Countercyclical capital buffers and real-time credit-to-GDP gap estimates: A South African perspective

Farrell, Greg

South African Reserve Bank, University of the Witwatersrand

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Greg Farrell *

South African Reserve Bank and University of the Witwatersrand

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Abstract

Countercyclical capital buffers are intended to protect the banking sector and the broader economy from episodes of excessive credit growth, which have been associated with financial sector procyclicality and the build-up of systemic risk. The Basel Committee on Banking Supervision has suggested in its guidance to national authorities that the credit-to-GDP gap be used as a guide to taking decisions regarding the countercyclical capital buffer. This paper provides a South African perspective on the implementation of this guidance. Credit-to-GDP gaps are estimated by applying a range of Hodrick-Prescott filters to real-time South African data, specifically constructed for this study, and these gaps are mapped to countercyclical buffers. The properties of these estimates are compared, and the calibration of the lower and upper thresholds of the buffer in the South African case is also investigated. The study confirms that the mechanical application of the credit-to-GDP guide is not advisable, and raises a number of issues that policy-makers will have to consider when implementing the countercyclical buffer guidance. The analysis also suggests that the calibration of the lower and upper thresholds for the gaps may need to be adjusted in the South African case if the Basel Committee's expectation that the buffers be employed only every 10-20 years is to be met.

JEL Classification: E44, E61, G21.
Keywords: Countercyclical capital buffers, financial stability, real-time data, credit-to-GDP gaps.

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Contents

1. Introduction

Countercyclical capital buffers are intended to protect the banking sector and the broader economy from episodes of excessive credit growth, which have been associated with financial sector procyclicality and the build-up of systemic risk. The deviation of the credit-to-GDP ratio from it's long-term trend, to the extent that it is able to provide an early warning of sytemic banking crises, is potentially useful as an indicator of financial sector vulnerability.[1] The Basel Committee on Banking Supervision (BCBS) has therefore suggested in it's guidance to national authorities (BCBS, 2010b) that this credit-to-GDP gap be used as a guide for deploying Basel III countercyclical capital buffers. All Basel Committee members are expected to introduce the countercyclical buffer as part of Basel III.[2]

In practice, policy decisions regarding the deployment of the countercyclical buffer will be taken in real-time, using only the data that are available to policymakers. This paper therefore uses real-time data to provide an analysis of the historical performance, in the South African context, of the credit-to-GDP ratio and gap proposed by the BCBS. The use of real-time data[3] for this analysis is important since the real-time properties of the proposed credit-to-GDP gaps are more important for policymakers than their *ex post* counterparts. Previous work on countercyclical buffers in the South African context does not use real-time data (SARB, 2011; van Vuuren, 2012).[4]

The paper highlights two distinct problems arising from the use of real-time data to estimate the gaps.[5] First, real-time data used to estimate the credit-to-

[1] There appears to be some support for this in the South Africa case. The SARB (2011) states that "the credit-to-GDP guide issued a strong warning signal for a buffer add-on for the 2006–2010 period . . . the credit-to-GDP gap also issued warning signals in 1982–1986 and 1998–2000, which coincide with the two other periods of banking crisis in South Africa."

[2] For South Africa, the countercyclical capital buffer will be phased in from 1 January 2016 (SARB Guidance Note 9/2012).

[3] Croushore (2011) provides a recent review of the literature on the analysis of real-time data.

[4] Section 4 explains these distinctions in more detail. The SARB (2011, 45) proposes forecast-augmenting the Hodrick-Prescott filter, but did not do this in real time. Van Vuuren (2012) notes the significant variation between the results of one- and two-sided Hodrick-Prescott filters, but appears to use final data only. He also uses a smoothing parameter of $\lambda = 14400$ for the Hodrick-Prescott filter, applied to monthly credit-to-GDP ratios (since South African GDP data are quarterly, this suggests that interpolated data were used for GDP). The BCBS (2010b, 13) guidance for ratios and gaps to be measured at the quarterly frequency is followed here.

[5] Watson (2007, 144), e.g., comments that "there are two distinct problems using real-time data

GDP gap can be subsequently revised a number of times as new information becomes available, or as a result of changes in the definitions of macroeconomic variables and the methods used to compile them. Second, end-of-sample bias can occur where the most recent estimates – usually the most important for policymakers – can vary considerably with the addition of a few observations. This is particularly relevant for the procedure suggested by the BCBS (2010b).

However, the purpose of the paper is not simply to test the reliability of real-time credit-to-GDP gaps relative to their revised counterparts. This is done, e.g., by Edge and Meisenzahl (2011), who argue that US credit-to-GDP gaps are subject to the same concerns regarding reliability that Orphanides and van Norden (2002) identified for real time measures of the output gap.[6] It is accepted here, in line with Drehmann *et al* (2011) and van Norden (2011), that unreliability in this sense does not necessarily negate the value of credit-to-GDP gaps as leading indicators, and hence as a guide to policy setting. The intention here is rather to consider, in a real-time context, a number of issues that are important for implementing the countercyclical buffer in South Africa. The specific issues addressed concern the data that should be used to calculate the credit-to-GDP ratio, how the credit-to-GDP gaps should be estimated, and how the countercyclical buffer add-on should be calibrated to South African conditions. Also, it is important to note at the outset that the paper focuses on the build-up of systemic stress and not on the release phase of the capital buffer. Since the credit-to-GDP gap is not viewed as a reliable coincident indicator of banking sector systemic stress, other indicators are proposed to initiate the release phase of the capital buffer (Drehmann *et al*, 2011).

The paper is structured as follows. Section 2 sets out the BCBS (2010b) guidance for national authorities operating the countercyclical capital buffer. Section 3 describes how the real-time credit-to-GDP ratios are calculated, and Section 4 deals with the estimation and analysis of real-time credit-to-GDP gaps. Section 5 covers the mapping of the credit-to-GDP gaps to the guide countercyclical buffer

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to estimate trends and gaps. First, data published in real time are often subsequently revised, and these revisions can be large. Second, for the purpose of estimating trends and gaps, future values of the series are needed, so that estimates of a trend at time t will change as data becomes available for time $t+1$, $t+2$, etc., even if the data at time t is not revised".

[6] Kramer and Farrell (2012) provide an analysis of the reliability of South African real-time output gap estimates.

add-on, and the calibration of the countercyclical buffer to South African conditions. Section 6 concludes.

2. Guidance for national authorities operating the countercyclical buffer

The guidance provided to national authorities for operating the countercyclical buffer (BCBS, 2010b: 2) states that policymakers "are expected to apply judgement in the setting of the buffer in their jurisdiction after using the best information available to gauge the build-up of system-wide risk." The guidance contains both general principles and more specific suggestions for calculating the guide capital buffer add-on. Five general principles are provided (BCBS, 2010b, 2-5):

1. (Objectives) Decisions should be guided by the objective that the buffer is intended to achieve, i.e. helping to protect the banking system against losses when excessive credit growth results in increased systemic risk.
2. (Common reference guide) The credit-to-GDP guide is useful as a common reference point when decisions regarding the buffer are taken, although it need not be the dominant factor in deliberations and the communication of decisions.
3. (Risk of misleading signals) The risk of misleading signals should be considered when assessing the information provided by the credit/GDP guide.
4. (Prompt release) Releasing the buffer promptly in times of stress helps mitigate the risk that the supply of credit will be adversely impacted by regulatory capital requirements.
5. (Other macroprudential tools) Albeit potentially important, the countercyclical buffer is but one of a suite of macroprudential tools available to policymakers.

The principles therefore focus attention on the credit-to-GDP guide as a common reference point in taking buffer decisions,[7] and on the role it should play in

[7] Under Basel III jurisdictional reciprocity will operate for internationally active banks. This reciprocity will not be discussed in this paper.

the policymaking process, i.e. that it need not be used mechanically in a rules-based manner. They also note the importance of investigating the factors that can lead to the credit-to-GDP guide providing misleading signals. The current research attempts to address these issues from the South African perspective.

The BCBS (2010b, 12-14) also provides a step-by-step guide to calculating the countercyclical buffer add-on (as a percentage of risk weighted assets) for each jurisdiction. They suggest a 3-step process:

1. Calculate the aggregate private sector credit-to-GDP ratio
2. Calculate the credit-to-GDP gap (the gap between the ratio and its trend)
3. Transform the credit-to-GDP gap into the guide buffer add-on

It is these steps that are addressed directly in the sections that follow. At the outset, though, it should be noted that the BCBS guidance proposes using a one-sided Hodrick-Prescott filter to establish the trend, so that only information available in real time is used. This (perhaps incomplete) acknowledgement of the real-time nature of the guide is discussed further in Section 4.

3. Calculating the credit-to-GDP ratios

The BCBS (2010b) suggests that a broad measure of credit to the private, non-financial sector be used together with GDP to calculate the credit-to-GDP ratio, both measured in nominal terms and at a quarterly frequency. This study uses data from the South African Reserve Bank (SARB) *Quarterly Bulletin*, as well as *Quarterly Bulletin* Supplements[8], to calculate nominal credit-to-GDP ratios. Monthly data for "Total credit extended to the private sector" were obtained from the series KBP1347M (available from the beginning of 1965 and averaged to generate quarterly values).[9] As the nominal measure of GDP, "Quarterly expenditure on GDP at current prices" (seasonally adjusted and annualised) was used (series code KBP6006L, available from 1960).

[8]These are published to document major revisions to South Africa's national accounts.

[9]For a consideration of both narrow and broad definitions of credit in the South African context, see SARB (2011, 45). Alternatives that remain to be explored include using the end-of-period (final month) quarterly observations and seasonally adjusting the quarterly credit extended data to match the treatment of the GDP data.

South African economic data are revised on a regular basis, in line with international practice. Variables are subject to regular minor revisions and also to more comprehensive revisions that occur every few years. Minor revisions reflect new information that has become available: for quarterly GDP data, for example, up to 16 historical quarters are revised in each *Quarterly Bulletin*.[10] It is not uncommon for an estimate to be revised up to 4 or 5 times after its initial release, with most of the revision occurring in the first few releases. In addition, there have been 8 comprehensive revisions of the national accounts data in the period considered here.[11] Comprehensive revisions are undertaken to accommodate a number of improvements such as changes in definitions and classifications of variables, updated methodologies and statistical techniques and rebasing exercises (South African Reserve Bank, 2010). Following comprehensive revisions, quarterly GDP data have been revised from 1960Q1 and monthly credit data from January 1965.[12]

In compiling the real-time data set, each *Quarterly Bulletin* represents a particular 'vintage' of the data. The first vintage is the June 1999 *Quarterly Bulletin*, which is used to calculate the nominal credit-to-GDP ratio from 1965Q1 to 1999Q1. The final vintage is the June 2013 *Quarterly Bulletin*, which was the most recent vintage at the time the study was undertaken. Altogether, there are 57 vintages over the period 1999Q1 to 2013Q1.

Figure 1 illustrates the evolution of the Real-Time credit-to-GDP ratios calculated using different vintages of the data. At any point in the 1999Q1–2013Q1 sample period, the estimate of the ratio available in real time may differ from that obtained using revised (and presumably more accurate) data. In the final quarter of 2003, for example, the real-time estimate (using the March 2004 vintage of the data) was 67.3 per cent, compared to the revised estimate of 63.8 per cent from

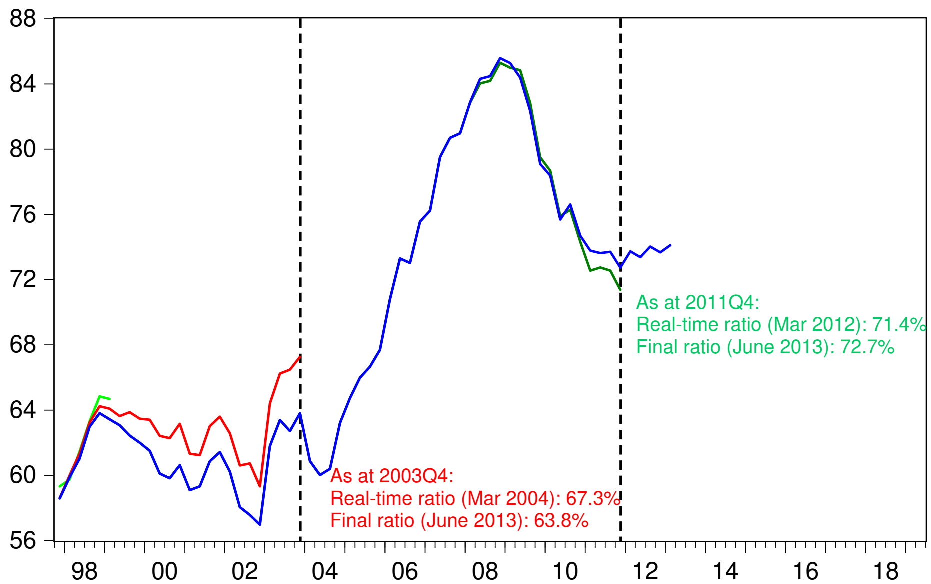
[10]The most recent or 'real-time' observation is published with a lag. For example, the GDP estimate for the quarter ending 31 March 2013 was released by Statistics South Africa on 28 May 2013 (a lag of 58 days), and the relevant *Quarterly Bulletin* was released 21 days later on 19 June 2013.

[11]These revisions were released in 1981Q4, 1986Q1, 1988Q2, 1991Q2, 1994Q2, 1999Q2, 2005Q2 and 2010Q1.

[12]For some vintages, typically when a comprehensive revision occurs, the revised data are published back to the series start date, while for others only a limited sample of the more recent observations are provided. To complete these vintages, observations from the most recent comprehensive revision were used to provide the earlier data points.

the final vintage of the data. Similarly, in the final quarter of 2011, the real-time estimate (using the March 2012 vintage of the data) was 71.4 per cent, compared to the revised estimate of 72.7 per cent from the final vintage of the data.

Figure 1: Real-time estimates of the credit-to-GDP ratio



4. Calculating the credit-to-GDP gaps

The credit-to-GDP gap is estimated as the difference between the credit-to-GDP ratio and its long-term trend, requiring that a trend-cycle decomposition be carried out. Of course, the trend and the gap obtained from a trend-cycle decomposition are both unobservable, and there are many possible decompositions depending on the properties (definition) of the trend and the correlation between the trend and the cycle. Two main alternatives are set out in Section 4.1, the one-sided Hodrick-Prescott filter suggested by BCBS (2010b), and an alternative that applies the (two-sided) Hodrick-Prescott filter to forecast-augmented data.[13] The

[13]The Hodrick-Prescott filter is a symmetric 2-sided filter. Trend estimates at the end of the sample are therefore necessarily preliminary, and subject to revision as new data points become

Final, Real-time and Quasi-real estimates and their role in the analysis of revisions are then discussed in Section 4.2. Finally, an analysis of the results of the various estimates is provided in Section 4.3.

4.1. Determining the trend

The BCBS (2010b, 13) views the trend as "a simple way of approximating ... a sustainable average ratio of credit-to-GDP based on the historical experience of the given economy". It argues that the Hodrick-Prescott filter[14] has an advantage over simpler moving average or linear trend measures in that it tends to give higher weights to more recent observations, and is therefore likely to be able to handle structural breaks more effectively.

Two unconventional choices are made regarding the standard Hodrick-Prescott filter in the guidance, the first being the choice of a one-sided trend and the second being the choice of the smoothing parameter λ (which is set to λ= 400000). The choice of a one-sided filter is justified on the grounds that only information available at each point in time is used for estimating the trend, and the high value of λ (relative to the value of $\lambda = 1600$ Hodrick and Prescott (1997) recommended for quarterly data) by the longer duration of the underlying credit cycle.[15]

Both of these choices require discussion. The choice of a one-sided Hodrick-Prescott filter reflects an awareness of the real-time data issue,[16] but raises other questions. Edge and Meisenzahl (2011), for example, compare the US credit-to-GDP gaps obtained from one-sided and two-sided filters (the latter they describe as 'true final estimates', which use data not available in real time). They find that

available. In the terminology employed here, the 2-sided Hodrick-Prescott filter estimates converge to those of the 1-sided Hodrick-Prescott filter at the end of the sample.

[14]The Hodrick-Prescott filter (Hodrick and Prescott, 1997) decomposes the series y_t into a trend μ_t and a stationary component $y_t - \mu_t$ by selecting μ_t (the control or instrument) so as to minimise:

$$L = \frac{1}{T}\sum_{t=1}^{T}(y_t - \mu_t)^2 + \frac{\lambda}{T}\sum_{t=2}^{T-1}[(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1})]^2$$

λ is the 'smoothness parameter' or 'smoothing constant' and determines how smooth the trend will be by penalising variation in its growth rate.

[15]Empirical analysis by Drehmann *et al* (2010) is cited as supporting the choice.

[16]Drehmann *et al* (2011, 205) acknowledge that this "is an important practical constraint, as policymakers have to take decisions in real time and rely on data that are available at that point".

the results differ substantially, and conclude that one-sided gaps are unreliable. In response, van Norden (2011, 300) points out that the guidance in BCBS (2010b) and Drehmann *et al*. (2010) relies largely on the leading indicator properties of *ex ante* or one-sided gaps for systemic risk, and not on their relationship with *ex post* revised estimates. Drehmann *et al* (2011, 219) also argue that the comparison in Edge and Meizenzahl is misleading since the "mismeasurement they identify is obviously impossible for the policymaker to correct in real time, since the data needed cannot be available."[17]

However, this response does not allow for the possibility that the end-of-sample problem could be addressed by forecast augmenting the credit-to-GDP ratio data prior to applying the Hodrick-Prescott filter. The suboptimality of the Hodrick-Prescott filter at time series endpoints is well known. It has been explored using Monte Carlo simulations by Mise *et al* (2005), who support Kaiser and Maravall (1999) in recommending the application of the Hodrick-Prescott filter to forecast-augmented data to reduce the revision errors of the most recent trend values.[18] In line with this recommendation, Gerdrup *et al* (2013) augment the credit-to-GDP ratio with forecasts and find that this improves the properties of the gap indicators for Norway.[19]

To investigate the affect of this procedure for South Africa, a forecast-augmented alternative to the one-sided Hodrick-Prescott filter is also considered here.[20] Each vintage of the credit-to-GDP ratio is augmented with a forecast of 25 observations[21] using an AR(4) model, and the Hodrick-Prescott filter is applied to the

[17]They go on to argue that "most importantly for the purpose of this paper, they do not assess the indicator performance of the credit-to-GDP gap calculated on the basis of future information. Only if the indicator performance is seriously hampered by the calculation of the trend could their conclusion be a reason for concern. Even then, from an applied policy perspective, a trend calculation that requires future information is problematic."

[18]Kaiser and Maravall (1999) refer to the Hodrick-Prescott filter applied to a series extended with ARIMA forecasts as the Hodrick-Prescott ARIMA (HPA) filter.

[19]The SARB (2011, 45) also considered this procedure, stating that "one weakness of the HP filter is its end-point bias. In order to mitigate this problem forecasted data are used."

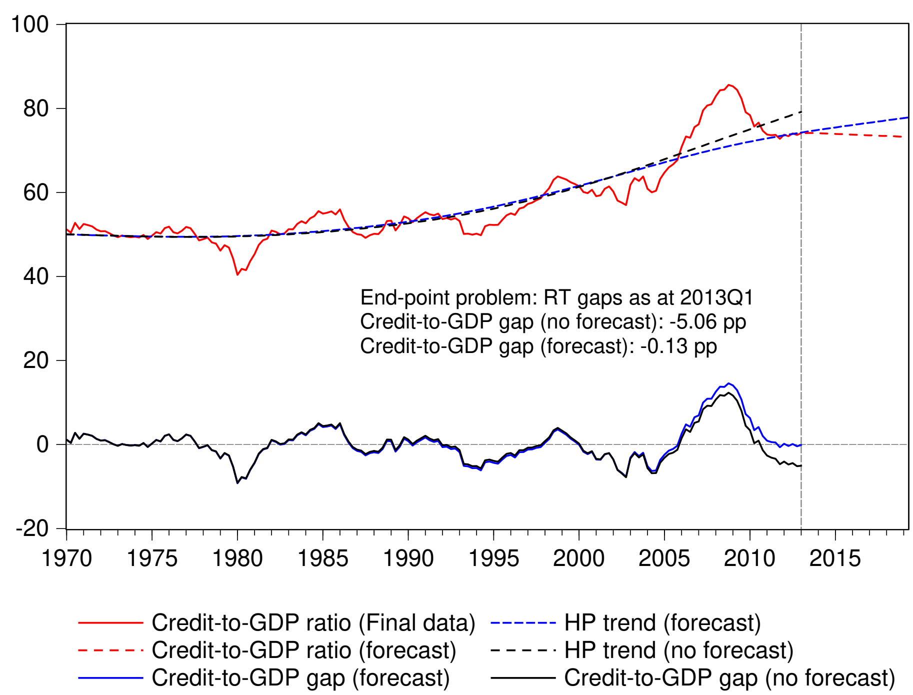
[20]A similar problem arises estimating the trend of the credit-to-GDP ratio at the beginning of the sample (Geršl and Seidler, 2012; Drehmann and Tsatsaronis, 2014). Since the South African data are available from 1960, this is less of a problem here.

[21]Mise *et al* (2005, 58) note that the theoretical analysis of forecast-augmentation requires forecasts infinitely far ahead, although the weights assigned to far-ahead forecasts become very small. Their experiments suggest augmenting by 28 quarterly observations. Gerdrup *et al* (2013) use a forecast horizon of 5 years.

augmented series to obtain an estimate of the real-time gap.

Figure 2 illustrates the end-point problem by showing the impact of forecast augmenting the Hodrick-Prescott filter on the estimate of the long term trend (and output gap) estimates. The standard Hodrick-Prescott filter (with no forecast padding) converges to the one-sided filter at 2013Q1, and gives a credit-to-GDP gap of -5.06 percentage points. The forecast-augmented Hodrick-Prescott filter, by contrast, estimates the current credit-to-GDP gap at a much smaller -0.13 percentage points. The question naturally arises as to which is the "better" estimate? Perhaps not surprisingly, as we will see in Section 4.3, the answer depends on the quality of the forecast.

Figure 2: Credit-to-GDP gaps: The end-point problem



The second unconventional choice, setting λ to 400000, implies that the financial cycles under consideration are four times as long as conventional business cycles.[22] Drehmann *et al* (2011, 206) argue that this is appropriate as crises occur on average only every 20-25 years in their sample. To check the robustness of

[22] Gòmez (2001, 366–67) shows that if the Hodrick-Prescott filter is regarded as a Butterworth

their choice, they also provide an analysis based on financial cycles of the same length as conventional business cycles (i.e. λ = 1600). Drehmann *et al* (2010) also consider choices of $\lambda = 25000$ and $\lambda = 125000$, but conclude that setting $\lambda = 400000$ is best.[23]

4.2. Final, Real-time and Quasi-real estimates

Three different types of credit-to-GDP gaps are estimated to analyse revisions. First, the "Final" gap estimates are generated by detrending the credit-to-GDP ratio obtained from the final, or most recent, vintage of the data (i.e., 2013Q2). The "Final" estimate provides the benchmark against which the other estimates are compared.

Second, the "Real-time" gaps are estimated. In this case, the credit-to-GDP ratios from each vintage in the real-time dataset are detrended to obtain credit-to-GDP gap series, and the most recent estimates of the gap from each series are collated to create the "Real-time" estimates. For example, the credit-to-GDP gap series estimated from the vintage 2008Q2 would provide the real-time estimate for 2008Q1. A comparison between the "Real-time" and "Final" estimates reveals the extent to which credit-to-GDP gap estimates have been revised at each point in time (the total revision, which as noted earlier, comprises of data revisions and revisions resulting from additional observations being available to estimate the "Final" gaps).

Third, in order to determine the importance of data revisions, the "Quasi-real" credit-to-GDP gap estimate is also constructed. To construct this "Quasi-real" series, the final vintage of the data is employed to estimate credit-to-GDP gaps recursively. For example, to obtain the Quasi-real estimate for 2008Q1, observations from the final vintage of the data (2013Q2) up to 2008Q1 are used. The difference between the Real-time and the Quasi-real credit-to-GDP gap estimates

filter, the gain function is $W(\omega) = 1/(1+\lambda[2sin(\omega/2)]^4)$, where $0 \leq \omega \leq \pi$. The relationship between λ and the cutoff frequency (ω_c) at which the gain of the filter is $1/2$ is $\lambda = [2sin(\omega_c/2)]^{-4}$. From this, if $\lambda = 1600$, then the cutoff frequency is 0.1583 and the corresponding period is $2\pi/0.1583 \approx 40$ quarters (approximately 10 years). For $\lambda = 400000$, $\omega_c = 0.0398$ and the corresponding period is around 158 quarters (approximately 40 years).

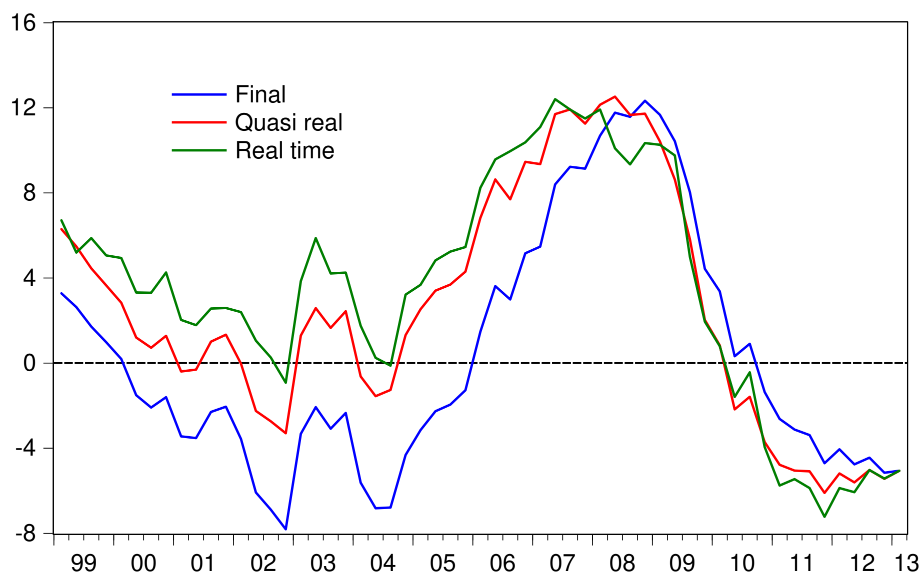
[23] The performance of alternative values of λ in the South African case has not been formally investigated yet. Given uncertainty regarding the financial cycle in South Africa this is an important issue.

at a particular time is due to data revisions alone, since the estimates use the same data sample periods.

4.3. Results: Analysis of the credit-to-GDP gaps

The Final, Real-time and Quasi-real estimates of the credit-to-GDP gaps over the sample period 1999Q1 to 2013Q1 are presented here. In Figure 3, the estimates with no forecast augmentation are presented. For the Final estimates, the credit-to-GDP ratio calculated from the June 2013 vintage of the data is used to together with a 2-sided Hodrick-Prescott filter ($\lambda = 400000$). These provide a benchmark since the revised data presumably provide a better measure of the developments in GDP and credit extended. The Quasi-real one-sided Hodrick-Prescott estimates are then obtained from the same data vintage, but using only the sample available at each point in time. Finally, the Real-time estimates are obtained by applying the Hodrick-Prescott filter recursively to the real-time ratios described in Section 3, and collating the final estimates.

Figure 3: Credit-to-GDP gaps: No forecast augmentation



In Figure 3, the estimates of the Real-time and the Quasi-real credit-to-GDP gaps track one another closely over the period 1999Q1 – 2013Q1, but are both generally further apart from the Final estimates. The mean absolute value of the total revision (|final gap - real-time gap|) is 4.3 percentage points, and the mean absolute data revision (|real-time gap - quasi-real gap|) is 1.36 percentage points. The Final gap has a correlation of 0.76 with the Real-time gap, and 0.87 with the Quasi-real gap.[24] Data revisions alone therefore account for a relatively small proportion of total revisions, and total revisions are mainly attributable to the impact of new data points becoming available (the end-of-sample problem).[25]

In Section 4.1 we noted that we could attempt to address the end-of-sample problem by forecast augmenting the credit-to-GDP ratio data prior to applying the Hodrick-Prescott filter. The results for the Final, Real-time and Quasi-real gaps with the credit-to-GDP ratios augmented with forecasts, are presented in Figure 4.

The Real-time and Quasi-real estimates are again relatively close to one another in Figure 4, reflecting the limited role for data revisions identified earlier, but both now differ markedly from the Final estimates.[26] The mean absolute value of the total revisions (|final gap - real-time gap|) is 5.92 percentage points, and the mean absolute data revision (|real-time gap - quasi-real gap|) is 0.97 percentage points. The Final gap has a correlation of -0.39 with the Real-time gap, and -0.12 with the Quasi-real gap. It is clear that total revisions of this magnitude would cause discomfort to most policymakers, since the *ex post* situation differs so much from the information available in real time when decisions need to be taken.

In Figure 5, a point in time (2007Q2) is selected to examine the reasons why the Quasi-real estimates differ so much from the Final estimates (since the Real-time and Quasi-real estimates are similar, we take the effects of data revisions out of play by excluding the Real-time estimates). The analysis translates directly to other sample points over the 2006-10 period in Figure 4.

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[24]The mean gaps are 0.3 percentage points (Final), 3.3 percentage points (Real-time) and 2.4 percentage points (Quasi-real).

[25]This is a common finding in the international literature on real-time output gaps. For South Africa, Kramer and Farrell (2013) find a similar result.

[26]The mean gaps over the period from 1999Q1 – 2013Q1 are 1.8 percentage points (Final gaps),

Figure 4: Credit-to-GDP gaps: Forecast augmented

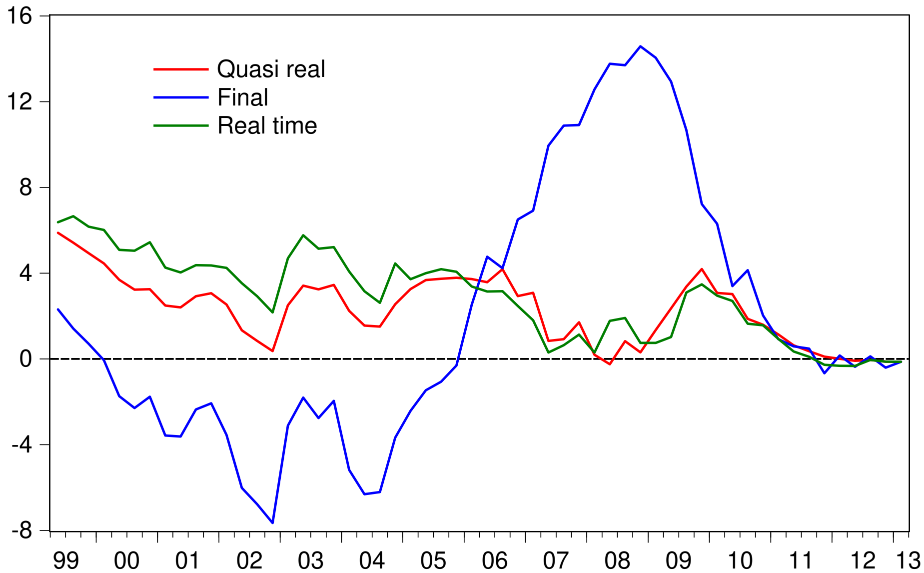
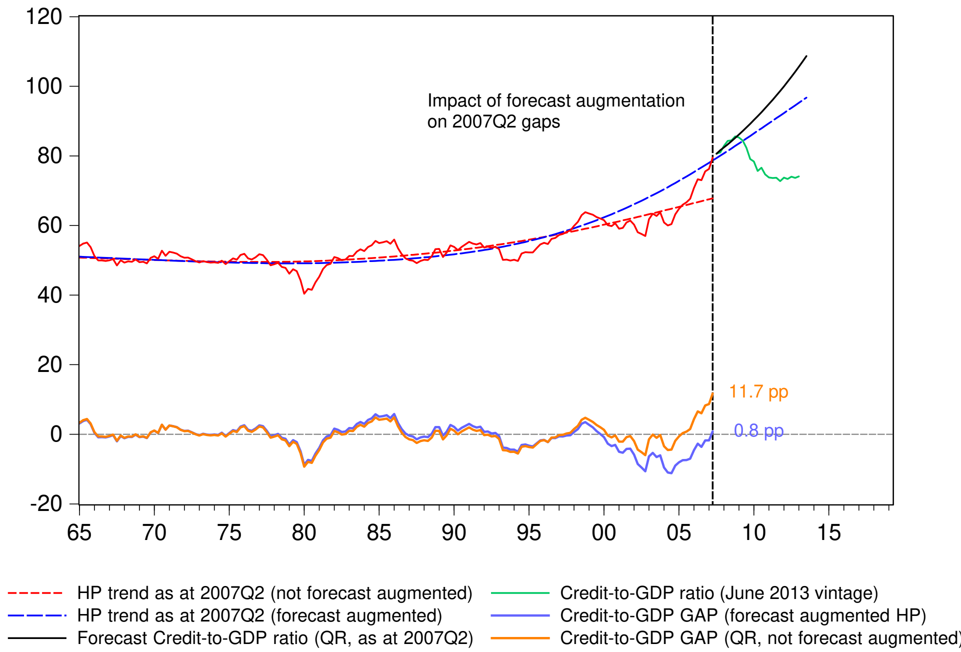


Figure 5 identifies the forecast augmentation used to address the end-of-sample problem as the culprit. Using (final) data up to 2007Q2, the forecast generated by our AR(4) specification shows the credit-to-GDP ratio continuing to rise over the next 25 quarters. The forecast-augmented Hodrick-Prescott trend reflects this, and generates a relatively small Quasi-real credit-to-GDP gap (0.8 percentage points). However, with the benefit of hindsight, it is clear that this was a poor forecast. The credit-to-GDP ratio subsequently fell sharply, and resulted in a much larger *ex post* credit-to-GDP gap. In this case, the one-sided Hodrick-Prescott filter, which provided a Quasi-real estimate of 11.7 percentage points for the 2007Q2 gap, would appear to have been a better option.

What is to be learnt from this? While the one-sided Hodrick-Prescott filter suffers from well-known end-point problems, and real-time credit-to-GDP gaps will be revised as a result, forecast augmentation is not always the answer. It may be that better forecast specifications than that used here will perform better, but this has yet to be established.

2.9 percentage points (Real-time gaps) and 2.3 percentage points (Quasi-real gaps).

Figure 5: Credit-to-GDP gaps: As at 2007Q2



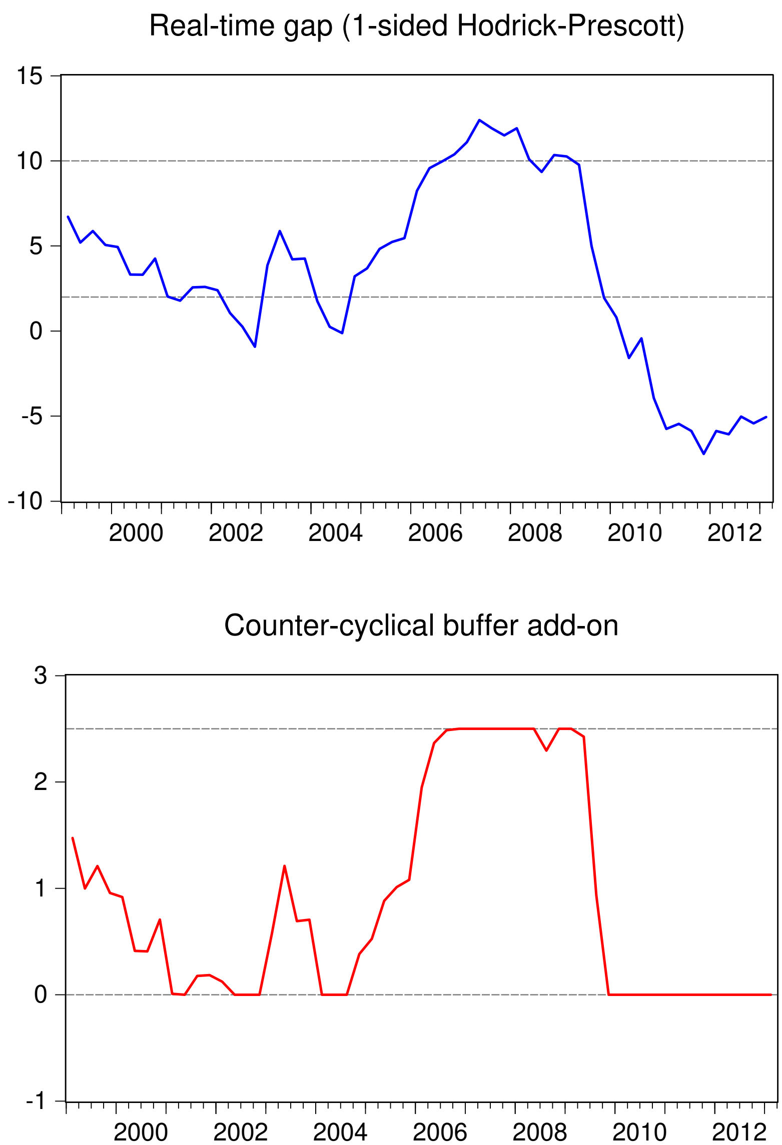
5. Calculating the countercyclical buffer add-on

The final step in the BCBS (2010b) process involves transforming the credit-to-GDP gap into the guide countercyclical buffer add-on. In this section, the methodology for mapping the one-sided Hodrick-Prescott gaps to the buffer add-on is discussed, as well as the calibration of the buffer add-on for South African conditions.

5.1. Mapping the gaps to the countercyclical buffer add-on

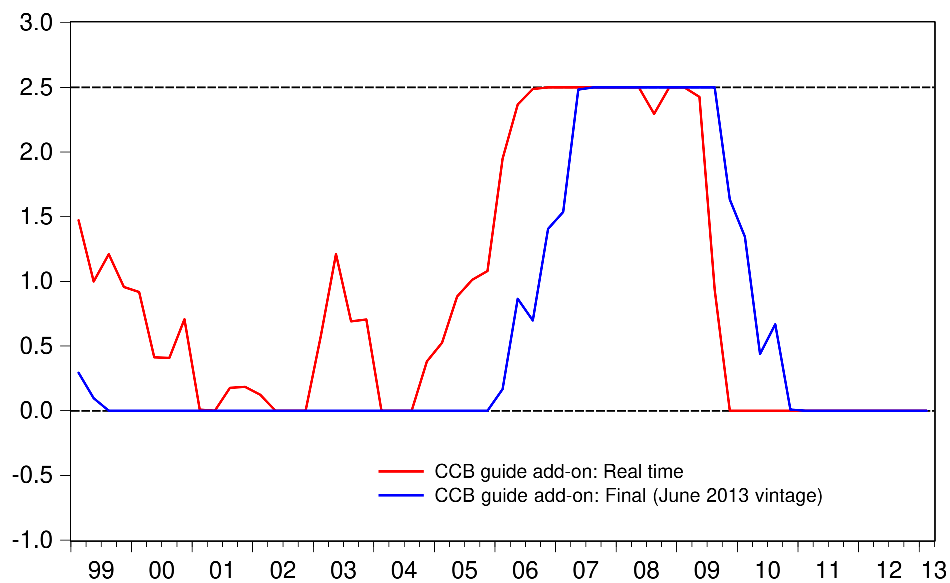
The BCBS guidance is for the countercyclical buffer add-on to be zero when the credit-to-GDP gap is below some lower threshold level (L). The guide add-on then rises as the gap increases, until it reaches its maximum level when the gap exceeds the upper threshold level (H). The lower and upper thresholds, L and H, are therefore key, and will be discussed further in the next section. For the moment, the BCBS' suggested thresholds of $L = 2$ and $H = 10$ are used to illustrate how the guide works. In Figure 6, when the one-sided Hodrick-Prescott gap is less than 2 percentage points, the buffer add-on is set to zero. If the gap exceeds 10 percentage points, the add-on is at its suggested maximum of 2.5 per cent. When $2 <$ gap < 10 percentage points, the buffer add-on is $(gap - 2) * (2.5/8)$ per cent.

Figure 6: Mapping the gap to the countercyclical buffer add-on



Using the distinction between Final and Real-time gaps introduced in Section 4, Figure 7 compares the guide buffer add-on suggested by the Real-time and Final one-sided Hodrick-Prescott gaps. As can be seen, the real-time gaps would have suggested implementing the buffer add-on more often than the Final gaps would have indicated with hindsight. Between mid-1999 and the end of 2003 the guidance in real time was for a buffer add-on in the lower half of the 0-2.5 per cent range. After mid-2004 the real-time guide add-on rises strongly to reach the maximum of 2.5 per cent by late 2006, where it remains until the beginning of 2009. The *ex post* guidance provided by the Final estimates has the add-on rising sharply from zero at the end of 2005 to the maximum of 2.5 per cent by 2007Q2, where it remains until 2009Q2.

Figure 7: Mapping the gaps to the countercyclical buffer add-on: Real-time and Final gaps



5.2. Calibrating the countercyclical buffer add-on for South Africa

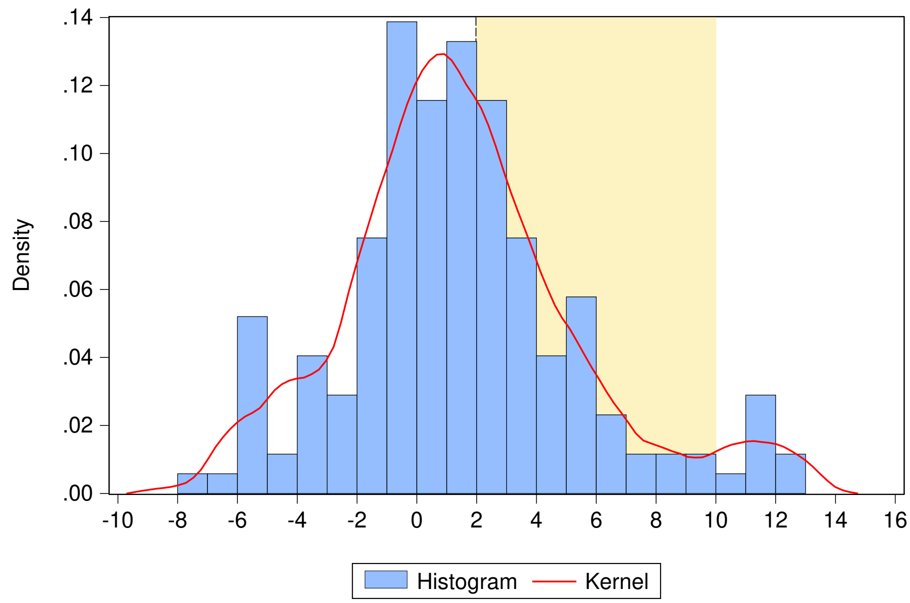
The BCBS (2010b, 13) argues that thresholds of $L = 2$ and $H = 10$ are a "reasonable and robust specification based on historical banking crises", but note that this depends on factors such as the choice of the smoothing factor (λ), and that authorities have the right to choose different specifications. Some additional insight into how reasonable these thresholds are for South Africa can be obtained by considering the distributions of the historical South African credit-to-GDP gap estimates. Ideally this analysis would be on real-time gap estimates, since these are what policymakers would consider, but the real-time data set compiled for this paper is available only from 1999Q1 to 2013Q1 (57 observations, taken from a period that includes a global financial crisis). However, since data revisions were shown to play a relatively small role in total revisions, it is possible to use the Quasi-real estimates to provide an expanded data sample.

Figure 8 reports the histogram for Quasi-real gaps estimated for the period 1970Q1 – 2013Q1 (173 observations). Over this period, 105 observations had a value less than 2 (60.69 per cent of the sample), while 8 observations had values that exceeded 10 (4.62 per cent of the sample). For the BCBS calibration ($L = 2$, $H = 10$), the guidance would therefore be for an add-on buffer to be implemented almost 40 per cent of the time since 1970 (and at the maximum level of 2.5 per cent for just less than 5 per cent of the time).

Note that this differs sharply from the guidance provided by the credit-to-GDP gaps estimated using Final data. For the corresponding period (1970Q1 to 2013Q1, 173 observations), the Final gaps were below $L = 2$ in 132 cases (76.3 per cent of the time) and exceeded $H = 10$, 3.5 per cent of the time (implying a buffer add-on signal just 23.7 per cent of the time). This result reinforces the importance of considering the calibration of the buffer in real time, and suggests that the default calibration may need to be adjusted if the BCBS's (2010a) expectation that the buffers be employed only every 10-20 years is to be met. [27]

[27] For the real-time data set (57 observations), the gaps were less than L=2 percentage points 36.8 per cent of the time and exceeded H=10 percentage points for 15.8 per cent of the time (implying a guide buffer add-on signal 63.2 per cent of the time).

Figure 8: The Distribution of Quasi-real gaps (1970Q1-2013Q1)



6. Concluding comments

This paper provides a South African perspective on the implementation of the Basel III countercyclical capital buffer. The BCBS (2010b) guidance to national authorities was taken as a starting point, and the implications of the guidance were examined from the perspective of South African policymakers who would have to take decisions in real time, using only the data that are available at the time.

A new real-time dataset for South African nominal credit extended and GDP data was constructed for the study. This allowed real-time credit-to-GDP ratios to be calculated, and for credit-to-GDP gaps to be estimated. Trends were estimated using Hodrick-Prescott filters, and used to generate Final, Real-time and Quasi-real estimates of the credit-to-GDP gaps that were compared and mapped to countercyclical capital buffer guides. The potential benefits of forecast-augmenting the data prior to estimating the trends were also considered.

The study provides important insights into the implications of the proposed methodology for implementing countercyclical capital buffers. First, the analysis demonstrates that data revisions account for a relatively small proportion of the total revisions to credit-to-GDP gaps. Instead, revisions stem mainly from new data points becoming available, implying that the end-of-sample problem is the most significant source of unreliability in real-time credit-to-GDP gap estimates.

Second, forecast augmenting the Hodrick-Prescott filter in an attempt to address the end-point problem was found to result in much larger revisions than when the one-sided filter was used. This problem may be the result of the relatively simple forecasting technique employed, and the poor forecasts made. Better forecasting performance would obviously alleviate the problem identified here, but until this is demonstrated a concern regarding the methodology remains. The one-sided Hodrick-Prescott filter proposed by the BCBS results in more consistent estimates when viewed *ex post*, but nevertheless remains subject to the usual end-of-sample problem.

Third, the mapping of the estimated gaps to the countercyclical buffer add-on reflects the two findings set out above. The real-time and *ex post* guide buffer signals are more consistent when the one-sided filter is used than when forecast augmentation is attempted, but nevertheless differ in line with total revisions, resulting in misleading signals (in this *ex post* sense).

Finally, the analysis suggests that the calibration of the lower and upper thresholds for the countercyclical buffer add-on may need to be adjusted upwards in the South African case if the Basel Committee's expectation (2010a) that the buffers be employed only every 10-20 years is to be met. In real time, at least, the buffer signal would seem to be generated too frequently with the proposed specification.

Overall, the study confirms the BCBS's view that the credit-to-GDP guide should not be applied mechanically. Authorities are expected to, and will need to, apply judgement in the setting and deployment of the buffer in their jurisdictions. This will require that further research be undertaken to better understand developments in credit growth and their relationship with systemic risk and financial sector vulnerability.

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