Counter-Cyclical Capital Buffers and Interest-Rate Policy as Complements – The Experience of South Africa

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ERSA working paper 476

November 2014

Economic Research Southern Africa (ERSA) is a research programme funded by the National Treasury of South Africa.

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November 11, 2014

Abstract

Counter-cyclical capital buffers are increasingly popular new "macroprudential" tools. However, there is limited empirical evidence on both the intended and unintended consequences of using these buffers. During the pre-crisis period (2002–2007), South Africa increased capital adequacy ratios to curb rapid credit extension, and so provides a useful test case.

Using a new data set from that period, this paper extends a standard large-scale macroeconomic model to include capital adequacy ratios as a policy lever. It is found that a 1 percentage point shock to the capital adequacy ratio has similar effects to an interest-rate shock of between 0.3 and 0.4 percentage points. These results are in line with those in other jurisdictions.

The econometric results are only indicative – if actively used as a tool, counter-cyclical capital buffers may have their own complexities, including asymmetric impacts and endogeneity problems. Monetary policy issues, such as signalling, time inconsistency, expectation and communication challenges also apply, reducing the usefulness of proactive macroprudential policy. Nevertheless, macroprudential policies have an important complementary role to play

1 Introduction

Following the global financial crisis, there has been substantial academic and policy rethinking about how economic fluctuations can be managed. In particular, a large and expanding literature has developed on possible "macroprudential

*National Treasury, South Africa. The author would like to thank Hugh Campbell at the Banking Supervision Department of the Reserve Bank for data; and Stan du Plessis, Erlend Nier, Laura Papi, Yibin Mu, Lucrezia Reichlin, Eric Schaling, Errol Kruger, Gideon du Rand, Charl Jooste, Cornelius Kuth, Nicola Brink, Andries du Toit and Jorge Canales Kriljenko and participants at seminars at the Treasury, Reserve Bank and Stellenbosch University for comments on earlier versions of the paper. The remaining errors are my own. The views expressed in this paper do not necessarily represent the views of the Treasury.

tools" – financial regulatory measures that can be used as part of a toolkit to manage financial stability risks and prevent future systemic crises.

Among these, a "dynamic" or "state-contingent" capital adequacy ratio, known to practitioners as the counter-cyclical capital buffer, has emerged as a viable and workable macroprudential tool[1]. It is a particularly interesting case of a "microprudential" tool that could be deployed for macroprudential purposes. Its stated objective is to increase the resilience of banks, specifically, and the banking system, more generally, to shocks. It is not generally thought of as a demand-management tool *per se*, but that such tools can have economy-wide effects on inflation and output is well established.[2]

Empirical evidence on the counter-cyclical capital buffer is thin, mainly because it is new and relatively untested. South Africa, however, used a variant of the buffer in the 2003–2007 period to manage a credit boom that the central bank judged to be potentially dangerous for financial stability. This provides a useful historical experience for South African regulators, and may also be useful for other jurisdictions.

The rest of this paper is arranged as follows: section 2 discusses the theoretical and empirical literature. Section 3 outlines the methodology used in the paper. Using a unique data set from the period, section 4 evaluates the results, noting the intended and unintended economic effects of using the tool, and identifies whether or not it assisted in managing South Africa's success in weathering the global financial crisis. Section 5 concludes with some pointers for future research.

In summary, although the two policy levers are complementary and not equivalent, a 1 percentage point shock to the capital adequacy ratio is estimated to have similar effects to an interest-rate shock of between 0.3 and 0.4 percentage points.

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[1] All Basel Committee members are expected to introduce a 'counter-cyclical capital buffer' as part of their Basel III implementation, making it the first globally consistent macroprudential tool.

The counter-cyclical capital buffer is designed to be an additional capital charge to allow national authorities to increase the "socially efficient" level of capital in response to financial stability and/or systemic risks. Regulators can increase capital by an additional 2.5 percentage points, using the ratio of credit to gross domestic product (GDP) compared to a trend level as a good indicator for the development of systemic risk (BCBS, 2010). However, the Committee notes that it should not be the "dominant indicator" and that authorities can use any information at their disposal to guide them, provided that they "explain the information used, and how it is taken into account in formulating buffer decisions".

[2] For a detailed overview of the interaction between microprudential and macroprudential tools, both at a general level and at a country level, see Bikker and Hu (2001), Galati and Moessner (2011), or IMF (2012), and the discussion below.

2 Literature review

2.1 The need to extend the toolkit beyond interest-rate policy

Traditionally, interest-rate policy was the only tool available to the central bank to manage economic fluctuations and counteract financial system risks, typically in the context of an inflation-targeting framework. It is perhaps an understatement to say that the global financial crisis exposed the weakness of such a narrow approach to central-bank policy, and the crisis highlighted the role of financial regulation and cross-border flows in macroeconomic risks. Blanchard *et al.* (2010) note that "the policy rate is a poor tool to deal with excess leverage, excessive risk taking or apparent deviations of asset prices from fundamentals".

There are, however, conceptual difficulties with extending the central bank's toolkit beyond interest-rate policy. There is a large literature[3] suggesting that the best candidates as policy levers are so-called "macroprudential" tools, that is, microprudential tools developed and applied with systemic soundness in mind.

2.2 Banks' balance sheets and the broader economy

In a review of the changing nature of macroeconomic policy, Blanchard *et al.* (2013) note that both theoretical and empirical evidence on the use of macroprudential policies such as the counter-cyclical capital adequacy ratio is still thin.

Importantly, capital adequacy requirements are traditionally "microprudential" tools, in the sense that they are used primarily to ensure the health and safety of individual banks.

The financial crisis has renewed theoretical interest in the interaction between banks' business models and credit conditions. In particular, interest has resurfaced in standard economic models that include bank balance sheets (e.g. Bernanke and Blinder [1988, 1992]), or in extensions that focus on the bank-lending channel of monetary policy, particularly the interaction between monetary policy and the "external finance premium" (Bernanke and Gertler, 1995), or how monetary policy affects bank balance sheets (Kashyap and Stein, 1995).

Much of this literature focuses on the effect *on* bank balance sheets in the transmission of monetary policy. However, since the crisis, the research question

[3] While definitions vary, the definition of the Committee on the Global Financial System at the Bank of International Settlements is perhaps the most useful. This group defines macroprudential instruments as "primarily prudential tools that are calibrated and explicitly assigned to target one or more sources of systemic risk" (BIS, 2012). In this sense "prudential tools" are those tools implemented by banking supervisors to ensure the safety and soundness of financial institutions. These could be "microprudential", i.e. designed to ensure safety and soundness of individual institutions, or 'macroprudential', i.e. for the stability of the system as a whole. For an overview of the origins of the term "macroprudential" see Clement (2010), while for recent comprehensive literature reviews of the subject see Galati and Moessner (2011), Turner (2012), International Monetary Fund (2011), or Lim, *et al.* (2011).

has become more nuanced. The focus is now also more on the effect *of* bank balance sheets. Put another way, the question is: "How do bank balance sheets influence economic outcomes?"

A rich and relatively well-known literature in this line provides insights into how capital adequacy levels could influence bank lending, including the use of durable assets as collateral (as in Kiyotaki and Moore (1997), for example), where a deterioration in asset quality reduces the ability to borrow. Extensions of the Kiyotaki-Moore model use capital adequacy levels as indicators of the value of the collateral for loans,[4] in the manner of a financial accelerator (e.g. in Bernanke, Gertler and Gilchrist, 1999). The leverage of both the lender (bank) and the borrowing entrepreneur affects the spread between the interest rate on loans and the risk-free rate, i.e. the external finance premium, and this cost is transmitted to the price of capital goods and investment. In other literature, particularly Cecchetti and Kohler (2012), capital adequacy ratios also feedback into economic conditions. (This model is considered in more detail below).

2.3 Empirical literature

The most significant empirical study on the use of the capital adequacy ratio as a tool is probably the report by the Macroeconomic Assessment Group (MAG) of the Bank for International Settlements (BIS, 2010). The MAG finds that an increase in capital adequacy ratios of 1 percentage point increases lending spreads by about 15 bps, but that this depends crucially on how banks adjust their profitability. Importantly, there is quite a range between countries – some countries are more affected than others. Crucially, the BIS study doesn't consider temporary changes in capital ratios, even less so the use of dynamic capital ratios for capital-market effects.

The BIS study is part of a longer line of literature – an earlier paper, Tahkor (1996) finds that risk-based capital requirements links to increased equilibrium credit rationing and lower aggregate lending, and has effects on the stock prices of lenders. In the case of Spain, Saurina (2009) finds that the dynamic provisioning system adopted by the regulator in 2000 had little influence on stopping the credit and real-estate boom – however, the building up of additional loan-loss provisions put the Spanish banking system in a better position to deal with the crisis as it unfolded (bearing in mind that the analysis was carried out mid-crisis). In the context of real-estate booms, Crowe, Dell'Ariccia, Igan, and Rabanal (2011) find that the use of increased capital requirements and/or risk weights on types of real-estate loans are either unsuccessful (Bulgaria, Croatia, Estonia and the Ukraine) or a "partial success" (Poland). Dell'Ariccia, Igan, Laeven, and Tong (2012) do a similar analysis for credit booms more generally. They note that destabilising credit booms are often in countries with fixed exchange rates, expansionary macroeconomic policies and low-quality banking

[4] Many banks use historical non-performing loan performance as an indicator of the amount of capital that needs to be held for a particular loan. This could be interpreted as consistent with Kiyotaki-Moore, only using different jargon – non-performing loan data gives an indication of creditworthiness, and the capital is the collateral.

supervision. Mésonnier and Stevanovic (2012) use a large data set and a variety of econometric techniques to establish the effect of leverage on bank balance sheets. The analysis to some extent conflates leverage and capital requirements – they argue that bank leverage shocks feed into changes to capital-to-asset ratios. The research is more interesting from the perspective of capital-to-asset ratio and how that affects bank behaviour. The intuitive result that capital adequacy requirements are asymmetric is to some extent borne out by their empirical findings – a sudden decrease in capital-to-assets ratio has positive output effects; while a sudden increase has negative effects. A large panel data set, containing data from 2,800 banks in 48 countries, is used by Claessans, Ghosh and Minet (2014). Their analysis shows that counter-cyclical buffers are not particularly effective through the cycle. Other macroprudential measures (e.g. caps on debt-to-income and loan-to-value ratios) are better at reducing asset growth. Similar results are found for measures more specifically aimed at financial institutions (e.g. limits on credit growth and foreign-currency lending)

3 Methodology

3.1 The theoretical model

In this paper, the capital adequacy ratio is introduced into a large macroeconomic model. The approach is based on Bernanke and Blinder (1988, 1992) and Cecchetti and Kohler (2012). Each of these is explained in more detail below.

3.1.1 IS-LM-CC (Bernanke and Blinder 1988)

In the Bernanke and Blinder (1988) model, hereafter IS-LM-CC,[5] the concept of (at least) two distinct interest rates is introduced: ρ, the loan rate, and i, the short-term nominal interest rate. The assumption is that borrowers and lenders choose between bonds and loans according to the change in the interest rates on the two credit instruments.[6] In IS-LM-CC, a simplified bank-balance sheet that contains assets and liabilities is introduced. The assets are in the form of reserves (R), bonds (B^b) and loans (L^s); whereas the liabilities are in the form of deposits. Reserves consist of required reserves (τD), plus excess reserves (E).As

[5] The Bernanke and Blinder (1988) analysis is widely regarded as an extension of the traditional IS-LM model because it includes what authors themselves refer to as a "commodities and credit", or CC, curve in addition to the well-known IS and LM curves.

[6] This foreshadows Bernanke and Gertler (1995), where the direct effects of monetary policy on interest rates are affected by changes to the "external finance premium" of a bank, defined as the difference between externally raised funds (e.g. funds raised on the wholesale funding market), and funds generated internally (e.g. retained earnings, generally generated by profitable enterprise). The size of this external finance premium is a function of credit-market imperfections. Because shifts to the short-term policy rate affect this external-finance premium, monetary policy also has an impact on credit supply, and on longer-term rates offered by banks. Their analysis highlights that this is due to both balance-sheet effects (the short-term interest rate affects household balance sheets) and bank-lending effects (the effect of changes to the overnight rate on the supply of loans by banks).

in practice, banks face a simple constraint that assets must equal liabilities, or $B^b + L^s + E = D(1 - \tau)$.

Thus, L^d, the demand for loans, is a negative function of ρ, a positive function of i, and a positive function of the overall economic conditions, y. Loan supply is function of the two interest rates: $L^s = \lambda(\rho, i)D(1-\tau)$.Setting the two equal to each other to find the clearing of the loan market, the clearing conditions for the loan market can be derived: $L(\rho, i, y) = \lambda(p, i)D(1 - \tau)$. Bernanke and Blinder (1988) then solve for ρ, and show that the rate at which banks lend at is a positive function of the rate on bonds and output (i and y) and a negative function of the level of reserves (R):

$$p = \phi(i_+, y_+, R\_) \tag{1}$$

The interesting thing about the further derivation of this model is that ρ disappears in the algebra.

3.1.2 Cecchetti and Kohler (2012)

Cecchetti and Kohler (2012) extend the IS-LM-CC intuition and more extensively specify the factors that may influence ρ. For this paper, the inclusion of a capital-requirement measure directly into the ρ calculation is particularly useful. Their equation is presented below:

$$\begin{aligned} \rho* = & \left(\begin{array}{c} \delta(w - b\tau) \\ A \end{array} \right) .\varepsilon + \left(\begin{array}{c} y(w - b\tau) \\ A \end{array} \right) . \\ \eta - & \left(\begin{array}{c} \beta y(w - b\tau) \\ A \end{array} \right) .i + \left(\begin{array}{c} K(y + \delta) \\ A \end{array} \right) .k \end{aligned} \tag{2}$$

That is, ρ is a function of white-noise error ε ;a transitory demand shock η; the rate on bonds, i; and the capital requirement imposed on banks, k (with the variables in parentheses denoting the structural co-efficent estimators).[7]

It is important to highlight some subtle differences between the relatively simple Bernanke-Blinder specification of ρ and the Cecchetti-Kohler one:

- In Cecchetti-Kohler, $\rho - i$ can diverge from zero for sustained periods of time depending on the nature of the demand shock and the nature of the capital requirement.
- In Cecchetti-Kohler, there are two policy levers, k (capital requirements) and i (short-term interest rates). In IS-LM-CC, R plays the role of monetary policy lever, in line with the thinking of the time.

[7] For the exact derivation and the meaning of each of the co-efficients, the reader is referred to equation 4 in Cecchetti and Kohler (2012).

3.2 The South African experience

During the 2002–2007 period, the South African banking supervisor was concerned with rapid credit growth. The response was to increase capital adequacy requirements, with the increase partly through discussions between the supervisor and the banks themselves,[8] and partly through changes in the regulations in advance of the implementation of Basel II. These six years therefore provide a useful period for analysing the impact of exogenous changes in capital adequacy requirements on economic activity.

The period is also interesting from an economic-policy perspective. In common with most countries, South Africa experienced strong economic growth and low inflation. This growth, however, was mainly consumption-led, and supported by an increase in credit extension.

The policy response to this rise in output, consumption and consumption growth was threefold:

- As reflected in the data in Figure 1, the main monetary policy instrument, the overnight rate, played no counter-cyclical role until early 2006, having been actually reduced between 2002 and 2005 on the back of a substantial decline in inflation and an appreciation of the currency.
- Fiscal policy did the bulk of the counter-cyclical policy work. The fiscal deficit was 2.3 per cent in the fiscal year 2003/4. By 2006/7 this deficit had turned to a surplus of 1 per cent of GDP, an improvement of 3.3 percentage points in the budget balance.
- Finally, and importantly for this paper, capital adequacy ratios were slowly increased from 2003 onward. This is analysed in more detail below.

Overall capital adequacy levels during this period are provided in Figure 2. As noted in the figure, changes to capital adequacy levels can be linked to three separate instances of regulatory change –

1. On 22 April 2003, Bank Supervision Circular 8/2003 made a number of changes to the quality of capital, which had the overall implication of raising the quantity of capital held.
2. On 20 February 2004, Bank Supervision Circular 1/2004 set out the consultation on the implementation of Basel II. This circular made it clear that banks would have to increase capital ahead of the full implementation of Basel II on 1 January 2007. Discussions with bankers at the time highlighted that banks began proactively and gradually to increase capital from this date onwards. Moreover, this circular highlighted that capital levels would be within the Registrar's discretion.[9]

[8] The author conducted interviews both with the then Registrar of Banks, Errol Kruger, and with the heads of the banks' regulatory and Treasury operations. All confirm that a series of meetings were held between the Registrar and banks during this period, at which it was made clear that banks were expected to raise capital levels.

[9] A detailed discussion of these changes can be found from page 26 of the Circular.

3. On 13 December 2004 Circular 19/2004 made changes to calculations of quality of capital. The effective date was January 2006.

The following sections analyse if these changes in capital adequacy had any measurable economic effects, both on banking-sector activity (e.g. constraining lending) and within the context of monetary policy (e.g. identifying whether the change had any effects on inflation).

3.3 Creating a series for ρ

In Bernanke and Blinder (1992), the authors use the Federal Funds rate as an indicator of the relative tightness or slackness of monetary policy.[10] However, in this analysis, we wish to distinguish econometrically between ρ , the rate at which banks lend, and i, the prevailing short-term rate in the market. Fundamentally, the thesis is that these may diverge over time. Estimating the value of ρ thus provides an important insight into how relatively tight or loose monetary policy conditions are. In this paper, the value of ρ is approximated as follows:

$$\rho = \frac{I}{L} \tag{3}$$

where I is the interest income earned on the outstanding stock of loans in the banking system, L. (See Annexure 1 for a list of data sources used in this paper.)

The approach to calculating the series this way has both advantages and disadvantages. The major advantage is that it is easy to calculate, particularly across multiple asset classes and loan books. This provides very useful information in terms of differentiated interest rates across different clients, and hence the interest rate on different asset classes. The major disadvantage is that it is the average interest income across the book, not the marginal interest income. Put another way, it simply measures total interest income, even on loans originated a number of years previously. It does not reflect the rate of interest on new lending, nor does it give insight into how much income has not been received (e.g. from non-performing loans). However, most loans in South Africa are variable rate, and so the average rate and the marginal rate tend to be the same. Finally, for the period this paper covers, non-performing loans were stable.

3.4 Comparing ρ and i – some simple econometric tests

In Figure 3, the long-run movement between ρ and i is presented. In this analysis, $i$is the overnight policy rate (known commonly as the 'repo rate').[11] The

[10] Interestingly, in the attempt to estimate IS-LM-CC econometrically, Bernanke and Blinder (1992) caused a seismic shift in thinking about policy tools. They introduced the "radical" notion that the Federal Funds rate could be seen as a measure of monetary policy. By the time of Bernanke and Gertler (1995) and Christiano, Eichenbaum, and Evans (1999), this was well established.

[11] It is, however, technically not a repurchase rate. It is a rate fixed by the central bank and maintained through open-market liquidity operations. It shows no variability between

simple correlation co-efficient is 97 per cent, but there are notable divergences. These include those observed during the course of 1998 and late 2001. Moreover, in the time period under review (2002–2007), there is a widening of the spread between the two. In Figure 4, we analyse the widening a little more closely, and note that it corresponds with the increase in aggregate capital adequacy ratio observed in Figure 2.

Indeed, this corresponds with the Bernanke-Blinder IS-LM-CC and Cecchetti-Kohler theoretical predictions of an increase in the capital adequacy ratio leading to an increase in the bank lending rate. The correlation co-efficient between the two variables is promising, with a 58 per cent correlation between overall capital adequacy and the spread.

Moreover, using both monthly and quarterly data, Granger causality tests indicate some suggestion of a causal relationship between the two variables, and in the expected direction (an increase in the capital adequacy level leads to an increase in rho). However, as is common with these tests, lag selection influences the results.

3.5 The problem of (weak) endogeneity

The inherent pro-cyclical (and hence endogenous nature) of bank capital requirements had been identified as early as 2001 as a concern (Borio, Furfine, and Lowe, 2001). During benign economic conditions, risk-based bank capital requirements encourage additional lending, further exacerbating potential credit-induced asset bubbles. This is because asset price increases supposedly reduce the potential loss when the loan goes bad. During economic downturns, bank capital requirements become increasingly onerous, discouraging lending, and exacerbating already-weak economic conditions, and creating a "credit crunch" (Bikker and Hu, 2002).

This has important implications econometrically. An increase in the capital adequacy ratio of an individual bank may simply reflect a deterioration of the loan portfolio. It may thus be difficult to tease out to what extent the fluctuations in capital adequacy experienced by the South African banking system reflect 'normal' (endogenous) fluctuations in bank regulatory capital; and which parts of the fluctuations reflect actual policy decisions by the central bank.

However, as mentioned previously, during the period used in this study, the proportion of non-performing loans remained relatively stable. Econometric tests suggest that capital requirements are indeed weakly exogenous. However, it is very important to note that endogeneity is a key weakness of the counter-cyclical capital buffer as a financial stability tool.

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interest-rate decisions. For monetary-policy analysis purposes it provides substantially less information than the Fed Funds rate used in Bernanke and Blinder (1988) and much of the subsequent literature.

4 Results

4.1 Larger model

To fully capture the economy-wide effects, this paper uses an existing large structural model. This is arguably appropriate, considering that the theoretical basis of the approach is the Bernanke-Blinder IS-LM-CC.

The National Treasury quarterly macroeconomic model (NTQM) is used in the analysis. An earlier version of the model, its characteristics and equations are fully described in Janse Van Rensburg, Oberholzer, Havemann, and Kularatne (2006). It shares many similarities with several other models, both in South Africa – e.g. the South African Reserve Bank Model (Smal, Pretorius, and Ehlers, 2007) and the Bureau of Economic Research model (Bureau of Economic Research, 2013).

Essentially, it is a relatively standard IS-LM model containing a set of estimated equations. At the heart of the model is a demand function (equation 4 below) and a supply function (equation 5), which balance through prices and interest rates (equation 6 and 7).

$$y = f(y_d, r, g, s) \tag{4}$$

$$y* \ = \ f(A,\ K,\ L) \tag{5}$$

$$p = f(p^e, wL \ / \ y,\ y \ - \ y* \tag{6}$$

$$r = f(p^e,\ y \ - \ y*,\ i * \ + i_r) \tag{7}$$

4.2 An equation for ρ

Following the Bernanke-Blinder and Cecchetti-Kohler intuition above, a new parameter ρ is introduced to stand between the policy rate i and the rest of the model. It is expected that this will influence economic conditions in two ways – through the effect on the lending rate ρ, and through the effect on other interest rates (e.g. the long bond rate), as highlighted in Figure 5.

The estimated equation for ρ is provided below. In this equation, the following should be noted:

- We find evidence of long-run homogeneity between the policy rate and the lending rate (econometrically, the Wald test does not reject the hypothesis of long-run homogeneity). This is important both theoretically and for model stability. Theoretically, short-run deviations between the policy rate and the bank lending rate can be expected, but in the long run they should move together.

- Nevertheless, the capital adequacy ratio is a statistically significant influence in the long-run component of the equation. Interestingly, over a longer time horizon, the capital adequacy ratio is found to be stationary.
- Various measures for demand were used in the econometric specification. All were found to be statistically significant. However, the model struggles to solve when endogenous demand variables are used. For this reason, a variable exogenous to the model is used. This is a composite house-price measure, which has a 99 per cent correlation with real GDP.

4.3 The introduction of ρ

Throughout the model, two equations that rely on the policy rate i were re-estimated to be instead a function of ρ.These were the equation for private-sector credit extension (FCP) and the equation for real consumption expenditure. Theoretically, the intuition is that both these variables are influenced by the bank lending rate. The long bond rate remains a function of the repo rate. This is an important distinction – the idea is that financial-market interest rates fluctuate according to the overnight policy rate, and real economy variables are a function of lending rates. (Of course, the imposition of long-run homogeneity means that in the long run this distinction is irrelevant.)

4.4 Impulse response

To measure the economy-wide effects, a 1 percentage point temporary increase in the capital adequacy ratio is modelled, shown in Figure 6.

Ex ante one can expect a widening of the spread between rho and the repo, with consequent slowdown in lending (through the credit extension link) and slowdown in the economy (through both credit extension and consumption expenditure).

Building on some of the insights in Cecchetti-Kohler, two separate scenarios are run:

In **Scenario 1**, the repo rate is kept exogenous, while in **Scenario 2**, the repo rate is endogenous. This assists to some extent in analysing whether the two instruments are complementary or not. It is important to note that the impact on the repo rate of changes in capital adequacy ratio is very small – in the order of 0.03 percentage points.

4.5 The impact on the model

The set-up of the model is that the increase in capital adequacy feeds through to changes in the bank lending rate, ρ. The results are as expected, with an overall increase in the bank lending rate of approximately 0.4 percentage points. As noted, with an endogenous repo rate response, the repo rate automatically absorbs some of the effect on economic activity and falls. This feeds through to a slightly lower overall bank lending rate.

The effect on the rest of the model is broadly as expected, but the interesting thing is the very small effect that the shock has on macroeconomic variables. Growth (PY1) declines by 0.07 percentage points, consumer price inflation by between 0.02 and 0.03 percentage points.[12]

However, the shock is not comparable to a standard interest-rate shock – note that the effect is to increase the rate at which banks lend by only 0.4 percentage points. A standard interest-rate shock would be 2.5 times bigger. Applying this factor, the growth decline is equivalent to 0.175 percentage points, and the inflation decline about 0.5 percentage points.

5 Conclusion

This paper sets out to empirically determine the effect on the economy of using counter-cyclical capital adequacy buffers, using South Africa's experience. The results suggest that such buffers can be useful to lean against credit cycles, but that capital adequacy increases may need to be quite large to have any meaningful impact on credit extension or on economic activity (towards the upper end of the 0–2.5 per cent of risk-weighted assets proposed in the guidance to authorities).

Indeed, using the pre-crisis experience of South Africa, it is estimated that a 1 percentage point increase in the capital adequacy ratio has an economy-wide effect of approximately the same as an increase in the policy rate of 0.3 to 0.4 percentage points. Put another way, to achieve the same result as an increase in the policy rate of 1 percentage point, capital adequacy ratios would need to rise by between 2.5 and 3 percentage points.

However, most interestingly for small open economies, the two tools have subtly different macroeconomic effects. Increasing capital adequacy ratios impacts on bank lending rates, and other interest rates (e.g. the long government bond rate) are largely unchanged. This means far less of an effect on the real exchange rate – indeed with the growth decline, the real exchange rate may actually depreciate. This is particularly useful for countries that are experiencing credit booms fuelled by capital flows, where an interest increase could have *a priori* ambiguous effects on credit extension. Also, consistent with the MAG results, capital adequacy ratio increases have very small growth impacts.

These results suggest that the actions taken by the South African Reserve Bank during the pre-crisis period were appropriate – faced by an exogenous demand shock (strong global demand) and declining inflation, the policy response of using capital adequacy ratios to stem credit extension was the correct course of action.

[12] The MAG results were a decline of about 0.03 percentage points in the average growth rate per 1 percentage point rise in capital.

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Table 1: Selected macroeconomic variables, 1996–2012 (%)

	Output growth	Household consumption growth	Consumer prices increase	Private sector credit extension growth
1996–2001	2.8	3.1	6.5	13.3
2002–2007	4.6	5.4	4.2	17.5
2007–2012	2.7	3.0	6.5	11.0

Source: South African Reserve Bank [SARB] data

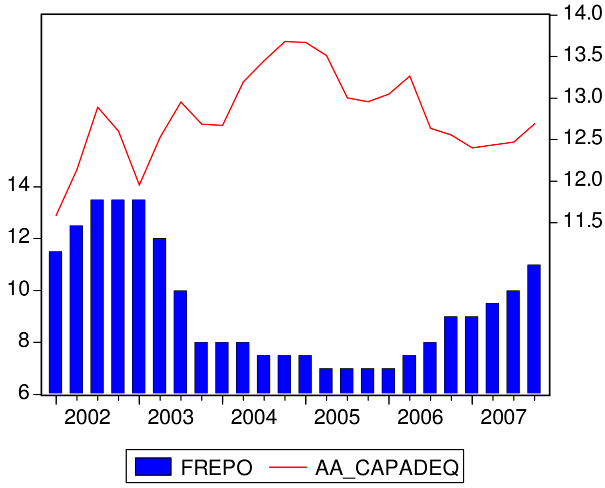
Table 2: Lending rate equation

Dependent Variable: D(AA_RHO)
Method: Least Squares
Date: 05/06/13 Time: 21:20
Sample (adjusted): 1999Q1 2007Q4
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AA_RHO(-1)-FREPO(-1)	-0.791066	0.087310	-9.060378	0.0000
AA_CAPADEQ(-1)	0.334800	0.117522	2.848828	0.0079
PHOUSE(-1)	0.002208	0.000869	2.540302	0.0165
C	-3.416074	1.450659	-2.354843	0.0253
D(FREPO)	0.255868	0.082015	3.119766	0.0040
D(AA_CAPADEQ)	0.257835	0.115469	2.232942	0.0332

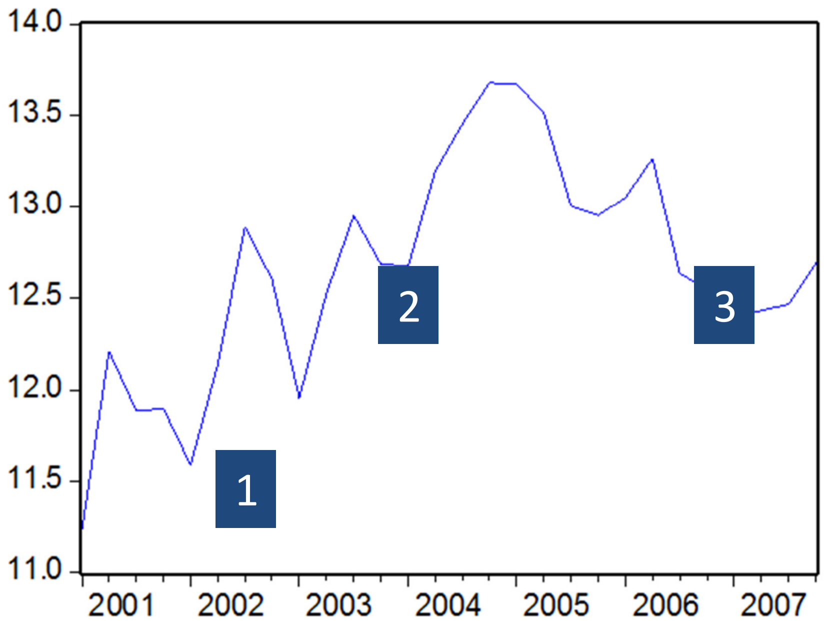
R-squared	0.864974	Mean dependent var	-0.259259
Adjusted R-squared	0.842469	S.D. dependent var	0.998765
S.E. of regression	0.396411	Akaike info criterion	1.138282
Sum squared resid	4.714255	Schwarz criterion	1.402202
Log likelihood	-14.48908	F-statistic	38.43575
Durbin-Watson stat	2.285897	Prob(F-statistic)	0.000000

Figure 1: Bank capital ratios and the overnight policy interest rate (2002–2007)



Source: SARB (Banking Supervision)

Figure 2: Total capital adequacy ratio – South African banks (2002–2007)



Source: SARB (Banking Supervision)

Figure 3: Comparison – rho and repo (1994–2007)

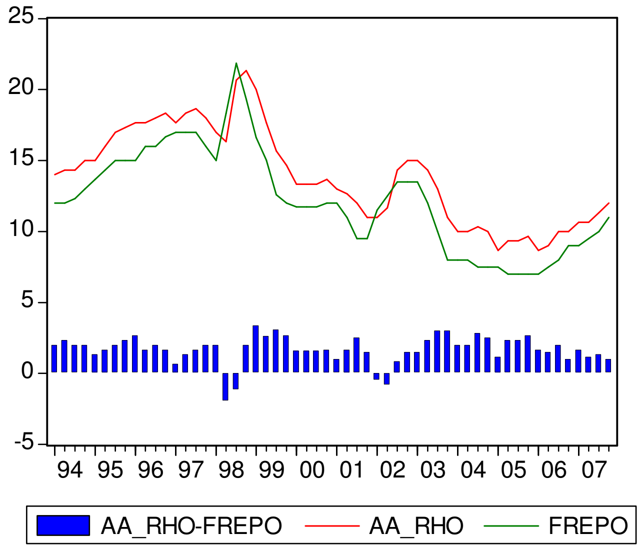


Figure 4: Capital adequacy and spread between rho and repo (2002–2007)

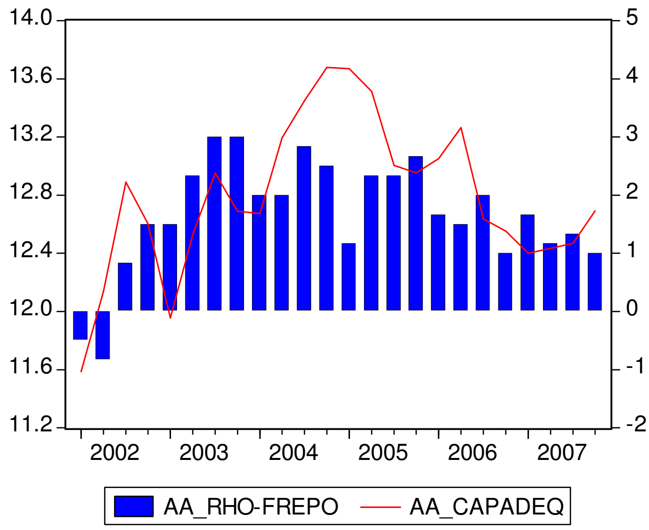
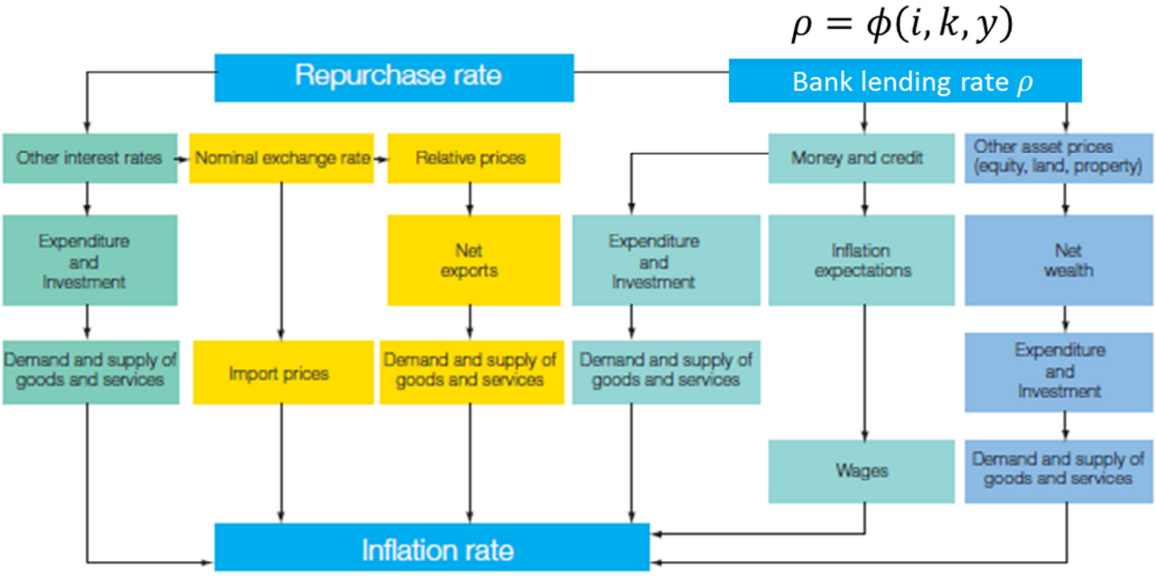


Figure 5: Monetary policy transmission including ρ



See Smal, Pretorius, and Ehlers (2007)

Figure 6: The shock to the model

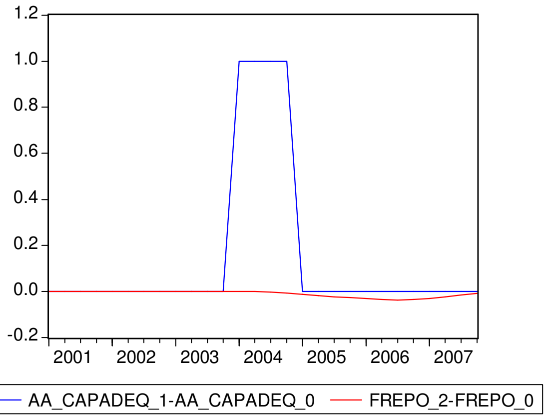


Figure 7: Impact on bank lending rate

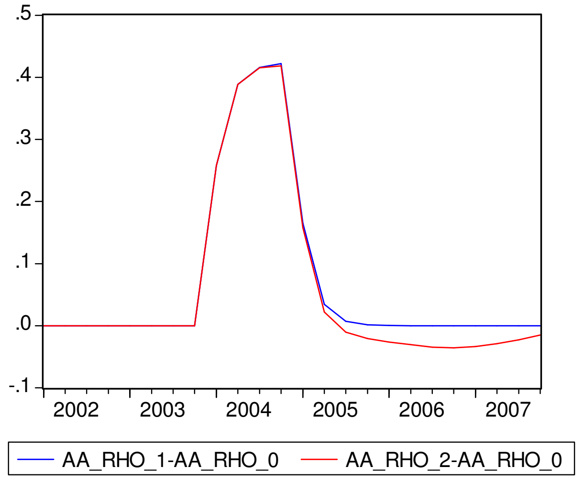
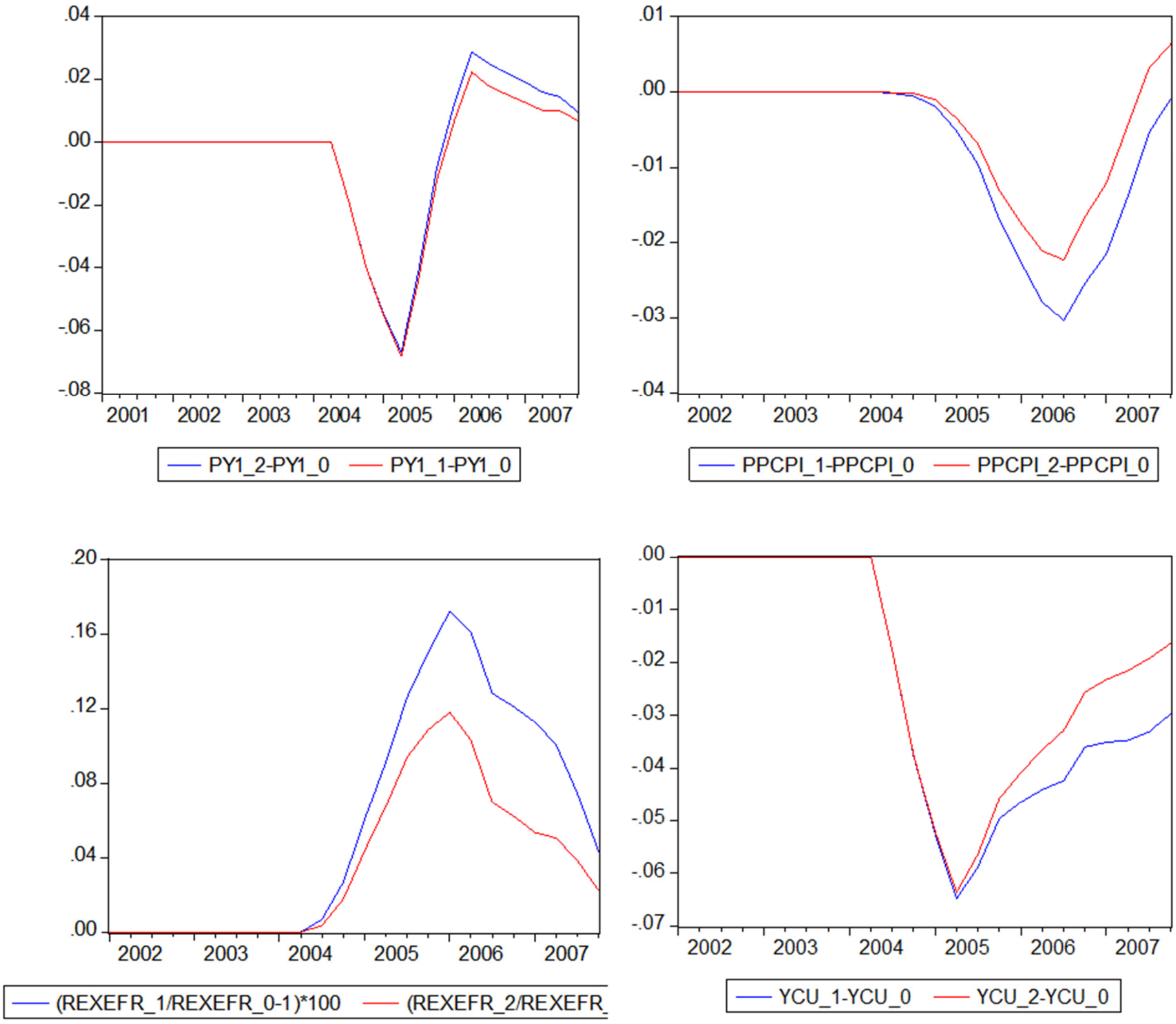


Figure 8: Impact on other macroeconomic variables



Annexure 1

Data

The choice of both the data set and the data period are quite important for the interpretation of the results. In this analysis, we use monthly banking sector data from the DI-900 regulatory data set for the period 2002–2007 (60 observations). The analysis begins at 2002 because during 2000–2001 period the South African banking system was experiencing a small-bank crisis – the collapse of Saambou bank during the latter part of 2000 led to the collapse of a set of other smaller banks, including BoE and Regal. During this period, total capital adequacy levels were exceptionally volatile as the smaller banks were absorbed into larger banks.

The analysis ends at 2007Q4 for two reasons:

- *Change in regulatory requirements*: from January 2008, banks implemented Basel III capital requirements, which changed the way capital was calculated. This is a break in the data (the capital adequacy ratio before January 2008 is not directly comparable to the series after). The new regulatory regime arguably also led to a change in bank behaviour – capital requirements were now more closely linked to historical losses across different portfolios (through risk-weighted asset calculations).

- *Change in economic conditions*: 2008 saw a sharp deterioration in domestic economic conditions, as international conditions worsened significantly during the onset of the global financial crisis. This creates additional complexities from an econometric perspective, particularly in how to account for changes to the bank-lending channel.

Data series

Series	Description	Global Insight Code	Source	Mean
ρ	Average interest rate charged by banks		Calculated: $\rho = \frac{I}{L}$	11.04167
I	Interest income from loans	BBS; D20000201	DI-200 income statement returns, Bank Sup	R11.2 bn
L	Gross loans and advances	BD900;B110003	DI-900 balance sheet returns, Bank Sup	R2.060 tn