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IMPLEMENTING COUNTERCYCLICAL CAPITAL BUFFER SCHEMES for Australian Banks

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SHIH-CHENG LEE, Professor of Finance, College of Management, Innovation Center for Big Data and Digital Convergence, Yuan Ze University, Chung-Li, Taiwan
CHIEN-TING LIN, Professor of Finance, School of Accounting, Economics, and Finance, Deakin University

As part of the Basel III reforms, a countercyclical capital buffer (CCB) scheme requires banks to build up equity capital during periods of high credit growth against potential losses in subsequent economic downturns. According to Basel III, the extent of the deviations of the credit-to-GDP ratio from its long-term trend is a good indicator of the need to build up a capital buffer two to five years prior to a crisis. Based on a sample period from 1976 to 2011 during which two financial crises occurred, we show that Australian banks should begin accumulating their capital buffers when the credit-to-GDP ratio exceeds its long-term trend. The capital buffers should increase linearly to a maximum of 2.5 per cent of risk-weighted assets when the credit-to-GDP ratio is 8 per cent or above its long-term trend. Under this particular scheme, Australian banks would have four years to accumulate their capital buffers at the beginning of a financial crisis.

In the aftermath of the global financial crisis (GFC), the Basel Committee on Banking Supervision (BCBS 2010a) introduced a number of new capital requirements to improve the safety and soundness of the global banking system. Under these reforms, known as Basel III, capital adequacy requirements will increase to include a minimum common equity capital ratio of 4.5 per cent of total risk-weighted assets and a further 2.5 per cent of risk-weighted assets for the mandatory capital conservation buffer. In addition, banks are required to hold a discretionary countercyclical capital buffer (CCB) during periods of excessive credit expansion against potential losses in subsequent economic downturns.

Table 1 shows the implementation timeline for the Basel III capital standards for Australian banks according to the Australian Prudential Regulation Authority (APRA 2012). The CCB scheme is scheduled to take effect in 2016. Given that the current minimum Tier 1 capital ratio is 6 per cent, and a capital conservation buffer of 2.5 per cent is to be added from 2016, the total Tier 1 capital including the CCB could amount to 11 per cent.

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<tbody>
<tr>
<td>Min common equity Tier-1 (CET1)</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
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<td>2.5</td>
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<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Min CET1 + conservation buffer</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Min tier-1</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Min tier-1 + conservation buffer</td>
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<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
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<td>8.5</td>
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<td>Countercyclical buffer</td>
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Under the CCB scheme, banks are required to build up additional equity capital when an indicator exceeds its long-term trend by a certain margin. The accumulation of capital buffers continues until the maximum of 2.5 per cent of risk-weighted assets is reached. Credit-to-GDP is one of several indicators which the BCBS has recommended as a guide for the accumulation of capital buffers, with other indicators also including funding spread, CDS spreads, stock and real estate prices. As a result, we demonstrate the build-up of capital buffers using credit-to-GDP as the indicator for the CCB scheme.

While the CCB scheme is intended to improve bank capital adequacy, it also aims to reduce runaway credit growth during good times, which Schularick and Taylor (2012) argue is a precursor to financial crises. By requiring increased capital buffers during periods of strong credit growth, the countercyclical measure can reduce the pro-cyclical impact of Basel II capital standards by slowing down credit expansions and thereby reducing bank competition. Moreover, the increase in capital buffers may mitigate predatory or aggressive lending behaviour through a higher cost of funding during credit expansionary periods. Conversely, as systemic risk tends to be low after a financial crisis, the release of capital buffers should encourage increased lending and competition. Overall, the countercyclical nature of capital buffers should help to achieve the broader macro-prudential goal of protecting the banking sector and enhancing global financial stability by smoothing out the booms and busts across financial cycles.

It is also important to emphasise that the CCB is a forward-looking mechanism that builds up sufficient bank capital during good times in preparation for bad times. By contrast, most regulatory measures tend to be backward-looking because they only take effect after a crisis occurs. For example, convertible bonds used as countercyclical contingent capital can be converted to equity to boost core capital after a bank’s capital ratio falls below a certain threshold during poor macroeconomic conditions. However, these convertible measures may be less effective as Guidara et al. (2013) find that Canadian banks with larger capital buffers during expansionary periods have performed relatively well during the GFC.

Although BCBS has outlined a regulatory framework for CCB, it is not clear how the scheme should be implemented in individual countries. Given that the behaviour of credit-to-GDP varies between different countries prior to a financial crisis, the critical threshold to trigger a capital buffer add-on is likely to differ. Therefore, our aim in this paper is to develop a CCB regulatory regime that can be applied to Australian banks in 2016. In particular, we use the past two financial crises to estimate the critical threshold for accumulating a capital buffer four years prior to the crisis and reaching its maximum at the beginning of the crisis.

The countercyclical capital buffer framework
An effective CCB architecture should include the following three criteria. First, the positive correlation between bank capital buffers and financial cycles needs to be established. Earlier studies show that the capital buffers of European and US banks are negatively related to economic upturns (see Ayuso et al. 2004; Stolz and Wedow 2011; and Shim 2013). Second, the credit/GDP gap according to BCBS (2010a, 2010b) should be used as an underlying indicator to measure excessive credit growth. This leading indicator provides a signal to banks about the need to build up capital buffers during periods of credit expansion. Third, the build-up of CCB requirements needs to be completed at least two years prior to a financial crisis.
To implement CCB schemes for Australian banks, we first define the deviations of credit-to-GDP from its long-term trend (credit/GDP gap therefore) at time $t$ as follows,

$$\text{Credit/GDP gap}_t = (\text{credit}_t / \text{GDP}_t - \text{trend}_t) \quad (1)$$

where $\text{credit}_t$ is the credit to the household and private non-financial corporate sector including non-banks and lending from abroad, $\text{GDP}_t$ is the gross domestic product, and $\text{trend}_t$ is the long-term trend based on a one-sided Hodrick-Prescott (HP) filter that can be used to separate trends from cycles in credit/GDP. Since the focus of the CCB schemes is on credit expansions and contractions within Australia, we do not include international operations of Australian banks in our estimations. Using a smoothing parameter (lambda ($\lambda$)) of 400,000 recommended by the BCBS, a trend can be estimated as follows:

$$\min_{(\text{trend})_{it}} \sum_t (\text{credit}_t / \text{GDP}_t - \text{trend}_t)^2 + \lambda \sum_t (\text{trend}_{it+1} - \text{trend}_{it})^2 \quad (2)$$

A low (L) threshold is required to trigger the capital buffer add-on. A high (H) threshold is also needed for the maximum capital buffer of 2.5 per cent of risk-weighted assets. The size of the buffer add-on increases linearly between these two thresholds. The level of the CCB can be classified into the following three regimes:

*Regime 1:* If credit/GDP gap $< L$, CCB = 0

*Regime 2:* If credit/GDP gap $\geq H$, Maximum CCB

*Regime 3:* If $L$ credit/GDP gap $< H$, CCB is proportional to $\max \text{CCB} \times \frac{(\text{credit}/\text{GDP gap} - L)}{(H - L)}$.

Figure 1 illustrates the relationship between the level of CCB and the credit/GDP gap.

**FIGURE 1: Countercyclical capital buffer as a function of credit/GDP**

This graph shows the relationship between countercyclical capital buffer (CCB) and the credit/GDP gap. L and H denote the low and the high thresholds respectively for CCB schemes.

![Graph showing the relationship between CCB and credit/GDP gap](image)

Applying CCB schemes for a specific country, Borio and Drehmann (2009) suggest that the noise-to-signal (NTS) and predicted ratios should be used to determine the low threshold. The high threshold can, in turn, be obtained by adding 8 per cent of the credit/GDP gap to the low threshold. To estimate these two ratios, a signal is first assigned with a value of 1 if the credit/GDP gap exceeds the low threshold and 0 otherwise. A signal of 1 (0) is judged to be correct if a crisis (no crisis) occurs within a time period.
As shown in Table 2, there are four possible outcomes between the signal and the crisis. $X$ represents the number of correct signals for a crisis occurs within a time period. $Y$ represents the number of incorrect signals for a non-crisis. $Z$ represents the number of incorrect signals for a crisis. $W$ represents the number of correct signals for a non-crisis. The NTS ratio is then computed as $\{Y/(Y+Z)\}/(X/(X+Z))$ or the ratio of Type II error $\{Y/(Y+W)\}$ and 1 – Type I error $(X/(X+Z))$. A lower NTS ratio indicates less errors or incorrect signals for the chosen threshold. The predicted ratio which can be calculated as $X / (X + Z)$ measures the proportion of correct signals (i.e. 1 – Type I error). Borio and Drehmann (2009) suggest that a desirable low threshold to trigger the build-up phase is to minimise the NTS ratio subject to a predicted ratio of at least two-thirds.

**TABLE 2: Possible combinations of signals based on the credit/GDP gap and occurrence of a crisis**

This table shows the four possible outcomes of whether a signal is true or false for a crisis or non-crisis. $X$ represents the number of correct signals for a crisis occurs within a time period. $Y$ represents the number of incorrect signals for a non-crisis. $Z$ represents the number of incorrect signals for a crisis. $W$ represents the number of correct signals for a non-crisis.

<table>
<thead>
<tr>
<th>Crisis occurs</th>
<th>No crisis occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit/GDP gap(T) &gt; L</td>
<td>$X$</td>
</tr>
<tr>
<td>Credit/GDP gap(T) &lt; L</td>
<td>$Z$</td>
</tr>
</tbody>
</table>

**Determining the low threshold of capital buffer for Australian banks**

We obtained the annual credit/GDP gap data from the World Bank for the period of 1961 to 2011. The annual data was converted to quarterly data to comply with the supervision frequency of BCSC. We used a rolling window of 15 years beginning from 1961 to estimate the long-term trend of credit/GDP. Therefore, the estimates of the credit/GDP gap according to Equation (2) begin in 1976. The choice of a 15-year period for estimating the long-term trend is based on Drehmann et al. (2010) who report that the duration between two crises ranges from five to 20 years, with a median of 15 years.

There were two financial crises (in 1989 and 2008) in Australia over the sample period that we can use to determine the low threshold (see Reinhart and Rogoff 2009; and Pais and Stark 2011). The former crisis took place as two large failed banks were bailed out by the government. Non-performing loans rose to 6 per cent of assets in 1991-92 and the total bailouts of state-owned banks amounted to 2 per cent of GDP (Caprio and Klingebiel 1999). The latter crisis is the GFC which started from the subprime mortgage defaults that eventually led to bailouts of large banks in the US and Europe. Pais and Stark (2011) find that the crash risk of the Australian banking sector increases significantly during the GFC. Contagion risk also rises between the banking and property sectors. The impaired assets ratio in banks’ commercial property portfolios in 2008 is more than doubled from a year earlier and it is at the highest level in the previous 10 years. As a result, the return of capital (net income/capital and reserve) on Australian banks declines sharply from 8.11 per cent in 2007 to -2.16 per cent in 2008 (see OECD iLibrary).

Drehmann et al. (2011) suggest that the trigger for the build-up of CCB should be as early as three to four years prior to a crisis to provide sufficient time for early warnings to banks and regulators. Warnings issued two years after a crisis are not important as banks should focus on releasing capital buffers and/or reducing risky assets to weather the crisis. We choose four years prior to a crisis as the beginning of the build-up phase, allowing banks to accumulate capital with a sufficient lead time. Therefore, our estimates of the NTS and predicted ratios are based on the credit/GDP gap exceeding the low threshold four years prior to a crisis. By varying the low threshold from -2 per cent to 6 per cent, we can determine the ‘optimal’ low threshold for triggering a CCB according to the NTS and predicted ratios.

Table 3 shows that a low threshold of -2 per cent to 3 per cent of the credit/GDP gap meets the CCB specification of Basel III. The proportion of correct signals measured by the predicted ratios are well above two-thirds, varying from 100 per cent to 72.5 per cent. Meanwhile, the corresponding NTS ratios ranges from 74 per cent to 3.4 per cent. As we move the threshold from 3 per cent to -2 per cent, the predicted ratio improves (i.e. there is an increased probability of a Type I error) because more correct signals are issued ahead of crises. However,
the corresponding NTS ratio also rises as false signals for crises that fail to occur increase
(i.e., there is an increased probability of a Type II error). Therefore, the 'optimal' choice for the
low threshold is to strike a balance between the two ratios. Among the possible low thresholds,
it appears that the 0 per cent threshold, with the predicted and NTS ratios of 90 per cent
and 28.9 per cent, respectively, is a good choice for Australian banks. In comparison, other
low thresholds tend to exhibit a considerably lower predicted ratio or higher NTS ratio. Our
results therefore differ from those of the BCBS (2010) which suggest a low threshold of above
1 per cent and a high threshold of above 9 per cent for Australian banks. Our results, which are
based on a longer sample period to estimate the long-term trend of credit-to-GDP and four years
to build up capital buffers prior to a financial crisis, provide a more conservative estimate of the
critical threshold.

**TABLE 3: Predicted and noise-to-signal ratios at various low thresholds**

This table presents the estimates of predicted and noise-to-signal ratios across different low
thresholds to trigger the countercyclical capital buffer scheme. The predicted ratio is the
proportion of correct signals predicted by credit/GDP gap. The noise-to-signal ratio is defined as
the ratio of Type II errors over 1 - Type I errors.

<table>
<thead>
<tr>
<th>Threshold</th>
<th>-2%</th>
<th>-1%</th>
<th>0%</th>
<th>1%</th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
<th>5%</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted ratio (%)</td>
<td>100.0</td>
<td>97.5</td>
<td>90.0</td>
<td>80.0</td>
<td>77.5</td>
<td>72.5</td>
<td>40.0</td>
<td>30.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Noise-to-signal ratio (%)</td>
<td>74.0</td>
<td>49.3</td>
<td>28.9</td>
<td>14.6</td>
<td>3.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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</tbody>
</table>

To demonstrate how effective the zero per cent low threshold might be in accumulating the
CCB prior to a crisis, Figure 2 shows the variations of the credit/GDP gap and CCB from 1976
to 2011 during which two financial crises occurred. As the credit/GDP gap exceeds the 0 per
cent threshold in 1984 and 2002, banks begin to build up the CCB. For the first crisis (in 1989),
the CCB build-up reaches its maximum of 2.5 per cent soon after 1988 as the credit/GDP gap
continues to climb beyond the high threshold of 8 per cent. For the second crisis (in 2008),
however, the CCB increases to 2 per cent in 2007, below the maximum CCB as the credit/
GDP gap does not reach the high threshold of 8 per cent. Therefore, despite the severity
of the GFC, Australian banks do not need to build up to maximum capital buffers to absorb
subsequent losses under CCB schemes. This is largely because credit growth prior to the GFC
is not as ‘excessive’ as those in Europe and the US, and thus the systemic risk in the financial
sector is relatively low. Overall, the timing of the rise and fall of the CCB around the two crises
is consistent with the objective of CCB schemes.

**Conclusion**

During the GFC, the Australian Government implemented a number of measures designed
to reduce its impact on the financial system and the economy. These include the following
measures. First, the Australian Government Guarantee Scheme guaranteed $18.7 billion of
large deposits and $24.0 billion of wholesale funding (including long- and short-term debt) for
financial stability reasons. Second, the government purchased $8 billion of Residential Mortgage-
Backed Securities (RMBS) to maintain liquidity in the mortgage market. Third, the government
announced an economic security strategy with a total value of up to $10.4 billion. Fourth, the $42
billion Nation Building and Jobs Plan measures were implemented to increase domestic demand.
While these post-event measures are useful, the CCB is a preventive countercyclical measure that
could be more cost effective in limiting the extent of a crisis, and therefore improving the stability
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While these post-event measures are useful, the CCB is a preventive countercyclical
measure that could be more cost effective in limiting the extent of a crisis, and
therefore improving the stability of Australian financial system.
Although our results show that a CCB architecture with a low threshold of 0 per cent and a high threshold of 8 per cent of the credit/GDP gap can be desirable to boost bank capital buffers, there are several caveats associated with this. First, as discussed earlier, the credit-to-GDP gap is not the only indicator that should be relied upon in implementing CCB schemes. Other possible indicators can complement credit-to-GDP for a more comprehensive CCB framework. Second, the estimation of the long-term trend of credit-to-GDP prescribed by the BCBS may not necessarily produce reliable estimates at all times. Regulatory reforms and changing economic circumstances can cause structural breaks in the trend in credit growth. These structural shifts can distort gap measures that require a long-term trend. A more sophisticated technique that detects and incorporates switching regimes may therefore be desirable to improve the accuracy of the estimate of the long-term trend in credit growth.

**FIGURE 2: Variations of credit/GDP gap and countercyclical capital buffer from 1976 to 2011**

This figure illustrates the movements of the credit/GDP gap and the corresponding countercyclical capital buffer from 1976 to 2011 in Australia. The vertical shaded areas indicate periods of financial crisis or severe credit contraction. Credit/GDP gap is the deviation of credit/GDP from its long-term trend based on the Hodrick-Prescott filter with a smoothing parameter $\lambda = 400,000$. CCB is the countercyclical capital buffer based on the low and high thresholds of 0 per cent and 8 per cent, respectively.

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**Notes**


ii  See Mid-Year Economic and Fiscal Outlook 2008–09, Treasury of the Commonwealth of Australia
References

Australian Prudential Regulation Authority (APRA) 2012, Implementing Basel III capital reforms in Australia.


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<td></td>
</tr>
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<td>4.5</td>
<td>4.5</td>
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<td>7.0</td>
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$$\text{Credit/GDP gap}_t = \frac{\text{credit}_t}{\text{GDP}_t} - \text{trend}_t$$  \hspace{1cm} (1)

where $\text{credit}_t$ is the credit to the household and private non-financial corporate sector including non-banks and lending from abroad, $\text{GDP}_t$ is the gross domestic product, and $\text{trend}_t$ is the long-term trend based on a one-sided Hodrick-Prescott (HP) filter that can be used to separate trends from cycles in credit/GDP. Since the focus of the CCB schemes is on credit expansions and contractions within Australia, we do not include international operations of Australian banks in our estimations. Using a smoothing parameter (lambda $(\lambda)$) of 400,000 recommended by the BCBS, a trend can be estimated as follows:

$$\min_{\lambda} \sum_{t=1}^{T} \left( \frac{\text{credit}_t}{\text{GDP}_t} - \text{trend}_t \right)^2 + \lambda \sum_{t=1}^{T} \left( \text{trend}_{t-1} - \text{trend}_t \right)^2$$  \hspace{1cm} (2)

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**FIGURE 1: Countercyclical capital buffer as a function of credit/GDP**

This graph shows the relationship between countercyclical capital buffer (CCB) and the credit/GDP gap. $L$ and $H$ denote the low and the high thresholds respectively for CCB schemes.

Applying CCB schemes for a specific country, Borio and Drehmann (2009) suggest that the noise-to-signal (NTS) and predicted ratios should be used to determine the low threshold. The high threshold can, in turn, be obtained by adding 8 per cent of the credit/GDP gap to the low threshold. To estimate these two ratios, a signal is first assigned with a value of 1 if the credit/GDP gap exceeds the low threshold and 0 otherwise. A signal of 1 (0) is judged to be correct if a crisis (no crisis) occurs within a time period.
As shown in Table 2, there are four possible outcomes between the signal and the crisis. $X$ represents the number of correct signals for a crisis occurs within a time period. $Y$ represents the number of incorrect signals for a non-crisis. $Z$ represents the number of incorrect signals for a crisis. $W$ represents the number of correct signals for a non-crisis. The NTS ratio is then computed as $[Y/(Y+Z)]/[(X/(X+Z))]$ or the ratio of Type II error $(Y/(Y+Z))$ and $1 -$ Type I error $(X/(X+Z))$. A lower NTS ratio indicates less errors or incorrect signals for the chosen threshold. The predicted ratio which can be calculated as $X / (X + Z)$ measures the proportion of correct signals (i.e., $1 -$ Type I error). Borio and Drehmann (2009) suggest that a desirable low threshold to trigger the build-up phase is to minimise the NTS ratio subject to a predicted ratio of at least two-thirds.

**TABLE 2: Possible combinations of signals based on the credit/GDP gap and occurrence of a crisis**

This table shows the four possible outcomes of whether a signal is true or false for a crisis or non-crisis. $X$ represents the number of correct signals for a crisis occurs within a time period. $Y$ represents the number of incorrect signals for a non-crisis. $Z$ represents the number of incorrect signals for a crisis. $W$ represents the number of correct signals for a non-crisis.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Crisis occurs</th>
<th>No crisis occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit/GDP gap($T &gt; L$)</td>
<td>$X$</td>
<td>$Y$</td>
</tr>
<tr>
<td>Credit/GDP gap($T &lt; L$)</td>
<td>$Z$</td>
<td>$W$</td>
</tr>
</tbody>
</table>

**Determining the low threshold of capital buffer for Australian banks**

We obtained the annual credit/GDP gap data from the World Bank for the period of 1961 to 2011. The annual data was converted to quarterly data to comply with the supervision frequency of BCSC. We used a rolling window of 15 years beginning from 1961 to estimate the long-term trend of credit/GDP. Therefore, the estimates of the credit/GDP gap according to Equation (2) begin in 1976. The choice of a 15-year period for estimating the long-term trend is based on Drehmann et al. (2010) who report that the duration between two crises ranges from five to 20 years, with a median of 15 years.

There were two financial crises (in 1989 and 2008) in Australia over the sample period that we can use to determine the low threshold (see Reinhart and Rogoff 2009; and Pais and Stork 2011). The former crisis took place as two large failed banks were bailed out by the government. Non-performing loans rose to 6 per cent of assets in 1991-92 and the total bailouts of state-owned banks amounted to 2 per cent of GDP (Caprio and Klingebiel 1999). The latter crisis is the GFC which started from the subprime mortgage defaults that eventually led to bailouts of large banks in the US and Europe. Pais and Stork (2011) find that the crash risk of the Australian banking sector increases significantly during the GFC. Contagion risk also rises between the banking and property sectors. The impaired assets ratio in banks’ commercial property portfolios in 2008 is more than doubled from a year earlier and it is at the highest level in the previous 10 years. As a result, the return of capital (net income/capital and reserve) on Australian banks declines sharply from 8.11 per cent in 2007 to -2.16 per cent in 2008 (see OECD iLibrary).

Drehmann et al. (2011) suggest that the trigger for the build-up of CCB should be as early as three to four years prior to a crisis to provide sufficient time for early warnings to banks and regulators. Warnings issued two years after a crisis are not important as banks should focus on releasing capital buffers and/or reducing risky assets to weather the crisis. We choose four years prior to a crisis as the beginning of the build-up phase, allowing banks to accumulate capital with a sufficient lead time. Therefore, our estimates of the NTS and predicted ratios are based on the credit/GDP gap exceeding the low threshold four years prior to a crisis. By varying the low threshold from -2 per cent to 6 per cent, we can determine the ‘optimal’ low threshold for triggering a CCB according to the NTS and predicted ratios.

Table 3 shows that a low threshold of -2 per cent to 3 per cent of the credit/GDP gap meets the CCB specification of Basel III. The proportion of correct signals measured by the predicted ratios are well above two-thirds, varying from 100 per cent to 72.5 per cent. Meanwhile, the corresponding NTS ratios ranges from 74 per cent to 3.4 per cent. As we move the threshold from 3 per cent to -2 per cent, the predicted ratio improves (i.e. there is an increased probability of a Type I error) because more correct signals are issued ahead of crises. However,
the corresponding NTS ratio also rises as false signals for crises that fail to occur increase (i.e., there is an increased probability of a Type II error). Therefore, the ‘optimal’ choice for the low threshold is to strike a balance between the two ratios. Among the possible low thresholds, it appears that the 0 per cent threshold, with the predicted and NTS ratios of 90 per cent and 28.9 per cent, respectively, is a good choice for Australian banks. In comparison, other low thresholds tend to exhibit a considerably lower predicted ratio or higher NTS ratio. Our results therefore differ from those of the BCBS (2010) which suggest a low threshold of above 1 per cent and a high threshold of above 9 per cent for Australian banks. Our results, which are based on a longer sample period to estimate the long-term trend of credit-to-GDP and four years to build up capital buffers prior to a financial crisis, provide a more conservative estimate of the critical threshold.

**TABLE 3: Predicted and noise-to-signal ratios at various low thresholds**

This table presents the estimates of predicted and noise-to-signal ratios across different low thresholds to trigger the countercyclical capital buffer scheme. The predicted ratio is the proportion of correct signals predicted by credit/GDP gap. The noise-to-signal ratio is defined as the ratio of Type II errors over 1 - Type I errors.

<table>
<thead>
<tr>
<th>Threshold</th>
<th>-2%</th>
<th>-1%</th>
<th>0%</th>
<th>1%</th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
<th>5%</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted ratio (%)</td>
<td>100.0</td>
<td>97.5</td>
<td>90.0</td>
<td>80.0</td>
<td>77.5</td>
<td>72.5</td>
<td>40.0</td>
<td>30.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Noise-to-signal ratio (%)</td>
<td>74.0</td>
<td>49.3</td>
<td>28.9</td>
<td>14.6</td>
<td>3.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

To demonstrate how effective the zero per cent low threshold might be in accumulating the CCB prior to a crisis, Figure 2 shows the variations of the credit/GDP gap and CCB from 1976 to 2011 during which two financial crises occurred. As the credit/GDP gap exceeds the 0 per cent threshold in 1984 and 2002, banks begin to build up the CCB. For the first crisis (in 1989), the CCB build-up reaches its maximum of 2.5 per cent soon after 1988 as the credit/GDP gap continues to climb beyond the high threshold of 8 per cent. For the second crisis (in 2008), however, the CCB increases to 2 per cent in 2007, below the maximum CCB as the credit/GDP gap does not reach the high threshold of 8 per cent. Therefore, despite the severity of the GFC, Australian banks do not need to build up to maximum capital buffers to absorb subsequent losses under CCB schemes. This is largely because credit growth prior to the GFC is not as ‘excessive’ as those in Europe and the US, and thus the systemic risk in the financial sector is relatively low. Overall, the timing of the rise and fall of the CCB around the two crises is consistent with the objective of CCB schemes.

**Conclusion**

During the GFC, the Australian Government implemented a number of measures designed to reduce its impact on the financial system and the economy. These include the following measures. First, the Australian Government Guarantee Scheme guaranteed $18.7 billion of large deposits and $24.0 billion of wholesale funding (including long- and short-term debt) for financial stability reasons. Second, the government purchased $8 billion of Residential Mortgage-Backed Securities (RMBS) to maintain liquidity in the mortgage market. Third, the government announced an economic security strategy with a total value of up to $10.4 billion. Fourth, the $42 billion Nation Building and Jobs Plan measures were implemented to increase domestic demand. While these post-event measures are useful, the CCB is a preventive countercyclical measure that could be more cost effective in limiting the extent of a crisis, and therefore improving the stability of Australian financial system.

While these post-event measures are useful, the CCB is a preventive countercyclical measure that could be more cost effective in limiting the extent of a crisis, and therefore improving the stability of Australian financial system.
Although our results show that a CCB architecture with a low threshold of 0 per cent and a high threshold of 8 per cent of the credit/GDP gap can be desirable to boost bank capital buffers, there are several caveats associated with this. First, as discussed earlier, the credit-to-GDP gap is not the only indicator that should be relied upon in implementing CCB schemes. Other possible indicators can complement credit-to-GDP for a more comprehensive CCB framework. Second, the estimation of the long-term trend of credit-to-GDP prescribed by the BCBS may not necessarily produce reliable estimates at all times. Regulatory reforms and changing economic circumstances can cause structural breaks in the trend in credit growth. These structural shifts can distort gap measures that require a long-term trend. A more sophisticated technique that detects and incorporates switching regimes may therefore be desirable to improve the accuracy of the estimate of the long-term trend in credit growth.

**FIGURE 2: Variations of credit/GDP gap and countercyclical capital buffer from 1976 to 2011**

This figure illustrates the movements of the credit/GDP gap and the corresponding countercyclical capital buffer from 1976 to 2011 in Australia. The vertical shaded areas indicate periods of financial crisis or severe credit contraction. Credit/GDP gap is the deviation of credit/GDP from its long-term trend based on the Hodrick-Prescott filter with a smoothing parameter $\lambda = 400,000$. CCB is the countercyclical capital buffer based on the low and high thresholds of 0 per cent and 8 per cent, respectively.

**Notes**


ii See Mid-Year Economic and Fiscal Outlook 2008–09, Treasury of the Commonwealth of Australia
References
Australian Prudential Regulation Authority (APRA) 2012, Implementing Basel III capital reforms in Australia.