MEMORANDUM FOR	Macro-Financial Committee
FROM	Mike Thornley
DATE	4 December 2017
SUBJECT	***What's the use of the countercyclical capital buffer?***
FOR YOUR	Discussion

SUMMARY

The paper presents evidence on the potential pros and cons of using the CCyB compared to the conservation buffer. As the CCyB is a new tool, the evidence is often patchy and circumstantial, but it suggests that the CCyB:

- Is unlikely to affect bank capital ratios and lending *during* a crisis.
- It may cause banks to operate with lower capital ratios and provide more lending in the recovery period after a crisis. This could support efficiency and soundness.
    - However, the increase in lending is likely to be relatively modest, unless the CCyB were large.
- It could weaken banks' capital ratios *during* a crisis if healthy banks were allowed to make excessively large dividend payments.
- It would weaken banks' capital ratios *going into* a crisis, if the Reserve Bank failed to raise the CCyB to the target ratio.

These findings (and those of a previous MFC paper) suggest the following lessons for the design and use of the CCyB:

- The CCyB is likely to be most effective when it is complemented by a robust conservation buffer.
- A large CCyB is probably required to have a material impact on bank lending.
    - The above bullets suggest the aggregate capital requirement ratios would need to be high to facilitate an effective CCyB.
- The Bank should be conservative in timing a CCyB cut.
- The capital ratios of individual banks and their groups should be considered as part of the decision to cut the CCyB, as they will influence banks' responses to a cut.
- Regulatory restrictions should be used to prevent a CCyB cut from weakening banks' capital buffers through large dividend payments.
- A CCyB cut would be more effective if the Bank publically committed to keeping the CCyB at zero for a few years after a crisis has abated.
- After these few years, the Bank should publically commit to gradually raising the CCyB to the target ratio, to mitigate the risk of inaction bias.

Introduction

1. In May the Committee discussed a paper describing strategies for setting the countercyclical capital buffer (CCyB).[1] Following comments in that discussion, this paper considers the potential impact of the CCyB on the soundness and efficiency of the financial system, compared to a conservation buffer of the same size. This allows us to draw lessons for the design and use of the CCyB. A possible process for calibrating the CCyB (and a rough, illustrative calibration) is also presented in the annex.

2. This paper may help our assessment of the CCyB tool ahead of the forthcoming macroprudential review. It could also help inform discussion on the relative weight that might be given to the CCyB and conservation buffers, if higher capital requirements were recommended as part of the capital review.

Main aspects of the CCyB and conservation buffer

3. The CCyB and conservation buffer were introduced in New Zealand in 2014 as part of the introduction of Basel III. The buffers are part of a package of measures designed to help increase the loss absorbing capacity of banks and to reduce the procyclicality inherent in Basel II. The intention of the buffers is to encourage banks to build up financial resources in good times which can be drawn down in times of financial stress without giving rise to a regulatory breach. Both the CCyB and conservation buffer incentivise banks to hold common equity Tier 1 capital above the minimum capital requirements by imposing dividend restrictions and requiring submission of capital restoration plans if the buffers are not met.

4. The key distinguishing feature between the buffers is that the CCyB varies over time while the conservation buffer does not. There are different approaches to how a CCyB could be operated. Under the early-strategy CCyB approach proposed in May, the CCyB would normally be above zero, but would be cut to zero at the start of a crisis and remain low for a few years during the post-crisis recovery period.

Assumptions about the roles of the CCyB and conservation buffer

5. To simplify the analysis we make some assumptions about the design and use of the CCyB and conservation buffer:

- Capital requirements are comprised of minimum capital requirements plus a single buffer, either the CCyB or the conservation buffer.[2]

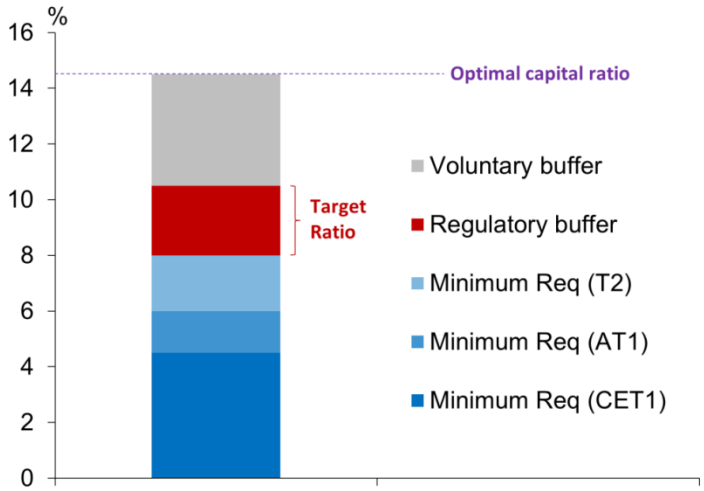
[1] Ref #6994986 v1.0, http://docs/webtop/drl/objectId/090000c3805b79ea

[2] The optimal approach may include both the CCyB and conservation buffer but considering the extreme cases, when there is a single buffer, simplifies the analysis without affecting the key findings.

- There is an 'optimal capital ratio' that the Reserve Bank does not normally want bank capital ratios to drop below. Banks are encouraged to have that level of capital by setting buffers to a specific ratio, the 'target ratio' (figure 1).
- The CCyB would be zero (or near zero) during a crisis and raised towards the target ratio when financial institutions, markets and the real economy have begun to recover. The conservation buffer would be set at the target ratio at all times.
- Bank capital ratios are indifferent to the form of capital buffer adopted, ie banks operate with the same capital ratios whether they face an X% CCyB or an X% conservation buffer.[3]

6. The final assumption means the choice of buffer should only affect the soundness and efficiency of the financial system at times when the level of the CCyB would diverge from the conservation buffer. Under the early-CCyB strategy, this should only occur during a crisis and in the recovery period after a crisis. The following analysis focuses on these periods.

Figure 1: Illustration of assumed capital requirements



Note: 'Voluntary buffer' is the amount of capital a bank holds above the level prescribed by the regulatory minimum capital requirements and buffers.

Impact on efficiency

7. A CCyB cut may improve financial system efficiency if it supports the supply of credit after a crisis by reducing the capital ratio banks must hold in order to avoid regulatory penalties. For this to be true, three things must hold: (1) lower capital buffer requirements must encourage banks to operate with lower capital ratios, (2) lower capital ratios must encourage banks to provide more credit and (3) the additional credit must be provided to productive borrowers.

[3] This is a reasonable assumption as the CCyB is imposed through changes in the conservation buffer, so the implications of breaching either buffer are the same, under current regulations.

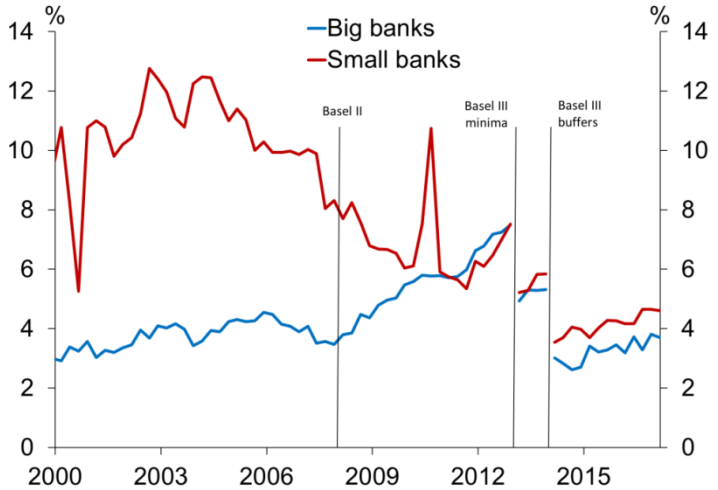
Do lower capital buffers encourage banks to have lower capital ratios?

8. Banks choose a capital ratio that balances the marginal cost and benefit of capital. Capital requirements can influence bank capital ratios by imposing costs on banks that operate with ratios below the level imposed by the requirements.

9. International evidence suggests that capital requirements influence bank capital ratios. A series of Bank of England papers find that changes to individual UK banks' Pillar 2 capital requirements have affected banks' choice of capital ratios in the past (Francis & Osborne (2009), Aiyar *et al* (2014) and Bridges *et al* (2014)). A 100bp increase in capital requirements is estimated to result in a 30bp increase in capital after 6 months and 90bp in the long run (de Ramon *et al* (2016)). There is also evidence that the capital ratios of German savings banks are responsive to capital requirements (Heid *et al* (2004)). These papers imply that capital requirements affect bank capital ratios even when they are not binding, as banks maintain buffers over regulatory thresholds.

10. One weakness of this evidence is that it is based on old vintages of the Basel framework, when buffers were not part of the regulatory framework. It is possible that bank capital ratios are less responsive to changes in regulatory buffers as the implications of falling below a buffer requirement are weaker (ie banks face dividend restrictions rather than the risk of losing their bank licence). However, there is little sign that large New Zealand banks treat regulatory buffers and minima differently. Large banks currently have 'excess' Tier 1 capital of around 4pp (ie their T1 capital ratios are 4pp higher than the combined minimum and buffer requirement), which is around the same excess as they had under Basel I, before buffer requirements were introduced (figure 2).

Figure 2: Excess of bank Tier 1 capital ratios to Tier 1 capital requirements



Note: Vertical lines indicate the dates at which different vintages of the Basel framework were adopted in New Zealand.

11. Another weakness of the evidence is that it generally relates to non-crisis periods, but any efficiency benefit of the CCyB would only occur when the CCyB is lower than the

conservation buffer ie during or shortly after a crisis. This matters because the capital ratios that banks target are procyclical (Francis & Osborne (2010)).[4] A Bank of England study, based on changes to Pillar 2 requirements before and after the GFC, finds that capital requirements have little influence on UK banks' capital ratios during a crisis, 2007H1 to 2009H2. However, it also finds that capital requirements were a key driver of capital ratios in the period after the crisis abated, end-2009 to 2013. The sensitivity of capital ratios to capital requirements is estimated to be the same in this period as in the pre-GFC period.

12. Finally, it is possible that banks may not respond to CCyB cuts if they expect the CCyB to be reinstated once the crisis abates. To mitigate this risk, the Reserve Bank could commit to keeping the CCyB at zero for a numbers of years after a crisis, before gradually increasing it towards the target ratio. Evidence suggests this commitment may be effective. For example, banks slowly increased their capital ratios after higher capital requirements were announcement and gradually introduced as part of Basel III ie they didn't immediately raise their capital ratios to comply with the Basel III end-point requirements.

This suggests that a CCyB cut would influence banks' capital ratios in the recovery period after a crisis, but may have no impact during a crisis.

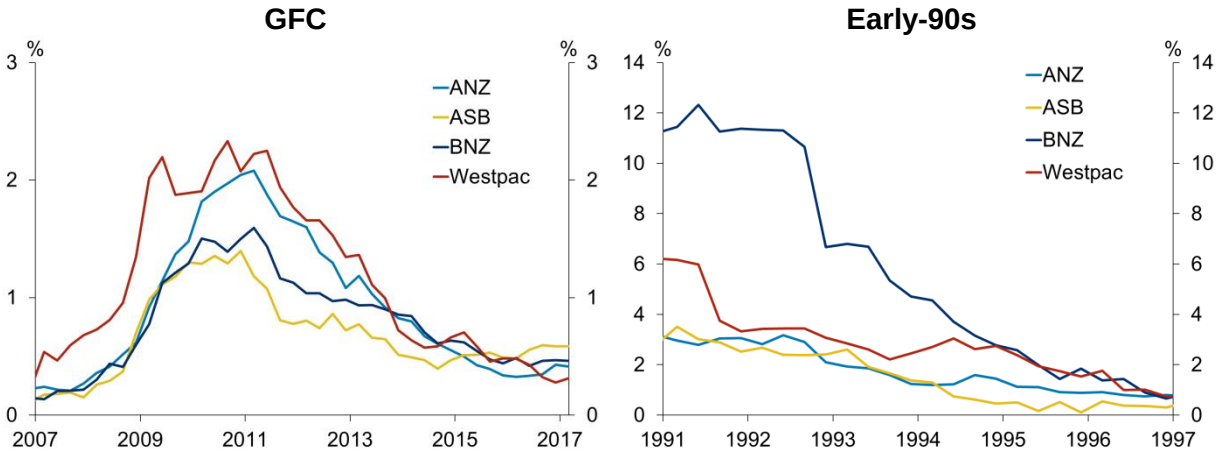
13. It is possible that the CCyB could influence capital ratios during a crisis if some banks were relatively unaffected by the crisis. Healthy banks should not be incentivised to raise capital ratios if investors recognise that their level of risk and resilience has not changed, so they may be responsive to a CCyB cut. This effect is not captured in the existing evidence on the impact of capital requirements on capital ratios, as that evidence is based on the GFC period when all banks were affected by the crisis.

14. History shows that crises can affect some banks significantly more than others. However, severe crises are likely to affect all banks, as they significantly weaken economic conditions, increase risk aversion and amplify contagion risks. In addition, the common portfolios of large domestic banks means it is less likely for some banks to be unaffected by a significant crisis in New Zealand. For example, the non-performing loans ratio of the large banks were similar during the GFC, although they did differ in the early 1990s (figure 3).

This suggests cutting the CCyB may be less effective during a crisis period in New Zealand than in countries with less concentrated and homogeneous banking systems.

[4] In a crisis, greater risk awareness and aversion incentivises banks to target higher capital ratios, which would counteract the impact of cutting the CCyB.

Figure 3: NPL ratios of large New Zealand banks in GFC and early-90s



Do lower capital ratios encourage banks to provide more credit?

15. The above analysis suggests that cutting the CCyB could mean banks choosing to operate with reduced capital ratios, particularly, in the recovery period after a crisis. But would this lead to more lending, as banks can use existing capital to support new lending rather than raising new capital at potentially high costs during the crisis. Or might it, for example, lead to larger dividend payments?

16. A relatively established body of literature suggests that banks with excess capital (ie capital ratios above the level they target) provide higher levels of credit, but the relationship is modest. Berrospide & Edge (2010) finds that US banks with excess capital grow lending more than banks with a shortage of capital but total loan growth increases just 25bp per annum when capital exceeds its target by 100bps. de-Ramon *et al (*2016) finds that UK banks increased loan growth by just 10bp per annum when capital exceeds its target by 100bp – this sensitivity is the same before and after the GFC.[5]

17. These estimates suggest that a CCyB cut of 1% in New Zealand could boost lending by up to $380-950mn per annum (table 1).[6]

Table 1: Potential boost to lending from a 1% CCyB cut ($mn)

ANZ	ASB	BNZ	Westpac	Kiwibank	All banks
109-272	71-178	72-180	71-177	16-40	380-951

18. There is significant uncertainty around these estimates. On the one hand, the increase would be less during a crisis if most banks were affected by the crisis or if the lending decisions of the major banks are influenced by the capital requirements of their

[5] Maurin and Toivanen (2012) estimate that a 100 basis point capital shortfall reduces annual loan growth by around 200 basis points. This estimate is based on euro area bank data spanning 2005 to 2011. But as the estimate is an order of magnitude higher than other estimates, it is ignored in this analysis.
[6] This compares to the $53bn of additional lending that could theoretically be supported by a 1pp reduction in capital requirements, based on average risk weights.

overall group.[7] On the other hand, there are potentially indirect effects from boosting bank lending during or after a crisis; for example, increased lending could support asset prices, employment and GDP, which would support bank balance sheets and further lending growth.

On balance, a large CCyB cut is probably required to generate a significant increase in bank lending. The sensitivity of bank lending to a CCyB will depend on the capital positions of individual banks and of their overall group.

19. There is also evidence that releasing capital (by lowering capital requirements) during a crisis could encourage banks to increase lending but only for banks with relatively high levels of capital. Using data on international banks, Brei *et al* (2011) finds that higher capital ratios are only associated with higher lending for banks with total capital ratios above 10% during the height of the GFC (2008-09). Jimenez *et al* (2015) also finds that the reduction of Spanish dynamic provision requirements in Q4 2008 and Q4 2009 (which is equivalent to a CCyB cut) had a larger impact on the lending of well capitalised banks.

This suggests that a CCyB cut would be more effective if banks had high capital ratios at the time.

<u>Would additional credit be provided to productive borrowers?</u>

20. The above analysis suggests that, relative to the conservation buffer, cutting the CCyB in a crisis could enable some banks to reduce capital ratios and moderately increase lending. But would the additional credit be provided to productive borrowers?

21. Answering this is difficult, but looking at the type of lending that typically contracts in stressed periods can inform our understanding. Following the GFC, bank lending growth fell to around zero in New Zealand but lending to the SME, commercial property and corporate sectors fell sharply (figure 4). International evidence suggests that, on average, business lending is disproportionally affected in past crises (figure 5). This is corroborated by banks' mitigating actions in recent stress tests: for example, in the 2015 stress test, banks estimated they would reduce non-farm business lending, particularly CRE lending, by more than mortgage (and farm) lending in the 3 years after the stress event. And cutting credit lines to businesses is a common mitigating action in the 2017 stress test.

[7] Even if it were reciprocated by APRA, a CCyB cut would have a smaller impact on the Australian group's capital requirements than it would for domestic banking groups, meaning the New Zealand subsidiaries may be less responsive to the cut.

Figure 4: Sectoral composition of bank lending growth in NZ after the GFC

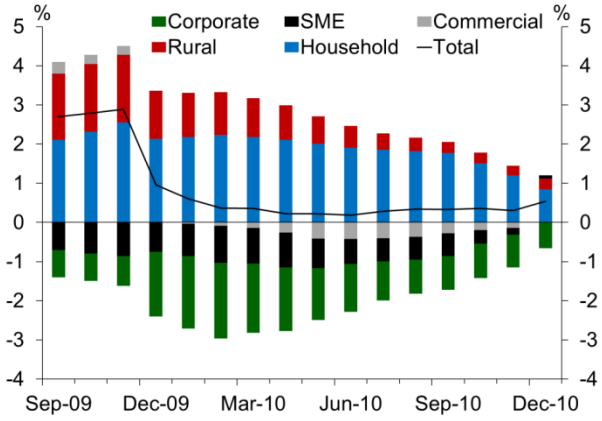
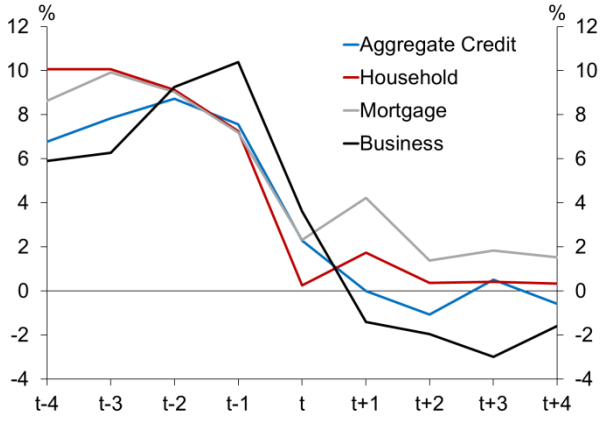


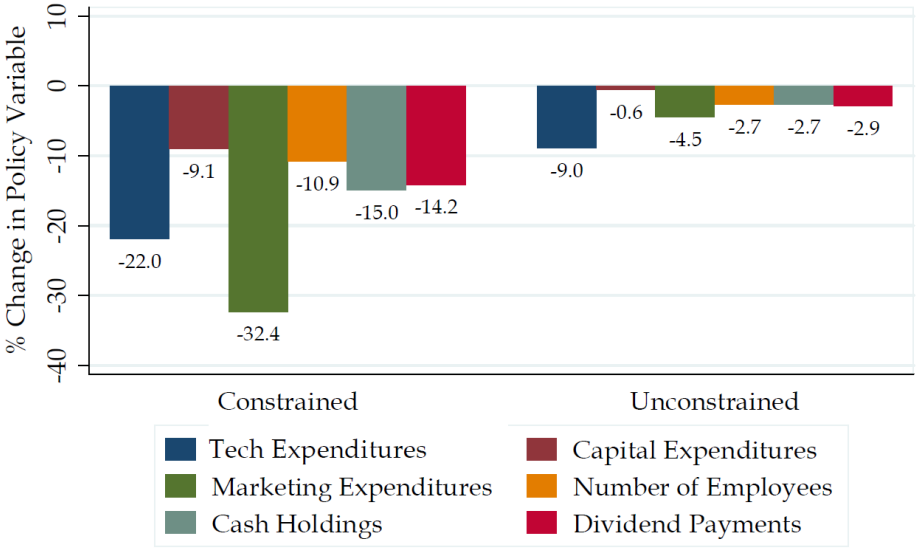
Figure 5: Average change in real credit in past international crises



Note: Chart shows average annual sectoral credit growth around financial crises in 14 advanced economies since 1960.

22. Assuming that the decline in low risk lending (eg residential mortgage lending) during a crisis reflects lower demand for loans, rather than credit constraints, business lending may be most likely to benefit from an increase in lending caused by a CCyB cut. A survey of CFOs in the US, Europe and Asia, conducted in Q4 2008, finds that smaller, private, less profitable and lower credit rated firms were more credit constrained in the crisis (Campello *et al* (2009)). These firms are more affected as they tend to be heavily reliant on bank funding. The survey also finds that credit constrained firms expect to reduce investment and staff numbers considerably more than unconstrained firms (figure 6). Reducing credit constraints may not improve the productivity or profitability of all firms, as some may need to reduce investment and employment, but it would likely help some small businesses, supporting GDP growth during a recession.

Figure 6: Policies of constrained v unconstrained firms in the GFC



Source: Campello *et al* (2009)

23. The additional lending created by a CCyB cut may not constitute lending to new customers. Instead, banks could use some of the released capital to manage bad loans. As argued in recent FSRs, it was desirable for banks to support lending to stressed dairy farms that were likely to be viable once dairy prices rose. However, there are times when this may be undesirable; for example, banks' tardiness in dealing with loans to zombie firms is considered a key factor in prolonging the Japanese financial crisis.

This analysis suggests that boosting lending during a crisis could support productive businesses, particularly small firms that are heavily reliant on bank financing. But in some cases, problem loans should be dealt with quickly.

Impact on soundness

24. This section considers the potential financial system soundness impact of a CCyB cut.[8] The theory is that, on the one hand, a CCyB cut could improve financial system soundness by supporting lending to the real economy in a crisis, which reduces the real economy impact of a crisis and reduces NPLs and supports the value of bank assets. On the other hand, a CCyB cut could reduce soundness by encouraging risky lending after a crisis and by reducing the loss absorbing capacity of banks in a crisis. These potential effects are investigated below.

Would the CCyB improve soundness by increasing lending?

25. Easing credit constraints can reduce the size and length of a crisis by supporting bank lending to household and businesses, which will help maintain consumption and investment and support GDP and employment. This is illustrated by figures 7a and 7b which show the relationship between credit growth and GDP growth and unemployment during past crisis periods in 14 advanced economies. Using the same dataset, Jorda *et al* (2011) finds that recessions associated with financial crises result in credit growth that is 4 times weaker than in normal recessions and are a third more costly in terms of GDP impact. Shocks to GDP and employment will affect bank credit losses. As part of the 2017 stress test, banks estimated that a 200bp increase in unemployment would increase mortgage credit losses by 10-40bp.[9]

[8] We do not relitigate the question of whether a CCyB cut would generate greater lending in a crisis, as it is considered in the previous section.

[9] Lending should also support asset prices, which could help mitigate bank losses. For example, banks estimate that a 10pps fall in house prices would increase mortgage credit losses by around 90bps.

Figure 7a: GDP and credit growth in crises since 1960

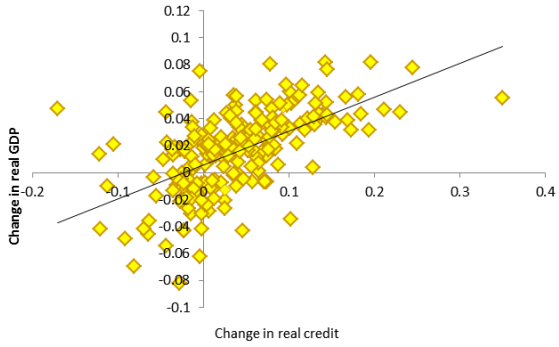
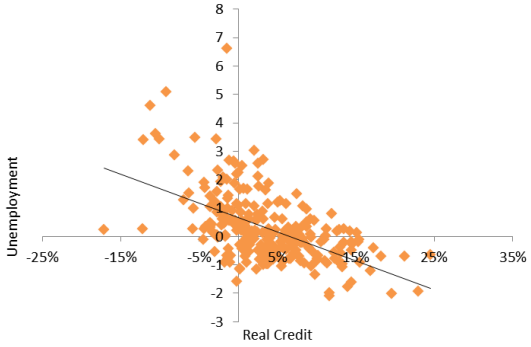


Figure 7b: Unemployment and credit growth in crises since 1960



This suggests a CCyB cut could improve financial system soundness by reducing loan defaults, supporting asset prices and boosting bank profitability.

26. However, it is possible that stimulating lending following a crisis could, instead, reduce soundness by encouraging risky lending; for example, Icelandic banks appeared to gamble for resurrection during the GFC. However, evidence suggests that banks raised lending standards in New Zealand during the GFC. And international studies show that during the GFC, euro-area banks reduced risky assets (securities) ahead of less risky assets (loans) (Maurin & Toivanen (2012)), and US banks tightened lending by raising the risk premium on more risky loans (Kwan (2010)). Prudential regulation could also help guard against banks substantially increasing their risk profile after a crisis.

This suggests a CCyB cut is unlikely to significantly increase risky lending in a crisis.

<u>Would the CCyB reduce soundness by reducing capital ratios?</u>

27. An obvious consequence of a CCyB cut is that it would encourage banks to operate with lower capital ratios / buffers during a period of crisis and recovery from a crisis. This could materially reduce banking system soundness if:

(i) the capital ratios were reduced to increase dividends, rather than absorb losses or sustain lending (which reduces the regulatory value of capital buffers built up prior to the start of a crisis); or

(ii) it took a long time to return the CCyB to target, especially in a period of elevated financial stability risks (which reduces the build-up of capital buffers after the start of a crisis).

Would banks reduce capital buffers by increasing dividends?

28. A CCyB cut could reduce soundness by allowing banks to erode their capital buffers by paying dividends in excess of their profits during a crisis. This diminishes the regulatory

value of capital held against the CCyB going into a crisis, as that capital is designed to be used to absorb losses and maintain the supply of lending in a crisis.

29. The conservation buffer mitigates this risk by imposing dividend restrictions on banks whose capital ratios fall below certain thresholds within the buffer. The CCyB, when cut to zero, has no equivalent provisions.

This suggests that the CCyB could decrease the resilience of banks in a crisis unless there are restrictions on how the released capital is used.

30. Such restrictions could take many forms but it is important that the restrictions do not remove the incentive for banks to operate with lower capital ratios after a CCyB cut (which is the key purpose of the CCyB). Ideally the restrictions would be simple. Three possible options include:

- restricting the percentage of profits paid out in dividends by a bank to the average percentage paid out by the bank in the three years prior to the CCyB cut; [10]
- limiting payouts to a certain percentage of CET1; and
- restricting the amount a bank pays in dividends if its lending growth is not positive (or above a certain level).

31. These restrictions could be implemented softly, ie using 'Governor's eyebrows'. But harder regulation would be preferable, as soft powers may be ignored in the heat of a crisis. More work would be required to develop the form of restriction and a method of implementation, if it was to be adopted.

How long would it take to return the CCyB to target, and what are the risks in this period?

32. The CCyB could also reduce soundness by reducing the capital buffers that banks build up after a crisis hits. This is a direct consequence of using the CCyB to stimulate bank lending by allowing banks to operate with lower capital ratios during a crisis. When cutting the CCyB there is a direct trade-off between the 'macroprudential benefit' of stimulating lending and the 'microprudential cost' of weakening banks' resilience to future shocks.[11] The macroprudential benefit is discussed above. The microprudential cost will depend upon the time period in which the CCyB is below target, the probability and potential scale of financial shocks during that period and the size of capital buffers retained by banks.

33. Under the early CCyB strategy, the CCyB should only be below target during a crisis and the initial years of recovery after a crisis (when the CCyB would be raised towards the

[10] When the Bank of England cut the CCyB in July 2016 it stated an expectation 'that firms do not increase dividends and other distributions as a result of [the CCyB cut]'.

[11] In practice, the costs and benefits are important to both macroprudential and microprudential policy. The sharp distinction is used here for illustrative purposes only.

target). The previous MFC paper on CCyB strategy suggested a range of indicators which would have pointed towards raising the buffer from mid-2011. However, it is possible that it could take more years to raise the CCyB to target following a more severe domestic crisis. In addition, there is a risk that inaction bias or political pressure could mean the CCyB would never reach target after a crisis. To mitigate these risks, it could be helpful to publically state the target ratio for the CCyB and describe a set of indicators which will inform the decision of when to raise and lower the CCyB. But it is unlikely to completely eliminate the risk of inaction bias.

34. The conservation buffer would encourage banks to quickly rebuild their capital buffers after a crisis, as it is always set at the same level and dividend restrictions force banks to rebuild their capital ratios if they fall within the buffer.

35. The CCyB would help ensure that the banking system has adequate capital buffers to survive the initial onset of a crisis. But the longer it takes for banks to rebuild their capital buffers, the greater the risk that a subsequent shock could hit the system. The Japanese financial crisis and European sovereign debt crisis illustrates that a series of shocks can hit a financial system. Using data on 140 years of 14 advanced economies, Jorda *et al* (2011) finds that the probability of a crisis is not influenced by the duration since the previous crisis.

This suggests that banks should not be encouraged to completely erode their capital buffers in order to support lending in a crisis.

36. Although the probability of a crisis is not affected by the duration since the last crisis, a crisis is likely to be smaller if it occurs shortly after another crisis. Evidence shows that crises are deeper and longer if they follow periods of high credit growth (Jorda *et al* (2012)), and, as shown above, credit growth is likely to be subdued after a crisis.[12]

This suggests that it may be acceptable for banks to operate with lower capital buffers after a crisis than later in the financial cycle.

[12] Furthermore, if credit growth was strong after a crisis, the CCyB should be raised towards the target.

Conclusion

37. The above analysis presents the theoretical and, limited, empirical evidence on the potential efficiency and soundness impact of using the CCyB, compared to the conservation buffer. As the CCyB is a new tool, the evidence is often patchy and circumstantial. That said, there is enough to suspect that a CCyB cut could have the following impact on efficiency:

- It is unlikely to affect bank capital ratios and lending during a crisis.
- It would probably cause banks to operate with lower capital ratios and provide more lending in the recovery period after a crisis.
- The increase in lending is likely to be relatively modest (10-25bp on annual lending growth, for a 100bp reduction in the CCyB).
- A CCyB cut would have a larger impact on the capital ratios and lending of well capitalised, healthier banks.

38. And a CCyB cut could have the following impact on soundness:

- It is unlikely to affect soundness during a crisis, as it does not affect capital ratios.
    - But it could weaken banks' capital ratios during a crisis by allowing them to make excessively large dividend payments.
    - And it could weaken banks' capital ratios going into a crisis, if the Reserve Bank failed to return the CCyB to the target ratio.
- It would likely boost lending by a modest amount during the recovery period. This could enhance soundness by improving GDP growth, reducing unemployment and supporting asset prices.

39. Taking this evidence, together with the suggestions from the previous MFC paper on the CCyB strategy, suggests a few lessons for the CCyB strategy:

Size of CCyB

- The CCyB is likely to be most effective when it is complemented by other substantial capital requirements and buffers, as (a) a CCyB cut will only stimulate lending if banks are well capitalised after adjusting to the cut and (b) soundness would be reduced if banks had low capital buffers following the cut.
- A large CCyB is probably required to have a material impact on bank lending and, therefore, the soundness and efficiency objective.
    - Depending on the outcome of the Capital Review, a significant CCyB could potentially form part of the capital framework whilst increasing other elements of the regime (see Annex).
- This suggests the aggregate capital requirement ratios would need to be high to facilitate an effective CCyB. See the annex for a method of calibrating the CCyB.

Varying the CCyB

- The Bank could be conservative in timing a CCyB cut, as it is unlikely to have a material impact on capital ratios and lending during a crisis.
- The capital ratios of individual banks and their groups should be considered as part of the decision to cut the CCyB, as they will influence banks' responses to a cut.
- Regulatory restrictions should be used to prevent a CCyB cut from weakening banks' capital buffers through large dividend payments.
- The Bank should publically commit to keeping the CCyB at zero for a few years (3 or 4) after a crisis has abated, to encourage banks to respond to the cut.
- After these few years, the Bank should publically commit to gradually raising the CCyB to the target ratio, to mitigate the risk of inaction bias.

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Annex: Calibrating the CCyB

40. If the CCyB were to remain a part of the capital framework and the above findings are accepted, the following top-down approach could be used to calibrate the target CCyB ratio.

Possible process for calibrating the CCyB

41. The 'optimal capital ratio' has already been considered in the Capital Review. The optimal capital ratio may vary by bank if D-SIB buffers or Pillar 2 requirements become part of the framework. The overall capital ratio suggested by the Capital Review will be informed by models of optimal capital ratios and will take account of the other components of the review, eg risk weights and the range of eligible capital instruments. The optimal capital ratio could be decomposed into individual capital requirements in 4 broad stages (see Diagram A).

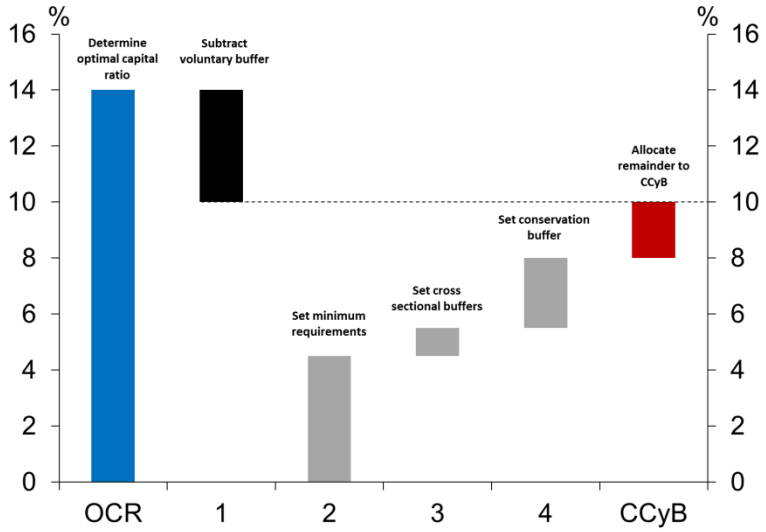
42. First, the voluntary buffer (ie the level of capital that banks typically hold in excess of the regulatory capital requirements) can be subtracted from the optimal capital ratio, to provide the optimal aggregate level of regulatory capital requirement.

43. Second, optimal capital requirement can be split into minimum requirements (to absorb losses in failure / OBR) and buffers (to absorb losses prior to failure) by setting the minimum capital requirements. Given the different purposes of minima and buffers, in theory, it may be possible to calibrate the minima independently from the buffers.

44. Third, the buffers can be split into cross-sectional and system-wide buffers. Cross-sectional buffers, D-SIB and Pillar 2 buffers, will depend on the desired variation in capital ratios across banks. In theory, they could be calibrated independently to the system-wide buffers, the conservation buffer and CCyB (which depend on the desired variation in capital ratios over time).

45. Fourth, the system-wide buffers can be split into conservation buffer and CCyB.

Diagram A: Possible process for calibrating the CCyB



Illustrative calibration for the CCyB's target ratio

46. Without wishing to front run the findings of the Capital Review, we can make an illustrative (ie rough) 'back of the envelope' attempt to calibrate the CCyB. To begin we need to determine the optimal capital ratio. A Sep 2016 FSO paper (#6665392 v1.2) found that estimates of optimal CET1 capital ratios across a range of studies suggest a range of 10% to 20%, with a number of estimates landing around the 14-18% level depending on modelling assumptions.[13] ***We assume the optimal capital ratio is 14%***.

47. Next we subtract the voluntary buffer that banks are expected to hold above the capital requirements. Based on figure 2, ***we assume the voluntary buffer will remain at 4%***.

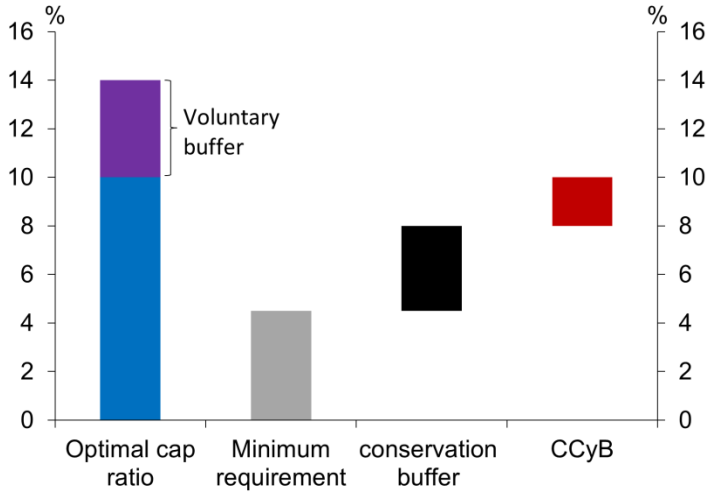
48. Next we need to determine the minimum requirements. Many factors will influence this choice but given New Zealand banks operate in an international environment and raise funding offshore, it is safe to assume the minima will not be lower than in Basel III. For simplicity, ***we assume the regulatory minima do not change***.

49. Next we need to split the buffer requirements between cross-sectional and system-wide buffers. For simplicity, ***we assume there are no cross sectional buffers***.[14]

50. Finally, we need to split the system-wide buffers between the conservation buffer and CCyB. It is unlikely that the conservation buffer should be below the 2.5% prescribed in Basel III, and the CCyB will be most effective if it is accompanied by a robust conservation buffer. Given that, ***we assume a conservation buffer of 3.5%***.

51. ***This results in a target CCyB ratio of 2%***.

Diagram B: Rough calibration of the target CCyB ratio



[13] These academic studies are based on international evidence so the estimates should be translated into New Zealand relevant figures, given differences in capital frameworks (eg risk weights are significantly higher in New Zealand than in other countries prior to the GFC) and difference in banking systems (eg New Zealand's concentrated banking system).

[14] In other words, this exercise calibrates the CCyB for non-systemic banks with no Pillar 2 requirements.