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The lending implications of banks holding excess capital

Neryvia Pillay[*] and Konstantin Makrelov[†]

Abstract

Banks hold capital above microprudential and macroprudential regulatory requirements for a variety of reasons, including as a risk mitigation measure. In this study, we assess how decisions around the size of excess capital as well as monetary and financial stability actions impact sectoral lending in South Africa. Using a unique set of micro data for the South African banking sector for the period 2008 to 2020, provided by South Africa's Prudential Authority, our analysis controls for bank characteristics such as bank size, profitability and liquidity. Our results suggest that banks' decisions around holding additional capital affect their lending. As expected, monetary policy actions have a strong impact on bank lending and so do regulatory changes to bank capital requirements. These impacts tend to be smaller for larger banks, in line with results published in the global literature. Our results highlight the difficulties of thinking about policy in a Tinbergen rule type of world. Fiscal, microprudential, macroprudential and monetary policy actions can affect price and financial stability goals through their impact on credit extension. When policies work at cross purposes, they can easily undermine each other's goals.

JEL classification

C23, E50, G21, G28

Key words

Financial regulation, capital buffers, excess bank capital, monetary policy

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1. Introduction[1]

Banks hold capital because they are required to do so by financial regulators in order to mitigate individual and systemic risk. Bank capital often exceeds the regulatory requirements. Most of the literature tends to focus on how these regulatory requirements impact credit extension and lending spreads.[2] There is rather limited analysis of how banks' holding of excess capital[3] affects their lending. In this study, we focus on this second element and assess how banks' decisions to hold excess capital impacts lending.

One reason financial institutions hold additional capital is to mitigate against breaching the required level, which can trigger restrictive supervisory actions and result in reputational damage and an adverse market reaction (Borio and Zhu 2012). More capital can also reduce the cost of deposit funding, especially in the absence of deposit insurance, provide cheaper borrowing and maintain monopoly profits (Fonseca and González 2010). Capital buffers can also be used with the expectation of higher loan demand in the future (Jokipii and Milne 2008). But most importantly, banks can hold additional capital to mitigate against the balance sheet impact of various economic and financial risks. For example, in a previous study we find that rising fiscal risks are a major driver of higher excess capital in South Africa.[4] Increasing capital, whether in response to regulatory requirements or rising risks, can reduce the volume of lending and increase lending spreads (Woodford 2010).

Our focus is on South Africa, which is an emerging economy with a very well-developed financial sector. Basel III regulations were phased in over the period 2013 to 2019.[5]

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1 We are grateful to Professors Laurence Harris and Alistair Milne for their initial reviews of this paper, which contributed to improving our analysis. We also benefitted from comments and questions from participants in the SARB Research Seminars.

2 For a recent review of the literature, see Fang et al. (2022).

3 Excess capital refers to the portion of bank capital over and above micro- and macroprudential requirements. This portion is also often referred to as a voluntary capital buffer or surplus capital. Our measure of capital is the capital adequacy ratio, which is the ratio of Tier 1 and Tier 2 capital to risk-weighted assets.

4 See Makrelov, Pillay and Morule (2023).

5 The phasing-in approach and timelines are outlined in Directive 5 of 2013 issued by the SARB and available at

This period was also characterised by deteriorating fiscal conditions and rising domestic political risks. Despite this, the financial system remained stable and large domestic banks were very profitable, which supported the accumulation of capital (Makrelov, Davies and Harris 2021). Monetary policy actions were characterised as too loose at the beginning of the period, as potential growth was overestimated, and later characterised by a more explicit SARB preference for a point inflation target of 4.5%, which implied policy tightening (Honohan and Orphanides 2022).

To examine the effects of regulatory change we follow the approach outlined by Aiyar, Calomiris and Wieladek (2016) and estimate the effect of capital requirements, the economic cycle and monetary policy actions on the supply of loans. While those authors focus on microprudential capital requirements, we also test the impact of changes to excess capital, which show significant variability across banks and years in South Africa. We use capital and sector credit extension data provided by the Prudential Authority, which is not publicly available. In our analysis, we control for loan demand using credit extension and gross domestic product (GDP) at the sector level. A serious problem with this type of analysis is endogeneity, whereby changes in lending affect bank capital and vice versa. This is addressed by estimating a series of panel vector autoregressive (VAR) models, following the approach presented by Aiyar, Calomiris and Wieladek (2016), to test the reverse causality relationship between capital and lending growth.

Our contribution to the literature is to provide empirical estimates of how excess capital holdings have impacted lending across different banks. South Africa's literature on bank capital and lending has been dominated by simulation exercises.[6] A recent study by Milne and Sibande (2024) provides empirical estimates of how capital requirements affect lending across different product lines. The analysis shows limited or no impact on specific loan categories.

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https://www.resbank.co.za/en/home/publications/publication-detail-pages/prudential-authority/pa-deposit-takers/banks-directives/2013/5686

6 See for example Makrelov, Davies and Harris (2021).

In this paper, we consider the role of monetary policy and the interaction of monetary policy with regulatory capital decisions more explicitly. The results of the analysis show that excess capital has a large and significant impact on credit extension across different specifications. Unlike Milne and Sibande (2024), we find a stronger effect of capital requirements on lending, in line with the global literature.[7] These effects are smaller for larger banks. Monetary policy actions have a stronger impact on credit extension, as expected, but the impact is again smaller for larger banks.

Together with the findings of our previous paper – that fiscal risks are an important driver of excess capital holdings in South Africa – these results establish a link between fiscal risks and credit extension via higher capital holding. Rising fiscal risks can increase banks' excess capital as an instrument to mitigate risk, which in turn reduces credit extension.

The rest of the paper is organised as follows. In the next section, we discuss the literature relevant to our analysis, focusing on how capital requirements and monetary policy actions impact lending. In section 3, we provide a short background of credit extension in South Africa, bank capital regulatory changes and monetary policy actions. This is followed by a discussion of the data used in the analysis and the presentation of our results. In the concluding section, we discuss policy implications as well as limitations of the study.

2. Related literature

Transitioning to a higher capital ratio, whether because of regulatory requirements or simply to increase excess capital, can reduce credit extension and negatively impact economic activity.[8] However, other factors can reduce and even eliminate these negative lending and economic effects. The impacts are likely to be smaller if banks have higher excess capital and the regulatory requirements are implemented gradually (Fang et al. 2022). Bank profitability is a particularly important factor as it allows banks

[7] Our focus is on the short-term costs associated with higher capital requirements. We do not assess the benefits in terms of a more resilient financial system.

[8] Several studies provide theoretical models explaining how the mechanism operates. See, for example, Borio and Zhu (2012), Woodford (2010) and Van den Heuvel (2008).

to increase capital through retained earnings rather than to reduce assets in order to achieve a higher ratio (Cohen and Scatigna 2016; Makrelov, Davies and Harris 2021). Over time, banks can also issue equity or substitute riskier assets with safer ones, and they can restructure their business models, reducing inefficiencies and compensation costs, which can reduce the impact on lending (Allen et al. 2012).

The empirical literature generally finds that transitioning to a higher capital ratio is associated with a slowdown in credit extension and higher lending spreads. The focus is mainly on the impact of capital requirements rather than the impact of changes to excess capital. The transmission channels and effects, however, are likely to be the same as banks may decide to increase excess capital at a time of rising economic and financial risks, when accumulating capital is more expensive, as was done in South Africa by many banks after the Global Financial Crisis (GFC).

Our approach closely follows the empirical analysis of Aiyar, Calomiris and Wieladek (2016). They study how changes to minimum capital requirements and the interaction with monetary policy impact lending in the United Kingdom (UK). While there is little evidence that repo rate changes interact with capital changes, each policy instrument individually has a strong impact on lending. In their analysis, they control for inflation, the economic cycle and bank liquidity. In this type of analysis, endogeneity is a concern. The authors use a tridimensional panel VAR to identify endogeneity and find no evidence of endogeneity.

These results are also confirmed by Noss and Toffano (2016), who use the same data but employ a different VAR model with sign restrictions to deal more effectively with endogeneity issues. The results from their study indicate that loan volumes declined between 3.5% and 8%, with larger impacts for smaller banks. These effects are in line with those generated for other countries. Fraisse, Lé and Thesmar (2020) find that a 1 percentage point increase in capital requirements reduces lending by 10% in France. Non-financial firms can mitigate somewhat against these impacts by substituting borrowing across banks.

Using credit register data, De Jonghe, Dewachter and Ongena (2020) highlight the importance of bank and firm heterogenous factors in explaining the impact of higher

capital requirements. Smaller, riskier and less profitable banks cut credit extension the most, while the most affected non-financial firms are large, risky and low-cost-borrowing companies. The impacts on credit extension are also sector specific. Bridges et al. (2014) find that in the year following an increase in capital requirements, banks, on average, cut credit extension the most to commercial real estate, other corporates and household secured lending. In the case of Danish banks, Imbierowicz, Kragh and Rangvid (2018) find that banks reduce more loans with higher risk weights, which is expected. Capital shortfalls also tend to have a particularly strong effect on syndicated lending (Gropp et al. 2018). Differential impacts on lending products are also confirmed by Osborne, Fuertes and Milne (2017). They estimate the relationship between Tier 1 capital and bank lending rates in the UK. Higher capital generally translates to higher lending rates; however, the relationship depends on the lending product. The coefficient signs change depending on the economic cycle, which is in line with theories that highlight how portfolio decisions are linked to cyclical variation in bank leverage and risk taking. There are also important cross-country effects that highlight the importance of global policy coordination. Aiyar et al. (2014) use bank-specific time-varying capital charges imposed by UK regulators to study the impacts on cross-border lending. They find that a 1 percentage point increase in bank-specific capital requirements reduces cross-border credit by 5.5%.

There are a limited number of studies on emerging markets. A recent study, by Fang et al. (2022), looks at the impact of higher capital requirements on lending in Peru, taking into account economic conditions and bank characteristics. The results indicate short-lived aggregate impacts which are stronger during downward phases of the economic cycle and for banks that are smaller, less profitable, less liquid and less capitalised. The authors address endogeneity concerns by introducing longer lags and leads and study whether the changes to capital requirements are anticipated. They find no anticipation effects.

The earlier South African literature on the impact of capital requirements is dominated by simulation exercises using econometric dynamic stochastic general equilibrium (DSGE) and computable general equilibrium models.[9] The results show small GDP

[9] See, for example, Grobler and Smit (2014), Havemann (2014) and de Jager et al. (2021).

impacts from increasing capital requirements. However, these impacts depend on how the higher capital ratio is achieved. Makrelov, Davies and Harris (2021) show that funding via retained earnings does not generate negative lending effects; however, it impacts household consumption through lower dividend payments, in line with the international literature. Hollander and Havemann (2021) use a DSGE model to assess capital adequacy interventions over the period 2003 to 2013. Their results suggest that higher capital requirements reduced credit extension and output past 2004 and contributed to higher levels of financial stability. The interventions, however, also offset some of the monetary policy stimulus after the GFC.

Empirical studies on South Africa focus on the impact of Basel II on intermediation or provide balance sheet analysis of how macroprudential measures have impacted banks' funding costs and balance sheet composition. Maredza (2016) finds a very small impact on intermediation costs using a panel of the 10 largest South African banks. Diesel et al. (2022) provide balance sheet analysis of the six largest South African banks with a focus on the accumulation of high-quality liquid assets (HQLAs) during the Basel III implementation period. The results show a significant increase in HQLA instruments; however, it is difficult to determine whether this is purely because of prudential requirements or better returns associated with government bonds at a time when the economy was in a decline. The analysis does not consider whether bank lending was impacted by the introduction of the liquidity coverage ratio and the net stable funding ratio, but it suggests that the Basel III implementation is associated with higher bank funding costs.[10] Most recently, Milne and Sibande (2024) estimate the impact of capital requirements on credit extension across different lending products. They find small impacts. Our analysis is different in several respects. Our focus is on excess capital and monetary policy actions. Whereas Milne and Sibande focus only on large banks, we distinguish between small and large banks, and we follow a different approach in addressing endogeneity concerns.

Understanding the higher impact of bank capital on lending requires considering other factors that may affect the supply of credit. One such factor is monetary policy, which

[10] See also Olds and Steenkamp (2021).

is designed to have systematic effects on credit extension and can also impact financial stability.[11]

The impact of monetary policy is linked to non-deposit funding and the ability of banks to create deposits. When banks extend loans, they also create deposits. These deposits, however, may be created at other banks, reducing central bank reserves and requiring that banks replenish them either in the money market or by borrowing from the central bank. The cost of borrowing is the policy rate or the interbank rate, which is close to the borrowing rate. In this case, changes in the policy rate directly impact the cost of borrowing and credit extension (Bofinger et al. 2023). Another channel operates through the effect of monetary policy on risk perceptions in financial markets and economic activity, which also generates so-called financial accelerator effects (Borio and Zhu 2012; Kashyap and Stein 2023). Improving risk sentiment (reducing expectations of macroeconomic risk) increases asset prices, expands balance sheets and leads to higher credit extension.

This mechanism, however, also highlights the links between monetary policy and financial stability. Periods of high risk taking and rapid credit extension increase the probability of severe recessions and financial crisis (Jordà, Schularick and Taylor 2013).

In the framework developed by Thakor (1996), capital requirements and monetary policy affect banks' portfolio choice between government securities and loans, but the impact depends on the change in the term premium. If an increase in either the policy rate or capital requirements leads to a rise in the term premium, then the relative returns of loans to bonds change and banks' portfolios will shift from loans to bonds, which are now more profitable. This mechanism has the potential to amplify or mitigate the impact of monetary policy and macroprudential actions on lending.

Changes in the policy rate can also affect the level of excess capital. Banks can become less risk averse in a low interest rate environment and willing to maintain lower

[11] For a detailed literature review of new theories of monetary policy transmission, see Kashyap and Stein (2023).

excess capital. Under this condition, higher capital requirements may have a smaller impact on credit supply, highlighting the importance of considering the economic cycle when transitioning to higher capital requirements (Aiyar, Calomiris and Wieladek 2016). Other channels operate via the cost of funding and collateral values used by borrowers, which have implications for financial stability; via liquidity in the payment system provided by the central bank; and via the impact of monetary policy and financial stability actions on exchange rates and capital flows (Lubis, Alexiou and Nellis 2019).

The response of lending to monetary policy depends on specific bank characteristics, which can strengthen or weaken the bank lending channel. Smaller banks, for example, may struggle to raise both deposit and non-deposit funding during monetary policy tightening due to information asymmetries (Kashyap and Stein 2000). Greater access to non-deposit funding also makes low excess capital more binding on lending, thus reducing the response to expansionary monetary policy (Disyatat 2011). More liquid banks are likely to have a smaller credit extension response as policy rates change (Kashyap and Stein 1995).

There is limited literature on macroprudential and monetary policy coordination in South Africa. Liu and Molise (2020) develop a DSGE model and study optimal policy coordination. They argue that monetary policy should focus on price stability and leave macroprudential policy to deal with financial stability issues. De Jager et al. (2022) argue that this is impossible to do as both monetary and fiscal policy have tools that impact both financial and price stability. Similarly, macroprudential policy can impact fiscal and monetary policy, for example through the characterisation of government bonds in the prudential framework, which can increase demand for government debt and the available fiscal space. In our analysis, we assess the individual and joint impact of monetary policy and capital requirements.

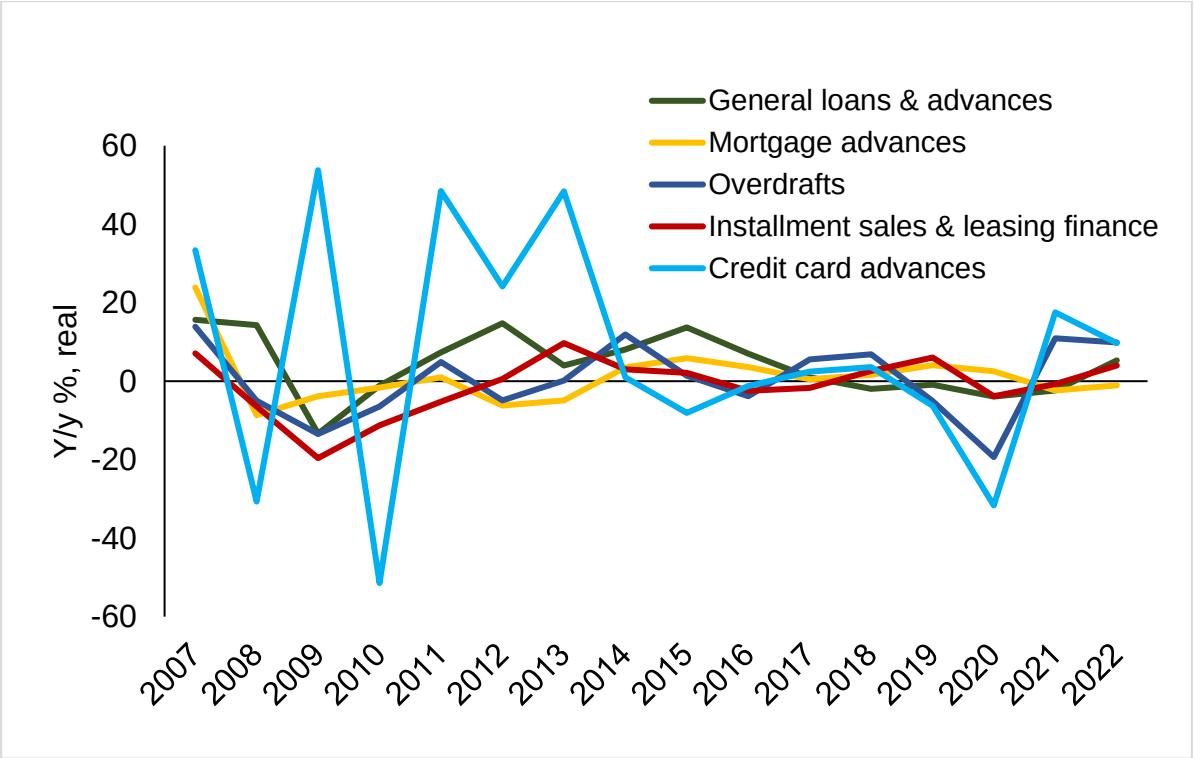
3. Background

Credit growth in South Africa has slowed significantly since the GFC. Figure 1 shows credit extension dynamics for households and corporates using aggregate data. While there is significant volatility in the different subcomponents, growth accelerated immediately after the GFC and then started to moderate. The behaviour of credit

extension was driven by macro factors and some structural factors. For example, unsecured lending recorded strong growth between 2010 and 2015 due to many factors, such as a slowdown in the property market and increasing funding costs for mortgages.

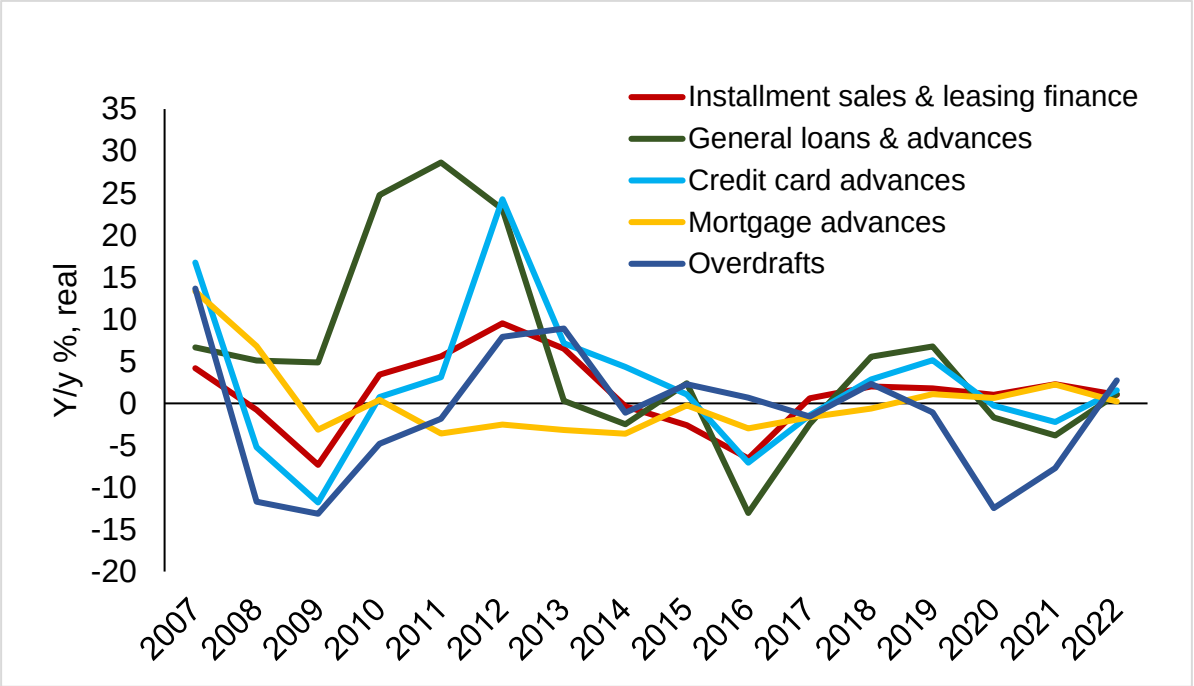
Figure 1: Credit extension to households and corporates

1a) Loans and advances to corporates



Source: SARB

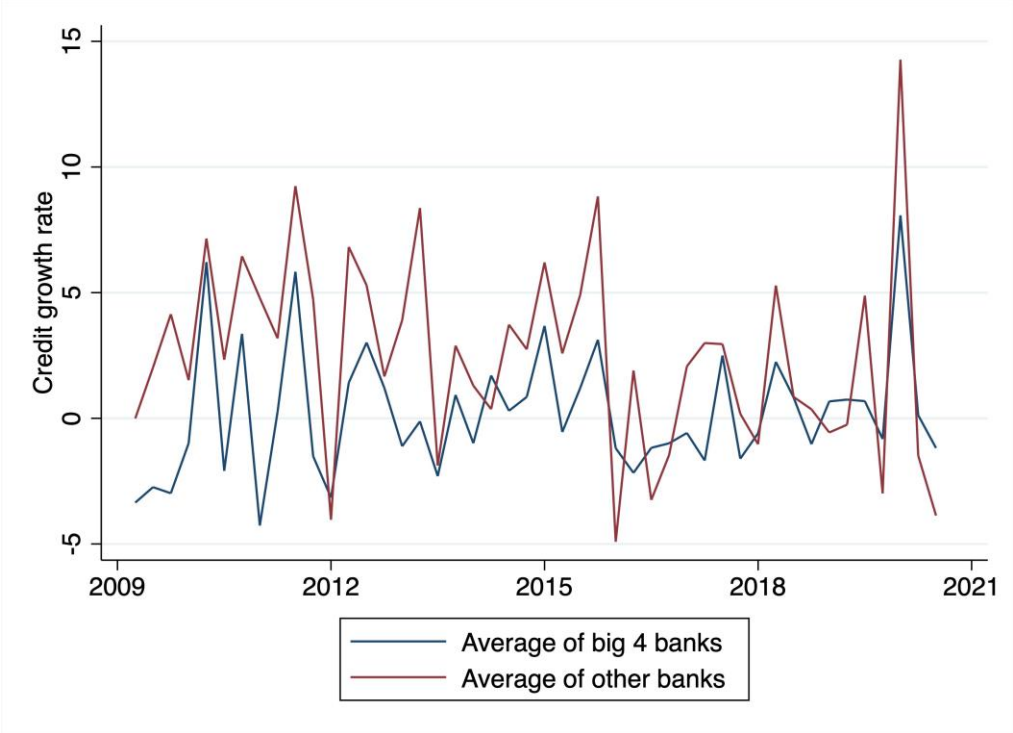
1b) Loans and advances to households



Source: SARB

When using disaggregated data from the BA900 forms, we see significant differences between small and large banks (Figure 2). Credit growth for smaller banks tends to be a lot more volatile, with larger growth and contractionary episodes.

Figure 2: Credit growth by bank size



Source: SARB

There are many possible factors that explain lending behaviour, including regulatory changes, the broader economic environment, bank-specific aspects and structural changes in the financial sectors such as more or less competition. We discuss these next.

In South Africa, Basel III regulations were phased in from the beginning of 2013. Table 1 presents the main capital requirements. Banks must hold significantly more capital than the Basel minima. The systemic risk capital (Pillar 2A) together with the systemically important banks buffer should not exceed 3.5%. The Pillar 2A for total capital was introduced at 1.5% in 2013. It peaked at 2% in 2015 and decreased to 1% as the systemically important capital buffer was phased in from 2016. Pillar 2A was further reduced to 0% in 2020, as one of the measures to support the banking sector during the COVID-19 crisis.

Pillar 2B is bank specific, with more 'risky' banks required to have even more capital. There are no upper limits and the Prudential Authority does not provide public data on each bank's Pillar 2B requirements. Smaller banks and those that are unsecured lenders have higher Pillar 2B requirements.

Banks are also required to have further additional capital, consisting of a countercyclical buffer, conservation buffer and systemically important banks buffer. Table 1 shows the maximum values for the different buffers, although their actual values are often below the maximum values.[12] For example, the countercyclical buffer was set at 0% in 2023.

[12] See Hollander and Van Lill (2019) for a review of financial sector policy.

Table 1: Basel III introduction

	2013	2014	2015	2016	2017	2018	2019	6 April 2020	2022
Total capital requirements (%)									
Minimum total capital ratio (per Basel III)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Pillar 2A for total capital (maximum 2.0%)	1.5	2.0	2.0	1.75	1.5	1.25	1.0	0.0	1.0
Minimum total capital plus Pillar 2A	9.5	10.0	10.0	9.75	9.5	9.25	9.0	8.0	9.0
Phasing in of specified charge for systemically important banks				25	50	75	100	100	100
Capital conservation buffer				0.625	1.25	1.875	2.5	2.5	2.5
Countrycyclical buffer (maximum **%**, if imposed)				0.625	1.25	1.875	2.5	2.5	2.5

Source: SARB

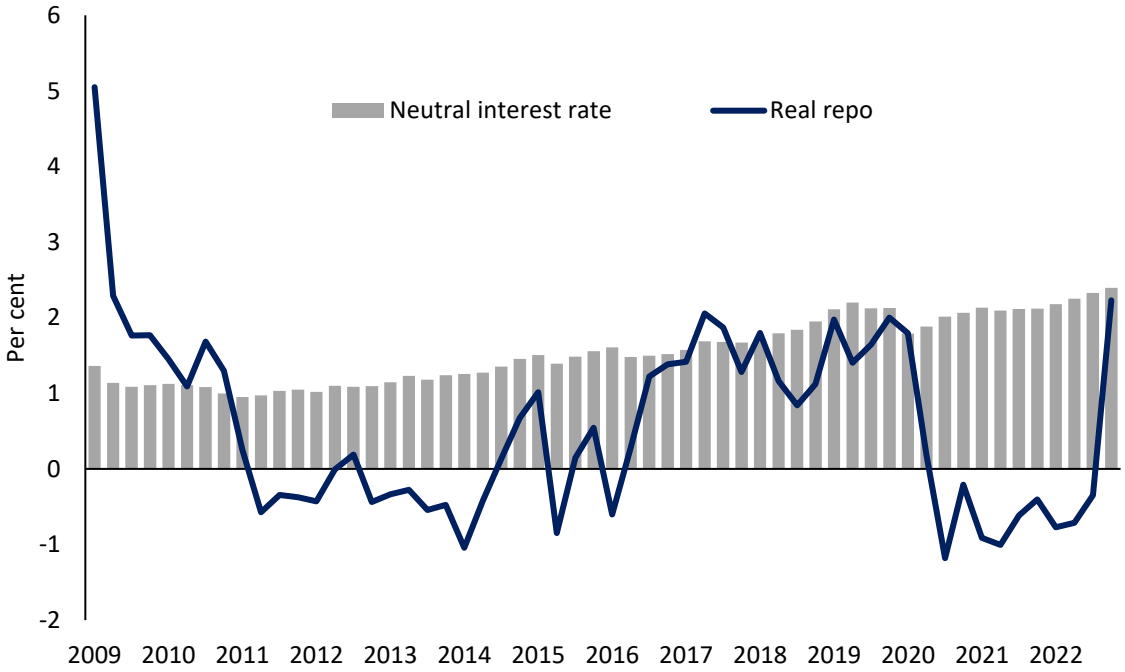
The Basel III requirements apply to almost all banks in South Africa. Only mutual banks are regulated differently. There are 18 local branches of foreign banks and 15 domestic banks. The top six banks are profitable, with a return on equity of over 15% in 2022. This high level of profitability is a function of the low level of competition (Rapapali and Simbanegavi 2020). While there are many banks, the market is completely dominated by the top six banks, which account for 93% of bank assets. Bank profitability and retained earnings are important determinants of how increasing bank capital can impact lending, as highlighted earlier. In our specification, we consider how the level of retained earnings may reduce the cost of increasing capital and consequently minimise any negative impacts on lending from holding more capital.

Monetary policy is also an important determinant of the credit cycle. In South Africa the credit and economic cycles are highly synchronised (Farrell and Kemp 2020). This suggests that economic variables such as inflation and GDP growth have strong effects on credit extension, along with fiscal and monetary policy decisions (de Jager et al. 2022).

Monetary policy remained accommodative for most of the post-GFC period, with policy rates below the neutral interest rate (Figure 3). Ex post assessments of the monetary policy stance suggest that policy was too loose for a part of the period as the output gaps were much smaller than initially projected (Honohan and Orphanides 2022). This

could have contributed to stronger credit growth and of course higher inflation. The approach to policy changed in 2017, with a more concerted approach to communications, emphasising the 4.5% mid-point of the target band as the preferred level of inflation (Loewald, Faulkner and Makrelov 2019). Policy became mildly contractionary as inflation outcomes were lower than expected. Policy again became highly accommodative during the COVID-19 crisis.

Figure 3: Monetary policy stance



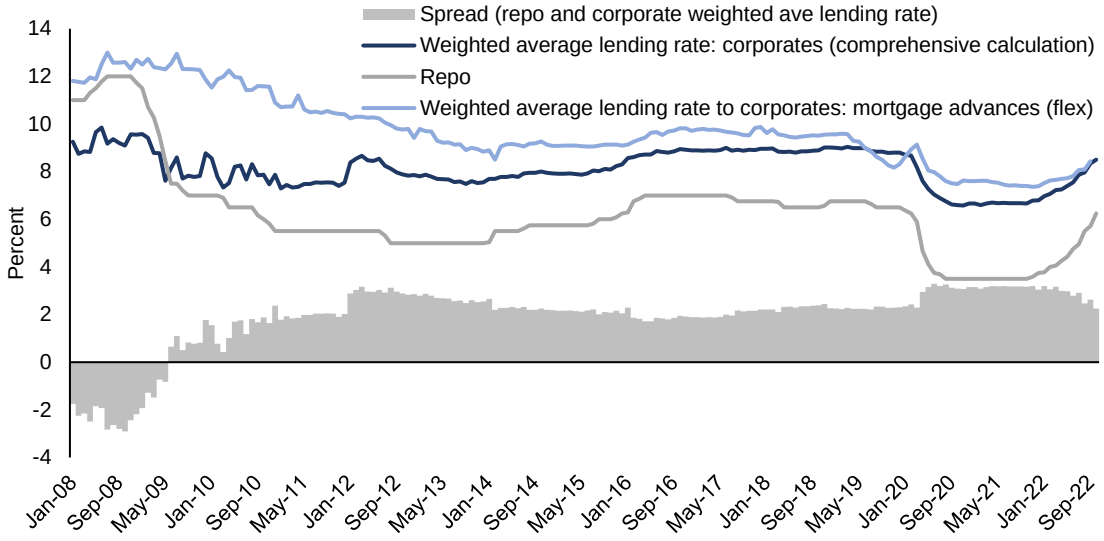
Source: SARB

There is high transmission of policy rates to lending rates in South Africa (Greenwood-Nimmo, Steenkamp and Van Jaarsveld 2022). However, Figure 4 shows that the pass-through is not always complete and lending spreads can offset or amplify monetary policy changes. The behaviour of lending spreads can reflect banks' perceptions of risks[13] as well as non-monetary policy factors that influence banks' funding costs, such as the introduction of Basel III requirements.[14] Osborne, Fuertes and Milne (2017) find, for example, that capital requirements impact lending rates in the UK, although the impact depends on the type of loan as well as the economic cycle.

13 See for example Woodford (2010).

14 See Diesel et al. (2022).

Figure 4: Lending rates and spread of corporate weighted average rate to repo



Source: SARB

The post-GFC period was also characterised by significant fiscal deterioration, which – along with policy and political uncertainty, and slowing economic growth – could have increased banks' risk aversion.[15]

In our analysis, we try to consider all these factors as possible drivers of lending. We move now to discuss our data in a bit more detail.

4. Data

We use bank-level data covering the period 2008:Q1 to 2020:Q3. The key variables used in our analysis – bank-specific credit extension (total and sector specific), voluntary capital buffers, capital requirements and retained earnings – are not publicly available and have been provided by South Africa's Prudential Authority. The remaining variables have been obtained from public sources. Table 2 summarises the data used and its sources.

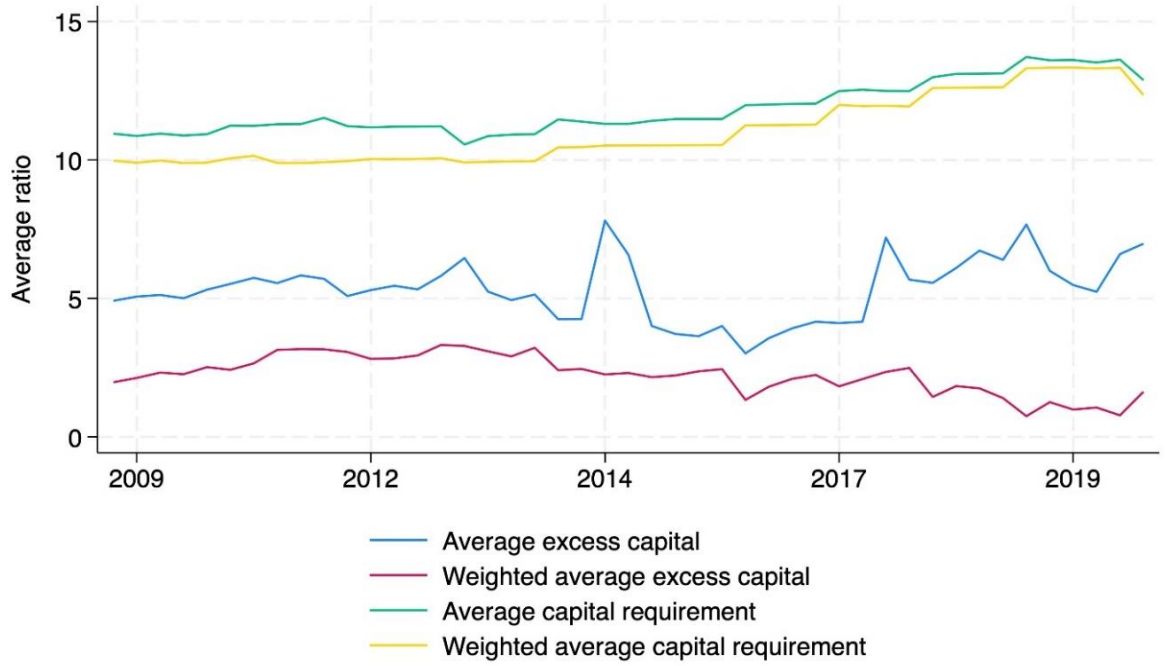
15 See Makrelov, Pillay and Morule (2023).

Table 2: List of variables

Variable	Definition	Source
DEXCESSCAP	Ratio of actual excess capital (= surplus capital held by bank in excess of requirement) to total capital, first difference	Prudential Authority
DCAPREQ	Ratio of actual capital requirement to total capital, first difference	Prudential Authority
LOANS	Total real credit growth, to all sectors and to only non-financial sectors of the economy	Prudential Authority
RETEARN	Retained earnings, dummy (=1 if retained earnings > 0)	Prudential Authority
LIQ	HQLAs/total assets, where HQLAs are defined as central bank money and gold, SARB debentures, and marketable government stock	SARB (BA900)
DREPO	Nominal repo rate, first difference	SARB (Quarterly Bulletin)
realGDP	Real GDP growth	SARB (Quarterly Bulletin)
CPIinflation	Inflation rate from CPI	SARB (Quarterly Bulletin)
LOANDEMAND	$\sum_q s_{iqt}\Delta z_{qt}$, where s_{iqt} denotes the share of sector *q* in bank *i*'s lending portfolio in period *t* and Δz_{qt} is real GDP growth in sector *q*	Calculated by authors based on Prudential Authority and Statistics South Africa data
BIG4	Big 4 bank indicator (=1 for Absa, FirstRand, Nedbank and Standard Bank)	Calculated by authors

In Figure 5, we show the average and weighted capital requirements and excess capital buffers for the banking sector. The capital requirements continued to increase between 2013 and 2020 in line with the introduction of Basel III, as discussed earlier. Surplus or excess capital has increased for small banks but decreased for large banks. As discussed earlier, there are a variety of reasons why big banks have less excess capital, such as having more diversified portfolios and being considered “too big to fail”.

Figure 5: Capital requirements and excess capital for the banking sector



Source: SARB and authors' own calculation

Although we have data available at the monthly frequency, we use quarterly data for two main reasons. The first is so that our estimates will be comparable with prior literature that has typically used quarterly data. The second is to avoid any noise that might be present in monthly data. We collapse monthly data to quarterly figures by averaging over the months in each quarter.

For our estimates we do not include mutual banks since they are not subject to capital adequacy requirements. We also drop African Bank, which experienced significant financial stress over the period and had to be bailed out and restructured. We exclude outliers, defined as those observations with an absolute value of excess capital or credit growth z-score greater than 3.[16] Unlike Milne and Sibande (2024), we include smaller banks in our analysis as some of them provide significant lending to specific sectors of the economy.

[16] In Annexure A, we show that our results are robust to winsorising at the 1% level instead of trimming outliers.

Table 3 provides summary statistics for the entire dataset. On average, loan growth to non-financial sectors has been higher than total loan growth and banks have decreased their capital buffers. Capital requirements have increased and the repo rate decreased on average over the sample period.

Table 1: Summary statistics (2008–2020)

	(1)	(2)	(3)	(4)
Variable	**mean**	**sd**	**min.**	**max.**
LOANS, total	3.382	16.60	-47.29	246.4
LOANS, excluding finance, insurance and real estate sectors	5.502	43.34	-99.79	1 162
DEXCESSCAP	-0.102	2.918	-34.97	25.50
DCAPREQ	0.0408	0.577	-9.123	6.500
DREPO	-0.149	0.517	-2.340	0.520
LIQ	0.0699	0.0547	0.000817	0.324
RETEARN	0.924	0.265	0	1
realGDP	-0.00498	3.745	-15.25	3.582
CPI inflation	1.219	0.477	-0.319	2.207
LOANDEMAND, total	0.418	0.679	-4.809	4.268
LOANDEMAND, excluding finance, insurance and real estate sectors	0.119	0.606	-4.650	3.919

Source: Authors' own calculations

5. Methodology

Following the approach of Aiyar, Calomiris and Wieladek (2016), we estimate the effects of excess capital, bank-specific characteristics and monetary policy on bank lending using the following panel fixed effects specification:

$$LOANS_{i,t} = \alpha_i + \sum_{j=0}^{L} a_{j\Delta \mathrm{EXCESSCAP}_{\mathrm{i,t\text{-}j}}} + \sum_{j=0}^{L} b_{j\Delta \mathrm{CAPREQ}_{\mathrm{t\text{-}j}}} + \sum_{j=0}^{L} c_{j\Delta \mathrm{REPO}_{\mathrm{t\text{-}j}\sum_{j=0}^{L} d_j}} LIQ_{t-j} + \sum_{j=0}^{L} e_j\, RETEARN_{t-j} + + \sum_{j=0}^{L} f_j\, realGDP_{t-j} + \sum_{j=0}^{L} g_j\, CPI\ inflatio\ n + \sum_{j=0}^{L} h_{j\Delta \mathrm{LOANDEMAND}_{\mathrm{i,t\text{-}j}}} + \varepsilon_{i,t}$$

Our measure of lending, $LOANS_{i,t}$, is real credit growth to all sectors and to only non-financial sectors of the economy. Our primary variable of interest is Δ*EXCESSCAP*, which measures the impact of changes in a bank's excess capital on lending (Makrelov, Pillay and Morule 2023). We consider two policy variables: *CAPREQ*, which reflects the bank-specific capital requirement imposed by regulators, and *REPO*, which is the nominal repo rate to capture the effect of monetary policy. Since the repo rate is likely endogenous with other macroeconomic variables, we control for GDP growth (*realGDP*) and CPI inflation (*CPI inflation*). The impacts of *EXCESSCAP* and *CAPREQ* depend on whether capital is relatively expensive to raise.[17] Following Fang et al. (2022), we include bank-specific characteristics such as bank liquidity, *LIQ*, measured by the share of HQLAs in total assets and profitability measured by retained earnings (*RETEARN*). When banks are profitable it should be easier to accumulate bank capital.

Bank characteristics are important for the transmission mechanism of regulatory capital requirements and monetary policy decisions. For example, Kashyap and Stein (2000) find that more liquid banks tend to react less to monetary policy. The lending impacts tend to vary depending on the size of the bank, with smaller banks being a lot more responsive (Aiyar, Calomiris and Wieladek 2016). In our analysis we interact bank characteristics, particularly size, with policy variables to study the differential impacts on lending.

To isolate loan supply changes, we control for loan demand based on the measure defined in Aiyar, Calomiris and Wieladek (2016). Our bank-specific time-varying measure is $LoanDemand_{it} = \sum_q s_{iqt}\Delta z_{qt}$, where s_{iqt} denotes the share of sector *q* in bank *i*'s lending portfolio in period *t* and Δz_{qt} is real GDP growth in sector *q*. In South Africa, real GDP data is available only on a quarterly basis. In addition to being able to compare results across different studies and avoid noise, availability of data is another reason why we use quarterly and not monthly data in our analysis.

For all variables, we include both the contemporaneous effect and four quarterly lags. The bank-specific fixed effect is given by α_i, and standard errors are clustered at the

[17] For example, Makrelov, Davies and Harris (2021) show that when equity is inexpensive, there is no contractionary impact on credit extension.

bank level throughout. The bank fixed effect controls for time-invariant bank characteristics that affect bank lending.

One concern with our empirical strategy is the potential endogeneity of excess capital. Banks could adjust their excess capital in response to changes in the composition of their portfolio, potentially rendering them endogenous to bank lending decisions. We address this concern by estimating a two-dimensional panel VAR in section 7, following the approach of Aiyar, Calomiris and Wieladek (2016) to test for endogeneity.

6. Results

Table 4 gives the results from estimating our main specification, with and without controls for lending to all sectors in columns (1) to (5), and excluding loans to the finance, insurance and real estate sectors in columns (6) to (10). All estimates are from a panel fixed effects specification with standard errors clustered at the bank level and a lag length of L = 4.

It is evident that changes in excess capital have large and significant effects on bank lending. A 1 percentage point increase (decrease) in the buffer reduces (increases) lending by 2 percentage points, with a larger effect of just over 3 percentage points for lending to non-financial sectors. The regulatory capital requirements have a large negative effect when we exclude the finance, insurance and real estate sectors from our analysis. This result is in line with estimates in other countries.[18] However, our results are different to those of Milne and Sibande (2024), who find a small impact of capital requirements on lending in South Africa. There are several aspects that differentiate our approach from their analysis. We include large and small banks in our analysis, we employ a different set of explanatory variables and our dependent variable is based on economic sector credit extension obtained directly from the Prudential Authority.

Generally, changes to the repo rate have a larger impact on lending than changes in the voluntary capital buffer and capital requirements. These results indicate strong monetary policy transmission via the interest rate channel.

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[18] See for example Aiyar, Calomiris and Wieladek (2016), as discussed earlier.

Retained earnings have a positive effect on lending, as expected, although the coefficient is not statistically significant in all specifications. Liquidity does not have a significant effect on lending, indicating that for many banks liquidity has not been a binding constraint over the period. High GDP growth has a positive effect on lending, while inflation has a negative effect when we consider all sectors of the economy.

Similar to the results presented by Fang et al. (2022), the loan demand variable is not significant in any specification.

In columns (4) and (9), we consider how the monetary policy instrument (the repo rate) interacts with excess capital and the capital requirement. The coefficient on the interaction between excess capital and the repo rate is statistically significant and negative, indicating that changes in monetary policy are amplified by excess capital: the higher the excess capital, the larger the negative impact of an increase in the repo rate on lending. This is in line with the literature on the bank lending channel. High capital buffers amplify monetary policy responses (Disyatat 2011).

In columns (5) and (10), we test whether the effects of excess capital and the policy variables are different for the four biggest banks. The four largest banks in South Africa have a market share of over 80%. Due to their size and profitability, we expect changes in the capital buffer to impact lending in different ways to that seen in the overall sample. In particular, we expect that changes in excess capital will have smaller impacts on lending for the big banks as they have larger retained earnings to total assets compared to small banks. As expected, we see that changes in excess capital have a smaller effect on lending among the four biggest banks. Changes to monetary policy also have a smaller effect on lending for these banks. Our results, however, suggest that policy actions to increase capital requirements do not have a different impact when we consider the size of banks. The coefficient on the interaction term is positive, as expected, but insignificant.

Table 4: Panel fixed effects results

	Loans, all sectors					Loans, excluding finance, insurance and real estate sectors				
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
dexcesscap	-1.789***	-1.862***	-2.005***	-2.285***	-2.009***	-3.155***	-3.195***	-3.353***	-3.685***	-3.354***
	(0.293)	(0.270)	(0.330)	(0.340)	(0.333)	(0.954)	(0.968)	(0.999)	(1.065)	(1.015)
dcapreq		-2.804	-3.461	-2.953	-3.472		-4.490*	-5.375*	-5.972**	-5.743**
		(1.998)	(2.344)	(2.407)	(2.375)		(2.367)	(2.697)	(2.874)	(2.658)
dreporate		-1.720	-3.806**	-0.989	-4.239**		-1.474	-5.934**	-4.531	-5.922*
		(1.403)	(1.668)	(1.886)	(1.839)		(2.432)	(2.832)	(4.194)	(3.237)
retearnd			4.225	7.056**	4.577*			3.394	5.210	3.904
			(2.541)	(3.250)	(2.353)			(3.126)	(3.779)	(3.176)
liquidity			3.438	-1.352	3.680			-3.353	-10.150	-4.079
			(10.825)	(8.676)	(10.681)			(20.552)	(20.121)	(20.414)
gdpgrowth			2.654**	2.755**	2.386*			5.615	5.106	5.369
			(1.121)	(1.172)	(1.160)			(3.693)	(4.120)	(3.856)
cpiinflation			-5.396**	-6.657***	-5.606**			-2.431	-2.762	-2.555
			(2.533)	(2.357)	(2.573)			(3.289)	(3.591)	(3.341)
loandemand			-0.281	0.674	0.492			-0.521	-0.538	0.547
			(1.285)	(1.377)	(1.212)			(3.998)	(4.110)	(4.229)
excesscapXdreporate				-0.588**					-0.223	
				(0.280)					(0.596)	
dcapreqXdreporate				8.766					-2.811	
				(8.568)					(15.802)	
dexcesscapXBIG4					1.845*					3.070*
					(0.899)					(1.571)
dcapreqXBIG4					3.437					11.890
					(3.592)					(8.730)
dreporateXBIG4					3.414*					0.495
					(1.897)					(3.891)
N	1 023	1 023	1 023	1 023	1 023	1 038	1 038	1 038	1 038	1 038
numbank	26	26	26	26	26	26	26	26	26	26

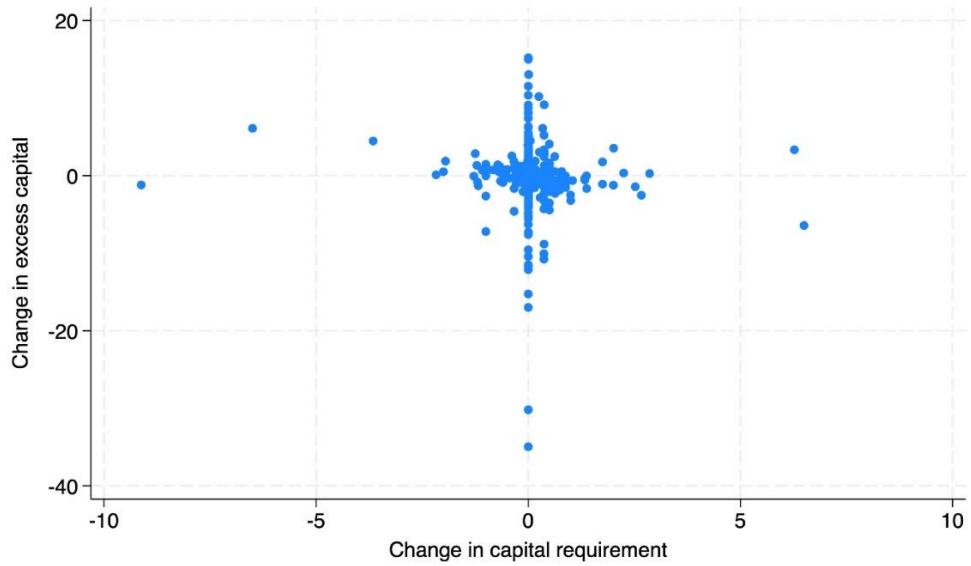
Notes: The table presents estimates of our main specification, for lending to all sectors in columns (1) to (5), and excluding loans to the finance, insurance and real estate sectors in columns (6) to (10). See Table 2 for definitions of all variables. All estimates are from a panel fixed effects specification with standard errors clustered at the bank level and a lag length of L = 4. * significant at the 10% level, ** at the 5% level, *** at the 1% level.

7. Robustness checks

Correlation between excess capital and capital requirement

One potential concern is that excess capital may be highly correlated with changes in capital requirements. Figure 6 shows that the changes in excess capital seem to be independent of the changes in capital requirements. Increases in capital requirements are sometimes associated with increases and sometimes with decreases in excess capital. Previous research has also demonstrated that the size of excess capital holdings depends on factors such as fiscal risks and bank size (Makrelov, Pillay and Morule 2023). This low level of collinearity validates our specification, which examines how both regulatory capital changes and banks' decisions to hold more excess capital separately impact lending.

Figure 6: Changes in capital requirements and excess capital across banks



Source: SARB and authors' calculation

Comparing columns (1) and (2) and columns (6) and (7) of Table 4 shows that the effect of excess capital on lending is unchanged by the inclusion of the capital requirement. To further confirm that our specification – which includes both the excess capital and the capital requirement – is valid, we repeat our main estimates but exclude the capital requirement from all regressions in Table 5. The results are largely unchanged and confirm that an increase in excess capital decreases total lending by around 2 percentage points, with a larger effect of 3–4 percentage points for lending to non-financial sectors.

Table 5: Robustness check excluding capital requirement

	All sectors				Excluding finance, insurance and real estate sectors			
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
dexcesscap	-1.820***	-1.939***	-2.247***	-1.952***	-3.148***	-3.262***	-3.616***	-3.274***
	(0.281)	(0.344)	(0.355)	(0.346)	(0.958)	(0.979)	(1.040)	(0.993)
dreporate	-2.108	-3.953**	-1.338	-4.416**	-2.145	-6.535**	-5.785	-6.523**
	(1.303)	(1.628)	(1.834)	(1.781)	(2.346)	(2.768)	(4.123)	(3.145)
retearnd		3.350	7.601**	3.697		1.686	6.027	2.060
		(2.590)	(3.083)	(2.426)		(3.113)	(4.137)	(3.101)
liquidity		2.959	-2.255	3.445		-4.160	-12.415	-4.614
		(11.065)	(8.836)	(11.010)		(20.617)	(21.086)	(20.583)
gdpgrowth		2.646**	2.984**	2.369**		5.786	5.901	5.429
		(1.100)	(1.102)	(1.127)		(3.741)	(4.003)	(3.828)
cpiinflation		-5.826**	-7.332***	-6.073**		-2.522	-3.293	-2.697
		(2.576)	(2.378)	(2.581)		(3.205)	(3.545)	(3.322)
loandemand		0.254	1.259	0.878		-0.299	-0.165	0.390
		(1.347)	(1.453)	(1.232)		(3.929)	(4.028)	(3.979)
excesscapXdreporate			-0.587*				-0.207	
			(0.287)				(0.585)	
dexcesscapXBIG4				1.463*				0.959
				(0.745)				(1.861)
dreporateXBIG4				3.434*				0.685
				(1.682)				(4.016)
N	1 023	1 023	1 023	1 023	1 038	1 038	1 038	1 038
numbank	26	26	26	26	26	26	26	26

Notes: The table presents estimates of our main specification excluding the capital requirement variables, for lending to all sectors in columns (1) to (5), and excluding loans to the finance, insurance and real estate sectors in columns (6) to (10). See Table 2 for definitions of all variables. All estimates are from a panel fixed effects specification with standard errors clustered at the bank level and a lag length of L = 4. * significant at the 10% level, ** at the 5% level, *** at the 1% level.

Endogeneity concerns

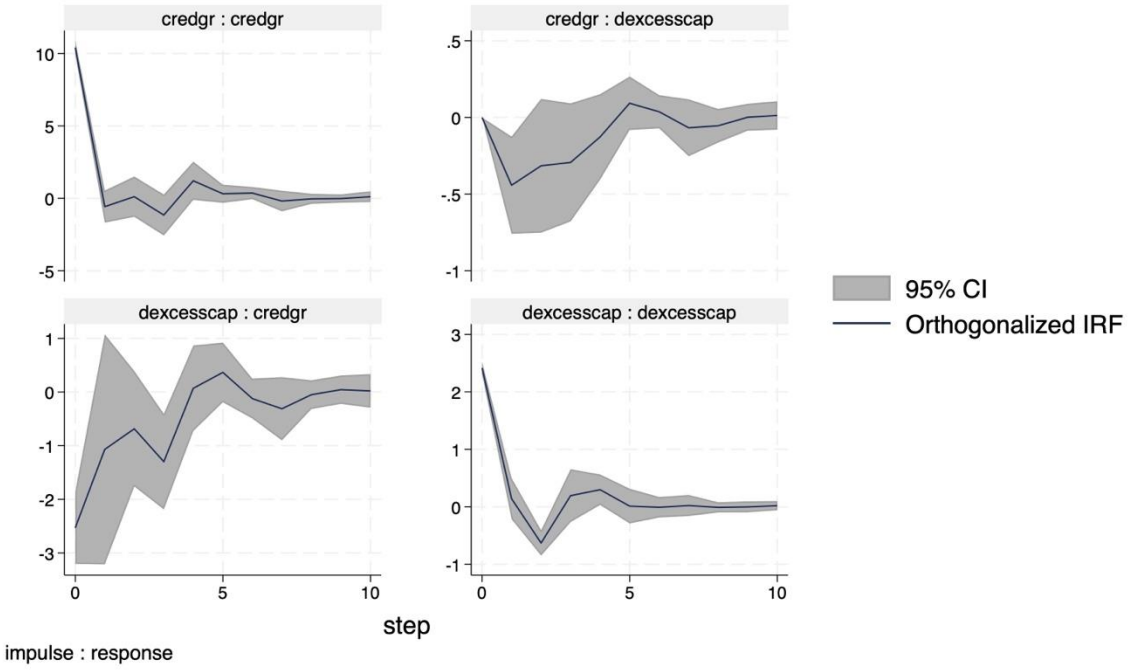
A key assumption in our main specification is that changes in excess capital are exogenous with respect to lending growth. However, reverse causality is a potential concern as banks could adjust their excess capital in response to lending growth risks. In order to address this concern, we estimate a two-dimensional panel VAR of lending growth and excess capital changes:

$$Y_{i,t} = \sum_{j=1}^{4} B_j Y_{i,t-j} + u_i + e_{i,t}$$

where $Y_{i,t}$ contains $LOANS_{i,t}$ and $\Delta\text{EXCESSCAP}_i$, and u_i are dependent-variable specific panel fixed effects.

To identify a change in excess capital shocks, we assume that the change in excess capital reacts to credit growth with a lag, following the VAR specification by Aiyar, Calomiris and Wieladek (2016). We estimate the panel VAR using the approach described in Abrigo and Love (2016) to deal with bias arising from the inclusion of lagged dependent variables and fixed effects. We plot the impulse responses to a 1 standard deviation change in excess capital and the associated 5th and 95th posterior coverage bands in Figure 7.

Figure 7: Panel VAR impulse response functions



The impulse response function (IRF) confirms the negative effect of increases in excess capital on lending. Table 6 shows the numerical impact on lending upon impact and for the first four periods. The table shows that the immediate impact is a 2.5 percentage point decline in lending, which falls to zero fairly quickly. The last column of Table 6 gives the individual coefficients from a regression that includes only the contemporaneous change in excess capital, together with four lags, and bank-specific fixed effects (this is equivalent to column (1) of Table 6 rescaled to match the 1 standard deviation change shown in the IRF).

Table 6: Panel VAR results

	Credit growth IRF to dexcesscap			Baseline model
Percentile	**5th**	**50th**	**95th**	**50th**
0	-3.196	-2.532	-1.868	-2.410
1	-3.100	-1.069	0.962	0.068
2	-1.810	-0.685	0.440	-1.027
3	-2.206	-1.298	-0.391	-0.933
4	-0.707	0.070	0.847	-0.019
Sum	-11.018	-5.514	-0.009	-4.321

Notes: The table presents estimates of the credit growth impulse response function to $\Delta EXCESSCAP$ from a panel VAR specification. Column (1) of Table 6 is reproduced in the baseline model column (with the coefficients rescaled to match the 1 standard deviation change shown in the IRF).

The cumulative effect of the impulse response up to five quarters has a median value of -5.5, which is very similar to, and not statistically significantly different from, the cumulative effect of -4.3 for the single equation baseline specification. Aiyar et al. (2014) demonstrate that the sum of the impulse responses will be identical to the sum of coefficients from the fixed effects estimates over the same horizon only if certain conditions, which are sufficient to rule out endogeneity bias, are met. Thus, the similarity of the panel VAR and fixed effects estimates indicates that reverse causality is not a significant problem in our baseline model. This is further seen by the impulse response of the impact of a lending growth shock on changes in excess capital in Figure 7. The effect on excess capital is generally not statistically significantly different from zero, confirming that reverse causality is not a concern.

Lag length

Our final robustness check examines the sensitivity of our results to the number of lags chosen. Table 7 re-estimates our main model using a range of lags from 0 (so including

only the contemporaneous effect) to 5. Our main specification uses a lag length of 4 (as reported in column 3 of Table 4 and reproduced in column 4 of Table 7), but it is clear that our central finding of a significant effect of excess capital on lending is not dependent on the lag length chosen. All specifications with a lag length ranging from 0 to 5 confirm that an increase (decrease) in excess capital has a negative (positive) effect on bank lending.

Table 7: Panel fixed effects results with different lags

Dependent variable: Loans to all sectors						
Lags	**0**	**1**	**2**	**3**	**4**	**5**
dexcesscap	-0.645***	-0.685***	-0.784***	-1.073***	-2.005***	-2.021***
	(0.164)	(0.175)	(0.164)	(0.325)	(0.330)	(0.354)
dcapreq	-1.381	-0.970	-2.900	-3.718*	-3.461	-3.608
	(0.865)	(1.147)	(1.713)	(1.917)	(2.344)	(2.958)
dreporate	-0.290	0.029	-1.405	-4.084***	-3.806**	-5.825**
	(0.898)	(1.027)	(1.169)	(1.408)	(1.668)	(2.251)
retearnd	-2.697	-1.048	-0.040	-0.838	4.225	2.411*
	(2.709)	(2.796)	(2.657)	(2.940)	(2.541)	(1.367)
liquidity	-10.029	1.030	8.098	9.513	3.438	5.034
	(7.128)	(10.769)	(13.920)	(11.931)	(10.825)	(11.490)
gdpgrowth	0.112	0.019	0.223	3.078**	2.654**	2.990**
	(0.118)	(0.374)	(0.489)	(1.160)	(1.121)	(1.321)
cpiinflation	-1.827**	-1.113	-2.503*	-2.869*	-5.396**	-3.303
	(0.669)	(1.005)	(1.339)	(1.609)	(2.533)	(2.365)
loandemand	1.487**	1.413*	2.551**	-0.191	-0.281	-1.169
	(0.628)	(0.690)	(1.131)	(1.611)	(1.285)	(0.901)
N	1 119	1 098	1 075	1 049	1 023	999
numbank	27	26	26	26	26	26

Notes: The table presents estimates of our main specification for lending to all sectors with varying lag lengths. Column (4) reproduces column (3) of Table 4. See Table 2 for definitions of all variables.

* significant at the 10% level, ** at the 5% level, *** at the 1% level.

8. Conclusion

Banks' decision to hold excess capital has a large impact on lending, especially for small banks. This is the main finding of our analysis. As expected, our analysis also shows that monetary policy actions have a strong impact on lending in the economy through the bank credit channel. This finding is in line with other studies that indicate

strong transmission of policy rates to lending rates.[19] Prudential actions to increase capital requirements also have a substantial impact on lending when we exclude the finance, insurance and real estate sectors from the analysis. The policy impacts tend to be smaller for larger banks, which is a finding in line with the international literature.

Together with the findings of our previous paper – that fiscal risks are positively related to the size of excess capital – these results establish a link between fiscal risks and credit extension via higher capital holding.[20] Rising fiscal risks lead to an increase in excess capital as a risk mitigation instrument, which in turn reduces credit extension. Our results also indicate that higher levels of excess capital amplify the effect of monetary policy actions on lending. This is another financial sector channel through which unsustainable fiscal actions impact the economy.

It is difficult to think about policy in a Tinbergen rule type of world. Fiscal, macroprudential and monetary policy actions can impact price and financial stability goals through their impact on credit extension. When policies work at cross purposes, they can easily undermine each other's goals.

We provided several robustness checks. However, tackling issues of endogeneity is difficult in this type of analysis, as highlighted in all studies on the topic. Developing new approaches to addressing this problem can further improve the robustness of the results.

19 See Greenwood-Nimmo, Steenkamp and Van Jaarsveld (2022).

20 See Makrelov, Pillay and Morule (2023).

Annexure A

The table below demonstrates that our main result is robust to winsorising credit growth and excess capital at the 1% level instead of trimming the outliers.

	Loans, all sectors					Loans, excluding finance, insurance and real estate sectors				
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
dexcesscap	-2.051***	-2.136***	-2.162***	-2.166***	-2.144***	-2.489***	-2.585***	-2.502**	-2.633***	-2.600***
	(0.466)	(0.432)	(0.464)	(0.393)	(0.436)	(0.711)	(0.711)	(0.904)	(0.830)	(0.721)
dcapreq		-2.594	-3.008	-3.867*	-2.693		-4.368*	-4.288	-5.821**	-4.459*
		(2.163)	(2.504)	(2.180)	(2.226)		(2.409)	(2.676)	(2.553)	(2.454)
dreporate		-2.489**	-4.514***	-2.199	-3.096**		-1.764	-5.253**	-3.253	-2.240
		(1.185)	(1.511)	(1.960)	(1.381)		(1.696)	(2.432)	(3.677)	(1.993)
reteamd			-0.658					-7.203		
			(2.191)					(9.256)		
liquidity			-4.116					-5.190		
			(11.655)					(14.419)		
gdpgrowth			3.393**					7.701***		
			(1.346)					(2.717)		
cpiinflation			-4.226					0.198		
			(2.589)					(2.859)		
loandemand			-1.055					-4.202		
			(1.326)					(2.648)		
excesscapXdreporate				0.003					0.404	
				(0.336)					(0.707)	
dcapreqXdreporate				-14.332*					-18.393**	
				(7.229)					(8.254)	
dexcesscapXBIG4					2.681***					3.781***
					(0.702)					(0.966)
dcapreqXBIG4					3.470					2.979
					(3.198)					(2.958)
dreporateXBIG4					3.990**					3.515*
					(1.678)					(2.039)
N	1 040	1 040	1 040	1 040	1 040	1 040	1 040	1 040	1 040	1 040
numbank	26	26	26	26	26	26	26	26	26	26

Notes: The table presents estimates of our main specification for lending to all sectors in columns (1) to (5), and excluding loans to the finance, insurance and real estate sector in columns (6) to (10). See Table 2 for definitions of all variables. All estimates are from a panel fixed effects specification with standard errors clustered at the bank level and a lag length of L = 4. * significant at the 10% level, ** at the 5% level, *** at the 1% level.

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