The long-term economic impact of higher capital levels

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1. Introduction

The 2007–08 financial crisis exposed the inadequacy of existing prudential regulatory arrangements, spurring various initiatives for reform.[2] One of the main lessons from the crisis was that the banking system held insufficient capital. A key question for policymakers is how much more capital the system should have. This paper presents a framework for assessing the long-run costs and benefits of increasing capital requirements for the economy. It provides background to the analysis presented in Bank of England (2010).

To determine the benefits, we model the banking sector as a portfolio of credit risks, and present a framework for assessing how the likelihood of a systemic banking crisis depends on the level of capital requirements. On costs, we assume that higher capital requirements increase banks' funding costs. Customers' borrowing costs rise; leading to a fall in investment and the economic stock of capital, thereby reducing the long-run level of GDP. Here, our key assumption is that Modigliani-Miller's theorem (Modigliani and Miller (1958)) does not hold in its pure form. If it did hold, variations in a bank's capital structure would not affect its funding costs. But real-world frictions may imply that funding costs depend on the composition of liabilities. To make our analysis robust against such frictions, we assume that banks' funding costs increase when they increase the share of capital among their liabilities. We provide some indicative bounds to our estimates using a range of different assumptions.

We provide an illustrative quantification of this framework and find that even when Modigliani-Miller's theorem does not hold, there is significant scope for increasing capital requirements. This is primarily because the steady-state costs of higher capital requirements are low, while the benefits can be substantial. Appropriate capital requirements appear to lie somewhere between 10% and 15% of risk-weighted assets, and substantially above that if the costs lie towards the lower bound and the benefits towards the upper bounds of our estimates.[3]

Importantly, we do not attempt to calibrate minimum capital requirements (below which the bank would enter resolution arrangements) but a "cycle-neutral" level of capital – the amount of capital banks would be expected to hold on average over the economic cycle. The main difference between the two concepts is that the minimum is not designed to ensure a bank's viability, but instead to protect creditors from losses once the bank has entered an insolvency regime. This minimum requirement needs to be complemented by an additional buffer of capital that can both be used to absorb unexpected losses and allow banks to maintain lending to the real economy. Figure 1 illustrates these concepts.

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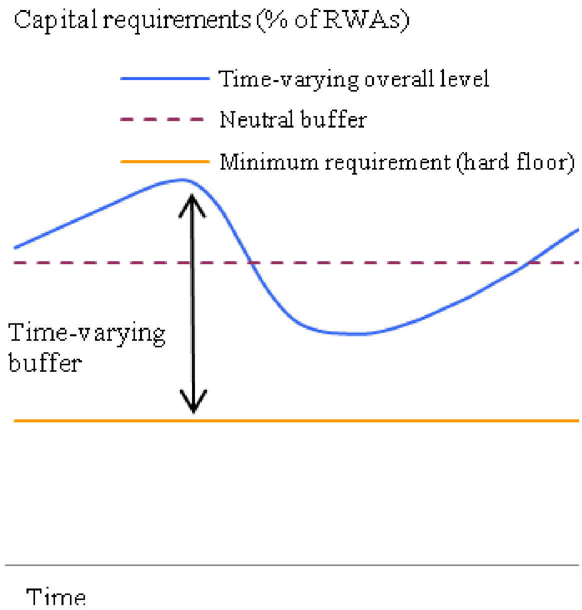
[1] The views expressed in this paper are those of the authors, and not necessarily those of the Bank of England.

[2] Various international committees provided for the discussion of these issues, with the Basel Committee on Banking Supervision playing a key role on the capital and liquidity adequacy front.

[3] These figures do not take into account the Basel III increases in risk-weighted assets.

Figure 1

Schematic representation of components of capital requirements



The paper is structured as follows. Section 2 provides an overview of related cost-benefit studies. To estimate costs (Section 3), we apply a simple accounting method to analyse the impact of higher capital requirements on the spread between banks' lending and funding rates (Section 3.1). We then translate higher lending spreads into GDP using the simplest possible macroeconomic model: a production function (Section 3.2). We also consider alternative plausible estimates based on different assumptions (Section 3.3). To assess the benefits (Section 4), we make use of a credit portfolio model to translate capital requirements into probabilities of banking crises (Section 4.1). We then draw on estimates of the cost of banking crises to establish a link between capital requirements and GDP (Section 4.2). Section 5 combines these estimates to determine plausible ranges in which appropriate capital requirements might lie. Section 6 concludes.

2. Related literature

A number of recent studies have discussed the costs and benefits of higher capital requirements. As in this paper, some focused on the steady-state impact at a point *after* the banks and the wider economy are assumed to have adjusted to the revised requirements (eg BCBS (2010)); others on the impact during the transition phase to the new requirements (eg BCBS and FSB (2010)).

Among these papers, BCBS (2010) is closest to the analysis contained here. To estimate the costs of higher capital requirements, BCBS (2010) follows a similar framework to the one presented in Section 3 of this paper. To estimate the benefits, BCBS (2010) again follows the same steps as we do, but presents the results of a broader range of models to assess the link between capital requirements and the likelihood of systemic crises. We differ from BCBS (2010) in that our analysis focuses on the United Kingdom, which is simpler and more transparent, and because we investigate the costs of higher capital requirements in more detail.

Other comprehensive cost-benefit analyses include Barrell et al (2009), Kato et al (2010), and Miles et al (2011). The first two studies analyse the effect of varying both liquidity and capital requirements. The third also focuses on capital requirements. Its estimates of appropriate capital ratios are larger, primarily because Miles et al use a different method to calibrate the volatility of banks' assets. It also takes into account the impact of lower leverage on risk-adjusted returns, but this is quantitatively less important. Using a different approach, Kashyap et al (2010) also conclude that the long-run costs of increasing capital requirements are likely to be small.

A number of studies investigate specific elements of the cost-benefit analysis. Using a method close to the one we employ, Elliott (2009, 2010) studies the long-run effect of tightening capital requirements on banks' lending spreads in the United States. Elliott's analysis suggests that these effects are small, in particular if banks are able to offset any increase in their funding costs by other means. King (2011) uses a similar method to investigate the long-run impact of tighter capital and liquidity requirements on bank lending spreads for 13 OECD countries.

3. The economic costs of higher capital

Modigliani-Miller's irrelevance theorem states that if a firms' risk only depends on the riskiness of its assets, variations in its capital structure do not affect its funding costs. If this is true, the response is straightforward: Over a wide range, higher capital requirements would have no real-economy costs.[4]

But to ensure that our conclusions are robust against the criticism that real-world frictions prevent the result from holding in reality, we assume that banks' funding costs increase when the share of capital in their liabilities rises. If banks pass on this increase, the real cost of financial intermediation increases. We therefore determine first how higher capital ratios might influence banks' cost of funding and their lending spreads (Section 3.1), and then how higher lending spreads might influence households' and firms' funding costs and their propensity to invest, and ultimately GDP (Section 3.2).

3.1 Translating higher capital ratios into bank lending spreads

Total assets of the UK banking sector – here proxied by major UK banks – were about £6.6 trillion on average during 2006–09, and risk-weighted assets were about £2.6 trillion. An increase in the capital ratio by 1 percentage point would imply that, in aggregate, banks would have to raise an additional £26.5 billion in equity. If remunerated at 10%, this would cost banks £2.65 billion per year.

But, at the same time, banks could retire debt worth £26.5 billion. Assuming a typical cost of wholesale debt of 5% and a tax rate of 28%, this would result in an after-tax saving of about £0.95 billion (= (1 – 28%) x 5% x £26.5 billion). This would leave banks with an annual increase in funding costs of around £1.7 billion to recoup. If this were recovered solely from global lending to non-bank customers, the lending spread after accounting for taxes would have to increase by about 7.4 basis points (= £1.7bn / £3.2trn / (1 – 28%)).

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4 The qualification "over a wide range" results from the observation that some bank debt (deposits held for transaction purposes) has value not only as a funding instrument, but also as a means for providing liquidity insurance to households and firms. Replacing this by equity could inhibit the payment for and settlement of goods and services and affect the overall level of maturity transformation in the economy. In this paper, we consider variations in capital requirements that would only substitute between equity and debt held for savings purposes.

3.2 Translating higher bank lending spreads into GDP

The long-run impact of higher bank lending spreads on GDP can be assessed using a simple production function. In this framework, an increase in non-financial firms' cost of capital reduces their investment and, ultimately, the level of GDP. Using a constant elasticity of substitution production function, the elasticity of output with respect to firms' cost of capital is $\sigma \times \alpha / (\alpha - 1)$, where σ, the elasticity of substitution between capital and labour, is taken to be 0.4, and α, the output elasticity of capital, is taken to be 0.3.[5] As bank lending represents only part of firms' total external financing, firms' overall cost of capital is likely to rise by only about a third of the increase in banks' lending spreads. A 7.4 bp increase in bank funding costs raises firms' cost of capital – here taken to be 10% – by 7.4 bp / 3 = 2.5 bp or about 0.25%.[6] This suggests that output might fall by about $0.25\% \times \sigma \times \alpha / (\alpha - 1)$, or 0.04%. That is, a 7.4 basis point increase in lending spreads maps into a 0.04% permanent decline in the level of GDP under these assumptions.

3.3 Construction of plausible bounds

As noted above, we consider a few alternative scenarios to derive some plausible bounds of the effect of higher capital requirements on lending spreads and GDP. One variation we consider assumes that Modigliani-Miller's theorem holds apart from the different tax treatment of debt and equity. The predicted increase in lending spreads (1.6 bp) and impact on GDP (–0.01%) of a 1 percentage point increase in capital requirements is, of course, much smaller than in our benchmark. We also consider a scenario whereby banks recover a third of the increase in funding costs through higher fees and commissions (increased by 4%) and by reducing operating costs (by 4%). In this scenario, our estimated impact on lending spreads and GDP would also be lower than our baseline example (4.9 bp and –0.03%, respectively). Other scenarios we consider include a higher equity premium, a higher real cost of capital for non-financial corporate and a lower share of bank finance for non-financial corporate.

4. The economic benefits of higher capital

Higher capital levels should make the banking system more resilient, reducing the probability or severity of financial crises. In Section 4.1, we determine how capital requirements affect the likelihood of a systemic banking crisis before combining this probability with an estimate of the loss in GDP that a crisis causes (Section 4.2).

4.1 Translating capital ratios into the probability of a crisis

Several techniques are available to analyse the relationship between capital requirements and the probability and severity of systemic crises. We focus on the impact of capital requirements on the probability of crises, and combine it in Section 4.2 with an estimate for the average severity of a crisis from the academic literature. Specifically, we use a Merton-style structural credit risk portfolio model based on Elsinger et al (2006) to quantify systemic solvency risks for a stylised representation of the UK banking system.[7] Their framework captures two channels of system-wide risk: (i) the risk that banks fail simultaneously because

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[5] Our estimate of α is in line with the literature. See Barnes et al (2008) for estimates of σ.

[6] That is, (10% + 2.5 bp) / 10% –1 = 0.25%.

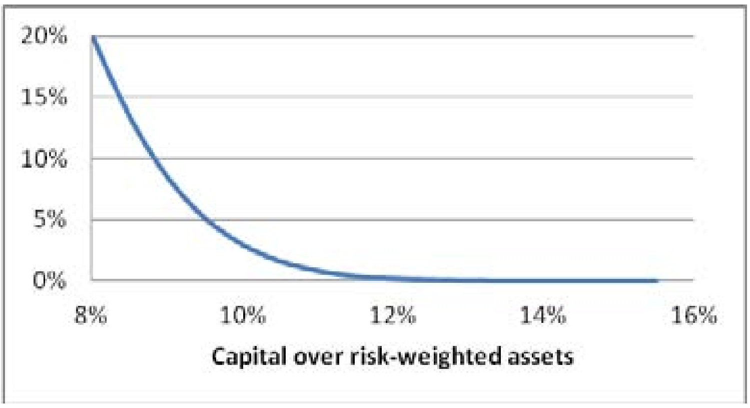
[7] Our model has been developed by Webber and Willison (2011).

their asset values are correlated; and (ii) direct balance sheet links between banks, through which the failure of one bank can cause the contagious failure of other institutions.

We assume that a bank fails if its capital ratio approaches the Basel II minimum of 4%; for purposes of illustration only, a 2 percentage point buffer is used. The model is calibrated using 2007 data for the five largest UK banks, with a systemic crisis defined as the joint default of at least two of these banks.[8] Figure 2 shows the predicted link between the probability of a crisis and the risk-weighted capital ratio.

Figure 2

Probability of systemic crises



4.2 Translating the probability of a crisis into GDP

In order to compare the benefits of higher capital requirements to the costs, we need to translate the probability of crises into expected losses in the level of GDP. Suppose that the initial output loss in a systemic crisis is 10%, with three quarters of this lasting for five years, while the remainder is permanent. Figure 3 shows this crisis pattern relative to a baseline scenario in which no crisis occurred: a decline of 10% in GDP until five years after the crisis occurred, reduced to 2.5% from year six onwards. For reference, the figure also includes an estimate of the mean output path of a typical banking crisis taken from IMF (2009), which considers only losses up to seven years after the crisis.

The expected loss in output per crisis, LPC, can then be computed as

$$\mathrm{LPC} = \left(\frac{3}{4} \frac{1-\delta^5}{1-\delta} + \frac{1}{4} \frac{1}{1-\delta} \right) \cdot 10\%$$

where δ is the discount factor. Using a discount rate of 2.5%, this amounts to a cumulated discounted cost of about 140% of GDP per crisis, and 1.4% of GDP per percentage point reduction in the likelihood of this crisis. As higher capital requirements would not only reduce the likelihood of a single crisis but of all future crises, the expected benefit of higher capital requirements would be

$$1\% \cdot \mathrm{LPC} \cdot \frac{1}{1-\delta}$$

per percentage point reduction in the probability of crises, or about 55% of GDP.

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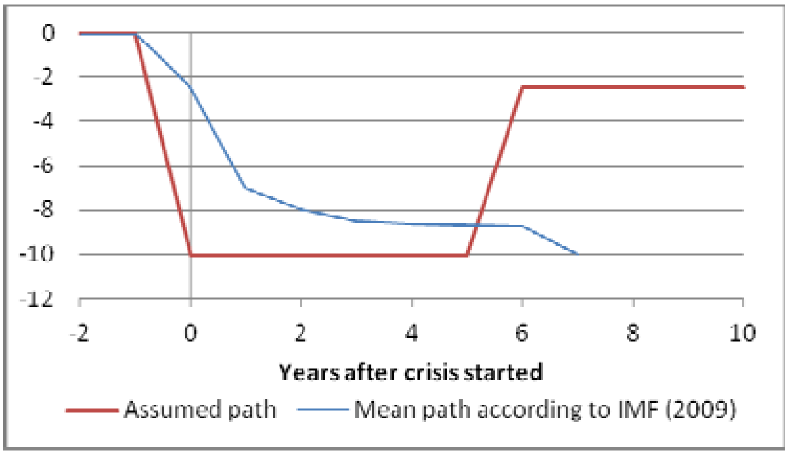
[8] Including other UK banks in the model is unlikely to affect the precision of our estimates materially, because the banks in our sample cover the vast majority of lending to UK households and businesses.

Figure 3

Output paths



5. Lessons for appropriate capital requirements

5.1 A range of appropriate capital requirements

One way of combining the cost and benefit estimates is by comparing the effects of an increase in the capital ratio by 1 percentage point on GDP. Table 1 collects the minimum and the maximum benefits and costs calculated in the illustrative examples and its variations (as discussed in Section 3.3), and adds a column with the average of both to facilitate the comparison. In our approach, the incremental costs of higher capital requirements are independent of the capital ratio, whereas the incremental benefits decrease the higher the capital ratio. We therefore present estimates of the costs and benefits for various capital ratios.

Table 1

Plausible bounds for appropriate capital requirements

	Marginal benefit (% of GDP)			**Marginal cost (% of GDP)**			**Net benefit (% of GDP)**		
Effects of an increase in the capital ratio ...	**low**	**mid**	**high**	**high**	**mid**	**low**	**low-high**	**mid**	**high-low**
from 8% to 9%	192	459	726	–3	–2	–0	189	457	726
from 11% to 12%	4	71	137	–3	–2	–0	1	69	137
from 14% to 15%	+0	3	5	–3	–2	–0	–3	1	5

Even when comparing very pessimistic (low) benefit estimates with pessimistic (high) cost estimates, the results suggest that appropriate capital ratios should be in excess of 11% of risk-weighted assets: at 11%, the benefits (4% of GDP) exceed the costs (3% of GDP). When comparing the midpoints, the results suggest that an appropriate capital ratio might lie in excess of 14% of risk-weighted assets.

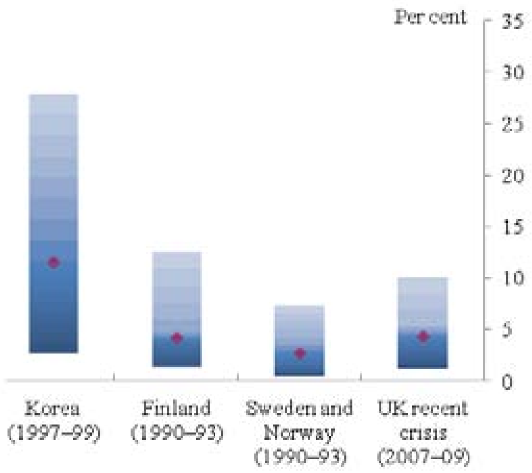
5.2 Banks' losses in past crises

As mentioned previously, the structural approach that we used to assess costs and benefits presents only one of several methods that can be used for a cost-benefit analysis. One way of checking whether our results are broadly sensible is to ask how much capital banks would have needed to survive past crises.

Evidence from such crises suggests that banks typically make losses equivalent to about 5% of risk-weighted assets (Figure 4).[9] But these numbers are likely to be underestimates for several reasons: government support substantially reduces realised losses; there is survivorship bias because losses at failed banks are usually not included; and mark to market losses during the crisis are likely to be substantially higher than the losses that are finally recorded in published accounts.

Figure 4

Cumulative peak losses as a percentage of risk-weighted assets at the start of the crisis



Source: Bank of England (2010).

Finally, the numbers take no account of the fact that additional capital is required to maintain a sufficient amount of lending to the real economy during a downturn. For example, to maintain growth in risk-weighted assets of 8% per year for five years after the start of a crisis, banks would need an additional buffer of about 3% of risk-weighted assets.[10] This back-of-the-envelope calculation suggests that banks would need to hold a capital cushion of about 7–8% above their viability threshold. These figures are broadly consistent with our illustration of our cost-benefit framework.

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9 Figure 4 includes only those banks that incurred losses. Each shaded band shows 5% (between the 5th and 95th percentiles) of the support of the interpolated distribution across banks. The diamond shows the median. Start of crisis defined as a year before a bank incurred a loss (defined as net income after tax and before distributions). UK figures based on the major loss-making UK banks.

10 Over five years, loans would grow by (1 + 0.08) x 5 – 1 = 45% of risk-weighted assets. If 6% of this is funded with capital, the required additional capital is about 3% of risk-weighted assets.

6. Conclusion

Two key insights can be taken from this paper. First, loss-absorbing capital is only a small proportion of banks' balance sheets. Increasing this proportion to 10–15% does not materially affect a bank's average cost of funding in the steady state, even if Modigliani-Miller's theorem does not hold. The second is that the net benefits of higher capitalisation can be substantial.

The estimates are subject to substantial uncertainties, in particular on the benefit side. But insurance against systemic banking crises (in the form of higher capital ratios) appears to be comparatively cheap in steady state, and the cost of crises is large.

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