

# Countercyclical Capital Regulation in a Small Open Economy DSGE Model

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Countercyclical capital rules based on the credit gap create a trade-off between the stabilisation of fluctuations originating in the housing market (which are attenuated) and stabilisation of fluctuations caused by foreign demand shocks (which are amplified). The reason is that the credit gap is not procyclical after every structural shock. The trade-off disappears if the regulator follows a rule based on the deviation of house prices instead of the credit gap. The use of judgement and reliance on several indicators rather than rigid adherence to rules is likely to yield better outcomes in terms of business cycle stabilisation.

## 1. Introduction

The Great Recession induced by the crisis in financial sectors of advanced economies has led to major changes in financial regulatory frameworks of advanced economies. One such change has been the introduction of rules where minimum capital requirements are based on some underlying indicator of the financial cycle. These rules have become known as the countercyclical capital buffer (CCyB) rules. The European Systemic Risk Board (ESRB) has formally recommended that macroprudential authorities pay particular attention to the deviation of the credit-to-GDP ratio from a long run trend - the credit gap - when setting CCyB rates.

Because the introduction of such rules is a structural reform that can significantly alter responses of an economy to shocks, it is natural to investigate the performance of such rules in a structural model. We look at a number of shocks that are typically considered important for small open economies in a DSGE model calibrated to Ireland, and use this framework to analyse the performance of two types of CCyB rules, one based on the credit gap and the other on the deviation of house prices from their long-run value. We also investigate the performance of constant, but substantially higher minimum capital requirements.

## 2. Outline of the model

The model is a standard small open economy DSGE model with import-content of exports, augmented with the banking sector, the housing market, and household default, similar to Clancy and Merola (2016). Banks extend loans to domestic households against housing collateral, and collect deposits from domestic households and from the rest of the world. Foreign capital is intermediated by the banking sector. Banks are subject to minimum capital requirements, which may be time varying. The non-financial sector consists of a non-tradable goods sector producing consumption and investment goods for the domestic market, and a tradable goods sector producing export goods. The economy is part of a currency union. Figure 1 gives an overview of the model.

Figure 1: Structure of the model  
FIGURE 1 HERE

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### 3. Countercyclical capital rules

We consider several minimum capital rules. A simple constant minimum capital requirement over the business cycle, either at the level prescribed by the Basel regulations or substantially higher is set as in equation 1.<sup>3</sup> Equations 2 to 4 are cases where the macroprudential authority sets minimum capital requirements based on either the credit gap or the house price gap. Specifically, equation 2 is the rule based on the ESRB Recommendation (“the ESRB rule”), where the minimum capital requirement responds only to positive values of the credit gap exceeding 2 p.p., and the maximum increase is capped at 2.5 p.p.. We also consider the case of a simple linear response to the credit gap (equation 3). Finally, as responding to the credit gap turns out to be destabilising in response to several shocks, we also consider a rule based on house prices (equation 4), as suggested by Drehmann et al. 2010.<sup>4</sup> The two simple linear rules are calibrated such that they eliminate two thirds of the peak GDP increase in response to a housing demand shock.

$$g_t = gmin \quad (1)$$

$$g_t = 8\% + \begin{cases} 0 & \text{if } gap_t \leq 2\% \\ 0.3125 * gap_t - 0.625 & \text{if } 2\% < gap_t \leq 10\% \\ 2.5\% & \text{if } gap_t > 10\% \end{cases} \quad (2)$$

$$g_t = 8\% + 0.43 * gap_t \quad (3)$$

$$g_t = 8\% + 0.85 * price\ gap_t . \quad (4)$$

### 4. Results

#### 4.1 Boom and bust on the housing market

We model the boom-and-bust scenario on the housing market by assuming that the agents expect an increase in the demand for housing to occur in three years (in quarter 13). When this date arrives, the demand increase does not happen. This should be viewed as a stylised representation of a housing bubble – a purely expectation-driven shock with no “fundamental” basis.

Expectations of a housing demand increase cause an immediate jump in house prices (Figure 2). With housing supply fixed, the increase in housing demand raises house prices, leading to lower loan-to-value ratios and thus the default rate. Banks pass lower expected losses on to households by lowering the loan rate, which stimulates consumption and investment. Lower

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<sup>3</sup> We consider doubling of the Basel capital requirements.

<sup>4</sup> The gaps are defined as  $gap_t = \frac{L_t}{Y_t + Y_{t-1} + Y_{t-2} + Y_{t-3}} - \frac{\bar{L}}{4 * \bar{Y}}$  and  $price\ gap_t = \frac{P_{H,t} - \bar{P}_H}{\bar{P}_H}$ .

interest rates further increase house prices. Because exports decrease and imports increase, foreign borrowing rises.

Loans to households increase for three reasons. First, the increase in house prices and domestic demand increases households' demand for transaction deposits. Second, the decline in the loan rate increases the demand of households for saving deposits. Third, the increase in households' expenditure relative to their revenue requires an increase in borrowing. Bank equity increases because the share of non-performing loans declines. Higher bank equity accommodates the increase in loans, as the bank capital ratio declines only marginally.

When quarter 13 arrives, the demand for housing *does not increase*. The disappointment causes a recession because the economy now has a too high physical capital stock and too much debt. The disappointment causes a sharp drop in house prices and a substantial increase in the default rate. With fixed capital requirements this implies an increase in the lending rate and causes a sharp recession. High fixed minimum capital requirements do not help much.

All rule-based approaches to setting the CCyB stabilise the economy during the boom and the bust. During the boom, the opening of the credit gap increases the regulatory capital ratio under all CCyB rules. Higher CCyB increases the risk of breaching the regulatory minimum capital and results in higher required return on assets and the lending rate than when minimum capital is fixed. Higher lending rates dampen the increase in domestic demand, and lead to higher bank equity.

Figure 2: Boom and bust in the housing market  
FIGURE 2 HERE

The main difference between CCyB rules is with respect to what happens during the bust. Because the drop in GDP partly offsets the sharp decline in borrowing, the credit gap does not close and both rules based on the credit gap still require banks to hold capital above the regulatory minimum (bottom-right panel of Figure 2). While there is some relief for the bank capital ratio from the swift decline in loans, the capital buffer of banks remains depressed and the required expected return on loans remains above its steady state value. Essentially, the ESRB rule and the linear rule based on the credit gap do not react sufficiently to release capital when the housing bubble bursts, and thus cannot counter the sharp increase in lending rates caused by the rising default rate. Therefore, during the bust, the stabilisation under the credit gap rules comes mainly from limiting the excesses of the boom through capital overaccumulation.

In contrast, the linear rule based on house prices reacts strongly both during the boom and bust. During the boom it strongly increases lending rates and dampens the domestic expansion. Higher lending rates make bank lending more profitable and both bank equity and bank capital ratio improve substantially (bottom-left panels of Figure 2). When the bubble bursts, the accumulated capital buffer is released, which undoes a large part of the lending rate increase. Moreover, the default rate does not increase as much during the bust because house prices fall by less (they have risen by less during the boom). Note that even though the rule based on house prices allows banks to decrease their capital below the regulatory minimum, this actually does not happen for the average bank, as banks have accumulated substantial capital buffer during the boom.

Note that the effectiveness of the ESRB rule depends on the timing of the events (first boom, then bust), because the rule does not allow bank capital to decrease below the minimum. Linear rules do not share this property and perform better when the sequence of shocks is reversed.

#### 4.2 Temporary decline in export demand

In this scenario, foreign demand for domestic export goods declines temporarily. This depresses exports and employment, while lower wage pressure reduces inflation and increases the real lending rate, depressing consumption, investment and house prices (Figure 3). The decline in house prices substantially increases the default rate and the lending rate, regardless of the type of capital rule used. The lending rate increase amplifies the drop in house prices, consumption, investment, and GDP.

The decline in domestic spending and a reduced incentive to hold saving deposits lead to the decline in loans. Because GDP declines by more than loans do, the credit gap opens. Part of the reason is that the loss in export revenue associated with this shock tends to dampen the decline in non-financial sector borrowing relative to the decline in GDP. Under the linear credit gap rule, this causes an increase in the minimum capital requirement to worsen the downturn caused by the shock (bottom-right panel of Figure 3). The same happens under the ESRB rule, just that the increase in capital requirements is less pronounced.

Figure 3: Temporary decline in export demand  
FIGURE 3 HERE

In contrast, under the rule based on the house price gap, minimum capital requirements are lowered quickly, because house prices decline. The likelihood that banks will have to pay the penalty for breaching the minimum capital requirement is lower, allowing the banks to decrease the required return on lending. The lending rate does not increase as much as under the alternative rule and declines after a few quarters because of the persistent reduction in house prices. This alleviates the decrease in consumption, investment and GDP. For example, the drop in GDP under the house price rule is about 1 p.p. lower at the trough than under the ESRB rule or the linear rule based on the credit gap.

This result means that the credit gap is a problematic indicator variable following a very common shock for small open economies. It requires tightening minimum capital requirements exactly at the time when foreign borrowing could be used to smooth the adverse effects of a decline in foreign demand. The reason for such an adverse outcome is that the credit gap is countercyclical in this case.

## 5. Conclusions

Our main finding is that the performance of a CCyB rule depends on whether the indicator variable (the credit gap or the house price gap) moves procyclically after the shock. In particular, after a negative shock to foreign demand, the credit gap is not procyclical and the capital rule based on the credit gap requires tightening of minimum capital requirements. This amplifies the adverse effects of shocks and exacerbates the business cycle. For shocks originating from the housing market, the credit gap is procyclical and the CCyB rule based on the credit gap is stabilising. Rules based on the credit gap therefore create a trade-off between stabilisation of fluctuations originating in the housing market (which are attenuated) and

stabilisation of fluctuations caused by foreign demand shocks (which are amplified). This trade-off disappears if the CCyB rule is based on the house price gap, which in our model is procyclical following all shocks considered.

Our findings indicate that the regulatory authorities in small open economies should use the flexibility provided by the ESRB Recommendation that, in addition to the credit gap, other indicators of the financial cycle, such as for instance house prices, could also be considered when setting the minimum capital requirements. The use of judgement and reliance on several indicators rather than rigid adherence to rules is likely to yield better outcomes in terms of business cycle stabilisation.

## **References**

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