OXFORD ECONOMICS

Analyzing the impact of bank capital and liquidity regulations on US economic growth

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Contents

Executive Summary

- In the aftermath of the global financial crisis of 2007-2009 and following the collapse of several major financial institutions around the world, there have been proposals for a major reform of the regulatory framework applicable to financial institutions in order to reduce the risks of financial instability. These reform efforts have proceeded at both the international level, under the auspices of the Basel Committee on Banking Supervision (Basel Committee), and also at a national level, for example through the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act or DFA) in the US. Over the last several years, there have been many proposed changes in the regulation of banks including increased capital requirements, new liquidity standards, and restrictions on the trading activities of banks. This report focuses on the potential impact of the Basel III capital and liquidity regulations proposed in December 2010.
- These and other regulatory proposals have in turn generated considerable literature devoted to estimating the effects of new regulations *on the cost of credit and on economic growth*. However, these studies differ markedly in their estimated impacts, with some studies estimating only modest decreases in GDP of a few tenths of a percentage point while others estimate losses in GDP of up to several percentage points.
- The differences in results across these studies depend on a range of factors including the assumptions on the amount of additional capital and/or liquid assets required by banks, the behaviour of funding costs for banks (debt and equity) due to capital raising efforts, and the size of capital 'buffers' that banks will hold above the regulatory minimum for several reasons including the avoidance of sanctions applicable to banks that fall below the regulatory minimum (which could be triggered by normal volatility or unexpected shocks) and satisfying the expectations of investors and credit rating agencies.
- We identify three main channels by which regulations may impact bank behaviour and the economy. Increased capital levels may push up the cost of bank credit (bank lending rates); a requirement to hold more liquid assets may also raise the cost of bank credit; and a shrinking of risk-weighted assets (RWA) by banks to try to meet higher minimum capital ratios may lead to a rationing of the quantity of credit or increase the cost of credit as other credit providers may require higher rates to hold the assets.
- Using a standard methodology and by varying key assumptions, we demonstrate that bank lending rates to their customers increase by 0.2 percentage points under the 'best case' scenario or by as much as 2 percentage points under the 'worst case' scenario due to the new Basel III capital and liquidity requirements.

- In comparison, similar studies[1] of the impact of regulatory effects estimate an increase in lending rates consistent with the lower end of the range found in our analysis. In our view the assumptions underlying some of these studies, and therefore their estimates of the impact on lending rates, are overly optimistic and we believe that a rise in bank lending rates of 0.9-1.3 percentage points is more likely. As a consequence, we can conclude that the estimated decreases in GDP reported in these studies are understated.
- We are particularly sceptical of the assumption made in some studies that banks may reduce the capital 'buffers' they hold above the regulatory minimums, thereby limiting the impact of the new minimums. This is especially the case in the US, where substantial buffers may be required to prevent banks from failing the Federal Reserve's stress tests and supervisory mechanism for assessing capital adequacy, known as the Comprehensive Capital Analysis and Review (CCAR). Moreover the buffers may increase if the US adopts the Basel III treatment of unrealized gains and losses on available for sale securities and defined benefit pension obligations[2].
- We estimate that a 1 percentage point rise in the common equity Tier 1 capital (CET1) capital ratio raises US lending rates by around 15 basis points (bps)[3]. Using the Oxford Global Economic Model[4] over a nine year forecast horizon to translate our estimates of increases in lending rates into effects on US GDP, we find that a 1 percentage point rise in the CET1 ratio for banks translates into a 0.14% decrease in the level of GDP. A simple modelling exercise raising the CET1 ratio from an in initial 6% to 10% would cut GDP by 0.6% compared to baseline, while a rise in the CET1 ratio from 6% to 16% would cut GDP by 1.4%.
- The economic impact of higher capital requirements is modified if other assumptions are also made concerning for example the required rate of return on bank equity, debt costs and the effect of new liquidity regulations. In our 'best case' scenario where bank lending rates rise by only around 0.2 percentage points, GDP falls by 0.2% compared to its baseline level. In our 'worst case' scenario featuring a rise in bank lending rates of over 2 percentage points, GDP falls by around 2%. 'Middle' scenarios yield a GDP drop in the range of 0.8% to 1.2%. In real dollar terms this implies GDP would be around US$30billion lower after nine years compared to baseline in the 'best case' scenario, US$120-180 billion lower in the 'middle' scenarios and US$300 billion lower in the worst case scenario. Unemployment would be around 100,000 persons higher in our 'best case' compared to the baseline, 400,000 to 600,000 higher in 'middle' scenarios and almost 1 million higher in our 'worst case' scenario.

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[1] For example Elliot et al. (IMF) 2012, BIS/MAG 2011, Slovik & Cournede (OECD) 2011, and Miles et al. (Bank of England) 2011.

[2] See further discussion at Section 3.1 and footnote 23.

[3] All references to lending rates and GDP herein relate to the United States.

[4] For further information regarding Oxford Economics and the Oxford Global Economic Model please see the Appendix.

- These results can be further modified by altering key modelling assumptions. Allowing for an accommodative monetary policy to cushion the rise in bank lending rates reduces the negative impact on growth – but only later in the forecast horizon given that US interest rates are close to zero even in the baseline during the early years of the forecast horizon.
- If we shorten the period in which regulations are introduced, the decline in GDP is significantly greater and the cushioning effects of the accommodative monetary policy on lending rates and GDP are relatively smaller. In a case where the CET1 ratio is required by regulations to rise by 5 percentage points, and the transition to the new ratio takes place over nine years, the decline in GDP is 0.3% after four years. If the transition period is shortened to five years, the decline in GDP after four years is double this at 0.6%. This result is important as arguably banks will try to meet Basel III minimum capital and liquidity regulations ahead of the official effective dates given that they are already being assessed by financial markets on the basis of how they perform against Basel III benchmarks.
- We further estimate the impact of banks trying to meet the new regulatory capital requirements (i.e., minimum CET1 ratio) by reducing RWA rather than by raising new capital. We find that the macroeconomic impact of RWA reduction would be much more severe – even meeting a relatively modest rise in the CET1 ratio by cutting RWA would imply a drastic cutback in RWA and thus bank lending to the economy.
- This remains true even after we allow for some substitution of non-bank sources of credit for the decreases in credit availability from banks as they deleverage in an effort to reduce balance sheet size and RWA. Full substitution of non-bank credit for bank credit appears unlikely as the scale of the increase in non-bank finance needed to meet the shortfall appears to be implausibly large. For example, to fully offset the lost bank loans implied by a 40% fall in RWA corporate issuance of US$3.6 trillion, or over 30% of outstanding corporate debt, would be required. This form of finance would also not be available for some classes of borrowers.
- Assuming only partial substitution of non-bank for bank financing, then even a modest increase in the CET1 ratio of 3 percentage points to meet the new regulatory capital standards results in a decline in GDP by over 2% if banks shrink their RWA to meet the required increase in the capital ratio.
- Overall, our results highlight the uncertainty around the potential macroeconomic effects of regulatory reform proposals for banks, and illustrate the need for such proposals to be carefully structured and calibrated to prevent unnecessary damage to economic growth.

Summary table of bank lending rates and GDP effects in different scenarios and comparison with other studies

	Rise in bank lending rates, % points	Decline in GDP level %
'Best case scenario'	0.2	-0.2
'Middle scenarios'	0.9-1.3	-0.8 to -1.2
'Worst case scenario'	2.1	-1.9
Other studies:		
Elliot et al. (IMF) 2012	*0.3*	*n/a*
IIF (2011)	*4.7*	*-2.7*
Slovik & Cournede (OECD) 2011	*0.6*	*-0.6*
BIS 2011	*0.7*	*-0.5*
MAG 2011	*0.2*	*-0.2*
Miles et al. (BoE) 2011	*0.4*	*-0.3*

Source: Oxford Economics. GDP results assume no monetary policy response or scaling for non-bank credit (see Section 4). For more information see Tables 2.2 and 3.2, plus Section 4.2.

1 Introduction

The global financial crisis of 2007-2009 was a watershed event for the financial services industry. This period not only featured a deep recession in the major industrialised economies but also the collapse of a number of major financial institutions and severe strains on many others. The pressure on the financial systems of the major economies led to major government interventions in the economy, including massive liquidity support by central banks in some cases, particularly in Europe, and the use of substantial sums of taxpayer funds to recapitalise financial institutions.

This intervention was soon followed by a series of proposals for new regulations for the financial services industry and in particular the banking industry. The expressed aim of these new proposals was to make the industry 'safer', thereby reducing the risks in the future of a repeat of the 2007-2009 crisis.

These proposals have been generated at both the international and national levels. At the international level, the main source of new regulations has been the Basel III proposals[5], focusing primarily on bank capital and liquidity rules. At the national level, there have been proposals targeted at these areas but also encompassing issues such as structural changes to banking, consumer protection, stress testing, and changes in crisis resolution regimes. In the US, national actions have included the Dodd-Frank Act, the so-called 'Volcker Rule' and the CCAR and DFA stress testing regimes[6].

These proposals have in turn spawned considerable literature on the possible effects of new financial sector regulations on the lending behaviour of banks and on economic growth. The conclusions of these studies vary widely, with the literature broadly splitting into two main groups: 'official' studies of the impact by organisations such as the International Monetary Fund (IMF), Organization for Economic Co-operation and Development (OECD) and Bank for International Settlements (BIS), and studies undertaken by groups linked to the financial industry, such as the Institute for International Finance (IIF). Generally speaking the 'official' studies tend to show modest impacts of new regulations on lending and growth while the industry-connected studies show somewhat larger effects.

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[5] See Basel Committee on Banking Supervision, "Basel III: A Global Regulatory Framework for more resilient banks and banking systems," December 2010 and Basel Committee on Banking Supervision, "Basel III: International framework for liquidity risk measurement, standards and monitoring," December 2010.

[6] The Dodd-Frank Act (signed July 2011) covers areas including reform of derivatives trading, consumer protection, a resolution regime for financial crises and consolidation of regulatory agencies. The Volcker Rule, added in 2010, restricts banks from trading on their own account. The CCAR and DFA stress tests are tools used by the Federal Reserve to ensure that financial institutions have robust capital planning processes and adequate capital when stressed against severe adverse economic scenarios.

These differences result mostly from key differences in the assumptions underlying the effect of regulatory changes on bank behaviour and the cost of credit, with some differences also due to varied methodological techniques adopted (e.g., whether the studies use an economic model to estimate output effects).

In this report we aim firstly to identify what the key assumptions are that can generate the wide variety of results seen in the literature, by examining a number of important studies. We then make our own estimates of the likely impact of a subset of the new regulations, focusing on the Basel III capital and liquidity standards proposed in 2010[7] in the context of the US economy and financial system. These estimates involve using the Oxford Global Economic Model, one of the most widely used private sector macroeconometric models[8].

The rest of this report is organised as follows. Section 2 looks at a number of key studies of the effects of financial regulation and examines the differences between them which lead to such widely varying results. Section 3 estimates the possible impact of new regulations on lending behaviour by banks, illustrating how varying key assumptions can produce very different results. Section 4 estimates the possible effects of regulatory changes on US GDP under a number of different assumptions. It also contrasts the impact on GDP of adjustment to regulatory changes via movements in lending rates with that of adjustment based on reductions in banks' RWA. Section 5 contains the report's conclusions.

[7] This follows the approach taken by other studies; we have not in this report looked at the country-specific applications of the Basel III rules (which may vary) but at the rules as generally proposed.

[8] Further information regarding the Oxford Model can be found in the Appendix.

2 Review of existing studies

2.1 Overview

Studying the literature on the effects of bank regulations on bank lending rates and economic growth makes it clear that the calculation of costs (and also the potential benefits) of regulations has 'many moving parts', allowing considerable scope for results to vary based on different assumptions. The results are especially sensitive to a few key assumptions such as: how the cost of equity and debt funding behaves in response to banks' efforts to raise more capital; what is defined as the starting point from which the effects of regulation on bank capital raising are calculated; the size of assumed capital buffers that banks hold above the regulatory minimum; the size of extra liquidity requirements and the scope for banks to reduce other costs to offset potentially increased costs of funding.

This section reviews the potential effects of bank regulation with reference to five key studies – the IMF study of Elliot et al. (2012), the study by the IIF (2011), the OECD study of Slovik & Cournede (2011), the BIS/MAG studies (2011) and the Bank of England study of Miles et al. (2011). Four of these studies may be considered 'official' efforts (i.e., from international regulatory and financial organisations) while the IIF study is from an organisation representing global financial institutions.

We have identified three main channels by which new regulations may impact bank behaviour and the economy:

- Increased capital levels may push up the cost of bank credit (bank lending rates);
- Regulations on liquid asset holdings may also raise the cost of bank credit; and
- A shrinking of RWA by banks to try to meet higher minimum regulatory capital ratios may lead to a rationing of the quantity of credit or put upward pressure on spreads for credit market debt.

The studies we have reviewed explore these different channels of potential impact to a varying degree and also use widely varying assumptions when examining the potential effects through these channels – especially in the case of analysing the effect on lending rates of a rise in minimum levels of regulatory capital.

2.2 The Loan Pricing Model

A good starting point for examining why the estimated impacts on bank lending behaviour and growth vary so widely is an examination of the 'loan pricing

model' that underlies much of the literature[9]. The precise form of this model varies from study to study but the basic shape is common and its structure allows us to identify some of the key potential drivers of the results of the studies.

The model structure below comes from the IMF study by Elliot et al. (2012), and takes the form

$$L*(1-t) >= (E*r_e)+((D*r_d)+C+A-O)*(1-t)$$

Where L = bank lending rate, t = tax rate, E=share of equity in funding, r_e = required rate of return on equity (cost of equity for the bank), D=debt & deposit share of funding, r_d = interest rate on debt and deposits, C=credit spread (based on expected losses), A=administrative and other expenses for loan, and O=other items.

Essentially this formulation means that the rate of interest charged on a loan needs to (i) cover the bank's cost of capital and funding, (ii) cover expected losses, and (iii) meet other expenses (including remuneration).

Changes to regulations have the potential to shift several variables in this formula. The commonly adopted modelling approach is to set initial values for the variables in the formula based on historic data or norms plus some assumptions. Regulation-driven changes are introduced (e.g., shifting the equity share of total funding) and actions by banks offsetting these changes are then assumed, including raising lending spreads.

A simple example would be a regulation that would involve a rise in the equity share of funding (E) and a corresponding drop in the debt share (D). If the cost of these two forms of funding was the same, such a shift should have no impact on the weighted cost of funding faced by the bank. However, it is generally assumed that equity funding is more expensive, so that, other things equal, a shift towards more equity funding will raise the weighted cost of funding. If no other variables shift, this would in turn imply a rise in the equilibrium loan rate (L). However, a glance at the formula above shows that there is scope for this simple pass-through effect to be altered if other variables do shift. Upward pressure on loan rates might be reduced if the cost of equity and debt were to fall, if credit spreads were compressed, or if other expenses were reduced. Alternatively, the upward pressure on loan rates might be amplified if the cost of debt and equity, or other costs, were to rise as a result of new regulations.

One factor often discussed in the literature in relation to how shifts in the equity and debt shares of funding might impact lending rates is the 'Modigliani-Miller' (M-M) effect. This derives from theoretical literature[10] which argues that the cost of funding of a firm should not change if the structure of that funding shifts

[9] Versions of the loan pricing model are used for example in Elliot et al. (2012), Slovik & Cournede (2011), and IIF (2011).

[10] Modigliani, F.; Miller, M. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment" *American Economic Review* 48 (3): 261–297.

between debt and equity. Following the M-M theory, some of the studies on bank regulation argue that increased regulatory capital requirements for banks will lower the cost of their financing (by making the banks 'safer') and thus offset some or even all of the upward pressure on funding costs and lending rates from regulatory changes.

There are a number of reasons why this theory may not hold with respect to banks. In particular, the idealised theoretical conditions required by the M-M theory (i.e., no taxes, no bankruptcy or agency costs and no asymmetric information) are unlikely to exist in the real world. In addition, the tax treatment of debt and equity financing is generally not the same, with the former usually more advantageous from a net income perspective. This implies that a shift toward more equity financing will tend to increase the weighted after-tax cost of funds faced by a bank[11].

Assumptions as to the scale of M-M effects are one of the key factors generating different results and vary considerably across different studies of changes in bank regulation. In the sections below, we examine in more detail five important studies and illustrate the importance of this and other key assumptions in generating the results of the studies.

2.3 Other channels – liquidity and shrinking of assets

The loan pricing model discussed above is a useful way to calibrate how a change in banks' funding mix due to increased capital requirements could affect the interest rates charged by banks for loans. But there are also two other channels we may identify by which regulatory changes could affect the economy that merit evaluation.

The first of these is liquidity regulations. The Basel III accord has proposed two new liquidity requirements for banks, the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR)[12], which are aimed at ensuring banks have sufficient liquid assets to withstand the kind of 'freeze' in funding markets seen

[11] For more on whether the M-M effect is relevant to banks, see D.Elliot "Higher Bank Capital Requirements Would Come at a Price" Brookings Paper 20 February 2012 available at www.brookings.edu. Among other arguments, Elliot notes that information asymmetries between banks and investors may increase the cost of raising new capital, especially when large amounts of new capital are needed. He also argues that investors may be slow to perceive any change in the 'safety' of banks as a result of capital raising, so that debt and equity costs do not fall as the M-M theory would argue they should.

[12] Recent discussions relating to the liquidity requirements under Basel III have suggested the NSFR may be delayed. See for example the speech by Stefan Ingves, Chairman of the Basel Committee on 12 March 2013 "Where to next? Priorities and themes for the Basel Committee" http://www.bis.org/review/r130312a.pdf. Changes to the LCR were also proposed in January 2013. In this report, however, we have proceeded on the basis that the NSFR and the LCR come into force as originally planned (i.e., in December 2010).

during the global financial crisis of 2007-2009 and reducing the risks associated with excessive mismatches between assets and liabilities[13].

In practice, what these new requirements demand is that banks undertake some combination of an increase in the length of their liabilities, a shortening of the maturity of their assets and a switch to higher quality assets, such that their LCR and NSFR ratios are greater than or equal to 100%. Banks may also meet these requirements by raising capital (which tends to have long or perpetual maturity) to replace short-term liabilities, which highlights the interplay between the capital and liquidity regulations.

Taking any of these actions will tend to reduce bank profits (and therefore increases to capital levels through retained earnings) because (i) longer-term liabilities tend to be more expensive than shorter-term liabilities, (ii) shorter-term assets yield less than longer-term assets, and (iii) higher quality assets tend to yield less than riskier assets. In response, a bank might choose to raise the interest rates charged on loans in an effort to restore (or maintain) profitability. In this case liquidity regulations may add to the upward pressure on bank lending rates that are created by increased minimum capital ratios.

The second alternative channel is through reductions in RWA. If banks are faced with the need to raise their ratios of regulatory capital to risk-weighted assets, they can either take measures that impact the numerator or the denominator of this ratio (or indeed both). To decrease its denominator, a bank would need to reduce the size of its RWA, either by reducing the whole of the asset side of its balance sheet or by shifting its composition from riskier assets towards lower risk assets. Such a move would imply a quantitative restriction on bank credit which would, be likely to impact the economy negatively through weaker consumption and investment.

2.4 Literature review – five key studies

2.4.1 IMF – Elliot, Salloy & Santos (2012)

The IMF study by Elliot et al. (2012)[14] looks at the US, Europe and Japan and considers a range of reforms including changes to capital and liquidity requirements and changes to derivative regulations, taxes and fees. The time horizon chosen in this study is a long-term one, so that only the final impact of regulations is considered, with no modelling of the transition period to new regulatory standards. The methodology used is relatively simple; a version of the loan pricing model (as described above) is used to gauge the effects of regulatory changes on the cost of credit, but no attempt is made to map these changes in credit costs on to changes in GDP.

[13] For more information on these ratios please see the Appendix.

[14] D. Elliott, S. Salloy & A.O. Santos, "Assessing the Cost of Financial Regulation", IMF Working Paper WP/12/233 (2012).

The results show rather modest increases in lending rates as a result of regulatory changes, with lending rates estimated to rise by 28 bps or 0.28% in the US, 18 bps in Europe and 8 bps in Japan. These results are broadly in line with those reported by other 'official' studies.

A number of key assumptions underlie these results –

Banks are assumed to target a minimum capital ratio of 10%. This ratio is defined as the level of CET1 to RWA. Under the Basel III rules, the CET1 ratio is set to rise from a previous effective minimum of 2% to 4.5% by 2015, with a further increase to 7% by 2019 as a 2.5% 'capital conservation buffer' is added. Elliot et al. therefore assume a target capital ratio 3 percentage points above the new minimum by 2019. However, this 3% buffer represents not only a discretionary element banks choose to hold but also makes some allowance for the possible SIFI surcharge (for large, systemically important financial institutions), which is also envisioned by the Basel III framework.

A target required return on equity (RROE) of 12% is accepted by investors[15]. This compares with a 15% average over the last fifteen years. Essentially, Elliot et al. are assuming that investors will settle for lower returns from bank equity than in the recent past.

The M-M effect operates. Elliot et al. assume that the M-M effect (as described on pp 7-8 above) reduces the impact of higher capital requirements on bank lending rates by 50%. That is, they do not assume that bank funding costs are unaffected by changes in the funding structure (as the pure theory would suggest) but do assume that banks being 'safer' in the new regulatory regime reduces their funding costs significantly[16].

Banks are assumed to offset the cost of regulation through expenses cuts. Other expenses, including remuneration, are assumed to decline by 5-10%, with some room also assumed for a reduction in the deposit rates offered by banks and some tightening of loan terms to reduce credit losses.

A portion of the increased capital holdings of banks is assumed to result from 'market forces'. Elliot et al. argue that the global financial crisis of 2007-2009 created an environment where banks would have had to hold higher levels of capital even in the absence of new regulations. As a result, they argue that it is appropriate to adjust the baseline capital levels above which the effects of increased regulation should be layered. Specifically, they argue that market forces alone would have led to the changes in bank capital ratios seen through the end of 2010 and that the changes in capital ratios up to the end of 2010 should not be ascribed to banks pre-empting new regulations.

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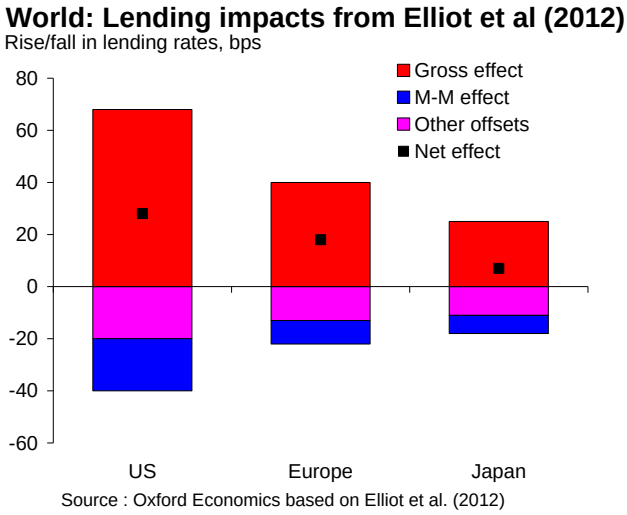
[15] The RROE is the effective cost of equity faced by a bank, and must be distinguished from the bank's return on equity (ROE), which is a measure of a bank's net income divided by shareholders' equity.

[16] There is further discussion on the potential for M-M effects in Section 3.4 below.

Liquid asset shortfall set at US$700 billion for LCR and long-term funding shortfall set at US$1000 billion for NSFR[17]. Elliot et al. make some assumptions for the additional volume of liquid assets required to meet the new liquidity standards outlined by Basel III, which for the US totals US$700 billion for the LCR and US$1000 billion for the NSFR. The authors concede that estimating these potential shortfalls is difficult, with considerable uncertainty about the calculations[18], but nevertheless their estimates suggest an upward impact on lending rates for the US of around 20 bps – similar in scale to the (net) estimated effects of capital regulations.

Chart 2.1 – Gross and net impact on lending rates in Elliot et al. (2012)



Source : Oxford Economics based on Elliot et al. (2012)

A striking feature of the Elliot et al. study is the extent by which the various 'offsets' they assume reduce the ultimate impact of regulatory changes on loan rates. For the US, Elliot et al. estimate a 'gross' impact of new capital and liquidity requirements of around 62 bps on lending rates (40 bps for capital and 27 bps for liquidity rules, reduced by 5 bps for 'overlap'[19]), but once the various offsets are applied, this falls to 28 bps. The M-M effects cut 20 bps from the impact, expenses cuts 15 bps and other adjustments cut 7 bps. Arguably these adjustments are on the high side. Aside from the validity of the assumed M-M

[17] These shortfalls are estimated on the basis of estimates of gaps under the LCR and NSFR compiled by the BIS and European Banking Authority (EBA) in 2012, plus private sector estimates from Japan. The BIS figures are for 103 global banks, from which the European and Japanese estimates are subtracted to obtain estimates for the US. The NSFR figure is further adjusted using some private sector estimates (see Elliot et al. p.46).

[18] This results from limited appropriate balance sheet data from banks but also an uncertain degree of overlap between the two new liquidity ratios. Elliot et al. assume half the cost of meeting the LCR is eliminated by overlap with the NSFR.

[19] This 'overlap' occurs because meeting one set of rules also helps meet the other – so that the total effect of meeting both sets of rules is less than the sum of the individual estimates for the two sets of rules.

effects in the context of banks given their theoretical nature (see Section 2.2 above and further discussion in Section 3.4 below), the assumed expense cuts also look large. As Roger & Vlcek (2011) argue, it is far from clear whether efficiency gains on a large scale are likely in a highly competitive financial system.

Moreover, their assumptions about baseline capital levels and the final 'buffer' US banks hold above the new regulatory minimum capital ratio also reduce the impact of regulation on loan rates. In the former case, the assumption that all capital ratio increases are due to market forces increases the baseline capital ratio by as much as 1.5 percentage points. In the latter case, Elliot et al.'s own calculations suggest that at year-end 2010 the 'buffer' US banks held over and above the regulatory minimum was 4.7 percentage points (they estimate the CET1 ratio at 6.7% at end-2010 when the effective regulatory minimum was 2%). But they then assume this buffer compresses to 3 percentage points in the long run (banks hold a CET1 ratio of 10% versus a regulatory minimum of 7%). This pair of assumptions means that the adjustment in capital ratios that they model for US banks is reduced considerably – their assumed adjustment in the CET1 ratio is around 3 percentage points, but without these assumptions it could have been almost double this.

2.4.2 Institute for International Finance (IIF) (2011)

This study takes a notably different approach to the previous one on a number of key points, and ends up with markedly different results. In geographical scope it is larger, covering the US, Eurozone, Japan, the UK and Switzerland. Like the Elliot et al. study it covers a variety of different reforms including new capital and liquidity requirements.

A key difference from the Elliot et al. study is that while that study focused on long-term effects, the IIF study covers both the short- and medium-term transition to the new regulatory regime. This allows the study to consider whether some key variables in the loan pricing model might move around during this transition, impacting lending rates.

The methodological approach also utilises a variety of the loan pricing model (as described above) to calculate the effects of regulatory changes on bank lending rates, plus a 'shadow bank equity pricing model' to calculate the targeted return on equity of banks. The estimated loan rate impact is then fed in to the UK National Institute of Economic & Social Research (NIESR) NIGEM macroeconomic model to produce estimated effects on GDP.

The results of the IIF approach are that US bank lending rates rise by around 5 percentage points in 2011-2015, with GDP cut by around 3% compared to its baseline (no reform) level. Over 2011-2020, the results show a rise in lending rates of 2.4 percentage points and a drop in US GDP of 1.1%. This is by far the biggest impact found among the studies considered in this report.

The key assumptions underlying this report are as follows –

Baseline capital levels are based on pre-crisis norms. This is in contrast with the Elliot et al. study which assumes market forces would have driven up baseline capital levels after the global financial crisis, regardless of regulatory changes.

Investors' expected return on bank securities issued rises as issuance rises. The IIF study argues that in an environment of high global risk aversion, the cost of issuing new capital to meet regulatory requirements will rise – potentially quite steeply – as the volume of issuance increases. Set against this, only limited M-M effects are allowed.

Increased long-term debt financing costs for banks. The IIF assumes the costs of long-term debt financing for US banks rises by 120 bps due to lower investor demand and regulations (including the Volcker Rule and derivatives changes).

Limited cutting of other expenses by banks in response to increased costs of capital. Again this is a notable contrast with the Elliot et al. study where cost reductions by banks are assumed to be relatively large.

Some quantitative restrictions on credit are assumed. The IIF does not assume that banks raise all the capital implied by applying new regulations to their existing asset base, but instead assumes capital is only raised by an amount they judge private markets can manage at a reasonable cost. As part of their adjustment, banks are thus forced to limit the growth of RWA.

Mortgage and company lending are constrained to grow well below nominal GDP to mimic the impact of liquidity requirements. In addition, long-term bond issuance is projected to grow by 5 percentage points more than nominal GDP.

Spillovers to non-bank financing costs. The IIF study assumes that the cost of credit supplied by non-banks in the US economy rises by 50 bps due to the Volcker Rule.

No offset from monetary policy in modelling GDP effects. In principle, increased lending rates by banks as a result of regulatory changes could be offset to some extent by central banks reducing their interest rates. Many macroeconomic models include an endogenous monetary policy response of this type, but this feature of the NIGEM macroeconomic model is 'switched off' in the IIF study.

Perhaps the most important of the assumptions used by the IIF is their assumption that bank funding markets will not be elastic in the transition to new capital requirements, so that issuance of new debt and equity will push up their cost. When this assumption is relaxed, the IIF finds that the effect on lending rates is roughly halved.

The IIF assumptions on changing costs of funding in the transition may be considered too pessimistic, although it would be surprising if banks found that attempts to raise large volumes of new debt and equity had no impact on their

costs. The IIF also assumes no difference between capital building through equity issuance and capital building through retained earnings (in terms of the effect of these two approaches on the 'shadow price' of equity that they calculate) which may also be too pessimistic.

Finally, the IIF study assumes that adjustment to the new regulatory standards takes place partly through banks restraining RWA growth rather than just adjusting their lending rates. As discussed in Section 4.3, RWA cuts tend to have significantly larger macroeconomic effects than adjustment via the price of credit.

2.4.3 OECD – Slovik & Cournede (2011)

This study is another 'official' study, and focuses on the US, the Eurozone and Japan, with the regulatory focus limited to changes in capital requirements. Like the IIF study, it focuses on the short- to medium-term transition period.

The methodology features a simple banking sector model used to assess the impact of increased capital levels on bank funding costs and lending rates. These effects are then translated into GDP impacts using the OECD macroeconomic model.

The results of this study are that a 1 percentage point rise in the CET1 ratio for US banks raises their lending spread by 21 bps, with a total estimated rise of 64 bps by 2019. This is quite similar to the 'gross' effects (before various offsets) found in Elliot et al. The level of GDP in the US is 0.59% lower after five years compared to the baseline, with GDP growth -0.12% per annum lower.

The key assumptions of this study are –

Complete pass-through from estimated increases in bank funding costs to lending rates. There are no M-M effects and no reductions in other expenses allowed which could offset increased funding costs.

Banks maintain constant buffers above the minimum regulatory capital requirements. This contrasts with the Elliot et al. study which has these buffers declining in the long term.

Limited cutting of other expenses by banks in response to increased costs of capital. This is similar to the IIF's study and contrasts with Elliot et al.'s.

No offset from monetary policy in modelling GDP effects. This is similar to the IIF study.

Overall, the assumptions used in this study are fairly conservative, including those regarding future capital buffers. US banks are estimated to raise their capital ratios by a little over 3 percentage points by 2019. One key difference from the IIF study is that elastic funding markets are assumed, so that in the transition period studied, the raising of additional capital does not increase the cost of that capital. In terms of the effects estimated on GDP, this study is broadly in line with other 'official' studies.

2.4.4 BIS/MAG (Macroeconomic Assessment Group) (2011)

This is a pair of related studies that look at the impact of regulatory reforms across the major economies. The BIS study concentrates on long-term effects while the MAG study focuses on the transition process to new regulatory standards.

The effect of regulatory changes on lending rates is estimated by the use of a representative balance sheet for several national banking systems; from this it is possible to calculate the rise in lending rates needed to recoup the costs of regulatory changes (a similar approach to the loan pricing model). The results of these estimates are then fed into a family of macroeconomic models to produce a range of estimated impacts on GDP.

The key result from the BIS study is that a 1 percentage point rise in the CET1 ratio raises bank lending spreads by around 13 bps across jurisdictions. In addition, the impact of liquidity regulation changes (with the focus mostly on the NSFR) is estimated to raise bank lending rates further, by an additional 14-25 bps (similar in scale to the estimates in Elliot et al.).

In terms of GDP effects, the BIS estimates that a 1 percentage point rise in the CET1 ratio reduces long-run GDP by around 0.09% across countries. For the US, a 4 percentage point rise in the CET1 ratio and the new liquidity rules (broadly approximating to the Basel III package) reduce long-run GDP by 0.4-0.7% depending on the type of economic model used with an average decrease of around 0.5%.

The MAG study, meanwhile, has headline results suggesting that global banks meeting the Basel III capital requirements would have relatively modest effects, reducing GDP by a peak of 0.22% below baseline after three years, improving to 0.13% below baseline after twelve years.

An additional element of the BIS study is that it also seeks to estimate the potential benefits of reforms. The BIS study estimates that a rise in the capital ratio from 7% to 10% would reduce the risk of a financial crisis by 70%.

The key assumptions of these studies are –

Complete pass-through from estimated increase in bank funding costs to lending rates. There are no M-M effects and no reduction in other expenses to offset increased funding costs.

No effect of increased capital issuance on funding costs. An elastic funding market is thus assumed, as in Slovik & Cournede and Elliot et al.

Return on bank equity set at 15%. The BIS notes the importance of this assumption, estimating that a lower RROE of 10% would mean that a 1 percentage point rise in the CET1 ratio would be recoverable with a rise in lending spreads of only 7 bps – around half their baseline estimate.

Assumptions about liquidity rules. The BIS study estimates changes in liquidity requirements only with reference to one of the two new ratios, the

NSFR. Elliot et al. suggest that their approach will in practice capture most of the effects of the NSFR and the LCR[20], but the BIS study accepts that its estimates of the costs of meeting the NSFR are highly sensitive to the assumptions it makes – notably about the initial structure of bank balance sheets and the gap between returns on safe and risky investments (set at 1 percentage point per annum). The IIF argues that the BIS is assuming a 25% rise in liquid asset holdings across banking systems and that this may be too low.

The MAG study has relatively low effects on GDP compared with other studies. One reason for this is that it assumes that banks only raise their capital levels to the new regulatory minimum and therefore do not maintain their normal 'buffers' above this level. In practice this means that the MAG study only measures the impact of a rise in the CET1 ratio from an estimated initial 5.7% (across its universe of global banks) to 7%, which is very different from the other studies.

In calculating the potential benefits from new regulation, the BIS study estimates that the probability of a financial crisis in any given year is 4-5%, and uses a discount rate of 5% to calculate the present value of lost future GDP resulting from such crises. A further key assumption is that financial crises have permanent effects on GDP. If this assumption is discarded and only temporary effects are allowed, the estimated net benefits from reform are dramatically lower – and low enough that further alterations to other assumptions might remove them altogether.

2.4.5 Bank of England – Miles, Yang & Marcheggiano (2011)

This study focuses mostly on the UK and on capital requirements of banks, with a focus on a long-term time horizon. Like the BIS study from 2010, this study also attempts to calculate the benefits as well as the costs of regulatory changes.

The methodology employed in this study differs somewhat from the other studies discussed above. Empirical evidence from UK banks is used to assess the costs of regulation and the potential benefits. This includes an attempt to relate the risk of financial crises to capital levels and a study of shocks to income over 200 years (aimed at capturing the costs of crises). Rather than using a loan pricing model or similar formulation, the effects of increased lending rates on GDP are instead calculated using a production function[21].

The results of this study show large net benefits from higher capital levels, and the authors conclude that the 'desirable' level for bank capital could be much higher than the Basel III levels, at up to 20% of bank assets. The authors also argue that even doubling the level of bank capital will raise funding costs for banks by only 10-40 bps. For the UK, the authors estimate that a doubling of bank capital (implying a 2 percentage point rise in the CET1 ratio) would raise

[20] As in Elliot et al. some overlap between liquidity and capital requirements in the BIS study reduces their joint impact on lending rates.

[21] A production function is an equation that relates output to factor inputs such as capital and labour.

banks' costs of funding by 18 bps (assuming large M-M effects), firms' cost of capital by 6 bps and reduce the level of GDP by 0.15%. The estimated effect on GDP is low compared to that of other studies.

The key assumptions of this study are –

Large M-M effects. Miles et al. estimate that M-M effects offset approximately 50% of the impact of higher capital ratios on lending rates (and as much as 70% in some of their estimates).

Discount rate of 2.5% used to estimate present value of future output losses. On this basis the estimated present value drop in future UK GDP from a doubling of bank capital is 6%.

A one-to-one ratio between changes in GDP and changes in bank assets is used to calibrate the risk of banking crises.

Banking crises assumed to lead to 10% output loss. Three-quarters of this loss is assumed to last for five years and one-quarter of the loss is assumed to be permanent.

This paper's importance partly results from its influence on other areas of the literature. In particular, the estimates of the size of M-M effects are an input into the IMF paper by Elliot et al. and in the Miles et al. paper, the relatively small impact of capital changes on loan rates is directly linked to the high estimated M-M effects. The robustness of these estimates is open to question, as the time period used to calibrate the size of M-M effects in this paper is relatively short at 1997-2010 and covers only a few UK banks. One additional weakness of this study is the use of a production function to estimate GDP impacts rather than a full economic model, as this will not necessarily capture all of the relevant effects of rising lending rates.

This paper is also important in defining an approach for calculating the potential benefits of regulatory changes. The general approach is to estimate the GDP losses associated with financial crises and then to estimate the present value of these losses using a discount factor. The probability of crises is then estimated, as is the reduction in this probability from regulations. After all these steps, the 'gain' from regulation can be calculated and compared with costs of regulation.

There are several problems with this approach. The estimated probability of crises is based on limited empirical studies and the estimate of how this probability is impacted by capital levels has even more slender empirical foundations. Yet the estimated effects are large – some studies suggest a 3 percentage point rise in capital ratios would cut the risk of crises by 75%. The net benefit calculation is also sensitive to the discount rate used and whether output losses are temporary or permanent. In the Miles et al. paper, if there is no permanent element, the estimated gain in terms of current GDP from a 1 percentage point fall in the probability of a financial crisis falls from 55% of GDP to 20% of GDP.

2.5 Conclusions

Studying the literature on the effects of regulatory changes on lending rates and on GDP makes it clear that the calculation of both costs and benefits has, as Miles et al. put it, 'many moving parts'. There is great scope for results to vary based on a number of critical assumptions.

The next section identifies more clearly some of the key sensitivities and estimates a plausible range of possible impacts on lending rates from regulatory changes, which can then form the basis of the macroeconomic modelling effort in Section 4.

Table 2.1: Summary of estimated effects of 1 percentage point rise in CET1 ratio on lending rates

Study	Effect on loan rate, bp
Elliot et al (2012)	12
BIS (2011)]	13
Slovik & Cournede (2011)	21
Miles et al. (UK only) (2011)	9

Table 2.2: Summary of regulation effects found in literature

Study	Estimated reform impact on:		Key assumptions						
	Lending rate (bp)	GDP level (%)	Initial RROE	M-M effects	Baseline	Capital Buffers	Expenses cuts	Scaling	Quantity effects
Elliot et al. (IMF), 2012	28	n/a	12%	50% offset, elastic funding market	end-2010 CET1 ratio	reduced to 3% from initial 4.7%	10% assumed	n/a	no
IIF 2011	468	-2.7	10%	Cost of equity and debt rises significantly	pre-crisis norms	some compression	limited	yes, based on bank share in US credit	yes
Slovik & Cournede (OECD) 2011	64	-0.59	n/a*	none but elastic funding market	end-2009	constant	none	yes, based on bank share in US credit	no
BIS 2011	66**	-0.53**	15%	none but elastic funding market	n/a	n/a	none	n/a***	no
MAG 2011	20^	-0.22^	n/a	none	end-2009	no buffer	none	n/a***	no
Miles et al (BoE) 2011	36^^	-0.3^^	15%	45% offset elastic funding market	2006-2009	n/a	n/a	Loans assumed 1/3 of corporate financing	no

Note: Elliot et al, IIF and BIS studies consider capital and liquidity changes, Slovik & Cournede and Miles et. al. capital changes only
RROE=required rate of return on equity for investors
M-M effects=Modigliani-Miller effects i.e. reduction in cost of bank funds due to increased bank 'safety'
Capital buffers= size of buffer held above regulatory minimum capital ratio at the end of the forecast period
Scaling=adjustment of lending rate impact when modelling GDP effects, e.g. interest rate rise in model may be scaled for share of bank credit in total credit extension
Quantity effects=quantitative reduction in credit supply due to reforms, e.g. by cut in risk-weighted assets
All figures relate to US except those of MAG which are global and Miles et. al. which are for the UK

* 2004-2006 average from bank balance sheets
** Assuming 4% point rise in capital ratio and liquidity effects. BIS GDP effects are averaged over different models used in the study
*** BIS/MAG results are averaged over a set of different economic models with different structures
^ peak effect after 35 quarters, based on 1.3% point rise in capital ratio
^^ Assuming 4% point rise in capital ratio

3 Estimating the impact on lending rates

This section draws on the literature review above to identify key sensitivities in the mapping of regulatory changes to changes in lending rates, with the extent of these sensitivities shown using the loan pricing model.

3.1 Key assumptions for lending rate effects

The structure of the loan pricing model as shown in Section 2.2 already gives us some clues as to the key assumptions underlying any estimate of the impact of regulatory changes on lending rates.

RROE – an increased/decreased RROE (cost of equity to the bank) will raise/reduce lending rates. In the literature, some models assume the RROE is constant or even falls (with banks becoming 'safer') – ***implying an elastic bank funding market. Other studies such as the IIF study assume that the RROE will rise due to the heavy capital needs of banks pushing up the cost of capital – what might be termed the problem of an 'issuance glut'***. The RROE may also vary over time – in studies of the transition to new regulatory requirements the RROE may be pushed up while banks raise capital but then decline again as this process winds down or as M-M effects start to play a role.

Cost of debt/deposit financing – an increased/decreased cost will raise/reduce lending rates. As discussed above, the literature is divided between studies assuming an elastic market for bank debt and studies assuming the cost of debt will rise due to regulatory changes (e.g., due to the 'issuance glut' problem mentioned above). Also as discussed above, debt costs could vary over time, as pressures on debt funding markets rise and fall, and due to time-varying M-M effects. On deposit finance, some studies (e.g., Elliot et al.) assume there is scope for deposit rates to be squeezed down to offset cost rises elsewhere.

Credit spread – a reduced credit spread would reduce loan rates, while an increased spread would have the opposite effect. Most studies do not stress this channel but some suggest the spread could be reduced by banks altering their loan portfolios, for example toward less risky borrowers. Such a shift would not necessarily be costless in terms of the wider economy.

Administration and other costs – the loan rate can be reduced to the extent that these costs can be squeezed, while rises in these costs would tend to raise loan rates. For example, the Elliot et al. study assumes a 10% cut in these expenses, reducing loan rates by 15 bps (total costs are assumed at an initial 150 bps).

Estimates of the impact of regulatory changes on loan rates (and the broader economy) are also sensitive to some other key assumptions –

Baseline capital levels. Studies differ on the appropriate starting point from which the effects of regulation on bank capital are calculated. Some studies (e.g., Elliot et al.) argue that a proportion of the rise in capital levels already seen at banks is due to market forces, which would have pushed capital levels

upward even if there were no regulatory changes. Other studies (e.g., the IIF) argue that banks are likely to have anticipated to some extent the higher capital levels required by new regulations. The impact of altering the baseline is potentially significant given the substantial rises in capital ratios that have occurred in recent years[22].

Size of capital buffers above the minimum. Banks have generally held levels of capital above the regulatory minimum in the past for several reasons including avoidance of the sanctions applicable to banks that fall below the regulatory minimum and to meet investor and credit rating agency expectations. Some studies assume that 'buffers' above the minimum are maintained at pre-reform levels (e.g., Slovik & Cournede) while others assume they are reduced (Elliot et al.). The MAG study implicitly assumes a zero buffer, with capital levels increased only to the regulatory minimum, which is unlikely to occur given the inherent volatility of the capital ratios[23]. Assumptions in this area can have a large impact on the amount of new capital banks must add.

Size of liquidity requirements. The new Basel III liquidity rules imply that many banks will need to hold substantially more liquid assets and/or longer-term liabilities[24]. But exactly what volume of extra assets/longer-term liabilities is needed depends on estimates of initial balance sheet positions of banks (which do not appear to be precise in the studies covered above). The cost of adding these extra liquid assets/longer-term funding is also dependent on estimates of the gap between the yields on liquid assets and on other riskier balance sheet assets and the gap between short- and longer-term funding, which may vary. An interesting point worth noting here is that most studies assume the additional bank demand for liquid assets such as government bonds will have no effect on their price/yield. But in fact this may not be so – the additional demand could compress yields and therefore increase the cost of maturity adjustment.

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[22] For example, the Federal Reserve estimates that the Tier 1 common ratio for 18 US bank holding companies rose from less than 6% at the end of 2008 to around 8% by the end of 2009 and to around 9% by end-2010 (see Board of Governors of the Federal Reserve System, 'Dodd-Frank Act Stress Test 2013: Supervisory Stress Test Methodology and Results,' March 2013).

[23] The volatility of capital ratios may increase as a result of other aspects of the Basel III regulations. For example, Basel III requires the recognition in capital ratios of unrealized gains and losses resulting principally from movements in interest rates (as opposed to credit risk) on available for sale (AFS) securities reported in accumulated other comprehensive income (AOCI) under US GAAP. Similarly, changes in the value of pension liabilities for defined benefit plans, resulting principally from movements in the discount rate, also are reported in AOCI. If the Basel III regulatory capital treatment for AFS securities and defined benefit pension liabilities is adopted by the US, banks may need to hold an additional capital buffer to address the resultant capital volatility.

[24] For example, the BIS estimated the aggregate shortfall with respect to the LCR at €1.8 trillion for a sample of global banks as of December 2011, and the shortfall with respect to the NSFR at €2.5 trillion (BCBS September 2012). It should be noted that the BIS methodology is to sum across all banks showing a shortfall – this is not netted off against the surplus holdings of banks which exceed the new liquidity ratios.

Long-term effect or transition? Some studies only model the long-term impact of regulatory changes while others model the transition to new regulations. In a transition period, the trajectories of key variables may vary over time. For example, it is more likely that raising new capital will increase the price of that capital around the time that capital raising is assumed to peak. In addition, it may take time for the cost of capital to be influenced by perceptions that banks are 'safer' (i.e., M-M effects might occur only gradually).

3.2 Illustrations of sensitivities

Some of the key sensitivities outlined in Section 3.1 can now be quantified using the loan pricing formula from Section 2.2. Our baseline for this exercise uses the basic parameters from the Elliot et al. (2012) study. These are –

- Initial share of equity funding in total funding 5.4%, debt and deposit share 94.6% (for the US). The initial CET1 ratio is estimated at 6.7%.
- Required return on equity (RROE) 12%.
- Debt and deposit costs 2%.
- Credit spread 3%.
- Administrative and other expenses 1.5%.
- Baseline for capital levels is set at end-2010.
- Assumed rise in CET1 ratio due to regulation is 3.3 percentage points (implying 'buffer' over regulatory minimum falls by 1.7 percentage points versus pre-reform level).
- US$700 billion of new liquid assets needed to meet LCR and US$1000 billion of longer-term funding to meet the NSFR.

Capital regulations. Using the initial parameters and the other assumptions used by Elliot et al., such as a tax rate of 30%, we can replicate their estimate of a rise in 'gross' (i.e., before offsets) lending rates due to new capital regulations for the US of around 40 bps. Table 3.1 below then shows how these results are modified by altering some key assumptions.

For example, a 1 percentage point change in the RROE increases/decreases the impact on lending rate by 11 bps, so that if the RROE were to be 15% rather than 12% the effect on lending rates would rise by 33 bps.

Similarly, a 1 percentage point rise in deposit and debt costs would raise the impact on lending rates of a given rise in capital ratios by around 90 bps, while a 50 bp cut in credit spreads would reduce the effect by around 50 bps. Finally, a 10% change in administrative and other expenses would increase/decrease the impact on lending rates by 15 bps.

Turning to other assumptions, if the baseline for capital levels is moved back to year-end 2009, this implies that the capital ratio needs to rise by an additional 1.5 percentage points and this implies an additional rise in loan rates of 23 bps.

And if capital 'buffers' above the minimum are maintained at pre-reform levels, this means that the increase in capital ratios due to regulatory reforms rises by 1.7 percentage points and this adds a further 26 bps to lending rates.

Table 3.1 – Sensitivity of lending rate change to altered assumptions

Assumption change	Effect on change in lending rates
RROE changes by 1% point	+/-11bp
Debt costs change by 1% point	+/-90bp
Credit spread change by 0.5% points	+/-50bp
Expenses change of 10%	+/-15bp
End-2009 baseline capital level	+23bp
Capital buffers maintained at pre-reform level	+26bp
50% higher liquidity needs	+12bp
Change cost of maturity change by 1% point	+/-13bp

Note: these calculations are based on the framework in Elliot et al. (2012).

It is important to note that not all these estimated sensitivities are constant regardless of the required rise in the capital ratio. Rather, because of the way the loan pricing formula works, some sensitivities increase as the required increase in the capital ratio rises. So for example, if the required rise in the CET1 ratio was doubled from Elliot et al.'s baseline of 3.3 percentage points to 6.6 percentage points, then each 1 percentage point rise in the RROE would add a further 15 bps to loan rates (rather than 11 bps as in the baseline).

Liquidity requirements. On liquidity needs we can again use the basic framework from Elliot et al. which operates on the basis that banks will suffer an increase in the average cost of funds as they lengthen their liability maturities or a decrease in their investment returns if they shorten the maturity structure of their assets (to meet new liquidity standards).

The key assumptions driving the calculation of the effect of these changes on loan rates are (i) the size of the initial liquidity 'gaps' (i.e., the shortfall between initial levels of liquid assets and the level needed to meet the new standards), and (ii) the cost of altering the maturity of assets and liabilities (in bps). The latter represents either the rise in pre-tax funding costs (from more expensive longer-term liabilities) and/or the reduction in investment income (from increased holdings of lower-yielding 'safe' assets).

In Elliot et al.'s baseline, the shortfalls of liquid assets are US$700billion for the LCR and US$1000billion for the NSFR, while the cost of altering the maturity structure of assets and liabilities is set at 2 percentage points (this is the gap between the cost of short-term and longer-term funding and/or the gap between higher-yielding risk assets and low-yielding 'safe assets). Notably, this estimate of the cost is somewhat higher than the 1 percentage point assumption used in the BIS study.

These assumptions yield a rise in lending rates of 21 bps for the US. If, however, we increase the initial shortfalls by 50%, as the IIF study of 2011 suggests may be appropriate, then the rise in lending rates increases to 33 bps. Alternatively, if

we alter the cost of maturity adjustment by 1 percentage point, then the effect on lending rates shifts by 13 bps.

3.3 Best and worst cases

If we combine together some of the altered assumptions outlined in Section 3.2, we can create a range of scenarios, which cover much of the wide spectrum of results found in the literature concerning the effect of regulatory changes on lending rates.

The gross effect (before various offsets including expenses cuts and M-M effects) on lending rates from a rise in the CET1 ratio of 3.3 percentage points is 40 bps using the loan pricing formula in Elliot et al. outlined in Section 2.2. But if we assume that capital buffers are maintained at the pre-reform level (4.7 percentage points over the regulatory minimum) and that the RROE (cost of equity) rises to 15%, then the effect on loan rates rises to 107 bps. If we further assume that debt costs rise by 50 bps and our baseline for initial capital levels is year-end 2009, then the rise in lending rates yielded by the loan pricing model in Elliot et al. rises to 175 bps.

Finally, if we assume 50% higher additional liquid assets are required than the amount estimated in Elliot et al., then the rise in loan rates increases to over 200 bps and we start to see a total rise in lending rates not dissimilar to the rise estimated by the IIF in their 2011 study.

On the other hand, if we assume that the baseline for initial capital levels should be year-end 2010, capital buffers drop to 3% above the regulatory minimum, expenses are cut by 10% and the RROE falls to 10%, then the rise in lending rates drops to just 2 bps. Add on the effects of liquidity requirements (as estimated in Elliot et al.) and the rise in lending rates increases to 23 bps (see Table 3.2 for this range of scenarios).

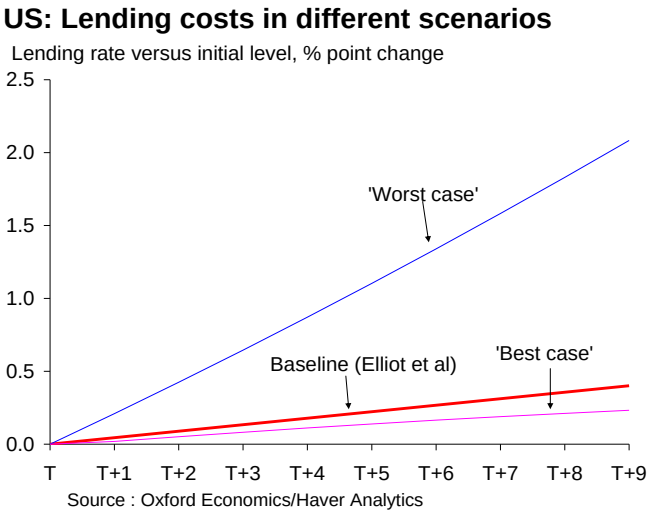
Table 3.2 – Alternative cases for lending rates using varied assumptions

Scenario	Rise in CET1 ratio, percentage points	Total effect on loan rate (bp)
BASELINE Elliot et al. impact from capital changes	3.3	40
Adverse cases		
1.RROE rises to 15% in long-term	3.3	74
2.Capital buffer over minimum maintained at 2010 level	5.0	66
3.Buffer & RROE assumptions	5.0	107
4.Buffer, RROE and debt cost higher by 50bp	5.0	153
5.Buffer, higher RROE & debt cost, end-2009 capital baseline	6.5	175
6.As above with baseline estimates of liquidity effects*	6.5	196
7.As above with 50% higher liquidity effects	6.5	208
Optimistic cases		
1.BASELINE plus expense cuts of 10%	3.3	25
2.BASELINE plus fall in RROE to 10%	3.3	17
3.BASELINE including expense cuts & lower RROE	3.3	2
4.As above with baseline estimates of liquidity effects*	3.3	23
WORST CASE (7) (including liquidity effects)	**6.5**	**208**
MIDDLE CASES (1-3) (including liquidity effects)	**3.3-5.0**	**87-128**
BEST CASE (4) Including liquidity effects)	**3.3**	**23**

* Baseline effects of liquidity effects from Elliot et al.

So by flexing the various assumptions, we can generate a 'best case' where regulatory changes to capital and liquidity requirements lead to a modest rise in lending rates of around 20 bps, and a 'worst case' with a rise in lending rates of over 200 bps (see Chart 3.1 for an illustration). 'Middle cases' with a limited number of adverse assumptions see loan rates rising by 87-128 bps (including liquidity effects).

Chart 3.1 – 'Best' and 'worst' cases for lending rates



Note: assumes linear approach to final values estimated from loan pricing model over nine years.

All the above are terminal estimates, i.e., assuming an instant shift to a new equilibrium where all variables have adjusted in line with regulatory pressures. As noted above, however, it is also possible to model a transitional process to the new regulatory regime where variables can shift their values over time rather than adjust immediately.

The pattern of these shifts may also vary considerably. One approach would be to have variables such as the RROE approach their 'target' final levels in a linear manner, while another might be to have such variables taking a non-linear path, perhaps at first rising sharply and then dropping back downward. Such a pattern might make sense in a modelling exercise that assumes a relatively inelastic equity funding market, for example, and a pattern of this type can be found in the IIF study of 2011.

3.4 Assessment

The above discussion shows that on the basis of varying key assumptions the impact of regulatory changes on lending rates can vary widely. This begs the question of where along this wide spectrum of possible results the likely 'real world' position lies. There is no straightforward answer to this question, but there is some evidence to suggest how some of the different assumptions necessary for calculating lending rate effects should be set.

On the issue of the baseline levels for capital ratios, we are uncomfortable with the idea that all capital ratio rises before year-end 2010 can be attributed to

market forces rather than regulatory effects, as Elliot et al. argue. Although it is true that the Basel Committee only published its initial report on the Basel III proposals in September 2010, the 'Basel II.5' guidelines of July 2009 already pointed to banks needing to hold greater capital levels against market risks in trading operations. Additionally, consultation papers at the end of 2009 pointed to a general need for higher capital and better quality of capital.

Meanwhile in the US, the Fed-sponsored Supervisory Capital Assessment Program (SCAP) stress tests took place in 2009, with the results released in May that year – mandating higher capital levels for banks. Banks raised $77billion by November of that year in response. The Dodd-Frank Act was also enacted during 2010, which included provisions such as the Volcker Rule aimed at limiting proprietary trading by banks (Title VII) and required the Fed to establish and monitor heightened standards for bank capital, leverage and liquidity including through stress tests (Title XI). So in our view, regulatory pressures were clearly at work in the US and abroad prior to year-end 2010.

In terms of the buffers banks will hold above regulatory minimums, we also have some doubts about the idea that these could be compressed compared to pre-reform levels as Elliot et al. and the MAG study imply. Slovik & Cournede quote some studies suggesting that buffers will be reduced and that only 50% of the increased minimum will go through to a higher capital ratio. ***But in the US case at least, we take the view that regulatory pressures may well push in the opposite direction[25].***

Most important here is the impact of the Federal Reserve's CCAR supervisory mechanism for assessing capital adequacy of large bank holding companies (BHCs) and the CCAR and DFA stress tests. Under these stress tests, banks need to show they will maintain a CET1 ratio above 5% even in stressful conditions[26]. In the stress scenarios specified by the Fed in 2012 and 2013 for the CCAR and DFA stress tests, the CET1 ratio of the participating banks would be reduced by 3.5-4 percentage points with projected losses in the range of US$460-580 billion. This implies that banks will need to keep substantial buffers over the 5% CET1 floor in order to avoid the risk of failing the CCAR and DFA stress tests. In our view, capital buffers over the minimum will need to be at least

[25] For more information on the impact of regulations on bank capital buffers, see The Clearing House Association study and white paper "How Much Capital is Enough Capital Levels and G-SIB Surcharges," 26 September 2011, available at theclearinghouse.org.

[26] These stress tests also have a qualitative element, i.e., banks may fail if the Fed determines that a bank's capital plan has a lack of robustness with respect to risk measurement processes or inadequate assumptions or analyses underlying the capital plans.

as large as pre-reform buffers[27]. Over time, the 5% floor may need to be re-calibrated as the Basel III rules are finalized in the US[28].

In terms of the scale of M-M effects, we are sceptical as to how big these can be in the context of the US banking sector. As noted above, the M-M effect derives from a theoretical literature and requires idealised theoretical assumptions that may not hold in the real world. The empirical evidence for its existence (e.g., in Miles et al.) is also arguably very limited, and there are also studies such as Cosimano and Hakura (2011), which provide empirical evidence against the M-M effect[29]. Indeed, it seems more likely to us that in the near-term, pressure on bank funding costs will be upwards given depressed bank equity prices and still-impaired financial markets. This is among the reasons that the Basel III regulations provide a lengthy phase-in period[30]. We are also sceptical about the scope for banks to offset the impact of upward pressure on loan rates by large cuts in expenses, as assumed for example by Elliot et al.

As a result, we take the view that the rise in lending rates from regulatory changes in the US is likely to be above the baseline estimates of Elliot et al., although probably not as large as in the IIF study of 2011. In particular, Elliot et al.'s estimate that US banks will have to raise their CET1 ratio by only around 3 percentage points looks on the low side. We would suggest that a rise of around 5 percentage points is more likely, based on the pre-reform buffers above the regulatory minimum being largely maintained. In fact, the actual rise could be over 6% depending on how much of pre-2010 capital increases we ascribe to regulatory rather than market pressures and the extent to which banks are required to hold additional buffers such as the Systemically Important Financial Institution (SIFI) surcharge. On the basis that each 1% rise in capital ratios increases lending rates by around 15 bps, then a rise in capital ratios of 5-6% implies a rise in lending rates of 75-90 bps – this is similar to the 'middle

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[27] Based on the Elliot et al., study these buffers were around 4.7 percentage points above the regulatory minimum as of end-2010.

[28] As well as meeting the 5% floor requirement under stress tests, the Fed also assesses whether US banks are on course to meet the Basel III capital requirements. As noted in footnote 22, other Basel III proposals relating to the regulatory capital treatment for AFS securities and defined benefit pension liabilities may also lead to banks holding increased buffers above the regulatory minimum/the 5% CET1 floor specified by Fed stress tests.

[29] Cosimano and Hakura's empirical evidence from a sample of 100 large banks across major industrial countries during 2001-2009 finds that a 1 percentage point rise in the equity-to-asset ratio is associated with a 12bp rise in lending rates, which they describe as evidence against the M-M theory.

[30] The Basel Committee stated in 2010 that "The Committee is introducing transitional arrangements to implement the new standards that help ensure the banking sector can meet the higher capital standards through reasonable earnings retention and capital raising, while still supporting lending to the economy." BCBS (2010), p.10. In addition, Kayshap & Stein (2010) note a longer phase-in period for new capital requirements reduces the risk that heavy issuance of new capital will drive up its cost, with banks instead able to accumulate capital gradually through retained earnings.

scenarios' identified in Table 3.2. Liquidity regulations would increase the rise in lending rates by around a further 20 bps.

In addition, we would argue that the bigger the required increase in capital ratios for banks, the bigger is the risk that other upward pressures on bank lending rates will appear. In particular, the larger the capital needs of banks, the higher is the risk that the cost of new capital will be driven up by the volume of new capital issuance (at least in the near-term). This is also true of liquidity requirements: the more long-term funding banks need, the higher is the risk that the cost of this funding will be driven up by debt issuance. Meanwhile, heavy demand for liquid assets, such as government bonds by banks, could drive down the yields on these assets, increasing the gap between yields on these assets and riskier assets and adding to upward pressure on lending rates. The importance of these potential effects can be seen from Tables 3.1 and 3.2. A rise in the RROE of just 1 percentage point could add 11 bps to lending rates and a rise in the cost of debt financing by 1 percentage point could add 90 bps to lending rates, based on the loan pricing model of Elliot et al. Moreover, the impact of a rising RROE would be higher if the required increase in the CET1 ratio was also higher than the Elliot et al. baseline of 3.3 percentage points. Rising debt and equity costs make a large contribution to the strong rise in lending rates seen in the 'worst case' scenario from Table 3.2.

4 Modelling the impact on GDP

4.1 Introduction

As noted in Section 2, a number of the studies of the effects of regulation on the cost of credit and economic growth use a macroeconomic model for the final stage of their analysis, that is, the mapping of estimated changes in lending rates onto changes in GDP.

In this report we also follow this approach, making use of the Oxford Global Economic Model (for more information see the Appendix). The model allows us to increase key interest rate variables (including consumer, mortgage and corporate borrowing rates) in line with our assumptions about the effects of regulation on lending rates. When the model is then run, this will have an impact on variables such as consumer spending, investment and wealth (generating further effects on spending and investment) and ultimately impacting GDP.

The Oxford Model also allows us to examine the effect of allowing monetary policy to adjust in response to bank lending rate changes, and the effect of assuming banks adjust to new regulatory needs over a shorter or longer time scale than in our base case. The model can also be used to simulate the effects on GDP of banks meeting new capital requirements by cutting RWA, i.e., reducing the size of their loan books, rather than raising interest rates charged on loans. All these alternative options are examined in the sections below.

4.2 Modelling rises in lending rates

In this section we model the impact on GDP of a rise in lending rates generated by changes to capital and liquidity regulations. This is done for a number of different scenarios, reflecting the varied possible effects of regulatory change illustrated in Section 3 above. In addition, we also examine the effect of regulations being met over different time scales[31].

We start with a simple exercise involving applying estimated rises in lending rates due to regulatory changes to lending rate variables in the Oxford Model (corporate, consumer and mortgage rates). From the literature discussion in Section 2.4, we see that studies using versions of the loan pricing model estimate that a 1% rise in the CET1 ratio for US banks raises the lending rate by an average of around 0.15 percentage points or 15 bps with other parameters kept constant. We use this relationship in our modelling[32].

We initially focus on the effect just of higher capital requirements (and assuming all other parameters including the RROE and debt costs are unchanged and

[31] Estimates of the impact using shorter effective implementation timetables are discussed below in Section 4.2.

[32] This is the simple average across the studies by Elliot et al., Slovik & Cournede and the BIS.

there are no changes to bank expenses or M-M effects) and assume that banks meet these new regulations gradually over nine years, broadly in line with the Basel III timetable. As the CET1 ratio rises, lending rates faced by firms and households are gradually increased above baseline levels and this generates a downward impact on GDP. Our model results suggest that a 1 percentage point rise in the CET1 ratio would reduce the level of GDP by 0.14% compared to the baseline after nine years. This result is broadly similar to those found in other studies.

Chart 4.1 – Estimated impacts on GDP of rises in CET1 ratio

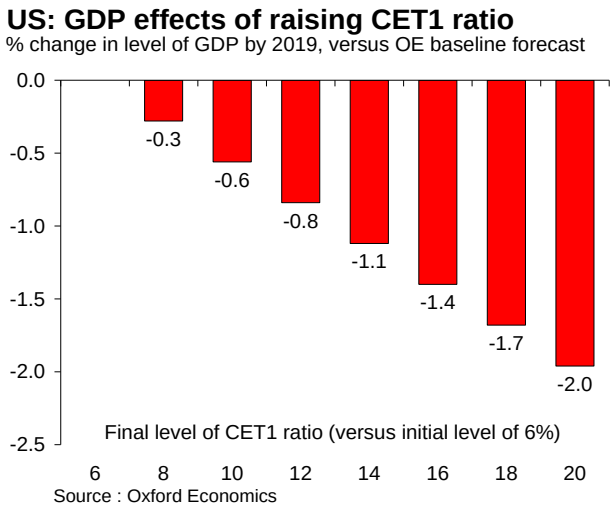
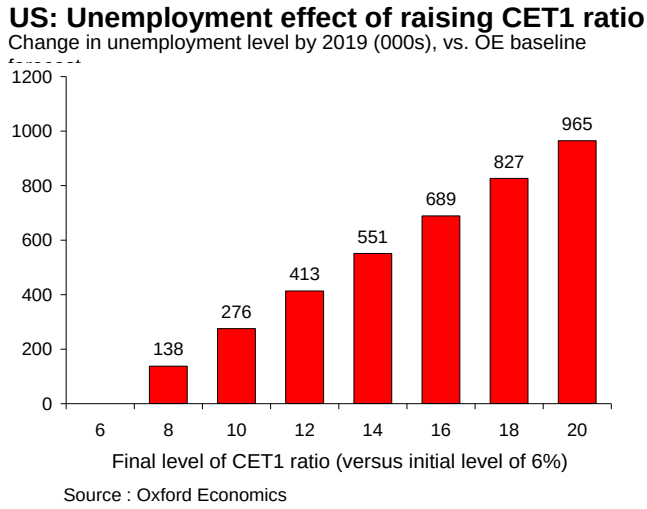


Chart 4.2 – Estimated impacts on unemployment of rises in CET1 ratio



As the required increase in the CET1 ratio resulting from regulatory change is increased, then the impact on GDP also rises in a linear fashion. So for example, if the starting CET1 ratio was 6%[33] and the ratio at the end of nine

[33] This is just an illustrative starting point rather than an estimate of the actual initial CET1 ratio for US banks.

years was 10%, the fall in GDP would be 0.6%. If the final CET1 ratio is increased to 16% (implying a 10 percentage point rise in the CET1 ratio), then the GDP decline is 1.4%. If the final CET1 ratio is increased to 20% – a figure mentioned by Miles et al. as a possible 'optimal' capital ratio – then the decline in GDP is some 2%.

The rise in capital ratios and lending rates also has a negative impact on unemployment, with each 1 percentage point rise in the CET1 ratio raising unemployment by around 70,000 compared to its baseline level. So a 4 percentage point rise in the CET1 ratio from an initial 6% to 10% would raise unemployment by around 280,000, a rise from 6% to 16% would raise unemployment by around 690,000 and a rise in the CET1 ratio from 6% to 20% would raise unemployment by almost 1 million.

As noted in Section 3.4 above, however, the effect on lending rates from a rising CET1 ratio may be exacerbated by other factors such as a higher RROE, higher debt costs and the effect of increased liquidity requirements. As a result, it is possible to get substantial effects on lending rates, and therefore GDP and unemployment, even if the required rise in the CET1 ratio is relatively modest.

So for example, our 'worst case' scenario from Table 3.2 saw a rise in lending rates of 208 bps, based on the loan pricing model from Elliot et al. This was the result of a rise in the CET1 ratio of 6.5 percentage points. But the rise in the CET1 ratio alone would only account for around half of the total increase in lending rates in this 'worst case', with the rest due to rising debt costs, a rise in the RROE and the effect of liquidity requirements. Applying this 'worst case' scenario to our model (meaning raising lending rates by 208 bps above baseline levels) results in GDP falling, after nine years, by around 2% compared to its baseline level. This is a similar result to that obtained from raising the CET1 ratio alone (with no other effects e.g., on RROE or debt costs) by 14 percentage points.

If we take some other scenarios from Table 3.2 above, we may see that in the 'best case' scenario where lending rates rise by 23 bps (based on a 3.3 percentage point rise in the CET1 ratio), GDP would fall by 0.2% compared to its baseline level. In this case, the other assumptions used to generate the 'best case' scenario reduce the impact on lending rates and the economy from the rise in the CET1 ratio.

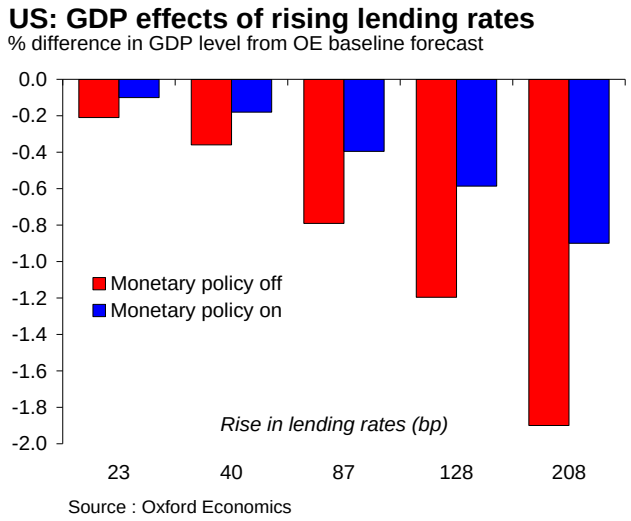
Finally in the 'middle scenarios' from Table 3.2 where lending rates rise by around 90-130 bps (based on a rise in the CET1 ratio of between 3.3 and 5.0 percentage points), GDP is cut by 0.8-1.2% compared to the baseline level. In these cases, the other assumptions made, in particular a higher RROE, again increase the impact on lending rates and the economy above that which would be generated just by the rise in the CET1 ratio[34].

[34] These scenarios from Table 3.2 incorporate a variety of assumptions including the effects of liquidity requirements, changes to the RROE and debt costs and changes in bank expenses. Note the 'middle' and 'worst' scenarios assume no changes in bank expenses. See Table 3.2.

These results imply that GDP in real US dollar terms would be around US$30billion lower after nine years compared to baseline in the 'best case' scenario, US$120-180 billion lower in the 'middle scenarios' and around US$300 billion lower in the 'worst case' scenario, all as compared to the baseline. Unemployment would be around 100,000 persons higher in our 'best case' compared to the baseline, 400,000 to 600,000 higher in 'middle' scenarios and almost 1 million higher in our 'worst case' scenario[35].

All these results assume no offsetting monetary policy action – as in the IIF study of 2011, the endogenous monetary policy response embedded in the model structure has been disabled for these estimates. If, however, monetary policy is allowed to act, with the central bank reducing its policy rate (i.e., the Fed Funds rate) in response to the impact of rising bank lending rates, the impact on GDP is reduced by around half[36].

Chart 4.3 – Estimated impacts on GDP of rising loan rates



One potential complicating factor is that banks do not provide all the credit in the US economy – non-banks are also considerable suppliers[37]. Our initial modelling results assume that the change in bank lending rates is applied across the economy (on corporate, consumer and mortgage loans) but this may be too pessimistic.

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[35] For more estimates of the impact on GDP and unemployment for a variety of scenarios and different increases in the CET1 ratio, see the appendix.

[36] The Oxford Global Economic Model has an endogenous monetary policy setting, in which central bank interest rates will adjust automatically to shifts in economic growth and inflation according to a modified 'Taylor Rule'. The Taylor Rule is a monetary policy rule that defines how much a central bank should change its policy interest rate in responses to changes in inflation and output.

[37] An additional risk connected with new regulations on banks is that they may drive more lending activity into the 'shadow banking sector' and thus outside the regulatory perimeter. See Financial Stability Board, "Strengthening Oversight and Regulation of Shadow Banking'," Consultative Document 18 November 2012, available at www.financialstabilityboard.org.

Our estimates suggest banks account for a little under one-half of all extensions of credit in the US[38], so arguably this should be taken into account by restricting the effect of regulations to bank lending rates only when modelling the GDP impact. This reduces the impact on GDP significantly, as can be seen in Table 4.1.

However, this is also a simplification, as it assumes no spillovers to non-bank credit costs. Such spillovers may well exist to the extent that banks are indirectly involved in the supply of non-bank credit and in addition, as the IIF (2011) argue, some new US financial regulations such as the Volcker Rule may increase non-bank credit costs significantly. Further, to the extent that the US non-bank financial sector is funded by the banking sector (for example through the reverse repo market), increases in bank funding costs are likely to reduce credit supply from the nonbank sector.

Table 4.1 – Effects on GDP of loan rate rises, summary

	Change in GDP level (%) with respect to OE baseline forecast			
	All loan rates increased		Bank loan rates only increased	
Rise in lending rate (bp)	*Monetary policy off*	*Monetary policy on*	*Monetary policy off*	*Monetary policy on*
23	-0.2	-0.1	-0.1	0.0
40	-0.4	-0.2	-0.2	-0.1
87	-0.8	-0.4	-0.4	-0.2
128	-1.2	-0.6	-0.5	-0.3
208	-1.9	-0.9	-0.9	-0.4

The timescale for the implementation of regulatory changes (including the market pressure on banks to meet Basel III minimum capital and liquidity requirements as early as possible) is also important. If the timescale is shortened from our initial nine years to just five, the upfront losses in GDP calculated by the model are larger, as can be seen in Charts 4.4 and 4.5. These charts show the results of modelling a scenario of a 5 percentage point rise in capital ratios (equivalent to the Elliot et al. baseline but with pre-reform capital buffers maintained) over nine and five years respectively (the simulations begin at a point 'T' in the charts). In the case where the transition period to the new CET1 ratio is nine years, GDP is 0.3% lower after four years. In the case where the transition occurs over only five years, the impact on GDP after four years is doubled, with GDP 0.6% lower[39].

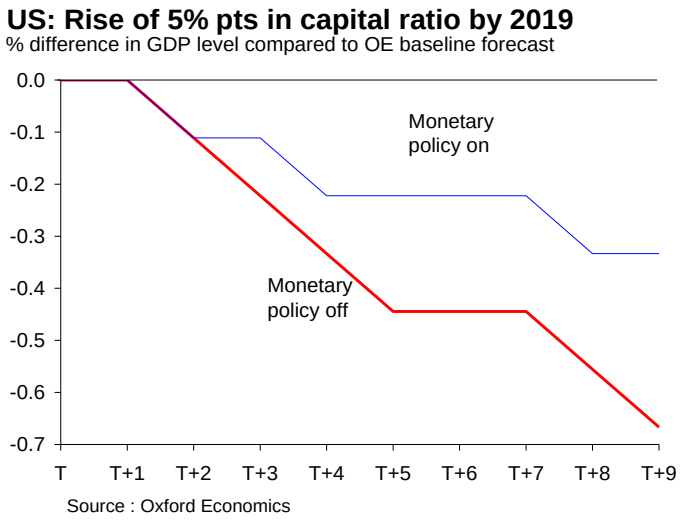
Importantly, a shorter implementation timescale also reduces the effectiveness of the monetary policy offset. This is because the Oxford Model baseline forecast has the US Fed Funds rate staying near zero until 2015 – so for much of the modelling period, the 'zero bound' constraint bites and policy rates cannot fall to cushion the impact of rising bank lending rates. As a result, GDP costs in

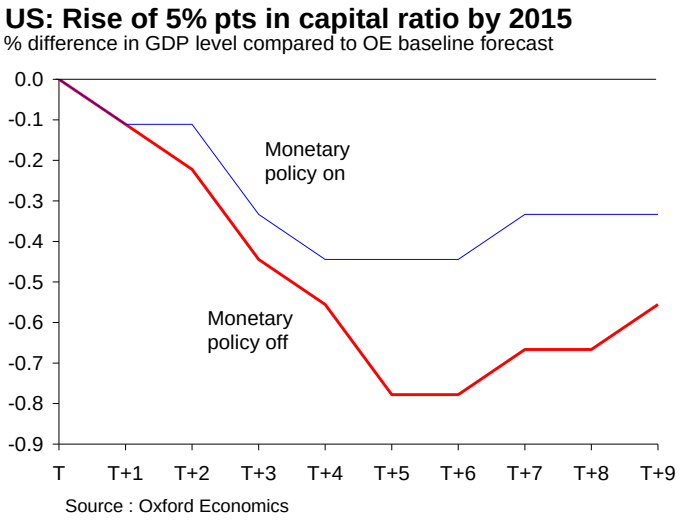
[38] Our estimates are based on work by Boyd & Gertler (1994), Feldman and Lueck (2007) and Choulet (2012). Note this estimate is higher than those used in the IIF (2011) or Slovik & Cournede (2011) which in our view understate the share of banks in US credit intermediation.

[39] Note in our 'worst case' scenario, shortening the implementation period from nine to five years would mean GDP after four years was 1.5% (US$230 billion) below baseline and unemployment higher by 800,000.

the early years of the transition would be higher[40]. The flipside of this is that if the transition period to new regulations were to be extended, there could be more scope for monetary policy to cushion the impact and GDP losses in the early part of the modelling horizon could be lower[41].

Charts 4.4 & 4.5 – Modelling results using different timescales





This is a potentially important result because it is quite likely that banks will attempt to meet the Basel III requirements as fast as possible, given that they are already being judged by financial markets on the basis of how well they are performing in terms of the key Basel III requirements.

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[40] A shorter timescale might well also imply a rise in the cost of capital raised, increasing the necessary loan rate increase and further raising GDP losses.

[41] It might be possible for non-standard monetary policy such as quantitative easing to be used to partially offset the impact of higher bank lending rates but consideration of this is beyond the scope of the current paper.

4.3 Cutting risk-weighted assets versus capital raising

Another possible scenario we can examine using the Oxford Model involves banks trying to meet new capital requirements by cutting RWA rather than raising loan rates. Essentially this means banks attempting to reduce the denominator of the capital/asset ratio rather than raising the numerator.

There are many reasons why a bank may choose to act in this way. First, the amount of capital needed could exceed that which can be raised in the near-term at a reasonable cost. Second, if banks do raise capital at a high cost, they may struggle to pass this cost on to borrowers and borrowers may simply turn down loans offered at high rates. There is also the risk of 'adverse selection', that is, that borrowers who do accept loans at high rates may have an unfavourable credit risk profile.

Nor is this merely a theoretical risk. There is some evidence from the Eurozone that banks have been shrinking their balance sheets in response to the combination of regulatory pressures and adverse funding market conditions[42] and stress test exercises organised by the European Banking Authority (e.g., in 2011) have attempted to discourage this.

An approach based on cutting RWA would risk having more negative impacts on GDP than an approach based on raising lending rates, because the scale of the required cut in RWA could be very large. This is the finding of other studies such as Roger & Vlcek (2011) and is confirmed by our own modelling results.

We estimate that for US banks to raise their CET1 ratio by 5 percentage points from 6.7% (the end-2010 level estimated by Elliot et al.) to 11.7% (i.e., a scale of increase similar to that in some of the 'middle' scenarios from Table 3.2), RWA would need to fall by around 40% other things equal, which would be a huge reduction even if spread over several years.

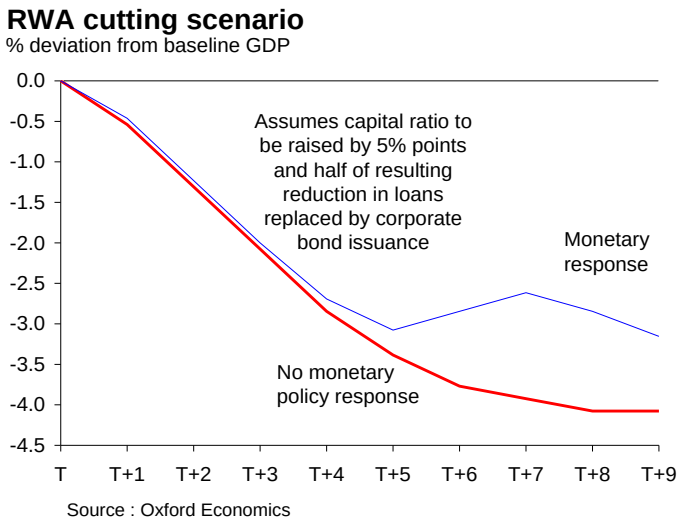
Realistically, a 40% drop in RWA would not translate into a similar fall in credit extension to the economy, as firms could substitute non-bank forms of financing such as corporate bond finance for bank loans. However, the scale of the increase in non-bank financing needed to plug the gap would be very large. To fully offset the lost bank loans implied by a 40% drop in bank RWA, corporate issuance of US$3.6 trillion would be needed. This is over 30% of the current outstanding level of corporate bonds, and moreover, this form of financing would not be an option for some classes of borrowers. In addition, it is possible that the substitution of credit from banks to other credit providers will raise the cost of that credit, as other credit providers might demand higher rates to hold these assets.

To model the effect of banks adjusting by reducing RWA, we assume that 50% of the drop in bank loans is replaced by non-bank credit including corporate bonds. The implied drop in total credit extension for a 5 percentage point rise in the CET1 ratio is then around 20%.

[42] See for example the IMF Global Financial Stability Report April 2012.

Based on the historic elasticities between real loan growth and real consumer spending and investment from 1948-2011 in the US, a drop in loans of 20% would imply a fall in consumption of 4% and in investment of 14% relative to our baseline forecast. Running these effects into the Oxford Model implies a drop in GDP after nine years of 4.1% relative to the baseline (assuming the cut in loans proceeds steadily over this period) and of 3.2% even with a monetary policy response.

Chart 4.6 – indicative scenario based on cutting risk-weighted assets



If we compare the result of cutting RWA with that of raising lending rates in order to meet capital ratios, we find that the economic costs of the former are much higher. For the case above of a 5 percentage point rise in the capital ratio, the GDP costs would be less than 1% (assuming no other changes to other parameters of the loan pricing model).

Any scenario involving such a large drop in RWA may be considered somewhat extreme, but this analysis does illustrate the risk to growth if even a proportion of the regulatory target for the capital/RWA ratio is met through cutting RWA. Indeed, even in a relatively benign case similar to that in Elliot et al. where US banks only raise their CET1 ratio by 3.5 percentage points to meet new regulations, we estimate, that were RWA-cuts used to achieve this, then even with 50% substitution of reduced bank loans by non-bank financing, GDP would fall by 2.8% compared to baseline. This is a similar result to our 'worst case' result involving increasing loan rates, in which loan rates rose by over 200 bps.

Table 4.2 – RWA cuts and increase in lending rates compared

Increase in capital ratio % points	GDP effect from capital raising	GDP effect from RWA cuts including 50% substitution
3.5	-0.5	-2.8
5.0	-0.7	-4.1
6.5	-0.9	-5.4

Note: Capital raising effects assume rise in all lending rates RWA cuts results assume 50% of reduced bank loans from shrinking bank RWA are replaced by other financing sources e.g., corporate bonds. No monetary policy response assumed.

5 Conclusions

This report has attempted to shed some light on why different studies focusing on the effect of financial regulations on US growth have shown such widely varying results. The literature splits between 'official' studies by bodies like the IMF and OECD, some of which show very modest effects and studies such as that by the IIF that show much larger impacts.

The different results of these studies can be traced to the complex nature of the underlying calculations of the impact of regulations on lending rates. Results are very sensitive to a number of key assumptions for parameters such as the cost of bank equity, bank debt costs, the size of capital 'buffers' held above regulatory minimums and their initial holdings of liquid assets. In addition, some studies argue that there may be substantial scope to offset upward pressure on lending rates from regulatory changes through banks reducing expenses and through the operation of the M-M effect, whereby bank funding costs will fall as regulatory changes are perceived to make banks 'safer'.

With all these factors in play, the degree of 'pass through' from regulatory changes to lending rates is uncertain. By using the methodological framework of just one of the major recent studies, the IMF study of Elliot et al. (2012), but varying the assumptions underlying it, it is possible to generate an impact on loan rates as low as 20 bps and as high as 200 bps.

Our analysis also suggests that some of the 'official' studies including the IMF study of Elliot et al. (2012) may be too optimistic about the scale of the impact of regulation on loan rates. In our view, the amount of additional capital banks are likely to add as a result of regulation changes will be larger than their estimate of around a 3 percentage point rise in the CET1 ratio. We are also not convinced that the M-M effect they assume or other 'offsets' such as squeezing down deposit rates will be as effective as they estimate in reducing the upward pressure on loan rates, and we exclude M-M effects from our modelling exercise. In our view, the 28bps net rise in lending rates estimated by Elliot et al. for the US is at the lower end of likely effects.

The second stage of estimating the impact on the economy of regulatory changes is to map the estimated rises in lending rates on to GDP. Here there appears to be less scope for variation among different studies. Our estimate that a 1 percentage point rise in the capital ratio reduces the level of GDP by 0.14% after nine years is broadly similar to those found in other studies. In our 'best case' scenario where loan rates rise 20 bps, GDP falls by around 0.2% compared to baseline, while in our 'worst case' where loan rates rise by over 200 bps, GDP falls by around 2%.

However, there are several factors that can alter these simple results. The first of these is whether the effect on lending rates needs to be scaled to take account of banks not being the only credit providers in the economy – and by how much. The second is whether a monetary policy response is permitted which allows the central bank to offset to some extent the rise in lending rates by cutting policy rates. The impact of the latter factor is reduced in our simulations

by policy rates in the US being close zero for much of the simulation period even in the baseline. Nevertheless, scaling and a monetary policy response can reduce the impacts on GDP considerably.

There are also factors that can push up the impact on GDP. The first of these is if the timescale for regulatory changes (or the market pressure to meet minimum capital and liquidity requirements) is shortened. This leads to bigger upfront losses in GDP and there is also less scope for monetary policy to offset the rise in loan rates. A short timescale would also raise the risk of the cost of bank financing rising steeply in response to attempts by banks to raise large amounts of capital.

The second factor we would highlight is if banks choose to cut RWA rather than raising lending rates to meet new required capital ratios. Our estimates show that adjustment by cutting RWA has a much bigger impact on GDP than via raising loan rates.

These considerations point clearly to the need for any regulatory programme to be carefully structured to avoid unnecessary damage to economic growth.

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7 Appendix

Additional tables – economic impacts of rising CET1 ratios under different assumptions

Economic effects of CET1 increases using 'best case' assumptions		
Final CET1 ratio %	**Effect on GDP, %**	**Effect on unemployment, 000s**
6	0	0
8	-0.2	78
10	-0.4	188
12	-0.6	303
14	-0.8	414
16	-1.1	528
18	-1.3	643
20	-1.5	754

Scenarios assume initial CET1 ratio of 6%
'best case' assumptions include expenses cuts of 10%, drop in RROE to 10%
Effects of liquidity regulations included with impact on loan rates as in Elliot et al.

Economic effects of CET1 increases using 'middle case' assumptions		
Final CET1 ratio %	**Effect on GDP, %**	**Effect on unemployment, 000s**
6	-0.2	97
8	-0.6	276
10	-0.9	455
12	-1.3	634
14	-1.6	809
16	-2.0	988
18	-2.4	1167
20	-2.7	1346

Scenarios assume initial CET1 ratio of 6%
'middle case' assumptions include rise in RROE to 15%
Effects of liquidity regulations included with impact on loan rates as in Elliot et al.

Economic effects of CET1 increases using 'worst case' assumptions		
Final CET1 ratio %	**Effect on GDP, %**	**Effect on unemployment, 000s**
6	-0.3	152
8	-1.3	639
10	-1.7	813
12	-2.0	988
14	-2.4	1163
16	-2.7	1346
18	-3.1	1512
20	-3.4	1682

Scenarios assume initial CET1 ratio of 6%
'worst case' assumptions include rise in RROE to 15%, increase in debt cost of 50bp
Effects of liquidity regulations included with impact on loan rates 50% higher than in Elliot et al.

Note: effects of liquidity regulations assumed even where no rise in CET1 ratio. All scenarios assume no M-M effects.

New Liquidity standards – the LCR and NSFR

The LCR

This standard aims to ensure that a bank maintains an adequate level of unencumbered, high-quality liquid assets that can be converted into cash to meet its liquidity needs for a 30 calendar day time horizon under a significantly severe liquidity stress scenario specified by supervisors. At a minimum, the stock of liquid assets should enable the bank to survive until Day 30 of the stress scenario, by which time it is assumed that appropriate corrective actions can be taken by management and/or supervisors, and/or the bank can be resolved in an orderly way.

The LCR builds on traditional liquidity "coverage ratio" methodologies used internally by banks to assess exposure to contingent liquidity events. The total net cash outflows for the scenario are to be calculated for 30 calendar days into the future. The standard requires that the value of the ratio be no lower than 100% (i.e., the stock of high-quality liquid assets should at least equal total net cash outflows). Banks are expected to meet this requirement continuously and hold a stock of unencumbered, high-quality liquid assets as a defence against the potential onset of severe liquidity stress. Given the uncertain timing of outflows and inflows, banks and supervisors are also expected to be aware of any potential mismatches within the 30-day period and ensure that sufficient liquid assets are available to meet any cashflow gaps throughout the period.

See Basel Committee on Banking Supervision, 'Basel III: International framework for liquidity risk measurement, standards and monitoring', December 2010 available at www.bis.org.

The NSFR

This metric establishes a minimum acceptable amount of stable funding based on the liquidity characteristics of an institution's assets and activities over a one year horizon. This standard is designed to act as a minimum enforcement mechanism to complement the LCR and reinforce other supervisory efforts by promoting structural changes in the liquidity risk profiles of institutions away from short-term funding mismatches and toward more stable, longer-term funding of assets and business activities.

In particular, the NSFR standard is structured to ensure that long term assets are funded with at least a minimum amount of stable liabilities in relation to their liquidity risk profiles. The NSFR aims to limit over-reliance on short-term wholesale funding during times of buoyant market liquidity and encourage better assessment of liquidity risk across all on- and off-balance sheet items. In addition, the NSFR approach offsets incentives for institutions to fund their stock of liquid assets with short-term funds that mature just outside the 30-day horizon for that standard.

The NSFR builds on traditional "net liquid asset" and "cash capital" methodologies used widely by internationally active banking organisations, bank analysts and rating agencies. In computing the amount of assets that should be

backed by stable funding, the methodology includes required amounts of stable funding for all illiquid assets and securities held, regardless of accounting treatment (e.g., trading versus available-for-sale or held-to-maturity designations). Additional funding stable sources are also required to support at least a small portion of the potential calls on liquidity arising from off-balance sheet (OBS) commitments and contingencies.

The NSFR is defined as the amount of available amount of stable funding to the amount of required stable funding. This ratio must be greater than 100%. “Stable funding” is defined as the portion of those types and amounts of equity and liability financing expected to be reliable sources of funds over a one-year time horizon under conditions of extended stress. The amount of such funding required of a specific institution is a function of the liquidity characteristics of various types of assets held, OBS contingent exposures incurred and/or the activities pursued by the institution.

See Basel Committee on Banking Supervision, ‘Basel III: International framework for liquidity risk measurement, standards and monitoring’, December 2010 available at www.bis.org.

About Oxford Economics

Oxford Economics was founded in 1981 as a commercial venture with Oxford University's business college to provide economic forecasting and modelling to UK companies and financial institutions expanding abroad. Since then, we have become one of the world's foremost independent global advisory firms, providing reports, forecasts and analytical tools on 190 countries, 100 industrial sectors and over 2,600 cities. Our best-of-class global economic and industry models and analytical tools give us an unparalleled ability to forecast external market trends and assess their economic, social and business impact.

Headquartered in Oxford, England, with regional centres in London, New York, and Singapore, Oxford Economics has offices across the globe in Belfast, Chicago, Dubai, Miami, Milan, Paris, Philadelphia, San Francisco, and Washington DC. We employ over 130 full-time people, including more than 80 professional economists, industry experts and business editors—one of the largest teams of macroeconomists and thought leadership specialists. Our global team is highly skilled in a full range of research techniques and thought leadership capabilities, from econometric modelling, scenario framing, and economic impact analysis to market surveys, case studies, expert panels, and web analytics. Underpinning our in-house expertise is a contributor network of over 500 economists, analysts and journalists around the world and our heritage with Oxford University and the academic community.

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The Oxford Global Economic Model

The key framework in which Oxford Economics' analysis is conducted is its Global Economic Model, which is the most widely used commercial international forecasting and scenario model, and is widely used to quantify the impact of developments such as changes in banking regulation, the fall in the dollar, the credit crunch and fiscal consolidation programmes.

The model covers 46 economies in detail (including the most important emerging markets), with each country's model containing a large system of equations. The model is also used to feed forecasts for a further 140 or so countries. The country models are fully interlinked via trade, prices, exchange rates and interest rates. In addition, the model includes a bloc of world variables such as oil and commodity prices, world GDP and industrial production.

This framework provides a rigorous and consistent structure for forecasting, and allows the implications of alternative scenarios and policy developments to be readily analysed at both the global and UK level.

The structure of each of the country models within the global model is based on the income-expenditure accounting framework. In the long run, each of the economies behaves like the textbook description of a one sector economy under Cobb-Douglas technology in equilibrium. Countries have a natural growth rate, which is ultimately beyond the power of governments to alter, and is the result of population and productivity growth. Output cycles around a deterministic trend, so at any point in time we can define the level of potential output, corresponding to which is a natural rate of unemployment. Firms are assumed to set prices given output and the capital stock, but the labour market is imperfectly competitive. Firms bargain with workers over wages, but they get to choose the level of employment.

Inflation is a monetary phenomenon in the long run. All the models have vertical Phillips curves, so expansionary demand policies put upward pressure on inflation. Unchecked, these pressures would cause the price level to accelerate away without bound, and in order to prevent this we have endogenised monetary policy. For the main advanced economies, the latter is summarised in an inflation target, and interest rates are assumed to move up whenever inflation is above the target rate, and/or output is above potential (a so-called 'Taylor rule'). The coefficients in the interest rate reaction function, as well as the inflation target itself, reflect our perceptions of how hawkish different countries are about inflation.

On the demand side, consumption is a function of real incomes, real financial wealth, real interest rates and inflation. Investment equations are influenced by "q-theories", in which the investment rate is determined by its opportunity cost, after taking taxes and allowances into account. Countries are assumed to be "small", in the sense that exports are determined by demand and a country cannot ultimately determine its own terms of trade. Consequently, exports are a function of world demand and the real exchange rate, and the world trade matrix ensures adding-up consistency across countries. Imports are determined by real domestic demand and competitiveness.

OXFORD
Abbey House, 121 St Aldates
Oxford, OX1 1HB, UK
Tel: +44 1865 268900

LONDON
Broadwall House, 21 Broadwall
London, SE1 9PL, UK
Tel: +44 207 803 1400

BELFAST
Lagan House, Sackville Street
Lisburn, BT27 4AB, UK
Tel: +44 28 9266 0669

NEW YORK
817 Broadway, 10th Floor
New York, NY 10003, USA
Tel: +1 646 786 1863

PHILADELPHIA
303 Lancaster Avenue, Suite 1b
Wayne PA 19087, USA
Tel: +1 610 995 9600

SINGAPORE
No.1 North Bridge Road
High Street Centre #22-07
Singapore 179094
Tel: +65 6338 1235

PARIS
9 rue Huysmans
75006 Paris, France
Tel: + 33 6 79 900 846

email: mailbox@oxfordeconomics.com

www.oxfordeconomics.com

OXFORD ECONOMICS