depreciation and higher inflation. This outcome is more likely the higher the initial level of debt, the higher the proportion of foreign-currency denominated debt and the higher the price of risk. Indeed, this theory fits well with Brazil's experience during its macroeconomic crisis in 2002-2003.

This chapter contributes to several strands of literature on the relationship between fiscal and monetary policy. It provides empirical evidence on the existence of fiscal dominance among inflation-targeting EMs. The chapter also contributes to the literature on the impact of risk premia on monetary policy among EMs, with a specific focus on the sovereign risk premium. Finally, the chapter also provides additional evidence on the importance of exchange rate changes for emerging-market monetary policy. In particular, the study contributes to the literature on the interaction between sovereign risk and exchange rates, and the impact of this covariance on monetary policy in an emerging-market context.

4.3 Empirical analysis of fiscal dominance in emerging markets

4.3.1. Data and methodology

I begin the empirical analysis of fiscal-monetary interactions by considering the special case of fiscal dominance in EMs. To do so, I follow the approach of Zoli (2005) and Ahmed et al. (2021) who use a monetary policy reaction function to test the responsiveness of monetary policy to changes in fiscal policy. In these papers, a monetary authority that accommodates loose fiscal policy by being less responsive to inflationary pressures is evidence of fiscal dominance.

Zoli (2005) estimates the following monetary policy reaction function for seven EMs:

$$i_t = \varphi_0 + \varphi_1 i_{t-1} + \varphi_2 (INFL_t^e - INFL^*) + \varphi_3 OUTPUTGAP_{t-1} + \varphi_4 \Delta RPB_{t-1} + \omega_t \tag{4.1}$$

where i_t is the monetary policy interest rate in period t, $INFL_t^e$ is expected inflation in period t, $INFL^*$ is the inflation target, $OUTPUTGAP_t$ is the difference between actual output and potential output in period *t-1* and ΔRPB_t is the change in the real primary balance in period *t-1*. The study finds no evidence of fiscal dominance in any of the countries under review.

I adopt the reaction function in equation 4.1 and use it in a panel approach. Specifically, I estimate the following basic equation:

$$i_{it} = \varphi_{i0} + \varphi_1 i_{it-1} + \varphi_2 (INFL_{it}^e - INFL_i^*) + \varphi_3 OUTPUTGAP_{it-1} + \varphi_4 \Delta FISCAL_{it-1} + \omega_{it} \tag{4.2}$$

where i_{it} is the monetary policy rate of country i at time t, $INFL_{it}^e - INFL_i^*$ is the expected deviation of inflation from its target rate in country i output in period t, $OUTPUTGAP_t$ is the difference between actual output and potential output in period *t-1* and $\Delta FISCAL_{it}$ is the change in country i,'s fiscal stance in period *t-1*, proxied alternately by the fiscal balance and net government lending. Furthermore, I consider specifications that alternately include the variable $\Delta REER_{it}$, the real effective exchange rate (REER), and ΔBER_{it}, the BER with respect to the USD, to control for the potential responsiveness of monetary to changes in exchange rates as in Ahmed et al. (2021) for EMs and Coco and Viegi (2020) specifically for South Africa. These variables enter the model with no lag as I expect central banks to respond to developments in the exchange rate markets contemporaneously, in line with Zoli (2005) and Ahmed et al. (2021).

The panel includes nine EMs with sufficient data coverage for the main period under review, 2000 to 2023. These include five countries[12] from Zoli (2005) and four additional countries[13] that were not in the earlier study.

I compile the data at the annual frequency as fiscal variables are typically reported or calculated at this level. The key policy rates, BER, and actual GDP data are obtained from the IMF's International Financial Statistics, while the fiscal variables and historical inflation forecasts are obtained from the IMF's historical World Economic Outlook forecasts. Data on the REER is taken from the Bank of International Settlements. Each country's inflation target is obtained from Jahan (2012), with the midpoint taken for countries that use an inflation targeting band. Lastly, to derive the output gap, I generate quasi-real time potential GDP estimates that only consider the data available at that point in time to produce trend-cycle decompositions using the Hodrick-Prescott filter (Orphanides, 2001). I take the first year of actual output data availability for a given country as its starting year for estimating potential output, ranging between 1993 for Mexico to 2005 for Colombia. The regression analysis covers the period from 2012 to 2023, with earlier data used to estimate initial potential output for the period of interest.

In line with Ahmed et al. (2021), I make use of panel methods to estimate the model. Panel methods have several advantages, including more degrees of freedom and sample variability which allow for more efficient estimates than those produced by

[12] Brazil, Colombia, Mexico, Poland, South Africa.
[13] Hungary, Indonesia, Russia, Turkey.

time series data. Panel data also allow for the observation of dynamic relationships by relying on inter-country differences in the case of this study to reduce collinearity that may be problematic with time series data. (Hsiao, 2007). While I initially estimate the model using fixed effects, I note that the small N, small T construction of my panel may result in unreliable estimates. I therefore also estimate the model using the feasible generalised least squares (FGLS) estimator, which addresses the likely serial correlation between observations and asymptotically results in a more efficient estimator than ordinary least squares (OLS) (Bai et al., 2020).

Table 4.1: Panel data summary statistics

	Observations	Mean	Std Dev	Min	Max
Key policy rate (%)	209	8.89	8.37	0.33	78.22
Inflation deviation (percentage	216	2.13	5.28	-2.72	50.42
Inflation rate (%)	215	7.39	8.55	-0.87	71.84
Change in inflation rate (ppt)	206	-0.02	5.30	-25.19	52.39
Output gap (% of GDP)	124	0.16	1.91	-7.05	4.87
Exchange rate variables					
Change in REER (%)	207	0.00	0.09	-0.24	0.26
Change in BER (%)	207	0.04	0.13	-0.33	0.67
Fiscal variables					
Change in operating balance (% of	100	-0.34	2.65	-17.33	7.08
Change in structural balance (% of	202	-0.09	1.85	-7.89	6.92
Change in net lending (% GDP)	206	-0.09	2.14	-10.44	9.33

There are several reasons why an extension of the Zoli (2005) analysis is useful. First, that paper covered the period from 1998 to 2003. Since many jurisdictions only adopted inflation targeting around 2000, the sample is restrictive. As this study covers a longer time period in which all countries were inflation targeting, it benefits from more EM experience with inflation targeting and the effects this regime has had on price and output growth stability (Gonçalves & Salles, 2006) as well as central bank credibility (Bordo & Siklos, 2014). Second, since the time period covered in this analysis comprises the post-GFC era, it allows us to observe the potential dominance of fiscal policy over monetary policy during a time which featured considerable structural changes among EMs and the global economy. In particular, global interest rates declined considerably in line with lower inflation (See Ha et al. (2022) and Mazumder (2018), for instance) in some countries and lower term premia (Cohen et al., 2018) in AEs amid the introduction of unconventional monetary policies in those jurisdictions. These factors contributed to increased demand for riskier assets amid a search for positive returns by global investors, supporting an increase in public and corporate EM debt issuance (Kose et al., 2021a). Consequently, the review period saw a combination of broad-based increases in public debt and varying experiences with inflation among EMs, an interesting setting for observing potential accommodation by monetary policy. Taken together, such an exercise would provide some insight about the general responsiveness of EM central banks to the fiscal policy stance following structural changes to the global economy as well as to the central banks' operations and credibility.

4.3.2. Results

Table 4.2 reports the FGLS regression results from equation 4.2 and some extensions to the baseline model. Consistent with evidence from other papers evaluating policy reaction functions (see Coibion & Gorodnichenko (2012) and Turkay (2017), for instance), the coefficient on the lagged interest rate is large and highly statistically significant, indicating persistence in the key policy rate. The output gap has a positive and consistently significant coefficient, with the size of the coefficient comparable to the results for the individual EMs considered in Zoli (2005). As expected, an increase in actual output relative to potential is associated with a higher monetary policy rate.

In terms of the relationship between the key monetary policy rate and price levels, I start with the specification including the deviation of inflation expectations from the target as per equation 4.2. The coefficient of the lagged inflation deviation is positive as expected, such that a higher deviation from target is associated with a higher key policy rate in the subsequent year, however this variable is insignificant across most specifications. I therefore consider alternative measures of price levels that central banks might be sensitive to, namely the inflation rate measured as the annual change in the consumer price index (CPI) and the change in the inflation rate. The coefficient on the lagged inflation rate is consistently significant and positive: higher inflation is associated with a higher key policy rate in the subsequent year. The change in the inflation rate also has a significant relationship with the key policy rate, albeit less so than the inflation rate itself. Notably, both of these variables' coefficients are larger than the inflation deviation, consistent with Zoli (2005) even though her sample included a period prior to the introduction of inflation targeting. This may suggest that emerging-market central banks are more concerned with the absolute level of inflation and its trend than its relationship to the inflation target. Table 4.4 and Table 4.5 report the full results for regressions using the inflation rate and the change in t as measures of the price variable (Annexure Chapter 4).

Table 4.2: Feasible generalised least squares estimates of the monetary policy reaction function

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Key policy rate (t-1)	0.762 ***	0.762 ***	0.759 ***	0.756 ***	0.827 ***	0.826 ***	0.767 ***	0.764 ***	0.766 ***	0.765 ***
	(0.0779)	(0.0784)	(0.0753)	(0.0754)	(0.0647)	(0.0646)	(0.0794)	(0.0797)	(0.0782)	(0.0786)
Output gap (t-1)	0.212 ***	0.192 ***	0.208 ***	0.191 ***	0.196 ***	0.182 ***	0.213 ***	0.192 ***	0.208 ***	0.183 ***
	(0.1361)	(0.1325)	(0.1323)	(0.1285)	(0.1318)	(0.1276)	(0.1365)	(0.1325)	(0.1362)	(0.1328)
Structural balance (diff) (t-1)	0.044		0.039		0.027		0.049		0.058	
	(0.0871)		(0.0849)		(0.0873)		(0.0888)		(0.0872)	
Net lending (diff) (t-1)		0.019		0.013		-0.001		0.019		0.021
		(0.0884)		(0.0865)		(0.0878)		(0.0885)		(0.0880)
Inflation deviation (t-1)	0.111 *	0.108					0.110 *	0.108	0.103	0.099
	(0.1396)	(0.1417)					(0.1394)	(0.1417)	(0.1395)	(0.1419)
Inflation rate (t-1)			0.194 **	0.195 **						
			(0.0508)	(0.0510)						
Change in inflation rate (diff) (t-1)					0.123 *	0.129 *				
					(0.0478)	(0.0483)				
REER (diff)							0.016	0.008		
							(1.9771)	(1.9720)		
BER (diff)									0.113 **	0.104 **
									(1.7543)	(1.7674)
Observations	116	116	116	116	116	116	116	116	116	116

Standardised beta coefficients; Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01

The exchange rate variables are defined such that an increase represents a depreciation of the domestic exchange rate. Consistent with exchange-rate pass-through to domestic prices, I expect the coefficient on the exchange rate variables to be positive, such that a depreciation is associated with a higher policy rate. I find that a depreciation in the REER has a small and statistically insignificant impact on the key monetary policy rate, whereas a depreciation specifically with respect to the USD - as reflected by BER – has a significant impact with the expected sign. A 1 % depreciation in the BER is associated with a key policy rate that is 10.4 to 11.3 bps higher; this result is robust to alternative measures of price levels.

The REER is measured against a trade-weighted basket of bilateral exchange rates, such that it can serve as a measure of international competitiveness. By contrast, I interpret the BER as an indication of the financial channel, in line with Avdjiev et al. (2019) and Hofmann et al. (2022). As such, I infer that the significant relationship between the policy rate and BER reflects the important role that financial flows play in EMs, while the insignificance of the REER suggests less concern with global competitiveness relative to trade partners.

Finally, I find the fiscal variables to be mostly statistically insignificant and economically small, with a 1 percentage-point (ppt) increase in the structural balance associated with a 2.7 to 6 bps higher key monetary policy rate, while a 1 ppt increase in net government lending is associated with a key monetary policy rate that is only up to 2 bps higher. Notably, the positive signs of these coefficients would suggest that a decline in the fiscal balance, that is an increase in the deficit, would be followed by a lower policy rate, which would be consistent with accommodative monetary policy. However, since the coefficients are small and not significant even at the 10% level, I conclude that there is no evidence of fiscal dominance among EMs during the period under review.

4.4 Interactions with monetary policy in South Africa

4.4.1. Data and methodology

While the previous section provides insight into or regarding the general monetary policy orientation of the post-GFC era, it provides limited understanding of how different variables relevant for monetary policy and fiscal policy affect one another in a more dynamic fashion. First, the panel construction of the data results in broad findings about EMs in general, as opposed to detailed findings regarding specific countries. More importantly, the analysis is undertaken on an annual basis due to the data available for fiscal variables. However monetary policy can change several times in a given year, while other variables potentially relevant to both fiscal and monetary policy can also change throughout the year. Therefore, an analysis focused specifically on South Africa using higher-frequency data can yield additional insights regarding how fiscal policy might affect the conduct or stance of monetary policy.

While Section 4.3 did not find evidence of fiscal dominance in the panel data analysis, there are other ways in which fiscal policy can have a significant impact on monetary policy, especially in the case of EMs. In particular, elevated levels of or changes in sovereign risk can affect monetary policy directly by raising inflation expectations, as proposed by Arellano et al. (2020). Sovereign risk can also indirectly affect monetary policy through its relationship with the exchange rate (Della Corte et al., 2022). The previous section finds that changes in the exchange rate have significant bearing on the monetary policy stance of EMs, in line with evidence from Zoli (2005) and Devereax et al. (2006), while sovereign risk has been shown to have a significant relationship with exchange rate risk in South Africa (see Chapter 2). This raises the prospect that sovereign risk can indirectly affect South African monetary policy through its impact on the exchange rate.

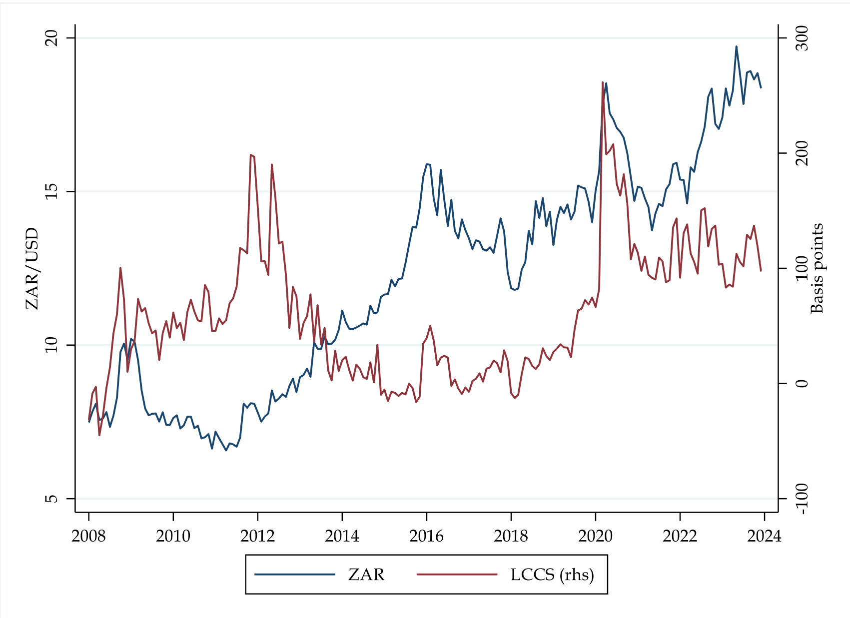
To investigate this, I first model the response of the exchange rate to sovereign risk shocks over a horizon of 12 months as follows:

$$y_{t+h} = \beta_h^o + \beta_h^1 S_t + \beta_h^2(L) y_{t-1} + \beta_h^3(L) X_{t-1} + \epsilon_h$$

(4.3)

where y_{t+h} is the logged ZARUSD h months ahead; S_t is a shock to South African sovereign risk, measured by the LCCS; X is a vector of control variables including the value of the US Move index to capture volatility in global interest rate markets; an index of a basket of major nominal exchange rates against the USD; and the South African repo rate[14]. In order to control for serial correlation of the error term and persistent effects, I also include six lags of the dependent and independent variables. The coefficients $\hat{\beta}_1^1$ to $\hat{\beta}_{12}^1$ estimate the response of the variable of interest to the shock variable over the 12-month horizon.

Figure 4.3: Sovereign risk and exchange rate co-movement, 2008 to 2023



Source: Bloomberg

[14] Lloyd and Manuel (2024) argue that while this two-step approach to evaluating the impact of shocks results in IRF estimates that are identical to a one-step approach that controls directly for confounding variables, it leads to wider standard errors. Nevertheless, I adopt the two-step approach in line with empirical analyses such as Romer and Romer (2004).

I use local linear projections (LLPs) to estimate my impulse responses. LLPs use direct forecasting with the model re-estimated for each forecast horizon, thus the projections are local to each forecast horizon (Jordà, 2005). Specifically, for the linear case

$$y_{t+h} = \alpha_h + \beta_h s_t + \gamma_h X_t + v_{t+h}; \quad v_{t+h} = u_{t+h} + \psi_1 u_{t+h-1} + \cdots + \psi_h u_t \tag{4.4}$$

where s_t is a shock administered at time t and X_t is a vector of exogenous variables, the impulse response is

$$IR(h) = E[y_{t+h}|s_t = s_1; X_t] - E[y_{t+h}|s_t = s_0; X_t] = \beta_h(s_1 - s_0) \tag{4.5}$$

The set of h regressions in equation 4.3 are LLPs, estimated using OLS, while the $\widehat{\beta_h^1}$ estimates constitute the impulse response function (IRF). Notably, the error terms v_{t+h}include a moving average from time t to t+h, and this serial correlation must be corrected for more efficient estimates (although it does not affect the consistency of the LLP estimate). I therefore use Newey-West corrections for the error terms, consistent with Jordà (2005). I note, however, that following Montiel-Olea and Plagborg-Møller (2021), Ramey (2022) argues that lag-augmentation in LLPs has advantages over using use Newey-West corrections, as the latter can lead to downward-biased standard errors.

The use of LLPs presents several advantages. They do not require the specification and estimation of the true multivariate dynamic system itself. While impulse responses estimated by vector autoregressions (VARs) are more efficient than LLP estimates when the VAR is correctly specified, LLPs are consistent and more robust to lag length misspecification such that the underlying data generating process need not be known (Jordà, 2005). Nevertheless, Plagbørg-Moller and Wolf (2021) show that in population, LLPs and VARs estimate the exact same impulse responses, and for a fixed number of p lags the two estimated impulse responses will be approximately the same out to horizon p. Jordà and Taylor (2024) also note their usefulness in analyses involving nonlinearities, state-dependence and cumulative responses.

The wide confidence intervals produced by LLPs and the challenges they pose for inference are noted in the literature. Jordà (2023) notes that while the shape of the IRF is the point of interest in LLPs, researchers make inferences about the shape the IRF based on confidence intervals. This is incorrect, as confidence intervals are for individual estimates in the impulse response path, and these coefficients are serially correlated (Jordà, 2009). Instead, Inoue et al. (2023) propose constructing significance bands based on the characteristics of the joint distribution. Specifically, they propose a joint probability test that the estimated impulse responses lie within the following band:

$$P\left(\bigcap_{h=0}^{H-1}\left\{\zeta_{\alpha/2H}\frac{\sigma}{\sqrt{T-h}} < \hat{\beta}_h < \zeta_{1-\alpha/2H}\frac{\sigma}{\sqrt{T-h}}\right\}\right) \geq 1-\alpha \tag{4.6}$$

where $\zeta_{\alpha/2H}$ is the critical value of a standard normal variable at $\alpha/2$, Bonferroni adjusted to avoid spurious rejection of the null hypothesis with increasing horizons. An IRF with coefficients that fall outside the significance bands is considered to be different from zero. I use the asymptotic approximation as proposed by Inoue et al. (2023) to construct significance bands for all my IRFs.

I compile data at the monthly frequency in order to take advantage of the variability of the financial market variables on one hand and changes in the repo rate on the other hand, which can currently occur up to six times a year. I obtain the data from Bloomberg, with the exception of the LCCS which I derive as per Du and Schreger (2016) (see Chapter 2). The analysis focuses on the period January 2008 to December 2023, in line with the limited availability of derivates data for EMs prior to 2008, including South Africa.

Table 4.3: South African analysis summary statistics

	Number of obs	Mean	Std Dev	Min	Max
ZARUSD	192	12.18335	3.636713	6.5686	19.7255
LCCS	192	60.0517	56.37575	-45,00	261.59
Repo rate	192	6.341146	1.903813	3.5	12,00
USD Index	192	89.77096	9.717466	71.802	112.117
Move index	192	85.27229	33.89384	39.21	214,00

While the period under review features interesting structural changes for EMs at large, as discussed earlier, it is also characterised by South African-specific developments that are relevant for the interaction between monetary and fiscal policy. As the stock of outstanding sovereign debt grew steadily since the GFC, market perceptions of sovereign default risk have gradually increased since late 2015. The notable deterioration in the fiscal position after the onset of the Covid-19 pandemic drove further increases in the sovereign risk premium. In line with a stronger USD and growing concerns about idiosyncratic South African risks (Fedderke, 2021), the exchange rate steadily depreciated since 2012, while the repo rate varied in line with a headline inflation rate that fluctuated in the range 4-6%. Following the global loosening of monetary policy in response to the Covid-19 pandemic, the repo rate increased from an historical low of 3.5% in September 2021 to a 14-year high of 8.25% by December 2023. These changes in the fiscal position and monetary policy stance amid variability in the exchange rate and domestic inflation provide a useful backdrop to analyse the interactions between these variables.

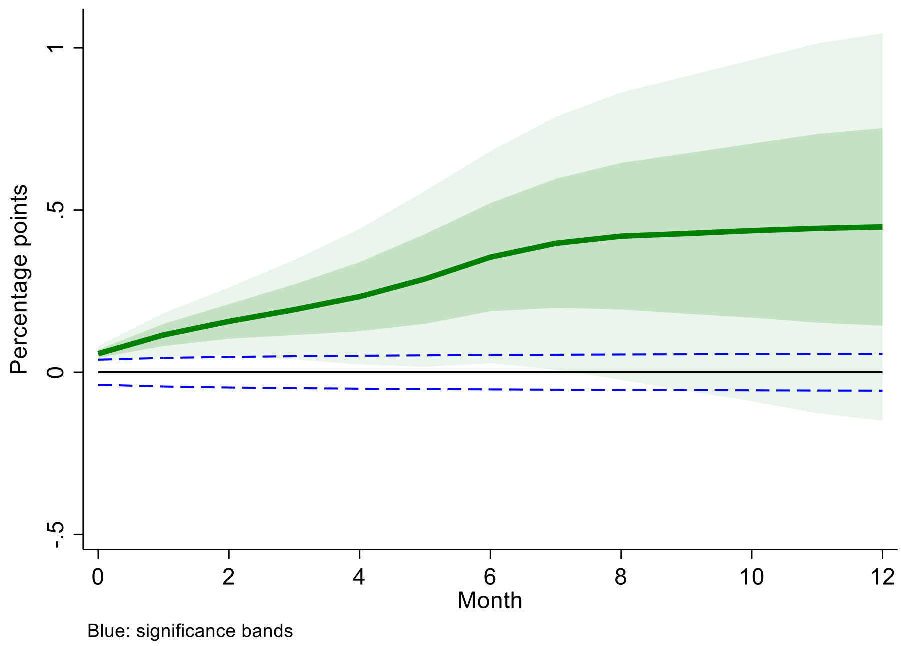
4.4.2. Results

In this section I present cumulative IRFs obtained from estimates of equation 4.3 using LLPs. The IRFs are presented with one and two standard deviation error bands and significance bands as per equation 4.6. The IRFs are estimated over a 12-month horizon.

Figure 4.4 reports the cumulative response of the ZARUSD to a shock in sovereign risk, as measured by the LCCS. Throughout the analysis, I identify a shock as a 1-

month change in a given variable exceeding one standard deviation above the sample mean. A LCCS shock results in a depreciation in the ZARUSD; this impact persists throughout the forecast horizon, reaching a peak depreciation of 0.45 ppts compared to the initial level after about 6 months. The persistence of the ZARUSD response to the shock indicates that the exchange rate does not return to its initial level, and given the importance of the exchange rate in EM monetary policy reaction functions as shown in Section 4.3, this likely has implications for domestic monetary policy over the forecast horizon.

Figure 4.4: Cumulative response of the exchange rate to sovereign risk shocks



After estimating the response of the exchange rate to sovereign risk shocks, I consider other responses that may be relevant for monetary policy. I model the response of the repo rate to a sovereign risk shock as follows:

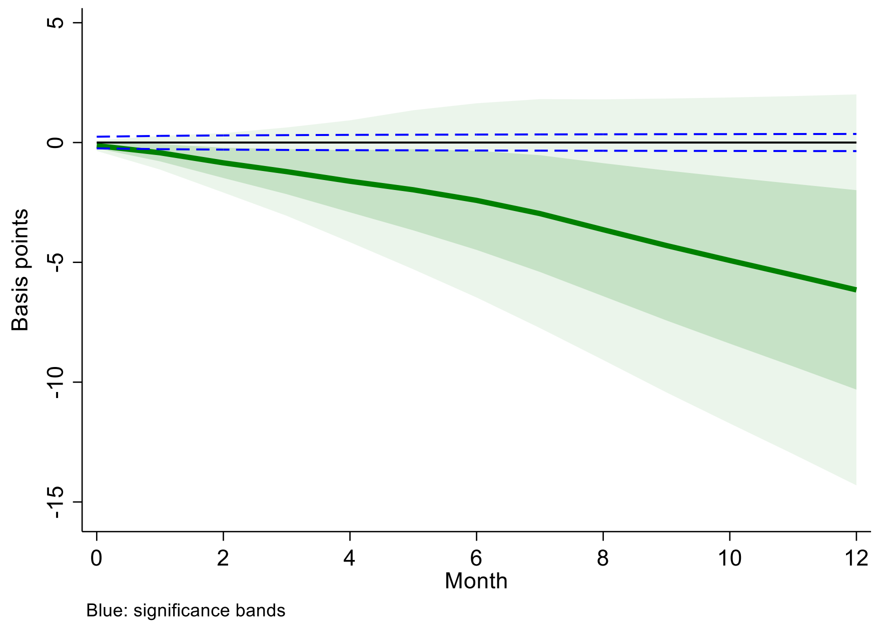
$$y_{t+h} = \beta_h^o + \beta_h^1 S_t + \beta_h^2(L) y_{t-1} + \beta_h^3(L) X_{t-1} + \epsilon_h \tag{4.7}$$

where y_{t+h} is the repo rate h months after the shock; S_t is a shock to South African sovereign risk, measured by the LCCS; X is a vector of control variables including the value of the US Move index to capture volatility in global interest rate markets; the USD index; and the ZARUSD. Figure 4.5 illustrates the impulse response over a 12-

month horizon: the repo-rate response to a LCCS shock lasts throughout the horizon period and is statistically different from zero, as evidenced by the impulse response path lying outside the significant bands. Unexpectedly, a change in sovereign risk premium leads to a lower repo rate than the initial level, by only 6.7 bps. Contrary to the front-loaded impact that fiscal risk has on the ZARUSD, this effect accelerates after 5 months, which may be due to the persistence of interest rates compared with the relative volatility in the exchange-rate market.

Given the impact of sovereign risk shocks on the repo rate, I also consider the response of domestic money market rates to innovations in sovereign risk, as proxied by the 3-month Jibar rate. The money market rate is indicative of actual short lending and borrowing rates in the financial system, with the strength of the relationship between this rate and the key policy rate a signal of the strength of monetary policy transmission (Kalemli-Ozcan, 2019). To the extent that a shock affects the spread between the repo rate and Jibar rate, then, it also affects the transmission of monetary policy.

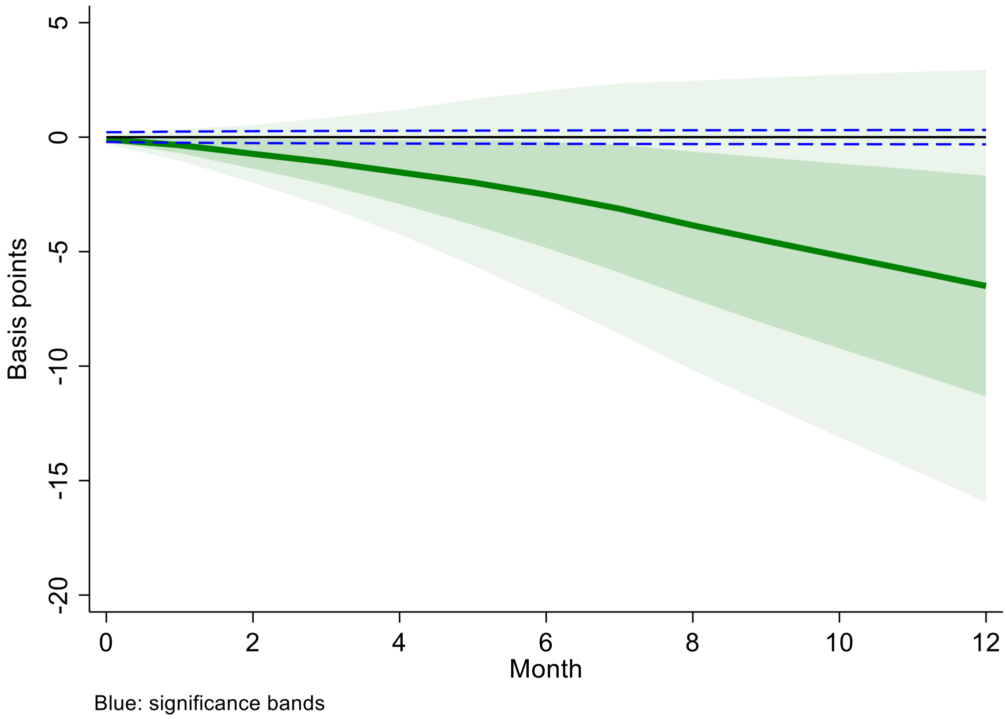
Figure 4.5: Cumulative response of the repo rate to sovereign risk shocks



The Jibar rate also falls in response to a sovereign risk shock, with a maximum impact observed in a decline of 0.7 bps after 8 months, and it remains persistently lower throughout the horizon (Figure 4.6). Thus, this impulse response path is statistically different from zero but economically small, consistent with the response of the repo rate. Notably, the spread between the Jibar rate and the repo rate, interpreted as a risk spread in line with Kalemli-Ozcan (2019), also has a significant response to sovereign risk shocks. The risk spread narrows after a few months following such a shock, consistent with the greater sensitivity of the Jibar rate to fiscal risk shocks relative to the repo rate. The risk spread also remains lower than its initial level after a year, however this effect reaches a maximum of only 0.1 bps.

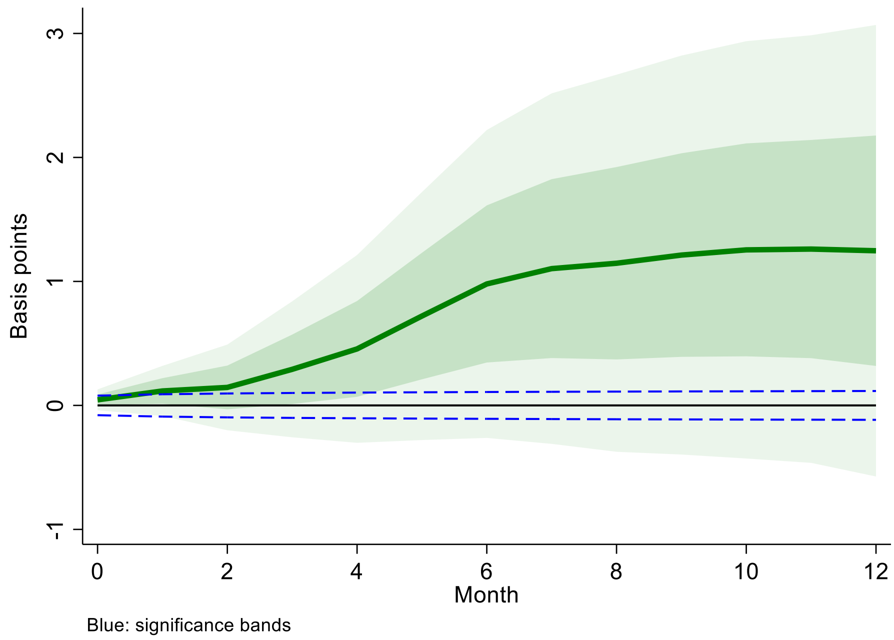
The finding of domestic short-term interest rates declining in response to sovereign risk shocks is consistent with passive monetary policy in the Leeper (1991) framework, with a monetary authority that accommodates fiscal policy through weaker responsiveness to changes in inflation. This is because a higher sovereign risk premium can have adverse have implications for the government's cost of borrowing on newly-issued debt. On the other hand, the unexpected response could also be a function of the source of the sovereign risk shock, such as a demand shock that affects the fiscal position but also necessitates a loosening of monetary policy. Specifically, the onset of the Covid-19 pandemic led to a significant increase in the sovereign risk premium, while it was also followed by central bank intervention that included historic reductions in the repo-rate to address the expected impact of the pandemic on the economy. In that case, the response of the repo-rate to the sovereign risk shock would not be an indication of passive monetary policy.

Figure 4.6: Cumulative response of the Jibar rate to sovereign risk shocks



To test whether the market dynamics during the Covid-19 financial market shock are dominating the responses of interest rates to the LCCS shock, I produce local projections for a restricted sample that excludes the onset of the pandemic and the post-pandemic period. Specifically, I run the regressions for the period January 2008 until December 2019 and compare the pre-Covid impulse responses with those of the full sample. As shown in Figure 4.7, the full sample response of the repo rate to a sovereign risk shock appears to be driven by the unusual market conditions at the onset of the pandemic: in the pre-Covid period, the repo rate increased by up to 1.26 bps in the 12 months following a LCCS shock. While the effect is statistically different from zero and persistent throughout the forecast horizon, its modest size suggests that the direct impact of sovereign risk shocks on the repo rate were marginal. Consistent with the pre-Covid response of the repo rate, the response of the Jibar rate to a sovereign risk shock is also positive, statistically significant but modest in size (Figure 4.12).

Figure 4.7: Pre-Covid cumulative response of the repo rate to sovereign risk shocks



As an alternative approach to accounting for the impact of the Covid shock on these impulse responses, I include an indicator variable for the year 2020 in my LLP regressions on the full sample. Specifically, I modify equation 4.3 as follows:

$$y_{t+h} = \beta_h^o + \beta_h^1 S_t + \beta_h^2(L)y_{t-1} + \beta_h^3(L)X_{t-1} + \beta_h^4(L)COVID_{t-1} + \epsilon_h \tag{4.8}$$

where $COVID_{t-1}$ takes the value 1 for each month in 2020 and 0 otherwise. As shown in Figures 4.15 to 4.19 (Annexure Chapter 4), the impulse responses including the Covid indicator variable retain a similar shape to the full sample impulse responses, although they are flatter such that the response is smaller. Most impulse responses remain statistically significant as they lie outside the significance band; the notable exception is the repo rate response to an exchange rate shock, is insignificant at nearer horizons.

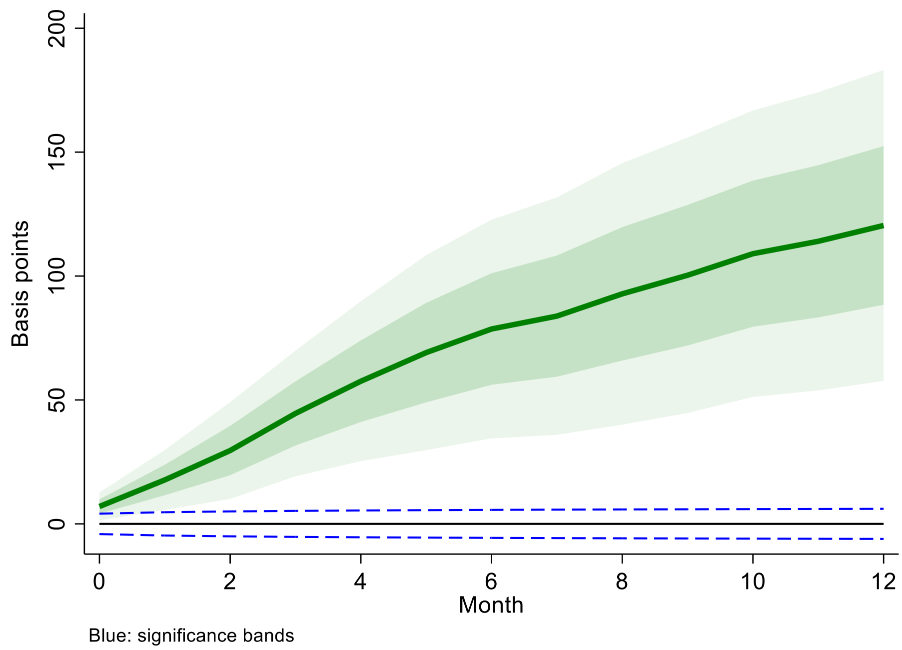
The persistence of the counterintuitive responses to shocks in the full sample, such as the response of the repo rate to a sovereign shock, even after the inclusion of a Covid indicator variable may suggest a fundamental change in the state of the economy after

2020. In such a case, the standard LLP estimator, which captures the direct or average effect throughout the sample period, would potentially mischaracterise the impulse responses in different states of the economy. In the literature, several studies address this issue by estimating state-dependent LLPs. Cloyne et al. (2023) propose an approach that employs the Kitagawa-Blinder-Oaxaca decomposition to derive two main components of impulse responses, a direct and indirect effect. In this framework, the direct effect captures the average effect estimated by standard LLPs while the indirect effect accounts for varying responses to a shock by state or over time.

Empirically, Jordà and Taylor (2015) employ an extended LLP framework and show that the impact of fiscal consolidation on growth depends on the state of the economy, with austerity imposing a larger drag on economic growth during a recession than a boom. In terms of their validity, Gonçalves et al. (2024) illustrate that the state-dependent LLP estimator will be asymptotically valid at any finite horizon if the information set used to define the state variable includes only exogenous variables. Given that the state of the economy is endogenous to model variables in macroeconomic applications, for instance, they note the considerable implication the exogeneity requirement has for empirical work.

I also consider other impulse responses that are of interest in the interaction between fiscal and monetary policy. Evidence from Section 4.3 suggests that a BER depreciation is associated with higher key policy rates in a given year, however we may also be interested in how the repo rate responds to larger exchange-rate movements as represented by a ZARUSD shock. In the restricted sample, I find that a ZARUSD shock has a significant positive impact on the repo rate, with the policy rate rising by a cumulative 128 bps relative to its initial level a year following the shock (Figure 4.8). Notably, the repo rate steadily increases throughout the year following the initial ZARUSD shock, indicating the lasting impacts that ZARUSD shocks have on domestic monetary policy. By contrast, in the full sample I find that the repo-rate response to a ZARUSD shock is contrary to a priori expectations: following a ZARUSD shock, the repo rate steadily *declines* by up to 98 bps (Figure 4.9). As with short-term interest rates, this effect appears to be driven by the 2020 market shock.

Figure 4.8: Pre-Covid cumulative response of the repo rate to exchange rate shocks



A ZARUSD shock also has a significant, albeit less persistent, impact on the sovereign risk premium. Sovereign risk increases in response to a shock depreciation in the local currency, rising by as much as 38 bps after 5 months before tapering back to the initial level by the end of the forecast period (Figure 4.13). While the effect of the exchange rate on sovereign risk is transitory, it can impair demand for government bonds among global investors during a period of global risk aversion and thereby raise sovereign borrowing costs (Hofmann et al. 2016). In the full sample, the sovereign-risk response to a ZARUSD shock is larger and more persistent, reaching 103 bps a year after the shock (Figure 4.10).

Finally, I model the response of the sovereign risk premium to a shock in the repo rate. In the restricted sample, the sovereign risk premium increases by a cumulative 83 bps in the 8 months following a repo rate shock (Figure 4.14). While the effect moderates towards the end of the forecast horizon, sovereign risk remains higher compared to its initial level a year after the shock. This effect is in line with a priori expectations, as a repo rate shock would increase sovereign borrowing costs and the sustainability of debt service costs. By contrast, in the full sample the sovereign risk premium steadily declines in the year following a repo rate shock (Figure 4.11) This negative relationship likely reflects the events of the pandemic-related market shock, when the sovereign risk premium continued to increase amid bond market dysfunction after the SARB's first repo rate of the crisis, a significant reduction of 100 bps. After moderating on the introduction of the SARB's bond purchase programme in late March, sovereign risk premia increased again following the central bank's second policy rate cut of 100 bps in mid-April before gradually normalising from May.

Taken together, the impulse responses reported here provide several insights regarding monetary-fiscal interactions in South Africa. Sovereign-risk shocks lead to a persistently weaker ZARUSD, which earlier evidence suggests is associated with a higher repo rate. When considering an observation period excluding the pandemic-related financial market shock of 2020, shocks in the sovereign risk premium also lead to marginally higher interest rates a year after the shock. By contrast, the results for the full sample including the market shock are characterised by unexpected impulse responses such as a sovereign risk shock resulting in short-term interest rate declines. Given that such responses are consistent with passive monetary policy that accommodates fiscal policy, an analysis that overlooks the market developments of early 2020 can support incorrect conclusions of fiscal dominance of domestic monetary policy.

4.5 Conclusion

The domestic monetary policy outlook remains uncertain amid global economic uncertainty and historically elevated long-term domestic inflation expectations. Meanwhile, sovereign debt and the sovereign risk premium are set to remain elevated given the long-term maturity profile of public debt and high debt-service costs. In this environment, the various ways in which monetary and fiscal policy interact will remain a salient issue for domestic macroeconomic policy for some time to come.

This chapter has shown that while I do not find evidence of fiscal dominance among inflation-targeting EMs, the bilateral exchange rate with respect to the USD is a significant factor in the monetary policy reaction functions of the economies considered. The BER, in the South African context at least, depreciates and remains persistently weaker following a sovereign risk shock. The domestic monetary policy rate also responds to a shock increase in sovereign risk, and remains higher for some time after the initial shock. Taken together, this suggests that while fiscal variables such as the primary fiscal deficit and net lending may not directly affect the monetary policy stance, fiscal policy can affect monetary policy through the effect of sovereign risk. Therefore, to the extent that sovereign risk shocks will continue to be experienced in South Africa, they will have a tightening effect on monetary policy.

The chapter also highlights the importance of accounting for the unusual market dynamics seen during the Covid market shock, as well as the potential long-term impact the shock may have had on the interaction between macro-financial variables. In the analysis presented in this chapter, a failure to allow for the post-2019 relationships between variables would support an incorrect conclusion of monetary policy accommodation of fiscal policy by the SARB during the full period under review. A valuable extension of this chapter could explore fiscal-monetary policy interactions in a state-dependent LLP framework in line with developments in LLP empirical methods.

4.6 Annexure Chapter 4

Table 4.4: Panel regression results using the inflation rate

	(1)	(2)	(3)	(4)	(5)	(6)
Key policy rate (t-1)	0.764	0.808	0.761	0.755	0.807	0.753
	(0.0757)***	(0.1259)***	(0.0757)***	(0.0755)***	(0.1071)***	(0.0756)***
Output gap (t-1)	0.209	0.124	0.189	0.203	0.081	0.180
	(0.1327)***	(0.1354)	(0.1288)***	(0.1320)***	(0.1161)	(0.1287)***
Structural balance (diff) (t-1)	0.047			0.055		
	(0.0867)			(0.0847)		
Net lending (diff) (t-1)			0.014			0.017
			(0.0869)			(0.0860)
Inflation rate (t-1)	0.199	0.143	0.197	0.195	0.062	0.194
	(0.0507)**	(0.0977)	(0.0510)**	(0.0507)**	(0.0859)	(0.0509)**
REER (diff)	0.028	0.167	0.019			
	(1.9432)	(2.5540)***	(1.9341)			
BER (diff)				0.121	0.357	0.112
				(1.7057)**	(1.7909)***	(1.7141)**
Observations	116	67	116	116	67	116

Standardised beta coefficients; Standard errors in parentheses

*p<0.10, **p<0.05, ***p<0.01

Table 4.5: Panel regression results using the change in the inflation rate

	(1)	(2)	(3)	(4)	(5)	(6)
Key policy rate (t-1)	0.835	0.959	0.832	0.824	0.871	0.822
	(0.0657)***	(0.0647)***	(0.0653)***	(0.0648)***	(0.0519)***	(0.0647)***
Output gap (t-1)	0.195	0.173	0.180	0.191	0.107	0.172
	(0.1324)***	(0.1405)**	(0.1281)***	(0.1314)***	(0.1183)	(0.1277)***
Structural balance (diff) (t-1)	0.034			0.044		
	(0.0892)			(0.0869)		
Net lending (diff) (t-1)			-0.000			0.002
			(0.0884)			(0.0872)
Change in inflation rate (t-1)	0.125	0.014	0.131	0.121	-0.018	0.129
	(0.0478)*	(0.0612)	(0.0485)*	(0.0472)*	(0.0487)	(0.0478)*
REER (diff)	0.026	0.182	0.020			
	(1.9696)	(2.5297)***	(1.9580)			
BER (diff)				0.121	0.386	0.114
				(1.7201)**	(1.7107)***	(1.7236)**
Observations	116	67	116	116	67	116

Standardised beta coefficients; Standard errors in parentheses.

*p<0.10, **p<0.05, ***p<0.01

Full sample cumulative impulse responses

Figure 4.9: Cumulative repo rate response to a ZARUSD shock

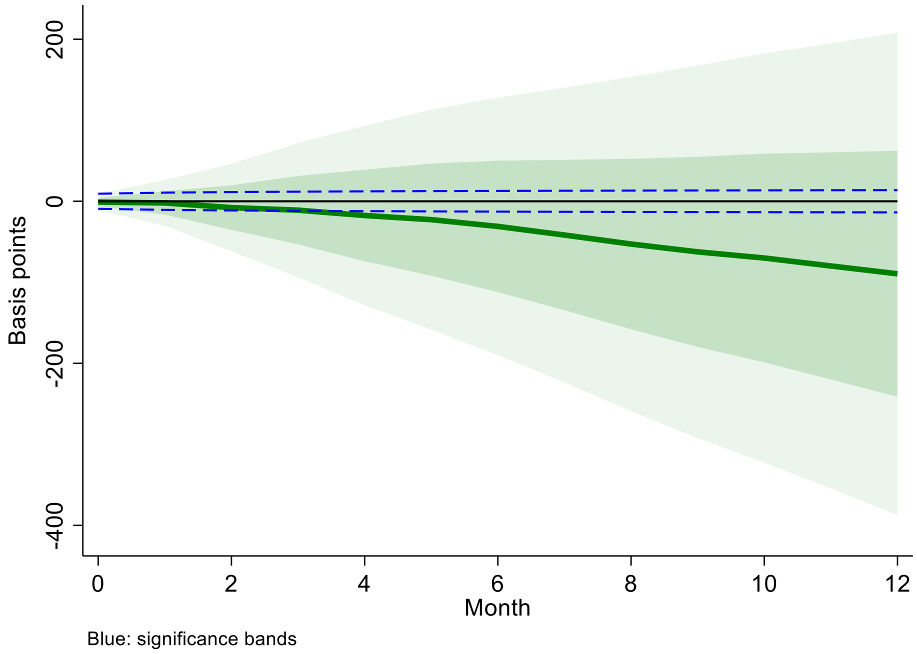


Figure 4.10: Cumulative sovereign-risk response to a ZARUSD shock

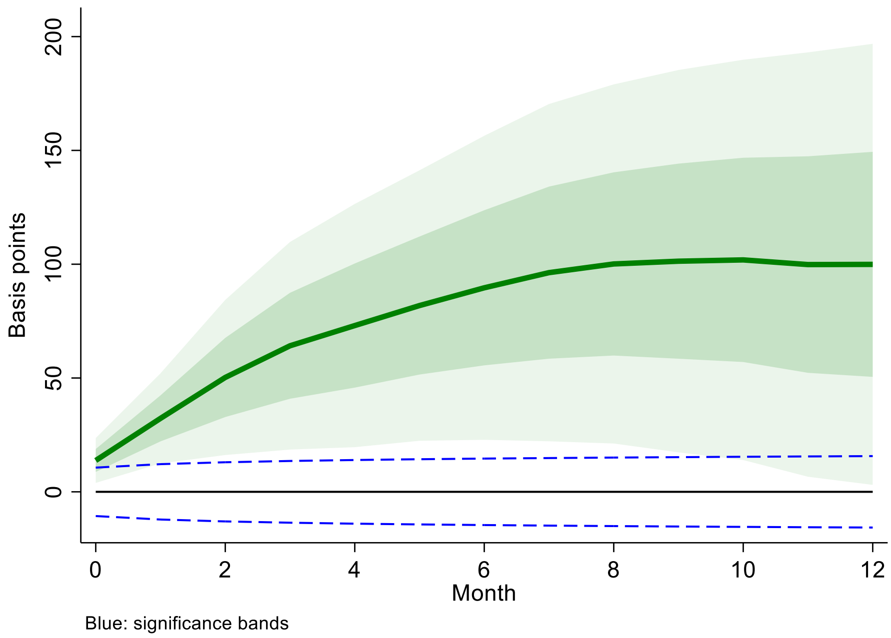
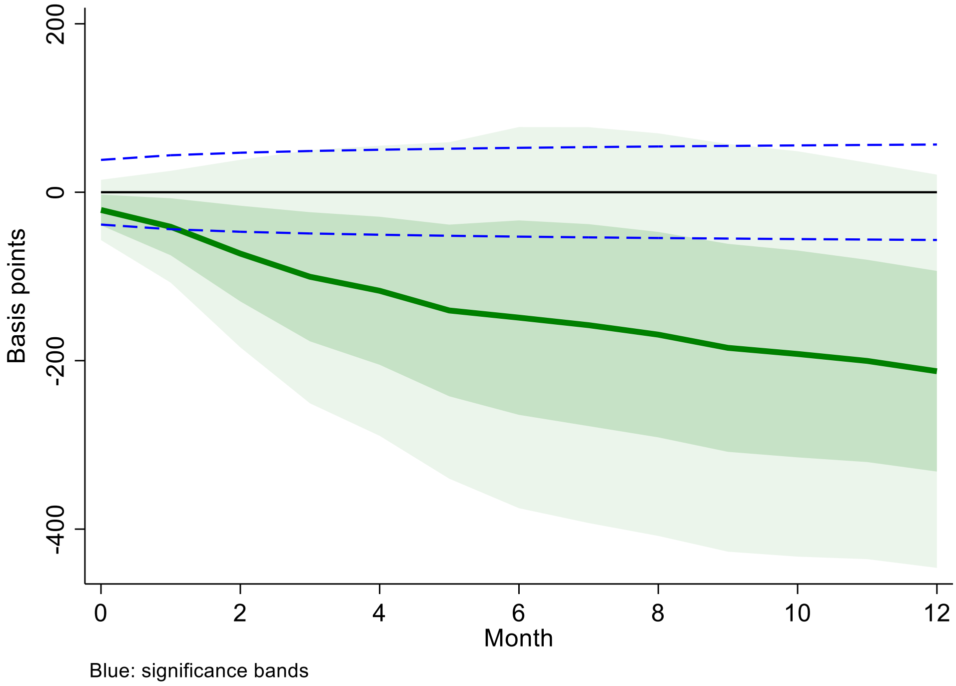


Figure 4.11: Cumulative sovereign risk response to repo-rate shock



Restricted sample cumulative impulse responses

Figure 4.12: Cumulative Jibar response to sovereign risk shock

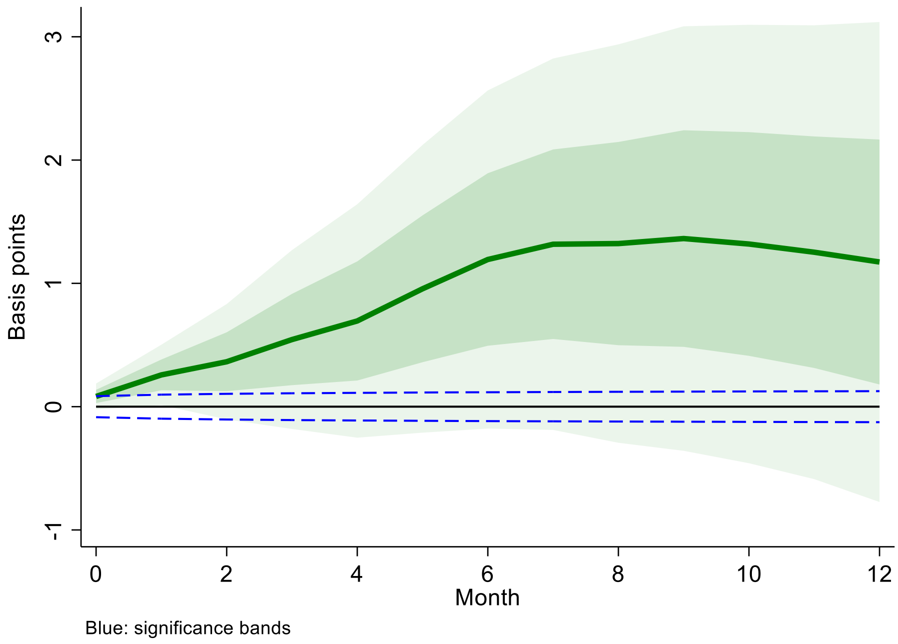


Figure 4.13: Cumulative sovereign-risk response to a ZARUSD shock

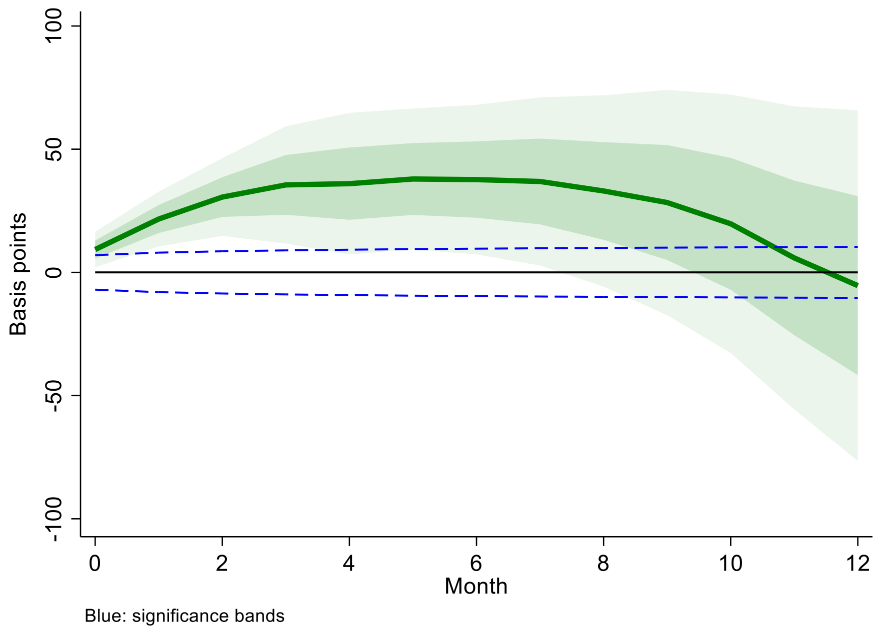
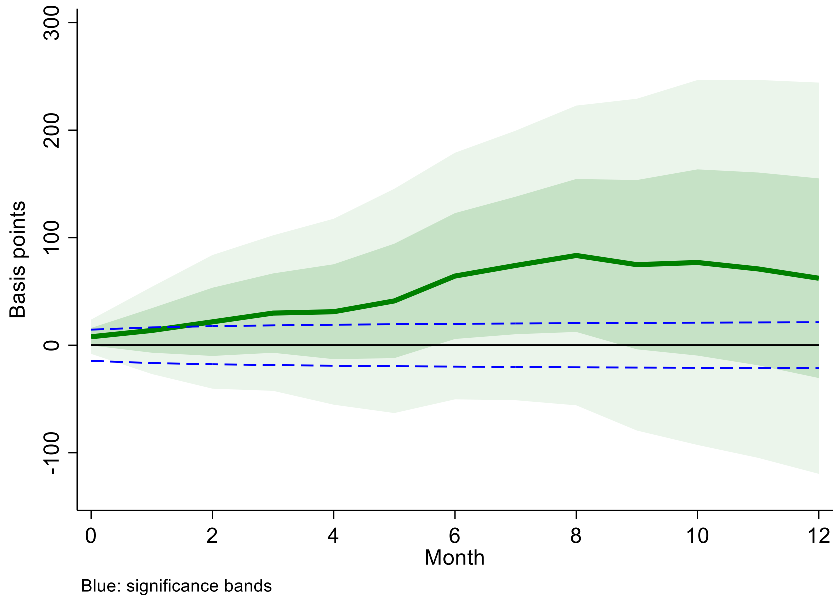


Figure 4.14: Cumulative sovereign risk response to repo-rate shock



Full sample cumulative impulse responses with Covid indicator

Figure 4.15: Cumulative ZARUSD response to sovereign-risk shock

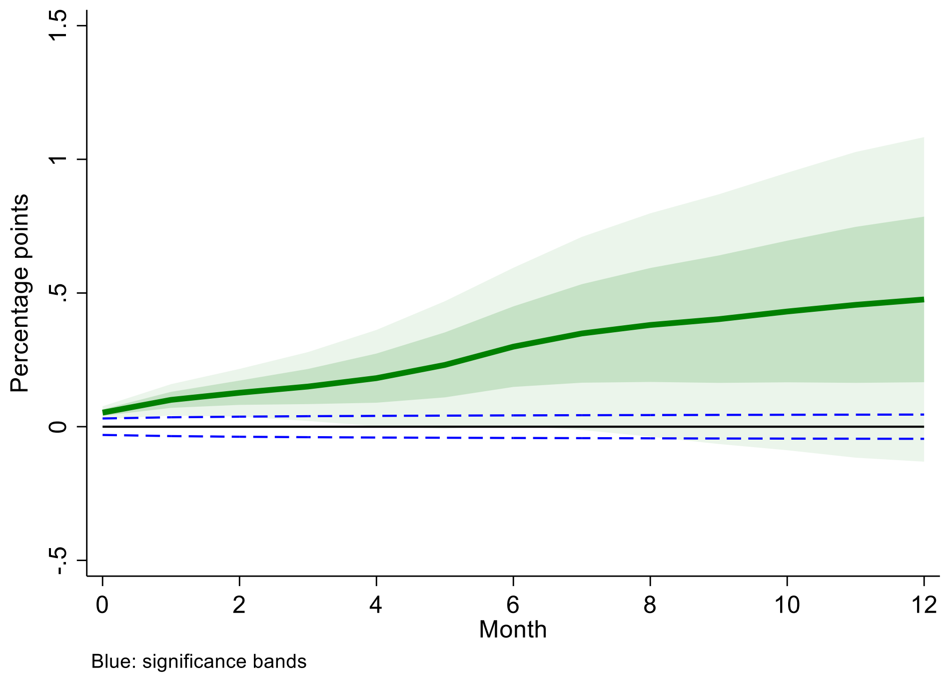


Figure 4.16: Cumulative repo rate response to a sovereign risk shock

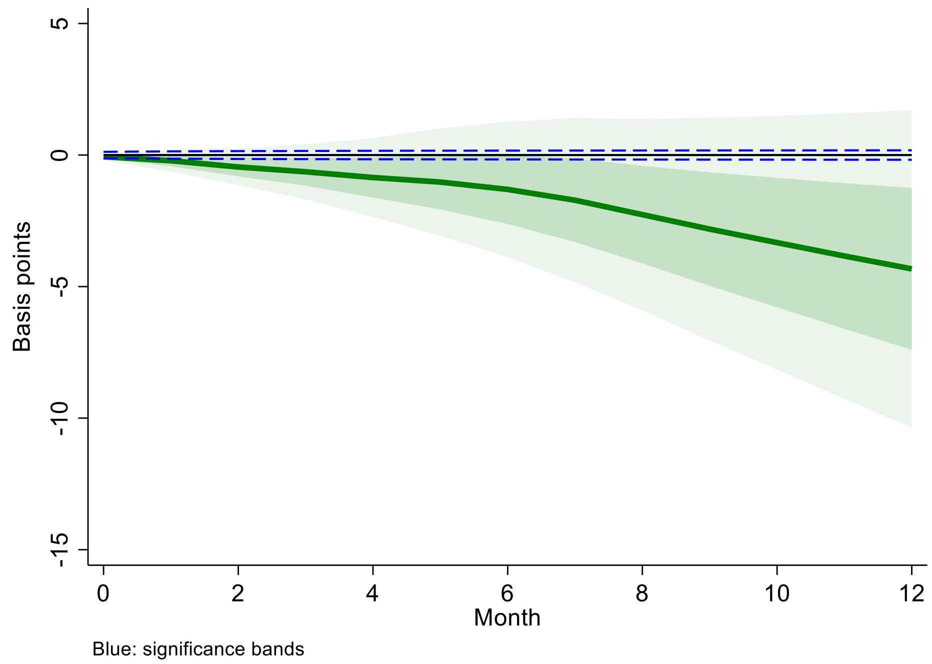


Figure 4.17: Cumulative repo rate response to a ZARUSD shock

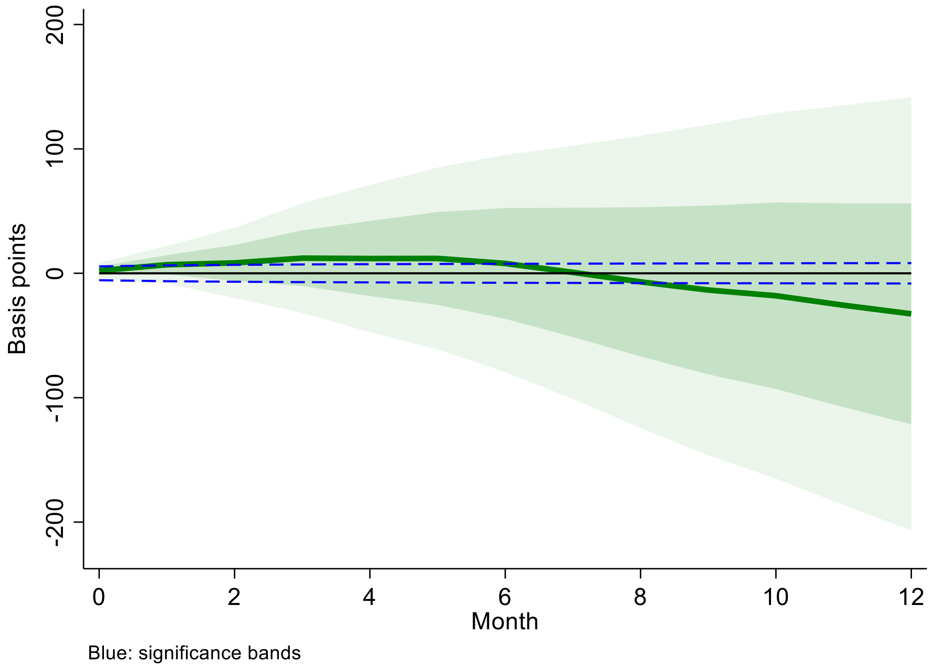


Figure 4.18: Cumulative sovereign risk response to repo-rate shock

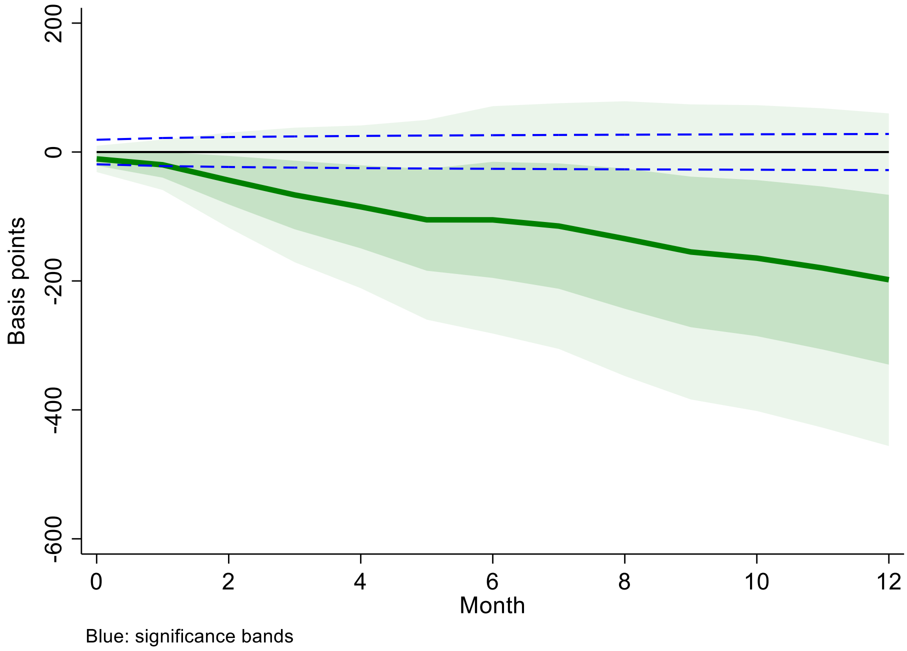
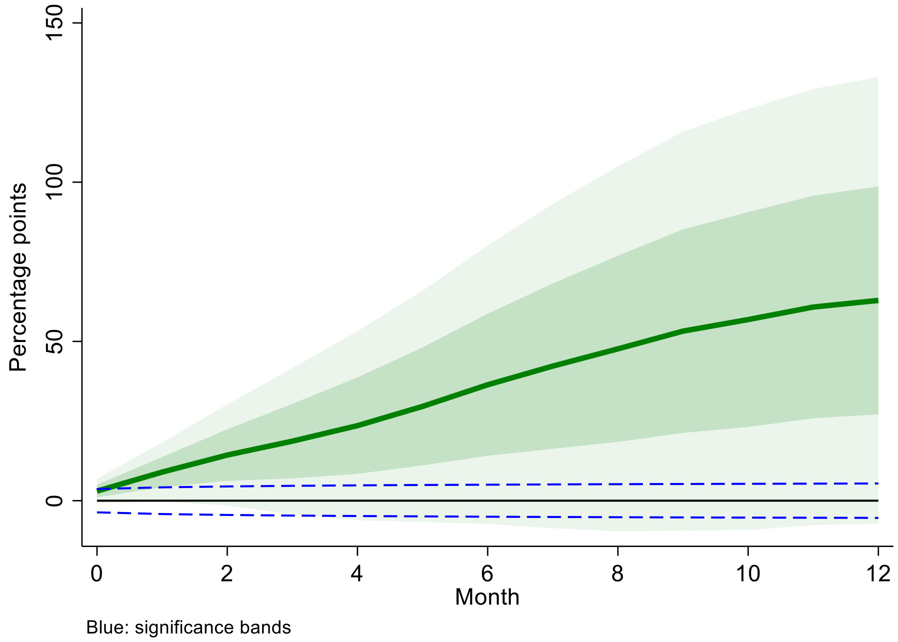


Figure 4.19: Cumulative ZARUSD response to repo-rate shock



5 Conclusion

In this chapter, I briefly summarise the main results of the thesis. I then discuss the limitations of the studies, policy implications related to the findings of the thesis, and propose areas for future research.

5.1 Summary of main results

In this thesis, I have made use of a local-currency measure of sovereign risk and analysed how sovereign risk affects various parts of the financial system. The studies have employed different methodological approaches, with some research questions addressed in a South Africa-specific analysis and others addressed using panel data techniques and therefore focused on EMs more broadly. Given the prominence of sovereign risk as a consideration among policymakers and financial market participants in South Africa over recent years as well as the growing focus on sovereign debt and risk following the post-Covid global monetary policy tightening cycle, this mixed approach provides helpful insights about the South African case with its longer history as well as the general EM case.

The first question addressed in the thesis is on the role of sovereign risk in local government bond markets. To address this, I follow Du and Schreger (2016) and derive the LCCS and show that it is a useful measure of sovereign risk on local currency-denominated debt for South Africa. I then use the LCCS in an analysis the considers the drivers of changes in local government nominal bond yields, considering both the possible existence of a cousin-risk phenomenon and varying impact of global and local factors on bond yield changes. As expected, I show that increases in sovereign risk contribute to increases in nominal yields, along with a weaker FX rate. In line with Hofmann et al. (2020), I find that global factors have become more significant drivers of changes in nominal bond yields than local factors since 2020, especially the USD. Furthermore, I also find some evidence of a cousin risk phenomenon in South African sovereign yields as shown by the interaction between sovereign risk and FX risk.

The second question I address is the impact of sovereign risk on the banking system, specifically what impact sovereign risk has on bank returns, valuations and lending activity, and whether this effect is dependent on a bank's level of sovereign exposure. Using a panel approach including the major banks in 13 EMs, I find that banks will hold government bonds in response to a demand for liquidity and the availability of central bank liquidity, while banks that already have higher levels of sovereign exposure will also increase their holdings of government bonds in response to elevated sovereign risk. I find that higher sovereign risk is associated with lower bank returns, especially among banks with higher levels of government bond holdings, and generally lower bank valuations. Furthermore, higher sovereign risk is associated with lower lending activity among banks, although this effect is attenuated among better-capitalised banks.

Finally, I consider the interaction between fiscal policy and monetary policy. In a cross-country analysis of the special case of this policy interaction, namely fiscal dominance, I find no evidence of the emergence of fiscal dominance among inflation-targeting EMs since the GFC. I do, however, find that the bilateral exchange rate with respect to the USD is a significant factor in these economies' monetary policy reaction functions. I then analyse in what other ways fiscal policy might affect the conduct of monetary policy in South Africa specifically. In particular, I consider whether fiscal policy might impact monetary policy through sovereign risk rather than the fiscal variables considered in the panel analysis. Using LLPs, I show that the ZARUSD depreciates and remains persistently weaker following a sovereign risk shock, while the repo rate increases in response to a shock increase in sovereign risk. Taken together, the evidence on fiscal-monetary policy interactions suggests that fiscal policy can affect domestic monetary policy through sovereign risk, with shock increases in sovereign risk resulting in tighter monetary policy.

5.2 Limitations of the studies

I note that the studies have some limitations related to data availability and the period under review. Firstly, as noted in Chapter 2, the construction of the LCCS relies on the availability of market data such as interest-rate swap pricing. In the event of market stress, such as during the Covid liquidity shock in early 2020, price discovery diminishes and deriving the LCCS becomes challenging amid a lack of market prices. This challenge of price discovery also arises when analysis includes segments of the market that are generally illiquid, such as when one is deriving the LCCS for a panel of EMs where some economies may have illiquid derivates markets. An improvement on the current methodology that addresses data availability may improve the performance of the LCCS, particularly during periods of market stress.

Secondly, the studies in this thesis all consider time-variance in the relationships analysed, especially the extent to which the findings may hold from 2020. However, given that the post-Covid period featured in the analyses is short and still feature a lingering impact of the pandemic shock itself, this may affect the robustness of the evidence related to this period. A future study that includes more data since 2020 and with more time elapsed since the pandemic shock would improve the robustness of these findings.

Finally, the cross-country fiscal dominance analysis in Section 4 finds no evidence of monetary accommodation of fiscal policy since the GFC. However, as the South African LLP analysis shows, there may be other ways in which fiscal policy affects the conduct of monetary policy besides through the significance of historical fiscal variables in the monetary policy reaction function. The low frequency of fiscal variables relative to changes in monetary policy, and the paucity of fiscal data relative to monetary policy and financial market data may also affect the robustness of the evidence related to fiscal policy among EMs.

5.3 Policy implications

Sovereign risk has broad spillovers for the financial system, including banks, investors and the conduct of monetary policy. An environment of rising sovereign risk therefore has implications for the system as a whole. First, given the relationship between FX risk and sovereign risk and their contributions to changes in nominal bond yields, rising sovereign risk will continue to place upward pressure on sovereign yields with adverse implications for government borrowing costs and bondholders' investment returns. Secondly, banks may continue to face incentives to increase their sovereign exposure in response to rising sovereign risk, potentially affecting the composition of bank balance sheets and credit extension. The banking system will also continue to experience lower returns and valuations amid higher sovereign risk. Finally, the domestic monetary policy stance will likely be tighter than in the absence of adverse shocks to sovereign risk, raising borrowing costs for the real economy.

Many of the spillovers that the financial system experiences because of sovereign risk are a function of the level of exposure the system has to the sovereign, such that lower sovereign exposure would reduce the harm imposed by rising sovereign risk. However, regulators and the monetary policy authority face some constraints in their ability to impose limitations on financial institutions' sovereign exposure. Imposing regulatory limits on sovereign debt holdings among domestic regulated financial institutions, or disincentivising excessive holdings of government debt by imposing meaningful capital charges for sovereign exposures for banks, would likely signal regulators' concern about the default risk embedded in sovereign debt to those investors outside the domestic regulatory purview, such as non-resident bondholders. This would likely increase the sovereign risk premium further and limit the effectiveness of such regulatory caps on sovereign debt holdings. Furthermore, the government relies on regular debt issuance to meet its financial obligations, and this debt issuance is increasingly absorbed by the domestic financial system. Limiting domestic financial institutions' holdings of sovereign bonds would result in decreased demand for those bonds, such that the government may face an increasing likelihood of experiencing a liquidity crunch, and it may have to face even higher borrowing costs to attract more non-resident investor demand. Either of these outcomes would raise the default risk for the government.

Given regulators' constraints in limiting the extent of the sovereign-financial sector nexus and their obvious inability to contain the sovereign risk premium, the most feasible policy solution for limiting the harm posed by rising sovereign risk on the financial system is a meaningful, sustainable decline in sovereign risk. South African sovereign risk is elevated because of longstanding concerns about fiscal policy, including persistent fiscal deficits which require elevated debt issuance. A sustainable decline in sovereign risk would thus require a credible fiscal policy addressing both the challenges with the primary balance and the growth in the sovereign debt stock. Such a change in fiscal policy would not only reduce the adverse outcomes experienced by the financial system by lowering sovereign risk, but it would also slow the pace at which the sovereign-financial sector nexus is intensifying by reducing the volume of government bond supply that the domestic system must absorb. While this would be challenging given its implications for other policies reliant on fiscal expenditure, it is the most direct way to address the harmful spillovers caused by sovereign risk in South Africa.

5.4 Scope for future research

Beyond the prospect of improving on the limitations noted in Section 5.3, there are also areas for potential future research that could expand on this study.

In the analysis on the drivers of changes in South African nominal bond yields in Section 2, I find evidence of the existence of a cousin risk phenomenon in the domestic sovereign bond market. A study that considers whether and how this phenomenon relates to the extent of foreign investor participation in the bond market would provide new insights on the significance of non-residents in EM local bond markets.

Related to this, an extension of both the cousin risk analysis and the fiscal-monetary policy interaction LLP analysis to a panel structure including several EMs would enrich our understanding of EM sovereign risk and help distinguish between the findings in this thesis that are actually general to EMs and those which are specific to South Africa.

Finally, the evidence in this thesis suggests that the post-2020 period may be characterised by fundamental differences in how sovereign risk affects the financial system. A useful extension to this thesis would be a more explicit time-varying approach to any of these research questions, which would benefit from more data from the post-2020 era.

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