III.1. Economic impact of changes in capital requirements in the euro-area banking sector

Introduction

The recent financial crisis has shown that highly leveraged financial institutions are insufficiently robust to withstand loan losses and/or write downs of asset values. The systemic risks associated with highly leveraged financial institutions led the Basel Committee on Banking Supervision (BCBS) ([26]) to propose in 2009 that capital requirements (CR) of commercial banks be increased. While higher capital standards make banks more resilient in times of asset losses, this comes possibly at the price of on average higher lending rates if regulation imposes higher funding costs on banks.

These new CR rules have prompted intensive discussions about their possible economic impact. For example, the Institute of International Finance (IIF), which is closely linked to the banking industry, estimates that an increase in capital requirements of 2 pp would reduce GDP in the EU by 4.1% (after 4 years) and increase loan interest rates by 130 bp. Also the BCBS has brought together a group of economists from central banks and international organisations, the Macroeconomic Assessment Group (MAG), to provide an estimate of GDP losses. They come to a very different result and only estimate a GDP loss of 0.3%. This paper presents results from the DG ECFIN's QUEST model and compares them to the results from other studies.

The role of macroprudential policy

A case for macroprudential policy or regulation of banks can be made if shocks originating in the financial sector have large spillover effects onto the rest of the economy. This has indeed happened with the current financial crisis and seems to be a pervasive feature of many financial and banking crises. There is now ample empirical evidence that financial crises are associated with a persistent drop in output. One of the factors that can explain this persistence is that adverse shocks to financial institutions become 'systemic', which means that there are mechanisms which allow shocks, initially only affecting individual banks or segments of the financial market, to spread throughout the financial system and weigh heavily on its capacity to supply loans and thereby on economic growth.

Broadly speaking, two types of market failures can be distinguished: incentive problems and coordination failures. Both types of market failure justify policy intervention, in general because of resulting economic inefficiencies and more particularly with a view to minimise systemic risks. Incentive problems can arise because public insurance policies towards the banking system in the form of (implicit) bail-out guarantees or explicit deposit insurance can lead to excessive risk taking (see Wallace ([27])). Coordination failures can arise because individual banks take insufficiently into account the fact that their balance sheet adjustments drive down asset prices and asset positions of other banks and force them to adjust. While incentive problems can lead to credit booms not justified by market fundamentals and thereby increase macroeconomic adjustment costs, coordination failures lead to unintended spillover effects across the financial system (see Wagner (2010) ([28]) for an overview of systemic externalities in financial markets). Rajan (1994) ([29]) provides an alternative explanation for excessive lending which is not based on moral hazard but rests on short horizons of bank managers who care about their reputation. He shows that they may be inclined to increase the supply of loans in order to conceal losses from bad loans.

Higher capital requirements can in principle deal with these problems. They force banks to internalise potential losses and thereby reduce excessive risk taking. At the same time, higher capital requirements make banks more robust in the event of actual asset losses. For example, the Bank of England (2009) ([30]) estimates that with an initial Tier 1 capital ratio of 8.5% Nordic and Japanese banks could have maintained a ratio of 4% during their banking crisis episodes of the 1990s without additional recapitalisation efforts or government support. Also the stress tests conducted by the Fed for the largest 19 US banks in 2009 suggest that a Tier 1 capital ratio of around 8% would be necessary for these

([26]) BCBS (Basel Committee on Banking Supervision) (2009), 'Strengthening the resilience of the banking sector', consultative document, Basel.

([27]) Kareken, J. H. and N. Wallace (1978), 'Deposit insurance and bank regulation: A partial-equilibrium exposition', *The Journal of Business*, Vol. 51, pp. 413-438.

([28]) Wagner, W. (2010), 'In the quest of systemic externalities: A review of the literature', *CESIfo Economic Studies*, Vol. 56, pp. 96-111.

([29]) Rajan, R. (1994), 'Why bank credit policies fluctuate: A theory and some evidence', *Quarterly Journal of Economics* Vol. 109, pp. 309-441.

([30]) Bank of England (2009), 'The role of macroprudential policy', *Bank of England Discussion Paper*, November 2009.

institutions to survive a deep and protracted economic downturn. It should, however, also be emphasised that tighter capital requirements may by itself not be enough to stabilise the financial system. For example, Shin (2010) ([31]) argues that greater "loss absorbancy" as envisaged by Basel III does not directly address excessive asset growth in booms which results from unstable short term wholesale funding, which makes banks vulnerable to large withdrawals in case risks emerge.

The possible implications of increased capital requirements (in normal times)

Increasing capital requirements induces banks to shift liabilities from debt (deposits) to bank equity. This can affect costs for banks in opposite directions. Keeping the rate of return on bank equity (ROE) and the deposit rate unchanged, an increase in capital requirements increases funding costs for banks because the ROE is substantially larger than the interest rate banks are paying for deposits. The cost-increasing composition effect is mitigated by a fall in banks' demand for deposits as equity partly replaces deposits in banks liabilities. This causes deposit rates to decline, depending on the interest elasticity of the supply of deposits of households to banks.

The major controversy is about the effect of higher CR on the ROE. While banks argue that higher capital requirements would likely be accompanied by an increase in ROE (see IIF (2009)) ([32]), the dominant view in the academic literature seems to be that an increase in CR is likely to be associated with a decline in ROE. For example, Admati et al. (2010) ([33]) argue that increased capital requirements would not increase funding costs for banks at all, i.e. the ROE would fall to fully compensate the composition effect. Their reasoning is based on the Modigliani-Miller (1958) theorem (M-M).

Modigliani and Miller acknowledge that there is a return differential between ROE and the interest rate on other bank debt because bank equity is more risky. However, increasing the capital requirement keeps the total risk, which is related to bank's asset returns, unchanged. ([34]) If risk is priced correctly, the risk per share will decline such that total funding costs of banks remain unchanged. Though M-M only holds under a certain set of conditions, Kashyap et al. (2010) ([35]) provide empirical evidence that there is a link between leverage and ROE for a panel of large banks.

In contrast, the banking industry (see IIF ([36])) argues that, because of frictions, it is costly for banks to raise a large amount of equity over a short period of time. There is some research which suggests that there may indeed be adverse selection problems and other frictions (see Myers and Majluf (1984)) ([37]) which make it difficult to raise new equity instead of accumulating it via retained earnings.

As a compromise between these two opposing views and taking into account that a long transition period is granted to banks in order to allow them to use retained earnings as a means of raising capital standards, in this analysis it is assumed that the bank equity premium remains unchanged. This is also the assumption made in the MAG study.

Table III.1.1: **Transition and long-run effects of a 1 pp increase in capital requirements in the euro area (% deviation from baseline)**

	Year 1	Year 4	Year 8	Long term	MAG* Year 4	IIF** Year 4
GDP	-0.05	-0.10	-0.15	-0.36	-0.16	-2.1
Investment	-1.12	-1.23	-1.15	-0.86	-	-
Consumption	0.18	0.13	0.03	-0.36	-	-
Loans	-0.10	-0.40	-0.52	-0.89	-	-
Deposit rate	-3.00	-9.95	-11.00	-10.25	-	-
ROE	-1.00	-2.26	-2.00	0.00	-	-
Loan rate	-1.00	10.49	12.00	12.66	-	-

* unweighted median path across 97 models
** the results are linearly scaled to a 1pp increase

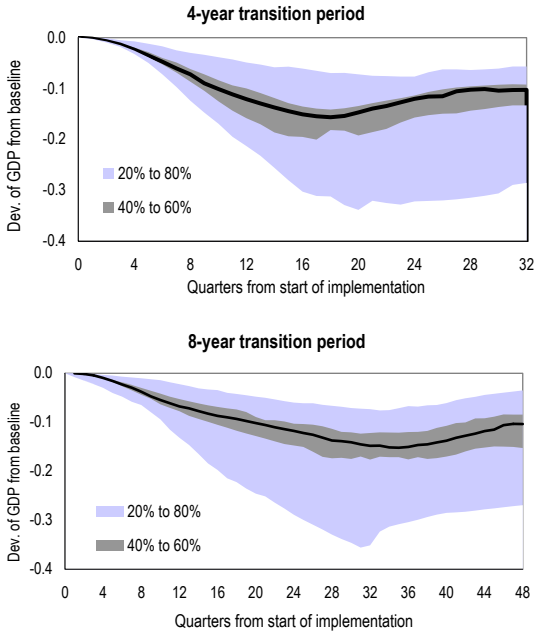
(1) The table shows pp deviations from baseline levels for GDP, investment, consumption and loans and basis point deviations from baseline for the deposit rate, ROE and loan rate.
Source: QUEST simulations, BCBS, IIF.

Table III.1.1 shows the effect of increasing capital requirements for euro-area commercial banks by 1 pp according to DG ECFIN's QUEST

([31]) H.S. Shin (2010), 'Macroprudential policies beyond Basel III', Policy Memo, Princeton University.
([32]) Institute of International Finance (IIF) (2009), 'Interim report on the cumulative impact of proposed changes in the banking regulatory framework'.
([33]) Admati, A. R., P. M. DeMarzo, M. F. Hellwig and P. Pfleiderer (2010), 'Fallacies, irrelevant facts, and myths in discussion of capital regulation: Why bank equity is not expensive', *Stanford GSB Research paper*, No 2065.
([34]) Risk could even decline if banks internalise losses more strongly with higher capital requirements and refrain from excessive risk taking.
([35]) Kashyap, A. K, J. C. Stein and S. Hanson (2010),'An analysis of substantially heightened capital requirements on large financial institutions', Mimeo.
([36]) Institute of International Finance (IIF) (2009), op. cit.
([37]) Myers, S. C. and N. Majluf (1984), 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics*, No 13, pp. 187-222.

simulations (see also Box III.1.1 for a description of the model used). This reduces the level of GDP by about in the range between 0.14 and 0.15% after 8 years, depending on the transition period. The composition effect dominates the deposit rate effect, leading to an increase in marginal funding costs for banks. This is shifted onto the loan rate, which increases by about 12 bp. Because deposit rates decline, the spread between the loan interest rate and the deposit rate increases by about 22 bp. The impact on the overall economy runs mainly via investment and to a lesser extent consumption. Firms, expecting permanently higher capital costs, reduce investment in order to adjust to a lower capital output ratio. This is only partly offset by a modest positive effect on private consumption of a fall in deposit interest rates. Longer transition periods slow down the increase in lending rates and allow a smoother adjustment of investment. According to these estimates, extending the transition period from 4 to 8 years reduces the GDP losses over the first 10 years by roughly 20%. These effects are close to the policy impacts found in the MAG study (also shown in the table).

Graph III.1.1: **MAG Results for a 1 pp increase in capital requirements (% deviation from baseline)**



Source: BCBS (2010a)

As an element of comparison, Graph III.1.1 shows the distribution of the GDP impact over all 97 models used in the MAG study ([38]) for a 4- and 8-year transition period respectively, by giving the 20% and 60% confidence interval. With 8 years, the level of GDP is likely to decline by about 0.15% after 36 quarters and will recover to -0.1% after 48 quarters. With 4-years of transition the GDP losses are slightly higher, because in a shorter time span it is more costly for banks to raise new capital and for borrowers to adjust to alternative modes of finance. The graph shows GDP effects from averaging country-specific results. The IMF used the country-specific results and calculated the total GDP loss taking into account country spillovers. Such international spillover effects increase the negative impact by 0.02%.

These results can be used to calculate the GDP effect of Basel III taking into account the global capital shortfall. In the Quantitative Impact Study (QIS) ([39]), the Basel Committee estimated that the ratio of Tier 1 capital to total assets was 5.7% at the end of 2009. ([40]) Under Basel III a minimum common equity ratio of 4.5% is envisaged, augmented by a capital conservation buffer of 2.5%, yielding a total Tier 1 capital ratio of 7% at the end of the transition period. This implies that banks have to raise the capital ratio globally on average by 1.3 percentage points.

Sensitivity analysis

The various studies presented by academic economists, policy institutions and commercial banks differ strongly concerning the assumptions made about the impact of the regulatory reform on ROE. While academic economists tend to assume that the ROE will fall, banks fear an increase in the ROE. Indeed, the study presented by the IIF assumes an increase in the ROE in the range between 200 and 400 BP (for a 2 pp increase in CR).

Another concern sometimes voiced in policy discussions is a possible stronger impact of the reform on euro-area GDP because the non-financial sector in Europe relies more heavily on loan financing. For example, the share of loans of the non-financial sector in GDP is about 1.3% in

([38]) Basel Committee on Banking Supervision (BCBS) (2010a) (MAG Report), 'The aggregate impact of the transition to stronger capital and liquidity requirements', Basel August.

([39]) Basel Committee on Banking Supervision (BCBS) (2010b) (LEI Report), 'An assessment of the long-term impact of stronger capital and liquidity requirements', Basel August.

([40]) The EU QIS estimates 5.6% as an average for group 1 banks in BE, FR, DE, IE, IT, NL, PT, ES, SE, and the UK using the new Basel III definitions.

Box III.1.1: **The QUEST model with a financial sector**

The QUEST model with a financial sector is a modified version of a standard closed economy DSGE model to which a banking sector with bank capital has been added. In order to allow for a meaningful financial intermediation function of banks the household sector is disaggregated into savers and borrowers (entrepreneurs). In order to allow for interbank lending and borrowing the banking sector is split up into 'savings' and 'investment' banks. Savings banks collect deposits from households, and only lend to investment banks in the interbank market. Investment banks can borrow from households in the form of deposits or from savings banks. Investment banks provide loans to entrepreneurs.

Savers:
In line with van den Heuvel (2008) ([1]), it is assumed that savers maximise an intertemporal utility function with consumption, liquidity services provided by deposits and leisure as arguments. Savers can hold wealth in the form of either government bonds, bank deposits or bank equity and receive interest income from bonds and deposits and dividends. Savers require a constant equity premium on bank stocks. Savers also offer labour services to entrepreneurs and receive wage income.

Entrepreneurs:
Entrepreneurs maximise an intertemporal utility function over entrepreneurial consumption, subject to an intertemporal budget constraint, a capital accumulation constraint and a collateral constraint. They combine capital and labour and produce output using a Cobb Douglas production function. In order to ensure a positive share of loans in the balance sheet of entrepreneurs it is assumed that they have a higher rate of time preference. In this case solvency of entrepreneurs requires that banks restrict lending by imposing a collateral constraint. This specification closely follows Kiyotaki and Moore (1997) ([2]).

Banks:
Banks provide loans to entrepreneurs and take deposits from saver households. They maximise the present discounted value of dividends which are paid to the household sector subject to a capital and liquidity requirement constraint. The capital requirement demands from banks that the ratio of deposits to loans should not exceed a certain target ratio, otherwise the bank will be penalised ([3]). Banks are required to hold liquid assets as a fixed share of loans. This imposes an opportunity cost for banks since liquid assets (government bonds and cash) yield a lower return. Banks can increase capital either by issuing new shares or via retained earnings.

Calibration

In order to analyse the transition from a pre-crisis and pre-reform steady state to a post-crisis and post-reform steady state, the model's pre-crisis capital ratio is calibrated using data from 2006. Calculations by the BIS, using an eight euro-area country aggregate balance sheet (for AT, BE, FI, FR, DE, IT, NL, ES) ([4]) suggest a ratio of capital and reserves to total assets of 5%. Again, following BIS calculations, concerning liquidity, it is assumed that banks hold 13% of their assets in the form of cash or liquid assets. About 10% of all liquid assets are held in the form of cash or central bank balances. About 20% of all bank assets are interbank deposits. Concerning aggregate lending of banks to the non-financial private sector the model must replicate a loan-to-GDP ratio of about 1.3. The interest data are from the ECB: 2006 figures suggest a loan interest rate of 6.1%, a deposit rate of 2.7% an interbank rate of 3.5% and a return on bank equity of 14.3%.

The interest semi-elasticity of the supply of deposits of households (ISED) is a crucial parameter for this exercise, since it determines by how much deposit rates will fall if the demand for deposits by banks declines. A value of 10 is assumed, which is at the upper end of existing estimates (see for example Ball (2001) ([5]) and Dedola et al. (2001)) ([6]). A high semi-elasticity parameter reduces the decline of the deposit rate and therefore increases the cost effect of an increase in capital requirements.

([1]) Van den Heuvel, S. J. (2008), 'The welfare cost of bank capital requirements', *Journal of Monetary Economics*, Vol. 55, pp. 298-320.
([2]) Kiyotaki, N. and J. Moore (1997), 'Credit cycles', *Journal of Political Economy*, Vol. 105, pp. 211-248.
([3]) There is a quadratic cost of deviating from the target.
([4]) ECB bank balance sheet data suggest a ratio of around 6% for the same period.
([5]) Ball, L. (2002), 'Short run money demand', *University of Maryland*, Mimeo.
([6]) Dedola, L., E. Gaiotti and L. Silipo (2001), 'Money demand in the euro area: do national differences matter?', *Banca d'Italia Working Paper*, No 405.

Europe and only 0.5% in the US. As can be seen from Table III.1.2, with a loan-to-GDP ratio as low as that in the US, the long-run impact of higher CR could be reduced in absolute terms from -0.36% to -0.19%. The table also shows the sensitivity of the long-run impact with respect to variations in the ROE. In the event of a permanent increase of 50 bp, the negative long-run GDP effect could be around -0.6%, while the GDP loss would be negligible if, as expected by Modigliani Miller, the ROE were to decline.

Table III.1.2: **Long-run GDP effects of a 1 pp increase in CR**

(1) Standard specification	-0.36
(2) US Share of loans in GDP (around 50%)	-0.19
(3) Larger/smaller equity risk premium (+50bp/-50bp)	-0.58 / -0.14

Source: Commission services – QUEST Simulations.

Volatility

Unfortunately, with the macro models currently available it is not possible to fully account for behavioural changes of financial market participants, especially regarding their attitude towards risk taking. Therefore, it is not possible to adequately measure what is probably the most important benefit of the regulatory reform, i.e. reduced risk taking by banks. The results reported below only show the impact of higher capital requirements on the volatility of GDP (measured by the unconditional standard deviation of GDP) under the assumption that attitudes towards risk do not change.

Table III.1.3: **Capital requirements and volatility of GDP**

	QUEST	Other models for the euro area (*)
2pp	-1.9	-2.8
4pp	-3.9	-5.4
6pp	-5.0	-7.7

* see Table 5 of Angelini et al. (2010)

Source: Commission Services.

The results reported in Table III.1.3, are based on stochastic simulations with shocks to supply (TFP), demand (government expenditure) and monetary policy. The results show that increasing CR reduces the volatility of GDP. The variance of GDP is reduced slightly less than proportionally to the increase in CR. These results are in line with other results used in the long-term economic impact study (Angelini et al. (2010)). ([41])

These results refer to a reduction of GDP volatility in normal times, they do not refer to possible gains associated with reducing the likelihood of financial crises. A recent BoE study (Miles et al. (2011) ([42])) provides a rough estimate of possible GDP gains taking into account the typical losses from financial crises. As shown by various empirical studies, financial crises are associated with GDP losses of about 10%. Assuming that about a quarter of these losses are permanent and using a discount rate of 2.5% p. a. the permanent GDP loss of one financial crisis is about 140% of one year's GDP. If higher regulation would reduce the likelihood of all financial crises in the future by 1% and applying the same discount rate, the gain from regulation would be 55% of one year's GDP. This benefit can be compared to the permanent GDP reduction due to regulation which we estimate to 0.36%. The present discounted value of this permanent GDP loss amounts to about 14% of one year's GDP, if one applies the same discount rate. Thus, the permanent GDP gain from financial market regulation could be substantial.

Conclusions

This section presents an analysis of the costs of increased capital requirements for banks, using a DSGE model with a banking sector and bank capital. An inherent degree of uncertainty surrounds these estimates, stemming principally from the ambiguous response of the return on equity, although on balance it appears reasonable to expect no large impact. Results are in line with those used in the MAG study. According to these results, banks will shift the cost of tighter regulation onto borrowers in the form of higher interest rates. The model stresses two mitigating factors. First, a reduction in deposit rates, which partly offsets the cost increase implied by higher capital requirements, and second, a move towards higher rates of self-financing.

The paper also finds that higher capital adequacy brings potential benefits in terms of lower GDP volatility, a slightly lower estimated level of GDP in this scenario notwithstanding. However, the

([41]) Angelini, P., L. Clerc, V. Cúrdia, L. Gambacorta, A. Gerali, A. Locarno, R. Motto, W. Roeger, S. Van den Heuvel and J. Vlček (2010), 'BASEL III: Long-term impact on economic performance and fluctuations', *BIS Working Papers*, No 338.

([42]) Miles, D., J. Yang, G. Marcheggiano (2011), 'Optimal bank capital', *Bank of England Discussion Paper*, No 31, January 2011.

GDP losses in normal times, due to regulation must be seen in relation to permanent GDP losses from financial crises. Estimates taking this into account yield substantial net social benefits. However, research on crisis prevention due to regulation is still at its infancy and more work is needed in order to come up with more precise estimates concerning the extent in which the risk of large financial crises can be reduced by more stringent financial market regulation. For this task, current macro models still need to be improved in order to adequately address possible excessive risk taking of banks in the presence of limited liability.