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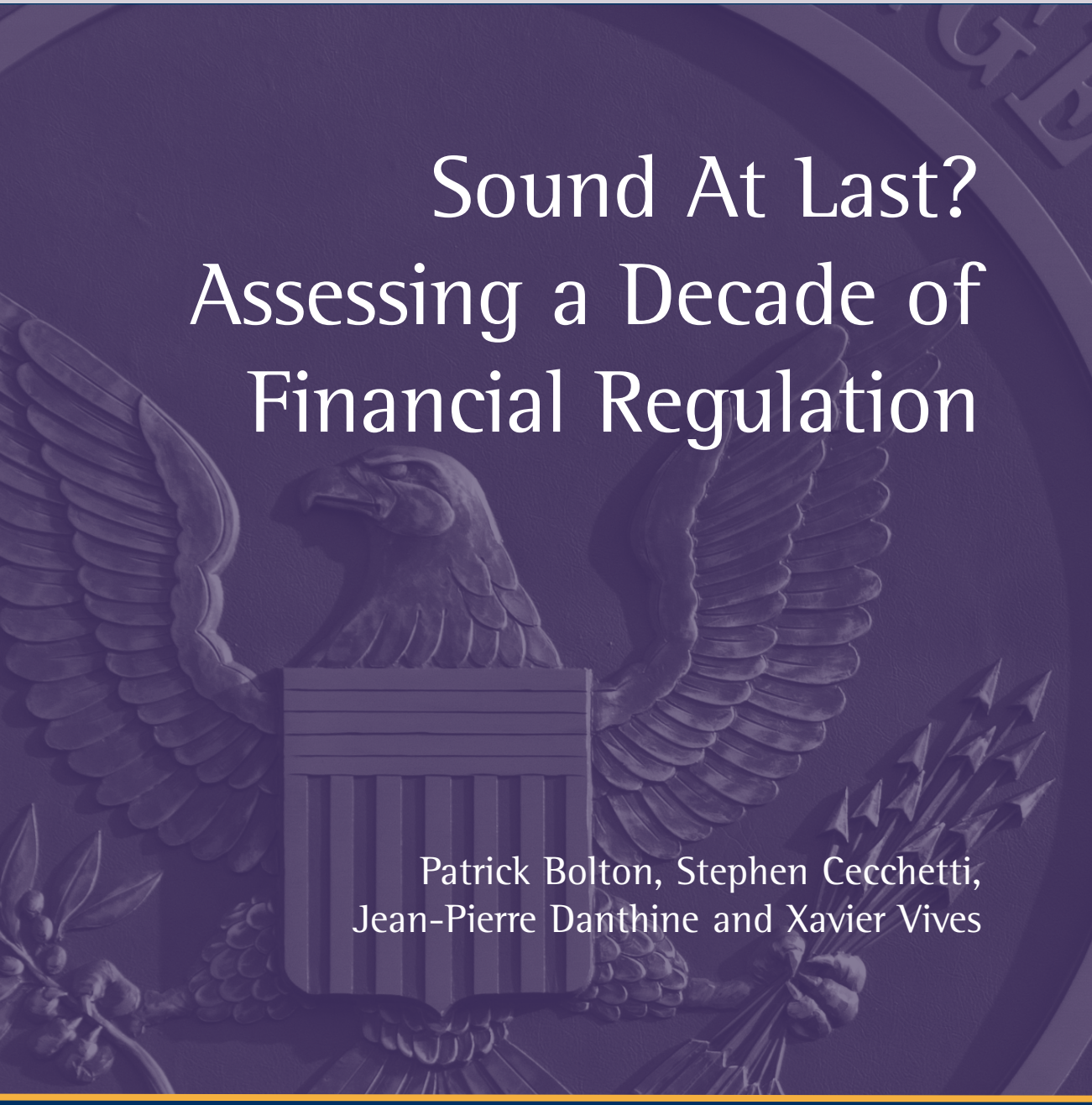

Sound At Last? Assessing a Decade of Financial Regulation

Patrick Bolton, Stephen Cecchetti, Jean-Pierre Danthine and Xavier Vives

IESE Business School University of Navarra Banking Initiative

CEPR

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The authors have benefited from the comments of the discussants of the report at the 22 March 2019 Barcelona conference, Philipp Hartmann, Fernando Restoy and John Vickers, as well as the conference participants, with particular thanks to Claudio Borio, Jaime Caruana, Francesca Cornelli, Dominique Laboureix, Núria Mas, Giovanna Nicodano and Silvana Tenreyro. We also wish to thank Roman Baumann, Matthias Jüttner, Mico Loretan, Martin Oehmke, and Matthias Zwicker. Giorgia Trupia provided excellent research assistance and Carlota Monner very efficient general support.

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IESE Business School
Friday, 22 March 2019

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11:30	*Coffee break*
12:00	**Resolving TBTF** Patrick Bolton, Columbia Business School Discussant: Fernando Restoy, Bank for International Settlements Chair: Dominique Laboureix, Single Resolution Board
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List of conference participants

Liudmila Alekseeva	PhD student, IESE, Spain
Dante Amengual	Associate Professor , CEMFI, Spain
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José Manuel Campa	Global Head Regulatory Affairs, Banco Santander, Spain
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John Vickers	Professor of Economics, Oxford University, United Kingdom
Xavier Vives	Professor, Department of Economics and Financial Management, IESE, Spain
Ernst-Ludwig von Thadden	Professor, Department of Economics, Universität Mannheim, Germany
Zhiqiang Ye	PhD student, IESE, Spain

Foreword

This is the first report in a new series on *The Future of Banking*, part of the new Banking Initiative from the IESE Business School that was launched in October 2018 and is supported by Citi.

The 2007-2009 crisis that brought the Great Recession had its origins in a banking and financial crisis. Several open questions remain. Was the crisis due to an excess of competition in the banking sector or to inadequate regulation and supervision? Today there is a larger role for regulation, following the aftermath of an era of deregulation since the 1970s. Traditional banking business models are under several simultaneous threats: from digital technological transformation and FinTech competitors; from a prolonged period of low interest rates; and from more intrusive regulation and supervision. The result is that the banking industry faces deep structural change and transformation.

The IESE Banking Initiative plans to establish a group of first-rate researchers to study post-crisis developments of banking and financial markets, paying particular attention to regulation and competition policy and to the impact on business banking models. The project aims to promote a rigorous and informed dialogue on current issues in the fields of banking and financial markets amongst academics, regulators, private sector companies and civil society. This will ensure that the programme is a reference point in the study of banking and finance and to contribute to the public debate.

The first report assesses fundamental aspects of the regulatory reform of the financial system, in particular banking, after the Great Recession. It critically reviews regulatory changes in order to ascertain whether the financial system is sound at last; whether regulatory reform has run its course; and what new dangers may arise from current arrangements. The Report concentrates on three crucial areas of post-crisis regulatory reform: Basel III and its aftermath; resolution procedures to end 'too big to fail'; and the expanding the role of central banks with a financial stability remit. The team of authors was brought together and is led by Xavier Vives.

The report was produced following the conference "Sound at Last? Assessing a Decade of Financial Regulation" which was held at IESE in Barcelona on 22 March 2019. The conference programme together with the comments of the three discussants are included in this report.

The Banking Initiative has benefitted from the enthusiastic support of the Dean of IESE, Franz Heukamp, and the former Dean, Jordi Canals. CEPR and IESE are very grateful to the authors and several discussants for their efforts in preparing material for this report, as well as to the conference attendees for their insightful comments. We are also grateful to Carlota Monner for her extremely efficient organisation of the conference as well as providing support for the report, and to Anil Shamdasani for his unstinting and patient work in publishing the report.

The views expressed in the report are those exclusively of its authors and do not represent those of CEPR, which takes no institutional positions on economic policy matters. CEPR and IESE are delighted to provide a platform for an exchange of views on this topic.

Tessa Ogden
Chief Executive Officer, CEPR

Xavier Vives
Director, IESE Banking Initiative

May 2019

Executive summary

In November 2009 Ben Bernanke, then Chair of the Federal Reserve, stated that "September and October of 2008 was the worst financial crisis in global history, including the Great Depression".

What has changed since then to ensure that the financial system is sound at last? Is regulatory reform going in the right direction? Has it run its course? This report provides some facts and ideas to help answer these questions.

A legacy of the crisis is stronger and better capitalised banks, as well as regulators and supervisors with increased clout who pay more attention to systemic risk. However, the crisis has also left us with high leverage in advanced economies, especially in terms of sovereign debt-to-GDP ratios. At the same time, interest rates are at very low levels. All of this, together with the digital disruption of the sector, poses formidable challenges for the banking industry.

A major challenge for regulators is to gather the necessary political support to take forward the reforms and appropriate regulation of the industry. This includes the need for public authorities to have sufficient powers to deal with major crises. The unpopularity of measures for dealing with crises has led several jurisdictions to curtail the power of regulators to react to a crisis in an attempt to "end bailouts forever". In the euro area political constraints are delaying the completion of the Banking Union, including a common deposit insurance scheme and a backstop for the banking system. There is a danger that the unrealistic commitment not to use public money, even in the face of a macroeconomic shock, will undermine current EU resolution procedures, as was the case with the recent treatment of certain banks in Italy. From a more general perspective, the credibility of regulators is at stake when political support is lacking or, even worse, when politics is the very source of instability (as it is in the United States, India and Turkey, with recent attacks on the independence of the central bank).

The report tackles three important areas of post-crisis regulatory reform: Basel III and its aftermath (Chapter 2), resolution procedures to end 'too big to fail' (Chapter 3) and expanding the role of central banks with a financial stability remit (Chapter 4).

A first broad message is that *narrow banking* is not a magic bullet to overcome the fragility of the system. The narrow bank 'solution' always emerges after a systemic crisis, and the 2007-2009 crisis was no exception. Fragility is inherent to the core banking function of joint supply of credit and deposits. If narrow banking were to be implemented, fragility would resurface elsewhere in the financial system.

A second broad message is that while we have seen improvements on many regulatory and supervisory fronts, there is still no framework for dealing with shadow banking and new digital competitors. Furthermore, new regulations and high compliance costs make entry difficult and have increased the tendency for concentration, potentially aggravating the 'too big to fail' (TBTF) problem.

A third broad message is that prudential regulation should take a holistic approach, considering and setting requirements for capital, liquidity and disclosure together and taking into account their potential interactions, together with the competitive conditions of the industry.

Regulatory reform: Basel III and beyond

Chapter 2 provides an assessment of the major components of the new regulatory reforms that form the core of the Basel III agreement. We focus on three aspects: capital requirements, liquidity requirements and stress testing. Beginning with the first, both capital requirements (including a new leverage requirement and several buffers of hybrid capital of loss-absorbing capacity) and capital levels are significantly higher than they were a decade ago. There is broad agreement that the pre-crisis requirements and capital levels were too low. We cannot be sure whether the current levels of capital in banks are enough, and we think it is probably better to err on the high side. An important caveat is that capital requirements should not be raised when the economy is weak. Furthermore, the interaction between leverage and risk-weighted capital must be explored so that there is no inadvertent introduction of perverse incentives.

Increased capital levels are essential for stability, but in a changing economic environment, stress testing is the authorities' primary tool for maintaining systemic resilience. For stress tests to be effective they must be flexible and sufficiently severe without being overly transparent. If the scenarios are insufficiently dire there is no point to the test, and without flexibility the tests are useless. And while there is considerable room for transparency, premature disclosure of scenarios can lead to gaming, so it is essential that they remain confidential. So, while we applaud the widespread adoption of stress testing, we encourage authorities to remain vigilant in imposing rigorous and frequent tests. A main lesson from the euro area is that effective stress tests can only be implemented when there is a credible backstop for the banking system. Current practice could also be improved by taking into account second-round effects.

The absence of comprehensive liquidity regulation prior to the crisis allowed banks to become heavily dependent on a combination of central bank lending facilities and short-term wholesale funding. The Basel Committee has responded with the development of two liquidity requirements that are central to Basel III: the liquidity coverage ratio aims at ensuring a sufficient quantity of liquid assets, while the net stable funding ratio is intended to control the level of maturity transformation. The structure of these two requirements is such that only one is likely to bind at a time. Given this overlap, we question the need for both, and instead recommend that authorities focus on refining and adjusting one to meet their objectives and discard the other.

While the Basel III standards have undoubtedly made individual banks safer and the banking system more resilient, they have important side effects. By making it more costly for banks to engage in their core functions of credit, maturity

and liquidity transformation, rigorous capital and liquidity requirements are encouraging the private sector to shift these activities elsewhere, outside of the perimeters of regulation. To ensure that the entire financial system is sufficiently resilient, we need a robust framework to monitor, assess, designate, regulate and supervise entities outside the perimeter of regulation. In most jurisdictions, such a framework is still lacking.

Resolving 'too big to fail'

Chapter 3 provides an overview of the improved resolution procedures for banks as a result of the 'too big to fail' crisis. TBTF is in part a reference to how failed banks were dealt with (i.e., with bailouts) and it has come to represent what should be avoided in the next crisis. How deeply has the global financial regulatory system been reformed to avoid a repeat of TBTF?

We discuss the new rules that have been put in place to ensure that global systemically important banks (G-SIBs) can be resolved in an orderly way without relying on bailouts. The two main innovations of the new resolution procedures are that (i) the liabilities that should be restructured and the liabilities that should remain outside resolution are now carefully delineated in advance, and (ii) G-SIBs are now required to hold sufficient capital to be able to absorb any losses without putting the liabilities that have been placed outside resolution at risk. These new additional capital requirements come under the heading of total loss-absorption capacity (TLAC).

Two other important new concepts are SPOE ('single point of entry') and MPOE ('multiple points of entry'). Behind these acronyms is the key innovation of specifying in advance which parts of a G-SIB will be resolved and which part will be left untouched. The simplest model – and the one adopted by most G-SIBs in the US – is SPOE, which specifies the resolution of only the parent holding company. Under this model, the parent holding company issues all the TLAC, which could be wiped out in a resolution, and all the affiliates' liabilities remain intact. MPOE is a slightly more complex model under which resolution can happen in multiple jurisdictions with TLAC pre-assigned across these jurisdictions.

This new resolution model not only constitutes an important shift away from a TBTF regime to a bail-in regime, but also fundamentally transforms the way G-SIBs are managed. It is perhaps the most important institutional transformation in international finance to come out of the recent financial crisis. How well this resolution model will work remains an open question, however, given that it has never been tested. Are there major contingencies that have not yet been fully anticipated which will disrupt its implementation? We find that for the resolution system to be credible and stable, the incentives of national authorities before and during a crisis must be assessed and aligned. Otherwise, national authorities may decide to ring fence capital and liquidity ex ante or refuse to abide by an agreement when it turns out to not be favourable ex post.

A major issue in this respect is liquidity provision in resolution. It would be presumptuous to assume that all possibilities have been thought through and that G-SIBs are now fully covered under the new resolution model. This is why it is important not to close down the option of a public liquidity backstop. Under the new G-SIB resolution model, it is no longer true that lender of last resort

(LOLR) interventions by the central bank represent a bailout. The LOLR backstop should now mostly be thought of as fulfilling the intended function of restoring trust in financial markets in the event of a panic. Current procedures are lacking, however, particularly in the euro area.

Better resolution provides good incentives for prudent management and allows for more competition in the market without endangering financial stability, but the TBTF problem, while alleviated, has not gone away. For example, post-crisis restructuring and new regulations have tended to increase the size of banks and market concentration (exacerbated by the current low-profit environment for banks in Europe in particular, as well as the financial investment needed for digital upgrades).

An expanded role for central banks

Chapter 4 looks at the expanded role of central banks in the wake of the crisis. An episode of instability of the magnitude of that seen in 2007-2008 forces a reconsideration of central banks' mission, scope of action and tools of intervention in exercising their reappraised mandate to promote financial stability.

The crisis has significantly changed our view of central banking along three dimensions. The first concerns the conduct of monetary policy at the zero lower bound. Here, we question whether the choice of unconventional policies was the result of a sufficient discussion between authorities on the most appropriate policy mix given the prevailing circumstances. We need to rethink the status of central banks, notably at the zero lower bound, to permit more intensive coordination between monetary and fiscal authorities. We discuss how the incomparably larger balance sheets that have resulted from these unconventional policies provide central banks with a new potential instrument to fulfil their financial stability mandate.

The second dimension relates to the unprecedented scale and scope of central banks' actions as lenders of last resort (LOLR) since the outset of the crisis deserves attention. We need to ensure that effective LOLR action by independent central banks continues to be viewed as democratically legitimate. Part of the answer here is to clarify the role and the mode of action of the lender of last resort, putting an end to the now untenable doctrine of constructive ambiguity (and finding other regulatory means to limit moral hazard). The call for increased ex ante transparency regarding the form and extent of liquidity support from central banks leads to the question of why this liquidity insurance could not be priced, with the financial institutions which are eligible for support being required to pay the corresponding insurance premium. We review some proposals in this area, but conclude that caution should be exercised to avoid exacerbating the current bias of the banking system towards collateralised credit.

A third dimension of change stems from the new emphasis on systemic risk and on 'macroprudential' policies, which require a significant updating of the financial stability element of the central bank mandate. It is legitimate, in our view, to question whether a fully coherent system should not entrust central banks with the main responsibility for the control of credit, with a view to achieving both price and financial stability simultaneously. This would imply that the narrow focus of central banking on inflation targeting would be superseded by a broader perspective.

The changes taking place along these three dimensions raise questions that have a bearing on the independent status of central banks. Two issues stand out: (i) ensuring the legitimacy of delegating increasingly broad powers to an independent unelected institution, and (ii) allowing efficient policy coordination between monetary and fiscal authorities that is compatible with central bank independence. On the former, we argue that whatever the architecture of the system, central bank independence will be best preserved if the articulation of the framework of communication that has been commonly agreed in the case of monetary policy and interest rate decisions is applied to the decisions of the single institution (or of the collective) in charge of financial stability. Regarding the latter, we call for the formalisation of a special regime that redefines the relationship between fiscal and monetary authorities once the zero lower bound has been reached. Under this special regime, in constrast to under normal circumstances, a regular exchange between authorities on the entire range of policy options, with open communication of the resulting policy choices, would be institutionalised. Potential disagreements and the reasons behind them would be made explicit.

With respect to the financial supervisory architecture, we look favourably on the 'one roof' approach whereby the central bank has both a price and a financial stability mandate, and consequently a transparent LOLR function as well as macroprudential authority with the appropriate tools. This is the case in the UK, where microprudential supervision is coordinated within the Bank of England and an independent authority deals with conduct and consumer protection, yielding a 'twin peaks' regulatory architecture. That said, we are aware of institutional constraints in different countries that may require variations in this model.

The goal must be to protect one of the main institutional achievements of the late 20th century by adapting to the new circumstances revealed by the crisis. Central banks must recover their traditional (and, historically, their original) financial stability remit, and these more powerful central banks will require strengthened accountability and democratic legitimacy.

We do not know where the next crisis will hit. If the past is any predictor of the future, however, we can be sure that entities that perform the functions of banks but are outside of the regulatory perimeter will play an important role. The next global crisis may have its origins in an emerging market where regulation could well be different from the reformed patterns of the West.

The challenge for incumbent banks is to adapt to digital disruption and to the increasingly competitive environment; the challenge for regulators is to maintain a level playing field and protect financial stability while allowing the benefits of innovation to permeate the system.

1 Introduction

Over the weekend of 13-14 September 2008, US Treasury Secretary Henry Paulson tries to sell Lehman Brothers to Barclays. On Monday 16 September, the AIG liquidity crisis begins, triggering a global bank run. Ben Bernanke, chair of the Federal Reserve, states in November 2009 that "September and October of 2008 was the worst financial crisis in global history, including the Great Depression".

What has changed since then to ensure that the financial system is sound at last? Is regulatory reform going in the right direction? Has it run its course? This report tries to answer these questions, or at least to provide some facts and ideas in an attempt to answer them.

The effects of the global financial crisis and Great Recession have been devastating – not only in terms of economic pain (through unemployment and salary reductions) but also in terms of increased inequality, fuelling middle-class anger and populism. It is an inescapable observation that the crisis has reinvigorated autocracies and undermined the foundations of free-market, liberal democracies. In Europe, the financial crisis and subsequent sovereign debt crisis put the monetary union at risk, along with the entire post-war unification project. More prosaically, banking and financial crises are not uncommon and when they occur, they have lasting negative effects on economic growth and public finances. The 2007-2009 crisis was particularly severe, raising the question of whether this was a highly unusual, 'once in a century' event, or whether it was more predictable with causes similar to those of other recent crises.

The recurrence of systemic banking crises makes one wonder why it is so difficult to tame them. We can think of at least three reasons for this.

First, all of the potential sources of market failures are present in banking: externalities, asymmetric information and market power. To these classical sources, we should add the potential behavioural biases of investors and consumers. More to the point, however, all of these sources of market failure are magnified in banking due to the fundamental fragility of the bank business model based on maturity transformation. The second-best principle tells us that if public intervention attempts to fix one market failure without fixing the others, the end result may be welfare-decreasing. For example, increasing competition may be welfare-decreasing in the loan market under adverse selection aggravated by overoptimistic borrowers.

Second, regulation tends to lag behind financial innovation that constantly bypasses the constraints imposed by well-intentioned regulators (or takes advantage of the lack of constraints due to regulatory leniency). Securitisation and the use of derivatives are good examples in the recent crisis.

Finally, and relatedly, banks and governments are deeply intertwined because of the privileged money creation role of the former and the corresponding insurance provided by the latter. This makes for a complex political economy of banking through the strong link between sovereign and bank solvency.

Banking panics were particularly frequent in the 19th and early-20th centuries. The 1907 panic in the United States was directed at the shadow banks of the time, the trust companies (and the Knickerbocker Trust in particular), because of the high risk in their portfolios, lack of access to the bank clearinghouse and lower reserves against deposits. There were numerous runs on both trusts and banks. This episode was actually not so different from the recent crisis. Northern Rock in the UK, the first bank to be struck by the crisis in 2017, experienced a run on deposits, but the major run was on wholesale short-term funds. This is the modern version of a run. In fact, after the fall of Lehman Brothers in 2008 a global run on the financial system occurred which included runs on the interbank market, on asset-backed commercial paper, on repo financing, and on money market funds.

In addition to the excessive reliance on wholesale financing, two other causes of the crisis were misaligned incentives and lax regulation. There is extensive evidence and consensus among analysts that private and social incentives were grossly misaligned in the housing market (on the mortgage-selling side), in the securitisation process, and in the evaluation of risk by rating agencies. Consumers' behavioural biases compounded this problem. Capital requirements had been relaxed to very low levels in practice, and banks did not maintain liquidity buffers as they believed that the lender of last resort would help them in case of trouble. In short, bank regulation was faulty. It has been argued that the level of individual banks' leverage was a better predictor of which banks would get into trouble during the crisis than the more sophisticated risk-weighted capital ratios. Capital requirements and accounting rules were procyclical and did not properly account for systemic effects. In fact, the build-up of systemic risk in the run-up to the crisis went largely unnoticed, especially since much of this build-up took place in the shadow banking sector and the credit insurance markets. Regulatory arbitrage was rampant, with a lack of uniformity in the treatment of banks and bank-like institutions. There was excessive confidence in corporate governance controls and self-regulation (even Alan Greenspan recognised this ex post) and market discipline was lacking because of the explicit and implicit safety nets in place together with regulatory forbearance.

While the panic of 1907 was quelled by J.P. Morgan (who had already rescued the US Treasury in the panic of 1893), the global run in 2007-2008 was ended by the Federal Reserve, the US Treasury, the European Central Bank, the Bank of England and the UK Treasury, several other central banks (most notably, the Swiss National Bank) and the IMF. Critically, the Fed established liquidity swap lines with other major central banks to allow them to provide dollars to local banks in need. Money market funds were insured. In the week when financial markets were imploding around the world, the US Congress finally approved the Troubled Asset Relief Program (TARP) to act as a backstop for the financial system. Importantly, the Federal Deposit Insurance Corporation (FDIC) followed up by substantially increasing the level of insured deposits and eventually fully guaranteeing all new debt liabilities of banks. Finally, the stress tests of 2009 worked to restore confidence in the system. In Europe, the ECB reacted promptly throughout the crisis by meeting banks' liquidity demands. In particular, it was quick to react to the closure of a BNP Paribas fund that raised the alarm on 7 August 2007. Then, in an historic moment in July 2012, when the euro crisis erupted and the monetary union was at risk of imploding, Mario Draghi uttered

the magic words "whatever it takes" and managed to restore sufficient confidence to quell the run on the euro. The stress tests in the euro area have not been as successful as in the US, however, due to the lack of a proper backstop for the system.

The first response to the crisis in terms of regulatory reform was to increase the resiliency of financial institutions, taking into account systemic risk (macroprudential regulation), increasing capital and liquidity requirements, improving supervision and stress testing, introducing structural reforms (trying to insulate banks from capital market activities), and making shadow banking and derivatives markets safer. The second major response was to put in place appropriate resolution procedures for banks ("no more bailouts"). The third response was to strengthen the corporate governance of financial firms and the regulation of banks' executive compensation. Finally, attempts were also made to reinforce consumer protection. These reforms have fundamentally reshaped the regulatory architecture of several countries, in particular the US and the UK, as well as the EU.[1]

The massive bailouts of the banking system – with commitments of up to 30% of GDP in public interventions in the EU and the US – together with the consolidation of banks has distorted competition. Competition policy matters were set aside. Indeed, market power concerns over mergers were overruled. For example, in the UK the merger between HBOS and Lloyds TSB was approved against the advice of the competition authority, while in the US several combinations (Bear Stearns–Washington Mutual–JPMorgan, Merrill Lynch–Bank of America, Wachovia–Wells Fargo, among others) were passed with only cursory competition analysis. The result is a more concentrated sector (particularly in several European countries) in which the surviving incumbents have increased market power and, as some have argued, potentially lower costs of capital because of their designation as too big to fail (TBTF).[2] It is worth noting that in the US, the five largest banking groups are the same today as in 2007, but they are now larger as a result of the acquisitions they made during the crisis.

Before summarising the analysis and conclusions of this report, we explain the specifics of banks' business model and why narrow banking is not a magic bullet to end financial instability. We then move on to tackle three important areas of post-crisis regulatory reform: Basel III and its aftermath, resolution procedures to end TBTF, and the enlarged role of central banks with a financial stability remit. We take those issues in turn, complement them with a box on developments on Banking Union in Europe, and close with conclusions.

1.1 Bank functions, fragility and narrow banking

Financial institutions come in many shapes and sizes, but they all have one key distinguishing feature in common: they are intermediaries, creating value through intermediation. The source of this value may be liquidity transformation, monitoring, private information, or any combination of these. One of the oldest functions of banks is maturity transformation. On the asset side of their balance sheet, banks make long-term illiquid investments, and on the liability side they issue short-term liabilities, demand deposit accounts and money-like short-term

1 See Section 3.4.3 in Vives (2016) for a survey of the reforms.
2 See Section 2.3 in Vives (2016).

securities (repo contracts and commercial paper). Value is created through this transformation in two ways. First, by mutualising the idiosyncratic liquidity risks of individual investors and borrowers, banks are able to manage liquidity reserves more efficiently than individual investors and borrowers on a stand-alone basis. Second, by collecting information, monitoring borrowers, and being continuously present in financial markets, financial institutions are able to make better and more informed investments. They are thus also able to provide valuable financial flexibility through relationship-lending services.[3]

Besides this liquidity transformation role, another traditional service that banks have provided is the administration of trusts. By being continuously present in financial markets, banks are ideally placed to offer trust services to their clients, which can range from estate planning, to escrow services, to asset management. On the retail side, these banking services are often referred to as private banking. Although they are as much a part of a bank's core activities as liquidity transformation, they have received much less emphasis in the finance literature. Part of the reason for this is that financial fragility is typically associated with maturity transformation.

This does not mean, however, that private banking is of no concern to prudential regulators, thanks to the fierce competition from non-bank financial institutions in the asset management industry, which may erode the franchise value of these activities for banks. Indeed, in the wake of the financial crisis of 2007-09, the US asset management industry has grown enormously relative to the banking industry. A major turning point for the asset management sector was the sale of Barclays Global Investors to Blackrock in 2009. While US banks obtained over half of US financial sector aggregate revenues in 2006, they obtained only one third in 2017. In contrast, the share of non-bank-affiliated asset management firms grew from 39% in 2006 to 49% in 2017.

Maturity transformation creates value, but at the cost of financial fragility. Banks create value by holding less than 100% of deposits in reserves. By mutualising the idiosyncratic liquidity shocks of depositors, they only need to hold a fraction of deposits in reserves. The other fraction they can lend out, thus creating value. There is, however, always the risk that depositors may panic and rush to take their money out from the bank before it runs out of reserves. A run on a bank is typically a self-fulfilling equilibrium, whether the bank has earned a profit on its investments or booked a loss. Indeed, when banks face withdrawals that exceed their reserves, they must sell their illiquid assets at fire-sale prices. The more they need to sell quickly, the lower the price, and there comes a point where the fire-sale value of the assets is lower than the bank's liabilities.

There are several responses to the risk of runs that is inherent to banking. Regulators can require banks to hold a higher fraction of reserves or they can limit their short-term liabilities by raising the required fraction of equity capital and long-term debt. This would provide a 'bigger cushion' to absorb losses and postpone the moment when the bank must engage in fire sales, but it would not completely eliminate the risk of a run. Only a narrow bank with 100% reserves could perfectly forestall a run. The problem with this solution, however, is that all the liquidity transformation will migrate outside the regulated banking sector. In addition, the regulated sector would be so constrained that it would hardly be

3 See Diamond and Dybvig (1983), Diamond (1984), Bolton and Freixas (2000, 2006), and Section 3.1 in Vives (2016).

able to generate any profits. Certainly, it would not be able to compete with the unregulated sector, as was the case for US commercial banks under Regulation Q, when money market mutual funds were attracting funds away from banks by offering better terms.

Another response is deposit insurance. If deposits are insured, then depositors have no reason to fear losing their deposits when a bank fails or if it has to engage in fire sales. With deposit insurance, a panic run is no longer self-fulfilling. Strictly speaking, this is only true if deposits are covered by close to 100% insurance; anything less could still result in a run. Only 100% deposit insurance is a large enough 'bazooka' that it will not have to be taken out. The US was the first country to introduce limited deposit insurance with the Banking Act of 1934, which also established the FDIC. The 50 years, or even 74 years, of US banking stability that followed led many to believe that deposit insurance works even when it is limited. At the time of the crisis of 2007-09, the limit per account was $100,000. Well-off and shrewd Wall Street bankers suspected that their personal deposits which exceeded this limit were at risk and literally ran to their banks in the days after the failure of Lehman Brothers on 15 September 2008. Several weeks later, Congress raised the limit to $250,000 in an effort to stem the flow of deposit withdrawals, but even that was not sufficient to calm financial markets. Eventually, on 31 October 2008, the US Treasury, the FDIC and the Federal Reserve invoked their powers under systemic risk exception to introduce the Transaction Account Guarantee Program, which provided 100% insurance to non-interest-bearing transaction deposit accounts, and the Debt Guarantee Program, which fully guaranteed any new debt issues by bank holding companies and their affiliates. Together, these programmes insured over $1.25 trillion in bank liabilities. According to Timothy Geithner, US Treasury Secretary under President Obama, it was only after these extreme measures were taken that liquidity was once more available in the interbank market.

If deposit insurance is necessary for financial stability and to avoid runs, it is puzzling that 'shadow banking' grew so large and that such a large fraction of liquid savings is invested in uninsured entities such as money market mutual funds or repos. There are three reasons why money market mutual funds were able to attract savers looking for safe and liquid investments. First, the answer to the lack of deposit insurance was to over-collateralise the investments with short-term assets with low credit risk. This is a form of private ordering – a market solution to make up for the lack of deposit insurance that, in theory, provides even better protection than (partial) deposit insurance. Second, money market mutual funds were marketed as essentially fixed-income instruments. They could report a fixed net asset value (NAV) as long as the book and market values of the assets were nearly identical. Third, money market funds offered slightly higher returns to investors than the remuneration on demand deposit accounts. Except for the NAV reporting rules and the redemption rules defining the terms on which money market fund investors could withdraw their funds, repos were essentially structured the same way. Both savings vehicles also offered great convenience to large institutional and corporate investors looking to park large volumes of savings in ultra-safe and liquid assets.[4]

4 See Poszar (2011).

Until the global financial crisis, both money market mutual funds and repo loans were considered to be essentially safe and run-proof investments. The roll-over crisis in the asset-backed commercial paper market in 2007, however, revealed a basic flaw in the notion that over-collateralisation ensured that the investments were safe. The same proved to be true for money market mutual funds after the Reserve Primary Fund 'broke the buck' the day after Lehman Brothers declared bankruptcy.[5] The fact that the market value of the collateral exceeds the invested amount on the day of the investment of course does not guarantee that it will under all circumstances. As with deposit accounts, a self-fulfilling run is possible for both repos and money market mutual funds because the run results in the sale of the collateral at fire-sale prices.[6] The run on money market mutual funds and the breaking of the buck by a leading fund took everyone by surprise and put the entire financial system at risk of a liquidity freeze. This was the 21st century version of a generalised bank run, and only the intervention of the Federal Reserve and US Treasury to essentially guarantee all money market funds stopped the panic.

The narrow bank model, which resurfaces as a 'magic bullet' to end fragility after every major crisis,[7] does not eliminate liquidity transformation and financial fragility; it merely displaces it. The extreme form of a narrow bank is one that holds 100% reserves; other proposals would have the bank invest only in safe short-term securities (such as US Treasury bills). The proposal puts an end to the financing of illiquid loans (opaque and non-securitisable business loans, for example, as opposed to mortgages or consumer credit) with liquid liabilities. As we have seen, however, money market mutual funds can be subject to runs since there are strategic complementarities (i.e., co-movements) in the redemption behaviour of investors of mutual funds because when a fund is faced with many redemptions, it has to sell assets at fire-sale value. Narrow banking proposals simply push the fragility problem elsewhere. For example, companies financing long-term projects may be backed by certificates of deposit, but the coordination problem of investors remains. This indicates that narrow banking does not address the basic problem dealt with by safety nets, namely, the adverse consequences of banking fragility in terms of credit supply and externalities for the private sector of the economy. Note that the commitment not to insure finance companies that take on the functions of banks may not be credible, as was the case for the structured investment vehicles (SIVs) sponsored by banks in the run-up to the subprime crisis.[8]

1.2 Basel III and beyond

Reform has focused on macroprudential regulation, aiming to counteract the external effects of banks' risk-taking behaviour and to prevent the build-up of systemic risk. The regulations address interconnectedness and contagion, and the reduction of fluctuations in the credit cycle. For the former, common equity as capital has been preferred, together with contingent and hybrid forms of

5 A money market mutual fund 'breaks the buck' when its net asset value falls below par.
6 See Gorton and Metrick (2012) and Section 3.2 in Vives (2016). For instances of runs in money market mutual funds, see McCabe (2010), Chernenko and Sunderam (2014) and Schmidt et al. (2015).
7 See Chamley et al. (2012), Pennachi (2012), Cochrane (2014), and Section 5.4 in Vives (2016).
8 Parlatore (2015) finds also that sponsored money market mutual funds may be a source of fragility.

capital for risk absorption. Furthermore, a (non-risk-weighted) leverage ratio and capital surcharges for systemically important banks have been introduced, as well as liquidity requirements. For the latter, cyclical capital requirements and several ratios to control credit growth are proposed and implemented.

Despite progress in strengthening capital and liquidity requirements, there is room for improvement on various fronts. To start with, there is an ongoing debate over the right level of capital and how leverage and risk-weighted capital requirements interact.[9] The latter were exceedingly low before the crisis due to the potential for manipulation provided by internal models. The leverage ratio is difficult to manipulate, since no internal model is involved. However, the interaction of the two requirements could lead to increased risk-taking unless properly calibrated. It is clear, however, that banks need a robust level of high-quality capital to provide credit and operate safely, and that capital should be accumulated in good times in order to confront bad times. Capital provides incentives for management to be prudent and is useful for absorbing losses when in trouble. However, imposing a high level of capital requirements when banks and the economy are weak would be counterproductive since banks will then shed assets instead of raising capital (as the post-crisis experience in southern Europe shows). Dynamic capital buffers are designed to avoid these problems under the umbrella of macroprudential policy (as we will discuss in Section 4). Another potential negative side-effect of increased capital is the migration of activities from banks to shadow banks.

The introduction of liquidity requirements in the form of two ratios – the liquidity coverage ratio (LCR) to prevent runs, and the net stable funding ratio (NSFR) to limit maturity transformation – has added complexity and, when looking at the balance sheet of a bank, one realises that one ratio should be enough. This is because the LCR essentially requires that liquid assets must be able to cover short-run liabilities, while the NSFR requires that stable funds should cover illiquid assets.[10]

A further complication arises since disclosure requirements also interact with liquidity needs. This is because increased disclosure or transparency may serve as a coordinating device for investor runs, and should therefore go hand-in-hand with higher liquidity requirements. An organising principle for how to view the interaction between regulatory tools is to see how changes in the market affect the degree of co-movement (i.e., the strategic complementarity) of the actions of investors. An increased tendency to co-move leads to enhanced fragility. If regulators want to keep the probability of insolvency and illiquidity of financial institutions in check, the interaction between the prudential tools should be taken into account. For example, more competitive scenarios – such as following a liberalisation – should be accompanied by increased capital requirements, and enhanced disclosure should be accompanied by increased liquidity requirements. The bottom line is that a piecemeal approach to prudential regulation may not work.[11]

9 The debate over the right amount of capital hinges on the fact that we still do not have a satisfactory theory of capital for banks. This lack of conceptual clarity translates into a wide range of estimates of the optimal bank capital.

10 Hoerova et al. (2018) point out, however, that the NFSR may contribute more than the LCR to limiting recourse to the lender of last resort in case of crisis.

11 See Vives (2014).

The concept of stress tests has been around for decades, but their systematic introduction represents a post-crisis regulatory innovation. The objectives are to guarantee rigorous internal risk-management processes and to provide authorities with a comprehensive systemic risk map. The stress tests carried out in the US in 2009 were crucial to restoring confidence in the banking system. They worked because they had TARP as a backstop and an appropriate combination of flexibility, severity and transparency (where the process and models can be disclosed, but not the scenarios). In the euro area, in contrast, a series of stress tests in 2009, 2010, 2011 and 2012 failed to detect important subsequent failures, including those of the Bank of Ireland, Allied Irish Bank and Dexia. A key explanation for this is that the euro area did not have in place a proper backstop for the financial system; a stress test requires a process and funds for handling banks that fail the test. Furthermore, euro area authorities have been reluctant to stress sovereign bonds, which are a material part of the assets of southern European banks (and which contribute to the doom loop between bank and sovereign solvency in a monetary union). On both sides of the Atlantic, stress tests have not yet incorporated a systemic perspective taking into account feedback effects among entities.

Other areas of regulation have shown less progress. No major changes have been made to the regulation of credit rating agencies (the big three still control more than 95% of the market), although they revealed major conflicts of interest in rating asset-backed securities before the crisis. Structural reforms have attempted to establish some degree of separation between commercial and investment banking activities to control excessive risk-taking and restrict the activities of TBTF banks. In the UK, the Independent Commission on Banking (the 'Vickers Commission') recommended ring-fencing retail activities in a universal bank, and this has been effective since January 2019. In the US, Dodd-Frank imposed the Volcker Rule (a modern, lighter version of the Glass-Steagall separation between commercial and investment banking) forbidding proprietary trading by banks on their own account, but allowing securities dealing for their clients. The latter has been criticised for its complexity and for restricting liquidity in market making. In the EU, the Liikanen Report proposed the separation of large trading activities within a banking group, but not much progress has been made in its implementation. Structural reform has remained controversial because of the potential loss of economies of scope in banking activities, but the fact remains that as long as insurance mechanisms are in place (deposit insurance, TBTF policies, etc.), capital requirements should be complemented with restrictions on activities to control risk.[12] Another area where progress is lacking is in reducing or eliminating the tax advantage given to debt (over and above the implicit subsidy through the lender of last resort (LOLR) backstop and TBTF policies), which incentivises excessive leverage. This is particularly the case for sovereign debt, since EU banks can assign a zero risk-weight to sovereign debt, and since there are no concentration limits on the holdings of government bonds – a practice that has been questioned for good reason.[13] The same applies to the sovereign debt of developed countries such as the US.

12 See Section 5.3.1 in Vives (2016).
13 See ESRB (2014).

One fundamental reason why the reliance on corporate governance controls failed during the crisis is that the alignment of interests between shareholders and managers does not in itself control incentives to exploit debtholders through excess risk-taking. Executive compensation has come under increased scrutiny in both the US and the EU. For example, Dodd-Frank deals with say-on-pay for shareholders, the independence of banks' compensation committee, enhanced compensation disclosure, and claw-back clauses for recouping compensation in case of bank trouble. Limits on executive compensation do not necessarily eliminate incentives for excessive risk-taking, however, since they do not link remuneration to the fate of a bank's creditors and the external effects of failure.

Regulatory reform has made regulation and supervision more intrusive and substantially increased compliance costs. The banking business has become much more bureaucratic and the attention that boards of directors must pay to compliance issues has increased dramatically. All of this represents a barrier to entry that favours large incumbent banks and shadow banks that face lower compliance costs, potentially shifting activities out of the regulatory perimeter. Indeed, the risk of activities migrating to less-regulated areas where systemic risk is reproduced always exists. A case in point is the rise of shadow banking activity in the US mortgage market. The share of shadow banks in mortgage loan origination has been steadily increasing since the crisis (from about 15% in 2007 to more than 35% in 2015, and much more in conforming and Federal Housing Administration loan submarkets). It is estimated that the increased regulatory burden on traditional banks explains about 55% of the shadow bank growth in this period. Furthermore, by 2015, 85% of the shadow bank loans were sold after origination to government-sponsored enterprises (GSEs).[14] We therefore see that the growth of shadow banking has relied on the guarantees provided by GSEs. This is replicating the scheme of government guarantees for the new non-bank entrants that led to excessive risk-taking pre-crisis.

Increased competition from new digital competitors outside the regulatory perimeter is a force for efficiency. New non-bank entrants may be lower risk since they have less leverage, but the erosion of profits of incumbents may induce them to increase risk-taking and thus end up being destabilising. Furthermore, the entry of 'big tech' companies in financial services will increase competition in the short term, although it may reduce competition in the long term if the new technological platforms manage to monopolise the interface with customers. This will pose a challenge for regulators looking to maintain a level playing field. A key issue will be the information-sharing requirements among platforms and providers in 'open banking' arrangements.[15]

The share of non-bank financial intermediation has grown from 31% to 36% of the financial system in the period 2007-2017, according to the Financial Stability Board (FSB). This is a significant shift given that during this period the financial sector has been shrinking, and shadow banking is known to grow mostly during periods of financial expansion. The proper regulation of shadow banking requires a focus on activities and functions, since the same banking activities should face the same regulations wherever they are undertaken. This is

14 See Buchak et al. (2017). The GSEs are Fannie Mae and Freddie Mac, which were nationalised in the week before Lehman Brothers fell and since then have been in 'temporary conservatorship'.

15 In the EU, the asymmetric obligations regarding data portability of banks (via the Payment Services Directive, or PSD2) and platforms (under the General Data Protection Regulation, or GDPR) are in question (Vives, 2017, 2019).

easier said than done, however, as it is entities that fail, not activities. Indeed, to ensure the resilience of the entire financial system, as opposed to just banks or other regulated intermediaries, we need a robust framework to monitor, assess, designate, regulate and supervise entities outside the perimeter of regulation. In most jurisdictions, including the US and the euro area, this framework is still lacking. The myriad of regulators in the US, despite Dodd-Frank, and the lack of full macroprudential authority for the ECB are cases in point. In the UK, both microprudential and macroprudential functions sit at the Bank of England, while securities regulation, consumer protection and competition are the realm of the Financial Conduct Authority. This 'twin peaks' system also has an agreed process to determine the entities inside the regulatory perimeter.

Finally, smaller entities should face lower compliance costs and regulatory burden if we want to encourage new entrants into the business. In both the US and the EU, several measures are being considered to lighten the burden for small and medium-sized banks.

1.3 Resolving 'too big to fail'

The recent financial crisis has also been referred to as the 'too big to fail' crisis. This is in part a reference to the bailouts of the failed banks, their unpopularity and the promise of "no more bailouts". What is clear is that neither the US nor the EU was prepared to resolve systemically important banks (SIBs), even less their global cousins (G-SIBs). In the US, the weekend purchase-and-assumption resolution method of the FDIC works well for small and medium-sized banks but not for large ones, and it is not applicable to non-bank institutions such as broker-dealers. Bear Stearns could not be resolved through FDIC receivership, for example, since it was not a bank holding company. Moreover, Chapter 11 bankruptcy was problematic since it would have triggered a financial panic. The Fed managed to provide liquidity support to Bearn Stearns to facilitate an acquisition by JPMorgan using Section 13(3) of the Federal Reserve Act of 1913. However, when Merrill Lynch and Lehman Brothers got into trouble only one US suitor could be found (Bank of America, which ended up absorbing Merrill Lynch) and Lehman was allowed to fail because its UK suitor Barclays could not push a deal through in time.

The situation was even worse in the EU, since there were less well-defined resolution procedures for financial institutions. This situation, combined with much broader intervention authority of finance ministries and treasury departments, led to generalised bailouts or nationalisations to take care of failed entities. Intervention was delayed in some cases because of the weak fiscal position of some countries (such as Spain). This stands in contrast to the US, where the government recapitalised banks under TARP and was able to perform strict stress tests which led to capital injections in the banking system. The problems in the EU were compounded because the resolution of entities operating in different countries – such as Fortis and Dexia – had to be implemented through distinct bankruptcy laws and different competent supervisors, with no agreed ex-ante burden-sharing. The result was uncoordinated action as well as incompatibilities

between the recapitalisation of financial institutions and EU regulations on state aid. Cross-border resolution problems were not limited to the EU. Barclays could not buy Lehman Brothers because of fears in the UK over the potential transfer of burden from the US to the British taxpayer.

According to the IMF in 2014, supervisory memoranda of understanding failed to enable cooperation during the crisis, with unilateral responses being the norm, leading in some cases to the breakup of groups into national components and the commitment of large amounts of public funds. National resolution frameworks were inadequate and arrangements for cross-border cooperation were lacking. Furthermore, concerns for domestic financial stability impeded cooperative solutions, and sovereign financial strength emerged as a key factor in determining national strategies.

The question is how deeply the global financial regulatory system has been reformed to avoid more bailouts, and indeed whether they can be avoided completely. According to the G20 in 2011, "[t]he new resolution framework should set out the responsibilities, instruments and powers to enable authorities to resolve failing financial firms in an *orderly manner*, by *protecting critical functions* and *without exposing the taxpayer* to the risk of loss". The main innovations brought about by the new resolution procedures are that (i) liabilities that should be restructured and liabilities that should remain outside of resolution are delineated in advance so as to give greater certainty to financial markets; and (ii) G-SIBs are now required to hold sufficient capital to be able to absorb any losses without putting the liabilities that have been put outside resolution at risk. The new instruments that can be written down or converted into equity in case of resolution (CET1, AdT1, T2 and senior subordinated debt) come under the heading of total loss-absorption capacity (TLAC). The minimum TLAC will be 16% of risk-weighted assets from 2019 (18% from 2022) and 6% of the Basel III leverage ratio denominator (6.75% from 2022). In the EU, the minimum required eligible liabilities (MREL) introduced by the Bank Recovery and Resolution Directive (BRRD) have similar objectives to the TLAC ("same dog with a different collar") and are to be applied to all institutions.

Furthermore, new rules have been put in place to ensure that a G-SIB can be resolved in an orderly way without relying on a bailout. Two approaches to the cross-border resolution of global SIBs have been established: SPOE and MPOE. Behind these acronyms is the key innovation of specifying in advance which parts of a G-SIB will be resolved and which parts will be left untouched. Under single-point-of entry (SPOE) resolution, a G-SIB is recapitalised by writing off debt/equity issues by a single global holding company that owns banking subsidiaries in multiple jurisdictions. Resolution losses are imputed to the bondholders of the parent holding and the statutory power of resolution is in the hands of the authority of the parent holding. Under multiple point of entry (MPOE) resolution, separate resolutions are performed in each country (if necessary) with funds from national subsidiaries or holding companies (with TLAC pre-assigned across these jurisdictions). Resolution losses are borne by the subsidiaries and the statutory power of resolution goes to the host country authority. A major difference is that under SPOE, resolution loss-absorbing capacity is shared across jurisdictions.

SPOE is the more efficient resolution mechanism if regulators can commit to cooperating in the midst of a crisis, emulating a *supranational regulator*. It allows a lower TLAC because of transfers between subsidiaries, yielding more banking services and enhanced economies of scale/scope because global bank

operations are preserved after resolution. It is efficient to structure global banks as multinational holding companies (HoldCos) with shared services and TLAC issued by the global HoldCo. However, SPOE requires that both ex-ante and ex-post conditions are fulfilled in order for national regulators to have incentives to implement the agreement. Indeed, the SPOE regime agreement requires expected cross-jurisdictional transfers to be sufficiently symmetric and the gains from increased banking activity/global banking to be larger than the expected net transfer. Furthermore, incentive constraints will be violated ex post (with the result of no transfer from a sound home jurisdiction or ring-fencing from a sound host jurisdiction) when the required transfers are larger than the loss of shared services and spillover costs that result from unilateral ring-fencing.

The choice between SPOE and MPOE resolution depends on the business model of the G-SIB. MPOE is likely to be more efficient in a more decentralised structure with less complementary subsidiaries. Many global banks, encouraged by regulators, have opted for the SPOE model, but not all. Retail global banks with a decentralised subsidiary business model (funded by local deposits, as in the cases of BBVA and Santander) have opted for the MPOE model.

This new resolution model not only constitutes the most important shift away from a too-big-to-fail regime to a bail-in regime, but also transforms the way G-SIBs are managed. It is perhaps the most important institutional transformation of international finance coming out of the recent global financial crisis. How well this resolution model will work remains an open question, however, given that it has not yet been tested. How will it affect international expansion or retrenchment? How will it affect the decision to open a branch rather than a subsidiary? Are there major contingencies that no one has fully anticipated and that will disrupt its implementation? We cannot forget the strategic incentives of national regulators and supervisors. We could envision international cooperation or instead ring-fencing and a move towards a 'strategic resolution policy'.

Bail-in requirements should be set so as to prevent increased fragility in a systemic crisis and avoid the flight of short-term wholesale funds. This suggests the need to concentrate the risk of bail-in on long-term junior liabilities of banks to avoid the incentives to run and limit the intervention of the lender of last resort. Under the new resolution regime in the EU (see Box 1.1), bail-in of 8% is required even under *systemic* stress, following a macroeconomic shock. The idea of protecting the taxpayer as much as possible makes sense for idiosyncratic shocks, but for macro-systemic shocks a monetary and fiscal backstop is needed. Indeed, despite the overall goal for bank resolution to replace bailouts, with bail-ins it is not possible to achieve an orderly resolution of systemically important banks by completely eliminating the public backstop. If there is even the remotest suspicion of a liquidity dry-up, it could become self-fulfilling and no resolution plan, no matter how well designed, will be able to deal with a generalised market panic. In the EU there is possible support for institutions that do not meet the 'public interest' criterion under the heterogeneous domestic insolvency regimes and subject to state aid rules. Homogeneous insolvency procedures for banks not subject to resolution should be developed in the EU in order to ensure an orderly exit. Here the FDIC model of 'purchase and assumption' may help. In the EU, there is also a population of medium-sized banks that have difficulties in meeting the MREL requirements.

Furthermore, bail-in suffers from time-inconsistency since, in a crisis, ex-post help is optimal but it is bad for ex-ante incentives to take risk. The tendency to bail out comes from a political economy problem: the resolution authority has to decide between imposing a cost on a reduced number of investors (who may be very vocal) or deferring the cost to the taxpayer with a bailout.

A major open question concerns liquidity provision in resolution. It is important not to close down the option of a public liquidity backstop. Under the new G-SIB resolution model, it is no longer the case that lender-of-last-resort interventions by a central bank represents a bailout. Much has been done to allow for the credible and orderly restructuring of debts – bail-ins – so that the LOLR backstop should now mostly be thought of as fulfilling the intended function of restoring trust in financial markets in the event of a panic. The new resolution procedures in the EU are silent on the subject of funding in resolution. This a major reason why time pressure is so strong in the EU, in contrast to the US where the FDIC can obtain interim funding by borrowing from the Treasury. The EU legislation should be amended to provide for funding in resolution, reduce the time pressure, and make holding and managing assets a viable alternative to a resolution weekend (or, as in the recent case of Banco Popular, a resolution night). However, recent proposals to allow for a moratorium on payouts may not solve the problem; it may just shift it forward as investors run out of fear of the moratorium, whereas before they ran out of fear of the resolution.[16] A possible solution is to consider a special central bank facility, like the Liquidity Resolution Framework in the UK, to provide liquidity in resolution procedures.

Box 1.1 The EU and Banking Union[17]

The instability in the euro area due to the European sovereign debt crisis from 2010 onwards made evident the need for a Banking Union. The aim of this is to break the feedback loop between sovereigns and banks at the root of the debt crisis, and to provide unified supervision for euro area banks and a backstop in case of a crisis. The first steps were taken in 2012 with the agreement to create a Single Supervisory Mechanism (SSM) at the ECB and a Single Resolution Mechanism (SRM). A parallel process to harmonise bank supervisory, resolution, and deposit insurance frameworks got underway in 2013 and 2014 with the new supervisory rulebook based on Basel III, the Bank Recovery and Resolution Directive (BRRD), and the Deposit Guarantee Schemes Directive (DGSD). The European Banking Authority (EBA) is in charge of achieving a consistent level of prudential regulation and supervision across the banking sector in the EU.

The European Systemic Risk Board (ESRB) performs macroprudential supervision in coordination with each country's macroprudential oversight authorities. The ESRB's target is to keep track of developments in the European financial system, so that it can determine possible causes of systemic risk and mitigate financial stability risk. It does so by delivering systemic risk warnings and suggesting measures for handling these risks according to "comply or explain".

16 See Hellwig (2018).
17 This box is based on Sections 7.1.2 and 7.3.1 of Vives (2016).

As of the end of 2017, the ECB was directly supervising 119 significant banks (representing more than 80% of the assets of the banks operating in the euro area), and supervised the rest of the banks in an indirect manner. The national regulators, under the supervision of the ECB, will directly supervise less-significant institutions. Banks in EU member states not in the euro area may also voluntarily join SSM supervision.

The ECB needs to take into account potential spillovers and guarantee consistent implementation of macroprudential supervision across the Banking Union. Nonetheless, the SSM constrains the ECB to using only those tools included in the EU directives (CRD IV/CRR). This includes the power to impose higher requirements for micro and macro risks beyond the levels chosen by national authorities (this is the case for the counter-cyclical capital buffer, or CCyB).

National authorities have full power over the application of crucial macroprudential instruments such as caps on loan-to-value, loan-to-income and loan-to-deposit ratios. Consumer protection, payments systems supervision, and combatting money laundering also remain under the jurisdiction of national authorities. In designing the SSM, the potential conflict of interest between monetary policy and supervision has been accounted for with clear task separation in the ECB.

Since January 2016, the SRM has held resolution powers to control the impact of bank failures on the taxpayer and the economy. The SRM operates in the same regulatory perimeter as the SSM and includes a Single Resolution Board (SRB), established in early 2015, and a Single Resolution Fund (SRF). The former is the European resolution authority for the Banking Union and has the power to determine the approach for resolving a bank. It is also in charge of the SRF, which is comprised of contributions of the banks of participating member states functioning as a limited safety net. The current level of funding would not be sufficient in the case of a systemic crisis, and recourse to the European Stability Mechanism (ESM) is limited. The ESM's objective is to maintain financial stability by offering financial assistance to euro area countries. In December 2018, it was agreed at the Euro Summit that the ESM would act as a common backstop for the SRF. The backstop is set to be effective by 2024 at the latest, with a credit line and aligned with SRF funds (about €60 billion, or 1% of covered deposits in the Banking Union). An assessment on the sufficient reduction of the banking risk exposure is planned for 2020 so that the backstop can be introduced earlier.

The Banking Union project is not yet complete given that the funds available for resolution are limited, and certainly inadequate for dealing with a systemic crisis. At the same time, a federal deposit insurance system is contentious as it entails a higher degree of fiscal union among euro area countries than presently envisaged, and its establishment has been postponed a few times. Nevertheless, such a system is vital for resolving the link between sovereign and bank risk.[18] The absence of an effective fiscal

18 In November 2015, the European Commission issued a regulation proposal on the European Deposit Insurance Scheme (EDIS), which would be the third pillar of the Banking Union. The scheme was initially meant to be introduced in a three-stage gradual implementation process to be completed in 2024 with the full mutualisation of national deposit insurance schemes. However, the plan has been cancelled and is under reformulation. The Commission also suggested that a properly redesigned Single Resolution Board would be in charge of the EDIS in order to facilitate crisis management (similar to the FDIC in the US) while the SRF and the EDIS would remain separate entities.

backstop for the resolution authority also compromises the credibility of the ECB as a supervisor, since if the SRM does not have the necessary fiscal funds available, the ECB may be less willing to initiate a closure or restructuring of a bank.

The coordination of the SRM and the competition authority at the European Commission, which handles state aid, is not simple. The decision to resolve a bank typically starts with the communication of the bank's imminent failure from the ECB to the SRB, the Commission, and the national resolution authorities. The SRB then decides on a resolution scheme and any use of the SRF given that the competition authority's (the European Commission) assessment of compliance with state aid rules is successful. The Commission may concur with the scheme, oppose on competition grounds, or object to the failing bank entering the resolution regime for reasons of public interest. In case of disagreement, the European Council is asked to intervene. If the resolution scheme is approved, the national resolution authorities implement it in accord with national law and the BRRD. The euro area model differs from that of the US in that the FDIC, apart from acting as an insurance fund, also functions as a resolution agency with microprudential supervisory powers.

The BRRD requires three basic conditions to hold for a resolution to be undertaken: (i) the bank is failing or likely to fail, which is based on the ECB's assessment; (ii) there is no alternative private solution; and (iii) it is necessary for the public interest. The SRB has jurisdiction over deciding whether the last two conditions are satisfied. Resolution decisions will be prepared and monitored centrally by the Single Resolution Board of the SRM, and the Single Resolution Fund is established so that the resolution is implemented without the use of taxpayers' money (through a 'bail-in' of shareholders and creditors). The BRDD has also introduced the MREL buffer to ensure that every bank has adequate liabilities for absorbing losses in case of failure and that creditors – rather than taxpayers – can contribute a large share of the recapitalisation burden. MREL has similar objectives to the FSB's TLAC requirement framework, but it is to be applied individually to all EU banking institutions whereas only G-SIBs will be required to adhere to TLAC requirements.

It is noteworthy that even though in the Irish banking crisis of 2008 all debt holders were promised to be made full (with a European rescue in late 2010), the MoU of July 2012 to recapitalise the Spanish banking system meant that hybrid capital and subordinated debt holders incurred partial losses, and in Cyprus's banking bailout programme of March 2013 all liability holders were bailed-in (with the exception of insured retail deposits up to the level of €100,000). However, in the latter case non-EU citizens (mostly from Russia) held numerous large, uninsured deposits.

According to the BRRD, in "circumstances of very extraordinary systemic stress, authorities may also provide public support instead of imposing losses in full on private creditors. The measures would nonetheless only become available after the bank's shareholders and creditors bear losses equivalent to 8% of the bank's liabilities and would be subject to the applicable rules of state aid."[19]

19 See the FAQs on the BRRD.

1.4 An expanded role for central banks

The financial crisis and Great Recession have forced a reconsideration of the mission, scope of action and tools of intervention of central banks, with the promotion of financial stability at centre stage. Central banks historically started their mandate with the preservation of financial stability as a central concern. This was the case with the establishment of the Federal Reserve in 1913 as a response to the instability of banking in the 19th century and, in particular, the panic of 1907. This central concern gave way to the 'modern' narrow mandate of controlling inflation, which was supposedly validated by the period of the Great Moderation. This period ended abruptly with the financial crisis in 2007, and the general perception now is that central banks should also worry about financial stability. The reconsideration of the role of central banks, back to its origins, points to the need for enlarging their mandate, a development that constitutes a critical element of the regulatory reform programme. However, the extent of the enrichment of the central bank mission and its tools is up for discussion. At one extreme, the central bank would have full responsibility for the preservation of financial stability on top of maintaining price stability; at the other extreme, the price stability goal would remain the priority, with the responsibility for financial stability being shared with prudential authorities and the ministry of finance. Both models raise governance issues and both extensions call for adaptations to the independent status of the central bank (to a varying degree depending on the solution).

The crisis has changed the view of central banking along three dimensions. The first is the conduct of monetary policy at the zero lower bound (ZLB). Here, our view is that the choice of unconventional policies was not the result of a thorough discussion among authorities on the most appropriate policy mix in the prevailing circumstances. This consideration points to more intensive coordination between monetary and fiscal authorities. We also note that the much larger balance sheets that have resulted from the unconventional policies provide central banks with a new, powerful instrument to fulfil a financial stability mandate. We discuss two possible avenues in this direction and their implications. The first is the potential of the central bank to tilt the maturity structure of consolidated public debt to reduce the incentive of banks to issue an overly large volume of short-term liabilities. The second avenue is acting to facilitate the fulfilment of liquidity regulations by banks in the face of an apparent global shortage of safe assets. Both measures constitute an expansion in the role of the central bank in promoting financial stability, and the advocated central bank actions would be a substitute for actions by the Treasury. Again, this implies the need for some form of coordination with the fiscal authority.

The second dimension relates to the scale and scope of the LOLR actions of central banks. All major central banks acted as lender of last resort and the Fed acted as a global lender of last resort, providing dollars with swap arrangements with other central banks to fulfil the needs of local banks. The discount window facilities of central banks proved ineffective because of the stigma associated with its use, and other facilities had to be put in place to stabilise the system. A lender of last resort is needed because in a fractional reserve system, a solvent institution can turn illiquid and the interbank market will not resolve the issue

by itself.[20] The rationale goes back to Bagehot's (1873) recipe for central bank lending without limit to solvent banks, against good collateral (valued at pre-crisis levels), and at penalty rates (understood as higher than those prevailing in normal market conditions). We believe that the role and the mode of action of the lender of last resort should be clarified, putting an end to the now untenable traditional doctrine of constructive ambiguity (and finding other regulatory means to limit moral hazard). This calls for increased ex-ante transparency regarding the form and extent of the liquidity support provided by the central bank without entailing restrictions on its capacity to react swiftly to a crisis. We question whether this liquidity insurance should not be priced, with the institutions eligible for support being required to pay an insurance premium. The potential problem with proposals that go in this direction is that they may increase the collateralisation of banks' credit activity, exacerbating the tendency to mortgage their balance sheet and damaging the financing of new activities based on intangible assets.

The third dimension of change relates to the new emphasis on systemic risk and on macroprudential policies that deal with such risk. Systemic risk is the risk of impairment of the functioning of a substantial portion of the financial system, typically with significant negative effects on the economy as a whole. There are several drivers of systemic risk: excessive credit growth with leverage as an amplification mechanism; excessive maturity mismatch and market illiquidity (since relying on short-term funding may lead to fire sales and contagion); direct and indirect exposure concentrations; misaligned incentives and moral hazard due to government guarantees; and TBTF policies together with the 'too many to fail' problem, when many institutions choose correlated risks (as was the case in the run-up to the 2007–2009 crisis – with high exposure to real estate, the central bank/government is compelled to bail out failing banks ex post). Macroprudential policies aim at strengthening the resilience of the financial system, decreasing the build-up of vulnerabilities and limiting the frequency and cost of banking crises.

The pre-crisis consensus was that detecting a bubble and trying to prevent its development was very difficult and could lead to costly policy mistakes. This view was reactive, allowing the LOLR function of the central bank to act as an interim reaction to a crisis. Post-crisis, the consensus has shifted towards a more proactive role for the central bank. However, the use of interest rate policy as a macroprudential tool ('leaning against the wind') has remained controversial, since the costs of such a policy may be high while it may not be very effective in preventing a crisis. This is where macroprudential policies enter the picture. The toolkit of macroprudential control includes the counter-cyclical capital buffer (CCyB), pioneered by the Bank of Spain with its dynamic provisions and first applied by Switzerland, and several ratios to control credit growth. However, the Swiss and the Spanish experiences suggest that while the CCyB is a useful instrument, it cannot be relied upon to single-handedly prevent a housing bubble. Other measures target the real estate market and focus on lenders (with limits on credit growth, asset concentration in specific sectors and loan-to-deposit ratios) or on borrowers (with limits on loan-to-value, loan-to-income and debt-to-income ratios). It is worth noting that all measures related to mortgages, particularly those that involve direct quantity restrictions, are politically charged.

20 See Rochet and Vives (2004).

The question is what role central banks should play in guaranteeing financial stability with macroprudential objectives and tools. There is a good case for enlarging the mandate of a central bank to include prime responsibility for price and financial stability. Indeed, credit supply is at the heart of both price and financial stability. Two key determinants of credit – the interest rate and banks' collateral requirements to obtain liquidity – are in the hands of the central bank. A broad mandate for financial stability for the central bank would ensure that the trade-offs arising when the timing of economic and financial cycles diverge are best addressed. This requires that the macroprudential toolbox be under the central bank's roof. It follows that the location under one single roof of monetary policy, micro- and macroprudential control, and financial supervision may be optimal. This leads to the 'twin peaks' financial supervisory architecture of the reformed UK system where the Bank of England has under its wing the Monetary Policy Committee, the Financial Policy Committee and the Prudential Regulatory Authority, while competition, conduct and consumer protection issues are in the hands of the Financial Conduct Authority. The single focus of central banks on inflation targeting would thus be superseded by a broader perspective. However, this broader view has the potential drawback that the accountability of the central bank is more diffuse because it has two remits instead of one, and there is a greater risk of political contamination and attacks to its independence because of the social sensitivity of macroprudential policies. These are possible reasons for why the financial supervisory architecture is so diverse. Indeed, how the optimal supervisory institutional structure should be determined is an open question.[21]

In the UK, after the fiasco with the single regulator, the FSA, and the failure of Northern Rock, the debate was wide open. The conclusion was that a central bank must preserve financial stability and be able to act as lender of last resort and crisis manager. A first argument for the central bank having a supervisory role, a key point in the Northern Rock debacle, is the need to have a single authority to act on first-hand information, to distinguish between liquidity and solvency problems and to be effective as a crisis manager. A second argument is to profit from informational economies of scope in the acquisition of information between liquidity provision and supervising functions, and between monetary policy and supervision. The central bank is also the natural candidate to be in charge of macroprudential regulation, since its aim is to preserve financial stability and it must have good information on macroeconomic developments. When establishing the Financial Services Authority in 2001, which initiated a trend toward establishing supervisors for banks and markets separate from the central bank all over the world, several counter-arguments against the integration of functions in the central bank were put forward. In favour of separation was the possibility to ease the potential conflict between the credibility of the monetary policy, the LOLR function and the reputation of the supervisor, as well as to improve the accountability of regulators. There are very good arguments for separating prudential and competition regulators and for integrating consumer protection in the latter, as in the UK's new system.[22]

21 See Section 7.1 in Vives (2016) for an overview of the arguments for and against the integration of regulators and the trade-offs involved.

22 See Section 7.1 in Vives (2016).

The situation is particularly complex in the Economic and Monetary Union (EMU), where national authorities and the ECB are jointly responsible for macroprudential policy and microprudential supervision for large banks is in the hands of the ECB, where there is an SRM with as yet no credible backstop, and there is no common deposit insurance and no integrated conduct authority. Consumer protection is typically in the hands of national supervisors, fostering a conflict of interest, and coordination with the federal competition policy authority is not trivial. The set-up is complex and prone to slow decision-making and coordination deficiencies. The EMU architecture (see Box 1.1) stands in contrast to the efficient, one-roof solution prevailing in the UK. However, having supervision centralised at the ECB represents a tougher enforcement, since national regulators in general have incentives to be more lenient with their national banks (similar to the enforcement of competition policy by the European Commission being perceived as tougher than by national authorities).

The changes occurring along these three dimensions all raise questions relating to the independence of central banks and its current interpretation. In this report, we address two issues: (i) how to ensure the legitimacy of delegating increasingly broad powers to an independent unelected institution; and (ii) how to efficiently coordinate monetary and fiscal authorities in a way that is compatible with central bank independence. On the first issue we argue that, whatever the architecture of the system, central bank independence will best be preserved if the framework and the principles of communication agreed in the case of monetary policy and interest rate decisions are applied to the decisions of the single institution or of the collective in charge of financial stability. On the second issue, we call for the formalisation of a special regime redefining the relations between fiscal and monetary authorities once the zero lower bound has been reached. Under the advocated special regime, in contrast to what prevails in normal circumstances, a regular exchange between authorities on the entire range of policy options would be encouraged and should be the topic of a public communication on the resulting policy choices where potential disagreements and their reasons are made explicit. In normal times, the central bank has enough leeway to adapt to policy decisions taken by fiscal authorities. The room to adapt to the stance of fiscal policy is severely limited once the zero lower bound has been reached, however, and, depending on circumstances, this may force central banks to venture into quasi-fiscal territory. This is when coordination with fiscal authorities is needed.

1.5 Conclusions

The legacy of the crisis and a decade of regulatory reform is that banks today are stronger and better capitalised. Moreover, regulators and supervisors have increased clout and pay more attention to systemic issues. However, another legacy of the crisis is high leverage in advanced economies, especially in terms of sovereign debt-to-GDP ratios, which remain very high historically. Another worrying legacy is low interest rates and even negative yields deep into the yield curve in some countries, with more than $9 trillion of debt with negative yields.

A major concern remains how best to increase the supply of safe assets to meet the untapped global demand for these assets. All this, together with the digital disruption of the sector to come, poses formidable challenges for the banking industry.

One major challenge is to gather the necessary political support to move the reforms and appropriate regulation of the industry forward. An example is the need for regulators and public authorities to have enough powers to deal with major crises. The unpopularity of measures for dealing with crises has led several jurisdictions to curtail the power of regulators to respond to a crisis, with the aim of 'ending bailouts forever'. For example, Ben Bernanke, Timothy Geithner and Henry Paulson (the latter two both former US Treasury secretaries) stated in September 2018 that "… in its post-crisis reforms, Congress also took away some of the most powerful tools used by the FDIC, the Fed and the Treasury. Among these changes, the FDIC can no longer issue blanket guarantees of bank debt as it did in the crisis, the Fed's emergency lending powers have been constrained, and the Treasury would not be able to repeat its guarantee of the money market funds. These powers were critical in stopping the 2008 panic".[23]

In the euro area, political constraints delay the necessary completion of the Banking Union, with its common deposit insurance scheme and backstop for the banking system. The danger is that the unrealistic commitment not to use public money, even in the face of a macroeconomic shock, will undermine current EU resolution procedures, as happened with the treatment of recent bank problems in Italy.

From a more general perspective, the credibility of regulators is at stake when political support is lacking or, even worse, when politics is the very source of instability (as is the case with Brexit, the backlash against multilateralism, or the attack on the independence of central banks).

This report provides several central messages.

The first broad message is that narrow banking is not the answer to the fragility of the financial system, since if it were implemented, fragility would resurface elsewhere in the financial system. After a systemic crisis, the narrow bank 'solution' always emerges as a proposal; the 2007-2009 crisis was no exception.

The second message concerns regulation. There have been improvements on all fronts, but as yet no framework exists to deal with shadow banking and the new digital competitors. Furthermore, new regulations and high compliance costs make entry difficult and increase the tendency towards increased concentration, potentially aggravating the TBTF problem. More specifically, there is room to fine-tune regulation:

i) Prudential regulation should take a holistic approach, with capital, liquidity and disclosure requirements set together and account taken of their interactions.

23 The authors continue by stating that "[t]he paradox of any financial crisis is that the policies necessary to stop it are always politically unpopular. But if that unpopularity delays or prevents a strong response, the costs to the economy become greater. We need to make sure that future generations of financial firefighters have the emergency powers they need to prevent the next fire from becoming a conflagration. We must also resist calls to eliminate safeguards as the memory of the crisis fades. For those working to keep our financial system resilient, the enemy is forgetting" (*New York Times*, 7 September 2018).

ii) We do not know whether current levels of capital are enough, but we believe it is better to err on the high side (as long as increased capital requirements are not imposed when the economy is weak). The interaction between leverage and risk-weighted capital must be explored so that no perverse incentives are introduced inadvertently.
iii) The introduction of liquidity regulation is an important innovation, but we question the need for two requirements. We believe that authorities should explore modifications to the liquidity coverage ratio that would make the net stable funding ratio unnecessary.
iv) Stress tests are very useful if well designed. A main lesson from the euro area is that effective stress tests can only be implemented when there is a backstop for the banking system. To remain effective, the tests must be severe, flexible and not overly transparent. Current practice could be improved by taking into account second-round effects.
v) Regulation inevitably leads to innovation aimed at escaping the new rigorous oversight. To ensure that an ever-changing financial system remains resilient, authorities need a framework to monitor, assess, designate, regulate and supervise entities outside the perimeter of regulation.

The third area of interest is resolution. The new resolution framework constitutes a major institutional advance in resolving systemically important institutions. However, a public backstop is needed even under the most refined resolution procedures. The TBTF problem has been alleviated (with the caveat on the effect of new regulations on concentration and size of banks), but it has not gone away. In addition:

i) Resolution needs liquidity support but current procedures are lacking, particularly in the euro area.
ii) Better resolution provides good incentives for managers and allows for more competition in the market.
iii) There are complex trade-offs in the choice between an SPOE model and an MPOE model. For the resolution system to be stable, the incentives of national authorities before and during a crisis must be contemplated (for example, national authorities may decide to ring-fence capital and liquidity ex ante, or refuse to abide by an agreement when it turns out to be unfavourable).

The fourth area of interest concerns the role of central banks. The debate over the expanded functions of the central bank in the post-crisis era is wide open. One thing seems clear, though: the central bank has to recover its traditional financial stability remit, and this more powerful central bank needs strengthened accountability and democratic legitimacy. More specifically:

i) The central bank should be prepared to use its balance sheet as a financial stability tool, although what the steady-state size of the balance sheet should be is an open question.
ii) We look favourably on the idea that central bank liquidity insurance should be priced, but we are wary of potential adverse consequences on credit provision to the economy when collateral is lacking.

iii) With respect to the financial supervisory architecture, we favour an expanded role for central banks encompassing financial stability. Under an integration ('one roof') view of the central bank functions (as in the UK), the central bank has both a price stability and a financial stability mandate, and consequently it should have a transparent LOLR function as well as macroprudential authority with appropriate tools. Microprudential supervision should be well coordinated with the central bank and an independent authority should take care of conduct and consumer protection, yielding a 'twin peaks' regulatory architecture. At the other extreme, under a 'many roofs' regulatory financial architecture view, the central bank should care only about price stability, and both macroprudential and microprudential supervision should be run by separate independent institutions. Our view is closer to the former model than the latter.

iv) To insure the legitimacy of delegating increasingly broad powers to an independent institution, and to preserve central bank independence, the framework and the principles of communication for the case of monetary policy should be applied to the decisions of the single institution or of the collective in charge of financial stability.

v) More intensive coordination between monetary and fiscal authorities is needed, particularly when the zero lower bound is reached. A regular exchange among authorities on policy options should then be encouraged, including public communication of policy choices and the trade-offs involved.

We do not know where the next crisis will hit. But if the past is any predictor of the future, we can be sure that entities that perform the functions of banks, but are outside the regulatory perimeter, will play an important role. Furthermore, the next global crisis may have its origins in an emerging market, where regulation may well be different from the structure adopted in advanced countries. A challenge for incumbent banks will be to adapt to the digital disruption and more competitive environment, while regulators will have to maintain a level playing field, protecting financial stability while allowing the benefits of innovation to permeate the system.

2 Regulatory reform: Basel III and beyond

The financial industry is one of the most heavily regulated parts of our economy.[24] There are three broad reasons for government involvement:

- protecting investors – while competition can discipline firms to act with integrity, in the case of finance there is broad agreement that the majority of individuals have neither the necessary information nor the knowledge to do the sophisticated analysis this would require;
- shielding consumers from monopolistic exploitation – there is always a tendency for small firms to merge, reducing competition and decreasing efficiency; and
- safeguarding financial stability – the combustible mix of liquidity risk and information asymmetries inherent in finance makes the system unstable.

Financial regulation addresses a number of incentive problems. Owners and managers of financial intermediaries will naturally behave in ways that put the system in peril. They may take risks that have large and potentially catastrophic externalities. Under stress, managers' actions can trigger fire sales that depress the value of assets held by similar firms, precipitate a credit crunch and a broader decline in economic activity, and respond to defaults in a way that leads to a cascade of further failures. Moreover, as the heart of the payments system, banks are like electric companies – they are public utilities, whose failure would lead the entire economy to grind to a halt.

Given both their centrality to the functioning of modern economies and the potential for individuals to act in ways that put the entire system at risk, it is unsurprising that banks have been subject to regulation for a very long time. In the US, for example, the National Banking Act of 1864 created the Office of the Comptroller of the Currency, which required reporting and began regular examination of nationally charted banks. In addition, banks were required to finance a portion of their assets with capital, with the amount dependent on the size of the city in which they operated. Moreover, until the early 1930s, bank owners faced double liability – that is, they could be liable not only for their paid-in capital, but for an additional, equal amount.[25]

Following the dramatic financial collapse during the Great Depression in the early 1930s, US authorities led the way in introducing deposit insurance as a second, critical component of the safety net that already included the central bank as lender of last resort. By guaranteeing the availability of liquid financing in the short term, and by insuring that a large class of liability holders would not suffer losses in the event of insolvency, the safety net creates moral

24 This chapter draws on Cecchetti and Kashyap (2018, forthcoming) and Cecchetti and Schoenholtz (2017).

25 See Dwyer (1981), White (1983) and Macy and Miller (1992).

hazard, encouraging banks managers to take on risk. The natural response is for governments to regulate (by establishing rules), supervise (by overseeing the intermediaries) and examine (by looking at operations in detail).[26] As a result, banks face broad requirements relating to how they interact with their customers, the size and scope of their activities and the information they must disclose. (We discuss the importance of a robust resolution regime in Chapter 3.)

The modern financial system, and the practices of financial institutions, is as dependent on cross-border flows as it is on activity that takes place solely within a particular country's borders. As global financing surged in the 1980s, bankers realised they could expand their operations across national boundaries and turn a profit internationally. While this was a welcome development for most bank customers, not everyone appreciated the competition from abroad. In some jurisdictions, bankers complained that foreign banks held an unfair competitive advantage because some home country authorities required lower levels of capital. Banks that finance their assets with more debt and less equity, and therefore take on more leverage, have lower costs and can offer borrowers lower interest rates.

This concern led to the creation of international regulations aimed at promoting financial stability within countries and ensuring a competitive balance globally. The result was the 1988 Basel Accord (Basel I), which established a requirement that internationally active banks must have capital financing equal to or greater than 8% of their RWAs. The initial agreement divided assets into four categories, assigning each a risk weight.[27]

Basel I had a number of positive effects. First, by linking minimum requirements to the risks banks take, it forced regulators to change the way they thought about bank capital. Second, it created a uniform international system. Finally, the accord provided a template that less-developed countries could adopt to improve the regulation of their banks.

However, the original agreement had clear limitations. In adjusting for asset risk, Basel I failed to differentiate between bonds issued by the US government and those issued by emerging-market countries like Turkey; both received a weight of zero. Moreover, a corporate bond received a weight of 100% regardless of whether it was AAA-rated or junk. Not only that, but a bank received no benefits from reducing risk through diversification. A single loan of $100 million was subject to the same risk weight as 1,000 loans of $100,000 each. These shortcomings encouraged banks to shift their holdings toward riskier assets with higher expected returns in ways that did not increase their required bank capital.

By the mid-1990s, bank regulators and supervisors realised that the original standards required revision. Starting in 1998, the Basel Committee on Banking Supervision (the 'Basel Committee') negotiated a revised framework for determining whether banks have sufficient capital financing. The new Basel II had three pillars: a revised set of minimum capital requirements, supervisory review of bank balance sheets, and increased reliance on market discipline to encourage sound risk-management practices. The first pillar refines the computation of risk-adjusted assets to reflect the risk banks actually take. For example, bonds issued by

26 In fact, at its inception in 1933, the Federal Deposit Insurance Corporation had the authority to impose capital requirements as a basis for participating in the deposit insurance scheme (FDIC, 1998, p. 29).

27 The original weights were 0% for sovereign debt issued by industrialised countries, 20% for claims on industrialized countries' banks, 50% for residential mortgages and 100% for consumer and corporate loans.

highly rated corporations receive a 20% weight, while for junk bonds the weight was 150%. The second pillar requires supervisors to attest to the soundness of bank managers' risk estimation and control methods. Supervisors would review the way banks assess their risk and decide how much capital they should hold. The third pillar compels banks to make public their risk exposure and their level of capital financing. The idea is that the market will reward banks that can show they are behaving responsibly with better credit ratings and higher stock prices.[28]

As governments around the world were in the process of implementing Basel II, the financial crisis hit.[29] Authorities realised immediately that the existing agreement, even when fully implemented, would be insufficient. This brings us to Basel III and the regulatory reforms formulated and implemented over the past decade.

Basel III represents a watershed in official-sector thinking. Critical to the redesign of international standards is the shift from traditional regulation focused on the solvency of individual institutions to an approach designed to ensure resilience of the financial system. That is, the objective is not to protect the owners, lenders and managers of financial institutions from losses or even bankruptcy. Instead, the system should be 'sufficiently' resilient to ensure that the core services of payments and credit supply are sustainable in the face of large shocks.[30]

With this background, we proceed to an assessment of the major components of the new capital and liquidity requirements that form the core of the Basel III agreement. While these changes have undoubtedly made individual banks safer and the banking system more resilient, they have important side-effects. By making it more costly for banks to engage in their core functions of credit, maturity and liquidity transformation, authorities are encouraging the private sector to shift these activities elsewhere, outside of the perimeter of regulation. To ensure that the entirety of the financial system is sufficiently resilient, as opposed to just the banks or other regulated intermediaries, we need a robust framework for identifying and then regulating these de facto, non-bank intermediaries.

2.1 The structure of Basel III

Before turning to specifics, it is worth saying a few words about the general structure of the agreement completed in December 2017.[31] The regulatory framework embodied in Basel III constrains the composition of banks' balance sheets. It has four parts: two relate to capital and two relate to liquidity. The capital regulations include a risk-weighted requirement that forces banks holding riskier assets to finance a larger portion of their activities with equity, as well as an equal-weighted leverage requirement that ties the level of capital to the

28 The Basel Committee constantly revises its recommendations to bank regulators. For information about the committee's activities and the Basel Accords in general, see www.bis.org/bcbs/aboutbcbs.htm.

29 It is important to keep in mind that in 2007, the US had not yet implemented Basel II (see https://www.federalreserve.gov/supervisionreg/basel/USImplementation.htm). In Europe, the original Capital Requirements Directive in 2006 represented the final step in this process.

30 See the discussion in Cecchetti and Tucker (2015).

31 Basel Committee on Banking Supervision (2017b).

overall size of the bank (including off-balance sheet items). These rules, designed to ensure sufficient buffers should banks face losses, are the outgrowth of decades of experience dating back to the original 1975 agreement (Basel Committee on Banking Supervision, 2011).

In describing the early days of the Basel Committee, Charles Goodhart (2011) notes that the original intent was to have a liquidity requirement to complement the capital requirement. However, until the completion of Basel III in 2010, agreement proved elusive.[32] Current standards include two liquidity regulations: the liquidity coverage ratio and the net stable funding ratio.[33] The intent of these rules is two-fold: to ensure that banks can withstand funding reductions such as deposit withdrawals or liquidity demands arising from off-balance sheet activities, and to give the authorities time to formulate responses.[34]

To understand the logic behind the capital and liquidity requirements, we need to think about the fundamental functions of a bank. As mentioned earlier, banks are at the heart of the payments system, providing both transactions liabilities and access to ensure smooth operation. Furthermore, banks' asset and liability management practices give rise to credit transformation, liquidity transformation and maturity transformation.[35] Each function generates returns by producing assets with a characteristic that diverges from that of liabilities: credit transformation results in assets that are riskier than liabilities; liquidity transformation creates assets that are less liquid than liabilities; and maturity transformation produces assets that are longer-term than liabilities. In addition, access to the payments system comes from providing appropriate types of liabilities.

A traditional bank performs all of these intermediation functions, funding long-term, illiquid, risky assets with short-term, liquid, safe liabilities. A combination of limited liability, the government safety net (in the form of deposit insurance, the lender of last resort, and other implicit guarantees) and the centrality of banking to the functioning of the economy has two very important implications. First, since a bank's owners and managers reap the benefits of their success without facing the full costs of their failure, they will tend to engage in too much credit transformation, too much liquidity transformation, and too much maturity transformation (too much, that is, relative to what society ideally needs). Second, it means that banks have an incentive to become so large and so interconnected that their failure would jeopardise the entire financial system. That is, they become too big to fail (a topic we return to in Chapter 3).

The intention of the various requirements is to control the degree to which banks engage in each of these activities. The capital requirements, aimed at credit transformation activities, simply say that equity financing must be greater than a fraction of the sum of assets, risk-weighted or equal-weighted by their riskiness. Liquidity requirements attend to concerns about the levels of liquidity and maturity transformation, with the liquidity coverage ratio (LCR) aimed at the former and the net stable funding ratio (NSFR) at the latter. The LCR says that a weighted sum of assets must be greater than a weighted sum of liabilities. By

32 This is not true of individual jurisdictions, nearly all of which had reserve requirements, and a number of which had liquidity requirements as well. For example, from 1951 to 1971, UK clearing banks were required to hold liquid assets equivalent to 28% of deposits (Davies and Richardson, 2010).

33 Basel Committee on Banking Supervision (2013a, 2014).

34 On this second point, see Santos and Suarez (forthcoming).

35 See, for example, Pozsar et al. (2012).

contrast, the NSFR reverses this, stating that a weighted sum of liabilities must be greater than a weighted sum of assets. As we will see, the fact that the LCR and NSFR effectively reverse the inequality between assets and liabilities creates some complications.

2.2 Capital regulation

Our discussion of capital regulation proceeds in three steps. Following a preliminary description of the definition and role of bank capital, we turn to the two requirements. We begin with the dramatic increase in requirements and the substantial rise in banks' capital buffers, and then move on to a discussion of stress tests.

2.2.1 Bank capital

There are several consistent definitions of bank capital (or, equivalently, a bank's net worth). First, capital is the residual that remains after subtracting a bank's fixed liabilities from its assets. Second, it is what is owed to the banks' owners (i.e., its shareholders) after liquidating all the assets. Third, capital provides the buffer that separates the bank from insolvency – the point at which the value of its liabilities exceeds the value of its assets.

Importantly, capital is a source of funds that the bank uses to acquire assets. This means that if a bank were to issue an extra dollar's worth of equity or retain an additional dollar in earnings, it can use this to increase its holdings of cash, securities, loans or any other asset.

Banks (and many other financial intermediaries) finance their assets with a far larger proportion of debt (relative to equity) than non-financial firms do. Recent data show that US non-financial firms typically issue between \$0.80 and \$1.50 worth of debt for each dollar of equity, implying a leverage ratio of 40% to 55%.[36] By contrast, the largest banks in the world issue between \$10 and \$20 of debt for each dollar of equity financing. The eight US banks G-SIBs have a leverage ratio of roughly 7%, so their debt-to-equity ratio is about 13. For European and Canadian banks, the number is less than 5%, implying a debt-to-equity ratio close to 20.[37] This high reliance on debt financing boosts both the expected return on, and the riskiness of, bank equity and makes banks vulnerable to even moderately adverse events.

Bank capital acts as self-insurance, providing a buffer against insolvency, and, so long as it is sufficiently positive, it gives a bank's management the incentive to behave in a prudent manner. Standard automobile insurance creates a similar incentive: car owners bear part of the risk of accidents through deductibles and co-pays, which also motivate them to keep their vehicles road-ready and to drive safely.

36 See the Federal Reserve's Financial Accounts of the United States, Table L. 103 (www.federalreserve.gov/releases/z1/current/html/l103.htm) and the Internal Revenue Service Statistics of Income, Historical Table 13 (www.irs.gov/statistics/soi-tax-stats-historical-table-13).

37 See the FDIC's Global Capital Index (www.fdic.gov/about/learn/board/hoenig/global.html).

When capital is too low relative to assets, however, bank managers have an incentive to take risk. The reason is straightforward. Shareholders' downside loss is limited to their initial investment, while their upside opportunity is unlimited. As capital deteriorates, potential further losses shrink, but possible gains do not. Because shareholders face a one-way bet, they will encourage bank managers to gamble for redemption. They also will discourage managers from issuing more equity, because that would dilute the value of existing shares, while the primary benefit would accrue to debtholders through reduced risk of bankruptcy.[38]

The bank's capital and compensation structure can mitigate this incentive problem. For example, higher capital requirements force equity holders to have more skin in the game, exposing them to greater losses and reducing the 'debt overhang' problem whereby a highly indebted firm is unable or unwilling to take on further debt or issue additional equity because the further funds will simply go to pay existing debtholders.[39] With requirements that banks issue subordinated debt, or bonds that are convertible into equity when some trigger is met (contingent convertible bonds), bondholders can be encouraged to monitor banks more intensively. In addition, through compensation based on equity or debt performance, with credible clawbacks, it may be possible to align bank senior managers' incentives more closely with those of society.[40]

Finally, a banking system that is short of capital can damage the broader economy in three ways. First, an undercapitalised bank is less able to supply credit to healthy borrowers. Second, weak banks are prone to evergreen loans to zombie firms, adding unpaid interest to a loan's principal and further undermining their already weak capital position to avoid the realisation of losses.[41] Finally, in the presence of an aggregate capital shortfall in the banking system, the system as a whole is more vulnerable to contagion and panic. Even a small spark can ignite such dry and fragile tinder.

Before continuing, we should note the recent emphasis on debt instruments that are convertible into capital. Additional buffers against loss, these can be used both to recapitalise banks, ensuring ensure viability ('going concern'), or they can be a source of resources in resolution ('gone concern'). These liabilities take on a number of forms and go by a variety of names. Following significant losses, contingent convertible bonds (CoCos) can allow for bank recapitalisation without entering resolution.[42] By contrast, bonds that are a part of a bank's TLAC may only be available once a bank becomes insolvent.[43] Similarly, the EU Banking Recovery and Resolution Directive's minimum requirements for own funds and eligible liabilities (MREL) aims at ensuring a private 'bail-in' rather than a public 'bailout'.[44] That is, the purpose of MREL is to ensure that once a bank exhausts its equity, liability holders take losses sufficient for recapitalisation.

38 Recent evidence confirms that bankers' liability and risk-taking are inversely related (Koudijs et al., 2018).

39 For a discussion of this debt overhang problem, see Myers (1977).

40 On subordinated debt, see Shadow Financial Regulatory Committee (2000); for a discussion of contingent convertible bonds, see Kashyap et al. (2008). These ideas are the basis for the Financial Stability Board's (2015) TLAC. For a discussion of compensation, see the Basel Committee on Banking Supervision's (2010a) principles and standards on compensation practices.

41 For a discussion of this tendency for banks to gamble for redemption and 'evergreen' loans, see Caballero et al. (2008) and Acharya et al. (2017).

42 Avdjiev et al. (2017) note that between January 2009 and December 2015, banks around the world issued a total of $521 billion in CoCos through 731 different issues.

43 For a discussion, see Financial Stability Board (2015).

44 See the discussion in Restoy (2018a).

In the following, we focus primarily on the nature of the capital requirements (common equity tier 1), leaving the important further discussion of the role of debt in resolution to Chapter 3.

2.2.2 Setting capital requirements

Walter Wriston, Citibank's CEO from the mid-1960s to the mid-1980s, claimed that bankers were so good at managing risks, and banks' assets so well diversified, that they did not need much, if any, capital.[45] Over the next 30 years, Wriston's views carried the day. As a result, capital requirements, especially those put forth as part of the Basel II framework, were extremely low.[46] The global financial crisis put Wriston's view to rest. Today, there is consensus that banks should be able to absorb large unforeseen losses that would otherwise threaten financial stability, so they need to finance themselves with substantial equity, not just debt.

As we mentioned earlier, Basel III sets out two capital requirements: one is risk weighted, and the other is not. Why? Common sense dictates that risky drivers, for example, are more likely to cause accidents, so they should pay more for their insurance. By analogy, a bank that engages in risky activity should have a bigger capital buffer to guard against what are likely to be more frequent and larger losses. In practice, however, measuring risk is difficult. In fact, as the Basel Committee found, assessment of the exact same portfolio of held-to-maturity (banking book) assets by different banks results in risk-weighted assets estimates that vary by as much as 50%.[47] The response to this humbling fact is the leverage ratio – a measure that treats all exposures (both on- and off-balance sheet) equally and which has been intended as a backup in the event that measures of risk-weighted capital fail.[48]

The leverage ratio requirement made its first appearance in the US in the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) for a different reason. The original Basel Accord adopted in 1988 focused on credit risk, linking the degree of banks' equity financing to the default risk of their assets. The US authorities quickly realised that this meant a bank holding solely Treasury securities would face a zero capital requirement. However, such a bank does face risk in the form of interest rate risk. The equal-weighted leverage ratio addresses this problem. Even a bank holding only high-quality, default-risk-free assets must have some minimal level of capital financing to guard against fluctuations in the market price of those assets.[49]

As a matter of simple arithmetic, only one of these two requirements will bind at a time. Which it is depends on two things: the average risk weight of a bank's assets (the ratio of risk-weighted assets to total assets) and the extent of off-balance sheet activity. The lower the average risk weight, and the higher the off-balance sheet exposure, the more likely it is that the leverage ratio binds.

45 Grant (1996).

46 After roughly a decade of negotiations, the Basel II capital framework was agreed in the mid-2000s (see the chronology at http://www.bis.org/publ/bcbsca.htm).

47 See Basel Committee on Banking Supervision (2013b) and the discussion in Cecchetti and Schoenholtz (2015).

48 Computation of both capital requirements requires conversion of off-balance-sheet exposures into on-balance sheet equivalents using "credit conversion factors." That is, there is no way to escape making some judgements in computing either risk-weighted capital or total exposure measures.

49 Leverage ratio constraints were important during the 2007-09 crisis. In jurisdictions where they were in place, they kept a very bad situation from getting even worse.

These features characterise the operations of investment banks and mortgage banks. By contrast, the risk-weighted capital requirement is more likely to bind on retail banks and specialised lenders, both of which tend to have relatively high-risk assets and fewer off-balance sheet exposures.[50]

Do we really need both? If we could adjust risk weights appropriately, then we may not. Greenwood et al. (2017) point out that a leverage ratio is nothing more than a risk-weighted capital ratio with all the risk weights set to one. However, as Schnabl (2017) notes, it is far from clear that this measure is a better approximation of risk than a well thought-out set of risk weights.[51]

The choices banks make further complicate risk weighting. While smaller banks tend to employ a standardised approach where assets are assigned fixed risk weights by their regulators, large banks use their own internal risk assessments to determine the capital requirement for a particular exposure. This has two significant drawbacks. First, risk managers may place too much confidence in their modelling skills. Second, banks will always be tempted to manipulate the internal ratings-based (IRB) approach in order to reduce the capital that they need to hold.

There are two obvious ways to address concerns about overconfidence and gaming. The first is to simply raise the leverage ratio requirement. The second is to restrict the degree to which banks employ the IRB approach to reduce their capital requirement below what would be implied if it were to be computed using the standardised approach. The Basel Committee took this second approach, instituting floors so that all IRB risk weights must be at least 72½% of the standardised equivalent.[52]

The creation of these limits has the clear impact of reducing the risk weights in the standardised approach. However, banks that have low asset risk density – that is, their risk-weighted assets are substantially lower than their equal-weighted assets – will see a rise in their capital requirement. As described in a recent Basel Committee report,[53] following full implementation, European banks' risk-weighted assets will rise by something in the range of 5% to 10%.

Turning to some additional details, compared to the abysmally low pre-crisis Basel II standards, Basel III represents a sharp increase in capital requirements. Under the 2010 agreement, which applies to internationally active banks, capital must be between 8% and 10% of risk-weighted assets. Using the tighter Basel III definition of capital, we estimate that the effective pre-crisis Basel II requirement is at most three-quarters of one percent of risk-weighted assets (see Table 2.1).[54] So, when policymakers say things like "[t]he system is safer because banks are now much more resilient, with capital requirements for the largest global banks

50 For US banks, this ratio is generally in the range of 1.5 to 2.0. For others, notably European banks making less use of securitisation, the total assets can be as high as four times risk-weighted assets (Sveriges Riskbank, 2015).

51 We also note that Wu and Zhao (2016) explore the possibility that while the risk-weighted requirement may be better in the context of full information, a leverage ratio could be the appropriate reaction to the possibility that supervisors may not be able to detect bank misreporting.

52 See Basel Committee on Banking Supervision (2017b) for details. We should point out that we are aware of no scientific basis for the choice of 72½%; it appears to have been a political compromise.

53 Basel Committee on Banking Supervision (2018).

54 See Cecchetti and Schoenholtz (2017).

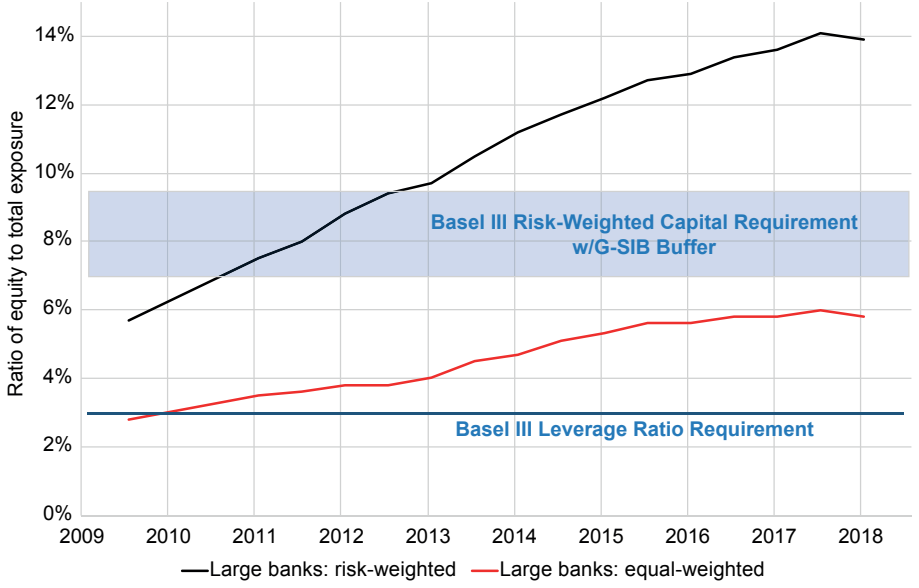
that are ten times higher than before the crisis",[55] their statements should be understood in this perspective. That is, because the earlier definition of capital was so lax, the risk coverage so inadequate, and the belief in public bailouts so pervasive, prior to the change, banks financed their assets with very little capital.

Table 2.1 Comparing Basel III and Basel II risk-weighted capital requirements for the largest systemic banks: Impact of Basel III capital definition

Basel III range	**8% to 10%**
Basel II baseline	4%
Adjustment for hybrid capital	-2%
Adjustment for goodwill, intangibles, deferred tax assets, etc.	-1%
Adjustment for changes in risk weights	-¼%
Effective Basel II converted to a Basel III basis	**< ¾%**

Source: Cecchetti and Schoenholtz (2017).

Figure 2.1 Risk-weighted and equal-weighted capital ratios fully phased-in Basel III definitions



Notes: Basel Committee Quantitative Impact Study (QIS) estimated ratio of common-equity tier 1 (CET1) capital to risk-weighted assets or tier 1 capital to total assets. Data from 2011 to 2018 are from a consistent sample of 86 large internationally active banks with capital in excess of €3 billion.

Source: Basel Committee on Banking Supervision (2010a and 2019), various tables.

55 Carney (2017).

Not only have requirements gone up, so too have capital levels. According to the Basel Committee's semi-annual quantitative impact studies, from end-2009 to mid-2018, capital ratios based on the new stricter definitions rose significantly. The numbers in Figure 2.1 are striking. Since end-2009, capital (as measured by common equity tier 1, the most effective loss absorber of the various capital categories) has risen by 6.8 percentage points of risk-weighted assets for the largest banks in the world. We note that for the first time since the Basel Committee began these monitoring exercises in 2009, the March 2019 report showed a decline in large bank equity finance.

On average, banks worldwide have much more capital than they did before the crisis on both a risk-weighted and an equal-weighted basis. Clearly, from the perspective of the banks, any level of capital has private costs, as it reduces the benefits of government subsidies and the option value of limited liability. But, from a social perspective, is the level of capital enough? Or, as some, including the US Treasury, have argued, have we gone too far and the requirements are now a drag on growth?[56]

It is very difficult to provide definitive evidence. Furthermore, any discussion of capital requirements has to confront issues of timing. Put differently, policymakers cannot escape having a view on the long-run steady-state level that is appropriate, a path to get to that steady state, and the desirability of requirements that vary over time depending on the state of the financial system and the economy.[57]

We note that during a transition to higher requirements, details matter.[58] For example, the manner in which the EU chose to implement Basel III almost surely aggravated the credit crunch that was ongoing. European authorities simply asked banks to increase their capital ratios. Furthermore, as we discuss in the next section on stress tests, they did this in the absence of a funding backstops. Without access to private or public capital, banks had little choice but to meet supervisors' requirements by shrinking their balance sheets, further reducing lending and depressing aggregate activity.[59] By contrast, since US officials had resources available, in 2009 they were able to require that banks meet capital requirements through a combination of an increase in private equity and a public capital injection.

The fact that the method of policy implementation matters, and that a public backstop can be critical to minimising further disruptions from raising requirements, says little about the appropriate steady-state level of capital financing. The original calibration of Basel III – a requirement that capital be no less than roughly 10% of RWAs for the largest banks – balances benefits and costs.[60] Critically, this original calculation assumes that the difference between the cost of equity and debt is equal to the average differential at the time. Put

56 See US Treasury (2017, p. 6).

57 We leave the discussion of time-varying capital requirements such as the countercyclical capital buffer to Chapter 4.

58 For a comprehensive study of the macroeconomic impact of the transition to higher capital and liquidity requirements, see Macroeconomic Assessment Group (2010).

59 For a discussion of the European experience, see Naceur and Roulet (2017) and Vestergaard and Retana (2013).

60 See Basel Committee on Banking Supervision (2010b).

differently, the presumption is that there is no Modigliani-Miller offset.[61] So, in a much more sophisticated context that did allow for some offset, Miles et al. (2013) subsequently concluded that the equity requirement should be closer to 20% of RWA.

Today, there is a range of views. At the low end, the work of IMF researchers, as well as that by William Cline, concludes that a leverage ratio requirement in the range of 7% to 8% strikes the right balance between growth and stability (Dagher et al., 2016; Cline, 2017). By contrast, the Minneapolis Plan suggests roughly double that – an equal-weighted leverage ratio in the range of 15%.[62]

The difference between these estimates turns on two factors. The first is the degree to which equity is more expensive than other liabilities – the larger the gap, the higher the costs in terms of reduced lending. Second, by increasing buffers, higher equity finance should reduce the frequency and severity of crisis. Here, the bigger the benefit, the higher the requirement can be and still meet the cost-benefit test. We simply note that estimating either of these is extremely difficult.

Finally, in addition to capital, banks have other liabilities that can buffer losses. As we mentioned earlier, they can issue subordinated or convertible debt that provides for either 'going concern' or 'gone concern' recapitalisation, or both. Structured properly, these provide buffers against losses, reducing the likelihood that a bank will come under stress. To see the point, consider the case of TLAC. Under Basel III, banks must have common equity capital financing equal to 3% of total exposure. In addition, standards agreed by the Financial Stability Board recommend that authorities require banks to have TLAC equal to 6¾%. Adding these together implies a buffer of roughly 10% of total exposure.

So, if we include debt instruments that are available for recapitalisation in resolution, then banks' buffers are at a level consistent with the low end of the levels suggested by current research. The issue is whether the system would be more stable if we were to shift the proportions. So long as the social cost of further equity finance is low, the increase in the size of the buffer against crisis is valuable, and the danger of pushing risky activity outside of the regulatory perimeter is under control, we should raise capital requirements. In our view the current system, with a leverage ratio of 3% of total exposure, meets this requirement.

While we may believe that private costs of bank capital generally exceed the social costs, the former drive behaviour.[63] This means that higher capital requirements create an incentive for activities to shift outside of the perimeter of regulation. It is essential that capital requirements be part of a comprehensive framework that monitors, regulates, and supervises banking activities, regardless of where they happen to be taking place. We return to this issue at the end of this chapter.

61 To maximise potential costs, and disarm critics, experts working on Basel III assumed that increasing levels of equity finance would not reduce the cost of capital (or the cost of debt). This the case both for the long-term economic impact study and the macroeconomic assessment of the transition.

62 See Federal Reserve Bank of Minneapolis (2016). We note that Admati and Hellwig (2013) argue that banks should operate with equity capital of 20% to 30% of total assets, but as far as we can see, they do not provide any empirical foundations for their conclusion. For a recent survey of the evidence on the impact of capital requirements on lending, see D'Erasmo (2018).

63 See, for example, Plantin's (2015) discussion of the relationship between capital requirements and incentives to shift activity to other types of legal entities.

2.2.3 Stress testing

When confronted with changing economic and financial conditions, how can authorities maintain systemic resilience? For example, with an increase in the risk of a commercial property price collapse, and the attendant defaults of corporate borrowers, it follows that banks should be required to rely more on equity finance than otherwise. How can authorities ensure that they do so? There are at least three answers to this question: increase overall capital requirements, as envisioned with the Basel III countercyclical capital buffer; raise sectoral risk weights, something that is possible in certain jurisdictions; or adjust the scenarios in stress test, a practice that is now widespread. In our view, the first is technically challenging and the second politically difficult. The third looks promising.

Modern stress testing builds on the US experience during the crisis. In late 2008, the solvency of the largest US intermediaries was in doubt. That uncertainty made their own managers cautious about taking risk and it made potential creditors, counterparties, and customers wary of doing business with them. Those doubts contributed to the extreme fragility in many financial markets, leading to a virtual collapse of interbank lending. Part of the remedy was a special disclosure procedure in which US authorities conducted an extraordinary set of 'stress tests,' with the results published in May 2009. The tests evaluated, on a common basis, the prospective capital needs of the 19 largest US banks in light of the deep recession that was well under way.

Former US Treasury Secretary Timothy Geithner summarises the strategy of the early 2009 Supervisory Capital Assessment Program (SCAP)[64] as follows:

> *The plan aimed to impose transparency on opaque financial institutions and their opaque assets in order to reduce the uncertainty that was driving the panic…. There were two parts to the plan. First, the Fed would design and execute a uniform test for the largest firms, analyzing the size of the losses each institution would face in a downturn comparable to the Great Depression.... [B]anks would be forced to hold capital against losses they'd incur on assets they planned to hold to maturity…but the banks would not be forced to hold capital against losses they'd incur by unloading assets at depressed prices during a panic…The stress test would provide information, and hopefully a measure of confidence. The second part of the plan would provide capital.*[65]

While observers questioned whether the tests were sufficiently rigorous — the stress scenario quickly became the central forecast — the results were sufficient to reassure the government, market participants and the banks themselves that most institutions were in fact solvent. Partly as a consequence, conditions in financial markets rapidly improved. Moreover, armed with evidence of their wellbeing from the stress test, most large banks could attract new private capital for the first time since the Lehman failure in the previous September.

64 See https://www.federalreserve.gov/newsevents/files/bcreg20090507a1.pdf.
65 Geithner (2014, pp. 437-438).

Current stress test practice is to assess the losses a financial institution would suffer under extremely adverse conditions. There are three primary objectives: guaranteeing that banks have rigorous internal risk management processes; ensuring that banks' management and boards of directors are attentive to the risks their enterprises face; and providing the authorities with a comprehensive map of the risks and vulnerabilities in the financial system.[66]

We can summarise any stress testing regime by measuring its transparency, flexibility and severity. The mix of these characteristics determines the regime's effectiveness.

To understand the trade-offs and pitfalls, consider the case of Fannie Mae and Freddie Mac, the government-sponsored mortgage lenders (GSEs). Unlike banks, the GSEs were subject to an annual government stress test before the financial crisis. Following a decade of development, the Office of Federal Housing Enterprise Oversight (OFHEO) began conducting tests in 2001. The GSEs always passed these tests – until they collapsed at the height of the crisis in September 2008. We can trace the ineffectiveness of these early stress tests to their mix of transparency, flexibility and severity. First, there was complete transparency: the OFHEO published the models and scenarios in the Federal Register prior to initiating the tests. Second, there was no flexibility: from year to year, neither the parameters nor the macroeconomic conditions changed. Third, the stress applied was not severe enough: house prices rose for the first ten quarters of the scenario, before falling only modestly over the full eight-year horizon (Frame et al. 2015).

Is any one of the three attributes (transparency, flexibility and severity) more critical than the other two? The answer is yes. First, if the scenarios are insufficiently dire, there is no point to the test. Second, flexibility is essential. Without it, the tests are useless. Third, there is considerable room for transparency, but there are limits. In jurisdictions where authorities employ their own models, as is case with the Federal Reserve, models change slowly and banks can glean considerable information about them. Here, disclosure is unlikely to be a problem. Premature disclosure of the scenarios is another matter. In contrast to the GSE tests, and in line with the Fed's current Comprehensive Capital Analysis and Review (CCAR),[67] scenarios should change frequently with disclosure only after the banks' portfolios are determined. The alternative invites gaming.[68]

The recent European experience provides a second cautionary example. In an attempt to follow the lead of the US authorities, the EU implemented a series of four stress tests – in the summer of 2009, the spring of 2010 and 2011 and the winter of 2012 – before initiating the comprehensive assessment, including the asset quality review, in the run-up to the start of the Single Supervisory Authority (SSM) in the autumn of 2014. Some of the highlights are as follows. The 2010 stress tests did not include any stress on sovereign bonds, even though Greek bond yields were above 10% and the cost of insuring against their default was in excess of 1,000 basis points. The Irish banks – both the Bank of Ireland and Allied Irish Bank – passed the 2010 test but collapsed several months later. The 2011

66 For further discussion of the history and uses of stress testing, see Cecchetti and Schoenholtz (2016b).
67 See https://www.federalreserve.gov/supervisionreg/ccar.htm.
68 For an analysis of recent Federal Reserve proposals to change their stress-testing regime, see Cecchetti and Schoenholtz (2018a).

stress test gave a clean bill of health to the Franco-Belgian bank group Dexia, which proceeded to fail several months later. In addition, the stress scenario in the 2014 comprehensive assessment assumed smaller risk spreads than existed at the height of the 2012 euro area crisis.

There is a variety of possible explanations for the contrasting US and European experiences. The most likely, and what we see as the biggest difference between the two cases, is that the Europeans had no financial backstop in place when they initiated the tests. An important element of the SCAP – what Geithner notes as the second part of the strategy – was that the Federal Reserve had access to government funds through the US Treasury's Troubled Asset Relief Program.[69] This meant that those executing the SCAP could credibly state that they had government funds at their disposal to recapitalise any banks that failed and could not raise capital on their own. This backstop was lacking in Europe. As a result, there was always the fear that any announcement that failing the stress test would be a death sentence, and that this would lead to contagion and further failures. The natural consequence of this was a suspicion that authorities could not afford to be fully transparent.[70]

Beyond implementation issues, there is the fact that current stress test methodology does not allow for what might be termed second-round effects. That is, the tests examine the impact of a common adverse shock on each bank individually, not taking into account what might happen to a bank's counterparties (or counterparties of counterparties, or counterparties of counterparties of counterparties, etc.). There are two interpretations for this methodology. From the perspective of a single institution, the tests ask whether, in the event of a severely adverse common shock, each institution can stand on its own without having to raise any funding (debt or equity) or sell any assets. Taking a network perspective, we can interpret the asset prices in the stress test scenario as the result of the amplification and feedback mechanisms in the system. At that point, both market and funding liquidity are gone. Fixing the assets and liabilities, we can simply use the resulting prices to determine each institution's solvency.[71]

In sum, we see stress tests as an important addition to financial supervisors' toolkit. So long as they remain sufficiently severe, flexible and opaque, authorities can use them to improve the safety of individual institutions and the resilience of the system.[72]

69 See https://www.treasury.gov/initiatives/financial-stability/reports/Pages/TARP-Tracker.aspx.

70 See Goldstein (2017) for a detailed discussion of the stress test experience during and after the 2007-09 financial crisis.

71 See Berner et al. (2019) for a discussion of network stress tests.

72 A number of researchers suggest using market information to examine banks' capital adequacy in something closer to real time. For example, Brownlees and Engle (2017) propose the use of SRISK, a forward-looking measure of each firm's estimated shortfall of capital (relative to a stated norm) in a bad state of the world (such as a 40-percent plunge over a six-month horizon in a broad aggregate of stock prices).

2.3 Liquidity regulation

In the absence of comprehensive liquidity regulation, prior to the crisis banks were heavily dependent on a combination of central bank lending facilities and short-term wholesale funding. Put slightly differently, central bank practice subsidised liquidity, allowing banks to convert assets into cash cheaply and easily at favourable rates through discount lending, or the equivalent. Predictably, bankers held substantial quantities of highly illiquid instruments, especially real estate loans. (We return to the role of central bank liquidity support in Chapter 4.)

In an attempt to reduce these subsidies, the Basel Committee developed two liquidity requirements. The first, the liquidity coverage ratio, aims at ensuring a sufficient quantity of liquid assets; and the second, the net stable funding ratio, aims at controlling the level of maturity transformation. We will briefly describe each of these.

To help understand the LCR, it is useful to start with a quote from the agreed international standard itself:

> *"The objective of the LCR is to promote the short-term resilience of the liquidity risk profile of banks. It does this by ensuring that banks have an adequate stock of unencumbered high-quality liquid assets (HQLA) that can be converted easily and immediately in private markets into cash to meet their liquidity needs for a 30 calendar day liquidity stress scenario. The LCR will improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy."*[73]

Reading this, we can see that the motivation for the LCR is to compel banks to hold an amount of liquid assets (a combination of central bank reserves and sovereign securities) that it can use to meet the deposit outflows and the takedown of loan commitments that might occur during a crisis. The goal is to ensure that banks can meet their obligations without relying on fire sales of their illiquid assets – something that has a negative impact on everyone else – or on borrowing from the central bank. That is, the central bank should be the lender of *last* resort, not the lender of *first* resort.[74] Furthermore, the structures of both the LCR and the NSFR (discussed below) expressly include the possibility that banks can fall below the 100% threshold for some amount of time. That is, the buffers should useable.[75]

73 Basel Committee on Banking Supervision (2013a).

74 For a discussion of the economics of liquidity regulation, see Stein (2013) and Diamond and Kashyap (2016).

75 For example, the paragraph 11 of the LCR rules text states: "The [Basel] Committee also reaffirms its view that, during periods of stress, it would be entirely appropriate for banks to use their stock of HQLA, thereby falling below the minimum. Supervisors will subsequently assess this situation and will give guidance on usability according to circumstances."

As an aside, we note that the LCR brings to mind the system in place over 100 years ago. Before the advent of the Federal Reserve in 1914, both national and state-chartered banks in the US were required to hold substantial liquid reserves to back their deposits. Although they have a somewhat different purpose, without an explicit focus on stress conditions, these are the reserve requirements (RR) that remain in effect in most jurisdictions today.[76]

Turning to the NSFR, again we quote from the rules text:

> *"The NSFR will require banks to maintain a stable funding profile in relation to the composition of their assets and off-balance sheet activities. A sustainable funding structure is intended to reduce the likelihood that disruptions to a bank's regular sources of funding will erode its liquidity position in a way that would increase the risk of its failure and potentially lead to broader systemic stress. The NSFR limits overreliance on short-term wholesale funding, encourages better assessment of funding risk across all on- and off-balance sheet items, and promotes funding stability."*[77]

The purpose of the NSFR is to limit the degree of maturity mismatch, requiring banks to finance long-term assets with long-term liabilities. Again, the details of the computation are complex, but the idea is simple: banks should not rely on short-term funding to support large volumes of long-maturity assets.[78]

In looking at these, it is natural to ask whether we need two liquidity requirements. For capital, as we discussed earlier, the answer is that the leverage ratio and the risk-weighted capital ratio bind at different times and on different types of banks. Is the same true of the LCR and the NSFR? Almost surely not.[79]

To see why the two requirements are likely to be redundant, consider a simple case where a bank has two types of assets (liquid and illiquid), two types of liabilities (runnable and stable) and no off-balance sheet exposures. (The presence of additional assets and liabilities, as well as off-balance-sheet exposures complicates the analysis without changing the logic of the following conclusions; see Cecchetti and Kashyap (forthcoming)).

Such a bank has a balance sheet that looks like Table 2.2.

Table 2.2 Simple bank balance sheet

Assets	**Liabilities**
Liquid	Runnable
Illiquid	Stable

Each of these assets and liabilities corresponds to a category in the one of the two regulations. Liquid assets are the high-quality liquid assets (HQLA) – primarily central bank deposits and short-term domestic sovereigns – in the LCR. Illiquid assets are the long-term loans and securities that require stable funding in the NSFR. Runnable liabilities are the funding sources that generate outflows for the LCR. Finally, stable liabilities are the available stable funding in the NSFRs.

76 For a discussion of the history of reserve requirements in the US, see Goodfriend and Hargraves (1983) and Carlson (2015).

77 Basel Committee on Banking Supervision (2014).

78 As Brunnermeier and Oehmke (2013) discuss, there is a natural tendency for lenders to gravitate toward short-term funding. We return to this in Chapter 4, where we discuss the apparently excessive appetite for very short-maturity liquid assets.

79 The remainder of this section draws on Cecchetti and Kashyap (forthcoming).

The two liquidity requirements look like this:

$$\begin{aligned} &\textit{LCR:} \quad \textit{Liquid} \geq \textit{Runnable} \Rightarrow \textit{Liquid} - \textit{Runnable} \geq 0 \\ &\textit{NSFR:} \quad \textit{Stable} \geq \textit{Illiquid} \Rightarrow \textit{Stable} - \textit{Illiquid} \geq 0 \end{aligned}$$

Now, note that the bank also has a balance sheet identity. This means:

$$\begin{aligned} &\textit{Balance Sheet Identity:} \quad \textit{Liquid} + \textit{Illiquid} = \textit{Runnable} + \textit{Stable} \\ &\qquad\qquad \Rightarrow \textit{Liquid} - \textit{Runnable} = \textit{Stable} - \textit{Illiquid} \end{aligned}$$

From this, we come to the following conclusion: the two requirements are the same![80]

This simple demonstration shows that a given LCR – with its definitions of HQLA, run-off rates, and treatment of off-balance sheet exposure – implies a shadow, complementary NSFR. So, the more restrictive the LCR's definition of HQLA – i.e., the fewer items that qualify – the more permissive the implied required stable funding factors in the shadow NSFR. Moreover, the higher the run-off rates on liabilities in the LCR, the lower the level of implied available stable funding in the shadow NSFR.

The practical implication of this substitutability (or collinearity) is that we only need one liquidity requirement. If there is concern that the shadow version of the other requirement is overly lax, then the solution is to change the one we have. For example, if we were to choose to have only an LCR, but were worried that the shadow NSFR it implied was insufficient in its treatment of liabilities between 30 and 365 days maturity, then the simple fix would be to increase the horizon of the LCR. If, conversely, we were to have only an NSFR, but there was a concern that the shadow LCR's definition of HQLA was overly accommodative, the solution would be to increase certain required stable funding factors.[81]

This leads us to the following conclusion. In the abstract, we are agnostic about whether a liquidity requirement should look more like the LCR or the NSFR. But, given that we now have some experience with the LCR, and that it tends to be the simpler of the two to administer, we suggest that authorities focus on refining and adjusting the LCR to meet their objectives and discard the NSFR.

2.4 Non-bank Intermediation

Designers of the financial regulatory framework face a trade-off: the safer they make the institutions they monitor and supervise, the greater the incentive for activity to shift beyond the perimeter of their control. Examples of financial activities moving from the light into the shadows are easy to find.

In the comprehensive banking reforms adopted under the 1933 Glass-Steagall Act, in an effort to mitigate the moral hazard resulting from the introduction of deposit insurance, legislators included a prohibition on paying interest on demand deposits and set caps on the interest rates banks could pay holders of

80 Vives (2014) makes a similar point; see his footnote 16.

81 Properly designed liquidity regulation would allow the stock of liquid assets to be readily usable without stigma. One possibility is to define high quality liquid assets so narrowly that there is a chronic shortage in the market, forcing the central bank to be the marginal supplier through a committed liquidity facility (with an associated ex-ante fee) analogous to the one used by the Reserve Bank of Australia (see the discussion in Chapter 4).

savings accounts. The Federal Reserve quickly implemented interest rate rules under Regulation Q. In the 1970s, inflation rose considerably, the interest rate on 12-month Treasury notes went up with it, and real yields became negative (eventually going below -6% in 1974). Unsurprisingly, savers were unhappy.

Banks responded by creating accounts that paid interest, provided payments system access (through methods like cheque writing privileges), but escaped the regulatory definition of a demand deposit. The much greater, more durable innovation came in 1971 in the form of the money market mutual fund (money market fund for short, or MMF). The MMF is a classic non-bank intermediary: it sells shares with fixed face value, allowing owner/liability holders instant withdrawal. It uses these funds to make loans, often in the form of short-term commercial paper. But, the MMF has no bank charter and does not face bank regulation. Regulation Q did not apply to its activities, so these new vehicles quickly boomed.

Driven by the cascade of bank failures during the Great Depression, lawmakers thought that capping deposit rates would make the system safer. They would protect banks from dangerous competition that would induce risky lending.[82] Instead, by restricting banks' ability to compete, Regulation Q eventually drove a significant fraction of checking and savings customers out of the regulated system altogether and into the new non-bank intermediaries. One could even argue that this enormous flow of money out of the regulated banking system eventually led to the collapse of the savings and loan industry in the mid-1980s and to the web of opaque interconnections between banks and non-bank intermediaries that contributed to the chaos of the global financial crisis. Indeed, the epicentre of the recent crisis in the US was large, too-big-to-fail non-bank financial institutions.

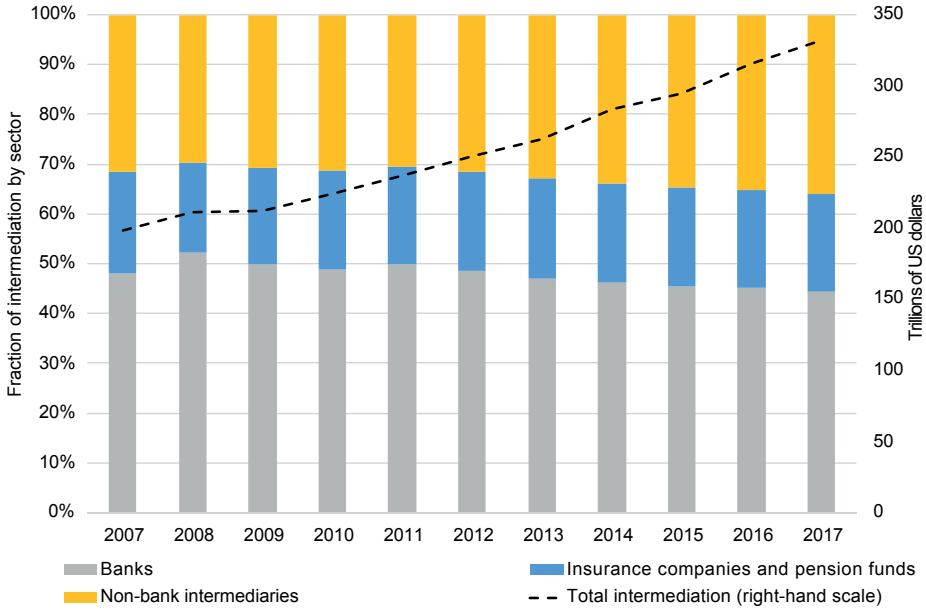
It is important that we not repeat the same mistake. As the discussion of Basel III makes clear, we believe that the official sector has made tremendous progress since the crisis. Capital requirements are stronger. Liquidity requirements are in place. Authorities conduct regular stress tests. Resolution regimes for large, complex intermediaries are stronger (see Chapter 3). And, there is a focus on the need to strengthen market infrastructures (see Box 2.1).

Not only has the rulebook been rewritten, enforcement is more diligent. Most importantly, regulators have changed their perspective. There is a renewed appreciation of the implications of the fact that the financial system is evolving continuously. That means that in order to maintain resilience, ensuring that the frequency and severity of financial crises remains tolerably low, the rules have to change constantly.

That said, the regulatory perimeter remains porous, so activities continue to escape. To see this, we can look at information from the Financial Stability Board's (2019) *Global Monitoring Report on Non-Bank Financial Intermediation* in Figure 2.2. From 2007 to 2017, as overall intermediation (measured by total assets) rose by two thirds to $333 trillion (the dashed black line), banks became somewhat less important, with their share of global declining from 48% to 44% (the grey bars). Meanwhile, non-bank intermediaries' share of total financial system assets increased from 31% to 36% (the yellow bars). So, it does appear that a shift is taking place.

82 See Matutes and Vives (2000) for a discussion of the rationale and effects of deposit rate caps.

Figure 2.2 Global financial system assets by sector, 2007-17 (percent of total)



Notes: Data are for the assets of financial institutions in 29 jurisdictions. Other non-bank intermediaries include money market funds, hedge funds, other investment funds, real estate investment trusts, trust companies, finance companies, broker-dealers, structured finance vehicles, central counterparties, captive finance institutions and moneylenders, and a category labelled "other." We exclude public financial institutions and central banks.

Source: Financial Stability Board (2019), monitoring dataset.

To understand why non-bank intermediation remains so pervasive, and why authorities may be permanently condemned to playing catch-up, it is useful to think about human disease. Through our governments and international institutions, we work to track mutations of viruses and bacteria. Infectious disease specialists are always on the lookout for bacterial mutations that might be resistant to antibiotics or new viruses that can easily spread in the population. Among the simplest examples is the work doctors and technicians do to isolate new flu viruses early enough to forge each year's vaccine in the hope of keeping infection rates low.

Financial innovation is to systemic resilience as viral mutation is to human health. Financial changes are often complex and difficult to detect, at least initially. Rapid change and opacity make it harder for counterparties and authorities (think antibodies) to figure out what is going on. Furthermore, like mutations, many innovations arise randomly, with the few survivors being the best adapted to the environment. And, like drug-resistant strains, some innovations prosper precisely because they help circumvent regulation. Finally, in the same way that biological warriors have an incentive to create drug-resistant strains, the profit motive spurs financiers toward innovations that circumvent rules designed to make the financial system safe.

The immediate implication is that, in the same way that an effective healthcare system needs to update the list of diseases and their treatments continuously, anticipating mutations whenever possible, financial regulatory authorities need to keep track of the continuous evolution of the system itself. This is a daunting task, especially since many financial innovations are clearly beneficial. Most people would agree that, by comparison with the arrangements in place a generation ago, today's financial system is much more efficient at mobilising savings and allocating them to the most productive uses, while ensuring that risk goes to those most able to bear it. Just consider the innovations – such as mobile payments – that are making financial access feasible for the unbanked, who still number about two billion adults (Cecchetti and Schoenholtz, 2018b). These changes increase the productive capacity of the global economy and make us all better off.

We note that the analogy to disease has an obvious limit, as the impact of technology on finance can be a two-edged sword. On the one hand, through competition it makes the system more efficient, providing services more cheaply and improving access. Innovations to payments are an obvious example. Furthermore, new providers may themselves be low risk, as they tend have balance sheets with little, if any, risk or leverage. But, new firms naturally cherry pick, taking away banks' most profitable activities. This means that the banks, in an effort to maintain their return on equity, will take more risk. In other words, as intermediation migrates outside of the regulatory perimeter, what remains inside may become more fragile. So, even if non-bank intermediaries are not themselves sources of potential instability, they could destabilise what is left behind.

This leads us to the conclusion that authorities face two related challenges: monitoring and mitigating risk arising both from regulated institutions undertaking new activities and from new entities (financial or non-financial) initiating activities that may or may not already exist. The issuance of pass-through securities by government-sponsored entities around 1970 (Ginnie Mae and Freddie Mac) and the development of credit default swaps by Bankers Trust two decades later are two examples of the former.[83] Examples of the latter include payments systems such as PayPal, peer-to-peer lending platforms such as Lending Club and robo-advisors such as Betterment. To balance innovation and safety, regulators must remain attentive to evolution of both securities and institutions.

The concept of a regulatory sandbox, recently implemented in a number of places, is one approach. To quote the UK Financial Conduct Authority:

> *"A regulatory sandbox is a 'safe space' in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question."*[84]

The hope is that this approach will lead to adjustments by both firms and regulators ensuring that safe and useful products come into widespread use quickly and at low cost.

83 Pass-through securities allow for securitisation where an entity issues certificates that provide rights to future payments or accounts receivable. A credit default swap is a derivative instrument that provides an investor with insurance against the default of a bond.

84 Financial Conduct Authority (2015).

As for the institutions, here we need a clear framework with the following elements: monitoring, assessment, designation, regulation and supervision.[85] Different jurisdictions are addressing this challenge in various ways. For example, in the US, the Office of Financial Research has the task of collecting information, monitoring the financial system, and then providing assessments to the Financial System Oversight Council (FSOC). The FSOC then has the legal authority to designate non-bank institutions as 'systemically important financial intermediaries' (SIFIs), a legal category that subjects them to stricter prudential supervision (including capital regulation and stress testing) by the Federal Reserve. At the time of writing, there are no non-bank intermediary with a SIFI designation.

Unsurprisingly, the US process does not work well. Given that banks, insurers and securities firms face a combination of federal and state regulators, there are well over 100 separate agencies that would need to coordinate to provide a coherent framework. Under such circumstances, change is extraordinarily difficult. Furthermore, when no existing agency has obvious authority to regulate and supervise a new instrument or new entity, legislative action would likely be required to provide the appropriate authorisation. At the national level, this would be nearly impossible to obtain.

The contrast with the UK system could not be starker. There, financial institution regulation is in the Bank of England – both institution-specific and system-wide – while securities regulation, consumer protection, competition policy, and financial market regulation is the province of the Financial Conduct Authority. Not only are there only two agencies, but there is an agreed process for expanding the regulatory perimeter. After determining that it is appropriate to bring an instrument or entity under its umbrella, the Bank of England can make a request to Her Majesty's Treasury. Once the Treasury agrees, they then take the proposal to Parliament, which provides the authority.[86]

While we could provide additional examples, our point is a general one. Authorities should get together, compare their experiences, and set to work constructing a dynamic framework capable of maintaining systemic resilience in the face of what will be continuous innovation at the boundaries of existing regulation. Importantly, such a framework should have the ability to monitor the entirety of the evolving financial system, the capacity to assess the risks new activities pose, the authority to regulate, and the resources to supervise. In other words, the authorities must be able to evolve and innovate as quickly as the private sector.

85 A number of jurisdictions engage in active monitoring; see, for example, the section in the November 2017 *Financial Stability Report* of the Bank of England (p. 52), Chang et al. (2016), or the European Systemic Risk Board's EU Shadow Banking Monitor.

86 This process is evident from the document where the Bank of England's Prudential Regulatory Authority (2013) describes the procedure for designating investment firms for regulation and supervision. Paragraph 7 states that "the Financial Policy Committee (FPC) will be able to make recommendations to HM Treasury regarding the boundary between regulated and non-regulated sectors of the UK financial system — the regulatory perimeter."

Box 2.1 Central clearing

Another important element of the financial regulatory reform process is the move to make derivatives trading safer. In the aftermath of the 2007-09 financial crisis, authorities in the advanced economies committed to overhaul over-the-counter (OTC) derivatives markets. The goal is to replace bilateral OTC trading with a *central clearing party* (CCP) that is the buyer to every seller and the seller to every buyer. (Exchange-traded derivatives have long cleared through CCPs.)[87]

The rationale for this is straightforward. In a system with bilateral contracts, buyers and sellers are unsure about the ability of the other to make good on a contract. Concern about one's counterparty's ability to perform naturally extends to unease about the counterparty's counterparty, their counterparty, and so on. In other words, the resilience of a network of bilateral arrangements depends on the strength of all of the links.

Shifting all transactions in a class of instruments to a single CCP improves the resilience of the financial system in three important ways: it diminishes the linkages among intermediaries, so that the default of one trading entity is less likely to harm others;[88] it facilitates the enforcement of uniform collateral standards; and it makes risk concentrations transparent, allowing market participants and the CCP to impose a commensurate risk premium.

To understand the enormity of this task, we can look at a few numbers. Figure 2.3 shows the gross notional amounts outstanding of OTC derivatives. Since 2013, the reported volume has fallen by more than $200 trillion to $480 trillion. (After adjusting for double counting created by the shift to CCPs, the amount outstanding has likely fallen by an additional $100 trillion.)

There has been notable progress in recent years in improving derivatives market infrastructure. In its 12th semi-annual progress report, published in June 2017, the FSB reports that roughly 80% of all interest rate and credit derivatives in the US are now centrally cleared. This is consistent with evidence from Bank for International Settlements (BIS) surveys that from 2007 to 2018 the fraction of interest rate derivatives centrally cleared globally rose from 16% to 75%.[89] Note that interest rate derivatives accounted for nearly 80% of outstanding OTC contracts over the past decade.

Of course, central clearing is *not* a panacea.[90] The key concern is what happens to a CCP in a period of market sßtress. What if one fails? While there are some safeguards in place – margin, prepaid guarantee funds, and the CCP's own capital buffers – they appear relatively modest.[91]

87 At their summit in September 2009, the leaders of the G20 agreed that: "All standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest."

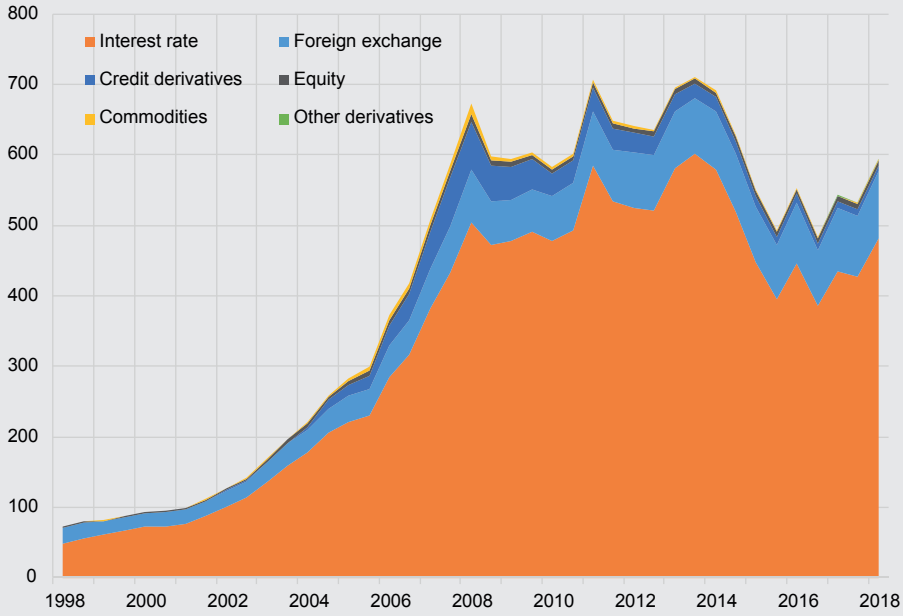
88 One way in which central clearing reduces linkages is through 'multilateral netting'. Netting eliminates the circles like the one in Figure 2.3, where only gross exposures exist. That is, if the CCP is counterparty to all trades, it can cancel those offsetting trades that merely move risk around a ring. Also known as 'trade compression', netting can reduce gross notional amounts significantly. While private trade compression services are available in the OTC market, it is more straightforward for a CCP that can directly observe complex netting opportunities to arrange to tear up the contracts (Cecchetti and Schoenholtz, 2016a).

89 See Schrimpf (2015), ISDA (2016) and the BIS semi-annual derivatives statistics.

90 See Domanski et al. (2015) for a detailed discussion of the risks of central clearing.

91 See Berner et al. (2019) for a discussion of the size of the components of the waterfall, and how small they are relative to the likely exposure of the largest CCPs.

Figure 2.3 Gross notional value of OTC derivatives outstanding, 1998-2018 (semi-annual, trillions of US dollars)



Source: BIS Semiannual derivatives statistics.

The vulnerability of CCPs (and other financial market utilities) has not escaped authorities. To manage systemic risk from these behemoths, supervisors have taken the obvious approach: stress testing.[92] We simply note that over the past few years, both the US Commodity Futures Trading Commission (CFTC) and the European Securities and Markets Authority (ESMA) have been stress testing CCPs (CTFC, 2016; ESMA, 2018). The CFTC's 2016 test, for example, started by creating a set of 11 scenarios that include different combinations of volatility across markets. For each scenario, positions are marked-to-market. The CFTC test assumes that no clearing member can respond to a variation margin call, so a member defaults when the sum of its existing margin plus its contributions to the guarantee fund is exhausted. Supervisors then compute the number of member defaults that a clearinghouse can withstand before exhausting its resources, and without the CCP resorting to demanding further resources from its members through assessments powers. The clearinghouses passed under two-thirds of the scenarios. Nevertheless, the question remains: how concerned should we be about the very thin buffer CCPs have to guard them against failure and the resulting possibility that they could become a transmission mechanism for stress in the system?

92 For a discussion of CCP stress tests, see Committee on Payments and Market Infrastructure (2017).

3 Resolving too big to fail

The financial crisis has revealed how deep and extensive the too-big-to-fail problem was. With the exception of Lehman Brothers, no distressed systemically important financial institution has been allowed to fail. And for many commentators and protagonists, the bankruptcy of Lehman Brothers was an egregious mistake:

> *"My Monday began with a call from ECB's Jean-Claude Trichet, who had been so complimentary about our Bear intervention. Now he wanted to know, in a French-accented blend of astonishment and derision, whether we had lost our minds. How could we let Lehman go? Why would we want to create a global panic?"*[93]

The political backlash against the massive bailouts of systemic banks during the financial crisis of 2007-2009 in the US, UK, Germany, France, Belgium, Italy, Switzerland and Spain has been so deep and widespread that a top priority for regulators after the crisis became to fix the TBTF problem of systemically important banks by increasing their resilience and making 'bail-in' a credible alternative to 'bailout'.

This chapter on how SIB resolution has been structured is divided into three parts. The first part reviews the main failures of financial institutions during the crisis, and why resolution was an impossible choice for most of them. The second part provides an analytical framework to explore the challenges and trade-offs involved in the orderly resolution of a SIB. The third part describes the resolution procedures that have been introduced in different jurisdictions, how they are designed to work, their strengths and weaknesses, as well as the resolution plans that most SIBs have outlined for themselves in the event that they should be faced with major losses.

The chapter concludes with open questions and suggestions for possible improvements in the different resolution models.

3.1 Lessons from the crisis of 2007-2009: Why bank resolution was an impossible choice

The global financial system at the onset of the crisis was not prepared for the orderly resolution of a major financial institution. What we mean by 'orderly resolution' is something akin to a bankruptcy reorganisation procedure of a large non-financial company. Take, for example, the bankruptcy of United Airlines in 2002, at the time one of the largest companies to go bankrupt in US history. This was by and large a very orderly resolution of an insolvent company. There was no visible disruption in the air travel industry and almost no disruption in

93 Geithner (2014, p. 291).

the operations of United Airlines while it was being resolved. Planes continued to fly, and debtor-in-possession financing was available to cover operating costs and pay employees while creditors were involved in a complex and lengthy debt restructuring procedure. There was no bailout or injection of public funds to keep the airline afloat. United Airlines shareholders were wiped out and, following a significant reduction in debt and employee compensation, the airline was able to re-emerge as a solvent company.

The closest to such an orderly resolution for a bank is the FDIC receivership procedure that has been perfected following the Savings and Loans (S&L) crisis of the early 1980s. This procedure works well for small and medium-sized banks, and was effectively applied during the financial crisis to deal with small insolvent banks. The receivership model is built around the idea of 'purchase and assumption'. The failed bank is purchased by a solvent bank, which agrees to purchase the failed bank's assets and also to assume most of its debts. If some debt reduction is needed to make the failed bank solvent, the FDIC may take on some of the debt obligations so that the acquirer does not have to assume debts in excess of the value of the failed bank's assets. A typical FDIC resolution occurs over a weekend, when banks are closed. The purchase is announced before the bank opens on the following Monday, so that the failed bank can continue operating unimpeded under the ownership and name of the acquiring bank. From the point of view of the bank's clients and creditors, nothing has changed except for the ownership of the bank.

This procedure minimises disruptions to the failed bank's operations. Moreover, the assumption of the failed bank's debts by an acquirer with a strong balance sheet provides the necessary guarantees to allow the newly acquired bank to continue to operate. The shareholders of the failed bank are wiped out. In this respect there is no bailout. However, the failed bank's creditors are in practice generally made whole. This is a key difference between FDIC receivership, as it has been implemented, and Chapter 11 bankruptcy. For non-financial firms, bankruptcy typically means debt write-downs, or what are generally referred to as 'bail-ins' in the banking literature, whereas for banks receivership typically only results in losses to shareholders (and sometimes the FDIC) but not to the failed bank's creditors.

The two canonical orderly resolution procedures described above were either not available to resolve large failing financial institutions or, when they could have been invoked, they were not designed to adequately deal with the resolution of large and complex financial institutions. In Europe the problem was even deeper as there was virtually no experience with bank resolution before the crisis and certainly no equivalent procedures to Chapter 11 bankruptcy or FDIC receivership. One notable exception is the Swedish real estate and banking crisis of the early 1990s which, however, resulted in a bailout.

This fundamental institutional weakness in dealing with financial distress of large banks, in effect, meant that large financial institutions were *too big to fail* or *too complex to fail*, but this was not fully grasped by regulators before the crisis. When the crisis hit, regulators were suddenly faced with the predicament of a failure of a major financial institution that could not be resolved in an orderly manner. They abruptly became aware of the fact that orderly resolution was

simply not an option. Accordingly, their interventions in the crisis to deal with the implosion of large financial institutions was, with one exception (Lehman Brothers), to do everything to save them and protect their creditors by bailing out the failed institutions.

3.1.1 The United States: Why FDIC receivership and Chapter 11 were inadequate

In the early phases of the crisis in the US it seemed that the institutional tools to address the failure of a financial institution were adequate. When New Century Financial, the second largest US subprime mortgage lender, failed on 2 April 2007 it filed for Chapter 11 bankruptcy without much ado. New Century was not a bank, it was a real estate investment trust. As such, it was not supervised by the FDIC and it could not be resolved via receivership. The only resolution option was Chapter 11 bankruptcy. Even though New Century was a somewhat large institution – it reported total assets in excess of $25 billion in 2006 – it had a simple business model and organisational structure. In particular, it did not have many affiliates in different jurisdictions and involved in different lines of business, nor a large derivatives and swaps book, so that a liquidation of the business through a bankruptcy court could be completed in an orderly way without significantly disrupting credit markets. Investors in subprime mortgage-backed securities issued by New Century and other failing subprime mortgage lenders incurred losses, but even for these investors it seemed that the problem was manageable. Hedge funds that had heavily invested in these securities, most notably two Bear Stearns hedge funds, simply closed down when they were faced with large losses (in June 2007 for the two Bear Stearns funds).

In the early phases of the crisis in the US the problem seemed to be mostly one of shortage of liquidity. If there were insolvent institutions, they could be resolved either through Chapter 11 bankruptcy, as in the case of New Century Financial, or through FDIC receivership, as was the case of Countrywide, a much larger institution that was purchased by Bank of America on 1 July 2007. As for the very largest financial institutions, they were thought to be adequately capitalised to be able to withstand losses related to subprime mortgages, which only represented a small fraction of their assets.

The first resolution challenge came with Bear Stearns, one of the eminent, stand-alone Wall Street broker-dealers. The size of Bear Stearns' balance sheet was comparable to that of Countrywide (approximately double its size), but its business model was much more complex and fragile. Most importantly, Bear Stearns was not a commercial bank, supervised by the FDIC and with access to the Fed's discount window. Its core business was securities dealing and it was an important counterparty for hedge funds in derivatives and swaps markets. Given that it was not a bank holding company, Bear Stearns could not be resolved through an FDIC receivership. It could only be resolved through a Chapter 11 bankruptcy filing.

But, for several reasons that was an unpalatable option. First and foremost, news of a bankruptcy filing would in all likelihood have triggered a financial panic. Even a week before its takeover by JPMorgan, the market believed that Bear Stearns was solvent and that its financial difficulties were mostly related to a liquidity crunch. As a broker-dealer it relied heavily on very short-term financing,

much of it repo financing. Repo lenders were increasingly reluctant to roll over their positions, especially when they were backed by subprime mortgage-backed securities.[94] A bankruptcy filing would have been a clear signal that the crisis was much deeper than anticipated and that it had entered a new disturbing phase.

The second reason why a Chapter 11 filing would have been problematic is more technical. The filing would not have protected Bear Stearns against its derivatives and swaps counterparties. These claims are commonly referred to as 'qualified financial contracts' (QFCs) and are exempt from the automatic stay rule that applies to debt contracts under Chapter 11. This rule forbids all creditors from pursuing any debt collection actions while the firm is under the bankruptcy court's protection. In other words, the automatic stay is a suspension of debt collection to prevent an uncoordinated run on the firm's assets and to allow the firm to continue its operations while its debts are being resolved. The problem for Bear Stearns and other broker-dealers was that its QFC book was exempt from the automatic stay, meaning that derivative and swaps counterparties could unwind their positions immediately upon the bankruptcy filing. Since Bear Stearns had a large derivatives and swaps book and since its securities dealing business was highly dependent on its ability to take hedging derivatives and swaps positions, it would have been drained of cash as a result of the unwinding of QFC counterparty positions and would have been unable to continue operating as a broker-dealer. In other words, the Chapter 11 resolution process would not have worked as intended. It would have resulted in a substantial loss of value and it would not have assuaged the panic.

But if neither FDIC receivership – for institutional reasons – nor Chapter 11 bankruptcy – for financial fragility reasons – was a feasible option to resolve Bear Stearns, how could it be rescued? As a broker-dealer, it did not have access to the standard public liquidity support of the Fed. Nor did the US treasury have the authority to recapitalise Bear Stearns with public funds. A public recapitalisation would have required a vote in Congress. When Bear Stearns' troubles became apparent, there was not enough time left to organise such a vote, and even if there had been enough lead time, the revelation of the need for such a recapitalisation could itself have precipitated a panic. Moreover, there was no assurance that there was sufficient political support for such an intervention.

The solution that was found was to appeal to a little-known provision of the Federal Reserve Act of 1913 – Section 13(3) – subsequently amended in 1991 in reaction to the crash of 1987, which could be interpreted as granting the Fed authority to support a large non-bank financial institution facing a liquidity crunch:

> *"Under unusual and exigent circumstances, the Board of Governors …may authorize any Federal reserve bank… to discount for any individual, partnership, or corporation, notes, drafts, and bills of exchange when such notes, drafts, and bills of exchange are indorsed or otherwise secured to the satisfaction of the Federal Reserve bank…provided that … such individual, partnership, or corporation is unable to secure adequate credit accommodations from other banking institutions."*[95]

94 See Gorton and Metrick (2012) and Brunnermeier (2009).
95 12 USC § 343.

This provision gave the Fed authority to support Bear Stearns provided that Bear Stearns faced "unusual and exigent circumstances", and that it was unable to obtain adequate funding in financial markets. But, even if the Fed had authority to provide liquidity support to Bear Stearns, the question remained of how Bear Stearns could be recapitalised. The Fed's idea was to follow the FDIC receivership model and to organise a purchase-and-assumption transaction of Bear Stearns by JPMorgan.

Following the FDIC receivership model, however, does not mean that the Fed has the same legal authority as the FDIC; it does not. Unlike the FDIC, it cannot impose such a transaction on Bear Stearns' shareholders. Nor can it allow the transaction to be completed without the approval by JPMorgan shareholders. Finally, the Fed does not have any discretion to modify the terms of any debt contracts.

The limits of Fed (and Treasury) authority severely constrained regulators' ability to resolve Bear Stearns. On Friday 14 March 2008, the Federal Reserve announced first, a loan of $12.9 billion to Bear Stearns; second, a merger between JPMorgan Chase and Bear Stearns at $2 per share with JPMorgan assuming all other Bear Stearns' debt obligations; and third, a loss-sharing arrangement with the Fed on a portfolio of $30 billion in Bear Stearns assets. These assets would be acquired at "fair value" and held in a special purpose vehicle (Maiden Lane LLC), and their purchase would be financed with a loan from the Fed and an equity capital injection by JPMorgan.

The structure of this transaction (later dubbed the 'Jamie deal' in reference to the first name of the CEO of JPMorgan) gave the appearance that Bear Stearns' shareholders had been essentially wiped out, so that the Secretary of the Treasury, Hank Paulson, could claim that there had been no bailout. That's as far as the 14 March announcement of the Bear Stearns rescue goes. However, the inconvenient truth was that, despite the generous public support by the Fed, the deal could not be finalised until Bear Stearns and JPMorgan shareholders had approved it.

This put Bear Stearns' shareholders in a strong bargaining position and exposed the Fed to enormous risk. The shareholders in effect held a valuable call option on the merger, with a maturity of around one month (the minimum time it takes to organise the shareholder vote) – a considerable time interval in the midst of a financial crisis with rapidly changing events. Should market conditions improve over this time period, they could simply vote down the merger agreement or renegotiate its terms. This is indeed what happened. The first reaction of the shareholders was one of dismay. They thought that the fair value of their shares was closer to $30, the closing price on Friday, than to $2. Eventually, on 24 March, the purchase price was revised up to $10 per share in exchange for stronger assurances that the merger would be approved by a majority of Bear Stearns' shareholders.

As it turned out, the merger between Bear Stearns and JPMorgan was successfully completed, but the outcome could have been different. As with many attempted mergers, the deal could have collapsed due to opposition of the shareholders of one of the parties. This deal uncertainty not only exposed the Fed to significant financial risk but also risked revealing the limited power of the central bank and bank regulators to stop the spread of a major financial panic.

In many ways the Fed had a lucky break with Bear Stearns. After the successful completion of the merger, financial markets recovered somewhat. Nevertheless, the Bear Stearns crisis revealed major weaknesses in the US financial system: the fragility of the broker-dealer business model, the extreme forms of maturity transformation inherent in its activities, its exposure to self-fulfilling runs, and the lack of protection against run risk. As analysts became increasingly aware, broker-dealers had limited access to lender-of-last-resort support, they had nothing resembling deposit insurance to protect their counterparties, and they had no adequate resolution procedures. Even though the Bear Stearns intervention was successful, it came at the steep cost of not only no bail-in of any of Bear Stearns' creditors but also a significant bailout of Bear Stearns' shareholders. What's more, the intervention gave rise to an even bigger financial institution that could be even more challenging to resolve in a future crisis.

All these weaknesses became abundantly clear a few months later during the fateful weekend of 13/14 September 2008, when the global financial system spiralled off-course. After Bear Stearns was taken over, there remained four large, stand-alone broker dealers: Goldman Sachs, Morgan Stanley, Merrill Lynch and Lehman Brothers. These were significantly larger entities and there were not enough US banks with large and strong enough balance sheets left that would be capable of playing the same role as JPMorgan with Bear Stearns. Indeed, over the weekend of 13/14 September it became clear that there was only one US bank willing to contemplate a merger with a broker-dealer facing financial difficulties (Bank of America) but there were at least two broker-dealers in need of a rescue (Merrill Lynch and Lehman Brothers).

Several books and numerous articles have already been written just about this weekend.[96] This is not the place to delve into the details of all the negotiations and attempted deals. While Merrill Lynch could be rescued through a merger with Bank of America, Lehman Brothers could not. The attempted merger with Barclays fell through because the deal had to be approved by Barclays' shareholders. Time had run out for Lehman and it could not wait for the Barclays' shareholder vote. Moreover, UK authorities were unwilling or unable to lift the shareholder vote requirement so that the merger could be announced on Sunday evening before the opening of financial markets in Asia. Instead, Lehman Brothers filed for Chapter 11 bankruptcy on Sunday, 14 September 2008. What happened next was a run on Lehman's cash and collateral by the Lehman QFC counterparties. The Lehman broker-dealer affiliate could no longer operate and was bleeding cash, so much so that on 17 September the bankruptcy court agreed to sell it to Barclays at a significantly discounted price.[97] The events following the Lehman bankruptcy filing fully confirmed regulators' and analysts' concerns with a Chapter 11 bankruptcy of a major broker-dealer that had been the main reason behind the rescue of Bear Stearns.

No matter what one concludes about the Lehman failure – whether it was a major error of judgement by regulators or not – one basic lesson from this episode is that one cannot indefinitely rescue distressed financial institutions through purchase-and-assumption. At some point one simply runs out of suitable

96 See Sorkin (2009), Paulson (2010), Gordon and Muller (2011), Geithner (2014) and Bernanke (2015).

97 Under Chapter 11 rules, the bankruptcy judge has authority to allow for the sale of assets or affiliates in the midst of bankruptcy proceeding if this is in the interest of creditors. A sale would be in creditors' interest, for example, if the purchase price exceeds the going-concern value of the affiliate under Chapter 11. The technical term for such a sale is a '363 sale'.

buyers. Even when there is a suitable buyer, the purchase-and-assumption deal sometimes can succeed only thanks to large public guarantees, a form of TBTF intervention. A resolution procedure is therefore necessary, even if it is only brought into play as a last resort. This, to be sure, became one of the two top priorities of policymakers in their regulatory responses to the crisis.

3.1.2 Europe: The absence of any bank resolution procedure

If the US narrative of crisis intervention is one of limited authority to intervene and enormous uncertainty generated by imperfectly appraised limits to regulatory rescue powers, the European narrative is one of a general lack of well-defined resolution procedures for financial institutions combined with much broader intervention authority of finance ministries and treasury departments. The absence of resolution procedures tailored to financial institutions assured that if a major bank were to go under and default on its obligations, this would result in chaos and a generalised panic. At the same time, European regulators had much greater discretion to bail out and even nationalise a failed bank, thereby avoiding any defaults. In other words, the European institutional context made bailouts the easy and natural response to the failure of a large bank.

Another major difference with the US is that most large European banks were universal banks, combining lending, securities dealing, asset management and insurance under the same umbrella. Unlike in the US, there were no large, stand-alone broker-dealers competing with commercial banks. In other words, there was no lightly regulated, broadly defined 'shadow banking' sector competing with the traditional banking sector.

The financial crisis hit Europe in two phases. The first phase, between 2007 and 2009, was tied to real estate lending and the crisis emanating from the US. The second phase, between 2010 and 2015, was tied to the euro sovereign debt crisis, which was largely a consequence of the financial crisis of 2007-2009.

The first European bank to be bailed out as a result of losses tied to subprime mortgage-backed securities was IKB Deutsche Industriebank, which received a €3.5 billion capital injection from a consortium of German state-controlled banks on 2 August 2007. This was followed on 18 August 2007 by the bailout of Landesbank Sachsen, which had also incurred large subprime mortgage-related losses, through a purchase-and-assumption deal with Landesbank Baden-Wurttemberg. This was to be the first of a series of bailouts of German *Landesbanken* that had invested heavily in US subprime mortgage-backed securities.

Next came the widely reported Northern Rock bailout by the Bank of England on 14 September 2007, and its subsequent nationalisation on 22 February 2008. Northern Rock had been an aggressively expanding building society that was caught by the global collapse of the mortgage securitisation market in the summer of 2007, and had been subject to the first run on a UK bank since 1866.

The subsequent wave of European bank bailouts came after the collapse of Lehman Brothers, which precipitated a global financial crisis and pushed the most vulnerable banks over the brink. The Belgian bank Fortis was bailed out on 29 September 2008. On the same day, the German mortgage lender Hypo Real Estate was bailed out and the British bank Bradford & Bingley was nationalised. The next day, the Franco-Belgian bank Dexia received the first of two major bailouts from the French, Belgian and Luxemburg governments.

To respond to the deepening crisis in a more systematic way, the UK government put in place a bank rescue package on 8 October 2008 which could fund equity injections into troubled banks. Lloyds Bank, which had just acquired the distressed HBOS in a purchase-and-assumption deal on 17 September, and Royal Bank of Scotland were the two main banks to be bailed out under this plan. Next came the bailouts of UBS on 16 October 2008 and of Commerzbank, Germany's second largest bank, on 3 November 2008. The year ended with the bailout and nationalisation of Anglo Irish Bank on 22 December 2008.

Of all the distressed European banks in 2007 and 2008, none was allowed to default or was pushed into some form of resolution procedure, with the exception of banks in Spain, Iceland and Cyprus (which we discuss below). All were bailed out and only the shareholders of these banks incurred any losses. This is also true for the interventions to support banks in the Netherlands (the bailout of ABN Amro), Austria (the bailout of Raiffeisen Bank), Hungary, the Czech Republic, Poland and the Baltic states, as well as the subsequent interventions to rescue Greek and Portuguese banks during the euro sovereign debt crisis of 2010-2015.

An unanticipated major difficulty with this approach that became apparent during the euro sovereign debt crisis was that the financial capacity of some states was not sufficient to be able to finance the huge costs of bailing out their largest banks. After bailing out most of their banking systems, some states needed financial assistance themselves. This was the case for Greece, Ireland, Portugal, and Spain. Even though the Memorandum of Understanding of July 2012, setting the terms for the recapitalisation of the Spanish banking system, imposed partial losses on hybrid capital and subordinated debt of Spanish banks, this was not sufficient to avoid a bailout for Spain. In two extreme cases, even a bailout of the state was not sufficient to avoid a partial default by their largest banks. The first is Iceland, where the government decided on 6 October 2008 to let its nationalised banks default on its obligations to foreign creditors. The second is Cyprus in July 2013, where deposits exceeding the insured limit of €100,000 were bailed in, as a condition for receiving a rescue package from the IMF and the EU.

This latter bail-in of depositors was unprecedented and was decided only as a very last resort.[98] Indeed, because of the fear of bank runs and of the political backlash following the imposition of losses on retail depositors, bank deposit accounts have become sacrosanct. As politically unpalatable as bailouts are, haircuts on bank deposits are much more so. Italian regulators and politicians learned this at their own expense when they bailed in Banca Etruria in December 2015 in application of the newly passed BRRD. It was widely reported that as a result of the bail-in, a pensioner lost most of his savings and committed suicide. With the political backlash that followed, Italian regulators, not surprisingly, did everything they could to avoid another bail-in. Despite the BRRD, they used all the loopholes they could find to prevent a bail-in of Banca Monte dei Paschi di Siena in December 2016 and of Veneto Banca and Banca Popolare di Vicenza in June 2017.

The economic rationale for avoiding bail-ins of bank deposits has been clearly articulated by Diamond and Dybvig (1983). If bank deposits are fully protected against any haircuts, depositors no longer have any incentive to run. This rationale has been forcefully stated by Timothy Geithner in his account of the financial crisis: "haircuts send a destabilizing signal that more haircuts are

98 The case of Cyprus was complicated by the prevalence of Russian depositors, with large deposits, who were using these banks as a gateway into the capital markets of the EU.

coming, encouraging runs on financial firms"[99] and "[u]nfortunately, the only way for crisis responders to stop a financial panic is to remove the incentives for panic, which means preventing messy collapses of systemic firms, assuring creditors of financial institutions that their loans will be repaid…".[100] In more colourful language, Hank Paulson appealed to the same economic principle when justifying the bailout of Fannie Mae and Freddie Mac in July 2008: "If you've got a bazooka, and people know you've got it, you may not have to take it out."[101]

Yet, as the precedents of the crises in Iceland and Cyprus most clearly illustrate, full bailouts may not always be feasible. Even if they are feasible, they are politically unpopular. And, against the economic rationale of preventing financial panics, there is the equally important economic principle of giving investors incentives to make prudent investment decisions. Investors need to have 'skin in the game' to make wise economic investment decisions. If bank creditors are always fully protected against credit risk, they have no incentive to do any due diligence on the bank's risk-taking behaviour. If a 'no haircuts' policy protects against run risk, it also exacerbates moral hazard in lending. This is the fundamental dilemma concerning resolution policy for systemically important banks.

3.2 SIB resolution: What are the challenges and trade-offs?

In this section we explore the economic trade-offs involved in the orderly resolution of a SIB. The business model of a bank as a financial intermediary, taking safe deposits and investing in risky assets, is by its very nature fragile. Moreover, this fragility involves systemic risks due to the interconnection of banks through the payments system. This is why banks require a specific resolution procedure. We begin by describing how recent innovations in financial markets have transformed the business model of the largest systemically important banks. We then turn to a discussion of the challenges of designing an adequate resolution procedure for these banks.

3.2.1 The repo, swaps and derivatives carve-out

When a bank is about to fail, how should it be resolved? There is surprisingly little theoretical literature on this basic question. Economists and legal scholars have pored over the question of how bankruptcy for non-financial companies should be structured,[102] but the failure of a financial institution poses specific challenges.

Any bankruptcy procedure must abide by three basic principles. First, there should be no violation of the priority ordering of claims. This is an ex-ante requirement that ensures that the firm is subject to proper financial discipline when it makes its investment decisions. Second, when the firm is in financial distress, its 'going concern' or 'gone concern' value should be preserved. This means, in particular, that there should not be a disorderly, uncoordinated run on the assets by the creditors. It also means that the firm should be able to obtain

99 Geithner (2014, p. 377).
100 Geithner (2014, p. 770).
101 Hank Paulson quoted in "Paulson's Itchy Finger, on the Trigger of a Bazooka", *New York Times*, 8 September 2008.
102 See Aghion et al. (1992) and Skeel (2003).

the necessary working capital to be able to continue operating efficiently. Third, if the firm's going concern value exceeds its gone concern value, its debts should be written down, or restructured, with the aim of removing any debt overhang problems. That is, legacy liabilities should be reduced to a level where the firm's (new or old) shareholders have the right incentives to make value-enhancing investments.

These three principles apply equally to financial and non-financial firms. But, the resolution of a financial firm faces another challenge: avoiding contagion, disruption of financial markets, and bank runs. Whether a bankruptcy procedure designed for non-financial firms can be adapted to financial firms has been the subject of heated debates in the US.

With the passage of the Dodd-Frank Act and the creation of the Orderly Liquidation Authority (OLA), US legislators decided that a special procedure was needed to resolve banks and other systemically important financial institutions. Yet, the Chapter 11 corporate reorganisation procedure still remains an alternative option, which many banks stated they prefer. In addition, several proposals have been made to replace OLA with a new Chapter 14 designed for the resolution of financial institutions.

Perhaps the main motivation behind the Chapter 14 proposals is to correct a major weak link in current bankruptcy rules, as they apply to a financial institution. The problem is that the stay does not apply to all the firm's liabilities. There is a *carve-out* for repo, swaps and derivatives, the so-called qualified financial contracts. These contracts are exempted from the automatic stay and the counterparties to these contracts can immediately repossess their collateral when the firm files for bankruptcy. While a typical non-financial firm only has a small fraction of such QFCs, this is not the case for financial institutions, especially the larger, systemically important ones, which have huge derivatives and swaps books.

As we emphasised in Section 3.1, when Lehman Brothers filed for Chapter 11, the repo, swaps and derivatives counterparties immediately started collection actions, which quickly drained Lehman of cash and prevented its broker-dealer affiliate from operating.

There is also no automatic stay under FDIC receivership. The FDIC's approach to addressing this problem has been to fully protect all QFCs and avoid any acceleration of obligations that might trigger a run. The way the FDIC protects QFCs is to transfer the failed bank's assets and QFC claims to a newly formed solvent bridge company.

The QFC carve-out and the FDIC's policy towards QFCs, in effect, provide super-seniority protection to QFCs. A number of legal scholars have taken up the question of the pros and cons of this privileged treatment. A common argument in support of the carve-out is that it allows banks and their counterparties to net out their swaps positions, which significantly lowers transaction costs in derivatives markets. It also provides greater certainty in collateral protections, thereby supporting greater stability in derivatives markets.

But, as much as an individual contract or counterparty benefits from these protections, collectively the absence of a stay can give rise to a *run on QFC collateral*, as was already the case when LTCM collapsed in September 1998.[103] Another concern with the QFC protections is that they create incentives for

103 See Edwards and Morrison (2005).

issuers to substitute debt with instruments such as total return swaps, which are swaps in name only (SWINOs) – debt instruments designed as swaps to escape the automatic stay chopper (Roe, 2010). If debt can easily be dressed up as a swap, the overall effect of the exemption for derivatives is to hollow out the stability provided by the automatic stay. In addition, the greater protections of QFCs do not eliminate default risk; they mostly displace the risk onto debt instruments.[104] What's more, this displacement is inefficient and raises the overall cost of borrowing, unless there are large netting benefits available for derivatives and swaps.[105]

3.2.2 International ring-fencing

Another significant feature of systemically important banks is that they operate in multiple jurisdictions. This raises special cross-border resolution issues. Dealing with the failure of a non-financial multinational corporation already poses complex challenges, as is immediately apparent from even a cursory reading of the cross-border insolvency framework proposed by the United Nations Commission on International Trade Law.[106] But these challenges are even greater for financial firms operating in multiple jurisdictions, because of the speed with which capital can flow across borders, and because of the unique complexities posed by national financial regulations and monetary policies.

The financial crisis revealed a fundamental weak link in the global financial architecture when it comes to the failure of a systemically important multinational bank. Faced with this challenge, the immediate reflex of national regulators and central banks is to focus first on the domestic implications of the bank's failure, and to ignore the wider repercussions for global financial markets. This domestic focus neglects the franchise value arising from an international footprint and risks undermining the smooth operation of global financial markets.

Even relatively simple bailouts of banks create difficult coordination problems among national regulators, as the cases of Dexia, Fortis, and Anglo Irish have revealed. And, according to multiple accounts, the failure of Lehman brothers was eventually due to a lack of cooperation between US and UK authorities. Two banks – Bank of America and Barclays – had expressed interest in acquiring Lehman Brothers to the Treasury Secretary, Hank Paulson, in the week preceding the Lehman bankruptcy. However, on Saturday 13 September, Bank of America made the surprise announcement that it would instead merge with Merrill Lynch.

This left Barclays as the only possible acquirer for Lehman. Most of the remainder of the weekend was devoted to efforts led by the New York Fed to divide Lehman into a solvent 'good bank', to be acquired by Barclays, and a 'bad bank' to be taken over, and recapitalised, by a consortium of Wall Street banks. The latter part was, understandably, the hardest to pull off, but a deal was reached on Sunday afternoon and the CEOs of both Barclays and Lehman were ready to accept the acquisition of Lehman Brothers by Barclays. One last obstacle remained: the shareholders of Barclays needed to approve the merger.

104 As shown in Bolton and Oehmke (2015).
105 Ibid.
106 See UNCITRAL (2014).

Under normal circumstances it would take at least one month to organise a shareholder vote. This was seen as too long and unlikely to reassure financial markets and Lehman's counterparties. To clinch the deal and be able to announce it on Sunday before the Asian markets opened, Hank Paulson requested from the Chancellor of the Exchequer, Alistair Darling, that the shareholder voting requirement for Barclays be exceptionally lifted.[107] Alistair Darling refused – "I said that we would not endorse it because basically what you're asking me to do is to transfer the burden of a bust American bank on to the British taxpayer and there's no way we can do that"[108] – and so the last deal that could have saved Lehman collapsed.

3.2.3 When to resolve and when to provide liquidity support

Finally, another major challenge for the resolution of SIBs is how to combine debt write-downs with liquidity support – when to do the debt write-down, and when to provide liquidity? As we emphasised in Section 3.1, when the crisis of 2007 hit, regulatory authorities did not have many options and, confronted with a growing financial panic, they erred on the side of caution by entirely avoiding debt write-downs whenever they could.

But, going back to the drawing board, if adequate options can be designed for regulators based on first principles, how should debt restructuring be combined with liquidity support? In the case of bankruptcy of a non-financial company, Chapter 11 allows for liquidity provision under debtor-in-possession (DIP) financing while the company's debts are being restructured. The basic principle is that the firm should be allowed to continue operating normally, so as to preserve its going concern value, while the debt-restructuring process is ongoing. The key institutional mechanism that ensures continued financing of the firm's working capital, even though it is insolvent, is the higher priority granted by the bankruptcy court to DIP loans.

The failure of a bank can, in principle, be dealt with the same way as the bankruptcy of a non-financial firm, except for the fundamental difference that the liabilities of a bank are mostly demand deposits or short-term commercial paper. As we explained in Section 3.1, there is an unwritten rule among bank regulators: *no haircuts for retail deposits*. The reason is obviously that haircuts on deposits could trigger a panic run. But another important factor is the political ramifications of potentially imposing losses on small pensioners. Realistically, therefore, only haircuts on long-term subordinated debt can be envisaged.

If there is a sufficient long-term debt cushion that the bank can write off to return to solvency, it may be able to continue operating following the debt restructuring. The only remaining issue then is the provision of liquidity while its debt is being restructured, to allow the bank to continue operating. In principle, this liquidity could be provided through DIP financing, the same way as with non-financial corporations. Indeed, those commentators most obsessed with ending 'too big to fail' advocate that liquidity provision should only come from financial markets. Any form of public liquidity provision should be proscribed.[109]

107 See Sorkin (2009), Paulson (2010), Geithner (2014) and Bernanke (2015).
108 Interview with Alistair Darling by Simon Watkins in the *Financial Mail on Sunday*, 7 September 2013.
109 This is one of the main stated goals of the Republican-proposed Financial CHOICE Act of 2016.

Proscribing public liquidity provision instils maximum financial discipline on banks. That is, to be sure, the desired effect of the policy. But, banning public liquidity support does not help reassure depositors that the bank will not fail while it undergoes a debt restructuring, simply because it may be short of liquidity. Only the credible backstop of a lender of last resort can provide that assurance.

When it comes to the failure of a systemically important financial institution, there is an added macroeconomic consideration in the provision of public liquidity. When a systemically important bank fails there are likely to be negative consequences for aggregate economic activity. Moreover, a systemically important bank rarely fails in isolation. Other financial institutions may fail at the same time and the entire financial system may suffer from a generalised liquidity freeze. In such a situation, countercyclical macroeconomic policy prescribes a monetary stimulus, which may require not only lower interest rates but also quantitative easing should zero nominal interest rates provide insufficient stimulus. The provision of public liquidity to banks then serves the dual role of maintaining banking operations and imparting a macroeconomic stimulus, if only a small one.

3.3 The SIB resolution model around 'single point of entry'

A major priority in the regulatory response to the crisis was to reform resolution procedures for systemically important financial institutions. The US took the lead with the passage of the Dodd-Frank Act in July 2010. Title II of the Act creates the Orderly Liquidation Authority (OLA), a resolution procedure administered by the FDIC, which can be triggered by the Financial Stability Oversight Council (FSOC), created under Title I of the Act, to resolve any systemically important financial institution.

The orderly liquidation authority is modelled after the FDIC receivership procedure. However, FDIC receivership has only been applied to small and medium-sized banks, for which a purchase and assumption merger with a healthy bank is relatively straightforward to implement. The novelty of OLA, as conceived under the Dodd-Frank Act, is that it could be used for large banks and also for large non-bank financial institutions that have been designated as systemically important by FSOC. From the beginning there were debates over whether FDIC receivership could really be applied to large and complex financial institutions. It is one thing to resolve a small or medium-sized bank over a weekend, under a purchase-and-assumption deal; it is quite another to push a large financial institution with many affiliates and operating in many different jurisdictions, like AIG or Citigroup, into receivership when no suitable acquirer is available. Therefore, a natural question was whether OLA would work as intended.

To be sure, the FDIC has authorities under the receivership procedure that are not available under Chapter 11, especially the authority to create a *bridge financial company* that can continue key operations unencumbered. One advantage of this structure is that the FDIC can transfer all QFCs to this bridge financial company, thereby avoiding any default and run on QFCs. Still, the general question of how to resolve a systemically important financial institution with operations in

multiple jurisdictions through an FDIC receivership remained open. In particular, if the resolution of Lehman Brothers could be done again through OLA rather than Chapter 11, how would the FDIC be able to resolve Lehman's affiliates in the UK or Asia?

The FDIC's solution to this problem – single point of entry – is one of the major regulatory innovations to have emerged from the financial crisis. This solution originated from discussions between UK and US regulators on how they should coordinate their resolution responses for a distressed financial institution, such as Lehman Brothers, that has major operations in both jurisdictions.[110] The basic idea of SPOE is that resolution would be executed only through the parent holding company – that is the single point of entry. Any losses incurred by operating affiliates in any jurisdiction would be pushed up and be absorbed by the parent holding company. The shareholders of the banking group would be the first loss absorbers through the parent holding company. The holders of unsecured long-term debt issued by the parent would be the next in line to absorb any further losses. The (short-term) creditors of operating affiliates, in particular depositors, would remain untouched.

Under SPOE no resolution of any affiliate would in principle be needed, solving in one stroke all the potential complexities associated with the resolution of multiple entities in multiple jurisdictions. This would also solve any run risk on any commercial banking affiliate. Finally, all QFCs could be transferred to a bridge financial company separate from the parent holding company, thus avoiding any acceleration of collateral collection on QFCs in the event of default. Importantly, the SPOE resolution model would allow operating affiliates to continue operations during resolution, not only preserving the going concern value of the bank group but also providing essential stability to other banks, counterparties and the financial system as a whole.

This solution is beautifully simple. SPOE resolution would be almost as seamless as a purchase-and-assumption deal. Naturally, for such a simple procedure to work requires preparation, reorganisation of the financial structure of the banking group, and other basic preconditions. The first and most obvious precondition for SPOE to work is that there is sufficient loss-absorption capacity at the parent holding company. It must be possible to return the banking group to solvency following a major loss by wiping out the liabilities of the parent.

Would the banking group parent build sufficient loss-absorption capacity in the form of equity value, COCOs and unsecured long-term debt liabilities? Although banks do have a commercial interest in ensuring their capacity to survive large negative shocks, in general their incentives to build sufficient loss-absorption capacity to successfully implement an SPOE resolution are not always aligned.[111] The reasons are, first, that equity and long-term debt financing have a higher cost of capital than short-term debt; and second, a bank may privately prefer to let a loss-making affiliate go under than recapitalise it by moving its losses up to the parent. The very business model of a financial intermediary involves the transformation of liquidity, borrowing short-term through deposits and wholesale funding to lend long-term. A bank's optimal liability structure in a

110 See Tucker (2013, 2014a, 2014b).
111 See Bolton and Oehmke (2019).

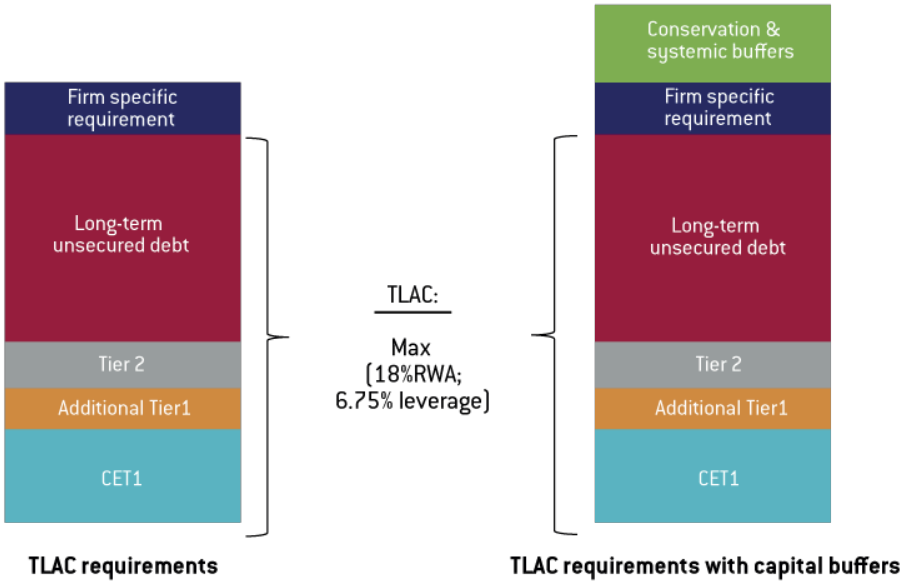
regulation-free environment will be tilted more heavily towards short-term debt than a typical non-bank's capital structure. To ensure that SPOE resolution would work, bank regulators therefore had to impose further capital requirements on G-SIBs: *the total loss-absorption capacity* (TLAC) requirements.

3.3.1 The ex-ante problem: TLAC and all that

Ever since the financial crisis there has been a raging debate around how much to raise minimum bank equity capital requirements.[112] Many commentators, including former Federal Reserve Chairman Alan Greenspan, advocated raising minimum equity capital requirements to levels in excess of 20% of risk-weighted assets. Critics argued that such high capital requirements would come at the cost of significantly lower bank lending volumes (see Chapter 2). It is ironic that this debate has now largely been settled not because the debate has been squarely won on intellectual grounds, but because bank regulators came to the conclusion that sufficient loss-absorption capacity was needed to make SPOE resolution work.

Indeed, the current TLAC requirements, set by the FSB in 2015 and to be phased in in 2019 in the first phase and in 2022 in the final phase, can be as high as 20% for G-SIBs. The eligible instruments for the TLAC requirements, however, are not limited to common equity, or tier-1 capital. Included in TLAC are COCOs and subordinated, unsecured long-term debt (with a maturity in excess of one year).

Figure 3.1 TLAC requirements



Source: Berger et al. (2016).

112 See Admati and Hellwig (2013).

Interestingly, bank regulators did not insist on only common stock as eligible TLAC instrument, as some commentators had urged. What is the logic for including non-equity liabilities? US regulators did not argue that including COCOs and long-term debt was an incentive and a cost-efficient way of requiring high levels of loss-absorption capacity.[113] Rather, the Federal Reserve's main argument is that long-term debt is desirable because holding long-term debt ensures that loss-absorption capacity has not already been used up by the time resolution is triggered. Under the Federal Reserves' 'capital refill' framework, long-term debt TLAC is set high enough to be able to recapitalise the bank group by wiping out these debt obligations or converting them in to equity.[114]

Beyond a high loss-absorption capacity, another important objective is to ensure that all the bank's assets are available to back its liabilities in the event of a resolution. A G-SIB is more resilient, less likely to become insolvent, if it can compensate losses in some affiliates with profits from other affiliates. Through their resolution plans ('living wills'), banking groups can prepare for such transfers through internal guarantees backing some investments, by identifying assets or even affiliates that could be quickly sold to generate liquidity, or by having affiliates issue instruments such as COCOs to the parent holding company to automatically 'push up' losses from operating affiliates to the parent holding company. In addition, the banking group may set up an intermediate holding company that holds liquid assets available to plug holes anywhere in the banking group and provide working capital wherever needed.

One major potential obstacle to the transfer of funds across affiliates of the banking group is ring-fencing interventions by national regulators seeking to protect their domestic banking industry and taxpayers. As the failures of Lehman Brothers, Dexia, Fortis and others illustrate, it is unrealistic to expect national regulators to step in to protect cross-border banking activities in a financial crisis. If large liabilities build up in foreign affiliates of their domestic banks, national regulators could ring-fence the healthy domestic parts of their G-SIB and prevent the large transfers that would be needed to save a troubled foreign subsidiary. Such interventions, of course, would fuel market uncertainty and could spoil any SPOE resolution intervention.

The new G-SIB resolution framework recognises this strategic difficulty and allows for several responses to reduce the reliance of SPOE on large discretionary transfers across jurisdictions, the most important being a 'multiple points of entry' alternative. Under MPOE a financially distressed G-SIB could potentially be resolved in several different jurisdictions, depending on where losses materialise. With the agreement of national regulators, a G-SIB would then have multiple resolvable entities (for example, a parent holding company in the home country and intermediate holding companies in other countries). Any of these holding companies could then be involved in a resolution procedure. One can envision either a home regulator pushing a G-SIB into an MPOE resolution in order to avoid transfers from the home to a host country, or a host regulator requiring that subsidiaries of foreign G-SIBs be resolvable in the host country. Thus, US regulators require large US-based subsidiaries of foreign G-SIBs to be set up as intermediate holding companies that can be pushed into a resolution by US regulators.

113 See Bolton and Oehmke (2019).
114 See Federal Reserve (2015, pp. 26-27).

Another way of pre-empting ring-fencing is to pre-position TLAC to jurisdictions where it might be needed and where a resolution procedure can be undertaken under MPOE. Thus, the FSB proposes that TLAC requirements be imposed not just on a consolidated basis, but also on each designated resolution entity within the G-SIB.[115] By designating resolution entities in different jurisdictions in advance, and pre-positioning TLAC to these entities, regulators can limit the need for ex-post cross-jurisdictional transfers that might be thwarted by ring-fencing.

What is more efficient, SPOE or MPOE? Generally, US G-SIBs have embraced the SPOE model, while MPOE is preferred by a number of non-US G-SIBs (including Santander and HSBC). If the goal is to maximise the scope of cross-border banking and global financial integration, then SPOE is the most efficient resolution model because it allows a G-SIB to use all its assets to the full extent to back its liabilities. As Bolton and Oehmke (2019) show, SPOE is the resolution model that requires the smallest amount of TLAC, and therefore the model that minimises the cost of capital to G-SIBs.

However, SPOE and MPOE have different incentive properties that could be the determining factor in the choice of resolution model. In very general terms, financial incentives are more high-powered under SPOE, but MPOE gives rise to a more resilient organisational structure with respect to affiliates' incentives. More precisely, Bolton and Oehmke (2019) uncover the following trade-off under SPOE in providing financial incentives to operating affiliates: any given affiliate's incentives are undermined by the greater sharing of risks across affiliates, but each affiliate also retains a larger share of profits, so that on net financial incentives may be strongest under SPOE. However, the very reason why a G-SIB under SPOE is more efficient is also why it may be more fragile: the greater efficiency rests on the ability to transfer profits across affiliates to cover losses wherever they materialise, so that the whole G-SIB is structurally more dependent on these transfers. Should there be any unexpected shortfall in profits due to incentive break-downs at some affiliates, then this could put the entire banking group at risk. In contrast, under MPOE, the G-SIB by construction relies less on intra-group transfers so that it is also better able to absorb a break-down in incentives at a given affiliate.

In sum, the new resolution model for G-SIBs, which in its simplest form involves a resolution intervention only at the parent holding company level, has fundamentally transformed the business model of global banks. The presumption now is that G-SIBs can never become insolvent. They will be closed down before they become insolvent. Global banks will have sufficient loss-absorption capacity that they can cover almost any loss that materialises in any affiliate, while allowing operating affiliates to continue functioning normally. Obviously, this puts much greater pressure than before on G-SIB executives and bank supervisors to close down loss-making operations before the hole becomes too large. More than ever before, the shareholders and long-term debtholders of a G-SIB are the residual claimants of the banking group. At the same time, the reliance of G-SIBs on a public backstop has been significantly curtailed. Yet, short-term creditors, depositors and QFC counterparties of operating affiliates have greater protections

115 See Financial Stability Board (2015).

than ever. Indeed, the presumption under both MPOE and SPOE is that these claims will never be bailed in. This obviously puts huge pressure on G-SIBs and their regulators not to put on excessive levels of non-bail-inable claims on the G-SIB balance sheet.

3.3.2 Living wills

The SPOE resolution model goes a long way towards addressing the institutional weaknesses that became apparent during the last financial crisis. When the crisis hit, banks and their regulators were like deer in headlights. They had not planned for such a contingency and were caught unprepared. One of the main merits of the SPOE and MPOE resolution models is that they compel banks and regulators to prepare for disaster, to spell out clearly who will be affected by resolution and how. This new clearheaded approach to managing tail risk is not just confined to the SPOE intervention. It also extends to better planning by banks for the months, weeks and days before a resolution intervention. Indeed, under the Dodd-Frank Act, systemically important financial institutions must prepare resolution plans, so-called living wills, and submit these to regulators for review every year.

Resolution plans must specify how a bank group will deal with a possible resolution, whether it has governance procedures in place to allow it to react promptly to a major loss, whether it has sufficient capital and liquidity to be able to continue key operations during resolution, and whether it has a protocol in place to rapidly unwind positions without causing major market disruptions. Banks have submitted resolution plans to the Federal Reserve or FDIC for a number of years now. The drafting of living wills is far from a pro-forma compliance exercise for banks. It has involved major efforts by financial institutions, as the Federal Reserve has put a high bar on what counts as an adequate plan and has even rejected the submitted plans of a number of financial institutions.[116] Still, many commentators have wondered how credible these living wills are, partly because the most important details of these plans are not disclosed. It is worth emphasising, however, that what could have easily become another box-ticking exercise has actually prompted banks to undertake major reorganisations and to put in place resolution protocols that have never previously been seen in such detail. Even a cursory read of the publicly disclosed parts of the resolution plans should convince a sceptical reader of the seriousness of banks' efforts.[117]

Banks have responded so diligently in drafting their living wills for two important reasons. First, the review of living wills is part of the Federal Reserve's annual stress testing, and failing a stress test could have significant financial consequences (as Citigroup learned in 2014). Moreover, if a bank's resolution plan is deemed inadequate, the FDIC and the Federal Reserve jointly can impose higher capital requirements.[118]

116 For example, the resolution plans of Bank of America, JPMorgan, BNY Mellon, Wells Fargo and State Street were found to be inadequate by the Fed in 2016 ("US rejects 'living wills' of five banks: Regulator says 'too big to fail' risk remains as it orders institutions to improve plans", *Financial Times*, 13 April 2016).

117 See, for example, the 2017 resolution plan of JPMorgan Chase.

118 A further authority granted by DFA to regulators is that after a repeated failure to comply with the preparation of a credible resolution plan, a bank could be required to divest certain risky operations.

Second, a major institutional issue at the centre of bank resolution in the US is who will be charged with overseeing the resolution – a bankruptcy court under Chapter 11 (as was the case for Lehman Brothers) or the FDIC under the Orderly Liquidation Authority. Under OLA, the parent holding company is placed into FDIC receivership, which essentially means that the FDIC takes over control of the failed financial institution. Moreover, equity-holders are wiped out, top management is replaced, and the FDIC has wide discretion to determine which assets and liabilities are transferred to the bridge financial company that continues operations. Basically, under OLA the debtor is no longer in possession.

In contrast, under Chapter 11 the debtor remains in possession; in particular, management can remain in place. Equity-holders are not necessarily wiped out, and creditors can better anticipate how the bankruptcy judge will proceed with the debt classification. For all these reasons, US banks and their investors strongly favour the Chapter 11 route versus OLA. However, the Lehman precedent has shown that Chapter 11 is not really suited for a large financial institution with many different trading activities, in particular in derivatives markets. US banks, through the elaboration of their living wills and other initiatives, have been working to make Chapter 11 a feasible option for a large, complex financial institution that would not involve the costly disruptions experienced by Lehman Brothers. To perform a Chapter 11 resolution, banks must be able to show that it will not affect financial stability, otherwise the FSOC could require a resolution under OLA.

Several major issues with filing for Chapter 11 protection therefore had to be dealt with, foremost among them being the treatment of QFC run risk and the risk with respect to legal challenges of *eve-of-bankruptcy payments* (those payments to creditors and counterparties in the days and weeks before the bankruptcy filing). Other issues relate to the adequacy of liquidity for a G-SIB under resolution.

3.3.3 The ex-post problem: Automatic stay and liquidity provision

To address the QFC run risk à la Lehman, several major steps have been taken. In an effort to replicate the temporary stay on QFC counterparty termination rights under FDIC receivership, the International Swaps and Derivatives Association (ISDA) amended its stay protocol in 2015. Under the new protocol, QFC counterparties are not allowed to immediately exercise their cross-default rights. Following a Chapter 11 filing they would have to wait up to two days to exercise their rights, giving the GSIB and bankruptcy court precious time to implement the first major restructuring steps under SPOE.

To address legal actions by long-term debtholders of the parent holding company to claw back certain eve-of-bankruptcy payments, or challenge the restructuring of their claims, US SIBs have created an intermediate holding company (IHC) just below the parent that, in effect, is similar to the bridge financial company that the FDIC would set up under receivership, except, of course, that the decision of what assets and liabilities to transfer to the IHC rests with the management of the banking group. By clearly specifying which liabilities are transferred to the IHC ahead of time, the SIB aims to eliminate any legal risk with respect to challenges of payments to service these liabilities. By singling out which liabilities are left behind in the parent holding company to be

resolved (and therefore are bail-inable) and which are transferred to the IHC, and by further strengthening the contractual language in the long-term debts that are bail-inable, US SIBs have taken major steps in reducing uncertainty related to legal challenges upon the filing on Chapter 11 bankruptcy protection.

In essence, by adopting an SPOE resolution strategy and by tailoring their organisation to facilitate the execution of such a strategy, US SIBs have replicated the main contours of the FDIC receivership model, except for transferring control to the FDIC. However, one other major difference between Chapter 11 and OLA remains with respect to the provision of liquidity and the availability of the public liquidity backstop.

Under OLA, the FDIC's expectation is that the bridge financial company would be able to obtain private financing from capital markets, as this company is created as a solvent financial institution. But, should the bridge financial company be facing a liquidity freeze, then it would be able to obtain liquidity from the Orderly Liquidation Fund (OLF). In other words, the bridge financial company would be able to rely on a public liquidity backstop, even if DFA puts some limits on the authority of OLF to provide funding.

In contrast, under Chapter 11 it is not clear that the SIB would be able to rely on a public liquidity backstop. It is also not clear whether it would be able to obtain debtor-in-possession financing similar to the financing that non-financial companies are typically able to obtain in Chapter 11 to continue operations. The reason is that the SIB would have to provide liquid collateral to back any DIP loan, but this collateral may already be pre-positioned in the IHC and operating affiliates. Indeed, the current resolution plans submitted by US SIBs presume that the SIB will continue operating on a self-financed basis during a Chapter 11 resolution. That is, under the resolution scenarios considered by US SIBs, their balance sheets are tested to be able to withstand a liquidity crunch under the assumptions that neither DIP financing nor a public liquidity backstop is available.

It is remarkable that US SIBs do currently hold enough liquidity to be able to withstand a major loss and go through a resolution without any public liquidity support. Still, one cannot but wonder what might happen should a SIB fall short. Any financial market concern that the SIB might run out of liquid assets could be self-fulfilling and trigger a generalised run. Alas, this possibility cannot be ruled out, so that US SIBs remain vulnerable to a panic run. The only remaining safeguard in this event is to move the resolution to OLA, so that OLF funding could be tapped.

In sum, despite the huge efforts by US SIBs to avoid an OLA resolution and to prepare as best they can for a smooth Chapter 11 resolution, they cannot completely avoid OLA simply because they cannot completely rule out a generalised panic run. Equally, despite the overall goal of bank resolution to replace bailouts with bail-ins, it is not possible to achieve an orderly resolution of systemically important banks by completely eliminating the public backstop. If there is even a remote suspicion of a liquidity dry-up, it could become self-fulfilling and no resolution plan, no matter how well it is designed, will be able to deal with a generalised market panic. Only a solution along the lines of the UK's Resolution Liquidity Framework, whereby the central bank is ready to provide liquidity in support of a resolution procedure, could then thwart a self-fulfilling run.

3.3.4 Bail-in for small and medium-sized banks

Understandably, much of the focus on how to put in place an orderly resolution procedure for banks has been on the largest, systemically important banks. But what about smaller banks? How would they be resolved when they fail? Isn't there also an inclination to bail out rather than bail in for small banks? Arguably, in the US the receivership model perfected over the years by the FDIC is a seamless and reasonably efficient resolution model. There is a limited risk of bailouts because shareholders of the failing bank are generally wiped out, and because the FDIC seeks to intervene and arrange a purchase-and-assumption deal with an acquiring bank before the target is insolvent. In some cases, of course, the intervention comes too late and the FDIC is forced to take on some liabilities of the failing bank to make a merger sufficiently palatable for the acquiring bank. In these cases, all liabilities of the failing bank are not necessarily made whole. Non-insured liabilities can be bailed in by the FDIC, as was the case with the resolution of Washington Mutual, where the acquirer (JPMorgan) did not assume the subordinated and senior debt of Washington Mutual.

Such a seamless procedure did not exist in Europe until recently. It is only since the creation of the European Banking Union in 2014 and the establishment of its two pillars – the Single Supervisory Mechanism and the Single Resolution Mechanism – that there is an administrative bank resolution procedure in place playing a similar role to FDIC receivership in the US. In addition to these two pillars, the BRRD, also passed in 2014, requires the establishment of national resolution authorities (NRAs) in each member state of the EU, which would be charged with the implementation of the SRM resolution procedure at the national level. An important provision of the BRRD designed to protect against bailouts is the 8% bail-in requirement before any public funds from the SRF can be tapped. Under this requirement, not only must shareholders be wiped out, but also unsecured debtholders up to 8% of total liabilities in any resolution that involves injection of public funds by the SRF.

This requirement can be very stringent and even more constraining than the TLAC requirements for SIBs that are calculated on an RWA basis. Of greatest concern is the fact that retail investors currently hold significant fractions of bail-inable bonds under the BRRD rule, as is the case in Italy. Indeed, the political and economic costs of imposing losses on retail investors were thought to be so high by Italian authorities that they avoided the newly established SRM resolution procedure altogether and instead put the failing Banca Popolare di Vicenza and Veneto Banca into an alternative national liquidation procedure in June 2017.

So far, the SRM resolution procedure has been applied only once, to resolve Banco Popular Español in June 2017 under a purchase-and-assumption deal with Santander akin to those routinely executed by the FDIC. The path towards an SRM resolution of Banco Popular was opened after the ECB, as single supervisor, declared that the bank was likely to fail and after the Single Resolution Board decided that it was approaching the point of non-viability (PONV). The SRB intervention resulted in the elimination of all of Banco Popular's equity claims and the conversion of its CoCos into equity, which was subsequently also wiped out. This bail-in was deemed sufficient for Santander to acquire Banco Popular for the price of one euro and assume all its remaining liabilities.

One view of the Banco Popular resolution is that it worked as intended. There was no bailout, there was no market disruption, and the CoCo instruments issued by Banco Popular played their intended purpose of facilitating a quick write-down of debt in resolution. Another view, however, is that the intervention was too heavy-handed, with no careful analysis of whether Banco Popular was suffering from a liquidity crunch or whether it was truly insolvent.[119] Generally, the approach taken by the EU to the resolution of small and medium-sized banks puts a greater emphasis on the protection of taxpayers from bailouts and a lesser emphasis on systemic stability and avoiding contagious market disruptions than is the case in the US.

3.4 Main takeaway

G-SIB resolution under the SPOE/MPOE model is a fundamental regulatory innovation in response to the financial crisis. It not only constitutes the most important shift away from a too-big-to-fail to a bail-in regime, but also fundamentally transforms the way G-SIBs are managed. It is perhaps the most important institutional transformation of international finance coming out of the crisis.

The obvious open question, however, is how well this resolution model is likely to work. Will it be executed as intended? Will regulatory authorities relent when confronted with the risk of a panic triggered by the bail-in of TLAC debt of a G-SIB? Aren't there major contingencies that no-one has yet fully anticipated and that will disrupt its implementation? For example, is the SPOE model making unwarranted assumptions about the lack of ring-fencing by host regulators, or the effectiveness of new ISDA protocol in preventing a QFC meltdown? Could there still be a run on QFCs after the very short stay period expires?

If anything, the enormous, sustained and extensive effort to plan for adverse events has been an eye-opener about the complexities of modern international banking and about all the things that could go wrong. It would be presumptuous to think that all possibilities have been thought through and that G-SIBs are fully covered under the new resolution model. This is why it is important not to close down the option of a public liquidity backstop. Under the new G-SIB resolution model, it is no longer true that lender-of-last-resort interventions by the central bank constitute a bailout. Much has been done to allow for the credible and orderly restructuring of debts – bail-ins – so that the LOLR backstop should now mostly be thought of as fulfilling the intended function of restoring trust in financial markets in the event of a panic.

119 See Hellwig (2018).

4 An expanded role for central banks

Our review of the regulatory reform programme would not be complete without discussing central banks' interventions during the crisis and attempting to draw the lessons from this dramatic episode. Central banks are on the receiving end of financial instability. This was all too clearly illustrated by their support for numerous failing institutions across the developed world at the outset of the crisis. Central banks have also been extraordinarily active on the monetary policy front. "Extraordinarily" because once the zero lower bound had been reached, their traditional instrument – the interest rate – was no longer available under usual conditions. Furthermore, the huge economic and social costs of a modern financial crisis have caused central banks to reinterpret the financial stability component of their mandate, moving away from the rather shy and passive way it was interpreted before.

An historical episode of instability of the magnitude of the one seen since 2007 understandably forces a reconsideration of central banks' mission, scope of action and tools of intervention in the exercise of their mandate to promote financial stability. As we will see, this reconsideration unmistakably points to the need to expand and enrich their mandate, a development that constitutes a critical element of the regulatory reform programme reviewed thus far. The extent of this expansion is up for discussion, however. It could reach a fully encompassing responsibility for the preservation of financial stability in the economy, and thus a major move away from the single-minded pursuit of price stability in an inflation-targeting context. Or it could remain more modest, with the price stability goal remaining a priority and the responsibility for financial stability being shared with the micro-regulator and the ministry of finance. Both models raise serious governance issues and both extensions (albeit to a different degree) call for adaptations to the independence of central banks.

The crisis has significantly changed our view of central banking along three dimensions. The first concerns the conduct of monetary policy at the zero lower bound.[120] Outside Japan, there was little precedent for conducting monetary policy in such a context. While the innovations in monetary policy experimented with in the course of the crisis and the recovery constitute a major development with serious implications for the future, the overlap with our evaluation of regulatory reforms is only tangential. Of course, a prolonged policy of low rates such as that in effect since the end of 2008 has an impact on the appetite for risk taking and encourages search-for-yield behaviours that have implications for financial stability. But this does not justify specific regulatory developments; it only makes more essential the measures to correct market participants' incentives and increase the resilience of the financial system described in the previous chapters. Two related issues deserve our attention, however. First is the

120 Or the effective lower bound (ELB), since modest steps into negative territory have been taken by several central banks, thus demonstrating that the lower bound may effectively be somewhat below zero. The lowest level for the policy rate proposed so far is -0.75%. We will use the two terms interchangeably, but preferring the term 'zero lower bound' when the use of negative interest rates is in question.

question of whether the choice of unconventional policies was the result of a sufficiently thorough discussion among authorities on the most appropriate policy mix under the prevailing circumstances. We doubt that this was the case, and relate our diagnosis to what will be the main thread of our overall message – the need to rethink the status of central banks, notably at the zero lower bound, to permit more intensive coordination between monetary and fiscal authorities. Second, the incomparably larger balance sheets that have resulted from these unconventional policies provide central banks with a new potential instrument to fulfil their financial stability mandate. We discuss two avenues that appear open in this direction and their implications.

The second dimension is the actions of central banks as lender of last resort, which have been unprecedented in scale and scope since the outset of the crisis. In some sense, the recent financial crisis was the first full-scale test of the LOLR function of central banks. The pre-crisis fragility of the banking system that the regulatory changes discussed in Chapters 2 and 3 aim at addressing is to be credited for this state of affairs. This experience with the action of the lender of last resort yields a number of lessons and questions, notably on how to ensure that effective LOLR action by independent central banks continues to be viewed as democratically legitimate. We believe part of the answer is to clarify the role and the mode of action of the lender of last resort, putting an end to the now untenable doctrine of constructive ambiguity (and finding other regulatory means to limit moral hazard). In addition to increased transparency regarding the form and extent the liquidity support of central banks may take, a move towards pricing liquidity insurance, with the eligible financial institutions being required to pay the corresponding insurance premium, would help further strengthen the legitimacy of central bank support. We review some proposals in this direction, but conclude that caution should be exercised to avoid exacerbating the current bias of the banking system towards collateralised credit.

The third dimension of change is conceptually newer. It stipulates that more emphasis in financial regulation should be placed on the interactions between institutions as opposed to a strict focus on the strength of individual institutions. Here, the focus is on systemic risk and 'macroprudential' policies, in which central banks naturally have an important role to play. The consequence of this evolution is a need for a significant updating of the financial stability element of their mandate. At one extreme, it is legitimate to wonder whether a fully coherent system should not entrust central banks with the main responsibility for the control of credit, both and simultaneously, in view of achieving price *and* financial stability. The insistence of central banking on inflation targeting would thus be superseded by a broader perspective which, however, generates the risk of creating 'overmighty' institutions. This risk needs to be confronted head on.

The changes occurring along these three dimensions all raise questions about the independence of central banks and its current interpretation. We therefore close with a discussion of how the status of central banks should be updated in order to meet the challenges presented by the expansion of their actions, in particular the requirement to coordinate with other authorities that goes hand-in-hand with their new role.

4.1 Conducting monetary policy at the zero lower bound

4.1.1 Unconventional monetary policies

The severity of the macroeconomic situation provoked by the financial crisis prompted most central banks to react swiftly and radically. Within a few weeks, in the autumn of 2008, all major central banks repeatedly lowered their policy rates until the zero interest lower bound had been reached. These conventional policy moves were accompanied by massive liquidity measures, at the national and international levels, notably as the result of the Fed and ECB entering into swap agreements with several partner central banks (see Box 4.1). The goal of these measures was to counter the liquidity squeeze that had set in. Trust among commercial banks had evaporated following the fall of Lehman. Asset prices were in free fall and doubts about the soundness of the balance sheets of banks and financial institutions were ubiquitous. In this context, financial institutions basically stopped lending to each other (except against the absolutely safest collateral). This meant that the daily redistribution of liquidity that normally occurs between banks with excess liquid assets and those with a deficit did not take place, and central banks rightly decided that they had to make up for this shortfall by directly providing unlimited liquidity to all institutions in need.

With these measures and further actions described in the next section under the heading of the lender of last resort, the worst of the crisis could be contained and the path towards a new Great Depression was avoided. It soon appeared, however, that the adopted measures were not sufficient to revive economic activity and that an additional macroeconomic stimulus was needed. Textbook macroeconomic prescriptions mandate that fiscal policies take over once interest rates have hit the effective lower bound. The interest rate instrument is no longer available, and the impact of fiscal policy is deemed to be larger when the nominal interest rate does not react to crowd out any fiscal stimulus. Admittedly, faith in the power of fiscal policy had been somewhat eroded notably because of the implementation lags in government spending. Congruent, and likely more important, the financial crisis had forced the treasuries of many countries to invest unprecedented amounts in support of failing institutions, with the resulting deficits leading to exploding debt-to-GDP ratios. To make matters worse, fiscal discipline had in many instances been lacking before the crisis so that the room to manoeuvre was curtailed any way. This last remark is particularly relevant for European countries for which the 60% debt-to-GDP ratio prescribed as the upper bound by the Maastricht Treaty was already reached, or even exceeded, before the crisis erupted. All in all, governments and parliaments generally displayed extreme reluctance to do more, often out of the conviction that the debt market would not allow it, and the forthcoming support from treasuries turned out to be very limited when not simply absent.

In fulfilment of their mandate, central banks thus sought new, untested means to revive the economy and embarked on what became known as 'unconventional' monetary policies. All unconventional monetary policies rely on the same logic. Confronted with the need to further lower rates while already at the zero lower bound – in the monetary policy jargon, with a negative r^* (i.e., the conviction that the appropriate interest rate should be negative) – central banks searched for substitutes. The goal was to bypass the zero lower bound and provide incentives for economic agents to bring their consumption and investment spending

forward ('spend now rather than later'), notably by encouraging borrowing. This was achieved by exerting pressure on long interest rates (via massive purchases of longer maturity assets), by attempting to boost inflation expectations so as to lower *real* rates (notably by committing to remain 'low for long') or by directly pushing nominal short rates into negative territory (in the direction of the effective lower bound).

A new chapter in monetary policy had thus been opened. The evaluation of the impact of these unconventional policies already occupies a lot of space in monetary policy analysis and will do so in the future. Reviewing these efforts would lead us too far away from the regulatory focus of this report. However, two issues associated with this important monetary policy episode merit our attention – the first because it is at the heart of what we perceived to be the need to update the independence status of central banks, a subject which filters through many observations made in the current chapter; the second because it relates directly to the role of central banks in the pursuit of financial stability and the instruments available to them for this purpose.

Box 4.1 The global dollar system

We can date the onset of the global financial crisis to mid-2007, when European banks came under increasing strain. On Thursday 9 August, BNP Paribas halted redemptions from three investment funds because it could not value their holdings of US mortgages. Responding to the ensuing market scramble for liquidity, the ECB injected €95 billion into the European banking system and the Federal Reserve put $24 billion into the US system. Today, with the benefit of hindsight, these numbers appear quaint, but at the time they seemed enormous.

With time, we learned that banks outside the US had been borrowing large volumes of dollars in short-term money markets and investing the proceeds in US mortgage-backed securities. As the mortgages started to default and the securities lost value, non-US banks had trouble rolling over their short-term debt. Researchers eventually estimated the dollar shortfall to be well over $1 trillion.[121]

Upon reflection, we should not be surprised that the use of US dollars in commodity pricing and trade invoicing requires the support of a financial system that runs in the same currency. To give just a couple of numbers, roughly 80% of trade finance and nearly 90% of foreign exchange transactions are denominated in US dollars.

Information from BIS gives us sense of the overall magnitude. First, US dollar bank liabilities outside the US are currently over $14 trillion. Given that the BIS data are not comprehensive – China, Russia and a number of dollarised economies are not included – we can estimate that this global dollar system has liabilities exceeding those of the US banking system. These are just the on-balance-sheet US dollar exposures of non-US banks. As Borio et al. (2017) describe, if we were to record foreign-exchange swaps and forwards in the same manner, the numbers would at least double. Then there are the potential liquidity needs of central counterparties, the largest of which have hundreds of *trillions* of dollars in gross notional exposure in more than a dozen currencies.

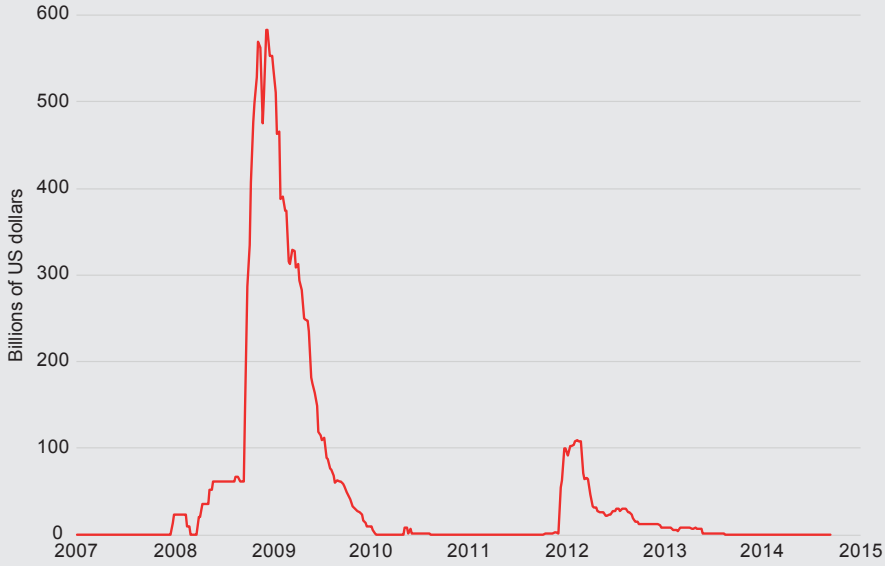
121 See McGuire and von Peter (2009).

This raises a very difficult, but important, policy question. How can financial institutions, or financial market utilities, gain access to liquidity in a currency other than the one issued by the central bank where they are operating? What happens when a Swiss or European bank suddenly needs dollars?

In 2008, the answer was central bank liquidity swaps. The Federal Reserve offered the ECB, for example, unlimited US dollar liquidity. As a technical matter, the Fed lent dollars to the ECB, and the ECB then lent the funds on to euro area banks. The amounts were enormous, reaching nearly $600 billion in December 2008.

The Fed had a very little choice at the time. The world's largest intermediaries are so interdependent that if one gets into trouble, others may, too. And the market for short-term dollar funding is unified globally, so stress in one region will quickly spillover to the rest of the world. If a systemic bank in Europe finds itself unable to roll over dollar liabilities, it can be compelled to sell assets at fire sale prices and, possibly, default. Such contagion meant that the dollar shortage in Europe put the entire financial system at risk.

Figure 4.1 Federal Reserve liquidity swaps with foreign central banks



Source: Federal Reserve.

Looking forward, we see that the fragility inherent in the global dollar system remains. What should policymakers do?

In the current institutional setting, the one thing that they cannot do is rely on the Federal Reserve to commit to the provision of the swap lines. As a technical matter, the dollar swap lines are under the purview of the Federal Open Market Committee. Beyond the enormous political risks associated with making such a long commitment of providing what the US Congress will inevitably view as a provision of funding to foreign governments, there is a legal impediment. A particular FOMC – with its membership, chair and

other officials – exists for one year at a time. Each January, it is reconvened with new members. Since the current FOMC cannot commit any future FOMC to a particular action, it cannot make any long-term commitments, including the provision of central bank liquidity swaps.[122]

There are other options, including authorities to control bank and non-bank US dollar exposures using prudential tools. But that may just shift activity to another jurisdiction. Official dollar reserves roughly match the scale of the dollar-based system outside the US, but most of the reserves are in China, Japan, India and Brazil, while European banks issue most of the dollar liabilities. The IMF could become the source of US dollars – except that it almost surely does not have sufficient resources.

The widespread use of US dollars yields substantial benefits; Cecchetti (2016) estimates that these could be as large as 2½% to 3% of US GDP per year. The implication is clear: so long as the US dollar remains in widespread use outside of the US, the Federal Reserve has an obligation to adapt its legal and operational framework so that liquidity swaps can be a permanent part of its toolkit.

4.1.2 Optimising the policy mix at the zero lower bound

Are we convinced that the unconventional monetary policies adopted by central banks in the aftermath of the global financial crisis constituted elements of an appropriate policy mix, given the circumstances? At a fundamental level, this question arises because one may have doubts about the soundness of addressing what started as an over-indebtedness problem by encouraging borrowing. Isn't this akin to advising drinking alcohol in the morning to cure the hangover from a drinking binge the night before? The crisis was first the outcome of excessive risk taking by credit granters (in relation to their excessively weak degree of resilience and in a contagion-prone environment). In the process, excessive credit volumes on one side, and excessive indebtedness on the other, were observed. The common sense conclusion is that the first-best policy in the post-crisis economic situation is unlikely to consist in incentivising even more borrowing and credit issuance, as was unambiguously the goal of the quasi-negative interest rate policies pursued by central banks. At an even deeper level, if the sluggish recovery is the result of unwillingness to spend and invest in recognition that the future is less favourable than previously anticipated – say, because of a perspective of secular stagnation or simply a downgrade in expected steady-state growth – bringing forward spending from the future to the present is only a short-term fix. As Mervyn King put it: "*After a time, tomorrow becomes today. Then we have to repeat the exercise and bring forward spending from the new tomorrow to the new today. As time passes, we will be digging larger and larger holes in future demand. The result is a self-reinforcing path of weak growth in the economy.*"[123]

122 A look at the minutes of every January FOMC meeting reveals a variety of technical preliminaries about membership and operations.

123 King (2016, p. 48).

More pragmatically, the answer to the question of the optimal policy mix depends on the assessment of the relative effectiveness of unconventional monetary policies in comparison with the alternatives. Numerous studies offer a comprehensive review of what is known about the mechanisms behind, and the estimated quantitative impact of, unconventional monetary policies.[124] A favourable reassessment of the effectiveness of fiscal policies is also ongoing.[125] What is relevant for us here is not whether the chosen course of action effectively constituted an optimal policy package, but whether sufficient efforts were invested in identifying ex ante the ideal policy mix and if, as we suspect, this was not the case, why not?

Our thesis is that the prominence of unconventional monetary policies in the aftermath of the crisis was the (possibly) suboptimal outcome of a strategic interaction between fiscal and monetary authorities in which the independence of central banks played a key role. It effectively led to technocratic and independent monetary authorities being the followers in a strategic game where the fiscal authorities were the natural leaders. The status of central banks implies the existence of a form of Chinese walls separating fiscal and monetary authorities. Governments are not meant to criticise monetary policy decisions, while central bankers must refrain from commenting on government policies. No appropriate forum exists where the distribution of responsibilities and the coordination of instruments can be seriously discussed. This implies that central banks have to fulfil their mandate taking as a given the policy measures decided by fiscal authorities. In essence, governments and parliaments move first and, in the case at hand, they generally asserted their unwillingness or inability to act.[126] It was then the duty of the followers, the central banks, to do what they could and had to do in fulfilment of their mandate (as the fiscal side could well anticipate). Moreover, in order to have a chance of success in a domain where influencing expectations was paramount, central bankers had little choice but to claim that their toolbox was not empty and that the remaining instruments were effective indeed, thus validating the position of fiscal authorities. In effect, central bankers were pushed into a corner where a huge weight was placed on monetary instruments and wonders were expected from them. They became 'the only game in town' – a very uncomfortable position for non-elected technocrats to be in, and one that led to a public questioning of the legitimacy of their status!

In sum, the understanding and practice of central bank independence in the last decades had led to a policy equilibrium where coordination between fiscal and monetary authorities was all but impossible. We are convinced that there is room for improvement on this front and that the stakes are high if low interest rates are to be the hallmark of future macroeconomic circumstances. As we shall see, similar challenges to the status of central banks arise along all three dimensions of change under consideration.

124 See, for example, Haldane et al. (2016).

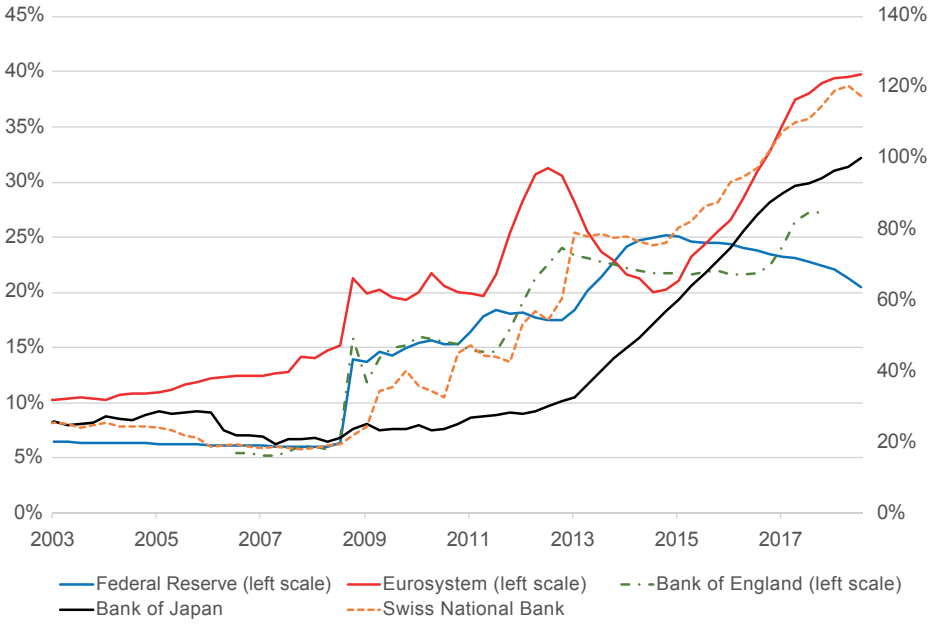
125 Christiano et al. (2011), for example, assert that the government spending multiplier can be much larger than one when the zero lower bound prevails.

126 With a few notable exceptions, notably in the US and Spain, while on the contrary the European debt crisis exacerbated the perceived constraints on fiscal policy in most of Europe.

4.1.3 Using central bank balance sheets as instruments of financial stability

The most spectacular element of unconventional monetary policies has been the massive asset purchase programmes in which the Fed, the ECB, the Bank of Japan, the Bank of England and the Swiss National Bank have engaged since 2008.[127] The corollary of these purchases was an explosion of their balance sheets to levels that were unimaginable before the crisis (Figure 4.2). While these were initially viewed as temporary blips, with few doubting that the central banks' balance sheets would return to their pre-crisis levels once the episode was over, this is no longer self-evident. There is first a question of operational procedures. With the decision of the Fed and other central banks to start paying interest on reserves, one can now imagine conducting monetary policy with large excess reserves in the system, where this was not the case before. In the traditional environment, an aggregate deficit of reserves forces the representative commercial bank to engage in daily repo operations with the central bank in order to borrow the missing liquid assets. The rate at which the central bank is willing to lend (i.e., the overnight repo rate) is the main policy lever and the size of the central bank balance sheet is determined by the level of the targeted reserve deficit. In the new environment, the excess reserves are deposited by commercial banks at the central bank and thus effectively neutralised. The rate at which these deposits are remunerated becomes the primary policy instrument. The new system thus accommodates arbitrarily larger central bank balance sheets.

Figure 4.2 Central bank assets as a percentage of GDP



Source: Central banks.

127 In the case of the SNB, the balance sheet expansion was the result of foreign exchange interventions aimed at preventing an excessive appreciation of the Swiss franc.

Table 4.1 represents a stylised central bank balance sheet. In the pre-crisis situation, the amount of 'reserves of commercial banks' was small, corresponding to the desired liquidity deficit, while on the left-hand side there was no, or few, long-term Treasuries and private debt. Unconventional monetary policies have led to the massive expansion of the two latter items, with a corresponding growth of commercial banks' reserves. The ability to remunerate these reserves means that there is no need to decrease them since they can be effectively sterilised at the central bank.

Table 4.1 A central bank balance sheet

Assets	**Liabilities and capital**
Net foreign assets	Reserve money
Net domestic assets	*Currency in circulation*
Short maturity Treasuries	*Reserves of commercial banks*
Long maturity Treasuries	Non-monetary liabilities
Long maturity private debt (e.g. MBS)	*Central bank securities*
	Others
	Equity capital

More recently, financial stability concerns have been voiced that have a bearing on the size of central banks' balance sheets. The critical consideration is the perceived worldwide shortage of safe assets. On the one hand, this shortage may, in some jurisdictions, have a direct impact on the ability of financial institutions to fulfil their HQLA requirements specified by the LCR and NSFR regulations (Section 2.3); on the other hand, it translates into persistently low interest rates, thus affecting the behaviour of financial intermediaries and impacting financial stability risks.

The shortage of safe assets can have many causes and interpretations. The dominant view is that the fall in interest rates reflects secular global forces that have lowered the trend in the world real interest rate by maybe as much as two percentage points over the past 30 to 40 years. This could be due to lower global economic growth, a global savings glut and/or an increase in the convenience yield for safety and liquidity associated with the quasi-money feature of short-maturity Treasuries[128] The latter is particularly relevant at the very short end of the yield curve. The out-sized appetite of the public and financial institutions for very short-term safe and liquid assets that are close substitutes to money renders these assets abnormally expensive, translating into extraordinarily low rates for short maturities. On average over the period 1983 to 2009, the yield on one-week Treasury bills averaged 72 points less than the yield on six-month T-bills.[129] These low rates represent an incentive to engage in excessively risky maturity transformation, borrowing very short and lending long. There is clear evidence that this resulting fragility was an important factor in the credit crunch that followed Lehman's collapse.

128 See Summers (2013), Bernanke (2005), Del Negro et al. (2018), Caballero et al. (2017) and Krishnamurthy and Vissing-Jorgensen (2019).
129 See Greenwood et al. (2017).

Observing this phenomenon, it has been proposed that, as a complement to the liquidity regulations of Section 2.3, the Fed uses its balance sheet to satisfy the extraordinary demand for very liquid assets, with a view to significantly impacting short-term interest rates and thus reducing the economic incentives for private-sector intermediaries to engage in excessive amounts of maturity transformation.[130] In order to do so, the Fed should maintain a large balance sheet – to be effective, it should not be much below its post-crisis level, at around $4.5 trillion – and keep long-dated securities on its books against reserves or short-maturity bills. The proposal is not only to roughly maintain the overall size of the balance sheet but also to keep longer-maturity Treasuries instead of just the traditional short-maturity Treasuries on the left-hand side of the balance sheet, with the overall intention of tilting the average maturity of the outstanding consolidated public debt. The price impact of such an operation would be to reduce the incentive of private institutions to issue dangerously large volumes of runnable short-term liabilities to finance their longer-maturity asset positions. This would constitute an unconventional contribution to the fulfilment of the Fed's financial stability mandate.

The second perspective stems from the observation that the shortage of safe assets can deeply interfere with the new liquidity constraints (LCR and NSFR), notably in small open economies with large financial institutions. The problem was first flagged by the Australian and Swiss authorities in the context of the LCR and NSFR discussions. The issue is that in these two jurisdictions characterised by the presence of large financial institutions and low debt-to-GDP ratios, the stock of tradeable public debt in local currency may be too small to accommodate the increased demand for HQLA resulting from the new liquidity regulations. In the Australian case, the Australian Prudential Authority and the Reserve Bank of Australia have announced the setting-up of a "secured committed liquidity facility" where the authorised deposit-taking institutions will be able to cover any shortfall between their holdings of HQLA and the requirement to hold such assets under the LCR. Essentially, the commercial bank will commit the required amount of eligible securities at the central bank in order to secure a credit line of the required size (taking account of the corresponding haircuts) to make up for the shortfall. The obtained credit line will be counted as HQLA, with the transformation of non-HQLA into HQLA by the central bank thus resolving the outstanding regulatory problem.[131]

In Switzerland too, the shortage of HQLA in Swiss francs that prevailed before the crisis was anticipated to create serious difficulties for banks to satisfy the new liquidity regulations.[132] This situation has been fundamentally altered, however, by the foreign exchange interventions of the SNB. These have led to a massive increase in the balance sheet of the SNB (see Figure 4.2) and resulted in abundant excess reserves at the disposal of financial institutes to fulfil their HQLA requirements. The question, then, is: does it make sense for the SNB to strive to return to its pre-crisis balance sheet size and recreate a problem that has effectively been solved? Of course, maintaining a large balance sheet and the

130 Ibid.

131 This is in accord with the Alternative Liquidity Approaches (ALA option 1) of the liquidity regulation.

132 In the repo market, the SNB addressed the same problem by admitting a majority of foreign-denominated assets (without haircuts) in its general collateral basket. In the same spirit, the Alternative Liquidity Approach (ALA Option 2) admitted in Switzerland authorises, under conditions detailed by the Finma and with haircuts, the use of foreign currency denominated HQLA to satisfy the Basel III liquidity requirement.

corresponding amount of excess reserves would imply that once it decides to increase interest rates, the SNB would have to absorb the excess liquidity in the system or else remunerate (positively) the deposits of commercial banks in its book. Since it has already practiced this policy in 2010, one can assume that the favoured alternative would be to issue SNB bills (in terms of the balance sheet of Table 4.1, this would mean maintaining a large stock of foreign assets on the asset side, but substituting short-term central bank securities for commercial banks' reserves on the liability side). At the current balance sheet size, the SNB would have to issue highly liquid and safe assets amounting to approximately 80% of GDP. This would largely make up for the shortage of Swiss franc-denominated safe assets. Hence, as in the Australian case, the balance sheet decision of the central bank could help fully solve the regulatory problem originating in the limited stock of HQLA.

Two things are worth noting in these instances. First, whether tilting the maturity structure of the consolidated public debt or acting to facilitate the fulfilment of liquidity regulations, both types of measures constitute a significant expansion in the role of the central bank in promoting financial stability, a fact that calls for some form of political validation. Second, in both cases, the advocated central bank action would be a substitute for action by the treasury. This implies that some degree of coordination with the fiscal authority would be required. Indeed, rather than the Fed acting to tilt the maturity structure of the outstanding public debt, one could more simply expect that the primary issuance by the US Treasury would conform to the structure ultimately targeted.[133] This would presumably require that the Treasury deviates from its first-best debt-management strategy to take on board the financial stability concerns provoked by the extraordinary low rates on short-maturity T-bills. It has been argued that the Swiss government should directly contribute to alleviating the shortage of safe assets and thus provide better consumption and investment smoothing instruments to Swiss citizens by stepping up its debt issuance.[134]

Yet, in both cases one may feel that the central bank is better placed to do the job. In the case of the Fed, it has been argued that the operation involves a significant degree of roll-over risk that the Fed as supplier of the final means of payment may be better placed to handle than the Treasury.[135] Evidence of this is the fact that despite strong economic incentives to do so, the US Treasury has not previously supplied the quantity of short-term bills under discussion. In the Swiss case, this is because the proposed policy would constitute a complete U-turn in the public finance strategy of the Confederation that would require lifting the constitutional debt-brake rule adopted a little more than a decade ago (which is viewed as highly successful, notably for having engineered a decade of decreasing debt-to-GDP ratios). Moreover, the ability of the SNB to decrease its balance sheet – i.e., to not engage in the proposed policy – is very much in question. Selling the foreign exchange reserves that make up the bulk of its assets is a very clear monetary policy move, requiring specific economic conditions that may not be fulfilled in the near future. Observing that financial stability concerns may make it unwise to even attempt to do so is therefore of great relevance.

133 Cecchetti and Schoenholz (2018d) support such a position while nevertheless arguing, as we do, that the objective can only be achieved through close coordination between the Treasury and the Fed.

134 See Bacchetta (2017), whose proposal is for the Swiss Confederation to set up a sovereign wealth fund with the proceeds of the extra debt issuance.

135 See Greenwood et al. (2017).

In sum, the new post-quantitative easing balance sheet size provides central banks with a new instrument to fulfil their financial stability objective. The question of a return to their pre-crisis balance sheets is therefore wide open. What needs to be stressed is the fact that the substitutability of the actions of central banks with actions by treasuries de facto implies a high degree of concertation and coordination. As pointed out by several observers, coordination problems were manifest during past quantitative easing operations: "*The Treasury was pursuing a strategy of extending the duration of U.S. government debt. At the same time, to pursue stimulus, the Fed was operating in the opposite direction, in effect, issuing short-term debt and buying long-term debt. Surely a coordinated policy would have reduced transactions costs and served the public interest?*"[136] The proposals discussed here obviously require that steps are taken to avoid such situations in the future. In our view, an in-depth discussion of the respective roles of the central bank and the fiscal authority is in order. This should lead to designing a framework that is conducive to the necessary policy coordination and permitting an explicit political blessing when it is found that the central bank is best placed to take over duties that could otherwise be assumed by the fiscal side.

4.2 Lender of last resort

In a fractional banking system, the stability of the maturity transformation process requires the existence of a lender of last resort.[137] This is because information asymmetries make it realistic that a perfectly solvent and well managed institution finds itself in a life-threatening liquidity shortage.[138] It is important to observe that this assertion is not in contradiction with efforts to prevent or limit occurrences of bailouts. Providing liquidity to a fully solvent but illiquid institution is conceptually very different from providing liquidity and ultimately recapitalising an insolvent one, even if distinguishing between the two situations may often be tricky in practice.[139] This justification for the presence of a lender of last resort and the principles under which it should act have a long-standing history typically attributed to Bagehot. In the words of Tucker (2014c), Bagehot's doctrine requires that "*central banks … make clear that they stand ready to lend early and freely (i.e. without limit) to sound firms, against good collateral, and at rates higher than those prevailing in normal market conditions.*"[140]

136 Summers (2018).

137 In this section we understand the lender of last resort in a broad sense, that is, including all forms of liquidity provision by the central bank.

138 Goodfriend and King (1988) argue that in modern inter-bank markets, informed participants can distinguish between liquidity and solvency problems. As a result, a solvent bank cannot be illiquid and the LOLR function is redundant. In our view, the interbank market freeze of the autumn of 2008 is a direct refutation of their position.

139 Saving an insolvent or barely solvent institution may also be justifiable according to some authors, either because it may prevent a contagious panic run (Aghion et al., 2000) or for incentive reasons (Rochet and Vives, 2004).

140 The Bagehot principle is often misunderstood as implying that the central bank should lend at terms that are less favourable than the market, even in a crisis. The opposite is true. Loan terms should be less favourable relative to normal times, but advantageous relative to those offered by the market during a crisis lest the lender of last resort loses its meaning.

4.2.1 The lender of last resort in action

The first role of the lender of last resort is to provide additional liquidity in large quantities when fears settle in the mind of market participants, leading them to hoard reserves. This primarily concerns the interbank market and, at times, specific financial institutions. The lender of last resort should satisfy the increased demand for reserves. The ultimate goal is to ensure that enough means remain available to fund consumers and firms who are still willing to spend, and thus prevent or limit the contraction in economic activity that would certainly materialise in the case of a credit crunch. This role of the lender of last resort was well understood and had been effectively practiced by central banks in the past, notably at the time of the October 1987 stock market crash, during the LTCM episode in 1998, and in 2001 when the dot-com bubble burst.[141]

In the autumn of 2008, the alert was particularly severe. After the fall of Lehman, the interbank market broke down. Financial institutions started to mistrust each other to the point where the daily redistribution of liquidity between cash-rich and cash-poor market participants effectively came to a full stop. Market participants would part from their excess liquidity only with the greatest reluctance, after having constituted a large enough cash cushion (which was costless since rates had been brought close to zero) and only against the very best collateral (almost exclusively US Treasuries and top-rated sovereigns). In such circumstances, monitoring the aggregate stock of liquidity, which is part of the day-to-day operations of a central bank, no longer suffices. The central bank must effectively be ready to act as the counterparty to every market participant in need of liquidity. This requires that the volume of liquidity-providing operations by the central bank corresponds to the gross demand for liquid assets, rather than to the net demand after all interbank trades have been effected.

Even in such a context, the Bagehot principles would have it that the lender of last resort lends at a premium against good collateral only. This may not do, however! Even if the central bank is more tolerant in its collateral policy than the market at times of intense stress, the question is whether there is enough 'good' collateral around. The answer is known: part and parcel of the Fed's and the ECB's reaction to the crisis was to water down their collateral standards, in other words, to accept an increasingly broad set of collaterals in their liquidity operations. Thus, on 27 March 2008, in the first auction under the Term Securities Lending Facility, the Fed allowed primary dealers to use less-liquid, investment-grade instruments as collateral for borrowing Treasuries, and on 15 October 2008 the ECB temporarily widened its collateral eligibility criteria to include collateral with a BBB assessment (instead of the prior A- minimum), foreign currency-denominated collateral, and a range of other assets not previously accepted, including non-marketable assets (bank loans).[142] These moves took into account the decreased supply of what the market considered to be good collateral together with the increased demand by financial institutions for the remaining safe assets which effectively meant that the massively higher global liquidity needs could not be met if the central banks insisted on their previous collateral standards.

141 See Neely (2004).

142 The overall volume of marketable assets eligible as a result of these temporary measures amounted to approximately €1.4 trillion by the end of 2009, not including non-marketable assets. Of course, the acceptance of these assets was assorted with corresponding haircuts.

The third and most spectacular element of LOLR activity goes beyond market-wide liquidity measures and standard discount window operations. Specific financial institutions are targeted that are particularly affected by the crisis and whose failure would constitute a real danger for aggregate economic activity. This is typically the case when their portfolio contains downgraded assets in large quantities (relative to their capital). Yet this does not mean that these institutions are insolvent. The fire-sale value of these assets may simply be so depressed that doubts on their solvency spread and, as a result, counterparties withdraw out of precaution. This is the domain of 'emergency liquidity assistance' (ELA) and corresponds to the spectacular operations described in Section 3.1.

Here again the Bagehot principles apply, although with more difficulty – ascertaining the solvency of the soliciting institution is clearly a major challenge. It is easy to recognise fire-sale prices ex post but much more difficult to do so ex ante, in particular given the urgency of an ELA decision and the confidentiality required in the process. This effectively means that the notion of 'good' collateral is only theoretical. The set of acceptable collateral has to be further enlarged to include assets not typically accepted in standard operations, and the appropriate haircuts are very hard to estimate. At times, such as in the extreme stress that prevailed in the autumn of 2008, the lender of last resort may have to accept collaterals for which there are no meaningful market and thus no observable or meaningful prices.[143] The financial risks associated with this challenge have already been described in the case of the March 2007 Bear Sterns support operation by the Fed. All this may explain why the commonly accepted principles had seen only rare and limited applications before the global financial crisis.[144] Until the crisis, the Fed's main instrument as lender of last resort – as for most central banks – had been the little-used discount window. Over the course of more than seven decades leading up to 2007, monthly discount-window borrowings of depositories from the Federal Reserve (based on a daily average) peaked at $8 billion. For comparison, borrowings climbed 50 times higher following Lehman's collapse.[145]

4.2.2 Strengthening the democratic legitimacy of the lender of last resort

The extended use of their firing powers by the various lenders of last resort across developed economies amounted to a highly effective – the financial system was stabilised and few central banks appeared to have lost money in these operations – but also highly visible demonstration of strength of which the general public and its representatives had little prior understanding. As a consequence of this surprise effect, questions over the legitimacy of delegating such immense powers to an independent technocratic institution have been raised. This concern is sound, and needs to be addressed while recognising that opening a Pandora's box is not without danger – a misguided discussion could result in curtailing the ability of the lender of last resort to act effectively in a future crisis. In a

143 Given their long horizons, central banks are justified in evaluating these collaterals on a hold-to-maturity basis and they have typically done so. Nevertheless, they have to rely on hard-to-estimate (given the extraordinary circumstances) default probabilities.

144 One remarkable instance is the liquidity support provided by the Fed in November 1985 against the entire balance sheet of the Bank of New York as a reaction to a computer failure preventing the bank from balancing its accounts overnight (Neely, 2004).

145 See Cecchetti and Schoenholtz (2018e).

September 2018 *New York Times* column, three of the main actors in the events of the autumn of 2008 – Ben Bernanke, Tim Geithner and Henry Paulson – indeed warn of this danger: "*in its post-crisis reforms, Congress took away some of the most powerful tools used by the FDIC, the Fed and the Treasury*", notably "*powers that were critical in stopping the 2008 panic*".[146]

In thinking about how to proceed, we first note that the surprise element was largely a consequence of the opacity under which potential LOLR interventions were shrouded. Indeed, the terms and conditions of LOLR interventions of central banks had rarely been made explicit. In the epilogue to his landmark history of the Fed, Allan Meltzer complained:

> *"The Board had never developed or enunciated a lender-of-last report policy. Markets had to observe its actions and interpret the statements as always in the past. Instead of reducing uncertainty by offering and following an explicit lending policy rule, it continued to prevent some failures while permitting others."*[147]

The opacity surrounding the actions of the lender of last resort was largely intended. It was part and parcel of the concept of constructive ambiguity, which was the main strategy used by central banks to contain moral hazard. Uncertainty about the availability of liquidity support by the central bank was viewed as an essential protection against financial institutions taking excessive risks in maturity transformation on the assumption of the presence of a safety net. The extensive interventions that took place during the crisis, together with the disastrous consequences of the one absent intervention (the Lehmann failure), have invalidated this perspective. Today one may fear that all major institutions work on the assumption that their central bank will be there to help if they find themselves in a liquidity shortage. This situation exacerbates the role of liquidity regulations in preventing bankers from taking excessive liquidity risks with some form of public guarantee in case of failure.

But, with no pretence of ambiguity, there are few reasons not to be transparent as to what support can be expected from the central bank. One should aim at making fully clear and explicit the conditions under which liquidity support is warranted, who the eligible (and non-eligible) institutions are, and what instruments are at the disposal of the central bank. Fully laying out the modus operandi of the lender of last resort in texts subject to political approval will result in strengthening the democratic legitimacy of the LOLR action by a non-elected institution. Here, we fully concur with Tucker (2018) when he states that "*in todays' democracies the only way to combine effectiveness with legitimacy is transparency around the rules of the game. […] If credible commitment and operating as an emergency institution can be reconciled in principle, getting from 'in principle' to 'in practice' requires public deliberation and debate, so that the requisite degree of comprehension and support is established.*"[148]

146 See also Geithner (2016).

147 Meltzer (2010).

148 Tucker goes on to list what he sees as important principles for an independent lender of last resort: 1) It should be reaffirmed that central banks act as lender of last resort. 2) No lending to fundamentally insolvent firms; with central banks being required to publish a framework for how soundness/solvency will be assessed. 3) No lending against assets that the central bank cannot understand, value and manage. 4) Central banks should not rule out lending to solvent nonbanks on a case-by-case basis. 5) Central banks' decisions should be made by a formal committee.

The danger is that such a clarification of the operating procedures of the lender of last resort leads to a restriction of the use of LOLR tools that have previously been effectively deployed. This is because the powers of the central banks in these situations may appear so extraordinarily great as to be unjustified in a democratic context. Moreover, as pointed out by Bernanke, Geithner and Paulsen in their *New York Times* column, it is also the case that "*many of the actions necessary to stem the crisis, including the provision of loans and capital to financial institutions, were controversial and unpopular. [...] the responses often seemed unjust, helping some of the very people and firms who had caused the damage.*" Still, "*we need to make sure that future generations of financial firefighters have the emergency powers they need to prevent the next fire from becoming a conflagration.*" To do so, one must fight the temptation to curtail these powers and in so doing the necessary range of actions of the central bank. As already mentioned, this unfortunately appears to have been the case with Dodd-Frank and the resulting changes in the law that would preclude the Fed from doing a range of things, notably lending to individual non-banks, that it did starting in 2008.

Fortunately, such a development is not inevitable. The Bank of England saw its liquidity reinsurance toolbox expanded in 2008 and in 2013 as the result of an extensive public discussion.[149] And indeed there is no real alternative – in the absence of a public debate on this issue, the risks of a negative political reaction after a new LOLR intervention, leading to a very significant curtailing of its potential, are very high. An explicit enunciation of the central bank's terms of intervention, leading to a full ex-ante political backing of potential future actions, is a safe way to reconcile the extraordinary powers of the lender of last resort revealed in the crisis with the need for swift and resolute action when a crisis occurs. Making the rules more explicit would also delineate and provide political validation for the inevitable remaining discretionary element of the actions of the lender of last resort. This would further protect the status of the central bank in the future.[150]

4.2.3 Pricing the liquidity insurance services of the lender of last resort?

A further way to legitimise the support of the lender of last resort would be to price the insurance services effectively provided. That is, shouldn't we move to a situation where the liquidity support of the central bank would be fully explicit and pre-ordained and also *paid for* by financial institutions? One natural approach to doing so would be to generalise the "secured committed liquidity facility" being set-up by the Reserve Bank of Australia.[151] This would mean that deposit-taking institutions, or all institutions eligible for liquidity support, would have to pre-commit eligible collaterals against a credit line from the central bank to be drawn upon in times of liquidity stress. The available liquidity would of course take account of the haircut attached to the deposited collateral. The volume of the credit line could be a fraction of the potential liquidity needs or, at the extreme, it could correspond to the entire potential liquidity deficit of the institution. This is in effect the 'pawnbroker for all seasons' proposal of former

149 See Hauser (2014).

150 An illustration of the direction we are advocating is provided by the Bank of England's Sterling Monetary Framework (the 'Red Book'); see Bank of England (2015).

151 The SNB offers a similar facility under the name of Liquidity Shortage Financing Facility (LSFF) although the goal of this facility differs. It only aims at providing support to the payment systems and is restricted to overnight lending against HQLA collateral, see Jordan (2006)

Bank of England governor, Mervyn King.[152] King sees his proposal as putting an end to the "alchemy" of the transformation of illiquid and risky assets into liquid and riskless liabilities, the trademark of maturity transformation. His motivation goes beyond the pricing of liquidity insurance that is our starting point; King sees it as a radical solution to the problem of financial stability in a world where Knightian uncertainty makes probability calculus impossible and, as a result, risk management is bound to be severely deficient.

The identities behind a bank balance sheet, however, imply that in the case of the 'pawnbroker for all seasons' – i.e., a credit line backing up the entire liquidity gap in a bank's balance sheet – the central bank haircut policy would exert a dominating influence on the lending activity of the insured institution. This is tantamount to attributing a major role to the central bank in the credit allocation process.[153] Moreover, while this would certainly increase the resilience of the commercial banking system, it would further increase the tendency for risks to shift to the unregulated sector. This makes the overall impact of this proposal on the resilience of the entire financial system uncertain.

In our case, the aim would be to force banks to pay for (at least part of) the insurance they receive not only ex post through a penalty interest paid when they use the credit line, but also ex ante through the opportunity cost of the posted collateral which would not be available for alternative usage. Similar concerns remain valid, however. Funds financing the holding of securities and easily collateralised loans would be granted a definite advantage over funding assets subject to larger haircuts when deposited at the central bank. In the extreme case, banks would be precluded from financing non-collateralisable loans or other assets not accepted as collateral by the central bank out of customers' deposits.

A disconcerting development of the last decades is what Jorda et al. (2016) refer to as the "Great Mortgaging" – the fact that commercial bank activity has been increasingly focused on real estate lending, to a point where, in their view, the traditional description of banking as channelling funds from retail savers to entrepreneurs has become somewhat of a fiction.[154] One may worry about this evolution and its impact on the availability of credit for productive investments. And one may fear that an increasing insistence on collateralisation, encouraged by the opportunity it offers to have recourse to central bank funding, would strengthen this evolution.

Worse still, with the diminishing importance of physical capital in the economy and the growing role of intangible assets that are less easy to collateralise, one may worry that the role of banks in the credit process could be waning and that the capacity of bank-centric economic systems, notably in Europe, to finance the needs of modern economies might be impeded. In our view, these issues must be thoroughly researched before a call for even a limited pricing of liquidity insurance can be made more forcefully.

152 King (2016).

153 Nyborg (2016) offers a critique of current central bank collateral policies on grounds of their impact on asset prices and banks' lending practices.

154 A more nuanced picture is provided by Lian and Ma (2018), who estimate that 80% of lending to US non-financial corporations is uncollateralized, with 50% of these funds taking the form of corporate bonds and 30% being cash flow-based loans.

It remains that the free availability of liquidity insurance from the lender of last resort constitutes a subsidy to the banking sector. What should we make of this?[155] The existence of such a subsidy could be seen as benign; under the hypothesis of a well-functioning system, the subsidy should be passed on to the users of credit (the entrepreneurs towards whom consumers' savings are directed). One may even accept, following the 'Great Mortgaging' perspective, that it constitutes an encouragement to private homeownership, an objective adopted by most advanced economies (although here the positive impact on growth is more questionable). But in light of persistently high levels of bank executive remuneration, one may also have doubts that the subsidy is indeed transferred to the end users of banking services. In our view, the existence of such a subsidy a priori legitimates scrutiny and contemplation of limits to bankers' remuneration.[156] Admittedly, the observed falling market share of banks at the expense of the less-regulated shadow banking sector observed in some jurisdictions (Section 2.4) may be interpreted as a sign that the constraints resulting from Basel III regulations constitute an appropriate quid pro quo for the subsidy in question. When analysing this evidence, however, a clear distinction between the social and private perspectives necessary before drawing a final conclusion.

4.3 Updating the central bank financial stability mandate

Let us now move to the third dimension where a significant evolution in central banking is ongoing. We start by describing the pre- and post-crisis views of the world on this front.

4.3.1 From cure to prevention

Most central banks have financial stability as an element of their mandate. Before the crisis, however, financial stability was clearly junior to the main objective of delivering price stability. The prevailing view – sometimes referred to as the Greenspan doctrine after the former Fed chairman – admitted that asset markets were likely to be excessively volatile and prone to crises. But it was widely believed that distinguishing ex ante a situation of dangerous excess – a bubble – from an episode with similar appearances but adequately reflecting new, positive economic developments was close to impossible. As a result, the consensus was that trying to prevent a bubble from forming could lead to costly policy mistakes – when positive productivity developments would be erroneously constrained – for which the potential gains in terms of stability could not compensate. It was therefore considered more appropriate to stand prepared to vigorously counter the negative effects of a bubble after it had burst rather than trying to prevent one

155 This question motivates the supporters of narrow banking which, however, implies an even more radical intervention of central banks in the credit allocation process (Cecchetti and Schoenholz, 2018f).

156 Beyond those focusing exclusively on the dynamics of remuneration for incentive purposes as proposed by the authors of the Squam Lake Report (French et al., 2010).

from forming in the first place. In a sense, this view had been validated during the 'new economy' crisis of the late 1990s, obviously a bubble when looking in the rearview mirror. The effects of this bubble bursting were adequately contained by the Fed's vigorous ex-post response.

The fact that it is very difficult to identify a bubble ex ante still holds.[157] From the huge cost of the crisis, however, a consensus has emerged that this argument is not sufficient to deter attempts to reduce the probability of a catastrophe taking place and to limit its costs if it cannot be prevented – that is, to monitor the build-up of financial excesses, adopt precautionary measures to reduce the probability of a bubble forming and bursting, and take anticipatory measures minimising the cost of a bad event. The pre-crisis view was essentially reactive, with the LOLR function of central banking centre-stage and the preventive element restricted to moral suasion typically taking the form of a financial stability report issuing warnings and advice. Today's mood calls for central banks to be much more proactive, implying a clear upgrade of the financial stability component of their mandate.

4.3.2 Systemic risk, macroprudential policy and central banking

This change in attitude regarding financial stability goes hand-in-hand with an increased awareness of the importance of systemic risk. Systemic risk is the risk of impairment of the functioning of a substantial portion of the financial system, typically with significant negative effects on the economy as a whole. It results from various interdependencies that exist among financial institutions and markets. These interdependencies need to be intensively monitored and specifically addressed. The quasi-exclusive focus on the resilience of individual institutions that prevailed before the financial crisis is demonstrably insufficient to achieve financial stability.

Systemic risk, and by consequence macroprudential policies, has a number of elements, three of which have already been discussed in this report: the existence of institutions that are too big to fail (Chapter 3), the interconnections and opacity of the shadow banking system (Section 2.4), and the reliance of the payment and settlement system on a few large CCPs (Box 2.1). In addition, systemic risk includes an important cyclical element that results from the propensity of actors in the financial system to act alike ('herding') together with their failure to take into account the impact of their (possibly rational) decisions – for example, to liquidate assets in order to raise capital – on the rest of the market ('externalities'). These two features lead to booms and busts in the financial cycle that are of concern to central banks in their role as liquidity providers and lenders of last resort (and also as monitors of monetary conditions). The crisis has made it obvious that they are particularly challenged by the existence of TBTF institutions and the consequences of a sudden stop in the financial cycle. Moreover, the increased emphasis placed on prevention and the need to envisage precautionary measures to moderate a cyclical build-up have introduced new considerations that are more closely related to the traditional concerns of monetary policy. Indeed, prudential policies directly or indirectly make the granting of credit more or less expensive. They are therefore either substitutes or complements to an interest rate decision, and their activation has an impact on monetary

157 Although significant progress has been made in measuring the risks of unfavourable developments; see Bisias et al. (2012) for a comprehensive overview.

conditions and, in turn, the context of a central bank's interest rate decision. In sum, countercyclical macroprudential policy is too close to central banking to be designed and decided in isolation from monetary policy; the involvement of the central bank is unavoidable.

The *extent* of central bank involvement is controversial, however. One view holds that financial stability should become the core of the central bank mandate. This can be justified by the deep interest of the lender of last resort in the resilience of the financial system and the fact that credit growth is at the heart of financial stability concerns while steering credit volumes is the main focus of central banks. Delegating the control of credit to the central bank with a mission to promote both price and financial stability thus makes a lot of sense. Recognising this, one key issue is whether the independent status of a central bank with such a mandate would remain legitimate. Paul Tucker proposes three conditions for granting multiple missions to an independent agency: a) the missions must be intrinsically connected, b) each mission faces a problem of credible commitment but does not entail making big distributional choices, and c) it is judged that the combination will deliver materially better results. In Tucker's view, the answer in the case at hand is 'yes' on all three counts, which motivates his proposal to extend a broad price and financial stability mandate to the central bank (under conditions that we discuss below).[158] Others object that a narrow measurable price stability mandate is best suited to a technocratic institution with independent status, at least until we have a better understanding of the impact of the available macro- and microprudential tools on financial resilience. Accountability would suffer from too radical a move in the direction of less well-defined objectives and more political interactions.

4.3.3 The instruments of counter-cyclical macroprudential policy

The set of instruments that authorities can rely on to steer the financial cycle can be divided into two categories. The first is the interest rate (i.e., the price of credit); the second is constituted of tools that are more specifically targeted to affect the conditions under which credit is granted, either on the supply side (the conditions under which banks allocate credit) or on the demand side (the incentives of borrowers to solicit credit). We first review the case for central banks using their main policy instrument to achieve their financial stability objective and then discuss the potential of targeted macroprudential instruments.

4.3.3.1 Leaning against the wind

Should the traditional instrument of monetary policy, the interest rate, be put to use against financial excesses? That is, should a central bank steer interest rates not only in view of achieving its price stability objective but also with a focus on financial stability? The issue of course arises when there is a tension, in other words, at times where preventing the build-up of financial imbalances and countering the financial cycle would force the central bank to deviate from its optimal anti-inflation interest policy, in particular by raising rates above the level that would be required to deliver price stability, or 'leaning against the wind'. The

158 Or, in Tucker's words, "monetary stability", with the latter being viewed as having two components: a) stability in the value of central bank money in terms of goods and services, and b) stability of private banking-system deposit money in terms of central bank money (Tucker, 2018, Chapter 20).

debate on this issue is raging. The BIS has been a strong proponent of leaning against the wind in recent years and has been critical of the extreme caution demonstrated by major central banks in exiting from their low-rate policies. Arguing that the policy of low interest rates pursued by central banks in the aftermath of the crisis leads to a search for yield that is feeding financial excesses and sowing the seeds of the next crisis, and stressing the high and potentially permanent output losses caused by financial crises, the BIS pleads for "*a financial stability oriented monetary policy (..) that takes financial stability considerations into account all the time. In doing so, it would respond systematically to financial conditions to keep them on an even keel throughout the entire financial cycle. The idea is not to be too far away for too long from some notion of equilibrium.*"[159] One argument in favour of leaning against the wind is that the interest rate policy goes into "all the cracks" of the economic system, while more targeted macroprudential measures often risk being circumvented by regulatory arbitrage.[160]

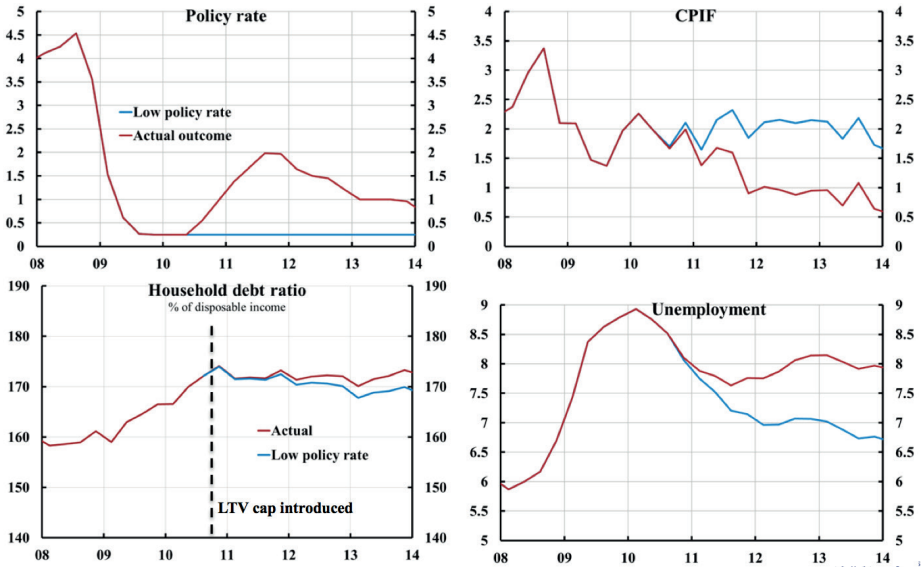
On the other hand, a number of studies have suggested that the costs of leaning against the wind may be prohibitive. Bean et al. (2010), for instance, estimate that in the US and the UK, a very aggressive leaning-against-the-wind policy before the crisis (a policy rate 200 basis points higher over three years) would have had a significant impact on house prices but only a trivial one on credit growth, despite generating a cumulative output loss of more than 3% of real GDP. The authors find the cost of this policy hard to justify given that the limited impact on credit, and other factors make them "*reluctant to conclude that it would have had a major impact on the probability of a crisis materializing*." They conclude that "*generally speaking, monetary policy seems too weak an instrument reliably to moderate a credit/asset-price boom without inflicting unacceptable collateral damage on activity*".

For Svensson (2014), the recent Swedish experience demonstrates that financial stability concerns should not affect the conduct of monetary policy. He estimates that the policy of leaning against the wind adopted by the Riksbank since 2010 has resulted in a level of unemployment that is 1.2 percentage points higher than a straight inflation targeting policy would have generated (as well as an unnecessary deviation from the 2% inflation target) without achieving any reduction in real household debt (see Figure 4.3) and with only "*minuscule benefits in terms of lower probability and less depth of a future crisis*".

Specifically addressing the European case, the European Department Director of the IMF argues that "*in the euro area a common monetary policy makes macro prudential tools even more important than in other jurisdictions. Because of the still significant fragmentation, member states will often be at different stages of economic and financial cycles and the extent of financial excesses will therefore vary across countries. This points to the critical importance of macro prudential policies.*"[161] Switzerland represents an extreme case of a small open economy (SOE) with an exchange rate concern rendering leaning against the wind particularly unattractive. In such an economy, the cost of deviating from the optimal interest rate policy in order to pursue a financial stability objective is compounded by the additional impact of 'too high' an interest rate on the exchange rate. In the case of Switzerland, strong safe-haven pressures on the exchange rate since the beginning of the crisis have effectively ruled out the use of leaning against the wind.

159 See BIS (2016).
160 See Stein (2013).
161 See Thomsen (2018).

Figure 4.3 Actual and counterfactual outcome of leaning against the wind in Sweden, 2010-2014



Note: CPIF: CPI inflation with constant mortgage rates.
Source: Svensson (2014).

In sum, keeping an eye on the state of the financial cycle and using the interest rate instrument in a pragmatic manner to remain as close as possible to a financial equilibrium, as advocated by the BIS, is sensible. And circumstances may exist – notably in largely closed economies – where it would make sense for a central bank to use its interest rate lever to counter a bubbly credit situation and lean against the wind. But there are also many instances where the room to manoeuvre for the central bank is very small, and still others where it is non-existent. The availability of alternative instruments and the readiness to use them thus appear essential to ensure that the toolbox can match the financial stability challenge. We now turn to reviewing these alternative instruments.

4.3.3.2 Targeted dynamic macroprudential instruments

As suggested in Section 2.2.2, it makes sense to impose stricter capital requirements on institutions that generate more risks to financial stability. In the same vein, it makes sense to strengthen capital requirements when the cyclical conditions grow riskier. This is the essence of the counter-cyclical capital buffer (CCyB) introduced for the first time under Basel III. The main intent here is to make banks more resilient when it is more important for them to be so, thus decreasing both the probability of an accident and its cost should it occur nevertheless. A corollary intent is to incentivise banks to adopt more conservative credit policies (by temporarily sterilising a portion of the funds they could use for issuing new credits), thus helping to starve the dynamics of the financial cycle.

The CCyB is the broadest instrument available to deal with the financial cycle, and in that sense, it is a close substitute to an interest rate move. Probably for that reason it is also the macroprudential instrument that has been most prominently discussed in central banking circles. The precursor to the CCyB was the dynamic provisioning instrument adopted by the Bank of Spain in 2000. While this instrument was clearly not sufficient to prevent the Spanish financial crisis, recent analysis suggests that it had a significant impact on the credit cycle.

Jimenez et al. (2017) review the Spanish experience with dynamic provisioning using exceptionally detailed micro-data – a comprehensive credit register comprising bank-firm-level data on all outstanding business loan contracts and the balance sheets of all banks – in conjunction with firm-level data. They first observe that the requirement that commercial banks build a provision fund had a clear impact on the offering of credit by the most-affected banks. The ability of borrowers to substitute credit from less-affected banks within three quarters of the policy change meant, however, that the impact on the aggregate credit supply was relatively weak and the potential for halting a credit boom modest. Nevertheless, the buffer that was built up in good times clearly helped mitigate the credit crunch. It decreased the capital constraint at a time when it was difficult for banks to raise new funds and the effect of a lack of capital on credit policy – which is found to be very significant – could not be alleviated because firms struggle to switch banks in bad times. In the words of the authors, "robust evidence shows that countercyclical capital buffers mitigate cycle in credit supply and have a positive effect on firm-level aggregate financing and performance".

Switzerland was the first advanced economy to make use of (a version of) the Basel III CCyB after the crisis.[162] Confronted with an exuberant residential real estate market, the SNB transmitted to the Swiss government a proposal to activate a sectoral CCyB, at the level of 1% of mortgage-based risk-weighted assets. This policy measure came on the back of a series of warnings in Financial Stability Reports from previous years and the introduction in July 2012 of a new legal basis regulating the use of this instrument. The CCyB is credited with having strengthened the hand of the central bank in the macroprudential domain, giving more weight to its assessment when discussing the state of the financial cycle with the other stakeholders, namely, the micro-regulator (Finma), the finance ministry and the bankers' association.[163]

The outcome of these discussions was the sequential adoption, over the course of 2012 and 2013, of a set of measures: an increase in the risk weights for riskier mortgages, a tightening of amortisation rules, a limit to pension fund withdrawals to finance mortgage down-payments, and the activation of the CCyB (see Figure 4.4). This portfolio of measures was met with success. Real estate price growth slowed down and then practically stopped, and the growth rate of mortgage volumes fell to a level approximately in line with the growth rate of the economy.

162 More recently the CCyB has been activated, or the decision has been taken to activate it, in Ireland (1%, effective 1 July 2019), France (0.25%, effective 1 July 2019), Lithuania (0.5%, effective 31 December 2018; 1%, as of 30 June 2019), Slovakia (1.25%; to be increased to 1.5% as of 8 January 2019) (source: ECB).

163 See Danthine (2015).

Macroprudential instruments thus appeared to have done the job.[164] This is all the more remarkable because the strength of the Swiss franc over this period made the interest rate instrument unavailable; leaning against the wind was not an option. In fact, the interest rate circumstances were particularly unfavourable throughout this entire episode. The policy rate (three-month LIBOR) was set at 0.25% in the autumn of 2008 and fell to 0% in March 2009. This coincided with a clear acceleration in the growth of mortgage credit and motivated the measures mentioned above. It was feared that the negative interest rate policy embarked upon in January 2015, at a rate of -0.75%, would further fuel the bubbly market developments. This did not occur; instead, the broad set of measures adopted cooperatively by the various stakeholders succeeded in taming the market dynamics.

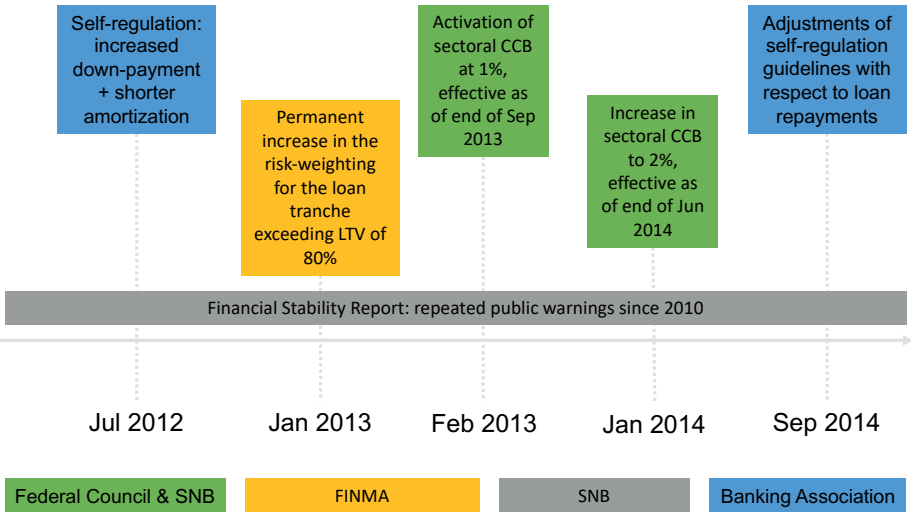
While the CCyB was probably an important element of the winning cocktail in the Swiss case, it would most likely have been insufficient on its own. This accords with the Spanish experience. Basel III stipulates a maximum CCyB of 2.5% of risk-weighted assets. In the Swiss case, with real estate mortgage risk weights of 0.3 and an average ratio of mortgage to total assets of 0.5, the CCyB could lead to a maximal increase of approximately 2.5 x 0.3 x 0.5 = 0.375% in the average ratio of capital to total assets (the leverage ratio of Basel III). By comparison, it is estimated that the dynamic provisions constituted by the average Spanish bank were approximately 1% of total assets before the crisis and that they had been depleted by the end of 2010.[165] The further observation that in good times borrowers can switch relatively easily to alternative, less-constrained lenders completes the assessment that the goal of making banks more resilient and less prone to cutting credit in bad times may be reached without halting the build-up of a credit cycle.

Together, the Swiss and Spanish experiences suggest that while the CCyB is a useful instrument, it cannot be relied upon to single-handedly prevent a financial bubble. Other instruments must simultaneously be put to use if that objective is to be attained. As we will argue in the next section, in the case where the responsibility for financial stability and the activation of the available instruments are shared between several authorities, this places a great deal of weight on the design of an institutional set-up that is conducive to cooperation and on the capacity to collectively foster the necessary political will to take preventive action to tame the financial cycle.

164 The war is not over. While at the time (2011-2015) the problem was with the market for owner-occupied residential property, the persistence of a low interest rate regime and the search for yield have transformed the problem into one affecting the real estate investment market, a market which the adopted measures did not target. The SNB's 2018 Financial Stability Report notes that "in the residential investment property segment, a large share of new mortgages (around 25%) were characterized by both high LTV and high LTI risks ('high-LTV/high-LTI loans'). These high-LTV/high-LTI loans also account for a material share of all new mortgages granted in 2017 (almost 10%)."

165 See Jimenez et al. (2017). Aikman et al. (2018) ask a different, but related question: how high would the CCyB had to have been pre-crisis to make the banking sector sufficiently resilient to the shock constituted by the crisis? They argue that a CCyB of 3% would have provided a level of resilience equivalent to the $200 billion TARP, while a CCyB of 4.2% to 4.7% would have been needed to avoid a credit crunch (i.e., allow banks to continue lending in line with historical growth rates).

Figure 4.4 Switzerland, 2012-14: A portfolio of complementary macroprudential measures



Source: Danthine (2015).

Most prominent among the alternative targeted measures, and specifically addressing the evolution of the real estate market (the most likely source of financial excesses), are policies focused on borrowers (as opposed to measures targeting lenders, such as the CCyB). These include restrictions on loan-to-value (LTV) ratios and on credit affordability (for example, limits on loan-to-income (LTI), debt-to-income or debt service-to-income ratios), and possibly dynamic adjustments to these as a function of the perceived cyclical situation. Aikman et al. (2018) argue that the imposition of LTI limits on new mortgages and affordability criteria that ensure that borrowers can continue to service their debt in the event of an increase in interest rates would have been influential in curtailing the unsustainable build-up in debt at the origin of the crisis in the US. They estimate that limiting the loan-to-income ratio to 4 would have had a noticeable impact on mortgage originations in the US through the 2000s.

Combining measures targeting supply (CCyB and increase in risk weights) and demand (LTV and LTI ratios) makes a lot of sense, as actions on the two sides of the market reinforce one another.[166] Demand-side measures are further from the traditional central banking mode of action, and making them part of the central bank's toolbox is not without consequences. One reason for this is that the targets of these measures are often relatively narrow demographic groups representing marginal borrowers (for example, young families with limited income in the case of loan-to-income restrictions and/or little equity in the case of loan-to-value). The narrower distributional aspect of these measures makes them much more

166 Aikman et al. (2018) support this assessment. Their detailed diagnosis on the causes of the crisis leads them to assert: "We argue that a macroprudential regulator would have to address vulnerabilities in both the financial system and in household balances to have materially improved the post-crisis performance of the economy."

politically sensitive than changes to the interest rate.[167] This is a strong argument for preventing central banks from assuming main responsibility for their usage. But then issues of policy coordination arise, since responsibilities over potentially substitutable instruments are shared among several authorities.[168] This represents a significant challenge to building a reliable and effective macroprudential framework.

The task of protecting society from financial instability is daunting. There is no magic bullet. What we have learned over recent years is that we must be much more alert to the build-up of risks and prepared to adopt costly precautionary measures to give ourselves a better chance of avoiding catastrophic scenarios. The set of tools contemplated today is much broader than those in use (at least in advanced economies) before the crisis. They include the classical instrument of monetary policy – the interest rate – the CCyB (a broad-based instrument aimed at increasing the resilience of the suppliers of credit) and a set of instruments targeting the demand side of credit, in particular the mortgage market. The role of the interest rate instrument is controversial and circumstances exist where it is simply unavailable. It is therefore important that targeted instruments can be efficiently deployed. In all cases, it is critical to ensure that coordination among the various decision makers, including the central bank, is effective and that the institutional arrangement benefits from clear political validation allowing the adoption of politically unpopular measures when needed.

4.3.4 What role for central banks?

Expanding the mandate of a central bank to have it embrace prime responsibility for price and financial stability has the obvious advantage of clarifying duties and accountability while also delivering the best possible conditions for efficiency in meeting the corresponding challenges. As stated above, the logic of a broad central bank mandate lies in the fact that credit developments are at the heart of both price and financial stability, and that the key lever for steering credit – the interest rate – is already in the hands of the central bank. A broad mandate for financial stability handed to the central bank would thus ensure that the trade-offs that are bound to appear when the timing of economic and financial cycles diverge would be best addressed. This requires that the macroprudential toolbox be under the central bank's responsibility. Pushing the logic further and with the inescapable LOLR function of the central bank in mind, the question of entrusting the central bank with a mandate for financial regulation and microprudential supervision naturally opens up. Indeed, "*at the most basic level, when central banks lend, they want to get their money back! They need to be able to judge which banks (and possibly near-banks) should get access to liquidity and on what terms*".[169] In addition, the need for macroprudential measures and their effectiveness are highly dependent on the existing microprudential regulation and on the quality of its supervision. What logically follows is the location under one single roof of monetary policy, micro- and macroprudential regulation, and

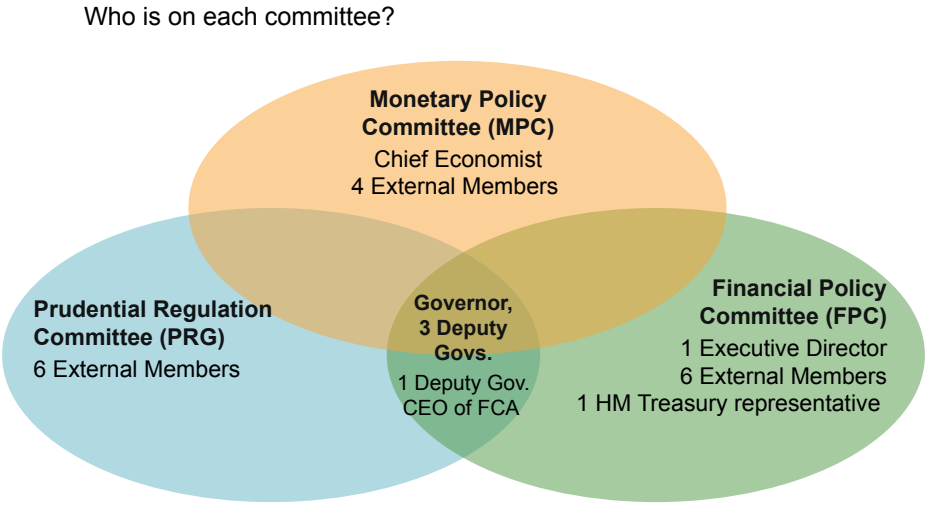
167 As argued by Müller (2018), who shows that macroprudential regulation exhibits a definite electoral cycle. He finds that regulatory tools were much less likely to be tightened (and somewhat more likely to be loosened) in the quarters preceding 207 elections across 58 countries between 2000 and 2014.

168 While clearly in favour of the encompassing model discussed below, Tucker (2018) considers LTV/LTI regulation to have too big a distributional impact to be included in the central bank's toolbox.

169 Tucker (2018, p. 447).

financial supervision. This 'encompassing model' raises significant organisational and accountability challenges. These are hinted at by the complex architectural design put in place by the Bank of England (Figure 4.5) which, since 2010, has been the foremost prototype of this model.

Figure 4.5 Membership of Bank of England policy committees



Notes: FCA: Financial Conduct Authority; FPC: Financial Policy Committee; MPC: Monetary Policy Committee; PRA: Prudential Regulation Authority.

Source: Bank of England.

In the alternative 'cooperative' model, primary and sole responsibility for price stability remains with the central bank while interventions on the macroprudential front have to be coordinated with other actors, notably the micro-regulator and supervisor and the ministry of finance. This model is faithful to a narrower view of the requirements needed for the delegation of monetary policy to an unelected independent agency. It has the further advantage of avoiding the creation of a mammoth institution with a weight and scope that may be uncomfortably, or unacceptably, large in some political environments and extremely exposed in case of failure. The cooperative model has clear disadvantages in handling the trade-offs existing when price stability and financial stability require measures going in different directions. Differences in diagnosis between authorities – which are easy to conceive of given the difficulty of appreciating the level of financial risks – could lead to divergence regarding the measures to be adopted and difficulties in coordinating the usage of (microprudential and macroprudential) instruments, which are in the hands of one authority, and other instruments, which are in the hands of another. With most macroprudential measures tending to unpopular with some interest group or other, it is not difficult to imagine a situation where a deficiency of coordination will lead to inaction and the tacit acceptance of an excessive level of risk. The difficulty may be particularly severe when the central bank is in favour of additional restraints on the macroprudential or microprudential side, but is not ready to use the interest rate instrument out of fear of derailing monetary conditions. Coordination difficulties are compounded

and may lead to 'shirking' by some authorities if clarity over who bears ultimate responsibility for financial stability is lacking. On strict efficiency grounds, it is difficult not to see this solution as being strictly inferior to the encompassing model.[170]

Yet, for a variety of reasons, the encompassing model is the exception rather than the rule. Thus, while central banks have almost uniformly acquired more financial oversight responsibilities since the crisis, the financial supervisory architecture remains extremely diverse.[171] This may have to do with history and inertia. As suggested above, this state of affairs may also be attributed to difficulties in envisaging the encompassing model as being compatible with the notion of delegation to an unelected independent institution, or more generally with institutional prudence on the part of the central bank or defiance towards it, or finally with the fear of creating 'overmighty citizens'. The dominant model today is one where the central bank remains focused on its price stability mandate and shares with several authorities a collective mandate for financial stability, often under a Financial Stability Committee. A recent paper surveying the institutional arrangements for financial stability in 58 countries concludes that only about 25% of the countries have "good processes and good tools" and that "the evidence suggests countries are placing a relatively low weight on the ability of policy institutions to take action".[172] This is an area where the question in the title of our report, "Sound at last?", yields an ambiguously negative answer that implies further analysis and concrete institutional developments.

The situation is particularly complex in the euro area, where doubts about the efficacy of the chosen model are legitimate. In the euro area, national authorities and the ECB are jointly responsible for macroprudential policy. Regulation gives national authorities the power to implement macroprudential measures, while in some cases (notably in the case of the CCyB) the ECB has the power to set higher requirements than those implemented by national authorities. The set-up is complex and is prone to slow decision making and coordination deficiencies. The situation in the euro area stands at the other extreme to the efficient, one-roof solution prevailing in the UK.

All in all, we take as a given the fact that the different models adopted in the various jurisdictions are still too young to be revisited – in most cases they date from the aftermath of the crisis – and the priority is not to propose structural changes that would most likely be politically unrealistic. Instead, we stress that whatever the particular financial stability architecture, the institutional arrangements should be strengthened, notably to reinforce accountability and allow an active role for the central bank without endangering its independent status.

170 In this regard, it is probably not a coincidence that Aikman et al. (2018) arrive at the conclusion that the UK Financial Policy Committee would be better placed to withstand a re-run of the factors that caused the last crisis, while the US FSOC would not.

171 See Calvo et al. (2018) for a comprehensive overview.

172 See Edge and Liang (2019).

4.4 Legitimising an expanded mandate for independent central banks

4.4.1 A new world…

The nature of the unconventional monetary policies adopted in the wake of the crisis and the reinterpretation of central banks' mandate towards a more active role in the quest for financial stability raise new interrogations on the appropriateness of central banks' current status.

With the advent of unconventional policies, central banks have ventured into areas that are increasingly closer to fiscal territory. Purchasing the debt of the sovereign in secondary markets may be seen as only semantically different from the prohibited monetary financing of the state. One may differ as to how severely these extensions impact the justification for the independent status of the monetary authority. One cannot dispute that these actions are best taken in a framework where concertation and often coordination between the authorities are made possible. This is a new configuration that demands a revisiting of central banks' status or, at a minimum, the current interpretation of this status.

The need for a vigorous debate on the optimal policy mix at the zero lower bound is yet another important reason to question the way the independent status has been lived, because it is not conducive to policy coordination. The maintenance of large balance sheets with a view to altering the duration of outstanding public debt and impacting the slope of the yield curve raises related issues of coordination between monetary authorities, treasuries and debt managers. Similar considerations are in order when a central bank manages its balance sheet to address a shortage of HQLA. Other extensions of the central bank's mandate may also benefit from coordination with elected authorities and/or political validation to protect the status of an institution that is managed by unelected technocrats.[173]

Finally, the expanded scope of central bank activity in the domain of financial stability raises further issues that have a bearing on the legitimacy of central bank independence. These questions are naturally most severe in the encompassing model, where the central bank assumes prime responsibility for both price and financial stability and has under its roof all the corresponding competences. But even in the cooperative model, where the central bank's role in the financial stability domain is more modest, the expansion of responsibilities, the politically controversial nature of the available instruments and the distributional impact of the various measures make central banks' technocratic status more debatable and fragile.

4.4.2 … in need of stronger institutional arrangements

The evolution in the role and modes of action of central banks recorded in the section above suggests that two issues should be addressed: (i) ensuring the legitimacy of delegating increasingly broad powers to an independent unelected institution; and (ii) ensuring efficient policy coordination between agencies, at the zero lower bound and in financial stability matters, is compatible with central bank independence. We address these two issues in turn.

173 One may think, for example, of the desirability of strengthening the democratic legitimacy of the central bank managing a large portfolio of risky assets.

The independent status of a central bank with a single price stability objective has solid foundations. The policy objective is well-defined and uncontested, the instruments for achieving the objective are reliable, performance is monitorable, and a credible commitment shielded from political pressure delivers outcomes that are superior in terms of social welfare. What is at stake is the enlargement of central banks' mandate that we believe is justified and is already occurring to a varying degree. Effectively adding another goal – financial stability – complicates the picture. A mandate to preserve financial stability is more difficult to monitor; the goal is harder to quantify, the instruments are less reliable (some are largely untested and have a level of efficacy that is strongly dependent on the existing political will) and, except in the case of the encompassing model, the central bank is sharing this responsibility with several other actors while having full control over only a limited set of instruments. The one-roof solution presents another difficulty: the extent of the delegation of powers is maximal, harder to legitimise, and the risk of creating 'overmighty' unelected citizens is non-negligible.

Tucker (2018) tackles the challenge head on, and provides a persuasive justification for the encompassing model: "*The case for independent central banks taking on the stability role is, therefore, essentially to combine credible commitments with reduced barriers to policy coordination.*" He also offers a set of principles and guidelines under which, he believes, this model can be made fully compatible with delegation to an independent agency. He notably proposes the adoption of a "Money-Credit Constitution" with five components: "*a target for inflation (or some other nominal magnitude), a requirement for commercial banks to hold reserves (or assets readily exchanged for reserves) that increases with a bank's leverage/riskiness and social significance, a liquidity reinsurance regime for fundamentally solvent banks, a resolution regime for bankrupt banks, and constraints on how far the central bank is free to pursue its mandate and structure its balance sheet*."

The principles at work to guarantee the democratic legitimacy of the encompassing model are applicable to the cooperative model, where delegation is partial and responsibilities are shared. They apply notably to the intervention of a central bank acting as a member of a Financial Stability Committee or to another independent agency in charge of financial stability. Besides the issue of policy coordination (which we tackle next), these principles call for a more explicit delineation of the scope and instruments of action of the lender of last resort (Section 4.2.2) and for guidelines on the margin of discretion for the central bank in emergency situations. In much the same spirit, a democratic debate around the objectives, the modus operandi and the instruments at the disposal of the Financial Stability Committee should take place. Most importantly, the agency in charge of financial stability should acknowledge the coordination difficulties inherent in a body formed of multiple authorities with heterogeneous objectives. The resulting risk of inaction should be faced head on. The deliberations should be the subject of open communications and the decisions, including decisions *not* to act, should be explained transparently within a time frame that is compatible with financial stability. Disagreements among authorities should be made public and recorded. In short, the standards of communication commonly recognised for monetary policy decisions should be applied, *mutatis mutandis*, to the decisions of the Financial Stability Committee or the equivalent body in charge of financial stability.

The second issue is how to adapt the institutional framework governing monetary policy to facilitate coordination between the fiscal authority and the central bank. First, we should reiterate that we firmly believe that the independent status of the agency in charge of monetary policy should be fully preserved. Price stability is better served by isolating monetary policy decisions from short-term political influence. We also believe, however, that the framework should be adapted to take account of the need to coordinate macroeconomic policies in extraordinary circumstances. Under the current regime, a significant distance between fiscal and monetary authorities is prescribed. Self-restraint on both sides is a strong signal of the recognition of the central bank's independent status. The executive branch of the government refrains from commenting on monetary policy decisions or *a fortiori* advising or pressuring the central bank ahead of a decision, while central bankers display the greatest restraint when responding to solicitations for comment on the policies of their governments. Examples of deviations from this code of conduct are not rare, but they have typically been looked upon severely. Mario Draghi's advice on European structural policies, or Janet Yellen venturing on the topics of inequality, are recent examples of central bankers deviating from what is viewed as appropriate self-restraint and being criticised for it; the tweet of Donald Trump attempting to pre-empt a December 2018 rate increase by the Fed is an extreme example on the other side.[174] Leaving aside these counter-examples, the normal state of affairs as described above prevents the opening up of a full and effective discussion on the appropriate policy mix, and thus makes policy coordination very difficult to achieve.

We believe the solution to this dilemma lies in recognising that reaching or leaving the zero lower bound – and here we mean effectively the zero interest rate level – delineates the boundaries of what should be a special regime under which the good practices adopted to protect the central bank's independent status when interest rates are positive are put on hold. In normal times, with its main instrument available, the central bank has enough leeway to adapt to whatever policy decisions are taken by fiscal authorities (in terms of the strategic game described earlier, it can remain the 'follower'). However, the ability to adapt to the stance of fiscal policy is severely limited once the zero lower bound has been reached and, depending on circumstances, this may force central banks to venture into quasi-fiscal territory. Coordination with fiscal authorities is then in order.

Under the advocated special regime, a forum of discussion should be created where the executive branch of the government and the central bank are invited to share their views on the entire range of available policy options without fear of failing in their duty for self-restraint. This discussion forum should be institutionalised and the partners should meet at regular intervals under transparent rules. The meetings should be concluded by joint public pronouncements on the assessment of the economic situation, the available policy options, and the chosen course of action. In case of disagreements, the

174 Summers (2018) offers another an example of the kind of response this can elicit: "No self-respecting central banker can be seen as yielding to pressure from a politician facing a difficult election. A central bank that appears subservient to political concerns will rapidly lose credibility in the markets, resulting in increases in inflation expectations and rising long-term interest rates. As those of us at the Treasury Department used to remind White House political staff during the Clinton administration: Fed bashing is a fool's game — the Fed doesn't cut short rates, and the market raises long-term rates. The sense that policy is being politicized increases uncertainty, which is likely to decrease investment and ultimately slow growth."

democratically elected government will inevitably have the upper hand, but it should be required to explain its position and the contrary arguments of the central bank should also be openly communicated. The latter will then decide on a second-best policy in fulfilment of its mandate. Even in this unfavourable situation, the outcome of such an open discussion would be preferable to the current situation where no coordination is attempted. Accountability would be improved and the (unconventional) policies adopted by the monetary authority as a result would de facto benefit from political sanction, which would protect the central bank's future independent status.

To conclude, our conviction is that the expanded role of central banks should lead to a corollary update in their status – a form of central bank independence 2.0. The goal must be to protect one of the main institutional achievement of the late 20th century by adapting it to the new circumstances revealed by the crisis.

5 Discussions

5.1 Discussion of Chapter 2 by Philipp Hartmann: Regulatory reform: Basel III and beyond

5.1.1 Introduction[175]

The chapter "Regulatory reform: Basel III and beyond" is a great read, written by intellectual leaders in the field. The authors take us from the basic foundations of prudential policy to the key pillars of the post-crisis regulatory reforms in fewer than 20 pages, also embedding valuable pedagogical elements for non-experts. Along the way, they make a number of good points about:

- relationships between the main Basel III capital and liquidity ratios,
- key features of successful bank stress tests,
- components of an overall prudential framework that prevents risks from migrating to unregulated sectors, and more.

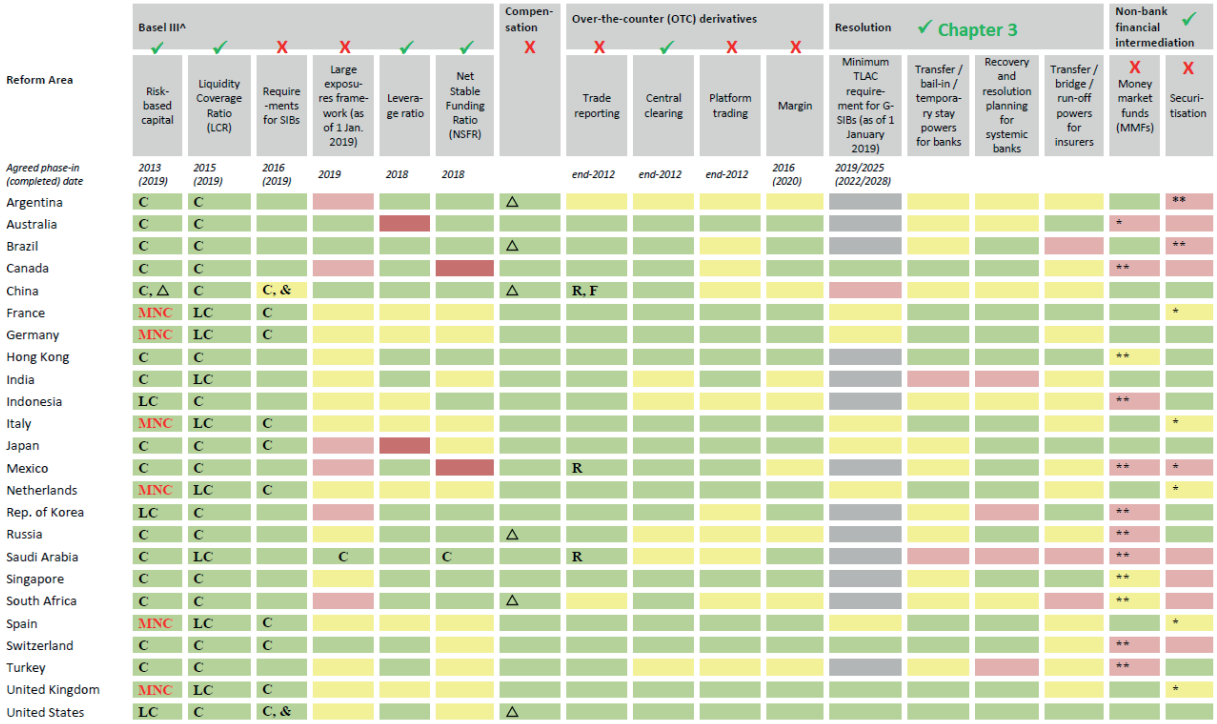
Obviously, given the enormous scope of post-crisis reforms, the authors had to make their choices about what to emphasise and what to leave out this time. Figure 5.1 is a snapshot of the Financial Stability Board's last implementation dashboard for priority reform areas. I have marked areas that are broadly covered in the chapter with a green tick and areas that are not covered with a red cross. So, we should keep in mind that priority reforms that are not discussed much include requirements for systemically important banks (SIBs), compensation, margining for over-the-counter derivatives, money market fund regulation and securitisation.[176] Moreover, the authors primarily adopt a very insightful conceptual approach but without using quantitative impact assessments that estimate implications of reforms for financial risks or economic growth.[177]

175 All views expressed in this discussion are only my own and should not be regarded as views of the ECB or the Eurosystem. I would like to thank Renzo Corrias, Fiona van Echelpoel, Marie Hoerova, Charalampos Kouratzoglou, Clement Rouveyrol and Michael Wedow for various inputs and Hannes Twieling for research assistance.

176 Resolution issues are covered in chapter 3 of the report, so I will not address them in this discussion.

177 See Crump and Santos (2018) for an overview of a few early attempts for such quantitative assessments at the Fed New York, and Hoerova et al. (2018) for an assessment of the new liquidity regulations in the European context.

Figure 5.1 Financial Stability Board priority reform areas, their implementation status and their coverage in this report



Notes: Green ticks mark areas covered in this report and red crosses areas not covered. The colours and symbols in the table indicate the timeliness of implementation (as of November 2018). For Basel III, the letters indicate the extent to which implementation is consistent with the international standard. For trade reporting, the letters indicate to what extent effectiveness is hampered by identified obstacles. More detailed explanatory notes can be found at http://www.fsb.org/wp-content/uploads/P281118-2.pdf.

Sources: Financial Stability Board and author.

Quoting the *Book of Common Prayer*, Charles Goodhart (2016) has pointed out that also in prudential reform there are not only "sins of commission" but also "sins of omission".[178] The chapter at hand mainly focuses on the former and not much on the latter. My discussion starts with the macroprudential policy approach, which sits somewhat in the middle between commission and omission. I then turn to one of the main policy recommendations from the authors concerning the new bank liquidity ratios. Next, I turn to the tax advantage of debt, a case of omission in the global prudential reform agenda.[179] Finally, I make some concluding remarks. I shall also bring in more European issues and facts as I proceed.

5.1.2 Much more progress in the macroprudential dimension of prudential policy is needed

A widely shared conclusion from the experience of the great financial crisis is that the macroprudential dimension of prudential regulation and supervision needed to be strengthened.[180] Despite the absence of a true 'global risk map'[181] and therefore with incomplete data on the relevant intermediaries, markets and exposures, a lot of progress has been made with systemic risk surveillance. Less progress has been with macroprudential regulation. Basel III, for example, primarily follows a microprudential approach, that is, one traditionally focused on the resilience of individual banks. In the words of Don Kohn (2015), there is a "'macroprudential finish' to standard microprudential tools".

The two main exceptions – i.e., the 'macroprudential finish' – are the countercyclical capital buffer and the capital surcharge for systemic institutions. Neither is addressed in the chapter that I am discussing. The macroprudential aspects that the chapter addresses are the default risk of systemic central clearing counterparties, perhaps some aspects of the US stress tests during the crisis and, in particular, the danger of risks migrating from highly regulated banks to less-regulated non-bank financial intermediaries. Given a relatively narrow regulatory perimeter, the authors recommend a very useful five-step procedure for preventing this regulatory arbitrage: 1) monitoring, 2) assessment, 3) regulation, 4) designation, and 5) supervision. Apart from the problem of many prudential authorities in the US highlighted by the authors, the two main challenges seem to me whether (i) all risks can be identified and properly assessed with incomplete data (in steps 1 and 2), and (ii) the democratic process will lead to the necessary regulation (in step 3).

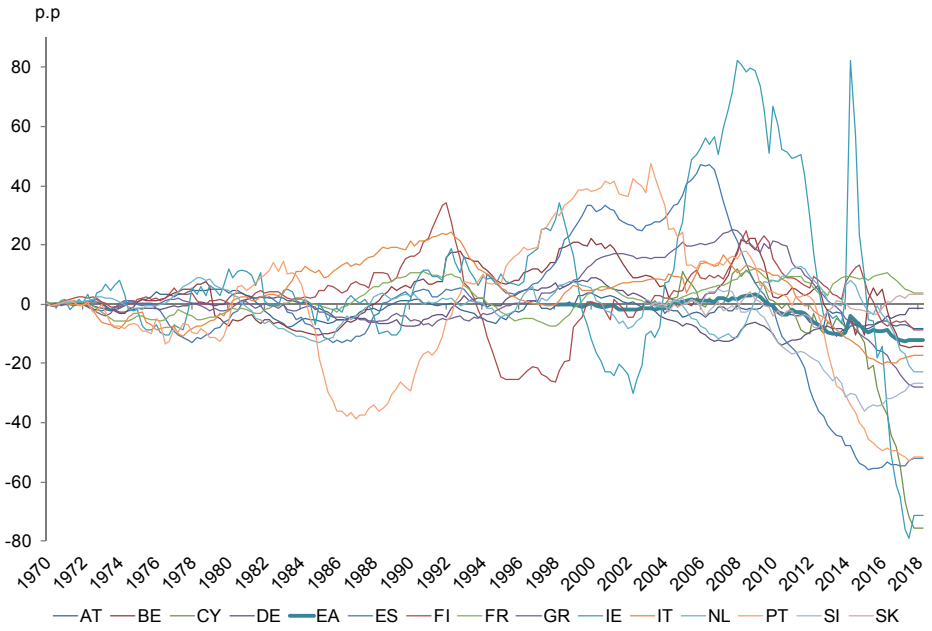
178 "We have left undone those things which we ought to have done; and we have done those things which we ought not to have done" (Book of Common Prayer 1715, The Order for Evening Prayer).

179 In Hartmann (2016) I have discussed – among others – a legal issue that is not often addressed in financial reform debates either, namely, the extent to which senior bank executives can be prosecuted by the courts for wrongdoings that contributed to the crisis.

180 See, for example, IMF (2009) and Caruana (2009).

181 See Issing and Krahnen (2009).

Figure 5.2 Basel credit-to-GDP gaps for euro area countries (percentage points)



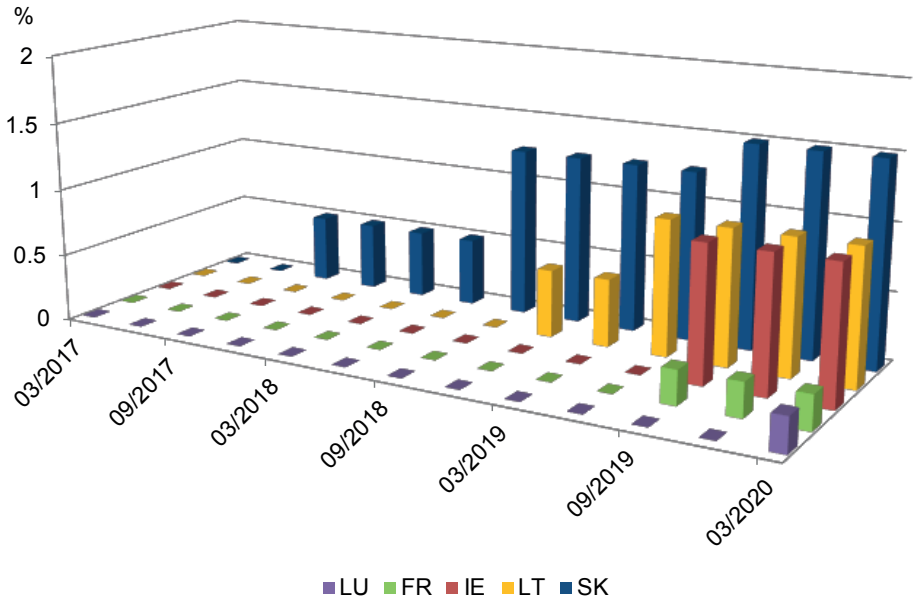
Note: EA: euro area.

Sources: ECB and ECB calculations.

Let me raise one point related to the Basel III countercyclical capital buffer (CCyB) that competent prudential authorities are currently wrestling with. As Figure 5.2 illustrates for 14 euro area countries, the credit-to-GDP gap that the Basel guidance (Basel Committee, 2010c) prescribes as the primary indicator for triggering and calibrating the CCyB has been negative in many countries for a number of years (and is likely to remain so for a while longer). This is a consequence of the specific implementation of the Hodrick-Prescott filter for identifying the trend component in the credit-to-GDP ratio, which is biased upwards if the estimation window contains a relatively long credit boom, and therefore the gap becomes biased downwards.[182] This could contribute to inaction in the application of this macroprudential tool. In case of late triggers, it could also lead to procyclical changes in bank capital. As a consequence, many authorities have developed, or are in the process of developing, their own indicator system for the CCyB. Very diverse systems could then contribute to inconsistent use of CCyBs across countries, in particular in highly integrated economic areas such as the European Banking Union. The issue then emerges of whether the Basel CCyB guidance should not be amended to embed the credit-to-GDP gap in a multiple or composite indicator approach.[183] Figure 5.3 shows the five euro area countries that (as of January 2019) have already enacted positive CCyB rates. The figure also displays how the rates evolve over time.

182 See Lang and Welz (2017).
183 See Detken et al. (2018).

Figure 5.3 Countercyclical capital buffers in the euro area



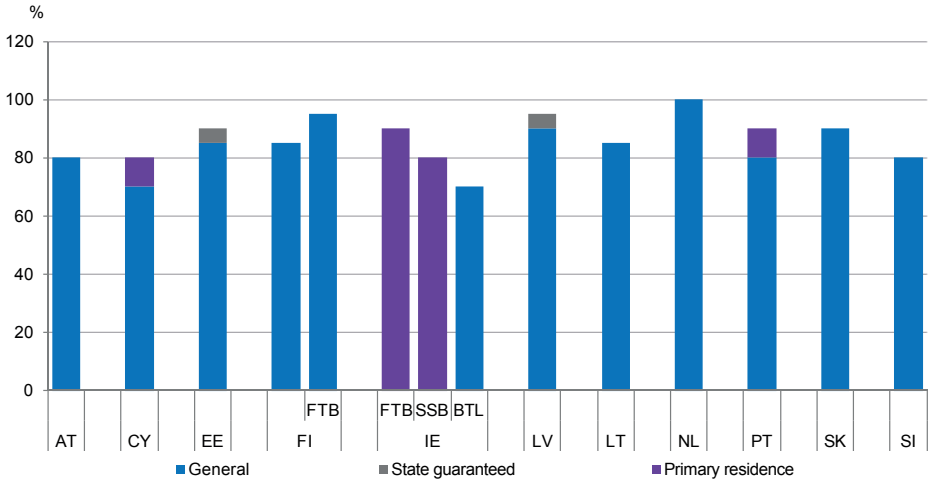
Notes: End of quarter buffers as enacted by January 2019.
Sources: National designated macroprudential authorities and ECB.

While enhancing individual banks' resilience, empirical research suggests that lender-based instruments (such as the CCyB or risk weights in capital requirements) do not effectively smoothen financial fluctuations. Borrower-based policy instruments, such as loan-to-value (LTV) limits, debt-(service)-to-income limits or amortisation rules, have been found to be more effective in this regard,[184] notably for leaning against real estate bubbles.[185] Against the background of rising real estate prices or credit quantities during the post-crisis recovery, a number of euro area countries have actively used such borrower-based macroprudential measures. Figure 5.4 shows a snapshot (as of January 2019) of the level of LTV limits in the euro area countries that have introduced them.

While such borrower-based measures emerge more and more as key macroprudential policy tools, they have not been part of the G20 reform agenda and are not discussed in this report. Nor have they found their way in the EU's prudential framework. Rather, individual countries established the necessary legislation when they believed they needed them. As more experience is gained, further quantitative impact assessments of these borrower-based macroprudential measures and their interaction with other policies would be extremely valuable.

184 See Lim et al. (2011), Claessens et al. (2013) and Kuttner and Shim (2013).
185 See Hartmann (2015) for the euro area experience with residential real estate cycles before and during the financial crisis as well as policy implications.

Figure 5.4 Loan-to-value limits for residential real estate loans in euro area countries



Notes: FTB=first-time buyers; SSB=second and subsequent buyers; BTL=buy to let. LTV limits in AT and PT are only recommendations. Status of January 2019.

Sources: National designated macroprudential authorities and ECB.

5.1.3 Before discarding the net stable funding ratio, it is worthwhile considering additional perspectives

The authors make an important point by directing attention to interactions between different reform elements. Given the urgency of getting the post-crisis re-regulation agenda done, these interactions have been relatively neglected. It is vital that ex-post reform assessments consider them seriously.

Building on previous work,[186] the authors focus on relationships between the different Basel III capital and liquidity ratios. They suggest that in a simple static bank balance sheet the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR) would be linked through an identity, making one of the two redundant. This leads to one of the strongest policy conclusions in the chapter – the recommendation to "discard the NSFR". Let me broaden this perspective by adding two considerations.

First, Perrotti (2018) has argued that in a dynamic framework with two different liquidity risk factors, one policy instrument may not be enough. For example, assume that there is one risk factor affecting the likelihood of being able to roll over short-term liabilities and another risk factor affecting the possibility of selling assets without large discounts. If these two liquidity risks are not strongly dependent, then one may need an NSFR-type regulation as protection against the former and an LCR-type regulation as protection against the latter. This is consistent with some unpublished empirical work done internally in the ECB showing that (i) euro area banks differ in which of the two ratios is binding,

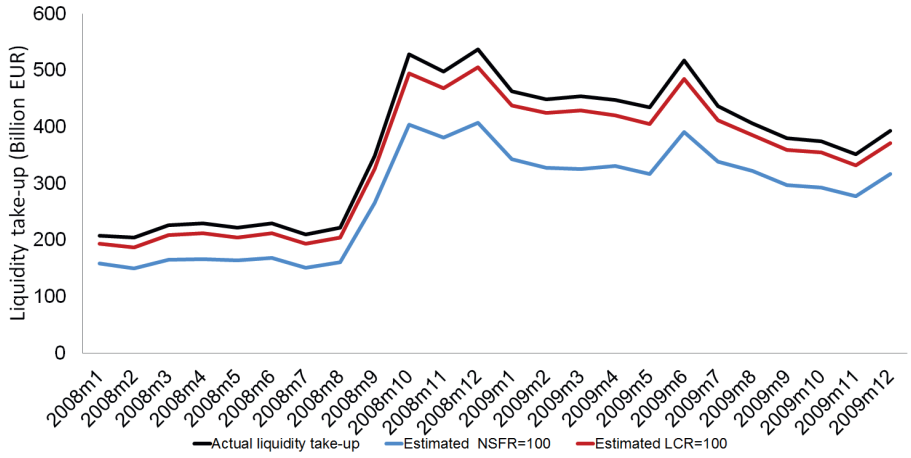
186 See Cecchetti and Kashyap (2018).

and (ii) there is material variation in both ratios left for the same bank after accounting for their positive correlation. These empirical findings may suggest that a simplified balance sheet omits some relevant items that weaken the relationship between the LCR and the NSFR.

Second, the crisis has stirred discomfort with the large amounts of liquidity that central banks have had to provide to private banks. The larger these amounts, the greater the risk that central banks incur losses, which means foregone seigniorage and, ultimately, taxpayers' money. In fact, there is evidence that during a crisis the credit quality of collateral deteriorates and the riskiest counterparties tend to draw the most from central banks.[187] Does the LCR, the NSFR, or both help in diminishing this risk? Figure 5.5 shows the results of counterfactual simulations by Hoerova et al. (2018) for the liquidity take-up from the ECB during 2008 and 2009. The black line shows the actual liquidity take-up observed, the red line shows the simulated take-up if there had been an LCR at the time, and the blue line if there had been an NSFR. While both ratios seem to provide some additional protection for central banks, the NSFR emerges as much more effective in this regard than the LCR.

In sum, while the relationship between both liquidity ratios is an important observation, one may want to consider additional arguments before discarding one or the other.

Figure 5.5 Euro area banks' recourse to ECB liquidity and estimated counterfactuals under a liquidity coverage ratio or a net stable funding ratio



Notes: Recourse covers total amounts for all ECB lending operations.

Sources: Hoerova et al. (2018), using ECB IBSI data (Individual Balance Sheet Items).

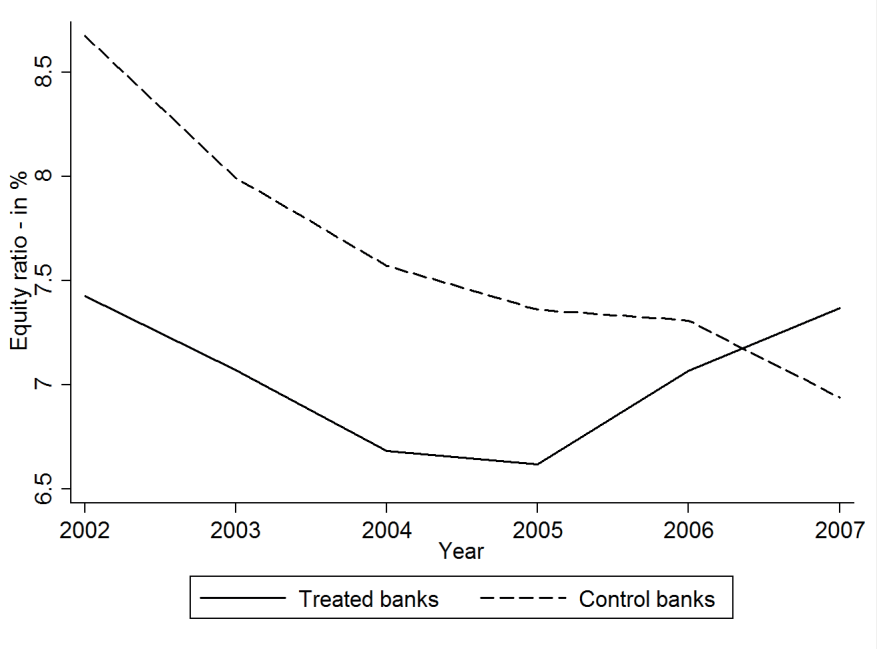
187 See Drechsler et al. (2016).

5.1.4 Removing the tax advantage of debt would promise tangible financial stability benefits

Let me close with another 'sin of omission' in regulatory reforms that is not mentioned in the report. As is well known, in many countries debt financing benefits from a more favourable tax treatment than equity financing. This promotes leverage and makes debt overhang problems more likely. In my view, this is a structural factor fostering system-wide financial stability risks. The few countries that have experimented with the removal of this tax advantage experienced financial stability benefits.

Figure 5.6 illustrates this, taking the example of Belgium. In 2006, Belgium (alone among EU countries) introduced an 'allowance for corporate equity', which basically added a similar tax advantage to equity as for debt. The solid line shows the evolution of the average equity ratio of 33 Belgian banks (treated banks). With the reform, the decline in Belgian banks' capitalisation reversed. The dashed line shows the average equity ratio for 99 non-Belgian EU banks (control group), whose capitalisation continued to decline after 2006. Schepens (2016) also confirms this resilience-enhancing effect with a rigorous regression approach.

Figure 5.6 Development of average bank equity in Europe around the removal of the debt tax advantage in Belgium



Notes: Treated are 33 Belgian banks that benefited from a tax allowance for corporate equity in 2006 and control banks are 99 other EU banks not affected by this change in Belgian tax policy. Equity ratios are defined as total equity over total assets.

Sources: Schepens (2016).

Of course, removing the tax advantage for debt also encounters a number of challenges that need to be addressed. For example, if the debt advantage is eliminated, then poorer households or small and medium-sized enterprises may find it more difficult to procure funding. If a similar advantage is introduced for equity, then tax revenues may decline. Interestingly, the Common Consolidated Corporate Tax Base proposal under the European Capital Markets Union project includes an 'allowance for growth and investment' that puts deductions for debt and equity on a similar footing.[188]

5.1.5 Concluding remarks

As the authors point out, the regulatory reforms over the last ten years have made banks undoubtedly safer. At the same time, I would argue that the macroprudential dimension of financial regulation and supervision remains very much a work in progress. Much more needs to be done in this regard. Note that, if done right, this does not imply more regulation, because better stabilising the system should allow less-intrusive regulation of non-systemic intermediaries. The authors' point about the risk of regulatory arbitrage to non-bank financial intermediation is one aspect of this, but there are many others – including for Basel III bank regulation and supervision, which remains primarily microprudential.

Moreover, we are missing at present (notably empirical) impact assessments of the overall risk and growth implications of the entirety of the reforms, including consideration of the interactions between different reform branches. There is an increasing number of impact assessments for single reforms[189] or small subsets of reforms.[190] This is understandable, given that parts of the G20 package are still in the process of being implemented (see Figure 5.1). In the not-too-distant future, however, early ex-ante assessments of key reforms, such as Basel III capital and liquidity regulations,[191] should be complemented with ex-post assessments of the extent to which expectations have been met. And these ex-post assessments should clearly go beyond bank capital and liquidity.

The authors make a nice conceptual contribution to the assessment debate. In my discussion I mainly try to complement this by focusing on areas that they emphasise less. But I also call for a broadening of the perspective on the substitutability or complementarity of the two Basel III liquidity ratios.

Writing all this, I am of course well aware that after a decade of intensive reforms, the regulatory cycle has turned to implementation and assessment. This means that many of the points I make here about how prudential policy should be further developed will likely be for another time.

188 See European Commission (2016).
189 See, for example, Crump and Santos (2018).
190 See, for example, Hoerova et al. (2018); see also the Financial Stability Board's reporting on the effects of reforms (http://www.fsb.org/work-of-the-fsb/implementation-monitoring/effects-of-reforms/). Over time, there have been a number of interim assessments (e.g., Duffie, 2016; Evanoff et al., 2016).
191 See Macroeconomic Assessment Group (2010) and Basel Committee (2010b).

5.2 Discussion of Chapter 3 by Fernando Restoy: The new bank resolution framework: Will it work?[192]

This chapter provides a comprehensive overview of the new resolution framework put in place in major jurisdictions after the global financial crisis, explains the rationale behind it and discusses a number of policy issues arising from the practical application of the new rules. The main focus is on the US, but the chapter also contains useful references to the European arrangements.

In particular, the chapter comments on:

- challenges faced by crisis management frameworks before and after the crisis,
- arrangements for cross-border resolution,
- provision of liquidity in resolution, and
- isues relating to small and medium-sized banks.

In this discussion I will comment on those four topics. However, I will start with an introductory note on the characteristics of the different policy regimes referred to in the chapter, which I trust will help shed additional light on the policy discussion.

5.2.1 Characterisation of policy regimes

Table 5.1 provides an overview of different policy approaches to dealing with failing banks. Before the crisis, those approaches fundamentally comprised of ad hoc bailouts, the application of regular insolvency regimes under corporate law and the implementation of bank-specific administrative regimes for failing institutions. These three approaches were used to manage the failure of banks in both the US and Europe. After the crisis, most advanced economies put in place new resolution regimes for systemically important institutions.

Regimes differ in many aspects, including objectives (e.g., either the liquidation or the continuity of a company or its critical functions) and targets (e.g., legal entities or banking groups). They also have different technical features, such as a temporary suspension of the exercise of termination rights under qualified financial contracts[193] (for example, swaps or repos) or the availability of administrative instruments (such as purchase-and-assumption operations) that may preserve the value of the failing institution. More importantly, different regimes entail different options for imposing losses on creditors (bail-in) or obtaining financial support from treasuries or deposit insurance funds (DIFs).

The first two approaches – bailout or liquidation under regulator insolvency proceedings – involve opposing options for authorities: they can either use public funds to protect all or a large part of banks' liabilities, or accept the winding-up of the institutions (including their critical functions) and the imposition of losses on all creditors (except those protected by the DIFs).

192 I am grateful to Patrizia Baudino, Jean-Philippe Svoronos and Ruth Walters for helpful comments and to Christina Paavola for very useful support.

193 Qualified financial contracts (QFCs) in the US terminology.

Table 5.1 Policy regimes to deal with bank failures

	US	EU	Objective	Target	Temporary stay	Admin. instruments (P&A, bridge bank, etc.)	Bail-in	Public (including DIF) support
Before GFC								
Ad hoc bailouts	✓	✓	Preservation of the bank	Group	n/a	No	No	Yes
Regular insolvency	✓ Chapter 11	✓ Domestic	Exit	Entity	No	No	Yes	No
Specialised regimes	✓	✓	Exit	Entity	Yes	Yes	Limited	Yes/limited
After GFC								
Resolution regimes	✓ OLA, T2-DFA	✓ (BRRD-SRM)	Preservation of critical functions	Group	Yes	Yes	Yes	No/limited

Note: GFC = global financial crisis.

Some specialised regimes – such as the US receivership model – constitute an intermediate option. In these regimes, administrative authorities (typically the deposit insurer) are given powers to split the bank. Specific assets and liabilities – including deposits – would be sold to one or more suitable acquirers, possibly with some financial public support. The remaining assets and liabilities would be wound up. While this regime was frequently used in the US during the crisis, in Europe there is no common administrative regime along these lines. In some European jurisdictions, however, the national DIF has traditionally played an active role in managing a crisis of specific banks with the support of funds contributed by the industry.

The new resolution framework is set out in Title 2 of the Dodd-Frank Act in the US, and the Bank Recovery and Resolution Directive (BRRD) in the EU, in conformity with the international standards developed by the Financial Stability Board. That framework builds on existing bank-specific insolvency regimes but enlarges the powers of administrative authorities to deal with crises of banking groups as a whole, to preserve their critical functions and to minimise external support by bailing-in creditors when needed. The latter is accompanied by the ability to impose minimum requirements for bail-inable liabilities (TLAC or MREL) that would be available to absorb losses and recapitalise failing institutions when need to be resolved.

5.2.3 Challenges faced by crisis management frameworks

The chapter emphasises a series of deficiencies of the regimes in place before the crisis. In particular, in the US the absence of a stay for early termination rights for QFCs under the regular insolvency regime (Chapter 11) constituted a major obstacle to managing crises of institutions (such as investment banks) that were not eligible for FDIC receivership. Moreover, FDIC receivership, which seeks the transfer of selected assets and liabilities from failing banks to a suitable acquirer through a purchase-and-assumption transaction, was not suitable for large systemic banks. In the EU, the absence of a bank-specific administrative regime (like FDIC receivership) at the EU level and in most countries severely constrained authorities' ability to manage bank crises without relying on bailouts.

It could be added that both regular and bank-specific insolvency arrangements before the crisis focused on ensuring orderly exit rather than preserving critical functions through options other than the sale of the institution to a larger one. Moreover, both types of regime focused on individual legal entities rather than on group approaches, and therefore lacked effective procedures to address crises of complex banking groups.

The new resolution framework aims at correcting these deficiencies. It focuses on the preservation of banks' critical functions, facilitates the resolution of groups rather than legal entities through a single point of entry (SPOE) structure, allows for a temporary stay on early termination rights in financial contracts, and gives administrative authorities a suite of instruments to achieve financial stability objectives. Those tools include purchase-and-assumption transactions, bridge banks and bail-in, and can be applied to both failing deposit-taking entities and bank holding companies.

A key issue in the discussion is the remaining scope in the new crisis management framework for public support in case this is needed to preserve financial stability.

In the US, under Dodd-Frank there is, in principle, no scope to support the solvency of failing large banks in any form, although liquidity aid could be provided by a fund contributed by the industry with a Treasury backstop. More scope remains in the case of deposit-taking institutions under the FDIC receivership model, as acquirers of failing banks could receive support from the FDIC – for example, in the form of cash or loan-loss guarantees – provided that the expected cost of that support is lower than all the other options, including pay-out of insured deposits and liquidation of the bank (the least-cost principle).

Likewise, in the EU the possibility of obtaining public support is severely restricted under the BRRD. Support from the resolution fund contributed by the industry is only available after the bail-in of at least 8% of the total liabilities of the failing bank. As seen recently in the crisis of two Italian banks, the possibility remains to provide support to smaller institutions that are not eligible for resolution, without minimum bail-in requirements, under domestic insolvency regimes, subject to the state aid restrictions specified by the European Commission.

Therefore, somewhat paradoxically, in both the US and EU there seems to be, in principle, less flexibility to deal with crises of larger banks – even if they would be systemic by definition – than to ensure an orderly exit of small non-systemic institutions.

Whether the new framework would allow systemic crises to be dealt with effectively is a matter for discussion. In any case, that would depend very much on authorities' ability and willingness to ensure the effective execution of their bail-in powers and the availability of a sufficient amount bail-inable securities. In that regard, it is somewhat disappointing that around half of the FSB jurisdictions have not yet included bail-in powers in their resolution regimes (FSB, 2018).

In addition, in order to be effective, the new resolution framework requires two important technical issues to be resolved. First, mechanisms must be developed that ensure an adequate distribution of the available resources within the complex banking groups to cover losses and capital deficits wherever they emerge. Second, liquidity facilities must be established to enable the continuity of operations of banks in resolution. These issues are covered in the next two sections.

5.2.4 Cross-border arrangements

The chapter provides a good overview of the challenges faced with regard to bank resolution in a cross-border context. In particular, host authorities have strong incentives to ensure that sufficient loss-absorption capacity is located at the subsidiary level (ring-fencing), thereby constraining international groups' flexibility to distribute their resources in different units within the groups. It also outlines the trade-offs between the two prevailing resolution strategies: single point of entry and multiple point of entry. The former allows the bank to decide where to issue the required TLAC instruments for the whole group as long as resources could be transferred to subsidiaries in trouble. The latter requires banking groups to issue TLAC instruments at the level of each resolution entity within the group. SPOE certainly allows assets and liabilities to be managed more effectively. By contrast, MPOE facilitates smoother management of the failure of local subsidiaries by not relying on a potentially uncertain transfer of resources within the group.

However, it could be added that the choice between adoption of SPOE or MPOE strategies does not depend only on the preferences of home or host authorities. The selection is also related to the business model of international groups. Some (such as Santander or HSBC) follow a corporate strategy in which subsidiaries are typically funded locally in the domestic currency. That model is more consistent with an MPOE, rather than an SPOOE, resolution strategy.

More importantly, while in theory SPOE and MPOE appear to be opposing models, in practice differences are likely to be less marked. The chapter rightly mentions the obligation imposed by some host jurisdictions (such as the US) for foreign groups to establish an intermediate holding company (IHC) which acts as an SPOE for the resolution of the subsidiaries located in that jurisdiction and must meet TLAC requirements in respect of the sub-group. Subsidiaries of international groups following a theoretical SPOE strategy would be resolved by the host resolution authority as if they were an MPOE sub-group in the jurisdictions requiring the creation of an IHC.

More generally, it is important to stress the role of internal TLAC (ITLAC) in SPOE strategies. The TLAC standard envisages that a large part of TLAC requirements should be prepositioned in the operating subsidiaries. Those prepositioned resources should be calibrated at between 75% and 90% of the TLAC requirements that would apply to the subsidiary if it had to satisfy them on a solo basis. That would be achieved by requiring subsidiaries to issue ITLAC, i.e., bail-inable claims directly or indirectly to the resolution entity (typically, the top group holding company) that could be converted into equity if mandated by host authorities.[194]

That mechanism ensures that resources could be down-streamed within the group in case of the crisis of a legal entity. At the same time, if ITLAC is excessively large, flexibility to allocate resources within the group would consequently be reduced. At the limit, ITLAC of around 100% of the required resources at the subsidiary level would be equivalent in effect to an MPOE model where all resolution entities should satisfy their own loss absorbency requirements. Developments in a few relevant jurisdictions point to ITLAC requirements that are at, or close to, the upper 90% bound.

It follows that either through the adoption of MPOE strategies or through SPOE strategies with large internal TLAC requirements, resolution actions are likely to be carried out predominantly at the local entity level rather than the group level. That would no doubt help host authorities to preserve financial stability by containing risks associated with the transfer of resources from the parent company to the subsidiaries. By the same token, it introduces rigidities for the management of international groups that could weaken incentives for cross-border banking.

194 The TLAC term sheet specifies that the trigger for the activation of ITLAC resides with the host authority, although for instruments that do not count as regulatory capital the consent of the home authority should be sought. However, in the absence of such consent, the host authority always has the option to put the subsidiary into resolution and apply statutory bail-in to the ITLAC.

5.2.5 Liquidity in resolution

The chapter also digs into one of the main challenges associated with bank crisis management: the provision of liquidity for banks in resolution.

In the US, relevant normative actions have been taken to ensure that banks subject to resolution or insolvency would have sufficient liquidity to continue operating. Indeed, banks must design resolution plans ('living wills') that would preserve their key functions even if the bank were subject to Chapter 11 and facilitate the provision of additional liquidity if needed by debtors in possession. Moreover, new protocols (to the ISDA Master Agreement) could prevent disorderly activation of early termination rights under QFCs that could trigger destabilising spirals.

Yet, as banks in resolution would always be subject to the threat of a run, the provision of external liquidity support cannot be ruled out. This is the rationale behind the creation in T2-DFA of the Orderly Liquidation Fund (OLF) with a backstop provided by the US Treasury.

In the European Banking Union, the framework for liquidity support in resolution is not yet fully developed. While the Single Resolution Fund could provide loans to banks in resolution, its resources are clearly insufficient for liquidity always to be available on the required scale. An agreement has recently been reached for the European Stability Mechanism to provide the SRF with additional funds. However, the exact terms and conditions, including maximum size of that support, are still to be developed.

In any case, the sufficiency of the current arrangements to confront situations of severe liquidity stress in banks in resolution is still to be tested. In principle, the maximum amount that the OLF could lend to failing US institutions should not exceed 10% of their balance sheet. In the SSM, the maximum amount that could be provided by the SRF, even considering the ESM backstop, is unlikely to exceed that limit. Recent episodes of bank runs – such as that on Banco Popular Español in 2017 – suggest that it is not inconceivable that a large amount of liquidity support could be necessary if the resolution process of large institutions could not be successfully finalised within a short period of time.

In that context, as a general feature of crisis management regimes, the establishment of a special central bank liquidity facility for banks in resolution, along the lines of the Bank of England's Resolution Liquidity Framework, may need to be considered. That facility foresees the availability of liquidity support against a wide range of collateral and the possibility for the Bank of England to obtain, in specific circumstances, an indemnity from the UK Treasury.

5.2.6 Small and medium-sized banks

The chapter devotes a section to the specific challenges arising in the resolution or winding-up of small and medium-sized banks. I would stress that this issue is significantly more pressing in the EU.

I would not contend that the resolution of Banco Popular is in any way illustrative of how the European resolution framework would normally operate in practice. The availability of a buyer at a moderate negative price that could be covered by a limited bail-in of the few existing subordinated liabilities is unlikely to happen in most crisis situations.

The new resolution framework essentially entails ensuring the orderly restructuring or winding-up of failing institutions with no, or very limited, involvement of taxpayers. The most relevant way to achieve this target is by entrusting an administrative authority with the power to bail in creditors in order to absorb losses and provide the capital required to preserve the critical functions of the failing bank.

In order for the bail-in tool to function effectively, banks should have on their balance sheets a sufficient amount of bail-inable liabilities, i.e., instruments that could be smoothly written down or converted into equity in resolution. Ideally, those instruments would be either equity or subordinated debt instruments whose loss-absorption characteristics in resolution would be fully transparent to all investors. This is the main rationale behind the TLAC and MREL requirements.

In general, the issuance of those instruments does not constitute a major obstacle for large international banks with regular access to capital markets. However, it may be a challenge for smaller institutions whose business model is focused on providing services to retail customers with limited activity in capital markets and which are typically financed by capital and deposits.

In the US, the new resolution regime – the Orderly Liquidation Authority in T2-DFA – only targets large systemic banking groups through their bank holding companies. Because the Dodd-Frank Act imposes a strict prohibition on external solvency support in case of failure, those bank holding companies must satisfy stringent TLAC requirements.

The smaller US institutions remain subject to the regime established by the FDI Act. As noted above, this regime provides for FDIC receivership, under which an orderly exit of failing banks through purchase-and-assumption transactions is possible. Those transactions could be facilitated by support from the DIF, if that is consistent with the least-cost principle. That support could consist in loan-loss guarantees, loss sharing arrangements or outright payments to the acquirer. That regime has been applied to deal with the crises of around 500 banks since 2007.[195]

In the EU, the approach to implementing the new resolution framework has been quite different. The new regime, as established by the BRRD and the SRM Regulation, is applied to any bank meeting a relatively general 'public interest' criterion. Although the definition of public interest is not fully spelled out, it is currently accepted that most significant banks (around 130 institutions, with a balance sheet above €30 billion) which are directly supervised by the ECB and fall under the SRB remit would meet that criterion.[196] That means that, unlike in the US, a large set of banks, including a number of mid-sized institutions, would be subject to the new framework, which establishes strict conditions for accessing external resolution funds – including a minimum bail-in of 8% of total liabilities – and stringent MREL requirements.

195 See FDIC (2017).

196 The prevailing notion is that the public interest criterion is met if the failing institution performs critical functions. According to Commission Delegated Regulation (EU) 2016/778: "a function should be considered critical where it fulfils both of the following: (a) the function is provided by an institution to third parties not affiliated to the institution or group; and (b) the sudden disruption of that function would likely have a material negative impact on the third parties, give rise to contagion or undermine the general confidence of market participants…"

The failure of smaller institutions – which do not meet the conditions for resolution – would not be managed through any common European framework but through domestic insolvency regimes.197 A recent study by the Financial Stability Institute[198] shows that domestic insolvency regimes in European countries are very heterogeneous but are often not bank-specific, tend to be court-based and do not normally envisage P&A transactions.

It is therefore the case that in the EU there are no sufficiently effective ways to deal smoothly with crises of mid-sized banks whose winding-up could have a systemic impact but which are unable to meet the strict conditions (i.e., sizeable MREL) required by the new resolution framework.[199] Indeed, there is a clear need to develop bank-specific administrative insolvency regimes for banks not subject to resolution. The essential ingredients of that framework are: (i) a clear objective to ensure an orderly exit based on purchase-and-assumption transactions, similar to the US model; (ii) the imposition of moderate loss-absorption requirements (MREL); and (iii) the potential availability of some forms of (public) support, subject to state aid rules.[200]

Ideally, that would amount to putting in place a European FDIC-like regime. In the short term, however, it could be more realistic – albeit certainly sub-optimal from a technical point of view – to promote adoption at the national level of administrative regimes based on common guidelines, to be established at the European level. In that regard, the domestic regime recently adopted by the Italian authorities – in agreement with European officials – at the time of the crisis of two mid-sized banks that failed last year and were not considered eligible for resolution could constitute a useful reference.

5.2.7 Final remarks

The new resolution framework developed after the financial crisis constitutes a major step forward in minimising the impact of the failure of systemic institutions with limited (or no) taxpayer involvement.

Certainly, much is to be gained by relying on administrative authorities rather than the courts to manage bank failures. At the same time, it is essential that those authorities be endowed with a suite of effective powers and, in particular, with the ability to impose loss absorption on unsecured creditors.

Yet we must acknowledge that the new framework is still to be tested in practice and that much remains to be done to make it fully operational, particularly in a cross-border context. Indeed, we have already observed serious implementation obstacles – mostly associated with the application of the bail-in tool. Challenges appear particularly pronounced in Europe. The absence thus far of a suitable facility for providing liquidity to banks in resolution and the lack of an effective regime to deal with crises of medium-sized institutions are deficiencies of the European crisis management framework that deserve swift corrective action.

197 See König (2018).
198 See Baudino et al. (2018).
199 See Restoy (2016, 2018a).
200 See Restoy (2018b).

5.3 Discussion of Chapter 4 by John Vickers: An enlarged role for central banks

Twenty years ago, when I was at the Bank of England, it had just become a monetary policy factory. The Bank's role was enlarged in that its Monetary Policy Committee now had the power to set the official interest rate, subject to an inflation target set by the government. But in another sense the Bank's role had been narrowed, because bank supervision had moved to the new Financial Services Authority, and a separate Debt Management Office had been created.

In the decade since the crisis, however, the Bank of England's role has been both enlarged and expanded, with prudential regulation returning to the Bank, the advent of macroprudential regulation, and an enormously expanded central bank balance sheet as monetary policy has entered new territory. Although the institutional arrangements differ, especially in the euro area, much the same is true for other central banks, as this chapter documents. Central bank power has grown, but independence is not what it was, and central banks now face risks – both political and economic – that were not anticipated before the crisis hit.

The following comments, which are more complementary to than critical of the chapter under discussion, are organised under three headings – monetary/fiscal policy coordination, macroprudential regulation, and prudential regulation.

5.3.1 Monetary/fiscal policy coordination

Before the crisis, monetary and fiscal policy in advanced economies seemed pretty much independent. The central bank would adjust the short-term interest rate to keep consumer price inflation close to an (explicit or implicit) target in the region of 2%. During my spell at the Bank of England, the nominal interest rate ranged from 5% to 7.5%, so the short-term (and longer-term) real rate was typically 3% plus. Central bank balance sheets were comparatively small, with most liabilities in the form of currency, not interest-bearing. Fiscal policy had become more aimed at medium-run stability than short-term demand management, but the automatic stabilisers would move with the cycle. Debt-to-GDP ratios were not especially high, at least if liabilities such as unfunded state pension promised were left out of account. The UK ratio, for example, was below 40%, so the impact of monetary policy on debt service costs was limited.

Of course, monetary and fiscal policy could not be wholly independent, because "every monetary policy action has fiscal consequences".[201] This can be illustrated by the relationship between the real value of the nominal debt of the consolidated government sector (including the central bank) and the expected present value of future primary surpluses – i.e., fiscal surpluses excluding debt service payments – as represented schematically by:

$$(B + M)/P = \mathrm{EPV}(s) \tag{1}$$

where B is nominal debt, M is the monetary base, P is the price level, and s denotes the (stochastic) vector of future primary surpluses, appropriately (and stochastically) discounted. Relationships such as (1) appear in analyses ranging from those of Willem Buiter to John Cochrane. How to interpret them is hotly contested, and not a topic that I dare venture into.

201 Sims (2016).

Until the crisis, *M* might not have figured on the left-hand side of (1). Indeed, the seignorage from non-interest-bearing money, if material, might have been added to the primary surpluses on the right-hand side. But now the monetary base is far larger thanks to quantitative easing, and the bulk of it consists of interest-bearing reserves at the central bank. Moreover, with bond yields at such low levels (as I write, the ten-year bund yield is sub-zero), the economic distinction between *M* and *B* has narrowed.

The crisis was very negative for current and near-term primary surpluses. In addition to the large contingent cost of bank bailouts, the automatic stabilisers and fiscal stimulus kicked in. As negative *s* passed through the system, the numerator of the left-hand side of (1) rose sharply and *M* became much more significant than historically, but the path of *P* was stable, in some economies lower than expected or intended. Finance ministries stressed – sometimes in terms labelled 'austerity' – with varying degrees of success that *s* in the further future would resume a stable trajectory.

A drag on the expected present value of future surpluses, including beyond the short run, is the (repeated) downgrading of estimates of future productivity growth. Quite how much long-run damage the crisis has done to the supply side is an important question. By any measure the answer would seem to be a lot. But assuming that future primary surpluses are generally positive, the lowering of real discount rates has been positive for expected present value(*s*). In the usual shorthand, (*r*–*g*) matters greatly for fiscal sustainability, and both terms have dropped post-crisis. Sensitivity to a rise in *r* might be an issue for the future.

The chapter questions whether the unconventional monetary policies adopted post-crisis were part of an optimal policy mix, the suggestion being that policy coordination involving greater use of fiscal policy was frustrated by the independence status of central banks. That is more plausible for some countries/regions than others. For institutional reasons, there was less scope for coordination in the euro area than in, say, the UK.

Would better coordination have made much difference? Arguably, both fiscal and monetary policy were being pushed to the maximum extent that policymakers judged feasible given the zero lower bound on interest rates and concerns over fiscal sustainability (as per equation (1)). The latter concerns were by no means fanciful. Before Mario Draghi's "whatever it takes" speech in July 2012 – a remark that presumably reflected coordination with political leaders behind the scenes – the spread on Spanish and Italian (never mind Greek, etc.) ten-year bonds relative to bunds was around 5%. This implies market perceptions of very considerable sovereign risk for major European states, exacerbated by sovereign exposure to weak banking sectors. There was more fiscal room for manoeuvre in some economies but that is easier to say with hindsight than may have appeared at the time. One aspect of hindsight is unusually low inflation in some economies. Sims's macro policy recommendation with monetary policy at the zero lower bound is fiscal expansion financed by future inflation. As *P* in the denominator of the left-hand side of (1) reflects, unusually and unexpectedly low inflation is in part a fiscal issue.

5.3.2 Macroprudential regulation

As the chapter argues, the new tool of counter-cyclical macroprudential regulation is so close to monetary policy that central bank involvement, one way or the other, is inevitable. Despite the potential political sensitivity of some aspects of that policy, I am with those who would house it under the same roof as monetary policy – i.e., that of the central bank.

We are in early days, but so far there has been more talk than action on macroprudential policy. One of its central components, the counter-cyclical capital buffer (CCyB), has been used in the Switzerland, Iceland, Norway and Sweden, and to a lesser degree in the UK, but elsewhere it hugs the zero lower bound. This notwithstanding indicators that the overall financial cycle is not exactly subdued.

There are indeed grounds for concern that the CCyB policy instrument has overall not been positive for financial stability. Its availability has been cited, not least by the Bank of England, as a reason for lowering the baseline capital requirements for major banks, on the grounds that the CCyB can be raised ahead of times of need for enhanced loss-absorbency. This is a remarkably rosy view of the agility and foresight with which a largely untried and untested policy tool can be used. Crises tend to be unanticipated, which is part of why they are crises. And if the CCyB tool goes largely unused, while softening the general (i.e., non-cyclical) stance of capital regulation, it is at best a very mixed blessing.

5.3.3 Prudential regulation

This leads naturally to the question of whether bank regulation generally should be under the wing of the central bank, part of its enlarged role. On one view, just as the proximity of macroprudential regulation to monetary policy argues for them to belong under the same roof, so too for bank regulation and macroprudential regulation. In which case they all become housed together, albeit with careful governance arrangements (as the chapter details approvingly for the UK).

Another view fears the potential contamination of monetary policy from bank regulation, whether fiscally or reputationally. The fiscal risk is from costly bank rescues, even if the accounting treatment puts them off the central bank balance sheet. The reputational risk is, put bluntly, that the reputation of the central bank is all-important, that banking crises are inevitable but fatal to the reputation of whoever is in charge of bank regulation, and so that had better not be the central bank.

There is no theorem that stipulates the uniquely optimal institutional architecture, but I share the authors' broadly positive view of the arrangements that have developed in the UK since the crisis for the relationship between the central bank and the finance ministry (HM Treasury, 2018), and between the elements now under the roof of the central bank.

A mystery, however, is why the Bank of England and its central bank counterparts internationally are not pressing for stronger capital regulation of banks. I will not rehearse here the reasons for believing that the Basel III settlement, and its modest enhancement for globally systemic institutions, falls well short of what the public interest requires (e.g., Vickers 2016, 2018). But some comments are in order on the associated heightening of risks to central banks, and their independence, from that laxity of regulation.

First, undercapitalised banks weaken the transmission mechanism of monetary policy, the core central bank function. They also weigh on productivity performance by gumming up the process of capital allocation in the economy.

Second, LOLR dilemmas are greater when the capital resilience of banks is insecure. There is only so much collateral to go round, and the more that is (pre-) pledged to the central bank, the less there is to back other exposures. Yet without ample, sharply haircut collateral, acting as lender of last resort puts central banks at risk, even if losses are on the account of the finance ministry.

Third and relatedly, there is the reputational risk mentioned above. Another banking crisis, within living memory of 2008, would be immensely damaging to central banks, all the more so given the reassuring tone projected by leading central bankers about Basel III. For example, the oft-repeated line that capital requirements are now ten times higher than pre-crisis is far from reassuring to anyone who knows the (very narrow) sense in which it is true. And, despite the lessons of a decade ago, apparent official faith in accounting measures of bank capital, upon which the regulator edifice including stress tests is built, is surprising when market evaluation of capital has price-to-book ratios well below one for a number of major institutions in Europe and elsewhere.

Finally, there is the balance sheet risk of the central bank itself. This was a non-issue 20 years ago, but following quantitative easing, central bank balance sheets – directly or indirectly[202] – have not only grown hugely but with interest on reserves have opened up asset/liability maturity mismatch risks on top of those that may occasionally arise from LOLR support. For Sims (2016), this development poses risks to independence and is not benign.

His wider theme, as in this chapter, is a point on which to conclude. In the macroeconomic, monetary and financial conditions a decade on from the crisis, "preserving independence requires forthrightly recognising the need for coordination".

202 As with the UK's Asset Purchase Facility, which the Chancellor of the Exchequer authorised the Bank of England to establish in 2009.

References

Acharya, V.V., T. Eisert, C. Eufinger and C. W. Hirsch (2017), "Whatever It Takes: The Real Effects of Unconventional Monetary Policy", CEPR Discussion Paper 12005.

Admati, A. and M. Hellwig (2013), *The Bankers' New Clothes: What's Wrong With Banking and What to Do About It*, Princeton University Press.

Aghion, P., O. Hart and J. Moore (1992), "The Economics of Bankruptcy Reform", *Journal of Law, Economics and Organization* 8: 523-546.

Aghion, P., P. Bolton and M. Dewatripont (2000), "Contagious Bank Failures in a Free Banking System", *European Economic Review* 44(4-6): 713-718.

Aikman, D., J. Bridges, A. Kashyap and C. Siegert (2018), "Would Macroprudential Regulation Have Prevented the Last Crisis?", Bank of England Staff Working Paper 747.

Avdjiev, S., B. Bogdanova, P. Bolton, W. Jiang and A. Kartasheva (2017), "CoCo Issuance and Bank Fragility," BIS Working Paper No. 678.

Bacchetta, P. (2017), "Is Swiss Public Debt too Small", in *Monetary Economic Issues Today*, Orell Füssli Verlag AG.

Bagehot, W. (1873), *Lombard Street: A Description of the Money Market*, John Wiley and Sons.

Bank for International Settlements (2016), *Annual Report 2016*.

Bank of England (2015), "The Bank of England's Sterling Monetary Framework", updated June 2015.

Bank of England (2017), *Financial Stability Report,* November.

Bank of England, Prudential Regulatory Authority (2013), "Designation of Investment Firms for prudential Supervision by the Prudential Regulation Authority," March 2013.

Basel Committee on Banking Supervision (2010a), "Compensation Principles and Standards Assessment Methodology", January.

_____ (2010b), "An Assessment of the Long-Term Economic Impact of Stronger Capital and Liquidity Requirements", August.

_____ (2010c), "Guidance for National Authorities Operating the Countercyclical Capital Buffer", December.

_____ (2011), "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems - Revised Version June 2011", June.

_____ (2013a), "Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools", January.

_____ (2013b), "Regulatory Consistency Assessment Programme (RCAP) - Analysis of Risk-Weighted Assets for Credit Risk in the Banking Book", July.

_____ (2014), "Basel III: The Net Stable Funding Ratio", October.

_____ (2017a), *Supervisory and Bank Stress Testing: Range of Practices*, December.

_____ (2017b), *Basel III: Finalising Post-Crisis Reforms*, December.

_____ (2018), *Basel* III Monitoring Report, October.

_____ (2019), "Basel III Monitoring Report", March.

Baudino, P., A. Gagliano, E. Rulli and R. Walters (2018), "How to Manage Failures of Non-Systemic Banks? A Review of Country Practices", FSI Insights on policy implementation 10, Bank for International Settlements.

Bean C., M. Paustian, A. Penalver and T. Taylor (2010), "Monetary Policy after the Fall", Federal Reserve Bank of Kansas City.

Berger, B., P. Hüttl and S. Merler (2016), "Total Assets Versus Risk-weighted Assets: Does it matter for MREL?", Bruegel Policy Contribution 2016/12.

Bernanke, B.S. (2005), "The Global Saving Glut and the U.S. Current Account Deficit", Sandridge Lecture, Virginia Association of Economists, Richmond, VA, May.

Bernanke, B.S (2015), *The Courage to Act: A Memoir of a Crisis and its Aftermath*, W.W. Norton & Company.

Bernanke B.S, T.F. Geithner and H. M. Paulson, Jr. (2018), "What We Need to Fight the Next Financial Crisis", *The New York Times*, 7 September.

Berner, R., S.G. Cecchetti and K. Schoenholtz (2019), "Stress Testing Networks: The Case of Central Counterparties", CEPR Discussion Paper 13604.

Bisias, D., M. Flood, A. W. Lo, and S. Valavanis (2012), "A Survey of Systemic Risk Analytics", *Annual Review of Financial Economics* 4: 255-296.

Bolton, P. and X. Freixas (2000), "Equity, Bonds, and Bank Debt: Capital Structure and Financial Market Equilibrium under Asymmetric Information", *Journal of Political Economy* 108: 324-351.

Bolton, P. and X. Freixas (2006), "Corporate Finance and the Monetary Transmission Mechanism", *Review of Financial Studies* 19: 829-870.

Bolton, P. and M. Oehmke (2015), "Should Derivatives be Privileged in Bankruptcy?", *Journal of Finance* 70(6): 2353–94.

Bolton, P. and M. Oehmke (2019), "Bank Resolution and the Structure of Global Banks", *Review of Financial Studies* (forthcoming).

Borio, C., R. McCauley and P. McGuire (2017), "FX Swaps and Forwards: Missing Global Debt?", *BIS Quarterly Review*, September.

Brownlees, C.T. and R.F. Engle (2017), "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk", *The Review of Financial Studies* 30(1): 48-79.

Brunnermeier, M. (2009), "Deciphering the Liquidity and Credit Crunch 2007-08", *Journal of Economic Perspectives* 23(1): 77-100.

Brunnermeier, M. and M. Oehmke (2013), "The Maturity Rat Race", *Journal of Finance* 68(2): 483-521.

Buchak, G., G. Matvos, T. Piskorski and A. Seru (2017), "Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks", *Journal of Financial Economics* (forthcoming).

Caballero, R.J., T. Hoshi and A.K. Kashyap (2008), "Zombie Lending and Depressed Restructuring in Japan", *American Economic Review* 98(5): 1943-1977.

Caballero, R.J., E. Farhi and P-O. Gourinchas (2017), "The Safe Assets Shortage Conundrum", *Journal of Economic Perspectives* 31(3): 29-46.

Calvo, D., J.C. Crisanto, S. Hohl and O. Pascual (2018), "Financial Supervisory Architecture: What Has Changed After the Crisis?", Financial Stability Institute Papers 8, Bank for International Settlements.

Carlson, M. (2015), "Lessons from the Historical Use of Reserve Requirements in the United States to Promote Bank Liquidity", *International Journal of Central Banking* 11(1): 191-224.

Carney, M. (2017), "The High Road to a Responsible, Open Financial System", speech at Thomson Reuters, 7 April.

Caruana, J. (2009), "The International Policy Response to Financial Crises: Making the Macroprudential Approach Operational", panel remarks at the Federal Reserve Bank of Kansas Jackson Hole Symposium, 21–22 August.

Cecchetti, S.G (2016), "The Global Dollar System," in M. Bordo and M. Wynne (eds), *The Federal Reserve's Role in the Global Economy: A Historical Perspective*, Cambridge University Press, pp. 278-284.

Cecchetti, S.G. and A.K. Kashyap (2018), "What Binds? Interactions between Bank Capital and Liquidity Regulations", in P. Hartmann, H. Huang and D. Schoenmaker (eds), *The Changing Fortunes of Central Banking*, Cambridge University Press, pp. 192-202.

Cecchetti, S.G. and A.K. Kashyap (forthcoming), "Inspecting Basel III".

Cecchetti, S.G. and K.L. Schoenholtz (2015), "Bank Capital Requirements: Can We Fix Risk-Weighting?" www.moneyandbanking.com, 19 May 19.

_____ (2016a), "Making Markets Safe: The Role of Central Clearing," www.moneyandbanking.com, 28 March 28.

_____ (2016b), "Reforming Mutual Funds: A Proposal to Improve Financial Market Resilience," www.moneyandbanking.com, 19 September.

_____ (2017), "Regulatory Reform: A Scorecard," CEPR Discussion Paper No. 12465.

_____ (2018a), "Ensuring Stress Tests Remain Effective," www.moneyandbanking.com, 22 January.

_____ (2018b), "Banking the Masses: 2018 Edition," www.moneyandbanking.com, 7 May 7.

_____ (2018c), "Taking the **Sock** out of FSOC," www.moneyandbanking.com, 29 October.

_____ (2018d), "What should the Fed own?", /www.moneyandbanking.com, 31 August.

_____ (2018e), "Financial Crisis: The Endgame", /www.moneyandbanking.com, 2 September.

_____ (2018f), "Pitfalls of a reserves only narrow bank", www.moneyandbanking.com, 24 September.

_____ (2019), "Improving Resilience: Banks and Non-bank Intermediaries," www.moneyandbanking.com, 18 February.

Cecchetti, S.G. and Paul M. W. Tucker (2015), "Is There Macroprudential Policy Without International Cooperation?" in R. Glick and M.M. Spiegel (eds), *Policy Challenges in a Diverging Global Economy*, Proceedings of the Asia Pacific Policy Conference, Federal Reserve Bank of San Francisco.

Cetorelli, N. (2015), "Shadow Banking: Challenges for Global Monitoring and Regulation," in S. Claessen, D. Evanoff, G. Kaufman and L. Laeven (eds), *Shadow Banking Within and Across National Borders*, World Scientific Studies in International Economics 40.

Chamley, C., L. Kotlikoff and H. Polemarchakis (2012), "Financial Reform—What's Really Needed? Limited-Purpose Banking–Moving from 'Trust Me' to 'Show- Me' Banking", *American Economic Review: Papers & Proceedings* 102 (3): 1-10.

Chang, B. Y., M. Januska, G. Kumar and A. Usche (2016), "Monitoring Shadow Banking in Canada: A Hybrid Approach", *Financial System Review of the Bank of Canada*, December.

Chernenko, S. and A. Sunderam (2014), "Frictions in Shadow Banking: Evidence from the Lending Behavior of Money Market Mutual Funds", *Review of Financial Studies* 27(6): 1717-1750.
Christiano, L., M. Eichenbaum and S. Rebelo (2011), "When is the Government Spending Multiplier Large?", *Journal of Political Economy* 119(1): 78-121.
Claessens, S., S.R. Ghosh and R. Mihet (2013), "Macro-prudential Policies to Mitigate Financial System Vulnerabilities", *Journal of International Money and Finance* 39(C): 153-185.
Cline, W.R. (2017), *The Right Balance for Banks: Theory and Evidence on Optimal Capital Requirements*, Peterson Institute for International Economics.
Cochrane, J. (2014), "Toward a Run-free Financial System", in M.N. Baily and J.B. Taylor (eds), *Across the Great Divide: New Perspectives on the Financial Crisis*, Hoover Institution Press, pp. 197–249.
Commodity Futures Trading Commission (2016), "Supervisory Stress Test of Clearinghouses", November.
Committee on Payments and Market Infrastructure (2017), "Framework for Supervisory Stress Testing of Central Counterparties (CCPs)", June.
Crump, R. and J.A.C. Santos (2018), "Review of New York Fed studies on the effects of post-crisis banking reforms", *Federal Reserve Bank of New York Economic Policy Review* 24(2): 71-90.
Dagher, J., G. Dell'Ariccia, L. Laeven, L. Ratnovski and H. Tong (2016), "Benefits and Costs of Bank Capital", IMF Staff Discussion Paper No 16/04.
Danthine, J.P. (2015), "Macroprudential policy in Switzerland: the first lessons", Next Steps in Macroprudential Policies Conference, Columbia University (summary on VoxEU.org).
Davies, R. and P. Richardson (2010), "Evolution of the UK Banking System", *Bank of England Quarterly Bulletin* Q4: 321-332.
Del Negro, M., D. Giannone, M. P. Giannoni and A. Tambalotti (2018), "Global Trends in Interest Rates", NBER Working Paper No. 25039.
D'Erasmo, P. (2018), "Are Higher Capital Requirements Worth It?", *Federal Reserve Bank of Philadelphia Economic Insights*, 2018 Q2.
Detken, C., S. Fahr and J.H. Lang (2018), "Predicting the Likelihood and Severity of Financial Crises over the Medium Term with a Cyclical Systemic Risk Indicator", *ECB Financial Stability Review*, May: 174-176.
Diamond, D. (1984), "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies* 51(3): 393-414.
Diamond, D. and P. Dybvig (1983), "Bank Runs, Deposit Insurance and Liquidity", *Journal of Political Economy* 91(3): 401-419.
Diamond, D. and A. K. Kashyap (2016), "Liquidity Requirements, Liquidity Choice and Financial Stability", NBER Working Paper No. 22053.
Domanksi, D., L. Gambacorta and C. Picillo (2015), "Central Clearing: Trends and Current Issues", *BIS Quarterly Review*, December.
Drechsler, I. T. Drechsler, D. Marquez-Ibanez and P. Schnabl (2016), "Who Borrows from the Lender of LastResort?", *Journal of Finance* 71(5): 1933-1974.
Duffie, D. (2016), "Financial regulatory reform after the crisis: an assessment", in *Proceedings of the Sintra Forum on Central Banking*, ECB, pp. 142-183.
Duffie, D. and D.A. Skeel, Jr (2012), "A Dialogue on the Costs and Benefits of Automatic Stays for Derivatives and Repurchase Agreements", Penn Law Legal Scholarship Repository Paper 386, University of Pennsylvania Law School.

Dwyer, G.P. (1981), "The Effects of the Banking Acts of 1933 and 1935 on Capital Investment in Commercial Banking", *Journal of Money, Credit and Banking* 13(2): 192-204.

Edge, R.M. and J.N. Liang (2019), "New Financial Stability Governance Structures and Central Banks", Hutchins Cener Working Paper 50.

Edwards, F. and E. Morrison (2005), "Derivatives and the Bankruptcy Code: Why the Special Treatment?", *Yale Journal on Regulation* 22: 91-122.

European Commission (2016), "Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB)", COM(2016) 683 final, 25 October.

European Securities and Markets Authority (2018), "EU-wide CCP Stress Test 2017', February.

European Systemic Risk Board (2014), "Is Europe Overbanked?", Reports of the Advisory Scientific Committee 4.

Evanoff, D.D., A.G. Haldane and G.G. Kaufman (eds) (2016), *The New International Financial System: Analyzing the Cumulative Impact of Regulatory Reform*, World Scientific.

Federal Deposit Insurance Corporation (FDIC) (1998), *A Brief History of Deposit Insurance in the United States*, September.

_____ (2017), *Crisis and response: an FDIC history, 2008–2013*.

Federal Reserve System (2015), "Total Loss-Absorbing Capacity, Long-Term Debt, and Clean Holding Company Requirements for Systemically Important U.S. Bank Holding Companies and Intermediate Holding Companies of Systemically Important Foreign Banking Organizations", Federal Register, November.

Federal Reserve Bank of Minneapolis (2016), "The Minneapolis Plan to End Too Big to Fail", November.

Financial Conduct Authority (2015), "Regulatory sandbox", November.

Financial Stability Board (2015), "Principles on Loss-absorbing and Recapitalisation Capacity of G-SIBs in Resolution", 9 November.

_____ (2017), *OTC Derivatives Market Reforms: Twelfth Progress Report on Implementation*, June.

_____ (2018), *Implementation and Effects of the G20 Financial Regulatory Reforms – Fourth Annual Report*, July.

_____ (2019), *Global Monitoring Report on Non-Bank Financial Intermediation 2018*, February.

French, K., M.N. Baily, J.Y. Campbell, J.H. Cochrane, D. Diamond, D. Duffie, A. Kashyap, F. Mishkin, R. Rajan, D.S. Scharfstein, R.J. Shiller, H.S. Shin, M.J. Slaughter, J.C. Stein and R. Stulz (2010), *The Squam Lake Report: Fixing the Financial System*, Princeton University Press.

Frame, W.S., K.S. Gerardi, and P.S. Willen (2015), "The Failure of Supervisory Stress Testing: Fannie Mae, Freddie Mac, and OFHEO," Federal Reserve Bank of Atlanta Working Paper, March.

Geithner, T.F. (2014), *Stress Test: Reflections on Financial Crises*, Crown Publishing.

_____ (2016), *Are We Safer? The Case for Strengthening the Bagehot Arsenal*, Per Jacobsson Foundation, Bank for International Settlements.

Goldstein, M. (2017), *Banking's Final Exam: Stress Testing and Bank-Capital Reform*, Peterson Institute for International Economics.

Goodfriend, M. and M. Hargraves (1983), "A Historical Assessment of the Rationales and Functions of Reserve Requirements," *Economic Review*, Federal Reserve Bank of Richmond, March.

Goodfriend, M. and R.G. King (1988), "Financial Deregulation, Monetary Policy, and Central Banking", *Economic Review*, Federal Reserve Bank of Richmond, May/June.

Goodhart, C.A E. (2011), The Basel Committee on Banking Supervision: A History of the Early Years, 1974-1997, Cambridge University Press.

_____ (2016), "Comment on 'Financial Regulatory Reform after the Crisis: An Assessment' by Darrell Duffie", in *Proceedings of the Sintra Forum on Central Banking*, ECB, pp. 184-187.

Gordon, J.N. and C. Muller (2011) "Confronting Financial Crisis: Dodd-Frank's Dangers and the Case for a Systemic Emergency Insurance Fund," *Yale Journal of Regulation* 28(1): 155-177.

Gorton, G. and A. Metrick (2012), "Securitized Banking and the Run on Repo", *Journal of Financial Economics* 104(3): 425–451.

Grant, J. (1996), "Too Big to Fail: Walter Wriston and Citibank," *Harvard Business Review*, July/August.

Greenwood, R., S.G. Hanson, J.C. Stein and A. Sunderam (2017), "Strengthening and Streamlining Bank Capital," *Brookings Papers on Economic Activity*, September.

Haldane, A.G., M. Roberts-Sklar, T. Wieladek and C. Young (2016), "QE: The Story So Far", Bank of England Staff Working Paper No. 624.

Hartmann, P. (2015), "Real Estate Markets and Macroprudential Policy in Europe", *Journal of Money, Credit and Banking* 47(1): 69-80.

Hartmann, P. (2016), "Financial Reform in Transition", in D.D. Evanoff, A.G. Haldane and G.G. Kaufman (eds) (2016), *The New International Financial System: Analyzing the Cumulative Impact of Regulatory Reform*, World Scientific, pp. 371-403.

Hauser, A. (2014), "Lender of Last Resort Operations During the Financial Crisis: Seven Practical Lessons from the United Kingdom", BIS Papers No. 79.

Hellwig, M. (2018), "Valuation Reports in the Context of Banking Resolution: What Are the Challenges?", Discussion paper 2018/6, Max Planck Institute for Research on Collective Goods.

HM Treasury (2018), "Financial Relationship between HM Treasury and the Bank of England: Memorandum of Understanding", June.

Hoerova, M., C. Mendicino, K. Nikolov, G. Schepens and S. Heuvel (2018), "Benefits and costs of liquidity regulation", ECB Working Paper Series 2169.

International Monetary Fund (2009), "Lessons of the Financial Crisis for Future Regulation of Financial Institutions and Markets and for Liquidity Management", Policy Paper.

Issing, O. and J. Krahnen (2009), "Why the Regulators Must Have a Global 'Risk Map'", *Financial Times*, 18 February.

International Swaps and Derivatives Association (ISDA) (2016), "Derivatives Market Analysis: Interest Rate Derivatives", 20 December.

Jiménez, G., S. Ongena, J.L. Peydró and J. Saurina (2017), "Macroprudential Policy, Countercyclical Bank Capital buffers and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments", *Journal of Political Economy* 125(6).

Jordà, Ò., M. Schularick and A.M. Taylor (2016), "The Great Mortgaging: Housing Finance, Crises and Business Cycles", *Economic Policy* 31(85): 107-152

Jordan, T. (2006), "Current Monetary Developments", speech at Money Market Event, Swiss National Bank, 23 March.

Kashyap, A.K., R. Rajan and J.C. Stein (2008), "Rethinking Capital Regulation," in *Maintaining Stability in a Changing Financial System*, proceedings of the Economic Policy Symposium of the Federal Reserve Bank of Kansas City, pp. 431-471.

King, M. (2016), *The End of Alchemy – Money, Banking and the Future of the Global Economy*, W.W.Norton & Company.

Kohn, D. (2015), "Implementing Macroprudential and Monetary Policies: The Case for Two Committees", speech at the Federal Reserve Bank of Boston Annual Economic Conference, October.

König, E. (2018), "Why we Need an EU Liquidation Regime for Banks", Eurofi, September.

Koudijs, P., L. Salisbury and G. Sran (2018), "For Richer, for Poorer, Bankers' Liability and Risk-taking in New England, 1867-1880", NBER Working Paper No. 24998.

Krishnamurthy, A. and A. Vissing-Jorgensen (2012), "The Aggregate Demand for Treasury Debt", *Journal of Political Economy* 120(2): 233-267

Kuttner, K.N. and I. Shim (2013), "Can Non-Interest Rate Policies Stabilise Housing Markets? Evidence from a Panel of 57 Economies", BIS Working Papers No. 433.

Lang, J.H. and P. Welz (2017), "Measuring Credit Gaps for Macroprudential Policy", *ECB Financial Stability Review*, May: 144-157.

Lian, C. and Y. Ma (2018), "Anatomy of Corporate Borrowing Constraints", mimeo, MIT.

Lim, C., F. Columba, A. Costa, P. Kongsamut, A. Otani, M. Saiyid, T. Wezel and X. Wu (2011), "Macroprudential Policy: What Instruments and How Are They Used? Lessons from Country Experiences", IMF Working Paper No. 11/238.

Macey, J.R. and G.P. Miller (1992), "Double Liability of Bank Shareholders: History and Implications", *Wake Forest Law Review* 27: 31-62.

Macroeconomic Assessment Group (2010), "Assessing the macroeconomic impact of the transition to stronger capital and liquidity requirements", Bank for International Settlements, December.

Matutes, C. and X. Vives (2000), "Imperfect Competition, Risk Taking, and Regulation in Banking", *European Economic Review* 44(1): 1-34.

McCabe, P. (2010), "The Cross Section of Money Market Fund Risks and Financial Crises", Finance and Economics Discussion Series Paper 51, Federal Reserve Board.

McGuire, P. and G. von Peter (2009), "The US Dollar Shortage in Global Banking", *BIS Quarterly Review*, March.

Meltzer, A.H. (2010), *A History of the Federal Reserve, Volume 2: 1951 -1986*, University of Chicago Press

Miles, D., J. Yang and G. Marcheggiano (2013), "Optimal Bank Capital", *The Economic Journal* 123(567): 1-37

Müller, K. (2018), "Electoral Cycles in Macroprudential Regulation", mimeo.

Myers, S.C. (1977), "Determinants of Corporate Borrowing," *Journal of Financial Economics* 5(2): 147-175.

Naceur, S.B. and C. Roulet (2017), "Basel III and Bank-Lending: Evidence from the United States and Europe," IMF Working Paper No 17/245.
Neely, C. (2004), "The Federal Reserve Responds to Crises: September 11th Was Not the First", *Federal Reserve Bank of St. Louis Review* 86(2): 27-42.
Nyborg, K.J. (2016), *Collateral Frameworks. The Open Secret of Central Banks*, Cambridge University Press.
Parlatore, C. (2015), "Fragility in Money Market Funds: Sponsor Support and Regulation", ECB Working Paper 1772..
Paulson, H.M., Jr. (2010), *On the Brink: Inside the Race to Stop the Collapse of the Global Financial System*, Hachette Book Group
Pennacchi, G. (2012), "Narrow Banking", *Annual Review of Financial Economics* 4: 141- 159.
Perotti, E. (2018), "Discussion of 'Inspecting Basel III' by Cecchetti and Kashyap", ECB Macroprudential Policy and Research Conference, Frankfurt, May.
Plantin, G. (2015), "Shadow Banking and Bank Capital Regulation", *The Review of Financial Studies* 28(1): 146–175.
Poszar, Z. (2011), "Institutional Cash Pools and the Triffin Dilemma of the U.S. Banking System", IMF Working Paper 11/190.
Pozsar, Z., T. Adrian, A. Ashcraft, and H. Boesky (2012), "Shadow Banking," Federal Reserve Bank of New York Staff Paper No. 458.
Restoy, F. (2016), "The Challenges of the European Resolution Framework", closing remarks at the "Corporate Governance and Credit Institutions' Crises" conference, Madrid, 29 November.
_____ (2018a), "Bail-in in the New Bank Resolution Framework: Is There an Issue with the Middle Class?", speech at the IADI-ERC International Conference "Resolution and deposit guarantee schemes in Europe: incomplete processes and uncertain outcomes", Naples, 23 March.
_____ (2018b), "The European Banking Union: What Are the Missing Pieces?", public lecture at the International Center for Monetary and Banking Studies, Geneva, October.
Rochet, J.C. and X. Vives (2004), "Coordination Failures and the Lender of Last Resort: Was Bagehot Right After All?", *Journal of the European Economic Association* 2(6): 1116-1147.
Roe, M. (2010) "The Derivatives Players' Payment Priorities as Financial Crisis Accelerator," Working Paper, Harvard Law School.
Santos, J.A.C. and J. Suarez (forthcoming), "Liquidity Standards and the Value of an Informed Lender of Last Resort", *Journal of Financial Economics*.
Schepens, G. (2016), "Taxes and Bank Capital Structure", *Journal of Financial Economics* 120(3): 585-600.
Schmidt, L., A. Timmermann and R. Wermers (2015), "Runs on Money Market Mutual Funds", CEPR Discussion Paper 9906.
Schnabl, P. (2017), "Bank Capital Regulation and the Off-Ramp," in *Regulating Wall Street: CHOICE Act vs. Dodd-Frank*, NYU Stern School of Business.
Schrimpf, A. (2015), "Outstanding OTC derivatives Positions Dwindle as Compression Gains Further Traction", *BIS Quarterly Review,* December, pp. 24-25.
Shadow Financial Regulatory Committee (2000), *Reforming Bank Capital Regulation: A Proposal by the U.S. Shadow Financial Regulatory Committee*, American Enterprise Institute.

Sims, C. (2016), "Fiscal Policy, Monetary Policy and Central Bank Independence", Economic Policy Symposium, Jackson Hole, August.
Skeel, D. (2001), *Debt's Dominion: A History of Bankruptcy Law in America*, Princeton University Press.
Sorkin, A.R. (2009), *Too Big to Fail*, Viking
Stein, J. (2013), "Overheating in Credit Markets: Origins, Measurement, and Policy Responses", speech at a symposium organised by the Federal Reserve Bank of St. Louis, February.
Summers, L. (2013), "Secular Stagnation", IMF Fourteenth Annual Research Conference in Honor of Stanley Fischer, Washington, DC.
_____ (2018), "Fed bashing is a fool's game", blog, 6 November.
Svensson, L.E.O. (2014), "Why Leaning Against the Wind Is the Wrong Monetary Policy for Sweden", mimeo, June.
Sveriges Riksbank (2015), "Capital Requirements for the Major Swedish Banks—the Riksbank's View", memorandum, 3 July.
Thomsen Poul, T. (2018), "The Pursuit of Financial Stability and Tasks for Monetary, Regulatory, and Macro-Prudential Policies", speech at the "ECB and its Watchers" conference, 16 March.
Tucker, P. (2013), "Solving Too Big to Fail – Where Do Things Stand on Resolution?", speech at the Institute of International Finance, Washington, DC.
Tucker, P. (2014a) "Regulatory Reform, Stability, and Central Banking", Hutchins Center on Fiscal and Monetary Policy Report at Brookings.
Tucker, P. (2014b), "The Resolution of Financial Institutions without taxpayer solvency support: Seven retrospective clarifications and elaborations," comments at the European Summer Symposium in Economic Theory, Gerzensee.
Tucker, P. (2014c), "The Lender of Last Resort and Modern Central Banking: Principles and Reconstruction", BIS Working Paper 79.
Tucker, P. (2018), *Unelected Power: The Quest for Legitimacy in Central Banking and the Regulatory State*, Princeton University Press.
United Nations Commission on International Trade Law (UNCITRAL) (2014) "UNCITRAL Model Law on Cross-Border Insolvency with Guide to Enactment and Interpretation".
U.S. Treasury (2017), *A Financial System That Creates Economic Opportunities: Banks and Credit Unions*, June.
Vestergaard, J. and M. Retana (2013), *Behind Smoke and Mirrors: On the Alleged Capitalisation of Europe's Banks*, Danish Institute of International Affairs Report 2013:10.
Vickers, J. (2016), "The Systemic Risk Buffer for UK banks: A Response to the Bank of England's Consultation Paper", *Journal of Financial Regulation* 2(2): 264-282.
Vickers, J. (2018), "Safer, But Not Safe Enough", Keynote address at the 20th International Conference of Banking Supervisors, Abu Dhabi, November.
Vives, X. (2014), "Strategic Complementarity, Fragility, and Regulation", *Review of Financial Studies* 27(12): 3547–3592.
Vives, X. (2016), *Competition and Stability in Banking: The Role of Regulation and Competition Policy,* Princeton University Press.
Vives, X. (2017), "The impact of Fintech in Banking", *European Economy. Banks, Regulation and the Real Sector* 2: 97-106.
Vives, X. (2019), "Digital Disruption in Banking", working paper.

White, E.N. (1983), *The Regulation and Reform of the American Banking System, 1900-1929*, Princeton University Press.
Wu, H.-M. and Y. Zhao (2016), "Optimal Leverage Ratio and Capital Requirements with Limited Regulatory Power", *Review of Finance* 20(6): 2125–2150.

What has changed since the 2007-2009 crisis to ensure that the financial system is sound at last? Is regulatory reform going in the right direction? Has it run its course? This report tackles three important areas of post-crisis regulatory reform: the Basel III agreement on capital, liquidity and leverage requirements; resolution procedures to end 'too big to fail'; and the expanded role of central banks with a financial stability remit. The report starts by noting that narrow banking will not overcome the fragility of the system; if it were to be implemented, fragility would resurface elsewhere in the financial system.

While there have been improvements in financial regulation and supervision during the decade since the global financial crisis, there is still much to be done:

- Prudential regulation should take a holistic approach, setting requirements for capital, liquidity and disclosure together and taking account of the competitive conditions of the industry. This approach casts doubt on the need for two liquidity ratios as currently envisaged.
- Stress tests are very useful if well designed – they must be severe, flexible and not overly transparent. However, effective stress tests can only be implemented when there is a backstop for the banking system, as the case of the euro area shows.
- To ensure that an ever-changing financial system remains resilient, authorities need a framework to monitor, assess, designate, regulate and supervise entities outside the perimeter of regulation. This applies to shadow banking and new digital competitors.
- Resolution needs liquidity support but current procedures are lacking, particularly in the euro area. The report points at the difficulties of implementing the 'single point of entry' model of resolution.
- Central banks have to recover their traditional financial stability remit, and these more powerful central banks need strengthened accountability and democratic legitimacy. The authors tend to favour endowing the central bank with macroprudential authority, along with the appropriate tools. More intensive coordination between monetary and fiscal authorities is needed, particularly when the zero lower bound for interest rates is reached.

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