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The impact of financial reforms 21

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CONTENTS

CONTENTS

Introductory article

Towards financial stability: a common good that needs to be consolidated and reinforced

François
VILLEROY de GALHAU
Governor
Banque de France

In the immediate aftermath of the crisis, at the London Summit in April 2009, the G20 heads of state and government got together to launch a concerted global action plan. Their joint aim was to address the flaws in the existing regulatory framework, which had proved incapable of preventing imbalances from building up in the financial system and from spilling over to the real economy. Eight years later, with most of the elements in this plan now being finalised, concerns are being raised as to the potential negative effects of the new regulations, with some even questioning the need for robust global regulations to safeguard financial stability.

In order to contribute to the debate and provide some factual enlightenment, the Banque de France has chosen, for its 2017 *Financial Stability Review*, to bring together the views of public authorities, academics and industry representatives. With the benefit of a few years' hindsight, and based on the results of various assessment exercises, the contributions point to both an achievement and a challenge. The achievement is that the regulatory reforms put in place since the crisis have made the global financial system substantially more resilient, with no noticeable adverse impact on growth. The challenge now is to finalise the regulatory framework and guarantee its long-term sustainability.

1| What we have achieved: the action plan agreed by the G20 has largely met its objective without weighing to any noticeable extent on economic growth

The 2008 crisis exposed the urgent need to reinforce financial stability, and prompted a swift and resolute response on the part of public authorities. The financial crisis had a huge impact on the real economy: many countries have still not seen a return to pre-crisis levels of output and are suffering from high levels of unemployment, while the cost of bank bailouts to public finances continues to weigh on growth. The cumulative loss of output since the crisis, compared to its pre-crisis trend, is of the order of 25% of one year's world GDP.[1] To prevent a repeat of the turmoil, considerable efforts have been made at international level since 2008. The members of the G20 have significantly reinforced the regulatory framework, starting with prudential standards for banks under Basel III, and then gradually extending their scope of intervention to other areas and sectors: the centralised clearing of over-the-counter derivatives, the resolution of systemically important banks, the regulation of the shadow banking system and of credit rating agencies, and the development of macroprudential policy.

These unprecedented regulatory reforms, coordinated globally, constitute an essential achievement and a shared foundation that must be preserved in all G20 jurisdictions. On the whole, the standards agreed at global level have been implemented in a timely and consistent manner by all G20 members, as evidenced by the findings of the Financial Stability Board's (FSB) annual country peer reviews. The impact of the reforms on the resilience of the financial system has been very largely positive. Banks in particular are in a much stronger position, both in terms of their ability to withstand liquidity shocks and their solvency: the core equity (CET1) ratio of the largest banks operating at international level has been raised from 7.1% in mid-2011 to 11.9% in mid-2016.[2]

Various studies have been carried out to measure the impact of the reforms on the financing of

1 See *IMF World Economic Outlook*, April 2015; Ollivaud (P.) and Turner (D.), *The effect of the global financial crisis on OECD potential output*, OECD *Working Papers*, No. 1166, 2014.

2 BCBS, *Basel III Monitoring Report*, February 2017. Data for Group 1 banks.

the economy and on growth. The most extensive were those conducted by the Basel Committee's Macroeconomic Assessment Group (MAG)[3] in 2010, before the introduction of the Basel III reform, and which used 97 models and simulation tools to examine the effects of the regulatory transition. These were complemented by the work of the Long-term Economic Impact group (LEI),[4] which measured the long-run effects of the reforms on economic growth. The MAG concluded, from a broad range of estimates, that the median increase in the cost of credit in response to a 1 percentage point rise in the target capital ratio would be roughly 15 basis points. But in actual fact, this impact never materialised. Indeed, the favourable effects of the interest rate cuts under the accommodative monetary policy stance have far outweighed the feared negative consequences of stricter regulatory requirements. Since then, other studies have been conducted by the financial industry itself, by academics, central banks and international and European organisations. The debate is clearly a complex one, and results may vary depending on the particular methodology used. Nevertheless, what largely emerges from these analyses is that the new bank prudential regulations have been implemented with no noticeable impact on global economic growth and without creating any major conflicts between the objectives of financial stability on the one hand and the financing of the economy on the other. I stand firm in my belief: no one can seriously claim, either in France or in Europe, or indeed in any advanced economy, that the credit supply has been excessively impaired by bank regulations. Outside the banking sector, the FSB notes that the resilience of all financial institutions has been improved, with no decline in the overall provision of financing to the real economy.[5] And although it highlights three areas warranting vigilance – market liquidity, the effect of reforms on emerging market and developing economies and the risk of financial market fragmentation – which may justify making minor adjustments to the final calibration of the rules under the planned regular reviews, this in no way detracts from the overall balance of the reforms.

2| The challenge for tomorrow: to consolidate and complete this achievement while ensuring the long-term sustainability of the new regulatory framework

The priority today, nearly ten years after the crisis, is to finalise the work in progress in order to stabilise the regulatory framework for both the bank and non-bank sectors.

With regard to the banking sector first, the main concern now is to complete the Basel III framework, and not to put together some hypothetical Basel IV reform. As reiterated by the G20 heads of state at the Hangzhou Summit in September 2016, Basel III should be finalised without significantly increasing overall capital requirements. The main elements of the package have already been approved at international level and have largely entered into force in most G20 jurisdictions, notably the standardisation and significant reinforcement of capital, the introduction of a leverage ratio, new liquidity ratios and macroprudential capital buffers, and the reform of bank trading books. The remaining work underway relates essentially to the measurement of risk in bank balance sheets. In this respect, the Basel Committee has made significant efforts over the past few years to simplify and improve the comparability of risk-weighted assets across institutions and jurisdictions, in order to reduce unjustified variations in results. The Group of Governors and Heads of Supervision (GHOS), which is endorsing the banking sector regulatory reforms at the international level, has not yet reached an agreement on key aspects, notably the framework for the use of internal models: setting the capital floor too high would discourage the use of internal models and lead to an excessive reduction in the risk sensitivity of the regulatory framework. However, France, Europe and Japan are all keen to ensure that the use of detailed models – subject to approval and oversight by the supervisory authorities – remains at the heart of bank risk monitoring. It is essential, therefore,

3 MAG, BCBS, *Assessing the macroeconomic impact of the transition to stronger capital and liquidity requirements*, December 2010.

4 LEI, BCBS, *An assessment of the long term economic impact of stronger capital and liquidity requirements*, August 2010.

5 FSB, *Implementation and Effects of the G20 Financial Regulatory Reforms*, 31 August 2016, 2nd Annual Report.

that we continue to work towards an agreement. Now, almost a decade after the crisis, the banking industry and its clients need finally to be able to operate in a stable regulatory environment.

At the European level, the main challenges for the finalisation of banking regulations relate in particular to **resolution**: the November 2015 Antalya agreement set out the new international total loss-absorbing capacity requirement (the TLAC ratio) for systemically important banks, and it is important to make this consistent with the European minimum requirement for own funds and eligible liabilities (MREL ratio). The proposals put forward by the European Commission last November are a step in the right direction. Inspired by the French system set out in the so-called "Sapin II" law, the measures introduce a new category of senior non-preferred debt which enables banks to comply with the TLAC standard, but without imposing excessive constraints on their financing structure or forcing them to modify existing contracts.

With regard to the other sectors of the financial industry, i.e. the "non-banks", major work has been started under the aegis of the FSB, and this should be carried forward. At this stage, in my view, the situation for the insurance sector is satisfactory, particularly in the European Union where the new Solvency II regulation recently came into force. However, work on asset management activities and on the resolution of central counterparties (CCPs) needs to be actively continued: this should be the main priority, in response to concerns over shadow banking. The FSB has already published its recommendations on **asset management** and we now need to ensure that they are effectively implemented. And a last major piece in the supervisory framework will be the application of resilience tests to measure funds' ability to withstand liquidity shocks to the entire financial system. With regard to **CCPs**, which have been made even more systemically important with the introduction of mandatory central clearing for standardised over-the-counter financial instruments, the European Commission published a draft regulation at the end of last year on their recovery and resolution; meanwhile, the FSB is working on proposed guidance that would apply at the global level. Given the closeness of the links between CCPs and their participants throughout the world, and not just in Europe, the European proposal has developed an approach that is very much consistent with the international guidance. This alignment should be both preserved and deepened over the long term.

In the longer term, ensuring the sustainability of the regulatory framework will mean striking a balance on two levels: between growth and financial stability on the one hand, and between ending "too-big-to-fail" and encouraging European cross-border consolidations on the other.

One criticism frequently put forward is that there is a fundamental conflict between the objectives of **economic growth and financial stability**. However, this argument does not stand up to long-term analysis. It is in nobody's interest to foster unstable growth that leads ultimately to a financial crisis; conversely, any excessive curtailment of the credit supply that hampered growth would undermine the very objective of financial stability. Ensuring that financial stability remains compatible with growth over the long term will first mean conducting regular and reliable assessments of the reforms put in place. To this end, the authorities will need to equip themselves with tools capable of covering the full range of measures and of capturing their cumulative effects. Germany has rightly made developing such a toolbox a priority for its G20 presidency, and indeed collective endeavours in this area are to be encouraged. Building on the work of the MAG in 2010, a periodical review should be introduced to systematically evaluate planned rules and their economic impacts ex ante, and analyse them comprehensively ex post. In parallel, authorities should take maximum advantage of review clauses, which enable them

to adjust the existing regulatory framework as much as needed.

Another point that warrants attention relates in particular to the European Union, where we need to find the right trade-off between monitoring systemically important (too-big-to-fail) institutions and the need to increase European financial integration. The construction of the European Banking Union is now almost finished. Its first pillar, the Single Supervisory Mechanism, is already in place, while the second, the Single Resolution Board, is well on the way to completion. Together, they provide a solid framework to ensure that the welcome consolidation of the European banking sector takes place in an orderly and sound manner. In anticipation of the creation of a genuine "Financing Union for Investment and Innovation", **cross-border bank consolidations** would help to channel savings more effectively towards investment and improve the sharing of risks. The banking sector in the United States is much more concentrated today than the European Banking Union.

3| Conclusion

Financial stability is a common good, but it is a fragile one and therefore all the more precious. In this respect, the banking and financial regulations adopted since the crisis are a major asset that needs to be preserved, as they have helped to stabilise the global financial system and make it more secure. Any temptation to go back on this or to massively deregulate would increase the risk of another financial crisis. The challenge now is to consolidate and reinforce these achievements; hence the importance of carrying out regular impact assessments. The attitude of the new US administration will, of course, be key: now more than ever, close international coordination and strong political determination are vital.

Overview and issues at stake

Ten years on: fixing the fault lines of the global financial crisis

Mark CARNEY
Chair
Financial Stability Board
Governor
Bank of England

It is nearly ten years since the global financial crisis began in the summer of 2007. A decade on, its aftershocks are still being felt not just in the financial markets at the epicentre, but across households and businesses globally.

In the immediate aftermath of the crisis, G20 leaders created the Financial Stability Board (FSB) to fix the fault lines of the financial system, working with national authorities and international standard-setting bodies. Given the depth of the problems and the scale of the solutions needed, detailed policy development and implementation has taken time. But now all the main elements of the reform package have been agreed, and their implementation is well underway.

Ten years on from the financial earthquake, the global financial system has been reregulated – leaving a safer, simpler, and fairer financial system that can support open markets and inclusive growth.

The post-crisis reforms have laid the foundations of an open and resilient global system. The reforms are built on the four pillars of: making financial institutions more resilient; ending the problem of financial institutions being too-big-to-fail; making over-the-counter (OTC) derivatives markets safer; and transforming shadow banking into resilient market-based finance.

Ten years on: fixing the fault lines of the global financial crisis

Mark Carney

It is nearly ten years since the global financial crisis began in the summer of 2007. A decade on, its aftershocks are still being felt not just in the financial markets at the epicentre, but across households and businesses globally. Despite massive public liquidity and solvency support for the financial system, the unprecedented severity of the crisis led to the worst global recession of the post-World War II era and has left a debt burden in its wake that is still weighing on growth. In the process, trust in the system and confidence in open markets has been reduced.

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Strong, sustainable and balanced growth requires open markets, durable international capital flows, resilient financial institutions, robust sources of market-based finance, and an end to too-big-to-fail.

The financial crisis exposed the inadequacy of pre-crisis regulatory frameworks in most advanced economies to meet the challenges posed by a financial system that had grown progressively more complex, capital-market focused, and globally integrated. As a result, national authorities often found themselves unable to effectively address the financial stability risks that developed nationally, or were transmitted through markets and financial institutions operating across borders. The global nature of the crisis meant that solutions also had to be global – and new methods of international cooperation had to be developed.

The commitment of the G20 leaders has been essential to maintaining an open and global financial system. Post-crisis reforms have been the result of intense cooperation between central banks, finance ministries, supervisors and regulators, across the G20 and beyond, coordinated by the FSB in conjunction with international standard-setters and organisations.

The FSB's strength lies in its members, who bring expertise and a sense of shared objectives, and who work together closely and effectively to find common solutions to common problems. The standards developed are not directly applicable; members must implement agreed standards through national law and regulation. But the FSB's consistent ability to forge consensus has led to common ownership and, in most cases, timely and comprehensive implementation of reforms at the national level. That progress is building both trust and effectiveness, keeping global finance open and diverse, and making it more resilient.

While the focus of the FSB's work is primarily on its 24 member jurisdictions, which account for over 80% of global economic activity and all globally-active systemically-important financial institutions (G-SIFIs), the FSB has also fostered dialogue and cooperation with the financial authorities from around 65 non-FSB jurisdictions through its Regional Consultative Groups. Regular dialogue during the policymaking stage and in evaluating the effects of reform has encouraged adoption of these strengthened standards well beyond FSB member jurisdictions.

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- making financial institutions more resilient;

- ending the problem of financial institutions being too-big-to-fail;
- making over-the-counter (OTC) derivatives markets safer; and
- transforming shadow banking into resilient market-based finance.

In addition to these four pillars, the FSB continues to scan for and address emerging vulnerabilities, as well as building institutional capacity for cross-border cooperation, and conducting peer reviews of reform implementation. In turn, this growing track record of cooperation, collaboration, and progress has strengthened the relationships and trust between authorities, which are essential for effective oversight of cross-border financial institutions at all times but especially during inevitable times of stress.

1| Making financial institutions more resilient

Post-crisis reforms have sought to make financial institutions more resilient, with higher capital and liquidity requirements and via more effective supervision.

Work to make banks more resilient started with wholesale reform of international banks' prudential rules by the Basel Committee on Banking Supervision (BCBS). The Basel III package is designed to address the inadequate pre-crisis minimum capital standards, to ensure that there is sufficient high quality bank capital to absorb losses, as well as to increase the stability of banks' funding and ensure they can withstand periods of stress. The common equity the world's largest banks are required to maintain in normal times, is now ten times higher than the pre-crisis standard. At the same time, banks' trading books have shrunk drastically – in Europe they have more than halved as a share of total assets – whilst the capitalisation of trading books has strengthened. The Liquidity Coverage Ratio (LCR) requires banks to maintain sufficient liquid assets to cover thirty days of stress. The Net Stable Funding Ratio (NSFR) will ensure banks' assets are financed with appropriate stable sources of funding. Globally-active systemically-important banks (G-SIBs) are now identified and required to maintain an equity surcharge that increases with systemic importance, to ensure their safety and reduce the likelihood of their failure. The BCBS continues to work to finalise Basel III, which will restore confidence to the bank capital framework and give certainty to international banks by revising risk-weights and introducing a non-risk sensitive capital backstop (leverage ratio), and will help to promote a level playing field internationally.

Following agreement on enhanced global standards, the BCBS initiated a peer-based programme of country reviews to assess the consistency of implementation. This found that implementation of Basel III has generally been timely and all large internationally active banks are on track to meet the fully phased-in minimum risk-based capital and LCR requirements ahead of the deadlines. Most jurisdictions are now focusing on implementation of the leverage ratio and the NSFR, which are due to come into force in 2018.

The peer-based assessments of the BCBS have, however, found some major advanced economies to be non-compliant with aspects of the agreed capital framework. Where these areas of non-compliance are material, it is important that they are addressed to reduce the risks that regulatory arbitrage weakens overall resilience of the system.

The crisis also showed weaknesses in standards of resilience in other financial sectors and highlighted the need for regulatory action. To this end, the International Association of Insurance Supervisors has been working to address more effectively systemic risks in the global insurance sector.

2| Ending too-big-to-fail

On its own, the increased resilience of individual financial institutions is not sufficient to deliver financial stability. Financial institutions also need to be able to fail in a safe manner, without significantly impacting on financial stability or public finances. The global financial crisis highlighted that national authorities were not able to resolve the failures of large cross-border financial institutions safely and without recourse to public funds. This was amply demonstrated by the instability that followed Lehman Brothers' insolvency: every other major financial institution at risk of failure thereafter was bailed out using public funds. The largest G-SIBs today are far larger than Lehman Brothers was in 2007, and provide a greater number of critical economic functions – such as retail deposits and payment services. In order for the financial sector to function effectively, firms need to be able to both enter and exit the market, as in other sectors of the economy.

As a consequence, in 2011, G20 leaders endorsed an integrated set of policy measures to address the risks to the global financial system from systemically important financial institutions (SIFIs), with a specific focus on global SIFIs (G-SIFIs) to reflect the greater risks that these institutions pose to the global financial system. The measures designed to end "too-big-to-fail" comprised:

- requirements for FSB member countries to implement in national law the FSB's *Key Attributes of Effective Resolution Regimes for Financial Institutions*. This is the minimum set of legal powers and operational arrangements needed to successfully resolve a G-SIB;
- requirements for resolvability assessments, recovery and resolution plans, to be developed by institution-specific cross-border crisis management groups for each G-SIB, underpinned by cooperation agreements;
- requirements for additional total loss-absorbing capacity (TLAC) to ensure that, should a bank enter resolution, there are sufficient liabilities to absorb losses and provide for recapitalisation, without disrupting critical economic functions (such as deposits, derivatives and payment functions) and without recourse to public funds.

All jurisdictions that are home to G-SIBs have put in place resolution regimes that are broadly in line with the *Key Attributes* and have implemented, or are in the process of implementing, legislation or regulation to give effect to the FSB's TLAC standard.[1] And G-SIBs are now putting in place arrangements to support operational continuity of critical functions and shared services in resolution, including by adopting contractual provisions to ensure that temporary stays on early termination rights have cross-border effect.

It is critical that G20 governments maintain momentum in making the needed legislative and regulatory changes to ensure that resolution plans for G-SIBs are credible and effective. Financial market participants are increasingly recognising that the owners and creditors of financial institutions will be required to meet the costs of a financial institution's failure, and as a result are now pricing this into bank funding accordingly, increasing market discipline and feeding back into resilience of institutions. Whilst the most immediate post-crisis focus has been on addressing the too-big-to-fail risks arising from systemic banks, work is currently also underway to put in place effective policies and regimes for systemically important non-bank financial institutions, in particular central counterparties (CCPs) and systemic insurers.

3| Addressing systemic risks from OTC derivatives markets

Effectively regulated OTC derivatives markets have an important role to play in reducing system risks and in helping financial and non-financial corporates manage their risks. However, during the crisis, banks did not have sufficient risk

1 With the exception of China, due to the unique nature of its banking sector.

management or loss-absorbing capacity (in the form of both capital and margin) in place to safely manage their derivatives exposures. In addition, banks' complex web of bilateral derivative exposures meant that nobody was sure of their credit exposures to troubled institutions. These complicated exposures caused contagion and uncertainty, which led to banks being unwilling to lend to one another; the subsequent removal of liquidity further exacerbated the crisis.

In Pittsburgh in 2009, reforming the broken OTC derivatives markets was made a key plank of the G20 reforms. Leaders committed to: trade reporting of all OTC derivatives; central clearing of standardised OTC derivatives; higher capital and minimum margin requirements for non-centrally cleared derivatives trades; and exchange or electronic platform trading of standardised OTC derivatives, where appropriate. Together, the purpose was to reduce systemic risk, increase transparency and curb market abuse.

The majority of FSB jurisdictions (covering over 90% of OTC derivative transactions) now have in force frameworks for determining when standardised OTC derivatives should be centrally cleared. Moreover trade reporting requirements covering over 90% of OTC derivative transactions are expected to be in force for 23 FSB jurisdictions by year end. Comprehensive trade reporting is important as it means that financial authorities can better understand emerging risks in the derivatives market.

More generally, implementation of these reforms has progressed more slowly than intended. Addressing the technical challenges to the reform of OTC derivatives markets has not been easy, and authorities continue to face a range of implementation challenges, many of which FSB members are seeking to address through both international and domestic workstreams.

These reforms have been implemented alongside measures to improve the resiliency, risk-management, and resolvability of CCPs, in order that the increase in central clearing reduces systemic risk and that these entities do not become "too-big-to-fail".

Together, with standard-setting bodies, the FSB has taken forward a workplan to address the risks posed by CCPs with a number of key reforms set to be developed and implemented in 2017. Earlier this year the FSB published a second consultation on proposed guidance on CCP resolution and resolution planning. The guidance will be finalised by mid-2017, along with resilience and recovery guidance issued by Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO).

As a whole these reforms aim to ensure that the important role of the derivatives markets in helping effective risk management can be maintained, but in the context of a simpler, safer market. The FSB, as part of its third Annual Report on the implementation and effects of the reforms, to be published ahead of the G20 leaders' Summit in July 2017, will comprehensively review members' implementation of reforms to derivatives markets and whether the package of reforms have put the right incentives and protections in place.

4| Building an open and resilient system of market-based finance

The financial system is changing to rely more on markets and less on banks. This is a major, positive development but it is also one that raises new vulnerabilities.

The financial crisis revealed how risks, which had built up outside the core banking system and without effective regulation, could have devastating effects on the real economy. Off-balance-sheet vehicles allowed enormous leverage to be masked, monoline insurers supported a system of unsustainable debts,

and banks became overly reliant on fragile short-term funding from money market funds. As the complex chains in shadow banking unravelled, a spiral of asset fire sales and liquidity strikes followed, threatening the entire financial system and withdrawing access to credit from millions of households and businesses.

In 2011, the FSB set out a comprehensive framework – the Shadow Banking Roadmap – to strengthen oversight and regulation of shadow banking. Since then, the FSB has systematically mapped the shadow banking system and developed new mechanisms to monitor and address risks. The FSB has created a system-wide monitoring framework to track developments in the non-bank financial system with a view to identifying the build-up of systemic risks and initiating corrective actions where necessary, publishing an annual Global Shadow Banking Monitoring Report.

Enhanced monitoring has been accompanied by a comprehensive series of policy actions. The policy work of the FSB and the international standard-setters has focused on five areas: (i) mitigating risks in banks' interactions with shadow banking entities; (ii) reducing the susceptibility of money market funds to runs; (iii) improving transparency and aligning the incentives in securitisation; (iv) dampening the procyclicality and other financial stability risks in securities financing transactions; and (v) assessing and mitigating financial stability risks posed by other shadow banking entities and activities. Each of these areas has been accompanied by detailed policy work that addresses these risks.

The FSB's latest assessment shows that this comprehensive policy response is moving these activities out of the shadows and into the light of resilient market-based finance. The toxic forms of shadow banking at the heart of the crisis – with their large funding mismatches, high leverage and opaque, off-balance-sheet arrangements – have declined to a point where they no longer represent a global stability risk. And the other, more constructive forms of shadow banking that were once sources of vulnerability, including money market funds and repo markets, are now subject to effective policy measures that reduce their risks and reinforce their benefits.

In tandem with these efforts, the importance of asset management has grown rapidly. In 2015, asset managers held USD 77 trillion of assets under management, making up 40% of global financial system assets – an increase from USD 54 trillion in 2005. Collective investment vehicles with run risk now account for almost two-thirds of identified shadow banking up from less than one-third prior to the crisis. The growth of asset management is positive overall. It is creating new sources of funding and investment, promoting international capital flows, reducing reliance on bank funding and bringing welcome diversity to the financial system. At the same time, however, asset management's vastly increased importance reinforces the need to minimise the risk of sudden stops in times of stress.

In January 2017, delivering on its commitment to the G20 leaders in Hangzhou, the FSB finalised its recommendations to address structural vulnerabilities and reduce liquidity mismatches associated with asset management. These recommendations will be operationalised by IOSCO with work on liquidity mismatches in open-ended funds to be completed by end-2017 and development of consistent leverage measures by end-2018.

In completing the Shadow Banking Roadmap, the FSB has not identified new shadow banking risks that currently require additional regulatory action at the global level. However, given that new forms of shadow banking activities are certain to develop in the future, FSB member authorities must maintain and continue to invest in an effective and ongoing programme of surveillance, data sharing and analysis so as to support judgements on any required regulatory response in the future.

5| Full, timely and consistent implementation of the reforms is essential

Since 2009, G20 leaders have called on the FSB to coordinate detailed monitoring of the implementation of these post-crisis reforms.

The FSB published its second Annual Report on the implementation and effects of post-crisis reforms last August. The report demonstrated that implementation has progressed steadily, though unevenly, across the four priority reform areas, and that the implemented reforms have been substantially net positive and have allowed the global financial system to cope with episodes of heightened stress and volatility. The FSB's third Annual Report on the implementation and effects of the reforms will consider these issues in more detail.

The FSB has identified three areas that merit ongoing attention as the reforms are implemented: the effects of reforms on market liquidity, on emerging market and developing economies (EMDEs), and on the maintenance of an open and integrated global financial system. While there is limited evidence of a broad deterioration in market liquidity, work is underway to assess the liquidity and depth of sovereign debt, corporate debt, and repo markets. While EMDEs have not reported any major unintended consequences from implementing the reforms in their domestic economies, there are signs of global banks reducing their presence and activities in EMDE markets. The FSB will further examine the drivers and implications of this trend. Lastly, the reforms appear to have helped avoid significant retrenchment and market fragmentation, which were common features of past financial crises. While cross-border bank lending has declined since the crisis, its structure has shifted towards more stable locally funded lending. The FSB will continue to monitor developments in all these areas.

Over the coming year the FSB will deepen its work to consider the effects of reforms. This includes further work with academics and industry participants, as we develop a structured post-implementation policy evaluation framework. The approach of dynamic implementation allows for learning-by-doing and improving reforms where new evidence comes to light.

6| Addressing new and emerging vulnerabilities

The FSB provides a forum to assess emerging vulnerabilities affecting the global financial system and to identify, within a macroprudential perspective, the regulatory and supervisory actions needed to address them. The FSB is currently considering a number of different emerging vulnerabilities, including risks from FinTech, climate-related financial risks and misconduct in financial institutions, and taking steps to mitigate them, where appropriate.

The FSB's work on FinTech is focused on harnessing the benefits while understanding any risks that might emerge, including cyber risks. The FSB is drawing out supervisory and regulatory issues raised by FinTech from a financial stability perspective, informed by a stock take of national authorities' existing and evolving regulatory approaches to FinTech activities. The FSB will also look to leverage the expertise and work of other international bodies exploring FinTech activities for financial inclusion, consumer protection, and investor protection. A report will be delivered to the G20 Summit.

The FSB's work has identified the potential of climate change to pose risk to financial stability. Access to better quality information on climate-related risks is essential to enable market participants to better understand and manage these risks. Without the necessary information, market adjustments to climate change could be incomplete, late and potentially destabilising. The private-sector industry-led FSB Task Force for Climate-related Financial Disclosures, under the leadership of Michael R. Bloomberg, was established to develop voluntary, consistent climate-related financial disclosures for use by

market participants. In December 2016, the Task Force issued its report for consultation, setting out specific disclosure recommendations, and it will publish its final report in June 2017.

In the years following the financial crisis significant issues have emerged with misconduct in financial institutions. Ethical conduct, and compliance with both the letter and spirit of applicable laws and regulations, is critical to public trust and confidence in the financial system. Cases of misconduct have threatened to undermine the safety and soundness of major financial institutions, including through financial and reputational costs. Particularly severe patterns of misconduct can damage the efficient functioning of financial markets and raise broader questions about the adequacy of corporate governance, risk management, and compensation practices.

Given the misconduct scandals identified since the crisis, the FSB has developed a workplan to address these risks. This work examines whether reforms to governance and compensation structures are having sufficient impact on reducing misconduct, and it includes efforts to improve global standards of conduct in the fixed income, commodities and currency markets; as well as steps to reform major financial benchmarks.

7| Reflecting on the reforms

A decade on from the first signs of the financial crisis, now is the right time to take stock. The G20 has made substantial progress in building a financial system that is more resilient and better able to fund households and business in a sustainable way. During recent episodes of market turbulence the financial system has continued to function effectively, by dampening rather than amplifying shocks – demonstrating some of the benefits of the agreed reforms. As the global recovery gains strength, it is important to avoid complacency. Now is not the time to risk these hard-won gains.

The FSB needs to adapt constantly as the financial system continues to evolve and new financial stability risks inevitably emerge. The development of a new structured framework for evaluating policies underscores the FSBs commitment not just to full, timely and consistent implementation, but also to dynamic evaluation of effects and effectiveness of our reforms. Based on such rigorous analysis, the FSB will propose targeted adjustments to measures, if required.

Eight years after the creation of the FSB, the fault lines of the crisis have been repaired. The financial system is now better supervised and regulated. We have built a safer, simpler, and fairer system. To avoid a repeat of the intense economic and social upheaval created by the financial crisis, the collective priorities of governments and regulators must now be to implement the agreed post-crisis reforms in a full, timely and consistent manner; to address new risks and vulnerabilities; and to continue to build an open global financial system that benefits all. In these ways, the FSB will make a lasting contribution to the objective of strong, sustainable, and balanced growth.

Have financial institutions been made more resilient?

Safer than ever before? An assessment of the impact of regulation on banks' resilience eight years on

Danièle NOUY
Chair of the Supervisory Board
Single Supervisory Mechanism

Eight years after the crisis, the regulatory framework has changed substantially. Moving away from a predominantly capital-focussed regime under which banks were able to operate with very high leverage, new regulations have been agreed regarding all aspects of prudential regulation, from higher capital levels to new liquidity proposals and new governance standards. But has this made banks more resilient in practice? Are they better able to absorb shocks while continuing to provide critical economic services?

In this article, the author takes stock of "where we are on the path towards putting into practice the new regulatory framework". She then discusses what this has meant for resilience. To what extend are banks now capable of dealing with losses and how does this compare with 2008? It is too early to draw firm conclusions on the steady state impact, given that implementation of post crisis reforms is still under way. However, assessments of banks' resilience through stress tests indicate that we have already seen substantial improvements. The author concludes by giving a brief overview of what is yet to come and by setting out key priorities for future work.

Danièle Nouy

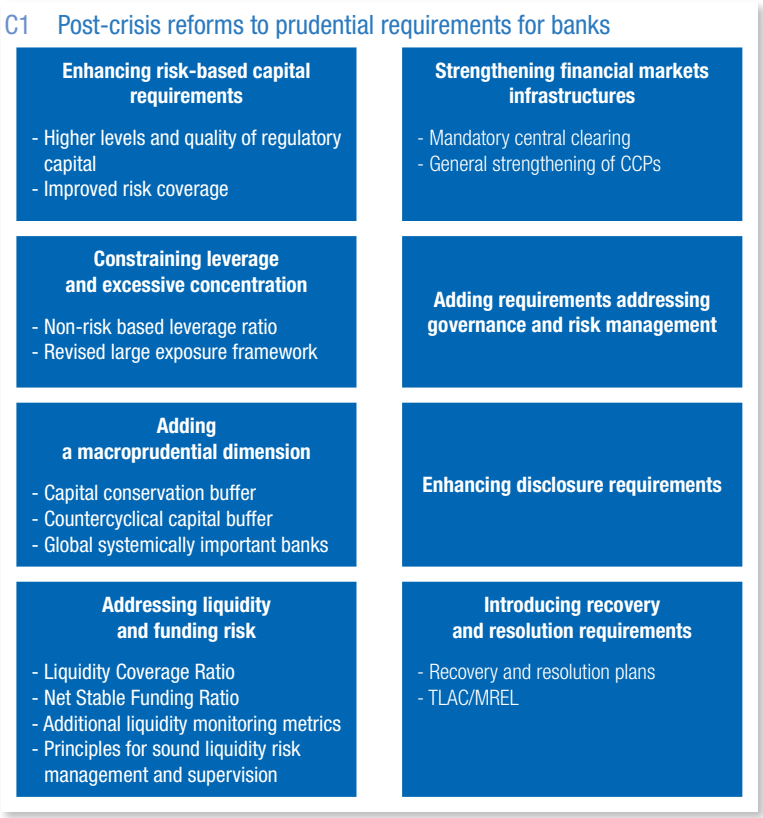
The financial crisis laid bare fundamental weaknesses in the global banking system which had gradually evolved during the pre-crisis period. These weaknesses included unsustainable credit growth in various market segments together with increasing levels of leverage facilitated by a broad underestimation and mispricing of risks, a high degree of systemic risk, as well as insufficient capital and liquidity buffers and inadequate resolution mechanisms. As a consequence, in 2008 the G20 agreed to an ambitious and comprehensive programme of strengthening prudential requirements for banks and developing resolution tools and frameworks.

The crisis also revealed shortcomings in the institutional architecture underpinning Europe's financial system. While the single European market allowed banks and other financial firms to move funds and provide their services across borders, the laws governing these activities were implemented from European directives at the national level with wide degree of flexibility and the EU-wide cooperation for their harmonised application was very limited. A fundamental overhaul of the institutional architecture of financial supervision in the European Union was required.

It is too early to assess the impact of these reforms. Some are yet to be finalised and others have not been in force for long. We are still seeing the impact of transition as banks adjust to the interplay of the new reforms. But looking at the shift in the ability of banks to withstand future shocks through the lens of our stress-testing methodology suggests that the change has indeed been dramatic, reflecting the substantial increases in capital.

While this is encouraging, let me be clear: agreement on regulation is just the first step in enhancing bank resilience. It is key to ensure that regulatory reforms are supplemented by consistent and fair supervision, and robust stress tests, so that we reap the full benefits of the new framework.

C1 Post-crisis reforms to prudential requirements for banks



1| Post-crisis reforms to prudential requirements for banks

The prudential framework for the banking system has a number of pillars, reflecting the complex set of risks to which the banking system is exposed (see Chart 1). These include:

- **capital and liquidity regulations** which set conditions on the resources banks have to hold on their balance sheets to enable them to deal with solvency or funding shocks, with add-ons for systemically important institutions.

- **risk management and disclosure standards** which require banks to meet minimum standards in how they govern themselves, manage risks and provide information to their stakeholders.

- **a resolution and recovery framework** which ensures that banks are better able to deal with crises and that banks can be resolved, where necessary, in an orderly fashion. An important component of this is that banks need to hold sufficient loss absorbing liabilities that can be bailed in reliably.

In a first reaction to the G20 call for action, the Basel Committee on Banking Supervision (BCBS) published revisions to the Basel II framework in 2009, referred to as Basel II.5, which were aimed at increasing capital and disclosure requirements for securitisations and market risk exposures measured by internal models – two types of banking activities that had turned out to be particularly under-capitalised (BCBS, 2009a and BCBS, 2009b).

The Basel III framework that followed shortly after in 2010 was a landmark agreement at global level, delivering higher levels of better quality regulatory capital and new capital buffers to provide a cushion against shocks to banks from the macro-economic environment. In addition, the risk coverage of the requirements in Pillar 1 was expanded, for example, with respect to exposures arising from derivatives and repos (BCBS, 2010c). Further to this reform of the capital framework, it introduced new measures: a leverage ratio that constrains the build-up of leverage in the banking sector, and two tools targeted at liquidity and funding risk (BCBS, 2010c, BCBS, 2013 and BCBS, 2014a). The Liquidity Coverage Ratio (LCR) ensures that banks hold a sufficient amount of high quality liquid assets to cover a net cash outflow under stress over a time horizon of 30 days. The Net Stable Funding Ratio (NSFR) requires banks to fund their activities with stable sources of funding to be sustainable over a time horizon of one year.

Subsequent additions to the capital framework include:

- a new standardised approach for the measurement of counterparty credit risk (BCBS, 2014b);
- revised internal models-based and new standardised approaches for market risk (BCBS, 2016); and
- surcharges for globally, systemically important banks in order to increase the additional going-concern loss absorbency for those banks (BCBS, 2011).

In 2015, an international standard for total loss-absorbing capacity (TLAC) was finalised (FSB, 2015). It applies to globally systemically important banks and should ensure that failing banks have sufficient capacities for loss absorption and recapitalisation in resolution scenarios in order to minimise their impact on financial stability.

Reforms to guidance on how to carry out banking activity include revised principles for bank governance (BCBS, 2010b and 2015a) and a fundamental overhaul of disclosure standards, including through the work of the private-sector Enhanced Disclosure Task Force (EDTF). This Task Force was formed in 2012 at the initiative of the Financial Stability Board (FSB) to develop principles for improved disclosures and to identify leading practice risk disclosures, reporting to the FSB. The change to accounting standards, soon to come into force through IFRS9, will support this by making sure banks can disclose a more timely view of expected losses.

The BCBS is currently finalising its post-crisis reform package (BCBS, 2015b). This includes a review of the standardised and internal models-based approaches for credit risk and operational risk, the finalisation of the leverage ratio as well as a revised framework on the design and calibration of a capital floor based on the standardised approaches for credit, market and operational risk. A review of the regulatory treatment of sovereign risk is still ongoing.

The timely and faithful implementation of the Basel reforms into EU legislation is crucial to the successful finalisation of the post-crisis reforms and to provide banks with regulatory certainty in order to facilitate their planning and the adaptation of their business models. The CRD IV/CRR

package (Capital Requirement Directive IV and Capital Requirement Regulation), which came into force on 1 January 2014, already transposed a number of key elements of Basel III, such as the major achievements from the 2010 reforms, into EU legislation – albeit with a number of modifications, some of which complicate the consistent application of the international standard for supervisors. The forthcoming revisions to CRD IV/CRR are aimed at implementing standards agreed after 2010 such as the revised market risk framework and the TLAC requirements.

Another important step in the European Union to ensure long-term financial and economic stability and to reduce the public cost of possible future financial crises has been the adoption of the Bank Recovery and Resolution Directive (BRRD) in 2014. Largely building on international standards (BCBS, 2014c and FSB, 2011), the BRRD has created a harmonised European framework for domestic and cross-border bank crisis prevention and management. Among other aspects, the BRRD requires institutions to prepare and maintain recovery plans which describe the arrangements and measures available to restore the financial position of institutions when they fall into situations of severe stress. The BRRD also grants competent authorities specific early intervention powers to remedy the deterioration of an institution's financial position and prevent its failure, though further amendments are needed in order to make these tools fully useable in practice. In addition, the resolution authorities have to draw up and maintain resolution plans that describe, inter alia, the preferred resolution strategy and tools that the resolution authority would apply once an institution fails, as well as the preparations by the resolution authority to ensure that a failing bank can be resolved in a credible way. Furthermore, the BRRD has introduced a minimum requirement for own funds and eligible liabilities (MREL) to ensure that institutions have sufficient loss-absorbing capacity at the time of resolution. The requirement is determined by the resolution authority on a case-by case basis for each institution.

C2 Milestones in the implementation of the post-crisis reforms

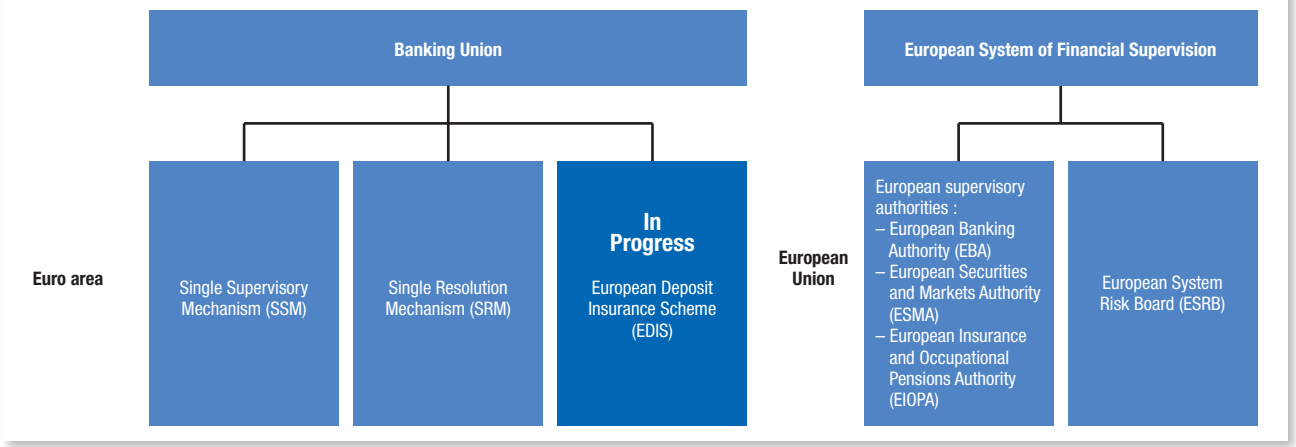
	Global regulatory reforms	Implementation in the EU
2009	**Basel II.5 framework:** Higher capital requirements for the trading book and complex securitisations, higher disclosure requirements for securitisations	CRD II/III (2011)
2010	**Basel III framework:** Higher levels and quality of regulatory capital, improved risk coverage, leverage ratio, liquidity standards, disclosure standards	CRR/CRD IV (2014)
2010	**Governance:** Principles for enhancing corporate governance (later updated in 2015)	CRD IV (2014)
2011	**G-SIB framework:** Assessment methodology and additional loss absorbency requirement for global systemically important banks	CRR/CRD IV (2014)
2015	**TLAC framework:** Standard for total loss absorbing capacity to cover the "too-big-too-fail" problem	Forthcoming
???	**Finalisation of the post-crisis reform package:** Review of the standardised approaches and the internal models (credit risk, market risk, operational risk), finalising the leverage ratio and risk-weighted capital floors, revisions to the risk-weighted framework	???

2| A new institutional architecture supporting EU banks

In order to harmonise and strengthen financial supervision in the European Union, the creation of the European System of Financial Supervision, and, in particular, the European Banking Authority (EBA) within that, was a major step towards putting Europe's banking system on a more solid footing with a set of common rules which all parties concerned need to observe. Since then, the EBA has contributed to the developments of the single European rulebook and safeguards its consistent application. Alongside it, the European Systemic Risk Board (ESRB) facilitates coordination of the system-wide (macroprudential) supervision of the banks.

We saw during the crisis that the financial interdependencies between countries sharing Europe's single currency are even stronger than the links between those Member States that have retained their national currencies. Indeed, the

C3 A new institutional architecture for banks



smooth functioning of the euro hinges on a resilient banking system which protects the savings of citizens across the euro area and channels these resources to borrowers effectively in order to support stable and sustainable economic growth. The project of a banking union began to take concrete shape at the euro area summit in the summer of 2012, when the European Commission was asked to present proposals for the establishment of a Single Supervisory Mechanism (SSM). The Council and the Parliament moved fast on the legislative proposals presented by the European Commission in September 2012, leading to the approval of the SSM Regulation within the space of about one year. In addition, the European Commission presented a roadmap that laid out plans for the completion of the banking union, including the SSM as a first pillar, a Single Resolution Mechanism (SRM) as a second pillar and a common system of deposit protection as a third pillar.

Through the establishment of the SSM, as the first pillar of the banking union, the European Central Bank (ECB) assumed official responsibility for the effective and consistent functioning of the SSM and exercises oversight over the functioning of the system. It supervises significant institutions directly while National Competent Authorities (NCAs) are in charge of supervising less significant institutions. The new system has been fully operational from day one onwards – a remarkable achievement which was only possible due to the excellent cooperation between the ECB and the NCAs.

As the second pillar of the banking union, the SRM ensures the effective and consistent application of the resolution framework across participating Member States. The first main element of the SRM is the Single Resolution Board (SRB), a central decision-making body in the form of an EU agency established on 1 January 2015 and which acquired full resolution powers on 1 January 2016. The SRB is primarily responsible for all institutions directly supervised by the ECB and for some cross-border, less significant institutions, while the National Resolution Authorities (NRAs) are responsible for the remaining institutions. The other major element of the SRM is the Single Resolution Fund (SRF), which functions as a second line of defence in resolution financing after loss absorption by shareholders and creditors.[1]

As a third pillar, the European Commission has proposed a European Deposit Insurance Scheme (EDIS), currently under discussion, that would provide deposit insurance through a euro area-wide scheme. For the time being, the Deposit Guarantee Schemes Directive (DGSD) requires that all

1 Some aspects of the SRF are contained in an intergovernmental agreement: see *Agreement on the transfer and mutualisation of contributions to the Single Resolution Fund*, May 2014.

credit institutions be part of a national deposit guarantee scheme, which needs to cover losses of up to EUR 100,000 per depositor in the event of a bank failure.

3| The link to resilience

As the reform package is taking shape, there is growing interest in an assessment of its impact, both in terms of resilience, building on the cost-benefit analysis carried out as part of the reform effort, and in terms of provision of economic services by banks. Indeed, the FSB has launched a dedicated workstream to establish a framework for such assessments.

It is too early to take stock of how these reforms have delivered in practice. First of all, they are not yet complete. For example, in the European Union, the legislative process to implement such cornerstones of reform as the Fundamental Review of the Trading Book has only just begun. And other measures, such as the reform of the standardised approach and internal ratings-based models to reduce excess risk variability, which underpin the capital framework, are currently being finalised in Basel, but will take a few more years to be put into place in the European Union. Even for measures already in force, the transition to the new framework is still under way. Moreover, regulation needs to be embedded through sustained practice, and banks need time to adapt their business models to reap the full benefits. Finally, we need to see how banks cope over the long term. History suggests that banking crises occur on average once every 20 to 25 years (BCBS, 2010a). It is clear that we cannot judge after a handful of years if regulation has been successful in reducing either that frequency or the cost of crises, or both.

Notwithstanding these difficulties, it is important to keep track of whether reforms appear to have the desired effects in order to ensure that we can cope with the possible unexpected consequences of the new framework and changes in risks as the financial system adapts. I will focus particularly on the ability of banks to withstand shocks by their holding more capital as one of the earliest changes of the post-crisis reforms and which has the most immediate impact on resilience – and we can see this in very real terms through the lens of stress testing.

Before I turn to that, let me give you two concrete examples of regulation that support resilience through changes in behaviour and planning. The first example is the requirement on banks to put together recovery plans. These plans bolster resilience in two ways: they enable faster and well thought out action during times of stress and, through planning, better preparation for unexpected shocks. Under the BRRD, banks have been required to maintain and submit such recovery plans to the ECB to have them assessed on an annual basis since 1 January 2015. We believe that good recovery plans will improve banks' and supervisors' capacity to implement in a timely manner measures to respond to a crisis. They are helpful even though the plan itself might not be implemented as circumstances change. At the same time, many recovery plans are still in their early stages of development and need to embed best practices to make them fully useful and credible.

The second example concerns changes in governance. Given its importance to an institution's overall risk profile, we carried out a thematic review of institutions' management bodies and risk appetite by assessing compliance with national and European legislation as well as consistency with best international practices (ECB, 2016). This exercise has already identified good practice in many institutions, but also drawn attention to a number of shortcomings in some instances. Mitigating those aspects will further enhance the effectiveness of internal governance in reducing the risk of inappropriate risk-taking. Further work is under way in this area. Governance also forms part of our annual supervisory review and evaluation process, which will ensure that improvement continues.

Progress on capital

It is clear, using any measure of capital, that levels and quality have risen sharply since 2008 in the euro area. From 2008 onwards, for example, we have seen euro area banks' Tier 1 transitional capital ratios increase by 5.3 basis points to 13.9% by year-end 2015 (see Chart 4). In parallel, Basel III requires that both Tier 1 and Tier 2 capital instruments have to meet more stringent criteria, which we have seen is reflected in the phasing-out of certain types of instruments.

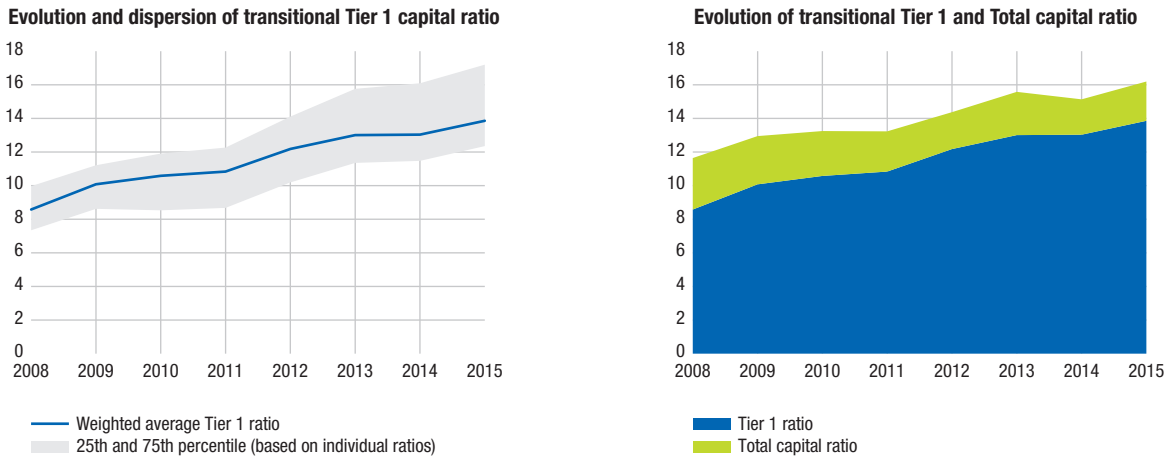
Of course, the strengthening of capital ratios in terms of quantity and quality is not only a reflection of regulatory change – as noted previously, the regulatory reform has been a gradual process and not all measures are yet in place. An important complement that is also reflected here is the action by supervisors through Pillar 2 requirements and guidance which ensured that banks continued to build up capital where necessary in an early and consistent manner.

To interpret the impact of these changes on SSM banks' resilience, we can draw on stress test exercises (which themselves also bolster resilience through the insight they offer into potential drivers of loss). Considering the 2016 EU-wide stress test vis-à-vis the 2014 EU-wide exercise, the results indeed reflect the increased resilience of the largest SSM banks. In the adverse scenario of the 2016 stress test, the average[2] depletion of the Common Equity Tier 1 (CET1) ratio was 3.9 percentage points, i.e. higher than the 2.6 percentage points in the 2014 exercise. This was partly due to a more stringent stress-testing methodology and a tougher adverse scenario. With an increase in the average CET1 ratio from 11.2% at the start of the 2014 exercise to 13.0% for the 2016 stress test and other improvements since 2014, the final average CET1 ratio in the adverse scenario was nonetheless higher, standing at 9.1%, compared with 8.6% in 2014. In other words, **the findings of the 2016 stress test signal an increased resilience of the euro area banking sector, which now has a higher stock of capital and is in a better position to absorb economic and financial shocks than it was in 2014 when the previous EU wide stress test was performed.**

2 All averages are weighted by bank total risk exposure amount (REA).

C4 Changes in the transitional Tier 1 ratio from 2008 to 2015 in the SSM

(%)



Source: S&P Global Market Intelligence.
Notes: The definitions of capital and risk-weighted assets have changed since 2008. In particular, the definitions of regulatory capital became progressively more stringent as Regulation (EU) No 575/2013 (CRR) came into force on 1 January 2014. Therefore, the increase of capital would be even more significant if a consistent definition of capital was considered. The sample used for calculating the Tier 1 capital ratio evolution is consistent across periods and comprises 74 SSM significant institutions.

This is further confirmed when applying the impact of the 2016 stress test to the capital positions of participating banks in the run-up to the global financial crisis of 2007-09, as in the following counterfactual exercise.[3] Applying the capital depletion projected in the 2016 stress test to the capital ratios recorded before the financial crisis (i.e. as of end-2007) would have led to a disastrous outcome. Calculations can be performed for 26 banks, including some of the largest SSM institutions, and comprising more than 50% of the total assets of the euro area banking sector. **For these 26 institutions, the average[4] Tier 1 ratio[5] at end-2007 was 7.3%, which would lead to an average Tier 1 ratio of 3.3% at the end of the horizon in the adverse scenario**. In this case, 22 institutions would have a final Tier 1 ratio below 4.5%, which would make them non-viable in this scenario. Even worse, three of these banks would see their capital base completely wiped out.

While these numbers give us reassurance that we are heading in the right direction, we should nevertheless not grow complacent. There is a lot of work left for us, for the banking sector and financial markets to embed the new structures and standards and continue to adapt as the financial sector changes.

Progress on liquidity

Banks in the euro area have also improved their resilience to liquidity shocks as measured by their ability to meet two quantitative liquidity requirements, namely the LCR and NSFR. In particular, since 2011, the share of banks already above a 100% LCR has increased significantly (see Chart 5).[6] During this period, the amount of high quality liquid assets (HQLAs) has nearly doubled, while net cash outflows have remained broadly the same.

We also see improvements in the longer-term measure of the NSFR, which was introduced at Basel level in 2013, though is not yet part of the legal framework in the European Union (the European NSFR legislative proposal was published in November 2016). As of December 2015, more than 75% of the banks in the sample already meet the 100% requirement as provided under the Basel III NSFR framework (see Chart 6).

The weighted average ratios are mainly driven by large cross-border universal banks that, on average, tend to have lower liquidity ratios compared with smaller banks. Many of these have business models that are less characterised by short-term wholesale funding.

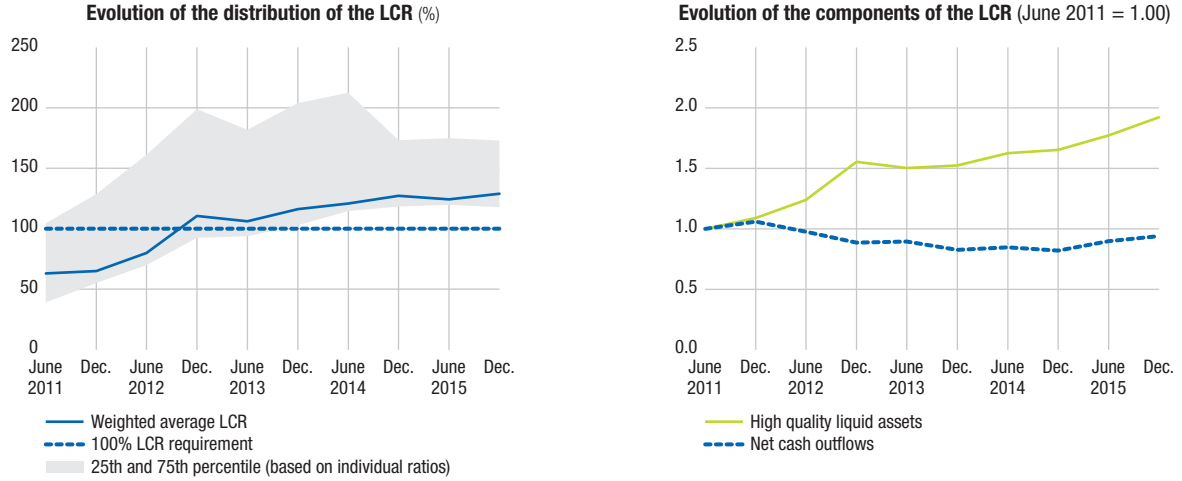
3 The counterfactual exercise presented here is subject to caveats and cannot replace a fully-fledged stress test. In particular, it only accounts for changes in the capital levels that have occurred over time, disregarding changes in the composition and quality/riskiness of banks' assets. Further, the simple algebraic addition of the stress-testing impact to an updated started capital level disregards possible non-linearities related to tax effects and regulatory deduction thresholds for deferred tax assets and significant holdings.

4 Average weighted by risk-weighted assets levels reported as of end-2007.

5 This simplified exercise is based on the Tier 1 capital position as the regulatory definition of CET1 only came into effect in 2014. The Tier 1 ratio can serve as a proxy which in general will be higher than the CET1 ratio.

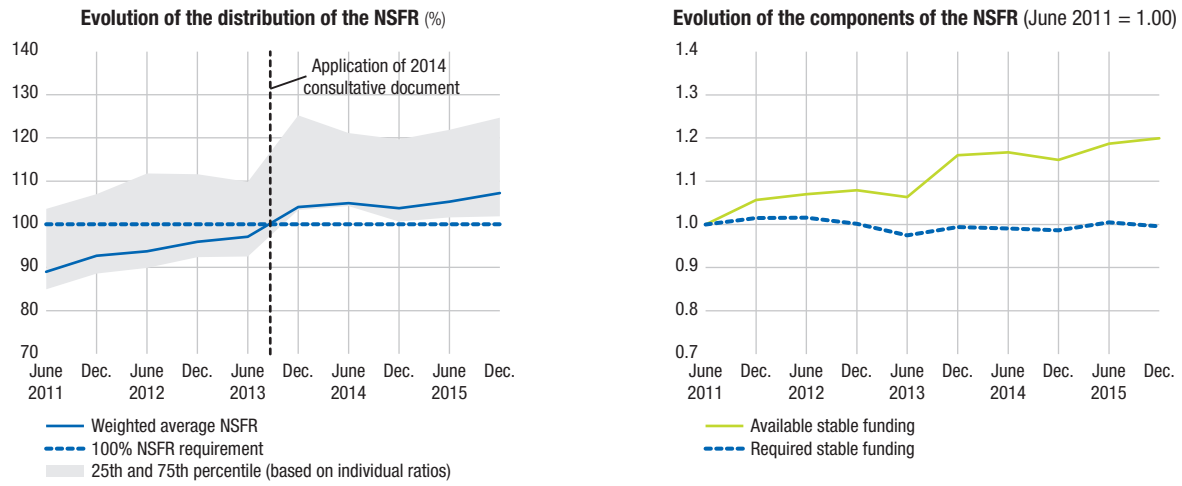
6 The LCR minimum requirement has been set at 60% on 1 October 2015 and gradually increases to 100% by January 2018. In 2017, banks in the European Union are subject to an 80% LCR minimum requirement.

C5 Evolution of the LCR



Source: QIS data for 60 banks in the euro area. Data are based on BCBS calibration. Calculations performed according to the final standard in January 2013 start with the end-December 2012 reporting period. Data as of June 2015 and December 2015 are based on the LCR Commission Delegated Regulation (EU) 2015/61.

C6 Evolution of the NSFR



Source: QIS data for 69 banks in the euro area. Data are based on the relevant BCBS calibration. Calculations performed according to the 2014 Basel standard start with the end-December 2014 reporting period.

4| Conclusion and outlook

We have already achieved much since 2008, both in terms of specific improvements to banks' resilience and in terms of creating the institutional structures, which will allow us to ensure that regulation and supervision are fit for purpose. This is a fundamental change to the regulatory and supervisory environment; and it is important that we do not lose momentum in embedding changes.

A top priority is to implement outstanding reform elements faithfully at the global level. We need a credible global minimum standard for financial regulation that prevents a regulatory race to the bottom – and at European level, we need a harmonised standard that will support both financial integration and financial stability. It is important not only to agree a robust standard, but also critical to do it speedily and with an appropriate transition time to ensure that the costs of uncertainty over regulation and adapting to new measures are minimised. Of course, in parallel, we also need appropriate reform of the CRD IV and CRR on non-Basel elements, in particular to maintain achievements such as a strong and flexible Pillar 2 tool and to ensure that early intervention toolkits are fully useable in practice.

Finally, here in the SSM, we need to continue our targeted supervisory work. For example, it is essential to assess and confirm the adequacy of SSM banks' Pillar 1 internal models, which play a key role in banks' effective capital levels. European banking supervision will roll out its multi-year targeted review of internal models (TRIM) in 2017. Equally, work will continue on risk management standards. High quality data are an essential precondition for accurate risk information and, hence, sound risk management and control as well as ultimately adequate capital requirements. European banking supervision will therefore finalise its ongoing thematic review of banks' compliance with the Basel Committee on Banking Supervision's principles for effective risk data aggregation and risk reporting (BCBS 239), and joint supervisory teams (JSTs) will follow up with institutions, as appropriate.

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Measuring the impact of Basel III

Douglas J. ELLIOTT
Partner, Finance and Risk/
Public Policy Practice
Oliver Wyman

Emre BALTA
Principal, Finance and Risk
Oliver Wyman

Basel III's enhanced capital and liquidity standards promise to bring greater stability to the financial system, but at a price. Higher safety margins raise costs for financial institutions, which must be borne by customers, employees, or funders. Estimating these costs is therefore critically important to finding the right balance of safety and efficiency. This paper highlights key findings from a 150-page impact study by the management consulting firm of Oliver Wyman,[1] based on a review of approximately 400 analyses by academics, official institutions, and the private sector.

Putting the studies on a common basis, the authors find expected gross increases in funding costs for lending that are substantial, often exceeding industry net returns on assets. They do not evaluate the size of financial stability benefits and therefore do not reach a conclusion as to whether the costs of Basel III exceed the benefits. However, this study provides a comprehensive assessment of the cost of enhanced standards – one side of the coin – to help policymakers better balance safety and efficiency.

1 Oliver Wyman (2016).

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Putting the studies on a common basis, the authors find expected gross increases in funding costs for lending that are substantial, often exceeding industry net returns on assets. The literature[3] review also indicates that reductions in lending volume may be substantial, in the range of 13% compared to a world without Basel III. These cost and volume estimates significantly exceed previous projections primarily because Basel III has pushed capital levels considerably higher than was originally assumed in official studies. Analyses also raise concerns about impacts on market liquidity, although these are considerably more difficult to measure.

They do not evaluate the size of financial stability benefits and therefore do not reach a conclusion as to whether the costs of Basel III exceed the benefits. However, this study provides a comprehensive assessment of the cost of enhanced standards – one side of the coin - to help policymakers better balance safety and efficiency.

1| Structure of the study

The global financial crisis and ensuing Great Recession emphasised the importance of the financial system and the need to ensure its stability and effective operations. In response, leaders of the G20 nations deputised the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) to reform the global standards for bank regulation and supervision to improve financial stability. Specifically, the Basel Committee was charged to raise the quantity and quality of capital required, create new global liquidity standards, fundamentally change risk modelling processes and take certain other related actions. As a result, many complex rules governing capital and liquidity were created or expanded. Furthermore, some institutions were subjected to particular scrutiny and regulation due to their size, complexity, and interconnectivity.

There is a strong argument that reforms since the 2008 financial crisis will make the banking system more resilient. However, the implementation of these rules has also created costs for the banking system and the broader economy, leading to fundamental changes in bank balance sheets and business models. The structure of financial markets is also impacted by the reforms, with resulting changes in their liquidity, efficiency and effectiveness. While in many cases changes to the business models of banks were intended, in other areas it is likely that the cumulative impacts go beyond those intended and may negatively affect the functioning of the financial system. The potential for this is fuelled by the multiple layers of regulation, the analysis of which

2 Oliver Wyman (2016).
3 A 1% increase in required capital ratios could result in a decrease of lending volume in OECD countries between 0.3% (Mendicino et al., 2015) to 8% (Fraisse et al., 2015), depending on the underlying macroeconomic model used, with an average decline of 2.6%. Although the impact is not necessarily linear, this would suggest, as a rough approximation, a decrease of 13% or more in total, based on capital ratio increases of 5 points or more in the various regions since 2010 and an average effect of 2.6% per point of change in the ratio.

T1 Basel III reforms and ongoing workstreams

Basel III	Ongoing and recently completed workstreams
• Quantity and quality of capital (minimum capital requirements and composition thereof) • Regulatory buffers (capital conservation buffer and countercyclical buffer) • Counterparty credit risk capital requirements (standardised approach for measuring counterparty credit risk exposures, margin requirements) • Leverage ratio • Liquidity reforms (Net Stable Funding Ratio – NSFR and Liquidity Coverage Ratio – LCR) • Measuring and controlling large exposures	• Standardised approach for credit risk, and operational risk • Capital floors • Constraints on use of internal models • Revised leverage ratio • Interest rate risk in the banking book (IRRBB) • Fundamental review of the trading book (FRTB) • Securitisation • Haircut floors for securities financing transactions • Total loss-absorbing capacity (FSB regulation) • Stress testing (primarily jurisdictional regulation) • Step-in risk

has frequently been performed, at least initially, in isolation.

The scale and scope of regulatory reform has led to calls for regulators to take stock of the cumulative effects of these changes and to assess whether unintended, undesirable consequences may mean that a recalibration of regulatory changes is required. Both market participants and some officials have raised potential concerns over the calibration of reforms. Calibration of both individual reforms (for example, the overall level of leverage ratio requirements) and the combined calibration of reforms (for example, the interaction between risk-sensitive capital ratio requirements and risk-insensitive leverage ratio requirements) have come into question. In particular, there is a concern among some observers[4] that the ongoing Basel workstreams will significantly add to banks' capital requirements, which may exceed appropriate levels (see Box 1), and counter some of the national and regional initiatives to meet G20 growth commitments.

We believe that the need for recalibration of the reforms analysed in this paper is inevitable when making such sweeping and detailed changes to the rules for a huge and complex industry on a global basis.

Box 1

About the optimal calibration of capital reforms

Research to date has shown a wide range of results about the optimal calibration of capital reforms, leaving the correct answer unclear. Differences in methodology and underlying assumptions have resulted in estimated optimal levels that range from 8% to over 20% of RWA. As an example of the lower end of calibration, Nguyen (2014) calibrated a model that indicated the optimal capital requirement to be 8% of Tier 1 capital over RWA, while Begenau (2015) identified 14% CET1 as the optimal capital requirement. Using a dataset of almost 200 years from a number of countries, Miles, Yang and Marcheggiano (2012) found an optimal calibration of bank capital to be around 16-20% Tier 1 capital over RWA based on the then prevailing definitions (this is important as changes to RWA definition impact the capital ratio). Finally, Dagher et al (2016) find that capital requirements of 15-23% of RWA would have been sufficient to "absorb losses in the majority of past banking crises."

2| Impact on bank lending

Reforms impose additional expenses for banks as lenders, through an increase in funding costs driven by higher capital and liquidity requirements. These higher costs may then be passed through to the wider economy through two key impacts on borrowers: increases in the price of credit and reduced loan volume.

2|1 Increased price of credit

As banks raise capital and total loss-absorbing capacity (TLAC) levels for the same amount of risk, their total cost of funding goes up.[5] Given shareholder expectations for returns on capital consistent with broader equity market pricing, banks will be faced with a choice between exiting certain business lines and passing on some or all of their increased funding costs by raising margins and fees for banking products. Pricing may impact some market segments more than others, creating an uneven distribution of these costs. This is one of the main transmission channels through which the changes in capital and liquidity regulations impact the wider economy.

We reviewed over 20 studies across multiple geographies to estimate the impact of Basel reforms on the price of credit. These studies by academics and the official sector analysed the overall effects of the main Basel capital and liquidity reforms, without consideration of the many workstreams that some industry observers lump together as "Basel IV", such as the revisions to the standardised approach for credit risk, and included both theoretical estimates and analysis of actual outcomes of the Basel reforms. Note that no industry studies were used in this section, as none comprehensively looked at credit pricing without including a number of regulations unrelated to Basel standards.

4 GFMA, IIF, and PwC (2015), GFMA and IIF to the Federal Reserve System (2016), Tarullo (D.) to Board of Governors (2015).

5 While Modigliani-Miller theorem states that higher capital requirements would not increase a bank's funding costs, in the study, the authors discuss why these assumptions do not fully hold and banks experience higher funding costs. See the study for a detailed discussion of the Modigliani-Miller theorem.

Our analysis of these studies (see chart 1, shows that, when put on a common basis and with updated assumptions on total capital requirements, estimates of the gross impact of the new Basel capital and liquidity requirements on funding costs in the United States range from 15-109 basis points (bps), with a median increase of 84 bps. The impact in Europe ranges from 9-97 bps, with a median increase of 60 bps. The estimated increase in funding costs in Japan ranges from 29-105 bps with a median increase of 66 bps. Even with the larger basis point effect on the United States, the higher funding costs are likely to have a relatively larger aggregate impact in Europe and Japan, where the average pre-tax rates of return on assets are lower than in the United States and the banking systems are much larger in comparison to the size of their economies.

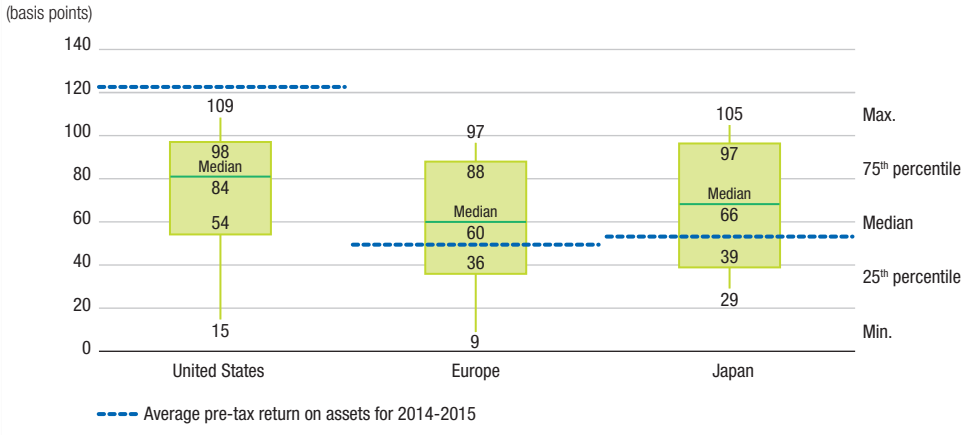
The magnitude of impacts is driven largely by the differences in the gap between starting and target capital ratios (larger for the United States and Japan than Europe) and differences in risk-weighted asset (RWA) density (higher RWA/total assets ratio in the United States than in Europe and Japan). Additionally, the impacts discussed in this report may vary within more specific jurisdictions than described here (for example, within Europe).

These results are based on a series of assumptions we made to put the studies on a common basis and to reflect the aggregate impact of the relevant reforms on capital levels. There are multiple choices one could make about a baseline.

First, the increase in the total capital ratio due to regulatory changes will need to be calculated. However, this is not as straightforward as it sounds as the calculation will need to factor in the change in the definition of capital (that is, one dollar of capital pre-crisis is not the same as one dollar of capital post-crisis) and factor out the increase in capital required by market forces (banks would have to maintain more capital post-crisis even if the regulatory requirements stayed constant). To address the former, we use the pro forma Basel III capital levels for all periods. The average pro forma 2010 baseline Basel III CET1 levels were 6.7% for the United States, 7.1% for Europe, and 6.6% for Japan. These calculations are taken from Elliott, Salloy, and Santos (2012), a comprehensive study for the IMF.

In line with that paper, we also assume that capital levels as of the end of 2010 reflected market forces and that further increases in capital since then have been driven by Basel reforms. A return to the

C1 Gross impact of regulatory reforms on bank funding costs



Source: Oliver Wyman, *Interaction, coherence, and overall calibration of post crisis Basel reforms*, August 2016.
Note: Average of 2014-2015 return as (total net income before taxes)/(total assets).

pre-crisis capital levels would not be acceptable to the markets and the bank themselves even without any change in regulation. December 2010 provided enough time for banks and market forces to adjust to the lessons of the financial crisis and to move capital levels to their new target levels. At the same time, it was sufficiently in advance of the implementation of Basel III that the prospect of the new and still somewhat undefined capital rules would not have been the main factor in determining capital levels. There are clearly potential objections to this choice of baseline, but we believe it provides a reasonable and balanced starting point for analysis.

Since the funding cost effects of capital are roughly linear (an assumption of this report and all, or virtually all, of the literature), readers can adjust up or down if they view the baseline as inappropriate.

The change from this baseline is calculated by assuming that banks will target an average ratio of CET1 of 12%. This target is 2 percentage points higher than in Elliott, Salloy, and Santos (2012) as a result of further Basel actions and a better estimate of targeted voluntary buffers above regulatory minimums, based on several additional years of experience. We assume that, at a minimum, average capital ratios will increase to 12% in all regions by the end of 2019: reflecting requirements of 4.5% common Tier 1 capital, 2.5% capital conservation buffer, and a 5% further buffer to account for surcharges for systemically important banks and additional voluntary Tier 1 buffers held by banks. This assumption was tested against recent average CET1 ratios for the top 50 banks in Europe and North America, which are reported to be 13-14% and ≃11% for 2014-2015, respectively. While this assumption may not hold for all banks, we assume this to be a representative target that banks will seek to reach by 2019.

For studies that evaluate the impact of equity-to-RWA increases, we multiply the estimated loan rate increases per one point of risk-weighted capital ratio by the difference between the baseline and target ratios for RWAs. For example, the CET1 capital ratio in the United States would need to increase by 5.3 percentage points, from 6.7 percent of RWAs in 2010 to the targeted 12%. The total impact on lending rates in the United States is then calculated by multiplying the increase in lending rates per one percentage increase in lending rates by 5.3. A different adjustment is used for studies that estimated the impact for the increase in non-risk-weighted assets (that is, total assets). For these, we first calculate the change in the non-risk-weighted capital ratios by using average risk weights (RWA/total assets). For simplicity, we assume risk weights to be constant.

We calculate the gaps to target as described in the figure above.

As shown in Table 2, the differential cost of meeting higher capital standards varied by region. Since European and Japanese banks have an average risk weight of approximately half of the level of the United States (≃40% versus ≃80%), banks in these nations will need to raise

T2 Target capital ratio and calculation of the gap from baseline

(%)

	BASELINE (OBSERVED)			TARGET (ASSUMED)			GAP	
	End-2010 pro forma Basel III CET1 ratio	Capital-to-(non-risk-weighted) total assets ratio	Average risk weighting	Target Basel III CET1 ratio	Capital-to-(non-risk-weighted) total assets ratio	Average risk weighting	Basel III CET1 ratio	Capital-to-(non-risk-weighted) total assets ratio
United States	6.7	5.4	0.8	12	9.6	0.8	5.3	4.3
Europe	7.1	3.1	0.4	12	5.2	0.4	4.9	2.1
Japan	6.6	3.0	0.4	12	5.4	0.4	5.4	2.4

Source: Elliott, Salloy, and Santos (2012).

less capital per dollar of total assets in order to meet an increase in the ratio of capital to RWAs.

Applying the gaps calculated above to the 1% increase in capital requirements estimated by academic and official studies allows us to compare the gross impact of reforms on lending rates. We do not adjust the projected impacts of increased liquidity requirements, because we have too little information to do so and cannot assume linearity.

This analysis does not normalise for the effects of historically unprecedented monetary accommodation and consequent low rates, which have different impacts in different jurisdictions. Likewise, significant changes and additions have been made since the initial Basel III rules were published, therefore many of the studies are based on only the initial set of Basel III rules (and do not include the ongoing or recently finalised workstreams) and are likely to underestimate the magnitude of the ultimate impacts.

The estimates would rise if they were to take into account two key recent regulatory changes: ongoing Basel reforms (likely to result in RWA increases) and the FSB's TLAC. Some analyses estimate that these additional changes will increase average bank RWAs and funding costs by large amounts.[6] More information is provided in our full impact study.

It is important to note that some of the lending rate increases discussed above could be offset by a number of factors. Banks can reduce expenses, decrease expected credit losses through tighter loan conditions, restructure businesses, and take other capital actions. Additionally, there are a number of external factors that could mitigate the impacts of reforms, including inherent offsets among reforms, changes to monetary policy, and reductions in the return on equity required by equity holders due to the increased safety of the banks. Most of the literature does not attempt to estimate the size of these offsets, but more detail is provided in our full impact study where available.

2|2 Decreased supply of credit

As a result of higher capital ratios, other technical changes increasing capital requirements, and changes in the definition of capital, banks may increase their credit standards and reduce their loan volumes, to decrease the amount of capital they have to hold. Additionally, customers could respond to higher loan rates by reducing their demand for credit.

The literature we reviewed suggests that, as a result of a 1% increase in required capital ratios, lending volume in OECD countries would decrease by 0.3% to 8%, depending on the underlying macroeconomic model used, with an average decline in the studies of 2.6%. Since the impact is not necessarily linear, we cannot estimate the impact of the cumulative increase in capital requirements without having access to the models used in the literature. However, a rough estimate assuming linearity implies decreases due to Basel reforms of 13% or more in loan volume.

Overall, the decrease in availability of bank credit for both corporate end-users and retail customers, either due to higher prices or lower supply, could impact the cost of capital for these end users and result in potentially lower output.

3| Liquidity

We expect market changes caused by recent regulatory reforms to flow through to end users, resulting in a decrease in market liquidity and an increase in market volatility. However, there are no comprehensive studies of this effect, so our full study laid out the reasons to expect this impact and showed some indications in different market segments that it was already occurring. More importantly, we believe the effects are likely to rise considerably over time and therefore encourage policymakers to continue to study this issue.

6 Durand (2015), Keenan and Spick (2015), Turner (2012), Graham, Li, and Kruse (2016), IIF (2016), BCBS (2015), ISDA, GFMA, and IIF (2015), Oliver Wyman and Morgan Stanley (2015).

3|1 Changes in market structure and behaviour of market participants

Banks play a central role as intermediaries to facilitate liquidity in the markets through their market-making activities. However, increases in capital and liquidity requirements have pressured the market-making business model by increasing the cost of providing intermediation services and driving down profitability. The combined leverage ratio and Net Stable Funding Ratio (NSFR) costs are estimated to impact bank costs in the 60bps-110bps range for low margin market making activities.[7]

Banks' balance sheets supporting traded markets have contracted by 50% in RWAs on a Basel III adjusted basis, implying 25-30% in terms of total (non-risk weighted) balance sheets, since 2010. Table 3 shows historical and forecasted balance sheet reductions by product. This points to a significant reduction in dealers' market making ability, potentially leading to a major impact on market liquidity.

While this situation may be indicative of a transition to a "new normal" in financial markets, and likely reflects additional factors beyond regulation, there has been little or no academic study so far on where the new equilibrium lies and how markets and central banks can avoid any bumps in the road that may lead to more serious systemic issues.

Data on trade sizes do suggest that the ability to perform large transactions may have decreased. For example, the average trade size for US treasuries, one of the most liquid markets, has shown a marked decline, more than 50 percent, since 2010.[8] Turnover ratios have also fallen significantly.

Analysis performed by the IMF in 2014 shows that the number of days required for liquidation of a US credit mutual fund has increased significantly post crisis. It is estimated that 50-60 days would be required for liquidation of a high yield fund, compared to the 7 day limit for redemption payments.

T3 Balance sheet reductions, 2010-2015

(% change)

PRODUCT	2010-2015	NEXT 3–4 YEARS
Repo	Down ≃50%	Down ≃10%
Prime	Up ≃20%	Flat
Bonds, FX & commodities	Down ≃25%	Down ≃10%
Structured & securitised	Down ≃20%	Down ≃10%
Listed, flow & cleared products	Down ≃20%	Down ≃5%
Issuance & advisory	≃Flat	Down ≃5%
Total	**-25% to -30%**	**-5% to -10%**

Source: Oliver Wyman and Morgan Stanley (2016).

3|2 Increase in market volatility

The speed and extent of price movements in the capital markets is influenced by market liquidity. A large number of participants with an ability to transact quickly and efficiently can ensure that price movements not aligned with the market consensus are quickly nullified. Further, in a liquid market with a constant flow of transactions, large-block trades would have a limited impact on price, resulting in lower price volatility. There have been a number of recent incidences of extreme movement in prices that may indicate potential illiquidity in some markets. In October 2014, following negative news on the US economy, 10-year US Treasury yields dropped by 37 bps, followed by a rebound to roughly the previous level, within a period of minutes. This represented a very large move by historical standards in that market in a very short space of time. In another episode of extreme market volatility, in 2015, when the Swiss National Bank gave up its policy of capping the Swiss Franc – Euro exchange rate, the value of the Swiss Franc jumped by 30% within the first 13 minutes of trading before significantly reversing the move over the course of the day. Some market observers believe that the extent of these price movements would have been more subdued in a more liquid market.

4| Interaction of rules

In analysing the impact of post-crisis Basel reforms, it is important to understand the cumulative

7 AFME (2016).

8 GFMA, IIF and PWC (2015).

Box 2

Bank decision-making processes

Accurate analysis of the impact of financial reforms on end users requires an understanding of how financial institutions make internal allocation and pricing decisions about capital, liquidity, and other scarce resources, as these have a direct effect on the supply and price of the services they offer. The aggregate effect of the decision processes of these intermediaries determines the provision of credit and other services to the wider economy. Therefore it is critical to understand these allocation decision processes as policymakers set capital, liquidity, and other regulations. Good cost-benefit analyses, for example, depend on an accurate reading of the actions that banks and other financial institutions will take in response to new regulations.

Academics and some policymakers frequently treat banks and large securities dealers as if they were unitary institutions, whereas a more accurate view is that they are internal markets of considerable dimensions, with many different units, often of substantial size, competing for the bank's scarce capital, liquidity, and other resources (for simplicity, this section will generally refer to "capital" allocation, since this is the most important aspect of a larger financial resource management process that also includes, at a minimum, allocation of liquidity, usually via funds transfer pricing and limits.)

Large and complex financial institutions use internal pricing to allocate resources to lines of business commensurate with their long-term risk-adjusted returns. Within lines of business, capital is usually allocated to the opportunities and client relationships with the highest returns, taking account of capital usage, liquidity effects, and other factors. In addition, absolute limits on usage of capital or liquidity are sometimes set for individual units. The evolution of RWA is closely monitored by investors, including their granular evolutionary split between business growth, regulatory changes, and management actions. Returns on RWA or returns on equity targets are also communicated to investors and the public for the primary business lines of banks (typically for the global banking and capital markets activities). The execution of the strategy and communication to analysts and investors requires a strict, permanent, and granular management, including on these key metrics, by all businesses and units of a bank. Whatever the mechanisms for allocation of capital and liquidity, business units and, even individuals, are judged on the returns they generate for the amount of capital that they use. Those that have more profitable opportunities will push for more capital to be allocated to them and those with less profitable opportunities will want to reduce their capital allocation so as to reduce their profit hurdles.

In practice, regulatory requirements are effectively replacing internal and rating agency criteria as the drivers of internal pricing and allocation mechanisms. The reason for this is simple; regulations are now virtually always considerably more constraining than the other methodologies in terms of the capital and liquidity they require. This reflects a considered decision by policymakers globally that the economic externalities of financial crises require that banks maintain more capital and liquidity for society's benefit than they would choose to for internal reasons or as a result of demands from their shareholders and funders.

Thus, in practice, regulatory choices about capital and liquidity rules and in particular, the risk-sensitivity or lack thereof will affect choices about the pricing and availability of credit and other services in quite specific ways throughout the organisation, as individual units and entire organisations determine how to allocate their capital according to their strategic priorities and whether the business they have traditionally done can still provide a reasonable return on capital under the new capital and liquidity requirements. In a context where capital is a scarce, inelastic resource, the internal allocation of capital is the primary constraint on business models. Policymakers have made clear that they do not wish to dictate business models, except to eliminate a few that they deem particularly dangerous, but the practical effects of various regulations and their interactions do, in fact, substantially influence business models for the future. This point is critical to understanding the future impact of Basel reforms.

impact and interaction of regulations in order to achieve the optimal design and calibration for a financial system that promotes stability and works to support economic growth. There is consensus that changes in the regulatory requirements were needed and the capital ratios (especially the higher quality CET1) were too low prior to the crisis. However, a number of concerns have been raised by academics and market participants about the calibration and implementation of the reforms.

Given the sheer volume of regulatory changes since the crisis, there may be specific cases where reforms overlap, potentially creating a duplication of requirements. Whatever one's view of the balance of the costs and benefits of the aggregate capital and liquidity levels, a review of the specifics of the financial reforms suggests it is likely that some of the costs are unnecessary and result from the problems inherent in such a large and complex regulatory process. The full study highlights the types of potential issues and provides examples.

5| Conclusions

The new and revised requirements related to bank capital, liquidity, and TLAC promulgated by the Basel Committee and the FSB represent major changes to a large, complex, and heterogeneous global financial system. The rules themselves run to thousands of pages including many technical calculations. Given all this, it is not surprising that there are a number of areas where knowledgeable observers are concerned about potential problems of duplication, harmful interactions between different rules, unintended consequences, and the sub-optimal calibration of requirements or the formulas for intermediate calculations. Indeed, it would be astonishing if there were no need for some re-evaluation and re-calibration.

The Basel Committee is to be commended for establishing a workstream to consider the "interaction, coherence, and overall calibration" of their reforms, as is the FSB for its own separate re-evaluation. As this report shows, there are many areas where it is possible that the reforms do not work as intended, either because the marginal costs of certain aspects outweigh the marginal benefits or because there are other undesirable and unintended consequences. The authors of this report are not able to do a full cost-benefit analysis and therefore we have chosen not to make specific recommendations, but we hope that the Basel Committee and FSB will look carefully at the potential problems that we have highlighted.

Additionally, the authors note that further research will be required to fully understand the impact of reforms. First, additional rigour could be applied to evaluating costs and benefits of financial reforms at a higher level of granularity: for example, the impact of liquidity reforms on a trading desk or product level. It will be critical to understand reforms' impact on different segments of the market to identify potential areas of undue burden or impairment of the efficient functioning of the market. Second, the empirical research to date has focused primarily on the impact of capital, and to a lesser extent, liquidity regulation and the joint impact thereof on banks. Other reforms, for example margin requirements, have received less attention and should be evaluated further. However, until all these reforms are finalised and fully implemented, the full impact cannot be determined, though it would be desirable, as a matter of policy, to address some of the perceived negative impacts. Third, a holistic study of the RWA increases that could result from the most recent set of reforms is necessary. Fourth, the interactions among reforms will require additional attention to understand potentially competing incentives or countervailing impacts. This will become increasingly important as the reforms currently under revision are implemented. Finally, study of the impact of reforms across multiple jurisdictions would also be beneficial, as research to date has focused primarily on developed markets, especially the United States and Europe.

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The impact of financial regulation: a G-SIB perspective

Axel WEBER
Chairman
UBS Group AG

Regulation of the financial services industry has undergone a complete overhaul since the global financial crisis that started in 2007 and led the G20 to define a comprehensive reform agenda which has since transformed the industry and the way financial services providers do business.

The aim of this article is to give an overview of the impact of financial regulation on financial institutions themselves as well as on economic activity – from a global systemically important bank (G-SIB) point of view. The article will describe where we stand today, how we got there and address both intended and unintended, adverse consequences of the G20 financial reform agenda. It also aims at providing an outlook on the way forward.

1| Thorough regulatory reforms have made the financial sector considerably more robust

The shaping and ultimately implementation of regulatory reforms have dominated the financial services industry since the subprime crisis.[1] As major projects have been completed, such as the Basel III capital and liquidity ratios, it is a good point in time to take a look back at how regulatory reform has evolved over the last decade and what has been achieved since inception. Traditionally, regulation had first and foremost been the responsibility of national authorities. However, due to the fact that financial markets had increasingly become global in scope and cross-border in nature, the G20 for the first time committed itself to implementing an internationally harmonised high-level policy agenda on a comprehensive range of issues.

In 2008, the G20 committed itself to a fundamental reform of the global financial system. The objectives were to correct the fault lines leading to the global crisis and to build safer, more resilient sources of finance to better serve the needs of households and corporations. The G20 Pittsburgh summit in 2009 further consolidated the political agreement with concrete measures to strengthen the international financial system (G20, 2009). More specifically, the overarching goals have since been transformed into a number of regulatory reforms, with responsibility for finalisation and implementation primarily given to the Basel Committee on Banking Supervision (BCBS) and the Financial Stability Board (FSB).

1 Over-regulation is the top threat identified by the banking and capital markets CEOs that participated in PwC's 20th CEO Survey (PwC, 2016).

T1 Overview of key regulatory reforms

Key reforms	Description of reform objective	Responsible body	Status
Building more resilient financial institutions	• The Basel III package of reforms is the centrepiece of the international community's work to build more resilient financial institutions • Enhancing compensation practices	BCBS FSB	• Basel III largely defined and implementation of Basel III capital and liquidity standards generally on track
Ending "too-big-to-fail"	• Framework for reducing the moral hazard posed by systemically important financial institutions	FSB	• Total loss-absorbing capacity (TLAC) has been defined and implementation of the policy framework has well advanced. Some open issues on cross-border elements and internal TLAC • On recovery and resolution plans (RRP), the FSB noted banks' substantial progress in making resolution "feasible and credible"
Transforming shadow banking into resilient market-based finance	• Addressing the fault lines that contributed to the global financial crisis and building safer, more sustainable sources of financing for the real economy	FSB	• Key issues remain to be addressed and implementation of agreed reforms remains at a relatively early stage
Making derivatives markets safer	• Comprehensive reform agenda to improve transparency in OTC derivatives markets, mitigate systemic risk, and guard against market abuse	FSB	• Finalised and implementation of international OTC derivatives reforms is well underway • Questions remain on consistent national implementation across the globe
Creating continuous markets – other market reforms	• Reforming financial benchmark-setting • Building a global legal entity identifier framework • Reducing reliance on credit ratings and improving oversight of credit rating agencies (CRAs) • Enhancing market functioning	IOSCO	• Benchmarks reform, reduction of external credit agency dependence not 100% achieved
Improving accounting, auditing and disclosures	• Enhancing and aligning accounting standards • Enhancing financial institutions' disclosures	IASB/FASB EDTF	• Near completion, but two key accounting standards still prevail

Source: FSB progress report "Implementation and effects of the G20 financial regulatory reforms", 31 August 2016; UBS.

Table 1 provides an overview of the key streams of the reform (FSB, 2016a).

Regulatory reform of the global banking system was necessary following the financial crisis and a key prerequisite for creating a reliable framework for investors and financial services providers alike and for restoring confidence in the financial system. As a result, financial stability has improved substantially since the crisis and both regulators and policymakers recognise this progress. Overall, the financial industry has been highly supportive of the efforts to improve the regulatory framework.

In particular, the Basel III framework is a major step forward and its holistic implementation should be finalised in a timely and globally consistent manner as a matter of priority. As a consequence, it is worth noting that since the crisis, the largest global banks have become considerably stronger from a capital and liquidity perspective. Mark Carney, Chairman of the FSB, confirmed in February 2016 that the largest global banks have to hold between seven and ten times more capital compared to pre-crisis levels (Carney, 2016). Thus, Basel III capital reforms have been highly effective in improving the safety and stability of the system, with banks holding more and higher quality capital against various asset classes, and against activities specifically identified post-crisis.[2] In addition, banks have significantly improved their liquidity positions and strengthened their resilience by introducing recovery and resolution requirements as well as total loss-absorbing capacity (TLAC) resources to reduce the probability of having recourse to public funds in idiosyncratic bank crises and to help mitigate disruption to the broader financial system, if resolution were to become necessary.

In its progress report of August 2016 to the G20, the FSB states: "*The strengthening of resilience to date has stood the global financial system in good stead. During recent episodes of market turbulence the financial system has continued to function effectively, dampening aftershocks rather than amplifying them. This resilience in the face of stress demonstrates the benefits of the agreed reforms, but should not lead to complacency. A sustained effort to complete the implementation of those reforms is needed*" (FSB, 2016a). The FSB also states that implementation progress remains steady across the four core areas of the reform programme: building resilient financial institutions, ending too-big-to-fail, making derivatives markets safer and transforming shadow banking into resilient market-based finance. With the main elements of the post-crisis reforms agreed on and implementation of some core reform efforts (such as Basel III) well underway, the FSB conducted a first analysis of their potential effects. This FSB analysis indicates that reforms already in place have enhanced resilience and hence have improved the financial system's ability to absorb shocks and support growth. More broadly and beyond financial institutions in the narrow sense, Table 1 summarises the main achievements to date in key areas.

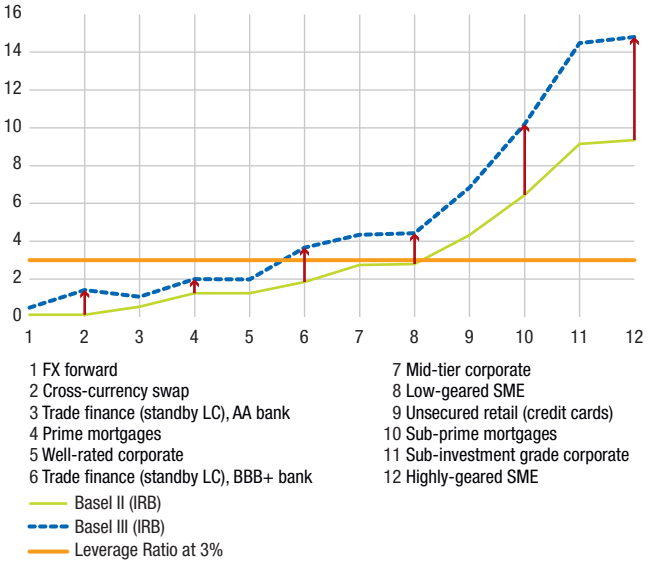
The effects of the reforms implemented to date have been generally positive. The core of the global financial system – the largest global banks – is considerably stronger today than before the crisis. Banks have built larger and higher quality capital buffers, largely through retained earnings. As can be seen in Chart 1, in particular higher risk assets require substantially more capital under Basel III. All large internationally active banks have fully met the Basel III minimum and CET1 target capital requirements ahead of the 2019 deadline (BCBS, 2016a), while continuing to pay out dividends and engage in share buybacks. In terms of resolvability, the largest global banks have been driving a number of projects, such as adjusting organisational structures to support operational continuity of critical shared functions. The FSB states in a progress report on this topic that banks have made substantial progress in making resolution "feasible and credible" (FSB, 2016c).

In terms of addressing risks in non-bank activities, the FSB has introduced a new activity-based "economic function" approach into its system-wide annual monitoring to help authorities

2 See IIF (2016a)

C1 Basel III raised capital requirements proportionately to the risk profile

(%)



Source: IIF Risk and Capital: the Essential Nexus (September 2015).

detect and assess the sources of financial stability risks from shadow banking. It has also made progress in its regulation of shadow banking by completing a regulatory framework for haircuts on non-centrally cleared securities financing transactions (FSB, 2015). Derivatives markets have been made considerably safer by introducing trade reporting and central clearing rules that cover more than 90% of trades, and margin requirements for non-centrally cleared derivatives in place in some but not all major jurisdictions (FSB, 2016b).

Furthermore, initiatives from organisations like the Group of Thirty (G30) have recognised that the banking community as a whole needs to also strengthen culture, values, and behaviour as one of the keys to sustainable performance. In a 2015 report on culture and conduct, the G30 authors identify concrete recommendations for banks, regulators and supervisors alike (G30, 2015).

2| Broader impact of regulatory reform and adverse consequences need to be observed

After the key regulatory requirements have largely been defined, national implementation of many of these rules is still on-going. One example is the Capital Requirements Directive V/Capital Requirements Regulation II (CRD V/CRRII) risk reduction package implementing Basel III reforms and FSB TLAC standards, announced by the European Commission in November 2016. The growing importance of national rules aiming to implement international standards is reflected in a staggering increase in regulatory alerts such as regulatory publications, changes and announcements. Between 2008 and 2015, their number multiplied almost six-fold to more than 51,000 a year (Thomson Reuters, 2016). Another notable driver of the increase in the number of regulatory alerts is the substantial

amount of regulatory reform that is still being negotiated at an international level. The BCBS recently announced its need for more time to finalise the revisions to the Basel III requirements and also postponed a discussion of changes to the treatment of sovereign exposures. The FSB meanwhile is still working on another set of issues, including CCP recovery and resolution planning, correspondent banking, conduct rules and treatment of climate change risks.[3] Other important areas of regulatory activity are cyber security and the digital transformation.

The industry is not only put to test by the amount of regulatory requirements and the speed of change but also by its complexity. Firms need to implement and comply with international regulations which may conflict or overlap with local requirements. Some rules may be appropriate if each one is looked at individually, but their interaction results in an undue regulatory burden on certain products or even on the system as a whole. There has been a trend for jurisdictions to seek to implement rules with extraterritorial impact, leading to an additional layer of complication for many cross-border firms.

Since the overall reform is clearly still ongoing, it is important to conduct a thorough review of what has been achieved, as well as at what cost these achievements have been made and which side effects – intended as well as unintended and even adverse – have been observed, in order to be able to make necessary adjustments in the interest of the whole economy. This notion is supported by Mark Carney, Governor of the Bank of England, who said in a letter to the Treasury Select Committee: "*Bank capital is not costless to society. If capital requirements are increased, some of those costs will be passed on to households and businesses in the real economy*" (Carney, 2016). And as Alex Brazier, Executive Director, Financial Stability Strategy and Risk at the Bank of England, said in a speech, "*Total funding costs do rise as companies – of all sorts, not just banks – swap debt for equity funding. And this effect goes beyond what can be explained by the differential tax treatment of debt and equity*" (Brazier, 2016).

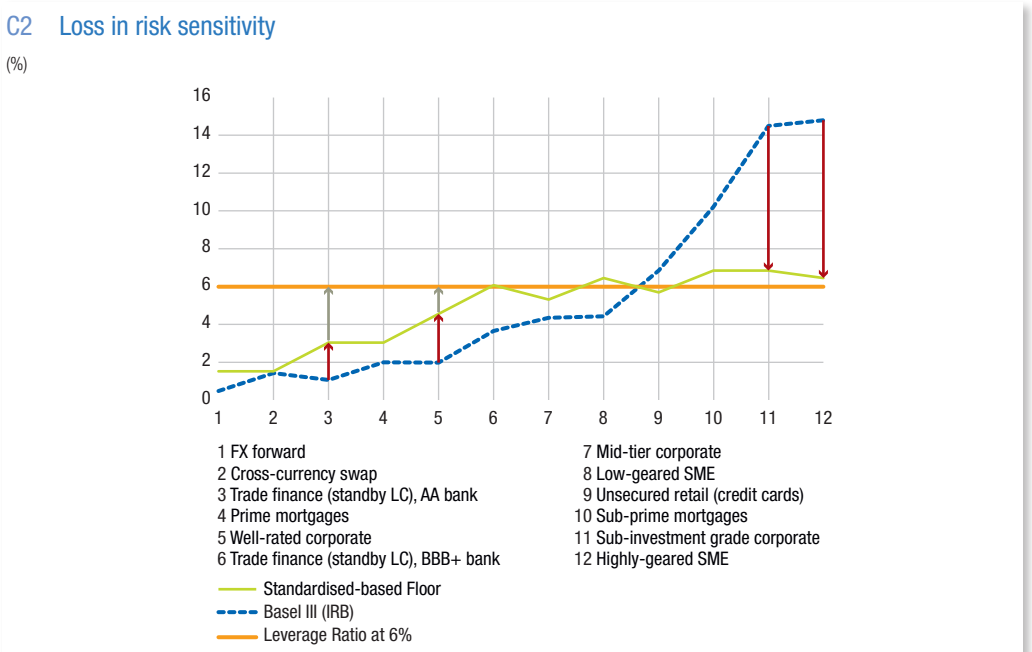
If the regulatory tightening is calibrated in an inappropriate manner, or if cumulative effects of independent measures that impact the same underlying resources are not taken into account, there is a significant risk that regulatory reforms may result in a number of adverse consequences, which will only fully come into effect in the coming years, once the measures are fully implemented. These consequences are characterised as adverse since they create additional disproportional costs or inefficiencies without further enhancing financial stability in a significant way. The current low interest rate environment helps to disguise some of the adverse implications of regulatory reform and makes them hard to detect. In these extraordinary times, it is difficult to link implications to actual causes. The cumulative negative consequences of re-regulation with unorthodox monetary policy will only become apparent years after they come into effect and after the macroeconomic environment has normalised.

Adverse consequences can be categorised as follows:

- *Pressure on profitability*: returns on bank equity are significantly lower in most regions than pre-crisis levels. This is partly due to reforms that enforced a reduction in leverage and materially raised the financial costs of risk-prone business models. In particular, the new requirements lead to large implementation costs and increased running costs due to the expanded control and regulatory framework. The cumulative costs of such new regulation in the first six years after the financial crisis have been estimated to be over USD 70bn for the six largest US banks alone (Federal Financial Analytics, 2014). At the same time, the requirements can also have a negative impact on revenues, by putting pressure on product pricing and restricting the service and product offering, e.g. to certain client groups. But there are also other factors at play,

3 Financial Stability Board 2017 workplan.

C2 Loss in risk sensitivity



Source: IIF Risk and Capital: the Essential Nexus (September 2015).

including inflexible cost structures, legacy issues (e.g. non-performing loans,[4] restructuring and legal costs, misconduct fines) as well as the low interest rate environment. These pressure points, combined with the impact of financial reforms on banks' profitability outlined above, will significantly alter the structure of the financial system. The high burden of regulatory fixed costs increases the need for economies of scale in the banking sector and thereby increases barriers to entry. Low profitability of banks is therefore leading to further market consolidation.

- *Loss in risk sensitivity*: two regulatory measures currently under consideration could result in a substantial loss of risk sensitivity: the use of a substantially more binding leverage ratio and a renewed emphasis on applying standardised approaches to risk-weighted assets including by means of a capital floor. Neither of these measures is sufficiently risk-sensitive as they fail to recognise significant differences in risk profiles through the incorporation of rather crude assumptions and simplifications. Chart 2 illustrates where a floor based on the standardised approach and an inappropriately calibrated leverage ratio would substantially reduce risk sensitivity in the system. Only a risk-based approach incorporates appropriate risk sensitivity and accurate risk measurement by ensuring that capital requirements correspond to actual risks incurred. The development of an overall measure of risk that is both comprehensive and broadly aligned with economic and financial principles is an important objective in itself and ultimately supports financial stability. The regulatory framework should motivate banks to properly manage their risks, by encouraging appropriate hedging mechanisms and other risk management techniques. In particular, regulatory capital rules should not create disincentives for banks to prudently manage their risks, or incentivise them to arbitrage the rules.

- *Increased lending costs or reduced lending activity*: the revisions to the capital framework increase

4 ECB banking supervision: Speech by Julie Dickson, Member of the Supervisory Board of the ECB, 28 November 2016: the percentage of NPLs in banks' balance sheets ranges from 1% to nearly 50% across the euro area.

the amount of capital that a bank has to hold. The changes currently under discussion at the Basel Committee are expected to have a major impact on the overall level of capital as well as its distribution across banks and asset classes. Studies show that new capital requirements can have a substantial impact on lending rates and the availability of loans. Oliver Wyman (2016) summarised results from different loan pricing analyses by the industry and authorities and showed that median credit spreads are estimated to increase by 60 basis points (bps) to 84 bps, depending on the geographic region examined (see Elliott and Balta in this review, Chart 1, source: Oliver Wyman). Loan volumes are estimated to decline as well, with an average decline across the studies of 2.6% for a 1% increase in required capital ratios. Higher prices and lower volumes, all else equal, would act as a drag on the economy, although it is difficult to measure precise effects and potential offsets, such as from the rise of alternative intermediaries.

- *Aligned behaviour*: more standardised approaches in risk measurement and more standardised trading of standardised products would result in an environment where market players act in an aligned way and diversification is reduced. Systemic risk can increase as market players act in a more correlated way. An effective risk-based capital adequacy approach and sufficient flexibility in terms of diversified business models are crucial for an overall stable financial system.

- *Reduced market liquidity*: regulatory reforms will have a substantial impact on the structure of capital markets and on the costs for market participants. There is already evidence of significant changes in market structure, driven both by regulation and by other factors. For example, banks' trading balance sheets have contracted by 25–30% since 2010 (see Elliott and Balta in this review, Table 3, source: Oliver Wyman). As a result, overall market liquidity may suffer, especially when the full effects of such changes, and those still in development, play out in a normalised interest rate environment. The cost of regulation to be absorbed by capital markets is likely to be substantial. For instance, one estimate is that the leverage ratio and NSFR requirements will impact costs in the range of 60 bps–110 bps in low margin market-making activities (Oliver Wyman, 2016). Potential consequences include higher direct transaction costs through wider bid-ask spreads, combined with higher indirect costs. The latter could result from bigger price movements when there is buying or selling pressure from all but the smallest transactions along with the indirect effects of greater overall volatility. Markets could become less stable and more vulnerable to shocks, which may have adverse systemic repercussions. There is already some evidence of reduced stability, although it is not conclusive. Such instability, combined with higher transaction costs, could push up liquidity premia demanded by investors and, again, there is some evidence of this happening already (Oliver Wyman, 2016).

In general, apart from the specific consequences outlined above, it is expected that the impact of market changes caused by recent regulatory reforms will flow through to end users over the course of the coming years, resulting in an increase in transaction costs, market volatility and credit costs. To be more specific: as the United States move ahead with monetary policy normalisation, it will be key to monitor the implications of tighter global liquidity conditions in conjunction with ongoing further initiatives such as the Basel Committee's capital reforms, particularly on cross-border capital flows – which have fallen to just 5% of GDP from 15% in 2007 – and on the efficient functioning of capital markets.[5]

Regulation always comes at a cost, both for banks as well as the overall economy. These consequences now become more clearly visible. Particularly in Europe, where banks still provide 80% of funding for the economy compared to 20% in the United States, it is not surprising that they are barely able to earn their capital costs, especially

5 IIF (2016b).

while loan growth has been sluggish and is expected to remain subdued.

Regulatory reforms also have consequences in terms of a level playing field or intra-industry competitiveness, as some national authorities have adopted global rules in a way that reflects specificities of domestic regulatory and legal frameworks, thereby often protecting domestic markets and players. National authorities look at capitalisation, resolvability and subsidiarisation from a local perspective, rather than a global one. Examples include the treatment of third-country banks in EU regulation, where, similar to the US foreign banking organisations intermediate holding company requirement, the recent CRD V/CRR II package introduced a requirement for non-EU G-SIIs to establish an intermediate EU parent undertaking. Such arrangements increase the complexity of managing an international banking organisation, which may reduce flexibility to take appropriate measures in times of severe stress and increases the cost for ensuring resolvability. For internationally active banks that are operating in many jurisdictions, adhering to the large amount of overlapping and interlocking regulations is a real and costly challenge.

3| The way forward: impact assessments and close dialogue

Going forward, it is important to better understand these adverse consequences and find ways for the financial services industry to adapt to the new "normal". Industry and policymakers alike have to analyse in detail the consequences of the regulatory reform of recent years and should muster the courage to change course if and where required. In addition, learnings from the past should be taken into account when designing new regulation measures wherever possible. As an example, and with respect to prudential regulation, a number of recent studies by international regulatory authorities show that optimal levels of capital are already achieved with the current framework. Additional requirements will thus most likely result in negative net benefits, where the costs in terms of lower economic activity outweigh the benefits in terms of additional financial stability.

A March 2016 BCBS working paper, reviewing the existing literature on economic costs and benefits from prudential regulation, concludes that the costs of higher capital ratios generated via the lending channel cannot be ignored and that the optimal level for Tier 1 capital requirements is achieved at a level of around 8-20% of risk weighted assets, which corresponds to the Basel III requirements and implies an even higher level may not be optimal (BCBS, 2016b). An IMF study from March 2016 concludes that capital in the range of 15–23% of risk-weighted assets would have been sufficient to absorb losses in the majority of past banking crises. According to the paper, further capital increases would have had only marginal effects on preventing additional crises, suggesting that this level of loss-absorption capacity is, on average, appropriate for advanced economies (Dagher *et al.*, 2016). A study of the Bank of England suggests that once resolution requirements and standards for additional loss-absorbing capacity that can be used in resolution are in place, the appropriate level of capital in the banking system is significantly lower than other estimates, at 10-14% of risk-weighted assets (Bank of England, 2015). A BIS study from 2010 shows that the marginal costs of increased capital requirements outweigh the marginal benefit once the optimal CET1 ratio of 10-13% is surpassed (BCBS, 2010).

Standard-setting bodies such as the BCBS and the FSB have created an expectation that the number of new regulatory requirements will decline over the coming years. However, new regulatory challenges will continue to emerge. With this in mind, there is a nascent consensus between industry, regulators and finance ministers that a number of key principles are important when defining new policies:

- New regulatory requirements should achieve a proper balance between financial stability

and economic costs. This requires an open and fact-based political debate and a good understanding of intended and unintended adverse consequences, which need to be measured consistently by quantitative impact studies.

- To achieve regulatory targets with minimal business disruption, it is important to involve the industry early on in the policy-design process. The aim should always be to obtain the industry's buy-in and to test initial hypotheses on the actual implications of new rules in terms of how business is likely to be impacted.

- New regulatory requirements should be consistent with the current framework and have limited extraterritorial impact. New rules should be aligned with regulation already in place, and reflect divergent regional financial structures as well as wider systemic concerns.

- Courageous initiatives are needed to address the adverse consequences of regulatory reform as well as level playing field concerns, before these consequences come to a point where they cannot be further ignored.

- With the increasing size of the shadow banking sector and the emergence of new players, especially from the technology space, entering the core business areas of maturity transformation and risk management, there is a need for prudent regulatory analysis and potentially measures to ensure financial stability and a level playing field.

4| Conclusions

Overall, the financial industry has been and remains highly supportive of the efforts to improve the international regulatory framework. Regulators have made much progress in making the financial system more stable and safer. Regulatory reform of the global banking system following the subprime crisis was necessary to create a reliable framework for investors and financial service providers and to restore confidence in the financial system. In particular, the Basel III framework was a major step forward and its implementation should be finalised globally consistently and in a timely manner. With large international banks' capital requirements having increased between seven and ten times compared to pre-crisis levels, having adopted recovery and resolution plans, and having started initiatives to strengthen organisational cultures, banks are in a much better shape today and contribute to a safer financial system, especially during episodes of stress.

The industry expects the regulatory wave of new requirements to continuously ebb away over the coming years, with national implementation lagging behind. Furthermore, there are a number of adverse consequences which will surface over the coming years and which need to be addressed by regulators and politicians appropriately based on an open and fact-based debate among all relevant stakeholders including from the industry. This will be crucial in order to further improve financial stability, and to continue to restore trust in the banking system.

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Bank health post-crisis

Kyriakos CHOUSAKOS
Doctoral Student
Yale University

Gary GORTON
Professor
Yale University and NBER

Economic growth is persistently low following a financial crisis, possibly because of a continuing weak banking system. In a financial crisis, bank health is significantly damaged. Post-crisis regulatory changes have aimed at restoring bank health, but measuring bank health by Tobin's Q, we find that the ill health of banks in the recent US financial crisis and the Euro crisis has persisted, especially compared to other crises in advanced economies. The low bank Q's cannot be explained by the state of the macroeconomy. The results seem to suggest that bank regulatory changes may be repressive.

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Bank health post-crisis

Kyriakos Chousakos and Gary Gorton

Why does low economic growth persist following a financial crisis?[1] While there are many possible explanations for the persistence of low growth following a financial crisis, one important possibility is that banks do not recover quickly. By definition, a financial crisis involving runs on the banking system is bad for the health of banks. Bank health is clearly important because we know that after a financial crisis unhealthy banks reduce lending. Many studies point to a transmission channel of post-crisis bank distress as causing lower economic growth.[2] But how bad is a crisis for bank health? And how long are banks ill? We explore these questions across countries and crises using Tobin's Q as a summary measure of bank health. We examine banks' health for five (and ten) years before a financial crisis and five (and ten) years after a financial crisis. In essence, Tobin's Q is a measure of the viability of banks' business models. We find that European and American banks suffered shocks to their health in the financial crises and that this sickness has persisted for five years (and ten years) after the Euro crisis and the US financial crisis, respectively. This pattern of a shock to bank health and the persistence of ill health is not present in other bank crises in advanced economies.

Banks suffer declines in capital during a financial crisis, and after a crisis they must adjust to new bank regulations. After the recent US and Euro financial crises, new international and national bank regulatory reforms have included higher capital requirements, higher liquidity requirements, limitations on leverage ratios, and the introduction of stress tests. In some countries the activities of banks were constrained, e.g. the Volcker Rule. And in the United States, the assessment for deposit insurance was changed so that it was based on total liabilities, regardless of the bank's level of insured deposits. Securitisation became moribund following the recent crises, raising banks' funding costs. Furthermore, in the aftermath of the recent crisis, banks have faced billions of dollars of fines with legal uncertainty still remaining. And banks have struggled in a low interest rate and low growth environment.

The recent crises in the United States and Europe, significantly worse in terms of output declines, compared to other modern crises in advanced economies, show persistently ill banks compared to the other crises, as measured by Tobin's Q. We also find that the dispersion of bank Q-ratios has declined post-crisis. Low Q banks may have failed, but low Q dispersion seems hard to explain as being due to capital leaving banking (for low Q banks), just when capital ratios have been increased. Another explanation is that low, bunched Q-ratios are due to regulation making all banks essentially the same and inefficient. This persistence suggests that traditional bank business models may no longer be viable. It also suggests that new regulations have not served to revitalise banking, but may have had the opposite effect. As measured by Tobin's Q, the future of US and European banks is not bright.

This paper is related to Sarin and Summers (2016) and Calomiris and Nissim (2014). Sarin and Summers (2016) examine a variety of measures of bank riskiness pre- and post-crisis, e.g. stock price volatility, credit default swaps, option-implied volatility, and find that banks are riskier post-crisis than before the crisis. They write that: "*...our findings are most consistent with a dramatic decline in franchise [charter] value of major financial institutions, caused at least in part by new regulations*" (abstract). Our findings are consistent with this. We, however, focus on a different issue, namely the pattern of bank health pre- and post-crisis in different crises across countries. Calomiris and Nissim (2014) study the cross section of US banks' Tobin's Q's pre-and post- the recent US financial crisis, relating their panel to measures of banks' activities. They find that low Q's indicate (in cross section) that banks' investments in intangibles (e.g. human capital, information technology) are expected to

1 Low economic growth following financial crises is documented, for example, by Cerra and Saxena (2008) and Reinhart and Rogoff (2014).

2 See, for example, Gibson (1995), Rosengren and Peek (2000), Calomiris and Mason (2003), Dell'Ariccia et al. (2008), Ivashina and Scharfstein (2010), Mladjan (2012), Iyer et al. (2014), Chodorow-Reich (2014), Frydman et al. (2015), Lee and Mezzanotti (2014), Carlson and Rose (2015). These papers show that post-crisis declines in lending are significantly due to bank loan supply rather than to low demand for loans, which may also be present.

generate negative economic profits in the future. This conclusion is also consistent with what we find, although we do not focus on a cross section of banks but on a cross section of countries.

We proceed as follows. In Section 1 we discuss the use and role of Tobin's Q in studying banking. We also discuss our data. Section 2 contains the main results. Final thoughts are contained in Section 3.

1| Measuring bank health

1|1 Tobin's Q

While Tobin's Q is widely used in economics, it plays a particular role in the case of banks because of bank "charter value".[3] In general, charter value derives from rents or quasi-rents on assets-in-place and future investment opportunities. Banks make loans, which involves banks in the production of valuable private information about borrowers. This information is valuable for future loans, and the associated bank relationship makes it hard for borrowers to switch banks. See Slovin et al. (1993) and Darmouni (2016). For a bank, rents or quasi-rents accruing from this information production are an intangible asset which the bank loses if it fails. These informational quasi-rents are the bank's private "charter value". In addition, charter value may derive from regulatory barriers to entry or from oligopolistic behaviour that limits entry.[4] Since banks uniquely produce short-term debt bearing a convenience yield, limitations on entry would also create charter value due to this cheaper source of funding. In oligopolistic industries like banking, the Q's may normally be above one, and can stay that way if there are barriers to entry.

We use a simple measure of Tobin's Q:

$$Q\text{-}ratio = \frac{market\ capitalisation}{book\ value\ of\ equity} \qquad (1)$$

While there are more complicated ways of constructing Tobin's Q, these other methods result in measures that are very highly correlated with the simple measure. See Chung and Pruitt (1994).

We construct indices of Q for countries experiencing different crises as follows. We first construct an annual Q for each bank in a country. These are then valued-weighted (by total assets) to get a country Q index. For all countries involved in a crisis, e.g. the Euro crisis, we weight countries by real GDP to obtain a Q index for that crisis or set of crises.

1|2 Data

Our data are from WorldScope and the World Development Indicators of the World Bank. The categories of financial institutions used in the analysis are commercial banks, including multi-bank holding companies and single bank holding companies, and savings & loan holding companies.[5] We also look separately at (what were) the US investment banks. The data are annual and span 1980 until 2015. We merge the real GDP data with the credit-to-the-private-sector data from the World Development Indicators. All variables are winsorised at the 1% level. Table 1 summarises the data, grouping data into all US banks, European banks, and the banks in the other countries that experienced financial crises. This last group will be called "the benchmark".

The variable "Short Yield" is a measure of the yield on short maturity government debt. It is apparent from the table that, even winsorising at 1%, the data appear to be somewhat noisy. This is perhaps due to differences in accounting procedures.

For the benchmark, we use the dates of financial crises (other than the recent crises in the United States and Europe) in other advanced countries from Kaminsky and Reinhart (1999) and Caprio et al. (2005). From these sources we calculate a benchmark for banks' Q's, as described above, before and after financial crises other than the US crisis of 2007-2008 and

3 This is sometimes called "franchise value". See Marcus (1984). High bank charter value (Q greater than one) is viewed as providing an incentive for banks to avoid risk, for fear of losing this intangible asset. There is an empirical literature documenting the decline in US bank charter values in the 1980s. See Keeley (1990), Gorton and Rosen (1995) and Demsetz et al. (1996).

4 On oligopolistic bank behaviour see Gorton and He (2008).

5 We exclude investment companies, commercial finance companies, insurance companies, land and real estate companies, personal loan companies, real estate investment trusts and business trusts, rental and leasing, savings and loans holding companies, and securities brokerage firms. Results do not change if the savings & loan holding companies are excluded.

T1 Mean, standard deviation, minimum and maximum

	Count	Mean	St.Dev	Min	Max
Qw (US)	11	1.321	0.605	0.606	2.246
Qw (EU)	144	0.986	1.006	0.003	5.995
Qw (ADV)	91	0.850	0.716	0.045	4.333
Assets (US - in bn)	11	9,949.935	2,544.574	5,546.078	12,684.959
Assets (EU - in bn)	148	851.874	351.235	434.993	1,654.476
Assets (ADV - in bn)	94	633.167	685.451	19.024	2,514.260
ΔAssets (US)	10	0.086	0.119	-0.122	0.285
ΔAssets (EU)	132	0.080	0.339	-0.906	1.531
ΔAssets (ADV)	85	0.113	0.256	-0.432	1.394
rGDP (in bn)	865	919.589	2,050.115	6.628	16,800
ΔrGDP	835	0.070	0.122	-0.620	0.481
Credit	926	80.208	47.823	0.186	312.154
ΔCredit	892	0.344	9.350	-0.671	279.229
Short Yield	599	11.918	35.481	0.001	816.100
σ(Q-US)	11	0.550	0.125	0.391	0.735
σ(Q-EU)	137	0.583	0.745	0	5.083
σ(Q-ADV)	89	0.884	0.935	0.005	3.656
No. of banks (US)	11	794.636	89.586	641	921
No. of banks (EU)	148	10.189	11.001	1	44
No. of banks (ADV)	94	36.574	56.377	1	215

Source: Authors' calculations.
Note: *Asset-weighted average Q–ratio, Assets, Δ(Assets),* and *σ(Qi)* for the financial sector of each country in our sample, and *rGDP, ΔrGDP, Credit,* and *ΔCredit* for the economies of the countries in our sample. All variables are winsorised at the 1% level.

the Euro crisis. The benchmark includes the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), Italy (1990), New Zealand (1987), United Kingdom (1974, 1999, 1995), and the United States (1984). Arguably, not all of these crises were systemic, and it seems clear that the crisis of 2007-2008 and the Euro crisis were worse than the sample, so the benchmark seems to concern less significant crises. Still, our view is that it is useful for comparison purposes. Keep in mind that Kaminsky and Reinhart (1999) and Caprio et al. (2005) define these events as systemic banking crises.

2| Post-crisis bank health: results

In this section we look at the evolution of bank health around financial crises.

Table 2 shows mean values for Tobin's Q, Total Assets, the cross-sectional dispersion of Q-ratios, and macroeconomic variables over the course of the five years prior to and five years after a financial crisis for four sets of banks: all US commercial banks and the US investment banks in the recent US financial crisis, European banks during the Euro crisis of 2008, and banks in advanced economies that experienced financial crises, as discussed above. Tobin's Q-ratios, the number of financial institutions, and the change in real GDP and Credit are, on average, lower post-crisis in the US and EU banks. However, we observe no significant differences in the Q-ratios of commercial banks in advanced economies' crises. Note that the policy rate, represented by "Short Yield", is lower post-crisis in all cases, but it is significantly different only in the cases of EU banks and the banks in the benchmark, but not for the US banks.

T2 Summary statistics

a) US banks (all)

	Prior	Post	Mean Diff.
Qw	1.921	0.820	1.101*** (9.10)
Assets (in bn)	7,711.798	11,815.049	-4,103.252** (-4.68)
ΔAssets	0.184	0.021	0.163* (2.81)
rGDP (in bn)	12,344.540	15,059.200	-2,714.660** (-4.78)
ΔrGDP	0.055	0.027	0.028+ (2.14)
Credit	181.549	188.431	-6.882 (-0.96)
ΔCredit	0.031	-0.015	0.047 (1.54)
Short Yield	2.638	0.895	1.743 (1.55)
σ(Q)	0.665	0.455	0.210*** (5.47)
No. of banks	829.200	765.833	63.367 (1.19)

b) US banks (specific)

	Prior	Post	Mean Diff.
Qw	2.021	0.836	1.186*** (7.24)
Assets (in bn)	5,320.737	8,982.943	-3,662.206*** (-6.13)
ΔAssets	0.177	0.051	0.127* (2.64)
rGDP (in bn)	12,344.540	15,059.200	-2,714.660** (-4.78)
ΔrGDP	0.055	0.027	0.028+ (2.14)
Credit	181.549	188.431	-6.882 (-0.96)
ΔCredit	0.031	-0.015	0.047 (1.54)
Short Yield	2.638	0.895	1.743 (1.55)
σ(Q)	0.447	0.297	0.149*** (5.49)
No. of banks	6	6	0

c) EU banks

	Prior	Post	Mean Diff.
Qw	1.403	0.632	0.771*** (4.94)
Assets (in bn)	627.206	1042.842	-415.636*** (-8.87)
ΔAssets	0.241	-0.031	0.272*** (4.91)
rGDP (in bn)	582.430	744.729	-162.299 (-1.32)
ΔrGDP	0.140	0.001	0.139*** (10.42)
Credit	95.328	112.516	-17.188** (-2.80)
ΔCredit	4.168	0.001	4.166 (1.10)
Short Yield	2.907	1.834	1.073** (2.82)
σ(Q)	0.655	0.527	0.127 (0.99)
No. of banks	10.824	9.650	1.174 (0.65)

d) Advanced banks

	Prior	Post	Mean Diff.
Qw	0.880	0.828	0.052 (0.34)
Assets (in bn)	519.395	725.060	-205.664 (-1.45)
ΔAssets	0.187	0.066	0.121* (2.16)
rGDP (in bn)	702.098	1,041.596	-339.498 (-1.30)
ΔrGDP	0.105	0.064	0.041+ (1.82)
Credit	58.546	69.638	-11.092* (-2.01)
ΔCredit	0.060	0.037	0.023 (0.61)
Short Yield	13.503	10.003	3.500*** (3.55)
σ(Q)	0.903	0.871	0.032 (0.16)
No. of banks	33	39.462	-6.462 (-0.55)

Source: Authors' calculations.
Note: The Table summarises the mean values of asset-weighted average Q-ratio, Assets, Δ(Assets), and σ(Qi) for (i) US banks (all) prior to vs. after the 2007 crisis, (iii) EU banks (all) prior to vs. after the 2008 crisis, (ii) specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) prior to vs. after the 2007 crisis, and (iv) advanced countries' banks prior to and after major financial crises.
The third column reports the difference in means and the t-statistic of the difference.
t-statistics in parentheses: + p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001.

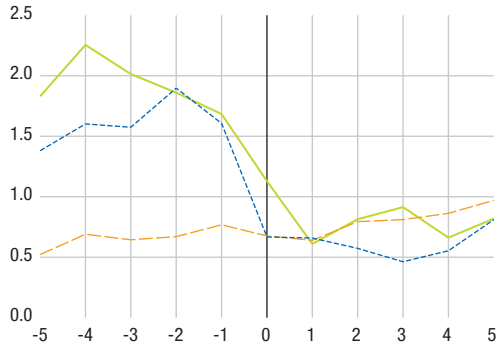
Table 2 also shows that Tobin's Q was above one prior to the crises in the United States and Europe and then fell below one, with the change being statistically significant.[6] In contrast, in the other financial crises, Tobin's Q was just below one in the five years prior to the crises (on average) and is about the same in the five years afterward. Also, real GDP dropped significantly in the United States but not in Europe or in the other crises.

6 This is consistent with the findings of Calomiris and Nissim (2014) for the United States.

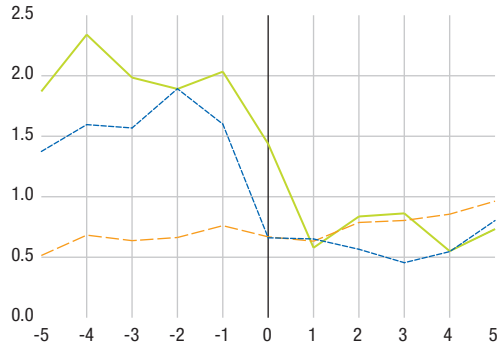
C1 Evolution of Q-ratios – Five years prior to and after the crisis

(X axis: time from crisis; Y axis: Q-ratio)

a) US banks (all)



b) US banks (specific)



United States, 2007 crisis — Euro, 2008 crisis — Advanced crisis

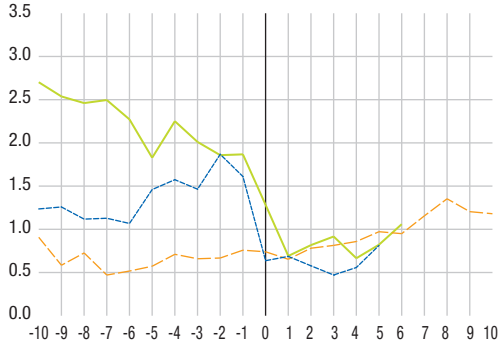
Source: Authors' calculations.

Note: In Chart a) the US, 2007 crisis line is the average Q-ratio for US banks five years prior to and after the 2007 crisis. In Chart b) the US, 2007 crisis line is the average Q-ratio for specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) five years prior to and after the 2007 crisis. The advanced, crises line is the average Q-ratio five years prior to and after the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), and Italy (1990),and New Zealand (1987), United Kingdom (1974, 1991, 1995), and United States (1984). The Euro, 2008 crisis line is the average Q-ratio five years prior to and after the following 2008 crises: Austria, Belgium, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Portugal, Slovenia, Spain, Netherlands, and Sweden.

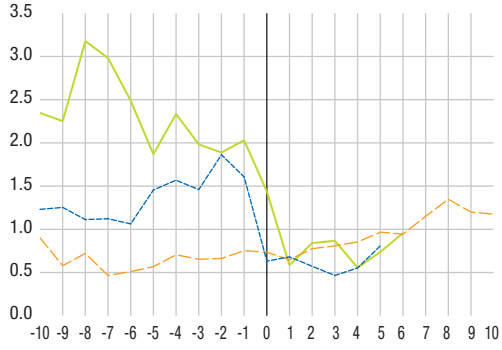
C2 Evolution of Q-ratios – Ten years prior to and after the crisis

(X axis: time from crisis; Y axis: Q-ratio)

a) US banks (all)



b) US banks (specific)



United States, 2007 crisis — Euro, 2008 crisis — Advanced crisis

Source: Authors' calculations.

Note: In Chart a) the US, 2007 crisis line is the average Q-ratio for US banks ten years prior to and after the 2007 crisis. In Chart b) the US, 2007 crisis line is the average Q-ratio for specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) ten years prior to and after the 2007 crisis. The advanced, crises line is the average Q-ratio ten years prior to and after the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), and Italy (1990), and New Zealand (1987), United Kingdom (1974, 1991, 1995), and United States (1984). The Euro, 2008 crisis line is the average Q-ratio ten years prior to and after the following 2008 crises: Austria, Belgium, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Portugal, Slovenia, Spain, Netherlands, and Sweden.

Chart 1a shows the evolution of Q-ratio indices for the above-mentioned different sets of banks. Chart 1a shows that, prior to the US financial crisis and the Euro crisis, banks were healthy with high Tobin's Q's, consistent with high charter value. The Q's plummet during the respective crises and do not recover during the subsequent five years. On the other hand, the banks in countries involved in the benchmark crises show a low Q prior to the crisis, on average, and after the crisis; the Q for this group does not move. It is flat. The figure is substantially the same if we look at the median Q instead of the average Q.

We interpret the high Q's for American and European banks prior to the crisis as evidence of oligopolistic banking systems – systems dominated by a few large banks. In addition, charter value could reflect implicit too-big-to-fail insurance. In any case, in the crises and their aftermaths, this charter value is significantly destroyed, resulting in Q ratios falling well below one. And this persists.

Chart 1b looks at the Q's for only the US banks that were at the centre of the financial crisis, i.e. the investment banks.[7] These firms show a very high charter value prior to the crisis and a huge drop during the crisis. These are the banks for which the Volcker Rule is binding. And this is the set of banks that face the most legal action.

Chart 2 shows the same figures as above but over a decade pre- and post-crisis. Over a ten-year period some data are lost so coverage of banks is not as complete as over the five-year horizon. Nevertheless, the figures show that the ill health of US and European banks persists beyond five years. This is consistent with Cerra and Saxena (2008) who document output losses from financial crises persisting even at a ten-year horizon. Reinhart and Rogoff (2014), in a study of 100 crisis episodes, find that it takes about eight years to reach the pre-crisis level of income.

Table 3 confirms that the difference between the US crisis and the Euro crisis and the benchmark is indeed significant. In a difference-in-differences context, a dummy variable for US and EU banks interacted with a dummy for the post-crisis period is highly significant. The table highlights another point, namely that the level and change in Q indices are not associated with measures of the macroeconomy, as measured by real GDP

T3 Difference-in-differences regression over the course of a crisis
Five years prior to and after the beginning of a financial crisis

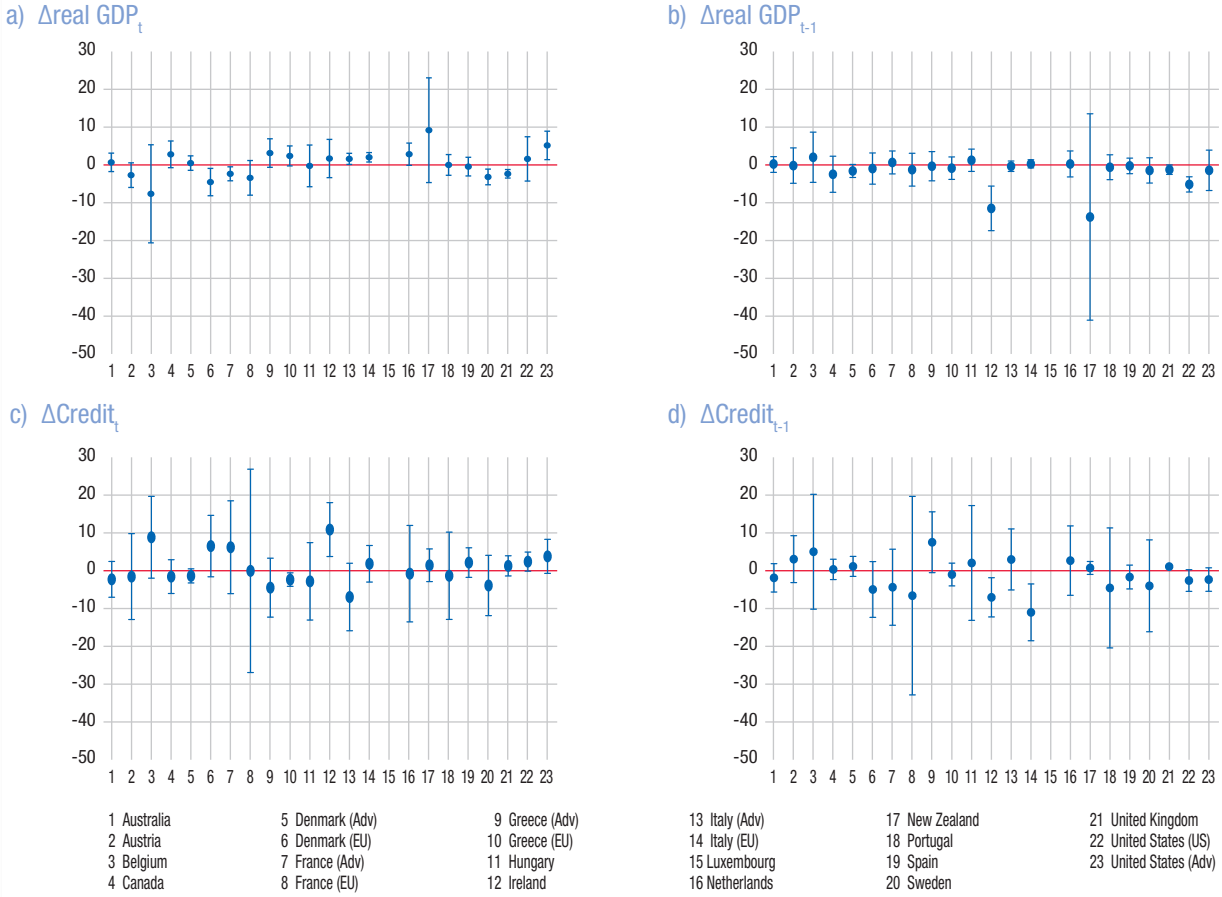
	(1) $log(Qw)_t$	(2) $log(Qw)_t$	(3) $log(Qw)_t$	(4) $\Delta log(Qw)_t$	(5) $\Delta log(Qw)_t$
$\mathbb{1}$(US & EU Banks)$_t$	1.232**	2.047$^+$	0.000	0.823***	1.188***
	(3.33)	(1.82)	(.)	(11.94)	(4.99)
$\mathbb{1}$(Post Crisis)$_t$	-0.300	-0.282	-0.108	-0.219	-0.208
	(-1.39)	(-1.37)	(-0.56)	(-1.49)	(-1.30)
$\mathbb{1}$(US & EU Banks)$_t \times \mathbb{1}$(Post Crisis)$_t$	-0.529**	-0.594***	-0.615**	-0.301*	-0.383**
	(-3.68)	(-4.41)	(-3.29)	(-2.51)	(-3.35)
log(rGDP)$_t$		-0.351	-0.895$^+$		
		(-0.69)	(-2.15)		
log(Credit)$_t$		-0.115	0.286		
		(-0.34)	(1.43)		
log(Short Yield)$_t$			-0.053		
			(-0.39)		
Δlog(rGDP)$_t$				1.062$^+$	0.632
				(1.80)	(0.88)
Δlog(Credit)$_t$				-1.295***	-0.979***
				(-4.77)	(-4.71)
log(Qw)$_{t-1}$				-0.398***	-0.437*
				(-5.59)	(-2.95)
Δlog(Short Yield)$_t$					-0.092
					(-1.30)
Constant	-1.044***	1.124	2.647	21.366$^+$	12.527
	(-7.38)	(0.41)	(1.09)	(1.74)	(0.84)
N	245	244	150	220	133
R^2	0.51	0.51	0.58	0.54	0.61
FE (Year)	YES	YES	YES	YES	YES
FE (Country)	YES	YES	YES	YES	YES

Source: Authors' calculations.
Note: *The table summarises the effect of the 2007 US financial crisis and 2008 Euro financial crisis on asset-weighted average Q-ratios of the financial sector of each country. The panel of countries in the regressions includes all countries in the sample. All regression specifications take into account country and year fixed effects, and standard errors are clustered by country. The specification is:* $\log(Qw)_{n,t} = \alpha_n + a_t + \beta\mathbb{1}(US \& EU\ Banks)_{n,t} + \gamma\mathbb{1}(Post\ Crisis)_{n,t} + \delta\mathbb{1}(US \& EU\ Banks)_{n,t} \times \mathbb{1}(Post\ Crisis)_{n,t} + \zeta^1 X_{n,t} + \epsilon_{n,t}$, *where* $X_{n,t} = (\log(rGDP)_t, \Delta\log(rGDP)_t, \log(Credit)_t, \Delta\log(Credit)_t, \log(Qw)_{t-1})'$.
t-statistics in parentheses: $^+$ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001.

7 These banks are excluded from "all US commercial banks" prior to 2009. The investment banks became commercial banks at the end of 2008 and are subsequently included in "all US commercial banks".

C3 Explanatory/predictive regression over the course of a crisis
Five years prior to and after the beginning of a financial crisis – country/crisis level

(X axis: country; Y axis: coefficient)



Source: Authors' calculations.
Note: Figures a) through d) summarise the predictive power of changes in real GDP, and credit to private sector, and their first-year lags on the change in Q-ratios.
All regressions are performed at the country level (countries with multiple crises are treated as separate time series) and standard errors are corrected using Newey-West (1987) with one lag.
The regression specification is: $\Delta Qw_{n,t} = \alpha_n + a_t + \beta' X_{n,t} + \epsilon + n, t$, where $X_{n,t} = (\Delta rGDP_{n,t}, \Delta rGDP_{n,t-1}, \Delta Credit_t, \Delta Credit_{t-1})'$.

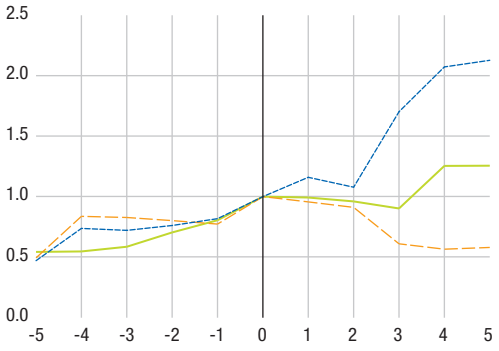
or credit-to-the-private sector. This is surprising because we would expect these variables to be significant if low bank Q's were due to the continuing recession (real GDP) or the credit boom prior to the crisis and the subsequent deleveraging in the economy. The regression also includes a measure of a short interest rate for each country (Short Yield) intended to capture the effects of the zero lower bound in recent crises.[8] Neither the level nor the change in this variable are significant. Thus the table suggests the presence of other factors explaining the low Q's. We further look into the relationship between Q-ratios and real GDP and Credit in Chart 3. We find that macroeconomic measures have little or no explanatory power over Tobin's Q measure.

8 These data are from Global Financial Data. The data are not available for our full sample of countries. Excluding the short yield, however, does not alter the results.

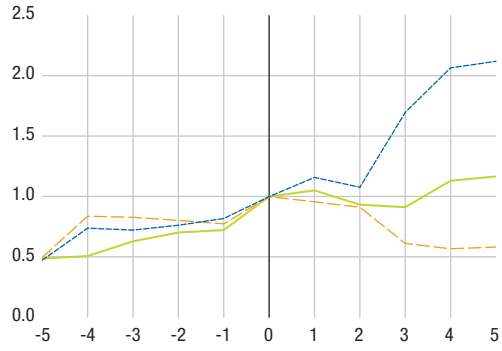
C4 Total cumulative cash growth – Five years prior to and after the crisis

(X axis: time from crisis; Y axis: cash growth)

a) US banks (all)



b) US banks (specific)



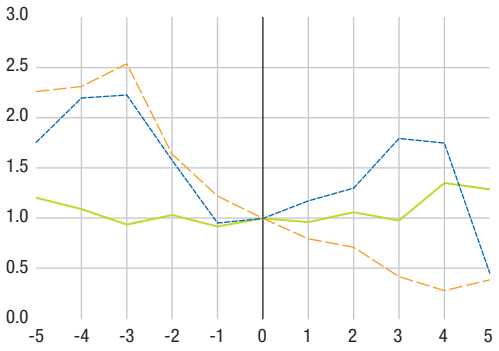
United States, 2007 crisis — Euro, 2008 crisis — Advanced crisis

Source: Authors' calculations.
Note: In Chart a) the US, 2007 crisis line is the total cumulative cash growth for US banks five years prior to and after the 2007 crisis. In Chart b) the US, 2007 crisis line is the total cumulative cash growth for specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) five years prior to and after the 2007 crisis. The advanced, crises line is the average cumulative cash growth five years prior to and after the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), and Italy (1990), and New Zealand (1987), United Kingdom (1974, 1991, 1995), and United States (1984). The Euro, 2008 crisis line is the average cumulative assets growth five years prior to and after the following 2008 crises: Austria, Belgium, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Portugal, Slovenia, Spain, Netherlands, and Sweden.

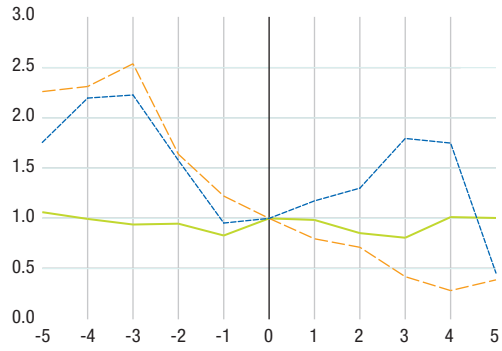
C5 Total cumulative cash/assets growth – Five years prior to and after the crisis

(X axis: time from crisis; Y axis: cash/assets)

a) US banks (all)



b) US banks (specific)



United States, 2007 crisis — Euro, 2008 crisis — Advanced crisis

Source: Authors' calculations.
Note: In Chart a) the US, 2007 crisis line is the total cumulative cash/assets growth for US banks five years prior to and after the 2007 crisis. In Chart b) the US, 2007 crisis line is the total cumulative cash/assets growth for specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) five years prior to and after the 2007 crisis. The advanced, crises line is the average cumulative cash/assets growth five years prior to and after the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), and Italy (1990), and New Zealand (1987), United Kingdom (1974, 1991, 1995), and United States (1984). The Euro, 2008 crisis line is the average cumulative assets growth five years prior to and after the following 2008 crises: Austria, Belgium, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Portugal, Slovenia, Spain, Netherlands, and Sweden.

2|1 Bank growth

We mentioned above the large literature that documents a decline in the supply of loans by banks following a financial crisis. If banks are seriously harmed in a crisis, and quite ill afterwards, we should see a decline in loan growth. Our data are not fine enough to examine loans specifically, but we can examine the growth of cash holdings and cash holdings as a percentage of total assets. Higher cash holdings and higher cash-to-assets ratios imply lower loan growth since the bank holds on to its cash. In Chart 4 above we look at the same three categories of crises as above. In Chart 4a, the cumulative growth of cash holdings starting five years before the crisis (normalised to one at the beginning of the crisis) is significantly higher for banks that experienced the US financial crisis or the Euro crisis compared to the benchmark. Chart 4b shows that the (old) US investment banks perform similarly in terms of cash growth. The patterns in Chart 4 are consistent with low Q's and ill health.

Chart 5 above confirms the above findings for the case of the cash-to-assets ratio.

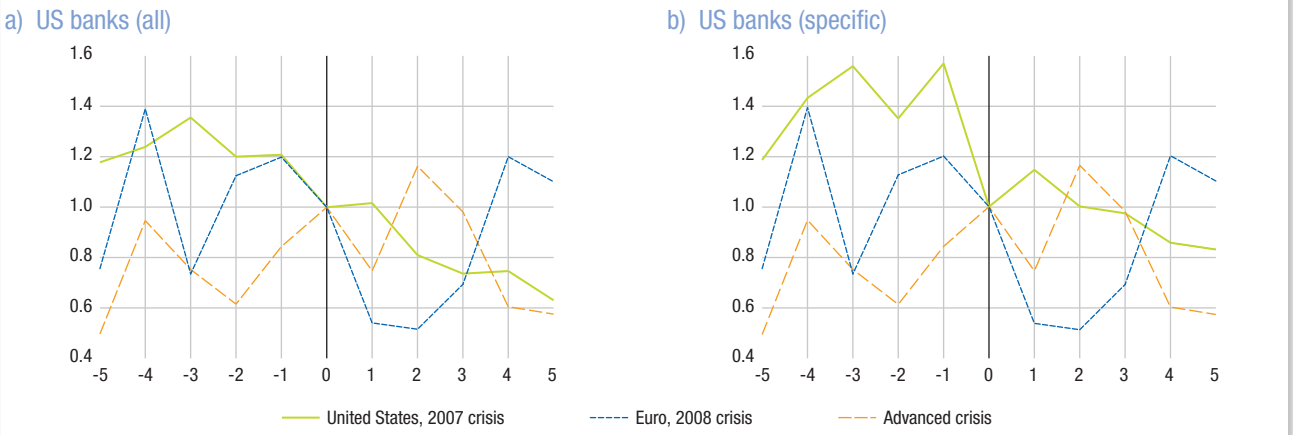
2|2 The dispersion of bank Q-ratios

We next examine the dispersion of bank Q-ratios. In theory, as capital is reallocated, efficiency would result in all firms having a Q of one. Capital should flow from firms with low Q's to firms with high Q's. For example, if there is a financial liberalisation, giving non-financial firms equal access to credit, then the dispersion of Q for the non-financial firms should go down. Indeed, it does. See, for example, Abiad et al. (2008).[9] However, in a financial crisis banks are not functioning well, and the dispersion of Q's for non-financial firms does not go down; see Chousakos et al. (2016). Post-crisis there are

9 The dispersion of Q is often used as a measure of capital reallocation. For example, Eisfeldt and Rampini (2006) use thedispersion of Q for this purpose.

C6 Average standard deviation of cross-sectional Q-ratios
Five years prior to and after the crisis, standardised to begin at 1 for all three categories

(X axis: time from crisis; Y axis: $\sigma(Q)_t$)



Source: Authors' calculations.
Note: In Chart a) the US, 2007 crisis line is the average standard deviation of cross-sectional Q-ratios for US banks five years prior to and after the 2007 crisis. In Chart b) the US, 2007 crisis line is the average standard deviation of cross-sectional Q-ratios for specific US banks (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, and Wells Fargo) five years prior to and after the 2007 crisis. The advanced, crises line is the average standard deviation of cross-sectional Q-ratios five years prior to and after the following crises: Australia (1989), Canada (1983), Denmark (1987), France (1994), Germany (1977), Greece (1991), Iceland (1985), and Italy (1990), and New Zealand (1987), United Kingdom (1974, 1991, 1995), and United States (1984). The Euro, 2008 crisis line is the average standard deviation of cross-sectional Q-ratios five years prior to and after the following 2008 crises: Austria, Belgium, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Portugal, Slovenia, Spain, Netherlands, and Sweden.

impediments to the reallocation of capital, because of the damage to the banking sector. What should we expect of the dispersion of banks' Q's during and after a crisis? If less efficient, low Q, banks fail and investment flows to higher Q banks, then dispersion should be reduced. But if this does not happen for non-financial firms post-crisis, it is hard to understand how it could happen for banks.

Chart 6 above shows the average standard deviation of cross-sectional bank Q-ratios for five years prior to and five years after the financial crisis (normalised to one five years prior to the crises). It is striking that the average standard deviation is declining post-crisis, and especially so for the six former US investment banks. For US commercial banks, the trend is upwards until the crisis and then downwards. The decline in the dispersion of bank Q's is paradoxical. It seems unlikely that the reason for the decline in the dispersion of Q is that capital is being reallocated in the banking sector at the very time when the banking sector is weak. We saw in Charts 1 and 2 that bank Q's are below one following the crisis, meaning that capital should be flowing out of this sector. Can this happen when banks are being required to hold more capital? Another possible explanation is that the raft of new regulations is essentially homogenising banks at low Q's.

3| Conclusion

US banks since the financial crisis of 2007-2008 and European banks following the Euro crisis have been persistently unhealthy as measured by Tobin's Q. Of course, there can be many, non-mutually exclusive, reasons for this continuing ill health. However, the state of the macroeconomy does not seem to explain low bank Q's. The zero lower bound of interest rates also does not seem to explain the low Q's. So what does explain the low Q's? An important remaining possibility is whether post-crisis bank regulation has been repressive, so much so that it accounts for the low Q's. And regulation could account for a decline in the dispersion of bank Q-ratios. If banks' business models are permanently damaged due to regulation, then their long-run survival is in question (at least in their current form). Post-crisis heightened survival risk is consistent with the results of Sarin and Summers (2016) who show that banks are riskier. New regulations may have made banks "safer" in that they are less likely to be subject to bank runs. But that may have come at a very high cost.

To be clear, we have not shown any direct evidence on whether or not the cumulative effects of new bank regulations are repressive or not. We have just summarised data. But some recent trends also seem to suggest this. Lux and Greene (2015), for example, point out that in 2014 nonbanks accounted for over 40 per cent of mortgage originations while in 2010 this number was 12 per cent. And according to Nash and Beardsley (2015), peer-to-peer lending grew from USD 26 million in 2009 to USD 1.7 billion in 2014. They argue that: "Regulation will continue to shift activities from banks to nonbanks" (p. 1). Academic research is also emerging that is consistent with this view. Morris-Levenson et al. (2017) study cross-sectional heterogeneity in the regulatory exposure of different types of mortgage originators in the US. They find that less regulated banks and non-bank firms have a larger share of the mortgage origination market post-crisis. Is this the start of a new shadow banking system due to post-crisis constraining bank regulations? Not clear. But still, the question is very important and the evidence we have produced is (to us) striking and suggestive.

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Have regulators successfully addressed the “too-big-to-fail” problem?

Implementing an efficient resolution framework in the Banking Union: lessons from the crisis and challenges ahead

Elke KÖNIG
Chair
Single Resolution Board

The last financial crisis underscored the need to develop an effective resolution framework internationally. In this context, the European Union (EU) resolution regime has been significantly enhanced, with a new legislative package that established the Single Resolution Board (SRB) and the Single Resolution Fund (SRF) for the Banking Union (BU). While the SRB has reached important milestones in 2016, including the first two waves of resolution plans for major banks and the collection of EUR 10.8 billion in contributions to the SRF, the SRB will further deepen and enlarge the scope of its resolution plans and start setting a Minimum Requirement for own funds and Eligible Liabilities (MREL) in 2017. Loss-absorbing capacity is key as it will strengthen EU banks and therefore financial stability.

Elke König

1| Lessons from the financial crisis and importance of resolution regimes for european banks

The last financial crisis underscored the need to develop an effective resolution framework, both within the European Union (EU) and internationally. In this context, the EU resolution regime has been significantly enhanced, with a new legislative package that established the Single Resolution Board (SRB) and the Single Resolution Fund (SRF) in the Banking Union (BU).

The recent financial crisis was exceptional in terms of the breadth of financial institutions affected, with a large number of banks that were bailed out with public funds. In the EU, the volume of national support to the financial sector between October 2008 and December 2011 amounted to around EUR 1.6 trillion (13% of EU Gross Domestic Product – GDP) according to the European Commission's (EC) 2012 State Aid Scoreboard;[1] 21% of this amount was recapitalisation support made with tax payer money. This does not include the massive amount of emergency liquidity and other non-conventional monetary policy measures that the European Central Bank and other national central banks pumped into the system to safeguard financial stability.

International standard setters introduced a new capital regime to make banks more resilient. The Basel III regulatory framework strengthened capital requirements and introduced a leverage ratio requirement. For the first time, new features that take into account a macroprudential perspective have been included in the regulatory toolbox to address systemic risks. The adoption of the Capital Requirement Regulation (CRR)[2] and Capital Requirement Directive (CRD) IV[3] enshrined many of these principles in law across the EU.

They also introduced principles for new statutory resolution regimes to mitigate the impact of bank failures. The Financial Stability Board (FSB) developed *Key Attributes of Effective Resolution Regimes for Financial Institutions* (KAs)[4] that would allow public authorities to resolve financial institutions in an orderly manner without taxpayer support, while maintaining their critical economic functions (see Box 1). One important tool, bail in outside insolvency, i.e. restructuring in a resolution, was introduced to allow authorities to write down

1 Report on State aid granted by the EU Member States, Report from the Commission, 2012 Update Brussels.

2 Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms amending Regulation (EU) No 648/2012.

3 Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC.

4 Key Attributes of Effective Resolution Regimes for Financial Institutions, Financial Stability Board, October 2011. An update was published in October 2014.

Box 1

The Key Attributes and the FSB's work on resolution

The Key Attributes set out the core elements necessary for an effective resolution regime for financial institutions and groups. They were endorsed as a new standard by the G20 leaders at their summit in Cannes in November 2011. The objective of this regime is to make resolution feasible without causing severe systemic disruption and without exposing taxpayers to loss, while protecting vital economic functions through mechanisms that make it possible for private stakeholders to absorb losses. The framework envisaged in the Key Attributes consists of four principal elements: (i) strengthened national resolution regimes; (ii) arrangements for international cooperation; (iii) improved recovery and resolution planning; and (iv) the elimination of practical barriers to cooperation.

In early 2011, the FSB also established the Resolution Steering Group (ReSG), a Committee that develops the FSB's work on resolution to improve authorities' capacity to resolve Global Systemically Important Banks (G-SIBs, referred to as Global Systemically Important Institutions –G-SIIs– in the EU) and support the development of effective resolution strategies and plans. The ReSG reports to the FSB Steering Committee and has set up a number of working groups and temporary workstreams to make targeted progress in key areas for resolution policies. The ReSG membership includes treasuries, central banks, supervisory and resolution authorities, international organisations and standard setting bodies working on resolution matters. The SRB is represented in the ReSG and is currently chairing the group.

liabilities of a failing bank and/or convert them to equity should its failure pose a significant risk to financial stability.

The European Union adopted the Bank Recovery and Resolution Directive (BRRD)[5] in April 2014, which implemented the Key Attributes in EU laws. In line with the KAs, the BRRD granted far-reaching powers to resolution authorities to allocate losses to a broad range of creditors, including through the use of the bail-in tool. Indeed, in the new regime, only covered deposits, secured liabilities,[6] short-term interbank borrowings, short-term liabilities owed to payment systems and other liabilities to employees, tax and social security or deposit guarantee schemes were explicitly excluded.[7] Additional exclusions can be granted only in exceptional cases,[8] such as: i) the impossibility to bail-in within a reasonable time frame; ii) the need to preserve critical functions and core business lines; iii) to avoid widespread contagion that can severely disrupt financial markets causing a serious disturbance to the economy of a Member State or of the Union; and iv) to avoid destruction of value such that losses borne by other creditors are greater than if the exclusion is applied.

The BRRD also introduced a Minimum Requirement for won funds and Eligible Liabilities (MREL). MREL shall ensure the banks have enough capital and "bail-inable" liabilities to facilitate bail-in. It prevents a situation where either due to the funding mix of the bank (e.g. purely deposits or purely secured funding) or following the consequences of recovery actions ahead of resolution, the resolution authority is unable to apply the bail in tool successfully. MREL is a minimum requirement that applies to all institutions, at solo and consolidated level under a Pillar 2 approach. Its primary objective is close to the purpose of the total loss-absorbing capacity (TLAC) developed under the aegis of the FSB for G-SIBs.

A specific regulation established the SRB in the BU. The Single Resolution Mechanism Regulation (SRM-R)[9] describes the institutional framework related to the implementation of resolution actions at the BU level. It establishes the SRB as the relevant resolution authority for BU participating Member States (MS), starting its operations as an independent EU agency on 1 January 2015. The SRB assumed its full legal mandate for resolution planning and resolution schemes on 1 January 2016. Its primary scope covers significant and cross-border banking groups established in the BU.

The SRM-R also established the SRF, a fund established at supranational level. The SRF is financed by contributions from the banking sector and will reach at least 1% of the covered deposits by the end of 2023. As of July 2016, the SRB had collected a total amount of EUR 10.8 billion in contributions to the SRF from nearly 4,000 institutions – not only banks, but also certain investment firms in the euro area. A precondition for accessing the SRF is the application of the bail-in rules and principles laid down in the BRRD and SRM-R, meaning a bail-in of at least eight percent of total liabilities and own funds and the contribution from the SRF is limited to a maximum five percent of the total liabilities, including own funds, of the institution under resolution. When the condition is fulfilled, the SRF may be used to ensure the efficient application of resolution tools and the exercise of the resolution powers conferred on the SRB by the SRM-R.

2| Role for the single resolution board

Important milestones have been reached, including the first two waves of resolution plans drafted for major banks. In 2017, the SRB will deepen and expand the resolution plans and develop its MREL policy further.

Resolution plans have been developed to allow banks to fail and be resolved without the use of taxpayer funds. One of the key principles is that banks are supposed to be resolved by placing the

5 Directive 2014/59/EU of the European Parliament and of the Council.

6 Except when market value is above value of the collateral.

7 Article 44.2 of the BRRD.

8 Article 44.3 of the BRRD.

9 Regulation (EU) No 806/2014 of the European Parliament and of the Council.

burden of losses firmly on equity holders and creditors instead of taxpayers. Resolution planning aims at making banks more easily and safely resolvable than in the past. The mission of the SRB is in essence forward-looking, and the work of the institution is not only in resolution. The preventive role of the SRB is key and its work is intended to end bail-outs, not least by incentivising private sector creditors to find a private solution without the use of public funds. Banks not only need to be resolvable – but they also need to have sufficient loss absorbing capacity. This will reduce volatility in the sector and promote trust and financial stability. By the end of 2016, the SRB developed 65 Resolution Plans and 31 Transitional Resolution Plans (TRPs – which include a less detailed analysis) for banks, which are now in the final process of being approved. This marks a significant step forward. But of course resolution planning is a multiyear project and much remains to be done.

The SRB is currently developing its policy for MREL determination.[10] Based on the obligations in the BRRD, the SRM-R and Delegated Regulation adopted in May 2016[11] in accordance with article 45(2) of the BRRD and based on the work conducted by the European Banking Authority (EBA), the SRB, together with the BU national resolution authorities, started to develop its MREL approach in 2016. Its initial approach consisted of informative targets for the major banking groups under the responsibility of the SRB, at consolidated level, which aimed to provide an orientation to banks as to how to prepare for future requirements. In this context, the SRB began to collect data from banks so as to develop a deeper knowledge of the banks' liability structure, particularly in respect of their MREL-eligible liabilities. The SRB will continue to refine its policies on consolidated MREL targets in 2017 and will also develop policies for setting MREL at an entity level within banking groups within the SRB's remit, as well as further policy considerations in respect of internal MREL. It will also start to address the quality and location of MREL, i.e. its stance regarding subordination.

The SRB is ensuring its preparedness for a crisis. In 2016, the SRB conducted a fully-fledged dry-run exercise that involved high-level participants from the EC, the Council and the SRB for a bank failure simulation. The main goal of the exercise was to test the interactions between the different EU bodies with responsibility for the resolution of a bank under the direct remit of the SRB, with a focus on the procedures and processes governing the interactions between the SRB, the EC and the Council. In addition, in October 2016, the SRB organised a trilateral crisis management exercise together with relevant resolution authorities from the United Kingdom and the United States. In 2017, the SRB plans to conduct a further round of dry-run exercises with the objective of testing the adequacy of the tools and procedures prepared to date.

3| Going forward: bank loss absorbency is key for financial stability

The building of loss-absorbing capacity in the EU is key for financial stability. It will take place in an evolving regulatory environment and present structural challenges for banks. In this context, it is essential for investors to fully understand the impact of the new framework.

The implementation of MREL will further strengthen the European resolution framework. It will increase the ability of resolution authorities to achieve resolution outcomes that are effective in safeguarding financial stability and public funds. By ensuring sufficient loss-absorbing and recapitalisation capacity in resolution, MREL will allow resolution authorities to minimise the impact of any resolution on financial stability, maintain the continuity of critical functions, and avoid exposing public funds to loss due to a failing bank, thus ending the "too big to fail" conundrum.

The European regulatory environment continues to evolve, with the ongoing revision of the BRRD and the SRM-R. The BRRD required

10 MREL: approach taken in 2016 and next steps, Single Resolution Board, 17 February 2017.

11 Commission Delegated Regulation (EU) 2016/1450 of 23 May 2016 supplementing Directive 2014/59/EU of the European Parliament and of the Council with regard to regulatory technical standards specifying the criteria relating to the methodology for setting the minimum requirement for own funds and eligible liabilities.

Box 2

The EBA report on MREL

EBA released its final report on the implementation and design of the MREL framework on 14 December 2016.[1] This report was sent to the EC in accordance with the mandate contained in article 45 of the BRRD. The conclusions of the report and the earlier underlying work carried out by the EBA contributed to the overall design of the EC's legislative proposal on TLAC and MREL, published on 23 November 2016.

The report contains 12 recommendations addressing policy as well as implementation issues, complemented by quantitative analysis and impact assessments. In particular, the report addresses key topics necessary to efficiently implement an MREL framework in the EU:

- stacking order: and its implications in terms of breach of MREL and the interplay with the maximum distributable amount (MDA) framework;
- subordination: the report recommends a mandatory subordination following the principle set out in the TLAC standard covering G-SIIs and Other Systemically Important Institutions (O-SIIs). This recommendation is not taken on board by the EC legislative proposal;
- internal MREL: the report makes recommendations addressing the need to i) revise the current BRRD to allow the determination of MREL for entities within banking groups; ii) limit the application of internal TLAC to subsidiaries of foreign G-SIIs considering the EU as a single jurisdiction; and iii) consider alternative sources of internal loss-absorbing capacity such as collateralised guarantees;
- reporting and disclosure: the report proposes the development of a uniform reporting framework covering information flows from institutions to resolution authorities at EU level, building upon existing data requests, as well as introducing a requirement for the disclosure of MREL-related information to the general public.

1 Final report on MREL, report on the implementation and design of the MREL framework, EBA-Op-2016-21, 14 December 2016.

the EBA to submit a report to the EC on the appropriateness of certain aspects of MREL (see Box 2).[12] Taking this assessment into account, the EC put forward a legislative proposal on 23 November 2016 about necessary revisions to MREL. This proposal implements the FSB TLAC standard within the EU and reaffirms the power of resolution authorities. However, some alterations could have a high impact and help improve the initial proposal, for instance by enlarging the scope of Pillar 1 beyond globally systemically important banks (G-SIBs), ensuring a sufficient level of flexibility for resolution authorities in setting MREL to ensure effective resolvability, and extending the scope of mandatory subordination.

The implementation of the European resolution framework and the outcome of the negotiation of the EC's proposal might trigger structural changes for banks. Ensuring institutions are resolvable may lead to significant changes to their organisational or liability structures. Resolution authorities are empowered to remove impediments to resolvability and can require MREL to be met with subordinated instruments in accordance with the resolution strategy. As such, building up MREL capacity is intertwined with additional constraints stemming from the resolvability assessment or external structural issues affecting the nature of the requirement or the ability to meet the requirement with new issuances. The new stacking order introduced by the EC's proposal is likely

12 Article 45.19 of the BRRD.

Box 3

The new stacking order and the interplay between MREL and the Minimum Distributable Amount

In the EC proposal, the combined buffer requirement (CBR) sits on top of MREL in the stacking order, with no double-counting allowed between MREL and CBR, in line with the FSB TLAC Term sheet.

One question likely to be of interest to equity investors is about how a breach of MREL affects the CBR and triggers the Minimum Distributable Amount (MDA), i.e. the calculation of the maximum amount a bank, which fails to meet its CBR, is allowed to pay in the form of dividends (on CET1 instruments), discretionary coupons (on additional Tier 1 instruments) or through bonuses and pensions rights.[1]

Indeed, the BRRD requires that MREL must be met at all times. In the event of a breach of MREL but not CBR (e.g. a bank that cannot roll over its MREL-eligible debt), the CET1 from the CBR would be first used to meet the bank's MREL requirements, which would result in a CBR breach and MDA restrictions. A bank could thus be penalised with MDA restrictions despite high levels of CET1, by virtue of CET1 from its CBR being used to fill an MREL shortfall, resulting solely from the bank's inability to roll over debt. To ease this issue, the current EC proposal allows for a "grace period" of six months, during which time banks would be allowed to restore their MREL levels and CET1 from CBR would not count towards MREL.

1 Article 141 CRD-IV. MDA is calculated as the amount of interim or year-end profits not yet incorporated in CET1 capital, multiplied by a factor ranging from 0 to 0.6 depending on the size of the CET1 shortfall against the CBR.

to be one area for attention from equity investors (see Box 3).

Without losing sight of its main objective of setting MREL in a harmonised and timely manner, the SRB will work on appropriate transition periods. Possible transition periods may be granted by resolution authorities to address bank-specific issues. An adequate balance is necessary to avoid endless phase-in of the requirement given the risks prolonged transitions pose to the credibility of the overall MREL framework. Going further, introducing transition periods not only for the compliance with the MREL target but also with eligibility requirements (such as subordination, grandfathering provisions for instruments that do not meet the additional eligibility criteria) may help to address specificities and could be part of the toolkit of resolution authorities to make banks more resolvable and meet the resolution objectives.

Building a strong financial sector

Valdis DOMBROVSKIS
Vice-President for the Euro
and Social Dialogue, also
in charge of Financial Stability,
Financial Services
and Capital Markets
European Commission

Over the past decade, the European Union (EU) has built a new regulatory architecture for its financial system, with a single rulebook for all financial actors across the single market. At its core are stronger prudential requirements for banks, improved depositor protection rules and rules to manage the recovery or resolution of a failing financial institution should the need arise. The Banking Union is now up and running.

These reforms have made Europe's financial sector stronger. EU Banks are more stable and resilient. Overall, they are much better capitalised and ready to withstand economic shocks. In spite of all of this progress, there remain areas where our regulatory framework still needs to be strengthened and adjusted. Strengthened to bear down on remaining sources of systemic risk, and adjusted to make our legislation more growth-friendly to support investment in the wider economy while sticking to strong prudential standards.

That is why the European Commission (EC) recently proposed a substantial EU-banking reform package. It builds on existing legislation to reduce risk further, but recognises the importance of maintaining a diverse banking sector in Europe. It would introduce into EU law international standards agreed by the Basel Committee and the Financial Stability Board. The package would also make adjustments to help support a competitive banking sector, drawing on the responses to the Call for Evidence, our public consultation on our post-crisis rules.

All these actions are part of a balanced approach where risk sharing and risk reduction go hand in hand as the EC works to complete the Banking Union and Europe's post crisis regulatory framework. They would make EU financial system stronger, and help deliver the stability and investment we need for growth in Europe.

Valdis Dombrovskis

The decade that has passed since the onset of the financial crisis has seen unprecedented efforts across developed economies to stabilise markets and contain negative externalities, followed by a period of soul-searching and intense constructive dialogue by international bodies, legislators, Member States, industry stakeholders, and consumer groups. The objective has been to improve regulation and raise it to a level of maturity appropriate to handle future crises and market failures.

The crisis revealed issues that had accumulated in our global financial system, some of which had wrongly come to be considered part and parcel of an inter-connected global financial system delivering deep markets and liquidity. Banks were undercapitalised and became highly leveraged, in search for ever higher yields and return on equity which the customer deposit funding model could not deliver. The maturity transformation function banks had historically provided to the real economy became a point of weakness and fragility once short-term funding could not be extended to support long-term assets. Moral hazard and other agency issues were widely spread. When there were coupled with accelerated financial innovation and securitisation as well as regulatory forbearance, this generated substantial financial misconduct and poor management of risk, with deleterious effects reflected across the system.

The supervisory tools available at the time of the crisis did not capture this complexity. They did not provide for well-structured action plans in case of failure based on ex-ante prepared scenarios. This forced regulators and supervisors into unchartered territory, improvising on measures that in other times would have been considered unthinkable: massive bail-outs through asset relief programs, capital injections, guarantees and provision of liquidity directly into the financial system, unprecedented "lender of last resort" operations, nationalisations as a temporary measure to stabilise systemic banks, or capital controls to reduce the effects of liquidity flight and buy time to devise restructuring and restoration plans.

The first crisis measures meant to extinguish the fire, followed by further measures meant to address the root causes of the issues, including poor capital adequacy ratios and loopholes in risk management practices, agency issues, the lack of resolution regimes, and the insufficient depositor protection in some countries. This first wave of measures set the foundation of the Banking Union and implemented Basel III in Europe through the revised Capital Requirements Regulation and Directive (CRR/CRDIV) finalised in 2013, adopted the first recovery and resolution regime for banks including a bail-in tool in 2014 and the deposit insurance scheme directive including a proposal for an EU-wide depositor protection scheme proposed in 2015.

The 2016 regulatory reform initiative goes further in completing the measures to address all the root causes observed and analysed during the crisis (e.g. high leverage, lack of long-term liquidity, lack of harmonised loss absorbing capacity, the divergent rules in the hierarchy of creditors, lack of view on system interconnectedness and flows). These measures are balanced in a way that do not hinder the bank's role to extend lending to firms, allocate resources and transform maturities within the economy, especially in these times of economic recession and subdued growth.

1| A stock-take of the European post-crisis regulatory architecture

The EU's response to the regulatory needs identified during the crisis was delivered in a strong and structured manner through the design and implementation of the Banking Union, as part of a new and comprehensive regulatory architecture for its financial system, as well as through strengthening the relevant regulatory regimes for the entire EU.

1|1 The macroprudential framework and the Single Supervisory Mechanism

The post-crisis EU regulatory reform efforts were first focused on the design and set-up of the Single Supervisory Mechanism and the strengthening of the macroprudential framework through the implementation of Basel III rules. This phase has been successfully achieved through the adoption of the Single Supervisory Mechanism Regulation granting the ECB the role of single supervisor of banks in the euro area, setting the process, governance and roles and responsibilities and through the completion of an asset quality review (AQR) exercise taking a snapshot of the financial standing of banks in its scope. This mechanism was complemented by the updated technical rulebook through the adoption of the CRR and CRDIV which are applicable across the entire single market. These rules included most provisions negotiated in the Basel III Accord but not yet all of them. The most notable ones still under consideration at the time include the leverage ratio, the Net Stable Funding Ratio and the revision of the trading book.

1|2 The recovery and resolution regime and the Single Resolution Mechanism

A second element on the immediate post-crisis reform agenda was the creation of a framework and related rulebook to deal with bank failures in an orderly manner. The European resolution regime sets the basic principles and governance for dealing with failing banks in an orderly and structured way and sets the regulatory objectives to be achieved. Fostering global financial stability and averting the risks of systemic disruption, identifying and protecting the critical functions provided by the financial institutions in distress in a way that ensures customers' continued access to these critical functions, ensuring that the costs of resolution are born by owners of capital, creditors, management and not by the public are some of the most important objectives of the European resolution framework.

As with the supervisory mechanism, this has been achieved through the design of principles detailing the functioning of a resolution regime – the Single Resolution Mechanism Regulation (SRMR) and the related new rule book dealing with the recovery and resolution of banks across the entire single market – the Bank Recovery and Resolution Directive (BRRD). The European framework is in line with the *Key Attributes of Effective Resolution Regimes* developed by the Financial Stability Board (FSB) as best practice specifying the core features that a resolution regime is expected to have.

The BRRD creates new national resolution authorities and the SRMR creates the Single Resolution Board for the Banking Union. Resolution authorities are granted new powers of intervention to execute successfully the assessment and resolution of banks. The rules foresee several phases which follow the likely lifecycle of events that could occur at a time of financial distress. First, the preparation phase includes the resolvability assessment, identification of the resolution strategy and drawing up recovery and resolution plans. Second, the early intervention phase is focused on an action plan taken to restructure the institution and bring it back to viability. Third, the resolution phase which starts when the bank is declared failing or likely to fail includes the execution of resolution actions and application of resolution tools, depending on the scenario identified in the preparation phase. The rules also define the high level governance and cooperation process as well as the mediation process among competent and resolution authorities, the European Banking Authority and the financial institution being resolved.

The new bail-in tool as well as the requirement for banks to hold a minimum level of own funds and eligible liabilities (MREL) as set by the resolution authorities are the centre pieces of the resolution regime. The bail-in approach accommodates distinct types of resolution strategies, whether "full or open bail-in" or "indirect or bridge institution bail-in". In either case the BRRD grants powers to

the resolution authorities to write-down equity or other instruments of ownership and to recapitalise the entity emerging from resolution by converting creditor claims into new equity, where necessary. This powerful tool aims to internalise losses and force investors and debt issuers to factor in the risk of bail-in in the pricing of these instruments. Such mechanism can fix the system of incentives in the financial system, which was previously skewed by certain banks being "too-big-to-fail" and the implicit public rescue contingency attached to this perception, which created moral hazard and funding cost advantages in the markets.

Besides breaking the link between sovereigns and their respective banks, the bail-in tool creates accountability for own actions, limits moral hazard while shifting the responsibility for solid risk assessment from the public towards the bank and its creditors.

The next step is developing an understanding of the operational aspects of bail-in execution to secure an ease of application under crisis conditions. This means detailing the range of resolution actions and processes required to write-down and convert bail-inable instruments, and to return or issue instruments to liability holders. However, ensuing initiatives to make bail-in workable in practice are complex. They start with practical aspects of setting the exact bail-in scope, valuation and title transfers or exchange mechanics, communication and governance, legal aspects and dealing with the "no creditor worse off" safeguard. Such technically complex processes could be difficult to apply in practice especially when dealing with numerous stakeholders. In this view, the Commission has participated alongside other stakeholders in a number of simulation exercises or resolution dry-runs to identify those aspects in the process that do not work smoothly or where operational, financial or legal issues persist and to find mitigating solutions for those issues. We are committed to continue working on making these processes as operational as possible.

On a final note, there is a need to progress on the agreed common fiscal "backstop". Technical work has been taken-up after the notification of transposition of the BRRD by all Member States and rapid progress on this important component of the system would be welcomed.

1|3 Risk sharing and depositor protection

Complementary to the supervisory and resolution powers and tools, the third pillar in the new European financial architecture was designed around the need to share risks and ensure a harmonised depositor insurance mechanism through the adoption of a pan-European deposit insurance scheme (EDIS). These measures proposed in 2015 aim to ensure an equal treatment of depositors irrespective of their location and it builds on the national depositor protection schemes and funding by gradually pooling together resources.

However, progress on a mutualised European scheme for depositors should go hand in hand with progress in other areas via measures targeted to further reducing systemic risk and ensuring the seamless application of risk reduction rules across the Union. Pursuing the completion of regulatory reforms in the areas of prudential and resolution frameworks would bring additional confidence required to implement the European depositor insurance measures.

2| The 2016 regulatory banking package

Yet for all the post-crisis progress achieved, areas for further strengthening and adjustment remain both with regards to the prudential and resolution frameworks. First, strengthening to bear down on remaining sources of systemic risk, and second, adjusting to cater for a more proportionate application of rules to encourage further lending to the real economy and foster economic growth.

A substantial regulatory reform effort is in the pipeline for agreement in 2017, building on the

previous prudential and resolution legislation. The measures balance the regulatory objectives on the one hand (enhancing resilience and risk reduction) and support banks to fulfil their role in the economy on the other.

The mandate behind these changes is three-fold. First, delivering on Europe's commitments made in international fora – the Basel Committee on Banking Supervision (BCBS) and the FSB – to incorporate the remaining elements of the prudential framework and extend the resolution framework to put an end to "too big to fail" institutions. Second, acting on the EU commitment to take further steps towards the completion of the Banking Union by providing credible risk reduction measures to mitigate threats to financial stability, as published in European Commission's 2015[1] Communication. Third, addressing the responses from stakeholders received in response to the Call for Evidence. This exercise was launched by the Commission to check whether the existing regulatory framework for financial services was working as intended and to address any unintended consequences or unanticipated interactions. The Call for Evidence was the first international example of such a holistic and comprehensive exercise. Overall, the responses showed great support for the fundamentals of the reforms put in place. At the same time, it became clear that some targeted changes could make our rules more effective in achieving their objectives. Based on an extensive analysis of the over 200 responses, the Commission identified four areas where fine-tuning of the framework is required.

First, there is a need to further reduce any unnecessary regulatory constraints on financing the economy. For example, the EU banking reform package provides explicit incentives for SME financing and long-term investments. Second, the Commission will look at ways to further strengthen the proportionality of rules without compromising on prudential objectives; more proportionate rules will help promote competition and enhance the resilience of the financial system by safeguarding its diversity. Third, the regulatory burden has to be kept at the minimum required for rules to achieve their objectives. This is one of the key aims of the REFIT programme of the Commission under the Better Regulation agenda. This year will see the launch of a REFIT review on reporting requirements. Lastly, the Call for Evidence also underlined the need to ensure consistency in the overall regulatory framework, and make it more forward-looking. This includes keeping rules up-to-speed with technological developments and addressing the gaps in the regulatory framework that were brought to our attention, including a recovery and resolution framework for central clearing counterparties (CCPs).

The 2016 banking reform package aims to achieve the regulatory objectives through targeted amendments to five pieces of legislation in the areas of prudential and resolution requirements.[2]

2|1 Completing the prudential framework (CRR/CRD)

Important changes were proposed to complete the prudential framework with elements agreed in the Basel standard introduce more proportionality into the rules as well as ensuring EU specificities are recognised, such as measures to support the sustainable financing of the EU economy.

Key elements of the prudential package include more risk-sensitive capital requirements, in particular in the area of market risk, counterparty credit risk and for exposures to CCPs, a binding Leverage Ratio, a binding Net Stable Funding Ratio (NSFR), a fundamental review of the trading book, a reduced reporting and administrative burden for smaller banks and an optimisation of the SME supporting factor to name the most important.

The proposal introduces a binding Leverage Ratio of 3% to prevent excessive leverage build-up in the financial system as institutions are in search of higher returns on equity. It adds the leverage ratio alongside the risk-based own funds

1 2015 European Commission Communication "Towards the completion of the Banking Union".

2 The Capital Requirements Regulation and Directive (CRR/CRDIV), the Bank Recovery and Resolution Directive, the Single Resolution Mechanism Regulation (BRRD/ SRMR) as well as the Creditor hierarchy Directive (part of BRRD).

requirement of the CRR and is intended to act as a backstop to banks' internal model based capital requirements. The binding NSFR aims to address the excessive reliance on short-term wholesale funding and to reduce long-term funding risk so that banks can better handle prolonged periods of market stress.

Following the Basel Committee's fundamental review of the trading book, an overhaul of the respective chapter of the CRR has been undertaken to ensure requirements for banks with sizable trading activities are aligned with risk. The proposal includes a three year phasing in-period to soften cliff-effects, proportionate rules for banks with small trading books and adjustment for European specificities such as covered bonds. The proposal also aims to support efforts to create deeper and more liquid capital markets in Europe and to encourage simpler and more transparent securitisation practices.

For smaller banks, the proposal reduces disclosure requirements, simplifies the calculation of related positions and lightens certain remuneration rules.

2|2 Completing the resolution framework

Ensuring loss absorbing and recapitalisation capacity

A major area of change in the resolution framework is the introduction of the total loss-absorbing capacity (TLAC) requirement, negotiated and agreed at the G-20 level and endorsed by our jurisdiction in November 2015.

The regulatory objective of the new requirement is to ensure that global systemically important institutions (G-SIIs), whose failure would have significant negative effects on the global financial stability, comply at all times with a minimum level of TLAC which would be bailed-in under resolution. This is a major achievement in alleviating the effects of being "too-big-to-fail" and averting or diminishing the likelihood of using public money to rescue big institutions.

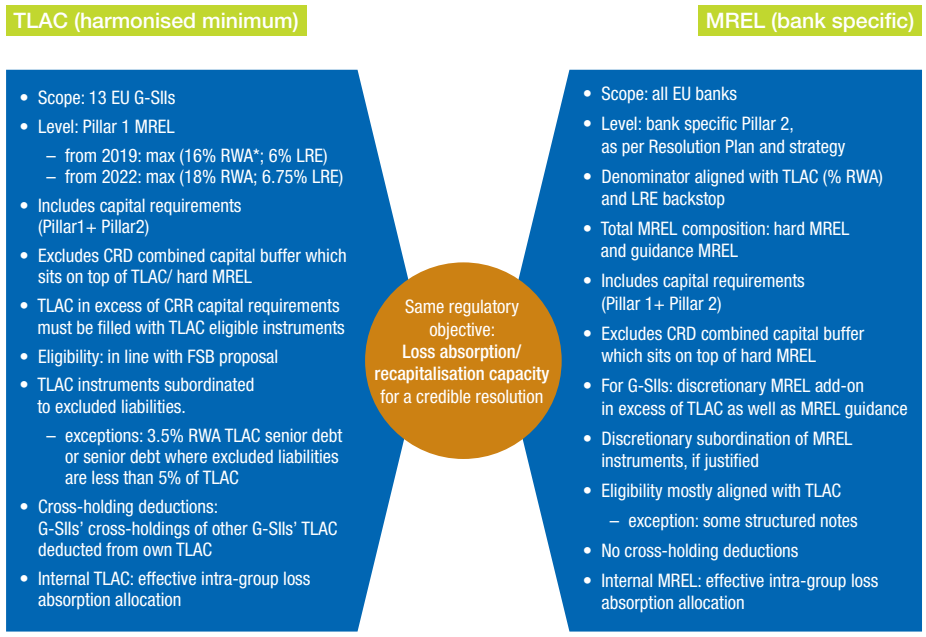
The level of the harmonised minimum TLAC was calibrated by the FSB based on a study of historical losses experienced by G-SIIs and other big institutions at the height of the crisis. The TLAC requirement for G-SIIs comes in addition to the already existing BRRD requirement that all EU institutions should hold enough funds and eligible liabilities to absorb losses and ensure recapitalisation as required by their resolution strategies. To prevent unwarranted legal and operational complexity and compliance costs due to a potentially parallel application of these two rules, the legislative proposal incorporates the TLAC standard into MREL in a way that preserves consistency with the already existing principles of the resolution framework and capital adequacy rules. The integration of TLAC/MREL requirement was achieved in a way that aligns certain aspects of their calibration while keeping some distinctions in areas where these are justified by their different nature. TLAC being a minimum harmonised Pillar 1 requirement is included in the CRR to warrant a uniform application across the EU. The BRRD is amended to include changes to the MREL standard which remains as before, a bank-specific Pillar 2 requirement calculated on a case-by-case basis.

Banks other than G-SIIs would continue to comply with the bank-specific MREL provisions. Setting the MREL requirement on the basis of a case-by-case approach delivers a more appropriate and proportionate outcome for smaller and less complex banks which fully accounts for their business model, resolution strategy and other specificities. At the same time the resolution framework is conceived to grant sufficient flexibility and powers for resolution authorities to impose bank-specific MREL at a level that is required to ensure a level playing field between G-SIIs and non G-SIIs which pose similar systemic risks. Resolution authorities are empowered, on the basis of bank-specific assessments, to require that G-SIIs comply also with a supplementary Pillar 2 MREL requirement, if justifiable, proportionate and in line with the resolvability analysis.

The proposal introduces the concepts of MREL Pillar 2 set at the amount necessary to absorb losses and to recapitalise the institution and an additional MREL "guidance". The latter may cover the risk of additional losses as estimated by the prudential capital guidance if set by the supervisor or additional recapitalisation needs to ensure market confidence in the resolved entity. While a breach in MREL guidance does not trigger automatic restrictions to distributable amounts (e.g. dividends, AT1 coupons), a breach of the base MREL requirement would bear such restrictions if the bank does not replenish the breached amount within a grace period of six months. This explains the rationale for a two-step MREL calibration to allow for greater flexibility in imposing higher levels of MREL if needed, without creating market disruptions through automatic restrictions to distributable amounts. This approach was chosen because the application of automatic restrictions to distributable amounts or a market perception for such restrictions could cause a temporary freeze in the MREL market which would render the instruments less investable and potentially make the framework more fragile.

Another aspect aligned with the TLAC term sheet is the stacking order of instruments. While under the existing legislation the CRDIV combined capital buffer was included in the MREL calculation, in the new proposal this buffer regains its initial role of acting as a safety net by being taken out of the MREL amount and placed on top. By allowing the capital buffer to act as a cushion, the effects of temporary market disruptions in case of MREL breach are reduced, giving the bank more time for reaction and initiative to restore the situation.

F1 An integrated TLAC/MREL requirement for EU banks



Source: European Commission.

The scope of the reform goes beyond quantitative calibrations, to clarifying and optimising the process and the coordination between relevant authorities and granting them necessary powers to act.

Harmonising the creditor hierarchy for senior unsecured debt

The harmonisation of the creditor hierarchy for senior unsecured debt came as a necessary addition to make the TLAC/MREL framework operational. The objective of this harmonisation is to improve market clarity and transparency and reduce the legal complexity with respect to the place creditors of subordinated instruments hold in the hierarchy of claims especially in potential cases of large cross-border resolution. As the situation stands now, different countries have taken different approaches to ensure legal clarity on the unsecured debt that requires subordination. Some countries have decided for a statutory comprehensive and retroactive subordination, others have decided on a more targeted approach within one specific category, while others focused on depositor preference.

The European harmonised approach intends to be as little intrusive as possible into the bank's funding mix and cost of funding, while at the same time giving banks the flexibility for target issuances in a new category of senior non-preferred unsecured debt which would comply with TLAC and subordinated MREL requirements, provided all other eligibility criteria are respected. The years in the run-up to 2019 when banks must meet the subordinated TLAC or MREL requirements will see important debt issuances whose success depend on investor confidence, transparency and market certainty around these instruments. The partial harmonisation of the bank creditors' hierarchy is estimated to reduce to a great extent the information asymmetry experienced by the buy-side when investing in bail-inable instruments of cross-border institutions. Our priority is to ensure that resolution resources are as investable as possible and to create the appropriate conditions for a sustainable investor base and sufficient market appetite for these instruments. One challenge is the pricing-in of bail-in risk, which is understandable given that such considerations have not been carried out before and given the transition period for the market to adapt to the new resolution framework and the internalisation of losses and recapitalisation needs instead of relying on contingent public guarantees.

3| Non-bank resolution regime

Measures to enhance the resolvability of CCPs have been pursued in parallel with the banking measures, through the adoption in 2016 of a proposal on recovery and resolution of CCPs also due for agreement in 2017.

The need for a separate recovery and resolution regime for CCPs stems from the very differences in the nature of business that characterise CCPs and banks, the former being specialised risk managers who do not hold deposits or issue debt.

Building on the European Market Infrastructure Regulation (EMIR) and similar to the BRRD, the CCP Recovery and Resolution proposal rests on three pillars. First, a preparation and prevention phase, during which CCPs must draw up recovery plans to be reviewed by the CCP's supervisors in coordination with the supervisory college established under EMIR. Furthermore, resolution authorities in coordination with the resolution college established under this regulation must prepare resolution plans describing how a CCP would be restructured and their critical functions maintained in the event of failure. This phase also includes an assessment of the CCP's resolvability and a mediation process where the European Securities and Markets Authority (ESMA) is in the lead in case of dispute.

A second pillar of this framework is the early intervention during which CCP's supervisors are granted specific powers complementary to those

granted under EMIR to intervene in a CCP's operations where their viability is at risk, but before they reach the point of failure.

A third phase includes the triggering of resolution and the application of resolution tools, in line with the FSB guidance. A CCP will, in principle, be placed in resolution when it is failing or likely to fail, when no private sector alternative can avert failure, and when its failure would jeopardise the public interest and financial stability. Harmonised resolution tools and powers, together with the resolution plans prepared in advance will ensure that resolution authorities in all Member States have a common toolkit to manage the failure of CCPs. Robust cooperation mechanisms among authorities in the EU and with third country authorities will set the conditions and requirements for ensuring that decisions are coordinated, recognised and enforced in a cross-border context.

4| Conclusions

The latest regulatory reform effort due for agreement in 2017 is balanced, well anticipated and necessary to make our financial sector more robust and resilient to future shocks.

The substantial additions to the prudential framework should make banks more resilient, eliminate loopholes and encourage banks to lend to the economy.

The recent changes to the resolution framework incorporate a lot of flexibility, allowing for a well calibrated case-by-case and proportionate application of rules to the entire population of the heterogeneous institutions in the EU. The resolution framework covers all types of institutions, ranging from systemic, interconnected and complex to smaller, simpler or regional institutions, from wholesale-funded to deposit-funded institutions; it applies to all banks, to banks in going concern as well as to banks emerging from resolution. The framework could be characterised as a middle point between a principles-based approach and a rules-based approach, with areas ranging from one spectrum to the other. It incorporates a high degree of adaptability that goes hand in hand with the best practice of ensuring transparency and appropriate justification of decisions made.

The legislative package has also been well anticipated by stakeholders, from Member State experts, industry players, investors and other institutions through the transparent process of handling the technical preparatory work via expert group meetings, consultation process and by launching the Call for Evidence to gather feedback to support potential improvements.

However, some challenges remain ahead, especially in ensuring the smooth operational implementation of the legislation. The new requirements come at a time of subdued economic growth, on the background of accumulated losses which remained unallocated within the system and low interest rates impacting banks' profitability. Significant levels of non-performing loans loom on the books of many banks making their financial fundamentals fragile and creating challenges in implementing the new rules. However, this difficulty must be balanced with the utility to have these requirements implemented to ensure a solid situation under going concern and a credible resolution otherwise. Additionally, liquidity in resolution and operationalising bail-in remain at the top of our agenda of priorities to address, together with improving resolvability for big complex cross border banks.

The regulatory work achieved to date marks important steps towards completion of the Banking Union setting the premises for a more stable, integrated and resilient financial sector. Further work needs to be done on effective implementation and fine-tuning of the framework as more practical experience accumulates once it reaches a steady state.

National and supranational banking regulators: between delayed intervention and time inconsistency

Bruno Maria PARIGI
Professor of Economics
University of Padova
and CESifo

The implementation of the Banking Recovery and Resolution Directive (BRRD) resolution rules has brought to light potential differences in standards and conflicts of interest between national and supranational regulators. National regulators may be more inclined to delay regulatory intervention. However, the draconian resolution measures that supranational regulators are to enforce may prove to be time-inconsistent. The banking crises in Italy in 2015 and 2016 – during which the rules envisioned by the BRRD were battle-tested for the first time on a large scale – offer good illustrations of the above issues.

Bruno Maria Parigi

The banking union has introduced a new architecture with far-reaching implications. Designed to overcome inefficiencies in policy actions stemming from supervisory fragmentation, avoid the use of taxpayer money to bail out distressed financial institutions and provide for their speedy resolution, the Banking Recovery and Resolution Directive (BRDD)[1] aims to centralise the management of banking crisis resolution using a hub-and-spokes system (Carletti et al., 2016). The framework of the Single Resolution Mechanism involves several institutions: the national regulators, the European Commission (EC), the European Central Bank (ECB), and the Single Resolution Board, each with different objectives and incentives. National regulators, which are more sensitive to the interests of their local constituencies and may face political costs from intervening in a bank, may be more inclined to delay regulatory intervention. Meanwhile, the resolution measures in the BRRD that involve the bail-in of shareholders, bondholders and large depositors may cause tensions between national and supranational regulators, and the enforcement of these rules may prove to be time-inconsistent.

Recent developments in the Italian banking industry offer good examples of these difficulties. With the Asset Quality Review (AQR) in 2014, it became clear that Italian banks had a lot of non-performing loans (NPLs) – loans that are 30 days or more overdue – in their books, a problem which the Italian monetary authorities (the Ministry of Economy and Finance and the Banca d'Italia) tried to play down. When, in November 2015, with the phasing in of the BRRD, the EC obliged shareholders and subordinated bondholders to share the burden of the resolution of four regional banks, the surprise and political fallout were huge. In December 2016, when the management of the crisis of Banca Monte dei Paschi di Siena (MPS) could no longer be postponed, to avoid the backlash from the rigid application of the more stringent bail-in rules, the EC and Italian monetary authorities interpreted the BRRD provisions in such a way as to minimise the impact on retail creditors, but in doing so potentially undermined the effectiveness of these rules. In the rest of this article, I show how recent academic studies can help to better understand these issues.

1| The consistent application of rules

1|1 National and supranational bank regulators

When banking regulators are fragmented and their remits overlap, the application of rules may be inconsistent. An example is offered by the experience of the United States. Historically, US banking regulation has been fragmented, with some banks having a State license and others a federal license. Agarwal et al. (2014) compare State and federal regulatory interventions. Exploiting an exogenous rotation between State and federal regulators in the case of on-site bank examinations, they find that State regulators have a larger propensity to be lenient than federal ones.

Being exposed to a distant bank regulator may have the benefit of helping society to uncover banks' losses and abuses. However, a distant regulator may not necessarily deliver a better outcome than a local one. In a regulatory architecture similar to the BRRD, Carletti et al. (2016) consider the different incentives to intervene in a bank faced by a national and supranational regulator. The supranational regulator needs the local expertise of the national one. However, this reduces the incentive of the national regulator to acquire information about the bank, as the supranational regulator may use it to take actions that the national regulator dislikes.

1|2 Regulatory forbearance

This tension is compounded by the classical problem of regulatory forbearance. Ample empirical and anecdotal evidence shows that banking regulators all over the world may have a tendency to respond slowly to banking crises and to be excessively lenient. The US savings and loans crisis in the 1980s, the 2007-2009 subprime crisis, the crisis

1 The BRRD is Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 (See *Official Journal of the European Union*, 2014).

of the Spanish *cajas*, and the ongoing crisis of MPS in Italy, are all examples of a delayed response by banking authorities in taking prompt corrective action. Yet, in many of these instances, evidence of brewing banking crises was in plain sight of the banking regulators.

A number of studies help to provide a better understanding of the framework under which forbearance occurs. Garicano (2012) identifies several possible reasons why the Banco de España waited so long to intervene in the *cajas*. First, supervisors tend to be reluctant to act because this would bring to light their own past mistakes. A second reason is the absence of an appropriate bank resolution framework, a problem that the Dodd-Frank Act in the United States and the BRRD in the eurozone aimed to solve. However, according to Garicano (2012), the main explanation for the Banco de España's supervisory failure was the political control exerted over the *cajas*.

Closing an insolvent bank may raise the well-known problem of time-inconsistency, as the threat to intervene may not be ex post optimal (Mailath and Mester, 1994). Acharya and Yorulmazer (2007, 2008) argue that, ex ante, regulators would prefer to be tough to prevent excessive risk-taking. However, during systemic crises, the costs associated with not providing assistance can be so high that regulators feel compelled to help.

There is also the risk that a bank closure might lead to financial contagion. Morrison and White (2013) show that the action of promptly closing a weak bank may raise fears that the regulator is less skilled at screening banks than previously thought. This revelation reduces confidence in other banks screened by the same regulator and, in some circumstances, can trigger financial contagion and the closure of these banks, even though their intermediation remains socially valuable.

The decision to resolve a banking crisis contains a "real option" component. In their ongoing research, Lucchetta et al. (2017) show that this implies that the decision-maker may find it optimal to postpone the resolution of a banking crisis if the associated costs are irreversible (as in a bank closure), while the economy may evolve in such a way that the crisis resolves by itself without intervention.

2 The resolution of four Italian regional banks

2.1 Some facts

The resolution of four Italian banks in 2015 offers a unique and interesting example both of the tensions between supranational and national regulators and of delayed regulatory intervention.

At the end of 2015 the gross stock of NPLs in Italian banks' books stood at EUR 360 billion – the highest level in the eurozone – and accounted for 18.1% of total loans (Banca d'Italia, 2016). In November 2015 the Italian monetary authorities were faced with a crisis at four small regional banks: Cassa di Risparmio di Ferrara, Banca Marche, Banca Popolare dell'Etruria e del Lazio, and Cassa di Risparmio di Chieti. These banks, which were outside the perimeter of the AQR and accounted for about 1% of Italian banks' total assets, had incurred losses of EUR 1.7 billion and accumulated a gross total of EUR 8.5 billion of NPLs. Under a decree of 22 November 2015, the Italian government closed all four banks, wrote down their NPLs to EUR 1.5 billion, and placed them in an asset management vehicle ("bad bank") with no banking license, tasked with directly managing or selling the troubled loans. Note that, in the absence of a market for NPLs, setting the value of these NPLs at 17.6% of their face value, i.e. EUR 1.5 billion divided by EUR 8.5 billion, had the unintended consequence of establishing a low benchmark for the valuation of the NPLs of other banks, which could make it more costly to conduct similar operations because of the gap in regulatory capital that the deconsolidation of the NPLs would entail.

In addition to the bad bank, four new "bridge banks" were created to house the good assets and deposits of the original four banks. These bridge banks were recapitalised by the National Resolution Fund (NRF), a tool comparable to the Single Resolution Fund (SRF) established under the BRRD, and which was managed by the Banca d'Italia. Note that, in the 8-year transition period before the SRF reaches its intended capacity, the mutualisation of the fund's assets is to be delayed so that losses from legacy assets are still borne at the national level.

Importantly, and in accordance with the BRRD, no State aid was involved in the rescue, as the entire operation was financed by sharing the burden with the shareholders and subordinated bondholders, and with loans and equity from the Italian banking industry. The largest Italian banks – Unicredit , Intesa, and UBI Banca – lent the NRF the initial EUR 3.6 billion needed to bring the bridge banks' capital up to 9% of risk-weighted assets (i.e. EUR 1.8 billion), cover the original banks' losses (i.e. EUR 1.7 billion), and endow the bad bank with EUR 140 million of capital. The loans granted by Unicredit, Intesa, and UBI Banca were guaranteed by the Postal Savings Bank, which is a joint stock company controlled by the Italian Ministry of Economy and Finance but which does not fall within the perimeter of general government; as a result, the guarantee did not count as State aid. About 130,000 shareholders lost all of their investment as the capital of the four original banks was cancelled. However, a much larger psychological impact was caused by the approximately EUR 750 million of losses imposed on the roughly 10,000 subordinated bondholders.

2|2 An assessment

These measures were an ad hoc solution in the transition phase, before the new resolution rules became effective. They enabled the four new banks to continue operations without any job losses, and avoided the bail-in of senior bondholders and large depositors. The losses suffered by the subordinated bondholders, almost all of them retail investors, dented the credibility of the Italian banking industry and of the Italian monetary authorities. In a belated attempt to restore confidence, the Italian government and banking industry offered only partial compensation to these bondholders.

This banking crisis built up in plain sight of the Italian monetary authorities, who were made aware of the mounting losses at the four banks through the on-site examinations conducted by the Banca d'Italia. It is impossible to second guess why the authorities were caught off guard. However, one conjecture is that they counted on the possibility of using the Italian Interbank Deposit Guarantee Fund to absorb the losses and recapitalise the four banks. If this was the case, it proved to be a miscalculation because, in its Banking Communication on State aid,[2] the EC had made it clear that, after 1 August 2013, State aid would only be allowed once shareholders and subordinated bondholders had absorbed losses.

In a letter to the Italian Minister of Economy and Finance dated 19 November 2015, just a few days before the closure of the four banks, the two European Commissioners for Competition and for Financial Services[3] reiterated that the bailout of these banks using the Interbank Deposit Guarantee Fund would be subject to European Union (EU) State aid rules, and, if an assessment led to the conclusion that State aid was involved, the resolution of the banks would have to occur within the framework of the BRRD. The argument was that, even though the fund's resources consisted of private contributions from Italian banks, the mandatory nature of the intervention would give an unfair advantage to the four resolved banks.

Whether this conjecture is accurate or not, a few lessons can be learned with the benefit of hindsight. First, it is fair to say that the Italian monetary authorities had not adequately taken on board all of the implications of the BRRD, approved by the European Parliament a year and a half earlier. Second, the same authorities did not do much to

2 Communication from the Commission on the application, from 1 August 2013, of State aid rules to support measures in favour of banks in the context of the financial crisis ("Banking Communication"). (See Official Journal of the European Union, 2013).

3 The letter that was leaked to the media can be found at *http://it.reuters.com/article/topNews/idITKBN0U613020151223?pageNumber=2&virtualBrandChannel=0*

communicate to retail investors what the new EU regulation meant for them, in particular that it implied a retroactive shift from a regime in which no Italian bank depositors had suffered losses since the end of the First World War, to a regime in which bank bonds bought under the pre-BRRD resolution rules became suddenly riskier.

Third, this episode highlighted the unresolved conflict of interest between the banks that sold the subordinated bonds and their largely uninformed, captive retail customers. For most of them, these investments were ex ante inappropriate both for their risk profile and given their lack of portfolio diversification. Although it is certainly possible that some retail investors were lured by the higher yields offered by these bonds, in most cases the banks themselves had easily bypassed the protection afforded to retail investors by Markets in Financial Instruments Directive (MIFID), which had consistently proved to be a rather ineffective bulwark.

Fourth, the EC appeared to exercise its newly acquired regulatory power in an unpredictable way. On 19 October 2015, that is just a month before the resolution of the four Italian banks, the European Commissioner for Competition had reached an agreement with the German authorities to conclude the State aid procedure on HSH Nordbank and approved a EUR 3 billion guarantee increase.[4] The entire rescue package, which was subject to a number of conditions, consisted of a EUR 3 billion capital injection by a public holding company, EUR 10 billion of guarantees from the two *Länder* (federal States) involved, and EUR 17 billion of liquidity guarantees from the German Financial Markets Stabilisation Fund. The official explanation, namely that this was the final step in a plan which had been initiated in 2013 before the BRRD regime, does not help to dispel the doubts surrounding the consistency of the EC's behaviour.

2|3 Learning from mistakes

In the spring of 2016, faced with the mounting crisis at two banks within the perimeter of the AQR – Banca Popolare di Vicenza and Veneto Banca, two former cooperative banks that had been forcefully transformed into joint stock companies just a few months before – the Italian monetary authorities found themselves constrained by the now fully operational BRRD bail-in regime.

The ECB had imposed recapitalisations of approximately EUR 1.5 billion for Banca Popolare di Vicenza and EUR 1 billion for Veneto Banca. However, Unicredit, which itself had only a thin capital cushion, realised that the market reception would be cold and backed away from guaranteeing Banca Popolare di Vicenza's rights issue. As the idea of imposing losses on retail investors on a much larger scale than in November 2015 was deemed unacceptable, in April 2016 the Italian monetary authorities orchestrated the creation of a privately funded and operated investment vehicle, the Atlante Fund.

The Fund had two tasks. The first and most important was to act as a backstop for the recapitalisation of the two banks, investing up to 70% of its capital in their rights issue. Second, it was supposed to invest more than 30% of its capital in buying up the NPLs of the Italian banking system and thus facilitate the creation of a market for distressed loans. Atlante raised approximately EUR 4.25 billion from various Italian financial institutions: EUR 3 billion from banks, EUR 500 million from bank foundations, EUR 500 million from the Postal Savings Bank, and EUR 250 million from insurance companies and others.

The first recapitalisation involved underwriting a EUR 1.5 billion rights issue by Banca Popolare di Vicenza. Since the shares could not be listed as less than 25% were held by the market, Atlante underwrote all of the rights issue and ended up controlling 99.33% of the equity. The existing shareholders were almost completely diluted, as the price of their shares plunged from EUR 62.50 in 2014 to 10 cents. The second recapitalisation involved a EUR 1 billion rights issue by Veneto Banca, which Atlante underwrote, giving it control of

4 *http://europa.eu/rapid/press-release_STATEMENT-15-5866_en.htm.*

approximately 97% of the equity. In this case again, the existing shareholders lost almost all their equity as the price of their shares plunged from EUR 40.75 in 2014 to 10 cents. The impact was devastating for more than 100,000 retail shareholders in the two banks, who saw at least EUR 5 billion of market capitalisation wiped out.

The second task, which is still in the early stages of implementation, was to buy up the NPLs of the two Italian banks at a price above their distressed market price, remove them from the banks' balance sheets, securitise their cash flows, keep the junior and mezzanine tranches, and resell the senior tranche to specialised investors.

Atlante has been a success story because, with limited funds, it managed to shift market expectations, albeit temporarily, regarding the stability of the Italian banking industry. By pooling together private resources in a way that the Italian monetary authorities could not due to the constraints of the new resolution regime, it played the role of a private lender of last resort, an institution that one would think belonged to a very distant past.

3I Taking Banca Monte dei Paschi di Siena public

3I1 The crisis

Unfortunately, the creation of the Atlante Fund was only a limited backstop measure which was unable to address the structural problems of the Italian banking industry, namely its low profitability and its huge stock of NPLs.

Much has already been written on the unfolding crisis at MPS which, prior to its difficulties, was Italy's third largest bank by assets. I would like to stress that it is a perfect example of the three concepts I have tried to illustrate: delayed regulatory intervention, potential conflicts of interest between national and supranational regulators, and the risk that the application of tough resolution measures may be time-inconsistent.

The root cause of the MPS crisis was the blitz acquisition in November 2007 of Banca Antonveneta for EUR 9 billion in cash (plus the acquisition of EUR 7 billion of its debt) from Santander. The operation was authorised by the Banca d'Italia without MPS conducting any due diligence on Banca Antonveneta, and after Santander had bought Banca Antonveneta from ABN Amro for EUR 6.6 billion just a few weeks before. Over the subsequent years, MPS used various accounting gimmicks involving derivatives to mask the ensuing losses.

The difficulty faced by national authorities in intervening in a large and politically connected bank is demonstrated by the fact that, once it was no longer possible to hide the size of the problems, Italian governments repeatedly lent to MPS to shore up its regulatory capital: EUR 1.9 billion in 2009, and a net EUR 2 billion in 2012, which was later repaid through recapitalisations. The first EUR 5 billion recapitalisation was conducted in 2014. In 2015, following the AQR, the ECB forced MPS to reclassify about a third of its loans as NPLs, leading to a capital shortfall and requiring a EUR 3 billion recapitalisation. In July 2016, MPS failed the European Banking Authority (EBA) stress test under the adverse scenario. As a result, the ECB imposed the sale of EUR 10 billion of NPLs. MPS proposed a more ambitious plan that was approved by the ECB's Supervisory Board, which involved selling EUR 27.7 billion of NPLs and recapitalising to the tune of EUR 5 billion. Note that MPS had failed a stress test under the adverse scenario, but was still a solvent bank, and that the stress test exercise itself may have contributed towards generating further instability. Several months were lost trying to raise the required capital in the market, convince subordinated bondholders to convert their bonds to equity – which most of them did – and find large long-term shareholders willing to subscribe to the rights issue. Indeed, the latter task proved impossible because of the negative outcome of a constitutional referendum which triggered a change of government. The failure to raise the EUR 5 billion prompted MPS to ask the new Italian government to activate the precautionary recapitalisation procedure.

3|2 The rescue plan

On 23 December 2016, the Italian government passed a decree effectively taking MPS public. The rescue package of EUR 20 billion, designed in principle for the whole Italian banking system, included a EUR 5 billion capital injection – the main component – and a temporary guarantee on the bank's new liabilities as MPS was suffering deposit outflows of around EUR 2 billion per week.

The capital injection for MPS has two legs. The first is the forced conversion of subordinated debt into equity. Tier 1 subordinated bondholders (mainly institutional investors) are scheduled to be converted into equity at 75% of nominal value; Tier 2 sub-bondholders (mainly retail investors) are scheduled to be converted into equity at 100% of nominal value. In the second leg, to minimise the impact on retail savers, the Italian State will buy back the equity given in exchange to the Tier 2 subordinated bondholders, who will in turn receive senior bonds of the same maturity and nominal value.

The whole operation, which had received informal preemptive clearance from the EC, was made possible under Article 32 (4) (d) of the BRRD. To preserve financial stability, said article allows for the precautionary public recapitalisation of a solvent bank of systemic importance in the event that it suffers a capital shortfall after failing a regulatory stress test – all conditions that MPS met. The burden-sharing principle was satisfied by the loss imposed on the Tier 1 subordinated bondholders. Meanwhile, the full compensation intended for Tier 2 subordinated bondholders was made possible on the premise that MPS had wrongfully sold EUR 2.16 billion of subordinated bonds to approximately 40,000 retail customers with an inappropriate risk profile.

However, the rescue plan was indeed just a plan, in that another player, the ECB's Supervisory Board, stepped in just few hours after the decree, demanding stiffer conditions, apparently without coordinating with the Italian monetary authorities. The board increased the size of the recapitalisation with respect to the market solution plan it had approved on 23 November, taking it to EUR 8.8 billion (of which EUR 6.6 billion is to be provided by the State). There appear to be two reasons for the additional capital request: to restore the equity wiped out through the imposition of losses on Tier 1 subordinated bonds; and to cover the capital shortfall stemming from the write-down of NPLs after the postponement of their intended deconsolidation under the market solution.

4| Conclusions

The resolution rules envisioned by the BRRD were battle-tested on a large scale for the first time in the banking crises in Italy in 2015 and 2016. In 2015, during the phasing-in of the BRRD, burden-sharing rules were applied to four Italian banks, causing a public backlash and frictions between supranational and national authorities. When the next large-scale crisis presented itself in 2016, the EC realised that a rigid application of the bail-in rules would be unworkable. Instead, the MPS crisis was managed in a cooperative fashion by the Italian authorities and EC, who interpreted the legal framework of the BRRD in a flexible manner. Praise for the wisdom of the authorities that contained the damage of the MPS crisis must nonetheless be tempered with two more sober observations. First, this episode offers yet another example of the risk of time-inconsistency in the case of draconian measures, as the costs of not providing assistance to a large distressed bank can be so high that regulators may feel compelled to be more lenient. Second, the implementation of the BRRD exposes fault lines in what was supposed to be a smooth process, with the consistent application of the new resolution rules and seamless communication between the national authorities, the EC and the ECB. In the end, it is difficult to escape the conclusion that, as Calomiris and Haber (2014) put it, bargaining is at the root of banking regulation.

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Are derivative markets safer?

Central clearing: reaping the benefits, controlling the risks

Benoît CŒURÉ
Member of the Executive Board
European Central Bank
Chair
Committee on Payments
and Market Infrastructures
(Bank for International Settlements)

As a result of structural changes in financial markets and the introduction of mandatory central clearing obligations for standardised over-the-counter (OTC) derivatives, central clearing has expanded significantly in recent years. In parallel, public authorities have devoted greater attention to strengthening the global safeguards for central clearing, notably with the adoption of the CPMI-IOSCO Principles for Financial Market Infrastructures in 2012, a complementary CPMI-IOSCO report on recovery of financial market infrastructures in 2014, and dedicated Financial Stability Board guidance on how to apply the "Key Attributes of Effective Resolution Regimes for Financial Institutions" to financial market infrastructures in 2014. In 2015 global standard-setting bodies launched a comprehensive work plan on central counterparty (CCP) resilience, recovery, resolution and clearing interdependencies to further enhance this framework.

This article takes stock of the latest achievements in this area and outlines future priorities, concerning the finalisation of the CCP work plan, interactions between requirements for central counterparties and those for banks, greater granularity of central counterparty supervision and oversight, cross-border cooperation between authorities as well as macroprudential safeguards for central clearing.

NB: All views expressed here are the author's own and do not necessarily reflect those of the ECB, the CPMI or CPMI-IOSCO.

Benoit Cœuré

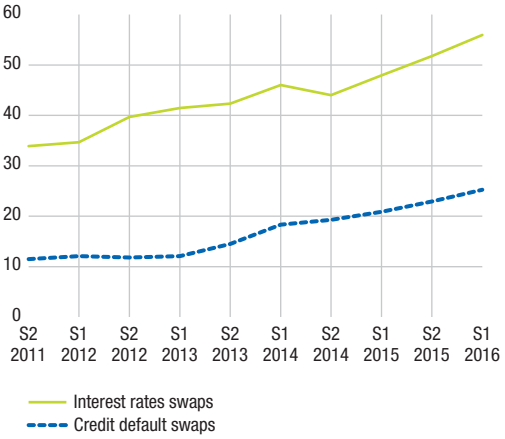
Central clearing has expanded significantly in recent years as a result of both market-driven and regulatory factors. The clearing industry had already started to undergo structural changes before the financial crisis in 2007-2009 against the backdrop of globalised financial markets, regulatory harmonisation, the removal of trade barriers, and technological process reducing the cost of services provided by CCPs (CPSS, 2010).

The financial crisis subsequently underscored the benefits of central clearing in terms of systemic risk reduction through robust counterparty risk management, greater transparency and more efficient use of collateral through multilateral netting. Particular concerns regarding bilateral clearing were identified with regard to OTC derivatives markets, as the opacity of the underlying exposures, together with uncertainty regarding counterparty creditworthiness and the inherent leverage and complexity of OTC derivatives, had been a major factor, if not in triggering the collapse of Lehman Brothers and the near-default of AIG, at least in amplifying market disruptions in their aftermath. At the Pittsburgh summit in September 2009, G20 leaders committed themselves to increasing the resilience and transparency of OTC derivatives markets, including through mandatory central clearing of standardised OTC derivatives. As a result, the share of OTC derivatives cleared centrally has increased markedly, especially in the OTC interest rate and credit derivatives segments (see Chart 1). As evidenced by the Financial Stability Board (FSB), there also seems to be scope for substantial further growth in central clearing, especially for interest rate swaps (IRS) and credit default swaps (CDS) (FSB, 2016).

Inevitably, the increased share of central clearing has been associated with further risk concentration in CCPs. This in itself is not a concern. As long as CCPs are superior risk managers and act as pillars of strength rather than sources of contagion during potential crisis situations, they act as risk *poolers*, not risk *takers*, and they therefore reduce the overall level of risk in the global financial system (not to mention other benefits such as a more efficient use of scarce collateral). In this respect, they are fundamentally different from banks, whose social function is to transform risk and maturity. In addition, the financial resources included in the CCP recovery waterfall provide for "built-in bail-in" of their shareholders and clearing members.

C1 Share of centrally cleared transactions in OTC derivatives markets

(%)



Source: FSB data, ECB calculations.

Nevertheless, in order to ensure that this is the case and that CCPs can withstand not only tail events but "tail of tail" events involving the default of multiple clearing members, policymakers have in recent years embarked on an ambitious agenda to enhance their robustness. The adoption by the CPMI and the Board of the International Organization of Securities Commissions (IOSCO) of the Principles for Financial Market Infrastructures (PFMI) (CPMI-IOSCO, 2012), related guidance on financial market infrastructure recovery (CPMI-IOSCO, 2014) and the FMI annex to the FSB's Key Attributes of Effective Resolution Regimes for Financial Institutions (FSB, 2014) were important milestones of this work.

In 2015, at the request of G20 finance ministers and governors, relevant global standard-setting bodies agreed to further strengthen the safeguards for central clearing with the adoption of the "CCP work plan" (FSB SRC/FSB ReSG/BCBS/CPMI/IOSCO 2015). The CCP work plan focuses on assessing whether existing international

requirements for CCP resilience, recovery and resolution are adequately implemented and whether additional guidance should be provided. It also provides for further exploring the interdependencies between CCPs and their participants to better understand respective contagion channels and potential vulnerabilities. Significant progress has been made in the CCP work plan in the meantime, with most deliverables expected to be finalised by mid-2017. Meanwhile, at the European Union level, the European Commission has proposed new rules for the recovery and resolution of CCPs (European Commission, 2016).

This article takes stock of recent progress in the global policy framework for CCPs (Section 1) and outlines future priorities (Section 2). Section 3 concludes.

1| Recent progress in the global policy framework for central counterparties

1|1 Resilience

CCPs are exposed to various types of risks, notably credit and liquidity risk, custody and investment risk, operational risk and general business risk. Robust credit and liquidity risk management is CCPs' first and foremost line of defence against potential financial threats to their viability. CCPs should be resilient in the sense that their financial resources allow them to withstand potential failures of major clearing members as well as any other extreme but plausible stress events ("non-default" scenarios, e.g. related to custody investment losses, operational and legal risk and cyber threats).

Box 1

CPMI-IOSCO additional guidance on PFMI requirements

In April 2017, based on public consultation, CPMI-IOSCO expects to propose clearer and more granular guidance on the implementation of certain PFMI requirements, including on:

- explicit board responsibilities and disclosure mechanisms regarding CCPs' financial risk governance to promote both closer senior level scrutiny and involvement of relevant stakeholders;
- rigorous stress-testing on the basis of more detailed guidance for identifying relevant risks, developing extreme but plausible scenarios and treating client exposures, as well as for calculating and aggregating stress test results;
- distinguishing between credit and liquidity risks in identifying stress scenarios and determining the necessary loss-absorbing resources as well as duly considering affiliates of clearing members when gauging the largest potential exposures arising from member default;
- deeper analysis to determine whether, in view of a CCP's specific risk profile, there could be a need to go beyond the minimum coverage requirements for credit and liquidity risk set out in the PFMI;
- robust margining practices through a more granular approach reflecting the specific risks of each product, portfolio and market served; prudent assumptions regarding the assumed margin period of risk, other margin model parameters and pricing data; measures to pre-empt a potential intraday erosion of initial margin and further safeguards for portfolio margining;
- further developing the toolkit to measure and address procyclicality with respect to margin and collateral haircut policies;
- determining and exposing an appropriate amount of CCPs' own financial resources to absorb losses related to participant default, custody and investment of participants' assets and ensuring that such resources are of high quality and sufficiently liquid.

Against this backdrop and in the context of the CCP work plan, CPMI-IOSCO assessed CCPs' loss absorption capacity and liquidity coverage against the related PFMI requirements.

In a report issued in August 2016, CPMI-IOSCO (2016b) reviewed the financial risk management and recovery practices at a sample of ten CCPs – including a mix of globally active and more regionally focused ones – that provide clearing services for derivatives in nine jurisdictions. The report underlined that while CCPs have made progress in developing frameworks in line with the PFMI, there are a number of shortcomings that should be addressed, notably in the areas of recovery planning and credit and liquidity risk management. Taking into account the stakeholder feedback received, CPMI-IOSCO issued initial proposals for guidance (CPMI-IOSCO, 2016a), which is expected to be finalised in April 2017 (Box 1).

1|2 Recovery

Notwithstanding the substantial work on CCP resilience including under extreme but plausible stress conditions, it cannot be excluded that CCPs may face even more extreme market events where their existing safeguards and financial buffers may not be fully sufficient. To address such tail-of-tail risks, the PFMI require CCPs to draw up recovery plans to ensure continuity of their critical functions without intervention or support from public authorities. CPMI-IOSCO have also provided specific additional guidance on the development of recovery plans (CPMI-IOSCO 2014).

While CCP resilience requirements have been in place for several years (CPSS-IOSCO 2004), recovery planning is still a fairly new area. When monitoring the implementation of the PFMI, CPMI-IOSCO (2016b) found that a number of CCPs had not yet put in place recovery plans fully in line with the PFMI. Against this backdrop, CPMI-IOSCO (2016a, 2017) recently reiterated the requirement for CCPs to have recovery plans in place that address both default and non-default scenarios. These need to include arrangements for comprehensively allocating potential credit losses and liquidity shortfalls as well as for replenishing mutualised default resources and capital after financial buffers for extreme but plausible conditions have been exhausted (see Cœuré, 2015a for a broader discussion of the loss-absorbing capacity of CCPs and its impact on stakeholders' incentives).

In addition, CPMI-IOSCO are currently working on guidance to further facilitate CCPs' preparation of recovery plans by elaborating on some aspects of their 2014 report (see section 2.1).

1|3 Resolution

Recovery arrangements are in principle designed ex ante and should be comprehensive. However, since extreme – and by definition implausible – market conditions are difficult to predict, there is a remote possibility that even a very carefully designed recovery plan may ex post turn out not to be effective in returning the CCP to viability or that its implementation may give rise to unexpected risks to financial stability. Besides, expectation of a possible public bail-out would weaken risk management practices in CCPs and encourage a race to the bottom in margining and haircutting practices. A framework enabling orderly intervention by a resolution authority must therefore also be in place, especially to ensure the continuity of critical functions of the CCPs, minimise risks to financial stability and set the right incentives for CCP shareholders and clearing members so as to avoid potential reliance on public bail-out funds and related risks for taxpayers.

It should be underlined that the resolution of a CCP would not necessarily imply winding it down. There could be cases where a CCP in resolution may cease to exist as a legal entity, for example where the resolution authority may choose to sell or transfer its business. However, the economics of clearing favour economies of scale and the emergence of local monopolies, making such a

solution in many cases difficult to implement. Interoperability between CCPs may facilitate the transferability of portfolios, but it may also have unwelcome financial stability consequences (Cœuré, 2015b, and ESRB, 2016). The continuity of the CCP's critical functions should be ensured in all cases.

As noted in the introduction, the FSB Key Attributes of Effective Resolution Regimes for Financial Institutions and the respective FMI Annex have already set out a framework for CCP resolution. Under the CCP work plan, the FSB has considered the need for additional guidance on implementation in order to assist authorities in resolution planning and promote consistency in approaches across countries. Following up on an earlier consultation (FSB, 2016), in February 2017 the FSB published draft granular guidance on central counterparty resolution and resolution planning for comments (FSB, 2017, see Box 2). Related work has been led by the European Commission (2016) at the European level.

1|4 Interdependencies

In order to ensure the robustness of the central clearing landscape as a whole, measures calibrated to individual CCPs may not be fully sufficient. In particular, CCPs all rely heavily on contributions, financial resources and liquidity provided by the same major banks (as clearing members and/or financial service providers), which creates significant interdependencies between CCPs. These interdependencies may affect the robustness of CCPs especially in the case of distressed market conditions that could trigger default management, recovery and/or resolution actions in more than one CCP at a time. Recent supervisory stress test exercises in the EU and in the United States have started lifting the veil on such interdependencies (ESMA, 2016, and CFTC staff, 2016).

Against this backdrop, the Basel Committee on Banking Supervision (BCBS), the CPMI, the FSB and IOSCO established a joint study

Box 2

FSB draft guidance on CCP resolution

Key elements underlined in the draft guidance include the following:

- CCP resolution should pursue the objective of financial stability, ensure the continuity of critical functions and avoid exposing taxpayers to losses in all jurisdictions where those functions are critical. It should also maintain appropriate incentives for effective default management and recovery.
- Resolution should to the extent possible, be predictable and ensure that no creditors are "worse off" in resolution than they would have been under CCP insolvency proceedings. Resolution authorities should therefore follow the steps under the CCP recovery plan unless a departure is deemed necessary to achieve the resolution objectives and safeguard financial stability. Resolution authorities should also have the power to award compensation to clearing members contributing resources in excess of their obligations under CCP rules in the form of equity or other types of ownership.
- In defining the timing of entry into resolution, there is a need to balance predictability for stakeholders with flexibility for resolution authorities. To this end, the draft guidance sets out potential indicators for default and non-default-related losses that may inform the decision on whether to place the CCP in resolution. In addition, relevant authorities should cooperate closely in the lead-up to resolution.
- Resolution authorities should pursue prudent and consistent approaches when assessing CCPs' resolution funding. To this end, the draft guidance sets out some common minimum criteria that should be considered. Temporary public funding should only be used as a last resort and coupled with very robust ex post recovery mechanisms.
- When conducting resolution planning, authorities should carefully differentiate between potential default and/or non-default resolution scenarios and related arrangements for allocating financial losses and replenishing CCPs' financial resources.
- Oversight, supervisory or resolution authorities should be able to address material impediments to resolvability that may be identified by the resolution authority.
- To assist in the establishment of crisis management groups for CCPs that are systemically important in more than one jurisdiction, further guidance is provided on identifying the relevant CCPs and the composition of these groups.

group in July 2015 to identify, quantify and analyse interdependencies between CCPs and clearing members and any resulting systemic interdependencies. As a first step, the study group collected data from around 25 CCPs globally in order to identify CCPs' exposures to banks as direct members, clients and financial service providers. This work was complemented by an assessment of existing information on banks' counterparty and funding exposures to CCPs compiled by the International Data Hub at the Bank for International Settlements.

2| Future priorities

2|1 Completing the CCP work plan

The CCP work plan is currently being finalised.

While, as regards ***CCP resilience***, final guidance on CCPs' risk management practices is expected to be issued in April 2017, CPMI-IOSCO have in the meantime also begun exploring the scope for *supervisory stress-testing* as a complement to CCPs' in-house stress testing. The rationale for supervisory stress-testing is twofold, namely to (i) support authorities' review of individual CCPs' stress tests and to (ii) make it possible to test the collective response of CCPs to shocks affecting them simultaneously. Given the latter rationale, supervisory stress-testing of CCPs has an inherently macroprudential dimension. The development of supervisory stress-testing is a project with a longer-term horizon, given the related data requirements and analytical challenges in terms of building relevant scenarios and identifying contagion channels across CCPs and (from and to) their clearing members. However, CPMI and IOSCO, also building on existing experience (as noted above), have recently taken a major step forward by launching the development of a basic conceptual framework to guide authorities in the construction and execution of multi-CCP supervisory stress tests.

Concerning ***CCP recovery***, one important area still under discussion relates to safeguards for effective *interaction between CCP recovery and resolution*.

There are at least three reasons why recovery and resolution plans have to be consistent. First, recovery planning provides the presumed starting point for resolution and may therefore limit the options available to the resolution authority. Second, recovery takes place in the shadow of resolution, implying that resolution plans shape stakeholders' incentives in recovery. Third, resolution should obey the "no creditor worse off" principle, for which recovery provides a relevant benchmark.

Since different types of authorities are involved, with supervisors and overseeers reviewing CCPs' recovery plans and resolution authorities conducting CCP resolution planning, good coordination is of the essence.

Potential risks for effective CCP resolution arising from the interplay with CCP recovery plans are not a remote theoretical possibility. CCP recovery plan provisions regarding requirements for participants to make additional contributions in cash to CCPs in the event of financial shortfalls ("cash calls") are an important case in point.

Cash calls are recognised as an essential element of resolution authorities' toolkit for allocating financial losses, notably in view of their measurability. Indeed, while clearing participants can fully prepare for cash calls if they are contractually defined and capped ex ante (e.g. in relation to clearing members' guaranty fund contributions), potential exposures arising from alternative measures, such as gains-based haircutting of variation margins (VMGH) or partial tear-up may be difficult to predict and prepare for as they depend on open positions and market movements at an uncertain point in the future. The ability of clearing members to measure and manage their potential exposures in CCP resolution is an important aspect not only from a bank supervisory perspective but also from a broader financial stability angle, as it clearly

has an impact on the credibility of resolution funding. However, based on a stocktake of public information on the rules of ten major global CCPs for allocating participant-default-related losses, the ECB found that half of those CCPs provide for only *one* cash call in their recovery plans. Therefore, if resolution authorities of those CCPs were to favour the use of cash calls over alternative loss allocation tools such as VMGH, they would be restricted in their ability to act accordingly: they could either be stripped of this tool (if they intervene after CCPs have already used the call) or, in order to make use of the cash call embedded in the CCP's rulebook, they would need to intervene immediately after the exhaustion of the prefunded waterfall, thereby entirely short-cutting recovery, which could also be unwarranted. Unless applicable statutory regimes provide the concerned resolution authorities with a dedicated resolution cash call on CCP participants, they may have to require amendments to the recovery plan to ensure adequate flexibility for their actions.

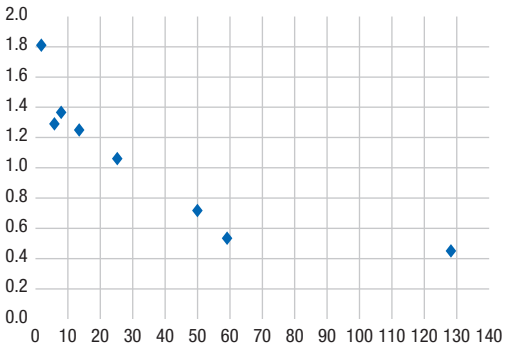
CPMI-IOSCO are also considering potential additional guidance for *non-default-related recovery events*, notably regarding loss allocation. As set out in the 2014 recovery guidance, losses arising from non-default risk are first and foremost the responsibility of CCPs and their owners, especially with regard to general business and operational risk. However, CCPs may provide for the involvement of participants in the allocation of custody and investment losses in a manner proportionate to participants' involvement in the respective risk governance.

An issue that may warrant further consideration in the medium term is the *calibration of CCPs' own defences against non-default losses*. Under the PFMI, CCPs are required to hold liquid net assets funded by equity equal to at least six months of current operating expenses to absorb general business losses. It must be underlined that this is a minimum requirement only. First, given that capital is calibrated in relation to normal operating conditions, it may not be sufficient for large-scale or recurring business losses in a highly distressed market environment. Second, potential losses will depend on the type of risk to which a CCP may be exposed. For instance, while losses arising from a small operational outage would be limited, substantial investment losses could arise in case of sharp and sudden market movements. Against this backdrop, consideration should be given to examining whether CCPs should be explicitly required to pursue an appropriately differentiated and prudent approach when calibrating their capital defences for non-default recovery scenarios.

When it comes to covering investment risk, the size of the initial margin could be an important metric to determine the size of losses that may crystallise. As set out in Chart 2 below, an internal ECB stocktake of the capital held by eight major EU CCPs, based on publicly available information, showed that capital amounts to less than 2% of initial margin holdings. This appears rather low in view of the prospectively very significant market movements during a CCP recovery situation and also considering the highly demanding requirements for taking into account large-scale market movements when calibrating CCPs' financial resources for default-related losses.

C2 Initial margins and capital at selected EU CCPs

(x-axis: total initial margins in EUR billions,
y-axis: total CCP capital/total initial margins in %)



Source: CPMI-IOSCO public disclosures ; financial statements.

With respect to ***CCP resolution***, the FSB is currently considering stakeholder feedback on its draft guidance issued in February 2017, with the objective of issuing final guidance by mid-2017. As set out in the draft guidance, one issue that will continue to be assessed with a longer-term horizon is *CCP resolution funding*. Robust requirements to ensure the availability of adequate funds to allocate financial losses in resolution and to replenish CCPs' financial resources are critical given that a key objective of CCP resolution is to avoid exposing taxpayers to losses. However, the determination of appropriate funding arrangements raises some complex issues.

On the one hand, there is a burden of proof on CCPs that the available funding credibly ensures the continuity of their critical functions, including in the event of very severe market conditions going beyond the scenarios covered under CCP stress-testing. In such circumstances, resolution funding that relies entirely on ad hoc funding could raise challenges as funds would need to be increased at the height of market stress, which could in itself further exacerbate market disturbances and may simply not work. Temporary public funding could be difficult to recover from the private sector in a comprehensive and timely manner. Especially in the case of global CCPs with members dispersed across multiple jurisdictions, there could be challenges in enforcing purely contractual obligations on a cross-border basis over a longer-term horizon, including in view of potential changes in the CCP landscape following the resolution of a CCP.

On the other hand, funding arrangements should be proportionate to the "tail-of-tail" nature of CCP resolution risks and should not weaken incentives for CCPs and their members to contribute to effective ongoing risk management and recovery. Funding arrangements should not become so costly so as to call into question the business case for CCPs, thereby thwarting the central clearing objective or adversely impacting market liquidity. Finally, it is difficult to accurately predict funding needs for extremely unlikely events that are, by definition, more severe than extreme but plausible market conditions.

Balancing these different considerations will require further analytical support. The work on CCP interdependencies, multi-CCP stress-testing as well as practical experience in actual CCP resolution planning under the forthcoming FSB guidance are expected to provide significant input in this regard. Against this background, the FSB intends to determine by the end of 2018 whether additional guidance for CCP resolution funding may be needed.

2|2 Addressing interactions between CCP and banking rules

CCPs and major financial institutions are highly interdependent. Global banks account for the bulk of centrally cleared business and provide critical services to CCPs, e.g. as investment agents, settlement banks, custodians and liquidity providers. The robustness of CCPs therefore depends on the ability of their participants and critical service providers to meet all ongoing obligations under CCPs' rules and arrangements (e.g. margin calls, contributions to default management and recovery, liquidity arrangements) in an effective and timely manner.

Robust CCPs are equally important for banks. Given the large share of banks' counterparty exposures concentrated in CCPs, any CCP failure or delay in its payment and delivery obligations to its members will imply significant risks for its members. Banks also entrust CCPs with large amounts of high-quality collateral and depend on CCPs for services ancillary to central clearing, such as securities lending and settlement facilities.

Given that the safety of banks and that of CCPs are closely interrelated, respective regulatory requirements are, in principle, mutually reinforcing. For example, progress on bank capital, liquidity and resolution significantly reduces the risk that CCPs will face the potential default of one of their largest members. Similarly, progress in reducing

the inherent procyclicality of CCPs' margin and collateral policies makes it less likely that banks may be exposed to sudden and steep increases in collateral requirements and related liquidity strains in tightened market conditions. However, given that banks and CCPs are quite dissimilar in terms of their risk profile, risk controls and balance sheets, the regulatory tools applied to them are different. For instance, while banks mitigate credit risk in their banking books with capital calibrated in relation to their risk-weighted assets, CCPs always maintain balanced positions and rely on mutualised default resources to absorb potential losses in case of member default. As already mentioned, assuming that they are properly managed under the PFMI, CCPs are fundamentally risk *poolers*, not risk *takers*. In addition, central clearing is by nature a more concentrated business than banking. These differences need to be taken fully into account when designing CCP and banking rules to avoid unwarranted cross-sectoral externalities.

A case in point is the treatment of clients' cleared derivatives transactions under the Basel III leverage ratio framework, which provides that clearing members are not able to offset the initial margin posted by their clients against their potential future exposure to that client. This treatment could weaken the business case for providing client clearing services, thereby limiting the scope for indirect access to CCPs and ultimately reducing hedging opportunities for end users. It could also give rise to disincentives for using CCPs and increased recourse to bilateral clearing, which would be associated with greater systemic risk, including for banks. In addition, the prospective further concentration of client clearing business in a smaller number of clearing members would further increase the respective financial risk concentration and could limit the ability to port client positions and collateral in case of member default, heightening potential systemic spill-over risks. The consequences of the Basel III framework for the incentives to clear OTC derivatives and other products centrally therefore need to be carefully monitored.

Similar problems could be associated with the potential inclusion of banks' exposures to CCPs under the large exposure framework. The large exposure regime, which applies quantitative limits to banks' exposures to individual counterparties, is in principle difficult to reconcile with the nature of the CCP industry. Even high hard limits may not be workable for products where only one CCP provides relevant services, and could conflict directly with mandatory central clearing obligations. Banks could also be forced to move to a greater extent into bilateral clearing, which would also be undesirable in view of the recognised greater safety of central clearing.

Such cross-sectoral frictions should be addressed in a manner that appropriately balances the prudential objectives of banking supervisors, the concerns of CCP supervisors and overseers, and the shared interest in an overall safe and efficient clearing landscape. The FSB as coordinator of the CCP work plan could play an important role in this regard, notably by supporting joint ex ante and ex post impact assessments of prudential changes by the affected standard-setting bodies. In this context, it would be important to also consider possible qualitative changes in market structures that could give rise to new systemic vulnerabilities and that may be difficult to subsequently control or reverse.

2|3 Making CCP supervision and oversight more granular

Increased central clearing and improved safeguards for CCPs contribute not only to the safety but also to the efficiency of the financial system, given the benefits of central clearing in terms of greater collateral efficiency and market transparency. However, more stringent CCP rules come at a cost to CCPs, clearing members and the financial system as a whole. It is also true that while CCPs are, in principle, systemically relevant in the markets served, each CCP is different in terms of its cross-jurisdictional risk implications and resulting impact on global financial stability.

It is therefore important to keep the regulatory requirements for CCPs strictly proportionate to the risks incurred.

To this end, CCP supervision and oversight should increasingly evolve towards a more granular calibration of requirements in line with CCPs' specific risk profiles. The PFMI already provide the basis for such a differentiated approach with their emphasis on minimum requirements and more demanding coverage requirements for more wide-ranging or complex CCPs. Recent additional guidance on CCPs' in-house stress-testing, the development of supervisory stress-testing as well as the enhanced understanding of CCP interdependencies could make it possible to move, in the medium term, towards an approach to CCP supervision and oversight that would combine standardised minimum requirements for CCPs with "Pillar II" entity-specific requirements reflecting individual risk in a proportionate way. Such requirements would derive from a supervisory review process, including regular supervisory stress-testing, similar to what is now in place for banks.

Such an enhanced framework would require far-reaching changes to the existing frameworks (such as, in the EU, an overhaul of the European Market Infrastructure Regulation), but it would have several merits. On top of allowing for more proportionate supervision and oversight, it could also help to reduce some of the open questions regarding recovery and resolution funding. While it will never be possible to fully predict events that are by definition implausible, a more granular approach to CCP supervision and oversight could help to reduce the "unknown unknowns" of central clearing and to better gauge and address residual vulnerabilities.

2|4 Ensuring effective cross-border cooperation

The introduction of mandatory central clearing obligations for eligible OTC derivatives has increased the role of CCPs with cross-border systemic risk implications, given the global nature and high degree of concentration of OTC derivatives markets.

Against this backdrop, the FSB (2012) identified effective cooperation of authorities as a critical safeguard for global clearing, including the existence of (i) cooperative oversight arrangements between relevant authorities, both domestically and internationally and on either a bilateral or multilateral basis, that result in robust and consistently applied regulation and oversight of global CCPs and (ii) resolution and recovery regimes that aim to ensure that the core functions of CCPs are maintained during times of crisis and that consider the interests of all jurisdictions where CCPs are systemically important.

These concerns were reflected in both the PFMI and the FSB *Key Attributes of Effective Resolution Regimes for Financial Institutions*. "Responsibility E" of the PFMI provides for cooperation between relevant authorities that is commensurate with a financial market infrastructure's systemic importance across jurisdictions for both normal times and crisis situations. Under the FSB Key Attributes, crisis management groups (CMGs) should be maintained for all financial market infrastructures that are systemically important in more than one jurisdiction for resolution planning and execution purposes.

Nevertheless, progress towards the actual establishment of cooperative arrangements in line with Responsibility E and of CMGs has been slow. CPMI-IOSCO found in their report on jurisdictions' implementation of the responsibilities for authorities under the PFMI (CPMI-IOSCO, 2015) that there was not yet sufficient evidence on Responsibility E-type arrangements to assess the practical outcomes of the respective cooperation across jurisdictions and called upon authorities to continue to establish or refine those arrangements. Similarly, an internal FSB stocktake of the resolution regimes in its member jurisdictions in 2015 highlighted that CMGs (or equivalent arrangements) and systematic resolution planning processes were not in place for several of the largest CCPs.

In this context, the CPMI, IOSCO and the FSB have taken action to increase the momentum for cross-border-cooperation. CPMI and IOSCO have developed criteria for identifying CCPs that are systemically relevant in more than one jurisdiction and have also launched a review of whether further guidance on the implementation of Responsibility E could be helpful. As part of its February 2017 draft guidance on CCP resolution, and based on a consultation by CPMI-IOSCO of CCPs' home and host authorities, the FSB has clarified the CCPs for which CMGs should be established and has also issued further guidance on the composition of CMGs.

An important additional priority in the future will be to ensure effective and consistent cross-border cooperation for major cross-border CCPs throughout their potential lifecycle. In particular, given the close linkages between CCP resilience, recovery and resolution, it will be essential for a core group of authorities to be able to assess the robustness of the CCP throughout its normal risk management, recovery and resolution planning processes as well as to prepare for close communication and coordination in emergency situations. Accordingly, authorities responsible for major cross-border CCPs should not only operate CMGs but also establish cooperative arrangements in line with Responsibility E (the composition of which does not have to fully coincide with that of CMGs), and for this purpose they should use multilateral information-sharing to the extent possible.

2|5 Enhancing the macroprudential safeguards for central clearing

Given the central role of CCPs in the financial system, it is critical to ensure that CCPs are not only robust on a stand-alone basis, but that their potential wider systemic risk externalities are also understood and mitigated.

Macroprudential safeguards for CCPs should, at a minimum, prevent CCPs from acting in a *procyclical* manner. This implies limiting potential contagion effects across the wider financial system in the event of a CCP emergency that may arise from the high degree of risk concentration in CCPs as well as interdependencies between CCPs and major financial institutions. Another, more ambitious, objective would be to act in a *countercyclical* manner by preventing the excessive build-up of risk in good times and smoothen the impact of CCPs' financial risk management during the economic cycle, similar to what is already pursued in the banking sector (ECB, 2016), but of course operationalised in a way that is appropriate to the specific nature of central clearing. Cœuré (2016) discusses the former objective, while Constâncio (2016) discusses the latter.

Macroprudential safeguards for central clearing were already established under the PFMI and the *Key Attributes* and have been further enhanced under the CCP work plan.

- The PFMI require CCPs to adopt stable-through-the-cycle margin and collateral haircut practices to avoid sudden and steep increases of related requirements during an economic downturn. The forthcoming CPMI-IOSCO guidance on CCP resilience will further strengthen the requirements for non-procyclical behaviour by requiring CCPs to adopt a holistic approach in addressing these issues, using quantitative metrics and considering this aspect during the model validation process.

- The PFMI emphasis on stress-testing CCPs' liquid and mutualised default resource has made CCPs' risk management much more forward-looking than in the past. The forthcoming CPMI-IOSCO further guidance on stress testing as well as expected progress towards supervisory stress-testing are designed to introduce additional caution in preparing for stressed market conditions.

- Under the PFMI, CCPs with cross-border systemic relevance or a more complex risk profile need to comply with more stringent coverage requirements for their credit and liquidity

exposures so as to ensure that their financial buffers will be commensurate with their wider systemic risk implications. Measures to spur the establishment of cooperative arrangements in line with Responsibility E as well as of CMGs will provide important checks and balances for the risk management, recovery and resolution planning of cross-border CCPs and will be essential in supporting effective cooperation between authorities. This will help to ensure that a potential CCP emergency can be addressed in a swift, orderly and comprehensive manner, thereby limiting potential wider systemic contagion effects.

One area where further progress is still needed relates to the enhanced consideration of interdependencies between CCPs and major financial institutions in identifying cross-sectoral vulnerabilities and contagion channels. It would seem useful to develop the recent stock-take of central clearing interdependencies into a regular global data collection in order to ensure effective monitoring of related exposures over time. In the medium term, subject to further progress on supervisory stress-testing, it would seem useful to conduct top-down (model-based) stress-testing of the central clearing network and potential risk implications for the wider financial system.

3| Conclusion

The recent review of CCP resilience, recovery and resolution under the CCP work plan has confirmed that the safeguards established by the PFMI and the *Key Attributes for Effective Resolution of Financial Institutions* are adequate. Additional guidance on the application of these requirements will promote further rigour and consistency in CCPs' approaches as well as enhanced cooperation between authorities. The main priority at this juncture is to finalise that guidance and to then ensure its full and timely implementation.

In this context, one important priority is to ensure a sufficient level of granularity in the approaches of both CCPs and the relevant authorities. The respective global rules are minimum requirements only. Enhanced CCP in-house stress-testing as well as progress in supervisory stress-testing should be used to assess more closely if and to what extent some CCPs, depending on their specific risk profile, may need to move beyond that. In the medium term, it is worthwhile considering an approach that would combine standardised minimum requirements with entity-specific ones based on a supervisory review process, including supervisory stress-testing. Greater granularity of CCP supervision and oversight will also help to better calibrate CCPs' defences for potential recovery or resolution scenarios.

Authorities should step up their efforts to enhance cooperation with regard to major cross-border CCPs and should ensure that the frequency and depth of cooperation is in line with the systemic risk implications of CCPs. Cooperation should also reflect the significant overlaps and interactions between potential default management, recovery and resolution scenarios and ensure that a core group of authorities from the most affected jurisdictions will be able to assess a CCP's defences throughout its potential lifecycle in a consistent and coherent manner. In addition, cooperation between authorities in charge of CCP supervision and oversight on the one hand, and resolution on the other, should ensure the consistency of recovery and resolution plans, the alignment of stakeholder incentives down the recovery waterfall and beyond, and the effective application of the "no creditor worse-off" principle.

Finally, authorities should work to further enhance the robustness not only of individual CCPs, but of the central clearing landscape as a whole. To this end, it would seem useful to move in the medium term towards a structured framework for the ongoing monitoring of central clearing interdependencies and multi-CCP stress testing. In addition, potential cross-sectoral spillover effects of CCP and banking rules should be carefully assessed when considering prudential changes.

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A systemic risk assessment of OTC derivatives reforms and skin-in-the-game for CCPs

Sheri MARKOSE
Professor
University of Essex

Simone GIANSANTE
Lecturer in Finance
Bath Management School

Ali RAIS SHAGHAGHI
Research Assistant
Cambridge Centre for Risk Studies

The G20 OTC (over-the-counter) derivatives reforms impose large collateral/liquidity demands on clearing members of Central Counterparty (CCP) clearing platforms in the form of initial margins, variation margins and contributions to the default fund. In Heath et al. (2016), it was shown how this introduces a trade-off between liquidity risk and solvency risk with the system manifesting considerable systemic risk from these two sources of risk while CCP penetration is at current levels. The authors extend this analysis to include the European Market Infrastructure Regulation (EMIR) skin-in-the-game requirements for CCPs, which aim to ameliorate the contributions to the default fund by clearing members and also to prevent moral hazard problems associated with the too-interconnected-to-fail (TITF) status of CCPs as more and more derivatives are centrally cleared. The authors provide a systemic risk assessment of these features of the OTC derivatives reforms using network analysis based on 2015-end data on the derivatives positions for 40 globally systemically important banks (G-SIBs).

1| G20 over-the-counter derivatives (OTC-D) markets reform in perspective

One of the key manifestations of the 2007 Great Financial Crisis (GFC) arose from the activities of large financial institutions (FIs) in derivatives markets, with credit default swaps being strongly implicated in the crisis. There was a threat of financial contagion when the American Insurance Group (AIG) suffered escalating margin calls on derivatives positions, and as the value of underlying assets plummeted, it simultaneously faced failure from solvency and liquidity problems. This led to an unprecedented bailout package for AIG by the US Treasury of over USD 85 billion, which included USD 35 billion in collateral payments to its counterparties and USD 30 billion for the remaining market value of credit default swaps protection sold to global banks by AIG FP division.[1] The SIGTARP audit of November 2009 of AIG-FP, observed that the secrecy surrounding counterparties in AIG's OTC positions and the lack of ex ante close-out valuation and loss allocation rules that authorities could apply, made it difficult for the US authorities to negotiate haircuts on the counterparties of AIG.

In this context, much has been made of the orderly and speedy settlement of the central counterparty (CCP) cleared segments of Lehman Brothers' derivatives positions.[2] Indeed, some salutary insights can be gained from the Fleming and Sarkar (2014) study on the Lehman Brothers failure resolution process, which in the case of its derivatives positions included both OTC and CCP components. Firstly, it should be noted that CCP settled derivatives positions for Lehman Brothers were a minuscule part of the USD 35 trillion in notional value of its OTC derivatives which accounted for 96% of the net worth of its derivatives. The latter suffered an arduous and lengthy settlement process, taking over five years. Fleming and Sarkar *(Ibid)* conclude that "customers of centrally cleared securities were generally made whole …. In contrast, many counterparties of Lehman Brothers' OTC derivatives suffered substantial losses." The losses that Lehman Brothers itself suffered on derivatives, as mainly big bank counterparties shielded themselves by not making payments on their out-of-the-money positions and also by sequestering collateral posted by Lehman Brothers, were spread widely to other creditors. Creditors on average received a historically low recovery rate of 28% on the USD 1 trillion claims on Lehman Brothers.

Thus, in no small measure, the administrative efficiency behind CCP clearing of Lehman Brothers' derivatives relates to the small size of such claims and the scope for the bulk of the risk from losses to spill over elsewhere. This signals the need to assess systemic risk consequences of derivatives markets *in toto*, namely the inclusion of both OTC and CCP segments which co-mingle CCPs with many globally systemically important banks (G-SIBs) and other financial institutions (G-SIFIs).

The GFC gave clear evidence that the large value of derivatives positions and the potential for extreme losses in their underlying asset values exceeded the liquid and capital resources of G-SIFIs. This has brought to the forefront the regulatory challenge of determining and managing adequate liquid and capital buffers for major participants of these markets not only to mitigate their own failure, but to mitigate their contribution to system failure. In addition to vulnerability to exposures to falling assets values, the threat of counterparty risk from potential cascade failures of counterparties (see Haldane, 2009, Yellen, 2013) is increasingly seen as the hallmark of interconnected financial systems. There is a further dimension, which is compounded under conditions of stress, of having to grapple with the opacity of the bilaterally negotiated OTC positions (see Acharya and Bisin, 2013) that generate under the radar interconnectedness between the participants which involve derivatives positions and other components of their balance sheets. With CCPs novating positions with clearing members, by becoming a buyer to the seller and vice versa to the buyer, they start with a balanced book

1 See, the US Special Inspector General for Troubled Asset Relief Program (SIGTARP) audit of November 2009 of the AIG Financial Product division – *http://pogoarchives.org/m/er/sigtarp-audit-20091117.pdf*

2 Specifically, LCH.Clearnet resolved USD 9 trillion in notional value of Lehman's OTC derivatives positions, within three weeks, well within the margin held and without loss to other market participants. See "Managing the Lehman Brothers' Default", LCH.Clearnet, *http://www.lchclearnet.com/swaps/swapclear_for_ clearing_members/managing_the_lehman_brothers_default.asp* Likewise, DTCC and CME had similar successes. See "DTCC successfully closes out Lehman Brothers bankruptcy," *http:// www.bloomberg.com/apps/news?pid=newsarchive&sid=aojt5wVkz_EM*

(Tucker, 2011; Heath et al., 2015) and can reduce interconnections in the system. In OTC markets, balanced positions come at the price of complex bilateral offsetting trades which add to the density of links between the G-SIB dealers.

Hence, with the view to gaining the administrative efficiency of CCP settlement and to reduce the complexity of financial links and their lack of transparency, the main thrust of the G20 financial reforms mooted at the Pittsburgh Summit in 2009 has been to make it mandatory for all standardised OTC derivatives (OTC-D) contracts to be cleared through CCPs along with an extensive collateralisation programme for both CCP and bilaterally cleared OTC derivatives.

As the reliance on CCP clearing increases with the G20 reforms, Cœuré (2014, 2015) has famously called CCPs "super systemic" players. CCPs have begun to dominate an already crowded centrally clustered network structure of the global derivatives markets with 16 or so G-SIBs which currently account for over 85% of derivatives positions[3] in the OTC domain and as clearing members of CCPs. The question here is can CCPs cope with an increased burden of clearing derivatives as this migrates from the OTC domain? Have CCPs become *too interconnected to fail* (TITF)? TITF is a euphemism relating to the moral hazard problem that the economic repercussions from failure of CCPs could be so wide ranging that they could become prime candidates to receive tax payer bailouts (see Wendt, 2015; Blackrock, 2014; Markose et al., 2012).

The purpose of this note is to examine frameworks for assessing the systemic risk from CCPs in derivatives markets. Specifically in view of the TITF status of CCPs, in Section 2, we will discuss the problem of determining the adequacy of CCP capital in the context of what is now called skin-in-the-game (SIG) funds that are put at risk in the first tranche of losses to mitigate incentives for the CCP to free ride on the resources of clearing members or on those of the tax payer.

One of the highlights we provide is an assessment of the extant hybrid system of OTC-D and CCPs using the network approach in Heath, Kelly et al. (2016) which is based on the BIS MAGD[4] report (2013) data on the 2012 derivatives positions for the 40 G-SIBs and using a reasonable OTC-D and CCP clearing spilt with five CCPs clearing each of the main derivatives products.[5] Retaining the VaR method in Heath, Kelly et al. (2016), widely used for the calculation of initial margin and default fund contributions, the systemic risk analysis is updated to cover the 2015 end derivatives product level data for the 40 MAGD G-SIBs. Comparisons that can be made at these two points of time provide interesting ballpark figures for the extent to which progress has been made in the direction of mitigating systemic risk in global derivatives markets. Further, the empirically calibrated hybrid network model for CCP and OTC-D positions of 40 G-SIBs gives a good basis to include the skin-in-the-game capital funding of CCPs in addition to clearing member initial margin and default fund contributions to assess improvements in the stability properties of the network system. Following Alter et al. (2015), Markose (2012) and Heath, Kelly et al. (2016), we recommend the application of network centrality measures for CCPs to estimate the skin-in-the-game surcharges that have the best potential to mitigate contagion losses from clearing member defaults that can be transmitted by CCPs. Sections 4 and 5 give some empirical evidence for the size of the SIG funds and their effectiveness in dealing with TITF for CCPs clearing each of the five main derivatives products using the Heath, Kelly et al. (2016) CCP-OTC clearing split involving the 40 MAGD G-SIBs (see footnote 5).

Finally, we conclude by reiterating the call to arms (see Haldane, 2009; Markose, 2013) for a granular data driven approach of digital maps for the contractual obligations of G-SIFIs, especially in global derivatives markets, at regular intervals of time.[6] Only this can vitiate the unacceptable levels of model risk that prove a stumbling block to managing systemic risk in financial markets. This case was also

3 For the 2012 data, Markose (2012) showed that this accounted for 97% of global derivatives in terms of gross notional. Brunnermeier et al. (2013) study the CDS market on EU reference entities and note that the network of bilateral CDS exposures among counterparties resembles a "core-periphery" structure with the CDS market centred around 13 or 14 G-SIFIs. Likewise, Duffie et al. (2015) who have bilateral CDS exposure data for all participants in the single name global CDS market, confirm a similar structure of high concentration of links around 13 G-SIBs who dominate the CDS market.

4 This stands for the Bank for International Settlements Macroeconomic Assessment Group on Derivatives (MAGD) Report.

5 In Heath, Kelly et al. (2016), the hybrid OTC-CCP split in derivatives clearing network model is called Scenario 1: CCP1 clears 75% of all interest rate derivatives; CCP2 clears 15% Forex derivatives; CCP3 clears 15 % equity derivatives; CCP4 clears 50% credit derivatives and CCP5 clears 20% commodity derivatives.

6 Our view is that systemic risk does not happen overnight but builds up and hence digital maps of extant who-to-whom obligations at reasonably regular intervals can alert authorities. The current practice of calibration and simulation exercises undertaken to provide reasonable replicas of the real world interconnections, due to a lack of data, can be avoided.

made by Brunnermeier et al. (2013) on why models based on limited segments of G-SIFI activities can be misleading and "hence from an ESRB perspective, a holistic view of the exposures map is required."

2| Skin-in-the-game: CCPs as "super systemic" or "super vulnerable" in a hybrid system of clearing

The regulatory reform process has set out extensive institutional mechanisms that ensure that CCPs have: (i) sufficient resources in the form of stable and conservative initial margins that avoid procyclicality by being precalibrated to meet stressed market conditions, (ii) higher capital charges and margin requirements for non-standardisable OTC instruments, drawn up by BCBS and IOSCO (2013), and (iii) other risk management systems to deal with failure of clearing members (see CPSS-IOSCO, 2012, EMIR, 2012).

With regard to (iii) the current practice is for the CCP to rely on the default fund contributions from clearing members where the fund is calibrated to withstand failure of the two clearing members with the largest liabilities under extreme but plausible conditions. This goes by the name of *Cover 2* (CPSS-IOSCO, 2012). There are rules pertaining to how CCPs can mutualise losses of defaulting members to surviving members after exhausting the former's initial margin and contribution to the default fund. This schedule of loss settlement is called the default waterfall structure. Rule books of CCPs include close out valuation process and novation procedures for outstanding positions of defaulting members to surviving members. CCPs also have so called assessment powers over surviving members to specify the replenishment of the funds used in the mutualised loses of the defaulting members.

As CCPs are not public utilities (Lubben, 2014) but private firms competing for custom, there could be a race to the bottom in terms of less costly margining requirements and default fund contributions for clearing members,[7] and also undercapitalisation. In order to mitigate free riding by CCPs and moral hazard due to their TITF status, authorities such as those implementing the EMIR have included skin-in-the-game (SIG) requirements for CCPs. CCP SIG is given precedence in the waterfall structure ahead of the loss mutualisation based on the prefunded default fund contributions of surviving CCP members. The implementation of formal capital requirements for CCPs will bring them in line with banks which are subject to regulatory capital requirements.[8]

It is customary in such regulations that some formulaic and absolute minimum standards are stipulated. European Union CCPs are required to hold a minimum capital buffer of EUR 7.5 million or, a larger sum sufficient to provide adequate cover against a number of risks which include credit, counterparty, business and operational risks. The latter can involve the cost of orderly winding down. The SIG is viewed as a surcharge on top of the minimum CCP capital requirement. The EMIR SIG rule (Reg. 153/2013 Article 35, §2) specifies a 25% surcharge on top of the minimum CCP capital requirement.

The discussions, to date, on whether the EMIR SIG rule of a 25% top up on minimum CCP capital is adequate for the job at hand have mostly taken a qualitative perspective or used rule of thumb. The size of the SIG, it has been argued, should be large enough as the first loss tranche in order to prevent the CCP from free riding on the prefunded margin and default fund contributions of its clearing members. In the case of non-existent or low CCP SIG along with low initial margin and default fund contributions from clearing members to attract custom, both the CCP and its clearing members have or potentially can have highly leveraged uncollateralised positions that signal moral hazard problems that may require taxpayer bailout. Also, the CCP SIG should not be so large that the threat of mutualised losses becomes remote and can lose its power to discipline clearing members to control the size of their open interest.[9]

7 Zhu (2011) in his survey of a sample of CCPs does not find evidence of an obvious dropping of standards in regard to this. However, initial margin calculations differ on details such as length of the close out period for which initial margin is calculated. Hence, UK CCPs prescribe seven days as opposed to the five day norm and the former needs more initial margin than the latter.

8 See, BCBS 227 (DFCCP).

9 Cœuré (2015) notes that "the purpose of CCPs is to mutualise counterparty risk, not to remove it from clearing members altogether and bear it themselves. CCPs are risk poolers, not insurance providers". The International Swaps and Derivatives Association (ISDA), has weighed in on the suitable size of CCP SIG fund. In response to the European Banking Authority (EBA) consultation paper, ISDA stated "that having a 50% skin-in-the-game requirement may not strike the right balance between protecting non-defaulting members and ensuring that they have incentives to bid competitively in an auction of a defaulting clearing member's portfolio at a time when resources need to be replenished."

As in principle, the CCP operates a balanced book and can become a source of financial contagion only if the residual losses (in excess of the prefunded initial margin) of its defaulting clearing members are passed on in substantial amounts to non-defaulting clearing members, we will argue that the role of SIG should be viewed as a Pigou surcharge for the TITF status of CCPs, namely the negative externality that they pose to others from their systemic vulnerability to the exposures of their clearing members that can arise from inadequate CCP capital.

3I Frameworks for assessing the systemic risk from CCPs in derivatives markets

Clearly, there has to be empirical analysis to provide evidence for the efficacy or not for the CCP SIG in conjunction with the other CCP resources such as the prefunded initial margin and default fund. There have been a number of studies that have attempted to provide calibration and simulation stress test exercises to quantify and assess the risk management capabilities of CCPs mostly in the context of the prefunded initial margin and the default fund rather than for CCP capital and SIG buffers. Typically, formulaic calculations are made for initial margin and default fund contributions and it is conceivable that CCP SIG can be made in a similar vein and then the stress tests are conducted to see, under different scenarios, how CCPs fare under extreme but plausible conditions. The latter include simultaneous defaults of several large clearing members (CMs). The main difference in the methodology of these studies lies in whether these stress tests are conducted with a model limited to a single CCP and its clearing members or one that can include G-SIB positions in both bilateral OTC clearing and with multiple CCPs.

Table 1 summarises the key steps in such exercises.

In Step 1, after having calibrated open interest positions of clearing members at the CCP in question or within a hybrid OTC-CCP split clearing model,[10] the first order of business is to determine the initial margin requirements. **Step 2** involves *Cover 2* default fund estimates. For both these steps, the best practice (see Lin and Surti, 2015) is the conventional VaR type metrics that are calibrated to satisfy stress period

10 Exceptionally, Duffie et al. (2015) have bilateral exposure data for some 30% of the global market of single name CDS. This data obtained from the DTCC gives a snapshot of this fragment of the financial network for 30 December 2011.

T1 Steps in systemic risk assessment in stress test models for CCP and OTC-D clearing

Note: At each ***step***, the light blue box highlights the wider liquidity stress, while the darker blue boxes indicate solvency risks.

Step 1 Based on bilateral open interest positions of derivatives market participants, determine initial margin collateral of OTC-D banks and as clearing members based on VaR type metrics precalibrated typically at 99% confidence level (C_{ij} is the collateral for initial margin from i to j, see Box 1).		
Reduces solvency risk: initial margin reduces uncollateralised derivatives exposures for both OTC G-SIBs and CCPs.	Heath, Kelly et al. (2016): initial margins add to liquidity encumbrance ratio of G-SIBs in both OTC and CCP positions vis-à-vis their available high quality liquid assets.	Current levels of CCP clearing at 35%-45% on average across all derivatives products with CCP fragmentation implies high levels of collateral demands, Duffie and Zhu (2011). Heath, Kelly et al. (2016) show this can trigger liquidity contagion.
Step 2 Determine Cover 2 Default Fund (DF) contributions of clearing members (CMs) for CCP.		
Reduces Solvency Risk: DF provides CCPs buffers against exposures to clearing members.	Heath, Kelly et al. (2016) adds CM default fund contributions to Liquidity Encumbrance Ratio of CMs; New EMIR 2014 rule permits CM to reduce capital of clearing members.	
Step 3 Stress test with extreme mark-to-market variation margin conditions (this is done pairwise between participants i and j as in V_{ij}, see Box 1: $V_{ij} - C_{ij}$ = Uncollaterised residual liabilties from i to j is a source of counterparty risk. Interject CCP skin-in-game ahead of waterfall feature for mutualisation of defaulted losses on non-defaulting clearing member default funds.		
CCP skin-in-game can be a panacea for *Too Interconnected To Fail* moral hazard problem; SIG can forestall variation margin haircuts; latter are realised losses on derivatives assets and threaten insolvency.	Cover 2 default fund exhausted fully in Heath, Kelly et al. (2016) with 3.89 volatility stress at ***Step 3***.	**Step 3** stress of 2.67 and 3.89 volatility can cause added liquidity stress as G-SIBs which are clearing members of multiple CCPs have high liquidity encumbrance (Singh, 2010a and 2010b). Replenishment of default funds and VMHC can bring about solvency stress.

conditions rather than use point in time estimates which suffer from the "paradox of volatility" (Borio and Drehmann, 2011; Markose, 2013; Markose et al., 2017). The latter, in addition to being procyclical, will severely underestimate the risk buffers needed in the run up to a financial crisis. **Step 3** in Table 1 involves stress tests wherein more extreme market conditions, than for which prefunded buffers have been calibrated, to drive variation margins and hence the size of residual uncollateralised positions. The systemic risk consequences for CCPs and the liquidity and capital shortfalls are typically assessed by the classic Furfine (2003) style failure of clearing members. Different scenarios involving CCP infrastructure rules and OTC-D and CCP clearing splits have been investigated.

Lin and Surti (2015) and Armakola and Laurent (2015) conduct detailed analyses of US and/or European CCPs and their specific clearing members.[11] Armakola and Laurent (2015) analyse CCP resilience by conducting stress tests based on the capacity of clearing members, as determined by their ratings and default probabilities, to make good on their derivatives obligations. They conclude that in a *Cover 2* situation with a failure of two major clearing members, many CCPs in their sample may face serious liquidity problems.

In Table 1, the pale blue boxes and darker blue boxes, respectively, highlight the wider implications for liquidity and solvency systemic risks as a function of the size of the margin and default fund requirements on G-SIBs for derivatives clearing. The main findings here show that the key factor in the demand for collateral is the extent to which counterparty exposures can be compressed by netting. Duffie and Zhu (2011)[12] show that multilateral netting benefits from CCPs with few clearing members is limited. Hence, there has to be substantial migration from bilateral OTC to CCP and that too to a single CCP for all product clearing to achieve close to 40% counterparty exposure reduction when compared to the case of 100% bilateral clearing which benefits from multi-product netting efficiency germane to OTC markets. Along the lines of Duffie and Zhu (2011), for instance Heller and Vause (2011) show that margin requirements can be reduced by up to 15% if both credit default swaps and interest rate swaps are netted by one centralised CCP.

Current levels of CCP clearing of derivatives, with growing fragmentation of CCPs, are estimated to average between 35%-45%.[13] Interestingly, our so called Heath, Kelly et al. (2016) Scenario 1 OTC-D and CCP clearing with the latter being along single product lines resembles Duffie and Zhu (2011) Table 3 Column 8 case which signals 20% reduction in counterparty exposures (see footnote 12). However, with collateralisation of both OTC and CCP exposures, Heath, Kelly et al. (2016) make a careful audit of the high quality liquid assets of the 40 MAGD G-SIBs and find that some of them can suffer liquidity encumbrance of over 87% as a result of their collateral commitments given in **Steps 1** and **2** of Table 1. As pre-funding of collateral grows, clearly residual uncollateralised counterparty risk from extreme variation margin volatility can be mitigated, but only at the cost of triggering a liquidity contagion as G-SIBs become more and more encumbered as members of multiple CCPs (see Singh, 2010a, b). At 3.89 volatility [14] stress tests at **Step 3** of Table 1, Heath, Kelly et al. (2016) instigate a variation margin hair cut (VMHC) to the winning side non-defaulting clearing members of some CCPs as they become unbalanced from defaults of clearing members. They also assume that CCPs can in principle exhaust all the non-defaulting clearing member share of the default fund if the losses of defaulting members exceed their initial margin and default fund contributions. Clearly, this can be considered to be highly permissive of free riding on the part of CCPs and can result in both solvency and liquidity contagion effects.

To date, perhaps with the exception of Lin and Surti (2015), no paper has analysed the role of CCP capital and SIG funds within a model in which initial margin and the default funds have been

11 Lin and Surti (2015) study Swapclear for interest rates swaps and ICE for credit default swaps, while Armakola and Laurent (2015) cover eight European CCPs and five US CCPs. Their analysis can be compared to how CME conducts its stress tests: *https://www.cmegroup.com/clearing/risk-management/files/principles-for-ccp-stress-testing.pdf*

12 See Duffie and Zhu (2011) Table 3 column 9. Cont and Kokholm (2014) show that exposure reductions from CCP netting are greater than what Duffie and Zhu (2011) have estimated for high volatility underlying assets.

13 The 45% figure is given in EC Safer Financial Infrastructure #saferCCPs.

14 Based on daily data, this is only about a one in 8 year event.

quantified. Even more remarkably, despite the call to arms to model the interconnectedness of the extant financial exposures in complex derivatives markets (see Brunnermeier et al., 2013) virtually no network analytics has been brought to bear on the study of systemic risk or of adequacy of buffers in such systems. Cont (2015) succinctly notes how essential it is to model the links for G-SIBs who are common to multiple CCPs and also the OTC connections between G-SIBS to make realistic systemic risk assessments of these markets and infrastructure rules.

In the context of interconnected systems, we will follow Alter et al. (2015) and Markose (2012) who find that network centrality, i.e. eigenvector centrality, based capital allocation and bailout surcharges are best placed to "stabilise" the system. Alter et al. (2014) show that other capital allocation rules are less effective at preventing Furfine (2003) type contagion failures when the system is stress tested. Markose (2012) and Markose et al. (2017) give a more extensive rationale for the use of a recursively derived fixed point solution for the network centrality of financial participants in propagating contagion failures in the system. The principle of a Pigou or externalities tax that is proportionate to the network eigenvector centrality of the financial institution to mitigate its *TITF* was first mooted in Markose (2012).

4l Heath, Kelly et al. (2016) hybrid OTC and CCP global derivatives network

Table 2 gives the changes that have occurred in the balance sheet data for the 40 G-SIBs from 2012 to 2015-end with respect to their total derivatives positions, both OTC and CCP cleared. Firstly, note the compression in gross notional from about USD 755 trillion in 2012 to USD 628.24 trillion in 2015, which is about a 17 % fall. More impressive is the fair value of derivatives payables that fell by just over a third from USD 14.34 trillion to USD 9.75 trillion. Derivatives receivables at fair value have fallen even more by 37% from USD 14.48 trillion to USD 9.05 trillion.

T2 Balance Sheet Data *(for 40 G-SIBs)*

(USD trillions)

	2015	2012	2015	2012
	All banks		Top 16 core banks	
Derivatives liabilities negative fair value	9.753	14.34	6.822	12.16
Derivatives assets positive fair value	9.035	14.48	7.541	12.35
Gross notional outstanding	628.249	755.08	534.731	633.49
Tier 1 capital	2.630	2.39	1.573	1.34

Source: 2012 financial reports data reported in Table 1 of Heath, Kelly et al. (2016); 2015-end data obtained from financial reports for each of 40 G-SIBs (from BIS MAGD).

The share of the top 16 G-SIBs recognised as global derivatives dealers was 83% in 2012 and this has increased to 85% in 2015. The share of the 16 top G-SIBs for fair value derivatives receivables has remained at around the 84%-85% mark while these G-SIBs seem to have reduced their liabilities considerably from 85% in 2012 to about 70% in 2015. Tier 1 capital of the 40 G-SIBs has increased from USD 2.39 trillion in 2012 to USD 2.63 trillion in 2015 which is about a 10% increase.

The 2015 initial margin and default fund contributions are pre-determined as in **Steps 1** and **2** given in Table 1. This is reported below for 2012 and 2015 in Table 3. The estimated total

T3 2012 and 2015 initial margin and default fund *(for 40 G-SIBs)*

(USD billions)

	Prefunded total initial margin				Default fund
	Total	Bank-bank	Bank-CCP	CCP-Bank	Total Bank-CCP
Scenario 1 2012 MAGD G-SIBs derivatives data (Heath, Kelly et al., 2016)	920.25	892.88	37.37	0	6.95
Scenario 1 2015 MAGD G-SIBs derivatives data	490.51	444.20	46.32	0	10.69

Notes: Estimates based on Heath, Kelly et al. (2016), Scenario 1, CCP-D and OTC clearing split for 40 G-SIBs (from BIS MAGD). 2012 data is reported in Table 5 (initial margin) and Table 6 (default fund) of Heath, Kelly et al. (2016).

initial margin has fallen from USD 920.25 billion in 2012 to USD 490.51 billion for all five CCPs. What is interesting is that while the initial margin for bank-bank OTC positions halves from USD 892.88 billion in 2012 to USD 444.2 billion in 2015, the initial margin from bank-CCP rises from USD 37.37 billion to USD 46.32 billon. The total default fund from banks to CCPs in 2012 is smaller than the USD 10.69 billion in 2015. This follows the trend in initial margins as well. The break downs for the default fund for each of the five CCPs will be reported in the next section.

Following **Step 3** of Table 1, the so-called stability matrix based on the residual uncollateralised variation margins (see Box 1) is derived for stresses modelled at 2.6 volatility in the underlying. The stability matrix and the systemic risk analytics for the global derivatives network are given Box 1.

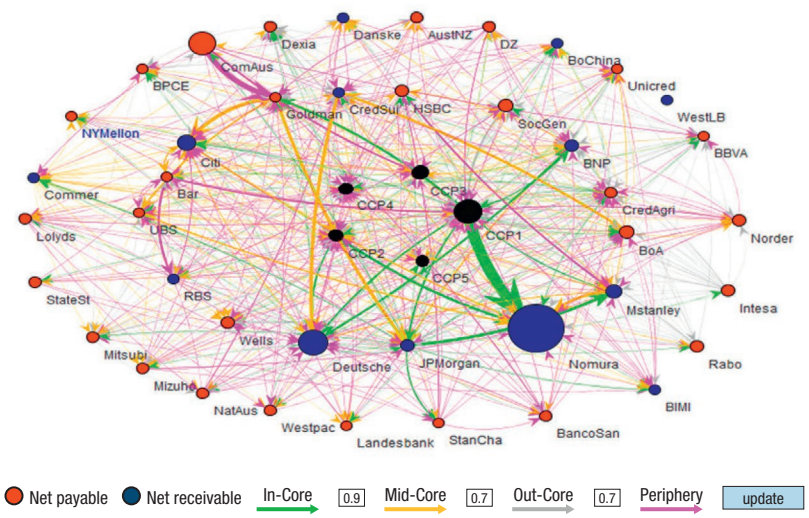
Chart 1 characterises the hybrid elements of the extant global derivatives markets with 16 G-SIBs dominating in both CCP derivatives clearing and also in the OTC markets, while the remaining 24 occupy the outermost tier of the network. The important feature of Scenario 1, as noted by Cont (2015) as being significant for realistic systemic risk assessments of CCPs, is the presence of common clearing members. Failure of a clearing member in one CCP will have implications for all others.[15]

The network analytics of systemic importance and vulnerability are based, respectively, on the right eigenvector centrality and left eigenvector centrality of the hybrid derivatives network described in **Box 1**. These resemble Google page rank statistics and are recursively obtained to establish a relationship between network participants in that a player is systemically important (vulnerable) not only because it has large liabilities (exposures) to counterparties but also because it is connected to other central players.

When comparing the 2012 MAGD-based derivatives network (see Heath; Kelly et al., 2016, Chart 5), with Chart 2 for 2015, there are considerable changes in the centrality positions. In 2015, European G-SIBs have

15 Cont (2015) states: "If one of these dealer banks defaults on its margin calls in one of the CCPs, it will simultaneously default on its positions in all CCPs of which it is a member, leading to possible draws on the default fund of one or more CCPs."

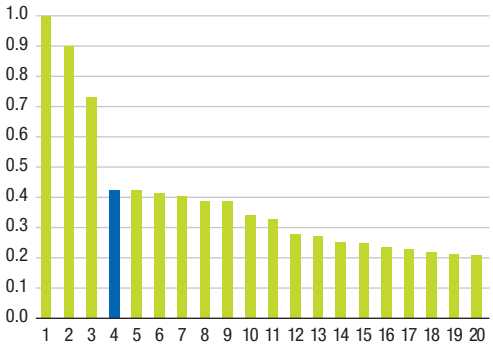
C1 2015 40 MAGD G-SIBS and hybrid derivatives clearing by CCPs and OTC (Scenario 1)



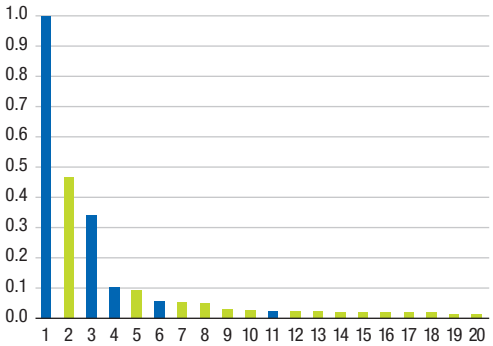
Note: CCP1 (clears 75% interest rate); CCP2 (clears 15% Forex); CCP3 (clears 15 % equity); CCP4 (clears 50% credit); CCP5 (clears 20% commodity)
The arrow starts from the FI making the net derivatives payables with the arrow head ending with the counterparty who is exposed to the former.

C2 Centrality measures for systemic importance and vulnerability of hybrid derivatives network for 40 MAGD global banks and CCPs (2015) (Top 20)

a) Right eigenvector centrality: measure of systemic importance



b) Left eigenvector centrality: measure of systemic vulnerability



Note: These have been normed by the largest centrality values.

taken the place that US G-SIBs held in the 2012 data for being most systemically important, see Chart 2a.

The systemic importance of CCP1 which clears interest rate derivatives is ranked 4th after 3 G-SIBs. A single net bilateral payable flow prominent in Chart 1 from CCP1 to Nomura is material here and this also shows up in the high ranking of Nomura in the vulnerability index. The greatest vulnerability in terms of the left eigenvector centrality is seen in CCP4 (credit) and CCP5 (commodity) in Chart 2b. The case of CCP5 reflects recent conditions regarding the high volatility in commodities markets.

5| Skin-in-the-game (SIG) fund calibration using spectral stability methods

A network system can be viewed as a dynamical system in which some network configurations or topologies determined by the distribution of links and weights of links between nodes give the potential for the network to be prone to cascade failures from arbitrary sized shocks. When systems fall into some regions of network configurations, they can become unstable and tip over. Box 1 shows how classical spectral methods given by the maximum eigenvalue (λ_{max}) of an appropriately constructed matrix representing snap shots for the network configuration of extant financial obligations of major financial institutions to counterparties relative to their buffers, can give the tipping point. Given the size of derivatives payables and the bilateral exposures faced by counterparties, regulators are concerned about the adequacy of the buffers that can be used. The point up to which these buffers can be eroded by losses is the so called regulatory loss threshold (denoted by ρ) when financial institutions are deemed to be in a state of distress. The question is how can network systems be constrained to stay in the stable region determined by the maximum eigenvalue of the stability matrix in Box 1 and loose no more capital than the given (%) regulatory loss threshold?

In Heath, Kelly et al. (2016) it is assumed that a G-SIB should be limited to using only 10% of its Tier 1 capital as a buffer against exposures

Box 1

Network based spectral systemic risk analytics for 40 G-SIB and CCP based global derivatives markets

In the hybrid case, derivatives are cleared both bilaterally by banks in an OTC setting and also centrally with separate CCPs, one for each of the derivatives products. We assume that there are $B+c$ financial institutions, where B is the number of banks (40 in the MAGD G-SIB data) and $c = 1, 2, ..,5$ are the number of CCPs, in Scenarios 1 of Heath, Kelly et al. (2016). The "stability matrix" Θ in (1) is instrumental for giving the Spectral Systemic Risk analytics derived below and it is based on the representation of the extant contractual obligations of the major participants and also of their relevant resources is a $(B+c)\times(B+c)$ matrix[1] as follows:

$$\Theta=\begin{bmatrix} 0 & \frac{V_{12}-C_{12}}{K_2} & \cdots & 0 & 0 & \cdots & \frac{V_{1CCP_5}-C_{1CCP_5}}{K_{CCP_5}} \\ 0 & 0 & \cdots & \frac{V_{2B}-C_{2B}}{K_B} & \frac{V_{2CCP_1}-C_{2CCP_1}}{K_{CCP_1}} & \cdots & \frac{V_{2CCP_5}-C_{2CCP_5}}{K_{CCP_5}} \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \frac{V_{B1}-C_{B1}}{K_1} & \frac{V_{B2}-C_{B2}}{K_2} & \cdots & 0 & \frac{V_{BCCP_1}-C_{BCCP_1}}{K_{CCP_1}} & \cdots & 0 \\ \frac{V_{CCP_1,1}}{K_1} & \frac{V_{CCP_1,2}}{K_2} & \cdots & 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ 0 & \frac{V_{CCP_5,2}}{K_2} & \cdots & \frac{V_{CCP_5,B}}{K_B} & 0 & \cdots & 0 \end{bmatrix} \quad (1)$$

Here $V_{ij} > 0$ is the variation margin (as determined in ***Step 3*** of Table 1) to be paid from i to j as i is out-of-the-money and $C_{ij} > 0$ is the collateral posted by i to j as the initial margin (in the prefunding ***Step 1*** in Table 1). Thus, pair wise between banks, only the positive residual obligations such as $(V_{12} - C_{1B}) > 0$ are included in the matrix Θ. The same is the case for bank to CCP elements with $V_{1CCP_5} - C_{1CCP_5} > 0$. In the case of CCPs, if for example, CCP_1 is out of the money vis-à-vis clearing member 1, as no initial margin is assumed to be paid by CCPs to clearing members, we have $V_{CCP_11} > 0$, as shown in the matrix Θ. Each bilateral uncollateralised exposure of a participant is expressed as a ratio of the resources of the participant. The latter is Tier 1 capital for each of the banks, denoted by K_i.[2] The CCP resources will typically be denoted as K_{CCP_1}. In Section 5 , we will consider two cases for K_{CCP_1}: ***pre skin-in-the-game*** and ***post skin-in-the-game***.

The significance of the formulation of the matrix Θ in (1) for driving the rates of failure denoted as u_i^L for each of the participants i in the network is that it can be defined as a dynamical system. Using matrix notation:

$$\boldsymbol{U}_{q+1} = [(1-\rho)I + \Theta']\boldsymbol{U}_q = \boldsymbol{Q}\boldsymbol{U}_q \quad (2)$$

1 Note, the lower right hand bloc has no connectivity as the CCPs do not have direct links to one another.

2 In Heath, Kelly et al. (2016), bank i's resources, Ki, i's Tier 1 capital is adjusted for bank i's contributions to any CCP default funds. Thus, this framework allows for the new EMIR (2014) rule for this.

In (2) rates of failure for each participant in vector $\boldsymbol{U}_{q+1}$ is given by the matrix of counterparty exposures relative to buffers and the $(1-\rho)$ is the extent to which *i*'s buffers are constrained from being used.

The system stability of (2) that can evaluated by the power iteration algorithm in (3), implies that the maximum eigenvalue of Θ denoted by $\lambda_{max}(\Theta)$ is less than ρ. If not the system will become unstable and participants can fail from an arbitrary size shock and with no outside interventions.

$$\boldsymbol{U}_q = \boldsymbol{Q}^q \boldsymbol{U}_0 \rightarrow \lambda_{max}(\Theta) < \rho. \quad (3)$$

Thus, (3) defines the tipping point and λ_{max} is the systemic risk index for system failure. In (2) and (3), ρ corresponds to the same cure rate or the regulatory loss threshold (%) of *i*'s buffers that can be used to offset losses from exposures to counterparties given in matrix Θ'. Using the eigenvalue equation $\lambda_{max} v^R = \Theta\, v^R$, we have the recursive solution for the right eigenvector centrality of each node in the system, while $\lambda_{max} v^L = \Theta'\, v^L$ gives the left eigenvector centrality. Following, Newman (2010, p. 651), $\lambda_{max}(\Theta)$ gives the % loss of resources in system as a whole from cascade failure and the product of the *i*th right eigenvector and λ_{max} gives the % loss of resources that *i* can potentially cause in the near term and so is a measure of systemic importance. Likewise, the product of the *i*th left eigenvector centrality and λ_{max} gives the % loss of *i*'s own resources and hence is the systemic vulnerability index. Thus, unlike averages based on simulated stress test losses, these indices are internally consistent. The same goes for the skin-in-the-game recursive solutions which targets the λ_{max} of the transformed networks to achieve no more than λ_{max}=10% of system wide losses by augmenting CCP resources, $K_{CCP_{c=1\ to\ 5}}$ in matrix Θ, by SIG funds proportionate to the respective eigenvector centralities of the CCPs. This is reported in Table 4 columns 2 and 4.

T4 Systemic Risk Index and CCP skin-in-the-game (SIG) fund to stabilise the system at 10% default fund loss threshold with 2.6 volatility stress for variation margin (2012 and 2015)

	2012		2015	
Systemic Risk Index: λ_{max} (See Box 1)	0.163*		0.148	
	Default Fund USD bns Precalibrated *Cover 2* **	SIG (USD bns)	Default Fund USD bns Precalibrated *Cover 2*	SIG (USD bns)
	1	2	3	4
CCP1 (Rates)	3.86	14.28	6.87	10.03
CCP2 (Forex)	0.45	1.19	1.75	2.15
CCP3 (Equity)	1.63	14.45	1.58	1.66
CCP4 (Credit)	0.84	2.11	0.29	1.74
CCP5 (Commodities)	0.17	0.43	0.21	0.57
Total	6.95	32.46	10.7	16.15

*For 2012 Scenario 1 case, see Heath, Kelly et al. (2016) Table 9 for the systemic risk index and Table 6 for default fund**.

to counterparties derivatives positions as the latter constitutes a subset, rather than the whole balance sheet. From Table 2, this corresponds to USD 263 billion in permissible losses in 2015. If a similar 10% loss threshold is used to proxy the maximum that a CCP can use of its pre-calibrated default fund under conditions of stress, then system stability requires that the systemic risk index given by λ_{max} of the stability matrix (see Box 1) cannot exceed 10% loss threshold.[16]

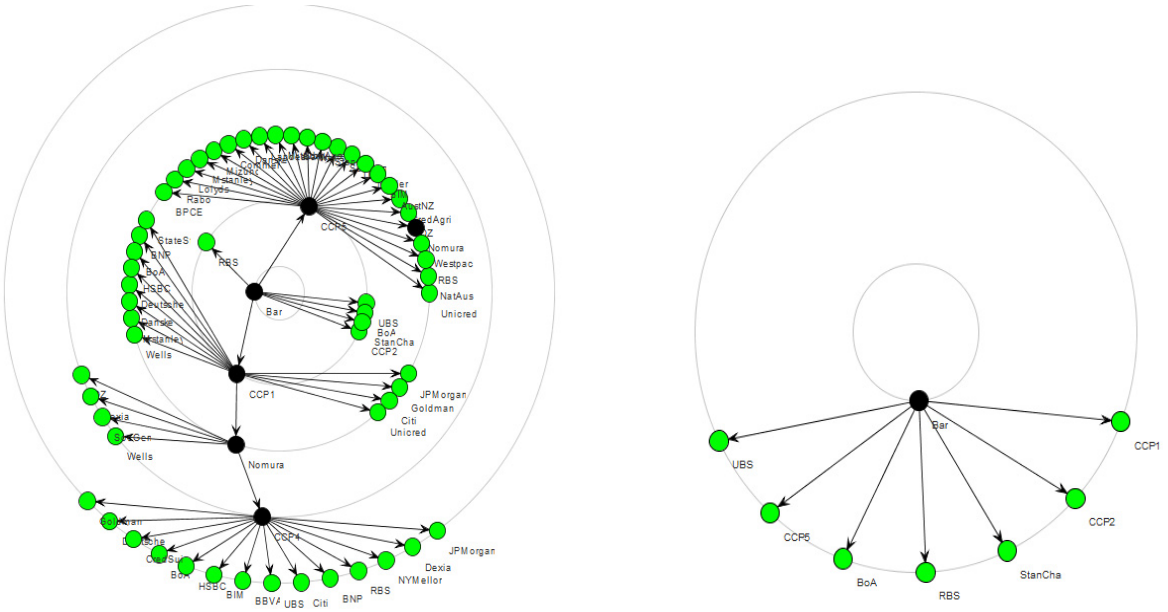
Table 4 shows that compared to 2012, the global derivatives markets in 2015-end is relatively more stable with lower systemic risk index,

16 The specification of loss thresholds are critical in the spectral stability analysis and also in Furfine (2003) simulated contagion stress tests. The following error is often commonplace: networks based on a subset of banks' balance sheets are calibrated and then an inappropriately large percentage of Tier 1 capital loss threshold is assumed when defining bank "*failure*" in the contagion stress test. A lack of direct contagion is reported when losses from counterparties arising from a subset of the balance sheet may not exceed all of Tier 1 capital or a large percentage of Tier 1 capital.

C3 2015 Before and after skin-in-the-game (SIG) fund cases for contagion "failure" of top systemically important G-SIB (loss threshold of 10% for G-SIB and CPP Buffers)

a) Before SIG fund system unstable

b) After SIG fund: stabilised at λ_{max} just below 0.10



Source: Hybrid OTC-CCP derivatives network based on 2015 MAGD G-SIB data.
Note: Distressed units in black when 10% loss threshold is breached; green units suffer some losses that are less than this threshold.

λ_{max}, at 0.148 when compared to 0.163 in 2012 for 2.67 volatility stress. In 2015, Table 4 shows the λ_{max}= 14.8% signals that some 14.8% of total capital and default fund resources could be lost while the loss threshold is 10%. The spectral approach shows there can be instability and contagion losses with respect to the failure of those participants which have right eigenvector centrality times λ_{max} that is greater than 10% (see Box 1) as shown in Chart 3a.

In the case of CCP buffers against clearing member exposures, we consider two cases. In the ***pre skin-in-the-game case***, CCPs only have the default fund to buffer exposures to the uncollateralised realised residual liabilities of their clearing members. In the ***post skin-in-the-game case***, the default fund for each of the CCPs will be augmented by a surcharge which is recursively estimated (see Markose, 2012 and Box 1) to be proportionate to the left eigenvector centrality of CCPs representing their vulnerability/exposure to clearing members. When modelled within a framework of failure rates for the financial institutions brought about by the erosion of their capital buffers, the left eigenvector centrality based capital surcharges targeting the CCPs will be internally consistent, as a fixed point result,[17] with the allocations being assigned to all CCPs given extant distribution of liabilities and buffers of other participants. Further, the CCP capital surcharges have to be made to satisfy a certain level of maximum eigenvalue for the network as whole, which is 10% to correspond to the loss threshold. Thus, we assume that the skin-in-the-game CCP buffers have to kick in with only a 10% hit on the CCP default fund being permissible. The latter can be regarded to be a proxy for the default

17 Gauthier et al. (2012) have underscored the importance of determining capital allocations that are fixed point solutions and are internally consistent. However, they did not use network analytics for this.

fund contributions of the two most systemically important clearing members. In other words, the SIG is modelled to precede any further use of the default fund beyond a 10% loss.

Table 4 columns 2 and 4 give the SIG funds needed for each of the CCPs to stabilise the pre-SIG networks for 2012 and 2015, respectively, to achieve λ_{max} below 0.10. As a result, as shown in Chart 3b for the after SIG case, there is no distress when the most systemically important bank (see Chart 2a) is subject to a Furfine (2003) type failure. Further, Table 4 shows that in 2015 a SIG fund of USD 16.15 billion will suffice to restore stability to the system while in 2012 a SIG fund of USD 32.46 billion is needed to do the same.

Finally, it must be clear as to what "failure" or distress (nodes in black in Chart 3a) means in the contagion analysis. The contagion/domino losses stemming from the default on the derivatives positions of the Furfine trigger bank exceeds the 10% loss threshold that has been assumed for all participants. Thus, the default of Barclays on its variation margin (net of its prefunded initial margins) clearly breaches 10% of the default funds of CCP1 and CCP 5 directly. Indirectly, in Chart 3a, each of these CCPs cause a Tier 1 capital loss of more than 10% for Nomura as the non-payment by the CCPs to the in-the-money positions of Nomura is booked as a loss in Nomura's derivatives assets. This leads to some distress in CCP4.

6| Concluding remarks

A case has been made for why it is essential to make systemic risk assessments for CCPs in a comprehensive network setting that reflects the hybrid structure of G-SIB dealers handling OTC positions as well as being clearing members of multiple CCPs.

In this note, we have updated the MAGD based G-SIB derivatives data from 2012 to 2015 in Table 2 and applied identical calculations (as in Heath, Kelly et al., 2016) for the prefunded initial margins and default fund contributions of clearing members for the five CCPs, reported in Table 3. This has provided interesting comparisons. The analysis shows considerable improvements in the stability of the hybrid derivatives network with the spectral systemic risk indexes in Table 4 showing smaller numbers for 2015 as compared to 2012. This is clearly the result of the USD 100 trillion compression of derivatives in terms of notional and an over 30 % reduction in their fair values. Nevertheless, the global derivatives network in 2015 still remains unstable even under 2.6 volatility stress. The proof of concept is given of how *skin-in-the-game* for each of the CCPs can be determined to mitigate potential contagion with the before and after SIG contagion results given in Charts 3a and 3b, respectively. The SIG has been designed to kick in after only 10% of CCPs' default funds have been eroded by the failure of most systemically important G-SIB to pay its residual uncollateralised variation margin. Chart 3a shows how this directly causes distress in two CCPs at once. The absence of such network based spectral systemic risk analytics is a major drawback for determining if a time series of snap shots based on bilateral contractual obligations relative to their prefunded resources are contagion prone or not. Further, we also need assessment of systemic importance and vulnerability of financial participants of these crucial markets.

While some progress has been made on data disclosures by CCPs (CPMI-IOSCO, 2015), G-SIBs and other participants in global derivatives market, it is our view that this falls far short of what is needed to create digital snap shots of holistic maps of financial interconnectedness (see also Brunnermeier et al., 2013) which can mitigate model risk from calibration of derivatives positions of G-SIBs.

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Central clearing and risk transformation

Rama CONT
Professor
Imperial College
Senior Research Scientist
CNRS

The clearing of over-the-counter transactions through central counterparties (CCPs), one of the pillars of financial reform following the crisis of 2007-2008, has promoted CCPs as key elements of the new global financial architecture. Given the cost of implementing central clearing mandates and the associated collateral requirements, it is important to examine how these reforms have affected risks in the financial system and whether central clearing has attained the initial objective of the reform, which is to enhance financial stability and reduce systemic risk.

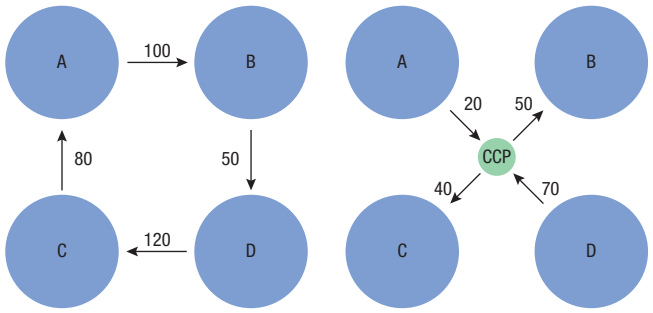
The author shows that, rather than eliminating counterparty risk, central clearing transforms it into liquidity risk: margin calls transform accounting losses into realised losses which affect the liquidity buffers of clearing members. Accordingly, initial margin and default fund calculations should account for this liquidity risk in a realistic manner, especially for large positions. While recent discussions have centered on the solvency of CCPs, their capital and "skin-in-the-game" and capital requirements for CCP exposures of banks, the author argues that these issues are secondary and that the main focus of risk management and financial stability analysis should be on the liquidity of clearing members and the liquidity resources of CCPs. Clearing members should assess their exposure to CCPs in terms of liquidity, rather than counterparty risk. Stress tests involving CCPs should focus on liquidity stress testing and adequacy of liquidity resources.

Central clearing and risk transformation

Rama Cont

One of the pillars of regulatory reform following the financial crisis of 2007-2008 has been the introduction of central clearing mandates for over-the-counter (OTC) derivative transactions. The clearing mandate for standardised OTC derivatives, together with collateral requirements and higher capital charges for non-cleared bilateral OTC transactions, as emphasised in Title VII of the Dodd-Frank Act, the Basel Committee's proposal for regulatory reform (Basel III), and the European Market Infrastructure Regulation (EMIR), have had a substantial impact on financial markets and institutions and transformed central counterparties (CCPs) into pillars of the new global financial architecture. At the same time, the cost of implementing the central clearing mandate has prompted legitimate questions on the real impact of these reforms. Has the implementation of these measures succeeded in reducing the risks that they were supposed to mitigate and made the financial system more stable?

C1 Bilateral vs multilateral netting



Source: Cont and Kokholm, 2014.
Note: Central clearing can reduce exposures through netting across counterparties.

This question has been primarily discussed through the angle of counterparty risk, which is the main reason central clearing was introduced in the first place. By replacing each bilateral transactions by a pair of symmetric trades with a *central counterparty*, which then becomes counterparty to both sides of the trade, and subjecting all counterparties to initial margin and variation margin requirements, central clearing can reduce counterparty exposures and isolate participating counterparties (clearing members) from each other's default.

Central clearing can reduce upfront counterparty exposures of clearing members through multilateral netting across counterparties (Duffie and Zhu, 2011; Cont and Kokholm, 2014), as illustrated in Chart 1. This large scale compression of exposures through multilateral netting was observed for example in the CDS market when bilateral trades in standardised CDS indices were gradually moved to central clearing in 2009 and 2010 (Cont and Kokholm, 2014). Chart 1 also illustrates how a chain of exposures, which may potentially lead to contagion in case one element in the chain defaults, is broken by central clearing through a CCP. Other benefits of central clearing include increased transparency in collateral requirements, the reduction of operational risk, the enhancement of price discovery and regulatory transparency in OTC markets, and the improvement of risk management standards. These benefits are illustrated by the observation that many OTC markets had implemented central clearing well before being mandated to do so by recent legislation.

The introduction of initial and variation margins also changes the nature of counterparty risk in the event of the default of a clearing member. In a bilateral transaction, default leads to a direct loss for the counterparty, in the form of a write-down on the value of assets held against the defaulted firm. As clearing members replace their bilateral exposures by exposures to the CCP, they are no longer directly exposed to other clearing members, so there is no write-down on asset values at the default of a clearing member. As long as the CCP continues to operate and is endowed with sufficient resources, it will continue to pay out the variation margins due to non-defaulted members.

So, it seems that a CCP endowed with sufficient financial resources effectively isolates clearing members from the counterparty risk associated with each other's default: counterparty risk among clearing members seems to have magically disappeared! This picture also seems to identify the worst case scenario as the one in which the CCP fails to operate; much recent debate has centered on recovery and resolution measures for propping up faltering CCPs, as well as capital and "skin-in-the-game" requirements for CCPs supposed to make them less prone to failure.

Following the recent move to central clearing and bilateral margining, OTC exposures net of collateral between major banks have decreased to a small fraction of bank equity, showing that the counterparty risk stemming from OTC exposures alone is not likely to trigger insolvency or contagion in the banking system (Clerc et al, 2013). Thus, at first sight, one has the impression that CCPs have "absorbed" the counterparty risk of the clearing members and isolated them from the failure of other members.

But this impression is incorrect and misses a crucial point: the distinction between "unrealised" or "accounting losses", which affect the firm's solvency but do not give rise to cash flows and "realised losses" – those which give rise to cash outflows and draw on a firm's liquidity resources.

1| Realised losses vs accounting losses

In the balance sheet of a firm, one traditionally distinguishes liquid assets – cash or securities readily convertible into cash – from other assets; similarly, one distinguishes short-term liabilities from other liabilities. A firm is said to be *solvent* if the total value of assets exceeds total liabilities: the difference is the firm's equity, or capital. A firm is said to be *liquid* if the liquid assets exceed the short-term liabilities: this means that there are enough liquid assets to pay off liabilities due in the short term.

If asset values fall below liabilities, the firm becomes "insolvent". This may occur for instance following the failure of a large counterparty, if the resulting loss in asset value exceeds the capital of the firm. As long as the firm is liquid and can meet its short term payments this may or may not entail any immediate consequence. In the case of a regulated financial institution, solvency and capital ratios are monitored by regulators; if such a regulated firm becomes insolvent, the regulator may choose to intervene, take over the management or restructure the firm. "Structural" models of credit risk and counterparty risk are in fact models of insolvency risk. Capital requirements, conceived as buffers against potential losses in asset value, address the issue of solvency.

Illiquidity, however, is a different story: if a firm, regulated or not, fails to meet a short-term payment obligation, such as a coupon or margin call, it is in *default*. In the case of margin calls, "short-term" refers to one working day in most jurisdictions.

In theory, a firm may be (in) solvent without being (il)liquid or vice versa. In practice, many financial institutions manage their liquidity through short term repurchase agreements (repos) or by borrowing against their assets; this links the amount of liquidity that they can access to the value of their assets, discounted by a "haircut". But, in the absence of full information on the assets of a financial institution, lenders can withdraw liquidity even from a solvent institution, resulting in an institutional "bank run". This seems to be in fact the typical failure scenario for large dealer banks or investment banks (Duffie, 2010; Gorton, 2012). Bear Stearns, Lehman Brothers and even AIG faced a shortage of liquid assets when faced with large margin calls. In a letter to the Basel Committee in 2008,[1] SEC chairman Christopher Cox made the point that Bear Stearns was not insolvent at the time of its default; neither was AIG: both had excess capital. It is thus important to carefully distinguish between solvency and liquidity risk when devising measures to prevent similar events from reoccurring.

1 https://www.sec.gov/news/press/2008/2008-48.htm

2| How margin requirements transform counterparty risk into liquidity risk

In the case of a bilateral OTC transaction with no margin payments, both sides mark-to-market their position daily but, outside coupon payments, there may actually be no exchange of cash flows: the resulting mark-to-market gains or losses are actually accounting losses which affect the asset values, hence the solvency risk, of the counterparties but may not affect their liquidity resources.

The same transaction, when cleared through a CCP, has a different impact on the balance sheet. First, a portion of the market risk – typically corresponding to a 99% Value at Risk (VaR) or Expected Shortfall (ES) – is requested from each counterparty as an upfront *initial margin* payment. Second, all mark-to-market gains (resp. losses) result in positive (resp. negative) cash flows between the CCP and the clearing members, on a daily, or more frequent, basis: this corresponds to the *variation margin*. Finally, the CCP may require members to contribute to a Default Fund (or Guaranty Fund) to provision for losses in case of member defaults.

What is the impact of these operations on the balance sheet?

First, we note that the transfer of initial margin and variation margin are "solvency-neutral": they do not alter the value of assets, the capital or the solvency of the firm. The clearing member retains ownership of the collateral posted as initial margin (and continues to receive interest on this collateral). So, posting initial margin has little or no impact on its solvency since the collateral continues to remain on the clearing member's balance sheet. Similarly, Default Fund contributions are technically owned by the clearing member; here there is a small impact on the balance sheet since Default Fund contributions lead to a 2% capital charge for the clearing member. As for variation margin, any cash outflow in the form of variation margin corresponds to a mark-to-market loss which is already accounted for in the valuation of the clearing member assets. So, the payment of the variation margin corresponds to a transfer from the firm's liquid assets to its non-liquid assets, to compensate for a loss in the latter, the total asset value remaining the same.

However, the impact of these collateral requirements on liquidity resources can be substantial. Both initial margin and variation margin are deposited in the form of liquid assets. Most CCPs adopt a narrow definition of "liquid assets" and require initial and variation margin payment to be made in cash and in some cases G8 sovereign debt instruments, with a haircut for all non-cash or foreign currency collateral. Thus, unlike accounting losses and "write-downs", initial margin and variation margin directly impact the liquidity reserves of the clearing member.

Thus the overall effect of central clearing on the clearing member's balance sheet is the net transfer of value from liquid to non-liquid assets, the total asset value remaining unchanged. This operation does not affect the equity of the firm, nor does it impact its solvency risk. We therefore observe that the net impact of the systematic application of initial margin and variation margin requirements is to replace counterparty risk resulting from exposures to clearing members – and the associated solvency risk – by liquidity risk.

According to data disclosures by major CCPs, members maintained an average of more than USD 400 billion of liquid assets as collateral with these CCPs in 2016. This amount is comparable to the total amount of liquid assets available on the balance sheets of major dealer banks which are members of these CCPs. Thus, although clearing members exposure to CCPs may not be large compared to their capital cushion, CCP collateral requirements and margin calls do represent a substantial proportion of members' available liquidity resources. If there is any potential for instability in such a system, it will manifest itself as a liquidity issue rather than a solvency issue.

3| CCPs as liquidity intermediaries

The balance sheet structure of CCPs reflects their role as pure liquidity intermediaries. In the absence of member defaults, a CCP collects margin and Default Fund contributions from its members, in the form of cash or other liquid assets, and passes on any variation margin collected from members with negative balances to those with positive balances. These margin and default fund contributions are the bulk of the balance sheet and are held in the form of liquid assets. The assets on the balance sheet of the CCP are subject to market fluctuations and this leads to a prudential capital requirement to prevent insolvency due to market losses. But, as the bulk of these assets are in the form of low risk, highly liquid assets, the level of capital needed for this type of insolvency risk is tiny.

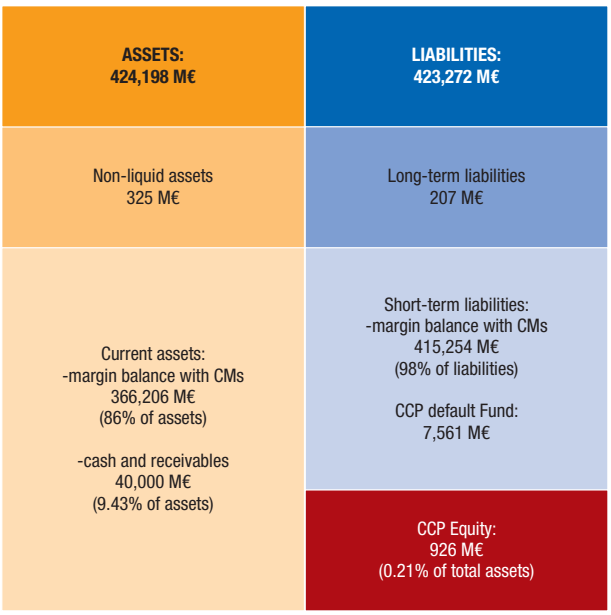
Chart 2 displays the balance sheet of LCH Group Ltd, one of the world's largest group of CCPs, in 2015. The liability side of the balance sheet is dominated by liabilities to clearing members stemming from margin balances and, to a lesser extent, Default Fund contributions. More than 99 % of the assets in the balance sheet are liquid assets, 99 % of liabilities are short-term liabilities (mostly to clearing members). The CCPs' equity only represents 0.21% of assets! As seen from this example, the capital is in fact so small that it would constitute an insignificant contribution to the absorption of default losses.

Regulatory discussions often refer to the "financial resources" that a CCP can use to "absorb losses". In the bank regulation terminology, "loss absorption" refers to the capital of a financial institution and its role as a buffer against insolvency. This vague terminology fails to distinguish liquidity risk from solvency risk, a distinction which is important for our discussion. As long as members have not defaulted, variation margin payments sum to zero: a CCP is affected by market risk of member portfolios only in scenarios where one or more clearing members default. Even then, losses due to the default of a clearing member affect a CCP's balance sheet only indirectly, insofar as it needs to make good on the payments to the counterparties of the defaulted member. Since these payments need to be made in cash or liquid assets, default losses pose a *liquidity risk* to the CCP, not an insolvency risk.

The size of this liquid reserve is the only relevant "loss absorption" capacity as far as default losses are concerned. Discussions regarding "skin-in-the-game" for CCPs which focus on CCP capital appear to miss this point.

The risk analysis and stress testing of CCPs and their clearing members, insofar as it concerns cleared products and products subject to initial and variation margin requirements, should thus be focused on liquidity risk, not solvency risk or capital requirements. In the light of this discussion, the emphasis of current CCP stress tests on CCP

C2 Balance sheet of LCH Group Ltd (December 2015)



Source: LCH Group Ltd Consolidated Annual Statement 2015.

solvency and CCP capital seems misguided. The relevant notion of stress test here is a liquidity stress test, in which losses are compared to liquidity buffers, not equity (Cont and Minca, 2016; Paddrik et al, 2016).

4I Provisioning for default losses: the CCP loss waterfall

The liquidity resources available to a CCP are used to absorb potential losses arising from the default of clearing members according to the "loss waterfall", in the following order:

1. **Initial margin**: the first layer of protection against losses is provided by the margin requirements. Each clearing member posts an initial margin requirement with the CCP, which corresponds to a measure of the risk of the member's portfolio over a standard risk horizon which depends on the asset class being cleared. The initial margin paid in by each member may only be used to absorb the losses arising from the member's portfolio, but cannot be used to offset losses of other members or other CCP losses.

2. **Default Fund contribution of defaulting member**: if the loss exceeds the initial margin contribution, the failing member's Default Fund contribution is used to offset the additional losses.

3. **Mutualisation of large losses**: if the loss exceeds the sum of the defaulting member's margin and Default Fund contribution:

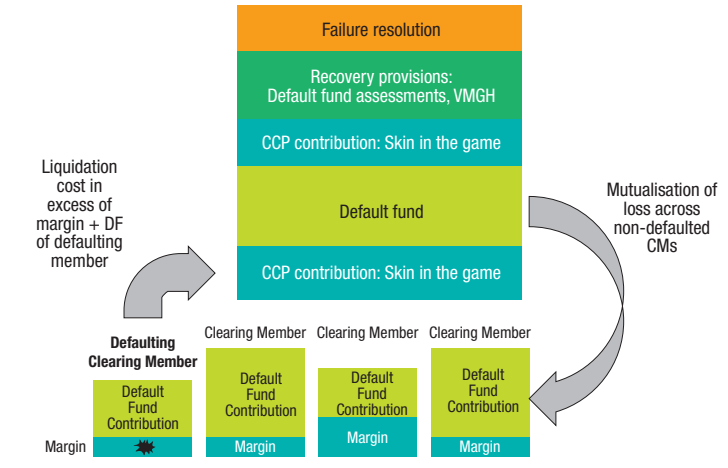
   - first the CCP makes a limited (capped) contribution to offset the remaining loss: this contribution is sometimes referred to as "skin-in-the-game";
   - if the CCP's contribution is insufficient, the Default Fund contributions of other members are used to absorb remaining losses.

4. **Recovery**: if losses exceed the size of the Default Fund, the CCPs may have recourse to:

   - an additional contribution to the Default Fund by non-defaulting clearing members: this "assessment" is often capped by the initial contribution of the members;
   - other measures to replenish the CCP's liquidity resources. One oft-discussed proposal is variation margin gains haircutting (VMGH): during the recovery phase the CCP continues to collect variation margin payments from members with negative P&L but does not transfer them entirely to their counterparties, retaining a portion for replenishing its resources (CPSS-IOSCO, 2014).

5. **Failure resolution**: if recovery measures fail to replenish the resources of the CCP or if the CCP or its members choose not to proceed with recovery measures, the CCP may enter failure resolution.

C3 Loss waterfall: allocation of losses in the event of a clearing member default



Source: Cont, 2015.

5l Margin requirements should address liquidation costs

Initial margin requirements for clearing members, which are the first layer of protection in the loss waterfall, are typically computed based on a measure of market risk – typically VaR or ES – for the clearing member's positions over a risk horizon. These risk measures are usually computed at a confidence level which ranges from 99% to 99.75%, depending on CCPs. The estimation of these risk measures is either done using historical data, a scenario based approach such as CME's "Standard Portfolio Analysis approach" (SPAN), or using a model-based simulation involving statistical assumptions on the risk factors affecting the clearing member's portfolios. The risk horizon, in current practice, depends on the asset class being cleared and ranges from one to several days but does not depend on the characteristics of the portfolio or position. The rationale usually offered is that the risk horizon represents the time necessary for the CCP to liquidate a defaulting member's positions. Validation of margin requirements is typically done using historical back testing: comparing margin requirements to realised losses for a set of test portfolios over a historical period.

However, the only scenarios in which the CCP is exposed to losses in a clearing member's portfolios are scenarios where this clearing member defaults. In this case, the CCP typically liquidates or auctions the defaulting member's positions. Since the clearing member has paid variation margin up to the time of default, the only exposure of the CCP is to the portfolio loss between the default time and the liquidation, that is, the *liquidation cost*.

Commonly used market risk measures such as VaR or ES do not yield a proper evaluation of liquidation costs: they do not account for differences in liquidity, market depth or bid ask spreads across instruments. Examples of large portfolio liquidations such as the JP Morgan's "London Whale" losses in 2012 (Cont and Wagalath, 2016) show that the cost of unwinding large portfolios can be quite high and exceed several multiples of the VaR. Also, while market risk depends on the net position (for a long-short portfolio), the liquidation cost is proportional to the gross notional size.

Liquidation costs are especially relevant for portfolios with large or concentrated positions.

Orderly unwinding of positions whose magnitude is large compared to the market depth may not be feasible over the (pre-specified) risk horizon and may require more time. For example, if a CDS position whose size is twice the magnitude of daily trading volume is liquidated at the rate of 20% of daily volume, its orderly liquidation requires 10 days, rather than the 5-day risk horizon conventionally used for CDS margin calculations. As observed in this example, for large positions the liquidation horizon may be larger than the risk horizon for margin calculations and increases proportionally to the position size. A consequence of this is a nonlinear scaling of liquidation costs with portfolio size. Recall that commonly used risk measures such as standard deviation, VaR or ES, when computed over a fixed horizon T, are proportional to the notional size N of the portfolio and typically have a square-root ($\sqrt{T}$) dependence with respect to the horizon. If the liquidation horizon itself increases linearly with the notional size N, as explained above, then the overall dependence of the risk measure with respect to the position size N will be proportional to $N\sqrt{N} = N^{3/2}$. Thus, if the notional size of the position is increased by a factor 4, standard deviation, VaR or ES would increase by a factor 4 but the liquidation cost typically increases by a factor $4\sqrt{4}=8$.

To account for these effects, margin requirements need to include a *liquidity charge* corresponding to the potential additional cost incurred by the CCP for liquidating the member's portfolio in an

extreme but plausible market scenario. A properly calculated liquidity charge should be:

- higher for portfolios with positions whose sizes are large relative to market depth, and
- higher for portfolios with positions in less liquid instruments.

As the list of centrally cleared OTC derivatives is steadily expanding to include less and less liquid instruments, the incorporation of a liquidity charge in margin requirements is an essential step towards a sound risk management of CCPs clearing such instruments. A properly calibrated liquidity charge can deter members from accumulating concentrated exposures and illiquid positions, and provides incentives to the clearing members for managing their exposure to liquidity risk.

The evaluation of liquidation costs can be a challenging task for complex, multi-asset portfolios. An integrated approach to the evaluation of margin requirements, which simultaneously addresses market risk and liquidation cost, is the Close-Out Risk Evaluation (CORE) method (Avellaneda and Cont, 2012), versions of which have been implemented in several major CCPs.

Liquidation costs should also be accounted for in the sizing of the CCP Default Fund, which is based on the exposure of the CCP to large clearing members. These members are typically large broker-dealer banks with multiple long and short positions which can be costly to liquidate and whose default is very likely to be associated with a high level of market volatility and/or widened bid-ask spreads. The calculation of CCP exposures to the default of such clearing members should therefore go beyond a standard market risk calculation for the portfolio and account for widening of bid-ask spreads and liquidation costs (Cont and Wagalath, 2013, 2016). Given that the liquidation costs are proportional to the gross, rather than net, positions a realistic assessment of liquidation costs for large members can result in a dramatic impact on the Clearing Fund size.

6| Liquidity at the end of the waterfall: recovery mechanisms for CCPs

In the situation where the losses exceed the total available Default Fund, one reaches the "end of the waterfall". In the absence of other resources, restructuring or liquidation would then ensue. However, given the CCPs' systemically important role as a conduit for transactions of other large financial institutions, it has been proposed to use further resources to ensure the continuity of the CCP's clearing services to prevent further contagion (CPSS-IOSCO, 2014; Cont, 2014; Singh, 2015). Such "recovery arrangements" act as a temporary backstop and may, if successfully deployed, delay further losses to the CCPs until liquidity resources are replenished to pre-stress levels.

7| Default fund assessments

The first recourse of a CCP once the Default Fund is depleted is an assessment right for Default Fund contributions: the CCP may request from all (non-defaulted) clearing members an additional contribution proportional to their previous contribution to the Default Fund in order to replenish it. In most CCPs, this contribution is capped by the pre-default contribution of each member. The presence of such assessment rights potentially gives the CCP access to a larger pool of liquidity resources to cover losses in stress scenarios.

Yet, if one considers that the depletion of the Default Fund will occur in a stress scenario where one or two large clearing members have already defaulted, the risk that other non-defaulted members may fail to have enough liquidity to meet the assessment is non-negligible. This is due to the fact that some non-defaulted members may have been exposed

to the same shocks or market losses which resulted in the failure of defaulted members. Even in the situation where the surviving members have the necessary resources to meet the assessment payments for replenishing the Default Fund, they will have an incentive not to do so, by closing their positions or migrating them to another CCP.

This observation shows that the unfunded portion of the Default Fund is subject to "wrong-way risk": the risk of its non-payment is correlated with the default events which trigger the assessment rights. A quantitative assessment of this wrong way risk may be quite challenging, so a conservative baseline assumption in CCP stress tests would be to rely solely on funded resources. If the clearing member is a bank, such assessment rights should be in principle provisioned for in the Liquidity Coverage Ratio (LCR) as a liquidity outflow in the LCR stress scenario. Under the Basel III bank liquidity regulation framework, this forces a clearing member to provision for the unfunded portion of the Default Fund upfront, which makes it less of an advantage compared with the funded portion of the Default Fund contribution.

8| Variation margin gains haircutting

If a clearing member defaults primarily due to losses on its positions cleared within the CCP, then these losses materialise as large variation margin payments to other clearing members. These variation margin payments are thus sufficient in principle to cover the (market) losses generated by the defaulting member's portfolio. VMGH consists in using these variation margin payments as a source of funds for recovery of the CCP's default resources: the CCP reduces pro rata the amount due to clearing members, while continuing to collect in full from those participants with out-of-the-money positions. This procedure allocates losses across surviving members similarly to what would occur in a resolution, while providing for continuity of clearing services and avoiding the irreversibility and costs associated with a full resolution. It can be an efficient recovery mechanism when losses arise from a large mark-to-market loss in instruments cleared by the CCP, but not when the loss originates from non-default losses of assets held in the CCP's treasury of Default Fund.

Like Default Fund assessments, VMGH restores the liquidity resources of the CCP at the expenses of clearing members. In a stress scenario where clearing members are otherwise subject to liquidity shocks, this may lead to further strain on the liquidity resources of clearing members.

In summary, although there may be no downside for the CCP itself in including assessments and recovery provisions in the loss waterfall, these mechanisms subject surviving members to potentially destabilising draws on their liquidity resources during a stress scenario, similar to the large margin calls which brought down Bear Stearns, Lehman and AIG, and may act as a channel of contagion for liquidity shocks, which contradicts the very purpose of central clearing. Some market participants (JP Morgan, 2014) have in fact argued against including any unfunded portion in a CCP's default resources. Whether or not one supports this view, which is not without merit, the benefit of such recovery provisions needs to be examined in a liquidity stress testing framework, not just from the viewpoint of the CCP but from a financial stability perspective.

9| Summary: follow the liquidity

The introduction of central clearing in OTC markets has been effective in reducing counterparty exposures across clearing members. But, rather than removing counterparty risk, central clearing –together with initial and variation margin requirements for non-cleared transactions– transforms it into *liquidity risk*. In a financial system where more and more transactions are subject to initial and variation margin requirements, accounting losses materialise –via margin calls– as (negative) cash flows which draw on liquidity resources of market

participants, shifting the focus from solvency risk to liquidity risk.

This has several important implications for risk management of CCPs, clearing members as well as for financial stability.

First, it shows that the primary focus of financial stability analysis of central clearing and margin requirements should be on the adequacy of liquidity resources of clearing members, especially dealer banks, rather than solvency and capital requirements. Stress tests of CCPs and their clearing member should focus on liquidity stress testing: the focus should be on comparing the size of the potential liquidity shocks to clearing members with their liquidity buffers, rather than their equity. In the event of a default, the main impact on surviving clearing members will be through margin calls and Default Fund assessments, which should be provisioned for in the liquidity reserves of clearing members and not, as is done in current regulation, through capital requirements against Default Fund contributions. Provisions such as "skin-in-the-game" requirements for CCPs, rather than focusing on CCP capital, should address the amount of liquid assets that the CCP can contribute in the loss waterfall to offset losses in a stress scenario. Likewise, clearing members should assess their exposure to CCPs in terms of liquidity, rather than counterparty risk.

Margin requirements for CCP members should not be solely based on an evaluation of the market risk of their portfolio but also include a component related to the liquidity risk of their position. This "liquidity margin" should correspond to a realistic assessment of its liquidation cost in extreme but plausible market scenarios. A properly calibrated liquidity charge can deter members from accumulating concentrated exposures and provide incentives to members for managing their liquidity risk.

Recovery provisions for failing CCPs have been primarily discussed as measures which would allow the CCP to continue operating through a stress period. Most recovery tools – such as Default Fund assessments and variation margin haircutting – are inherently procyclical and tap into the liquidity resources of clearing members in order to replenish the liquidity pool of the CCP. But draining the liquidity pool of clearing members in a market stress scenario may have a destabilising effect on large clearing members. CCP stress tests should attempt to assess how these potential draws on clearing member liquidity compare with the members' liquidity buffers, and whether such recovery measures and assessment rights are not detrimental to financial stability, which, let us not forget, is the reason for central clearing mandates in the first place. Access of (large) clearing members to central bank liquidity during such episodes can provide relief and prevent failure of solvent but illiquid clearing members. CCP recovery mechanisms should be centered not on maintaining a CCP's operations at any cost but on avoiding financial instability and safeguarding the financial system. Design of recovery and resolution mechanisms should be based on an assessment of system-wide losses in different scenarios, including spillovers to non-member institutions via margin calls, inter-CCP cross-margin agreements or the risk of fire sales.

Bear Stearns, Lehman and AIG failed following large margin calls that they were unable to meet. Much of the reforms related to central clearing and margin requirements for non-cleared derivatives have been motivated by the desire to avoid a repeat of these spectacular failures. Remedies need to focus on the actual causes of failure. *Liquidity risk* seems to be the key to understanding these examples and improving risk management practices for preventing similar events in the future.

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Towards sound market-based finance?

Have post-crisis financial reforms crimped market liquidity?

Avinash PERSAUD
Chairman
Intelligence Capital Limited
Emeritus Professor
Gresham College

In this article the author considers the nature of financial market liquidity and the impact on liquidity of recent regulatory initiatives, including increases in capital requirements for bank trading books. There is some evidence and much logic that higher capital in the trading book has led to a reduction in the willingness and capacity of banks to act as market makers, reducing market liquidity. In response some officials invoke a market structure view that there is a trade-off between day-to-day liquidity on the one hand and systemic resilience on the other. They then argue that a switch towards greater systemic resilience and away from day-to-day liquidity was a necessary and overdue step.

There is however little evidence that we are moving along this trade-off. A more serious attention to market structure suggests that the increasing dominance of algorithmic traders, only partly related to the rise of capital on bank trading books, and increased capital requirements for insurance companies and pension funds, would inevitably lead to a downward shift in market liquidity in general. Curbs on high-frequency trading such as levies on cancelled or very short-term trades and a change in the treatment of capital requirements for long-term savings institutions could push us to a Panglossian point where banks are not only safer but there is also more liquidity.

Have post-crisis financial reforms crimped market liquidity?

Avinash Persaud

Liquidity matters. Economic recessions that follow banking crises are deeper and longer than others, and at the centre of most major banking crises lie liquidity crises. To a significant extent, the Great North Atlantic Recession was a funding liquidity crisis. At the beginning of 2007, the vast majority of bank assets were performing. But a collapse of confidence in the veracity of the ratings of securities based on packages of mortgages meant that banks could not sell these assets for immediate liquidity without taking a big hit and could not put up these assets as collateral for cash without accepting large haircuts. Hearing this, bank customers began withdrawing their deposits, compounding the liquidity shortage. Uncertain about the liquidity of their counterparties, banks stopped lending to each other. The interbank market dried up. The authorities stepped in and offered unprecedented amounts of liquidity against the widest range of collateral. Central banks became the market-maker of last resort, calming the funding crisis.[1]

The Lehman Brothers bankruptcy in 2008 led to a further lurch into risk aversion and higher liquidity preference by banks and their customers and the authorities had to continue providing large amounts of liquidity to the banks and markets for some time. If they had not done so, it is likely that we would have seen a collapse in lending that might have turned the Great Recession into another Depression.

Given this recent trauma, you can imagine that the authorities are particularly sensitive to claims from market participants that market liquidity is falling once more. Worse, market participants argue that this is a direct result of regulatory reforms in response to the crisis. It is not crystal clear what is happening to liquidity so it is important to get the situation into perspective. We are far from a general liquidity crisis. But there have been some well-publicised episodes or points of falling liquidity. Since 2010 we have seen flash crashes in the largest markets that were previously considered the most liquid in the world: the US stock market, the US Treasury and the German bund markets and most recently the sterling/dollar exchange rate market. Market participants argue that this is just one indication of a shift lower in market liquidity that has only just begun.

The most frequently used measure of liquidity is the "bid-ask" spread: the difference between a trader's quote for buying an instrument (the bid), and his quote for selling it (the ask). If a dealer is worried that he will be caught holding an instrument that he cannot quickly sell as its price begins to fall, he will quote a larger spread. The spread is often thought of as the liquidity risk premium, or a significant component of it. There is plenty of data on bid-ask spreads and consequently plenty of analyses of it. Bid-ask spreads in the government and corporate bond markets spiked globally in 2008-2009 and again in Europe in 2011. However, since then, they have gradually returned to where they were before the crisis.

If bid-ask spreads are back to where they were, is this much ado about nothing? Market participants are skeptical about reading too much into bid-ask spread data. Bid and ask are quotes, not traded prices. The best measure of past liquidity is the realised price impact of trading: how far the price falls as you try to sell a security or how far it rises as you try to buy it. In a liquid market price impact should be low, at least for average sized trades. There is not much public data on the price impact of trading. When I have been able to measure this myself using State Street's custodial data,[2] I have found to my surprise that the price-impact of trading is far more volatile than quoted bid-ask spreads. My interpretation of this is that the bid-ask spread has become more a convention than a time sensitive measure of liquidity. Market makers quote a fairly standard bid-ask spread to signal that they are open for business in that security. When there is a decline in liquidity they manage this by lowering the amount that they are prepared to trade at the quoted spread, not widening the spread. In a limited version of "Goodhart's Law" it seems

1 I first heard the term, "market maker of last resort" from Willem Buiter.

2 With the assistance of Professor Ken Froot and Dr Paul O'Connell.

that the more the authorities and customers have focused on bid-ask spreads, the more meaningless they have become.

Market analysts refer to the quantity behind bid-ask quotes as "market depth." The Committee on the Global Financial System's latest report on market liquidity in the fixed income markets is a good summary of measures of market depth and the average size of trades for different fixed-income markets around the world.[3] It is the Committee's second report on market liquidity in a couple years underscoring its sensitivity to concerns that market liquidity has either fallen or become more transient. Both depth and the average size of trades have followed a strong trend lower in recent years. Despite the relentless efforts of the authorities to pump liquidity into the system, the report throws up an odd dichotomy: markets are bigger or just as big as before when measured by daily turnover, yet thinner when measured by average trade size.

Traders say that the decline in liquidity is causing major structural shifts in the way in which the market operates and is organised and that these changes are not captured by traditional measures of liquidity. For instance, if an investor has an illiquid security to sell, the trader will no longer buy it and hold it on his balance sheet until he finds a buyer. This has become more expensive to do. He will instead start searching for that buyer and will then match the trade, earning the full bid-ask spread. Rather than charging the customer for using the trader's balance sheet for an uncertain length of time, via the inflexibility of the one-off bid-ask spread, traders are "forcing" investors to warehouse assets on their own balance sheets. Bank traders are acting and being paid as brokers, not market makers. Traders say that this is because of the large increases in the amount of capital that they have been required to hold against their exposures in the trading book since 2009 and additional increases announced in early 2016 for implementation in 2019.

Bank assets that were held in the "trading book" were considered to be highly liquid and easily sold. Consequently, before the last liquidity crisis, regulators were content for banks to hold less capital for assets in the trading book versus those in the banking book – like non-marketable loans. No surprise then that banks tried to push as much assets on to the trading book as possible to reduce their capital and raise their leverage and profitability. Partly as a result of this concentration of holdings in the trading book, when the liquidity crunch occurred in 2008-2009, banks could not sell these assets quickly and they held too little capital to absorb the valuation losses.

In 2009 the Basel Committee on Banking Supervision responded by increasing the capital requirements of assets held in the trading book by over 200%. However this was still lower than the new, higher, capital requirements in the banking book and so banks continued to engage in this regulatory arbitrage. In 2016 the Basel Committee announced new proposals for implementation in 2019 that would tighten the ability of banks to reclassify assets between trading and banking books and would take greater account of tail risk – the risk of extreme events. This will increase capital requirements for the trading book by a further 40%. Higher capital in the trading book has caused a renewed focus on the risks and returns of market-making operations and led to a reported reduction in the willingness and capacity of banks to trade. Banks have shrunk their assets and announced reduced staff levels in trading businesses.

Banks are not just responding to a relative shift in capital requirements between trading and banking books. Revised Basel II includes new leverage and liquidity ratios. Supervisors subject banks to a more frequent and intense level of stress tests that include assets held in trading books. Large hypothetical losses from illiquid assets can lead to still higher capital requirements. Underlying these regulatory initiatives is a belief that if banks had held more capital in 2007-8 the crisis would

3 See BIS (2016).

have been far more contained and recourse to tax payer support and central bank liquidity might have been more limited. The name of the game is higher capital across the board. This has caused banks to completely rethink their business strategies. Bank managements are saying to their shareholders that they intend to shift out of capital intensive parts of their business towards the less capital intensive parts such as advisory, arranging, structuring and brokering. It is likely then that the switch from trading and holding risky assets currently underway and to come is greater than what can simply be explained by a reduction in the capital discounts that banks used to enjoy for assets held in their trading books.

Traders always complain about the unintended consequences of regulation. This time around the authorities have been careful not to dismiss these concerns out of hand. In response to industry concerns, regulators have, for instance, slowed the implementation of new liquidity rules. However, central banks and regulators generally cast doubt over the degree of change in liquidity actually underway. They also argue, correctly, that the extra focus on the real risks lurking in the trading book was long overdue. They look upon the new practice of investors holding their illiquid assets on their own book while their banks look for a buyer as a positive development and better risk sharing. They also hint that there may be a trade-off between day-to-day liquidity and systemic resilience and previously they may have placed too much emphasis on trading liquidity – the ability to find a ready buyer for an instrument that you want to sell in normal market conditions – and not enough to systemic liquidity – the ability to find any buyers in a stressed environment even after prices have fallen a long way.

This is the first time that the authorities have indicated that a trade-off may exist between different types of liquidity. In the decade prior to the financial crisis there was a general assumption that anything that was good for trading was good for the financial system. First securitisation, then high-frequency and algorithmic trading were all welcome. The more the better it was thought. This attitude contributed to capital requirement discounts in the trading book and pressure to reduce or increase the exemptions from financial transaction taxes. I am sensitive to these subtle hints of a trade-off, having long espoused the slightly unconventional idea that one existed and warned that improvements in trading liquidity were coming at the expense of systemic liquidity.[4] The challenge I have found with this idea, however, is that it is not easy to test directly given that systemic crises are few and far between. To test it indirectly we need a little theory of liquidity to help us know what to look for outside of a full-blown crisis.

Liquidity is about diversity of behaviour; not size. If a market had just two traders, with one always wanting to buy when the first one wanted to sell, maybe because they had different ways of valuing the same asset or different time horizons, that market would be very liquid. The reader may imagine that bigger markets would naturally be more diverse, but if market participants follow a common valuation convention then it is possible for a market with a great many traders to be illiquid as they all seek to buy or sell at the same time. An example is the Nasdaq, the technology-focused US stock market versus the Australian equity market. The Nasdaq is many times larger, but its concentration on tech stocks, the tendency for tech to be "in" or "out" and the presence of large superannuation funds in the Australian market means that according to my analysis of price impact of trading measures of State Street's custodial data, price impact of trading is generally lower in the Australian stock market than in the Nasdaq.[5] The more diverse a market is the more liquid it will be. Small markets may be diverse and liquid and large ones non-diverse and illiquid in times of stress.

I won the Jacques de Larosiere Award in Global Finance in 2000 for arguing that regulators' preference for common risk management and value accounting systems would support liquidity in quiet times and markets would grow fat on

4 See Persaud and de Larosiere (2000); Lagana, Perina, von Koppen-Mertes and Persaud (2006).

5 For a fuller treatment of this subject and empirical results see Persaud (2005).

short-term trading, but during these quiet times these systems will point to the same assets as having a superior risk-return trade-off and banks and short-term investors would herd into them. When some, possibly random event took place that made these same assets less attractive, there would be a rush for the door. This would lead to a spike in volatility that would cause the similar risk and valuation systems to shout sell at the same time and we would end up with a contagious crisis and a liquidity black hole. Regulators were overly seduced by having the biggest markets and were not paying sufficient attention to diversity and structure.

There is a natural degree of diversity in any financial system. Diversity does not need to be artificially imposed. Banks with short-term liabilities, for instance, should be more sensitive to short-term volatility than life insurers, pension funds or other long-term savers. In times of strife, banks should sell assets to long-term savers. From the long-term perspective of these savers, assets are cheap after a crash and in times of a boom they have become expensive and so long-term savers should be net sellers and this process should provide systemic liquidity and resilience. This type of behaviour is in fact observed between defined benefit pension plans that are more focused on reaching a long-term goal and defined contribution plans that follow short-term developments in the markets more closely. In general, defined benefit plans trend out of equities during booms and back into them after crashes. It is possible then that by curbing bank traders, day to day trading liquidity may have fallen, but an increase in diversity has led to an increase in systemic liquidity. It is not clear where is the right point on this trade-off, between trading and systemic liquidity, but it is clear that we were at a corner, and any shift from where we were would have brought a better balance. If this were the case, regulators would be justified in politically ignoring the whining from bank traders.

The bad news then is that the retreat of bank traders has not been associated with an increase in diversity and may have led to a reduction. Long-term investors like pension funds and life insurers are being encouraged to act more like short-term traders through new capital requirements that are based on measures of short-term risks and not measures of risk that capture their long-term perspective. For instance, the new regulation of insurers and occupational pension funds, Solvency II, treats a short-term sovereign bond with a near zero yield as less risky for a long-term pension fund trying to keep pace with the growth of earnings and inflation, than public or private equity. Long runs of data suggest the opposite is the case.[6] Long term savers are unable to buy assets that have just crashed and from a long term perspective are cheap, because the new rules require them to put up more capital for the short-term volatility.

This perverse development has occurred because most financial regulators are bank regulators and, or, adherents to a flawed, perhaps legalistic, view that common approaches are better than diverse approaches to different behaviour because they minimise regulatory arbitrage.[7] Consequently, Solvency II is modeled on a short-term or bank-like approach to risk when a long-term approach is required to ensure that long-term savings institutions appropriately add diversity and liquidity to the financial system.

Bank traders are being replaced by traders who are even more short-term than they are, such as high frequency and algorithmic traders. Much attention is paid to their algorithms but these traders are really distinguished by the fact that they tend to be leveraged and have little capital and have trading strategies that can switch rapidly. In times of quiet, short-term, debt-laden traders can profit from contrarian strategies, buying when others are selling and selling when others are buying. By doing this they are adding to liquidity. Studies of their behaviour in quiet times conclude that they are a positive addition to markets. Their activity will compress bid-ask spreads. The more a market is made up of these traders the greater will be the appearance of day-to-day liquidity in quiet times.

6 See Persaud (2015).

7 See Warwick Commission on International Financial Reform(2009).

At the time of strong declines in markets, however, short-term focused and debt-laden investors are forced to be sellers. Their slim capital would be quickly spent if they were buying as the market gapped lower.[8] At these times bank traders will stand back and avoid taking on risk. These new types of traders will instead pull their constellation of buy orders and switch from being contrarian to being aggressively momentum driven. By aggressive I mean that they try to create a congestion of sell orders in the hope that this would drive the market lower still, or they try to sell before other sell orders get through. This behaviour explains some of the heavy investment in super fast, private, wired, communication networks between exchanges and these traders. Selling more and faster when others are selling reduces liquidity and spawns flash crashes.

The increasing proportion of high frequency traders in markets explains both declining bid-ask spreads in quiet times and the rising number of flash crashes or extreme jumps in the market. We are witnessing a rise in illusory liquidity: liquidity that is there in quiet times when you do not need it and disappears when you do. The new capital regime for banks has played a role in reducing the willingness and capacity of banks to take risks and offer liquidity. This was deliberate. It could have happened in a way that led to a compensating rise in systemic liquidity. It did not. A small transaction levy, like the high frequency trading (HFT) tax recently introduced by France and Italy might help. A reduction in HFT will reduce liquidity when we do not need it in quiet times, but reduce its disappearance when we do need it in stressed environments. Appropriate adjustments to the definition of risk in Solvency II could then allow long term savers to fill the role partly left by banks and play a stabilising role boosting systemic liquidity. Most importantly of all though we need our regulators to appreciate more that market structure matters.

8 See Persaud (2002).

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A stability perspective of market-based finance: designing new prudential tools?

Steven MAIJOOR
Chair
European Securities and Markets Authority

Clément BOIDARD
Senior Risk Analyst
European Securities and Markets Authority

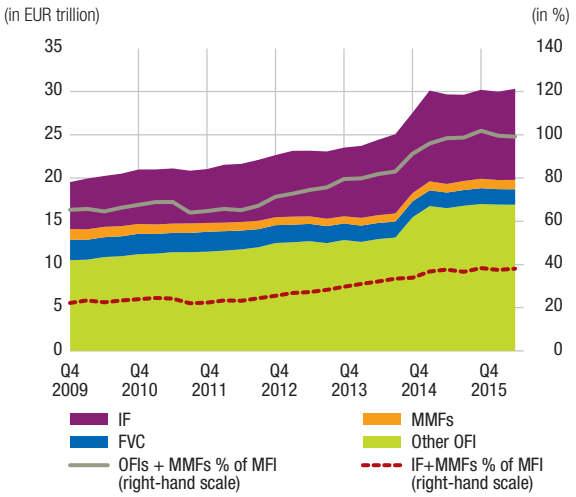
Market-based finance is expected to grow in the future. There is strong potential for demand facilitated by a supportive policy environment and the limited ability of banks to finance the economy. The development of market financing as a complement to bank financing must be accompanied by an adequate and effective prudential framework because of the systemic nature of these activities. In this article, the authors analyse how European legislation on securities markets already include a number of microprudential tools available to supervisors, which need to be taken into account when designing macroprudential tools for ensuring the stability of market-based finance.

Steven Maijoor and Clément Boidard

Over the last years, market-based finance has developed steadily, while at the same time banks have reduced their balance sheets mostly as a response to new regulatory requirements. The growth of market-based finance has raised some concerns due to the potential risks to the stability of the financial system and there are on-going discussions about how these activities should be regulated from a prudential perspective.

In this article, we first discuss why we should expect market-based finance to continue to develop in the future and why such growth would be welcome in particular in Europe, provided certain conditions are met. We then present how market-based finance can create risks to the stability of financial markets. Finally, we explain how European legislation on securities markets already provide safeguards against the systemic risk of these activities and what the priorities for regulators should be to ensure the stability of financial markets.

C1 Growth in market-based finance in Europe by type of institutions



Sources: ECB, ESMA.
Note: Total assets for euro area Money Market Funds (MMFs) and other financial institutions (OFI): investment funds (IF), financial vehicle corporations (FVC), other OFI estimated with ECB Quarterly Sector Accounts MFUA, in EUR tn, on left-hand scale. In % of bank's assets on right-hand scale.

1| Market-based finance: a growing market

Between end-2009 and end-2015 (see Chart 1), the size of market-based finance in Europe, comprising total assets of investment funds (including money market funds) and other financial institutions, grew by 54% to stand at EUR 28 trillion at the end of 2015. Such growth was mainly driven by investment funds (including money market funds) that grew by 71% over the same period, representing 41% of market-based finance at the end of 2015. Compared to the activity of credit institutions, market-based finance represented 61% of credit institutions' total assets at the end of 2009 but grew to 93% at the end of 2015.

In the future we should expect the role and the size of market-based finance to further increase. This growth will be driven by institutional borrowers seeking alternative financing channels, in the face of limited availability of traditional financing from banks. Also, initiatives from public authorities might facilitate the development of market-based finance in Europe. Indeed, in 2015, the European Commission (EC) launched the ambitious project of the Capital Markets Union (CMU). The objective of the CMU is to develop stronger and deeper capital markets in the European Union (EU) to allow funds to flow to European companies, thereby benefiting growth, investment and the real economy.

This is a much appreciated initiative. Indeed, unlike their North American counterparts, which diversify their financing, European small and medium-sized enterprises still depend heavily upon bank financing. While the European economy needs to be able to rely on the funding provided by the banking system, the current over-dependence is suboptimal for the development of our businesses and consequently for the growth of our economy. This has been particularly apparent in the aftermath of the 2008 financial crisis. The recovery of the European economy slowed down due to the reduced bank lending to European businesses while alternative sources of financing were not easily available to them.

The ambition that motivates the CMU will require a change of mindset. Indeed, European savers have historically been reluctant to channel their savings into capital markets and have steadily favoured the low risk profile of banking deposits. The preference for banking deposits is illustrated by the fact that the banking sector remains a destination of choice for European savings despite the gradual decrease in the return offered by this type of investment over recent years.

The CMU emphasises the importance of financial stability and investor protection, and regulators and supervisors have an important role to play. Indeed, it is the responsibility of regulators and supervisors to make sure that the risks, and in particular the systemic risk of market-based finance, are appropriately mitigated by adequate regulation and supervision.

2| Potential systemic risk from market-based finance?

From a macroprudential standpoint, market-based finance has generally been less pro-cyclical than bank credit. However, some activities, such as corporate debt financing by non-banks or loan origination by funds, could eventually lead to excessive credit growth during upturns, followed by deleveraging during downturns, potentially leading to severe consequences for the real economy.

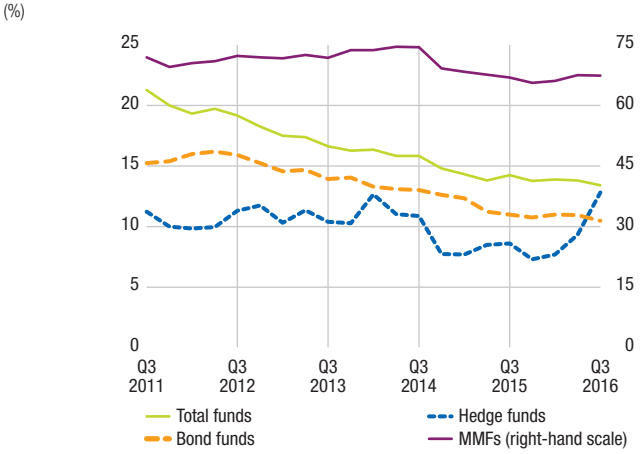
In particular, within the non-banking field, asset management is one sector that is attracting a lot of attention these days. Beyond its mere size, which makes it relevant from a stability perspective (see Chart 1), there are growing concerns that the alleged search for yield, coupled with ample market liquidity, leads to mispriced risk and overvaluation of some asset classes. Eventually, significant sales could depress asset valuations, thereby transmitting stress to other institutions that may in turn be forced to sell assets. Cascading effects from fire sales could ultimately further deteriorate market confidence and deepen a crisis.

This is particularly true for open-ended vehicles where liquidity risk can arise if investors wish to have shares redeemed, but the cash amount in the fund is not sufficient, and assets cannot be sold on short notice (i.e. there is a mismatch between the liquidity of fund assets and the liquidity offered to investors). This liquidity mismatch could create run risks for the fund in stressed market conditions and asset sales in response to redemption could in turn spread to other portfolio market segments.

Also, leverage generated by the use of financial derivative instruments or borrowing arrangements is a potential driver for fire sales and may force asset managers for example to sell assets at depressed prices when facing higher haircuts or margin calls from creditors.

Moreover, financial institutions and in particular asset managers are interconnected with the rest of the financial system, through direct investments or through financial intermediation and securities financing transactions. In particular, the re-use of collateral creates a network of linkages between

C2 Interconnection between European investment funds and the euro area banking system



Sources: ECB, ESMA.
Note: Loan and debt securities *vis-à-vis* MFI counterparts, as a share of total assets. Euro area investment funds and MMFs, in %. Total funds includes: bond funds, equity funds, mixed funds, real estate funds, hedge funds, MMFs and other non-MMFs investment funds.

financial institutions across different market segments, including between banks and non-bank institutions. Distress at the level of a non-bank intermediary such as an asset manager may create risk for its counterparties, and have a broader impact on market liquidity and risk aversion. At the end of the third quarter of 2016 (see Chart 2 above), 13.5% of the assets of European investment funds were invested in loans and debts issued by the euro area banking system. While the exposure of EU investment funds to the euro banking system remained stable between 2015 and 2016, European hedge funds increased their exposure from 7.3% to 12.8% of their assets during the same period. The European hedge funds sector has thus become more closely connected to the euro area banking system.

The CMU will reinforce the role of non-bank participants and make European capital markets even more interconnected. The financial stability of these entities must therefore be a priority for strengthening European capital markets. In this context, European and global regulators are discussing the merits of extending the macroprudential framework to market-based finance. In particular, at the global level, the Financial Stability Board (FSB) and the International Organization of Securities Commissions (IOSCO) are providing financial-stability recommendations relevant to the non-banking sector, including market infrastructures, asset management and securities financing transactions. In June 2016, the FSB published a consultation paper on proposed recommendations to address structural vulnerabilities from asset management activities.[1] The FSB is expected to finalise the recommendations in early 2017, some of which will be operationalised by IOSCO and the relevant FSB working groups. At the European level, the EC is consulting on the review of the European macroprudential policy framework. Also, in July 2016, the European Systemic Risk Board (ESRB) published a strategy paper in order to promote the development of a macroprudential framework beyond banking.[2]

These initiatives are necessary and will undoubtedly help enhance the stability of market-based finance. However, having a macroprudential framework in place for market-based finance does not necessarily imply designing a brand new framework and developing and implementing new supervisory tools.

3| Microprudential tools to address systemic risks beyond banking activities already exist in the European Union

3|1 Building on existing expertise

In 2008, the G20 provided regulators with a roadmap where no financial product, no market and no territory with a potential systemic impact should remain without appropriate regulation and effective supervision. Since 2011, the European System for Financial Supervision (ESFS), which encompasses the ESRB, the European Supervisors Authorities (ESAs) and National Competent Authorities (NCAs) has been the framework for financial supervision in the EU.

When implementing the expansion of the macroprudential framework beyond banking, one needs to consider the obvious: non-bank entities are not banks. They cover a wide range of entities such as investment funds, special purpose vehicles or central counterparties with different risk profiles, which means that macroprudential tools designed for non-banks need to be fit for purpose. Therefore, a mechanistic transposition of macroprudential tools used in the banking field will be unlikely to properly address macroprudential risk arising for securities markets or investment funds. Also, securities market regulators' expertise is crucial because of their experience in dealing with financial stability issues for non-bank entities. Indeed, ESMA and the ESRB have conducted significant work in the financial stability area around the non-bank financial services industry and this expertise has been recognised in the

1 *http://www.fsb.org/wp-content/uploads/FSB-Asset-Management-Consultative-Document.pdf*

2 *https://www.esrb.europa.eu/pub/pdf/reports/20160718_strategy_paper_beyond_banking.en.pdf*

financial stability discussions with respect to this area. Finally, it is important to always analyse whether existing regulatory tools designed from a microprudential perspective already address macroprudential issues.

3|2 Building on existing tools

Drawing on these principles, it is important to recall that, from a European perspective, many of the FSB's recommendations are already addressed or in the process of being addressed through the existing legislative and regulatory framework. This means that an extension of the macroprudential framework to market-based finance will not need to be built from scratch. However, a number of the FSB recommendations, such as those on stress testing and leverage, could lead to changes to current practices.

As explained before, liquidity risk can have very adverse consequences for funds and ultimately for financial stability. From a regulatory perspective, both the Undertakings for Collective Investment in Transferable Securities (UCITS) Directive and the Alternative Investment Fund Managers Directive (AIFMD) have various requirements in relation to liquidity management which are designed to mitigate this risk. The UCITS requirements are the most prescriptive, reflecting the fact that UCITS are supposed to be liquid products that can be sold cross-border to retail clients on the basis of the passport. The UCITS Directive requires that liquidity be ensured for all investments by UCITS, and sets out specific rules for the eligibility of transferable securities, money market instruments and financial derivative instruments. Where appropriate, they are also required to carry out stress tests as part of their liquidity risk management. Moreover, the Regulation on Money Market Funds, on which a political agreement was recently reached in the EU, should provide adequate safeguards to address the systemic risk of this type of funds.

With respect to the AIFMD, there are requirements on the fund manager that the liquidity profile be managed and adjusted on an on-going basis to ensure that the portfolio composition remains in line with the redemption policy of the fund. Also, managers have to put in place liquidity management procedures and stress tests, especially if they manage open-ended or leveraged funds. The results of the stress tests must then be reported to NCAs.

In addition to these requirements, under the UCITS Directive and the AIFMD, NCAs have the possibility, under exceptional circumstances, of requesting that managers of UCITS management companies and AIFMs suspend the redemptions of the funds that they manage. This tool can be used by NCAs to prevent fire sales and runs on funds under stressed market conditions.

Leverage is another important issue addressed by sectorial legislation in Europe. Indeed, UCITS are subject to strict rules on the extent to which they can use financial derivative instruments to increase their exposure. Under the AIFMD, there is no legal limit but managers must report this information to their NCAs. Moreover, the AIFMD foresees the possibility for NCAs and ESMA to limit the leverage employed by a manager. In particular, ESMA can advise NCAs to limit the use of leverage by a manager in their jurisdiction. If an NCA takes action contrary to ESMA's advice, ESMA can publish the fact that the authority is not compliant.

With respect to the network of linkages created by the re-use of collateral by investment funds, it should be noted that ESMA has already taken important steps. Indeed, in 2012, ESMA *issued guidelines on ETFs and other UCITS issues*[3] which put strict limits on the extent to which UCITS are able to reinvest cash collateral received in the context of repurchase transactions and over-the-counter financial derivative transactions.

A number of sectorial legislation in Europe give NCAs and ESMA the powers to intervene in the case of a threat to the stability of financial

3 https://www.esma.europa.eu/sites/default/files/library/2015/11/2012-832en_guidelines_on_etfs_and_other_ucits_issues.pdf

markets. For example, under Regulation (EU) No 600/2014 (hereafter referred to as "MiFIR") NCAs and ESMA will have the powers to prohibit or restrict in the EU a type of financial activity or practice that poses a threat to the stability of financial markets. These powers will become available to NCAs and ESMA on 3 January 2018. The other two ESAs, namely EBA and EIOPA, and their NCAs will have similar powers under MiFIR and Regulation No 1286/2014 (PRIIPs).

Finally, under Article 32 of its founding Regulation,[4] ESMA shall, in co-operation with the ESRB initiate and coordinate Union-wide assessments of the resilience of financial market participants to adverse market developments. It is on the basis of this mandate that, in 2016, ESMA carried out its first EU-wide stress test of central counterparties.[5]

The microprudential framework of market-based finance in Europe therefore already provides a comprehensive framework that can be leveraged upon for mitigating the systemic risk of this sector. Indeed, the majority of European sectorial legislation include tools that can be used to mitigate the systemic risk of market-based finance and in particular the asset management sector. However, we cannot be complacent with this situation and acknowledge that more needs to be done to ensure the stability of the market-based finance sector and in particular in terms of data analysis and supervisory convergence.

4| But more cooperation and some regulatory adjustments are still needed

4|1 Increasing supervisory convergence among National Competent Authorities

Most importantly, and as highlighted above, some sectorial legislation, such as MiFIR for product intervention or AIFMD for leverage, have empowered ESMA and NCAs to take actions against market participants when their activities pose a threat to the stability of financial markets. In this context, the capacity for NCAs and ESMA to use these powers in an effective and co-ordinated manner will be of paramount importance. With this challenge in mind, ESMA has decided to strengthen the collaboration between NCAs by developing an ambitious Supervisory Convergence Work Programme and enhance its co-ordinating role. For 2016, the ESMA work programme included, inter alia, exchanging information and experiences on supervisory actions in relation to liquidity management tools by asset managers and developing a common procedure for the operation of the powers to impose leverage limits under the AIFMD.

Also, when supervision is carried out at the national level, ESMA should continue to use its powers to conduct European-wide stress tests in collaboration with NCAs and the ESRB. In particular, a joint European approach to stress testing of asset managers must be further developed to assess the resilience of financial participants to adverse market developments. In this respect, work in collaboration with the ESRB has already started. The objectives and design of such stress tests need to fully take into account the specific characteristics of the asset management sector and the business model of investment funds.

4|2 Adjusting the regulatory framework where needed

As explained before, European sectorial legislation already address to a large extent the systemic nature of market-based finance. However, there are still some sectors or businesses that would require bespoke legislation because of their potential threat to the stability of financial markets.

In particular, the CMU action plan of the EC highlighted the potential merits in identifying the alternative sources of funding for the economy, and in this context explicitly mentioned loan originating funds as such source. Some Member States have already introduced a bespoke regime for loan

4 *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:331:0084:0119:FR:PDF*

5 *https://www.esma.europa.eu/sites/default/files/library/2016-658_ccp_stress_test_report_2015.pdf*

origination by funds in their national legal frameworks. Such national initiatives have however also led to difficulties in carrying out business on a cross-border basis. The EC noted that clarifying the treatment of loan originating funds in the regulatory framework across the EU could facilitate cross-border development while ensuring that they are regulated appropriately from an investor protection and financial stability perspective.

Leveraging on the action plan of the CMU, ESMA has already started work to develop what it considers to be the key elements of a common European framework for loan origination by investment funds and this work led to the publication of an Opinion in 2016.[6] The ESMA Opinion covers a number of elements of a common framework of this activity including organisational requirements, eligible investors and eligible debtors. The EC is now considering the next steps in light of ESMA's Opinion.

From a market infrastructures perspective, certain entities such as central counterparties have become systematically relevant. Mandatory central clearing is one of the most prominent responses in the EU to the financial crisis. However, challenges remain as the risk concentration within central counterparties has increased and defining an appropriate recovery and resolution framework for central counterparties is one of the main forthcoming regulatory challenges.

4|3 Strengthening the capacity of National Competent Authorities and ESMA to analyse market data

Finally, with all the regulations developed after the 2008 financial crisis, securities regulators benefit from the collection of unprecedented amounts of data that can be used for financial stability. The central concern in this context is the availability of market data and the capacity to analyse them adequately. Market data significantly improve the ability of ESMA and NCAs to understand the risks to financial stability, and important progress has been made in the EU since the crisis. For example, ESMA has developed an advanced system of risk indicators and metrics, both in terms of coverage (securities markets, investors, infrastructures) and sophistication, building on internal research and the latest quantitative techniques for assessing complex activities (including such issues as market liquidity, interconnectedness, and the systemic dimension of hedge funds). Also, in its semi-annual reports on Trends, Risks and Vulnerabilities, ESMA analyses key market developments in its remit, provides risk indicators and discusses topical issues relevant for financial stability, market integrity and investor protection. On a quarterly basis, the ESMA Risk Dashboard presents updates in key risk metrics and market developments.

However, the data quality still needs to be improved and some critical data gaps in the investment fund industry, especially for UCITS funds, must be filled. Adequate resourcing to enable these data collections and analyses is critical, and increasing the current resources, throughout the ESFS at both ESMA and national level, should be an important priority. Also, we are only at an early stage of understanding the complex channels of interaction between the banking sector and non-bank activities. The ad-hoc studies that ESMA has undertaken in cooperation with the ESRB on, for example, the credit-default swap market and its network structure, or securities financing transactions and the market for cash and non-cash collateral suggest that the transition from ad-hoc to on-going monitoring in matching these data will be a challenging task.

5| Conclusion

We should expect market-based finance to continue to increase in the future. Such a development could be an opportunity for economic growth because market-based finance could play an important role in the funding of the real economy. Indeed, the growth potential and need for capital markets in the EU is strong, and well documented. The Commission's

6 *https://www.esma.europa.eu/sites/default/files/library/2016-596_opinion_on_loan_origination.pdf*

Action Plan has real potential to unleash additional growth in the EU's capital markets. This growth will imply even greater involvement of non-bank participants and larger and more interconnected European capital markets. Ensuring their financial stability must therefore be a key element for making European capital markets stronger.

The challenges for policymakers and supervisors will be to maximise the potential benefits of market-based finance while minimising systemic risks, i.e. to help limit risks to financial stability and market integrity in market-based financing and make it support sustainable economic growth.

In this context, we believe that the expansion of the macroprudential framework beyond banking is appropriate and necessary. However, processes and instruments will need to be tailored to the specific risks and regulatory provisions in the relevant sectors. Indeed, unlike the banking sector, which is homogeneous in terms of entities, market-based finance includes a wide range of participants with different risk profiles. This means that a mechanistic transposition of macroprudential tools used in the banking field would not be the right approach to take.

Moreover, any new future prudential framework for market-based finance should leverage upon the number of microprudential tools that already exist in the sectorial legislation in Europe. Indeed, European legislation for market-based finance are already well equipped in terms of microprudential tools and one could say that, de facto, the expansion of the macroprudential framework has already started.

When putting in place a prudential framework for market-based finance in Europe, efforts should therefore be concentrated more on making the best use of already-available tools rather than designing new tools and legislation. Of course, there may be a need to adjust the regulatory framework for some activities such as loan-origination by funds for which no harmonised legislation exists in Europe. However, the priority should be to use more effectively all the tools that are available to regulators and supervisors.

In particular, ESMA and NCAs are in the best position to analyse and process the significant amount of market data that they receive. By improving their capacity to analyse market data, they will increase their capacity to understand the risks to financial stability. Also, we should enhance the supervisory convergence among NCAs to ensure that powers available to NCAs and ESMA are used in a consistent and co-ordinated fashion across Europe.

Finally, in order for a European macroprudential framework for market-based finance to be successful, it will need to consider the global environment in which European entities and market infrastructures operate. It is therefore essential that the proposed measures be made to converge, for example under the auspices of the FSB and IOSCO. Indeed, differences in the implementation of macroprudential instruments would potentially introduce a non-level playing field and open up the potential for regulatory arbitrage which might significantly reduce any positive impact on financial stability.

Macroprudential measures and capital controls: towards a framework for policy evaluation

Claudia BUCH
Vice-President
Deutsche Bundesbank

One decade after the onset of the global financial crisis, the stability of the global financial system remains a key concern to policymakers. The question as to what policies are actually effective and help to promote financial stability is at the heart of the current regulatory debate.

This article has two main goals. First, it discusses the channels through which capital controls and macroprudential policies affect the stability of financial markets. Cross-border capital flows may destabilise economic activity in particular if the domestic financial system is underdeveloped and institutions are weak. Similar frictions and weaknesses cause domestic imbalances to build up. Second, this contribution outlines how capital controls and macroprudential policies can contribute to a stabilising role of capital flows and mitigate financial contagion. A structured framework for the assessment of policies is needed. Such a framework can provide valuable insights into the effectiveness of macroprudential instruments, their relationship with capital controls, and potential side effects. One precondition for effective policy evaluation is the availability of sufficiently granular data on the activities of financial institutions and on the regulatory framework across countries.

On this basis, internationally coordinated policy analysis can significantly enhance our knowledge of the effects of financial stability policies.

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1 Background

One decade after the onset of the global financial crisis, the stability of the global financial system remains a key concern to policymakers. The financial crisis casts long shadows. In many regions, real economic activity remains suppressed and adverse effects on the labour market persist, reflecting the long-term consequences of the crisis. In addition, levels of both private and public debt remain elevated in many regions, testifying the difficulty of dealing with high levels of debt and transforming the financial system to reduce its reliance on debt finance (see Chart 1).

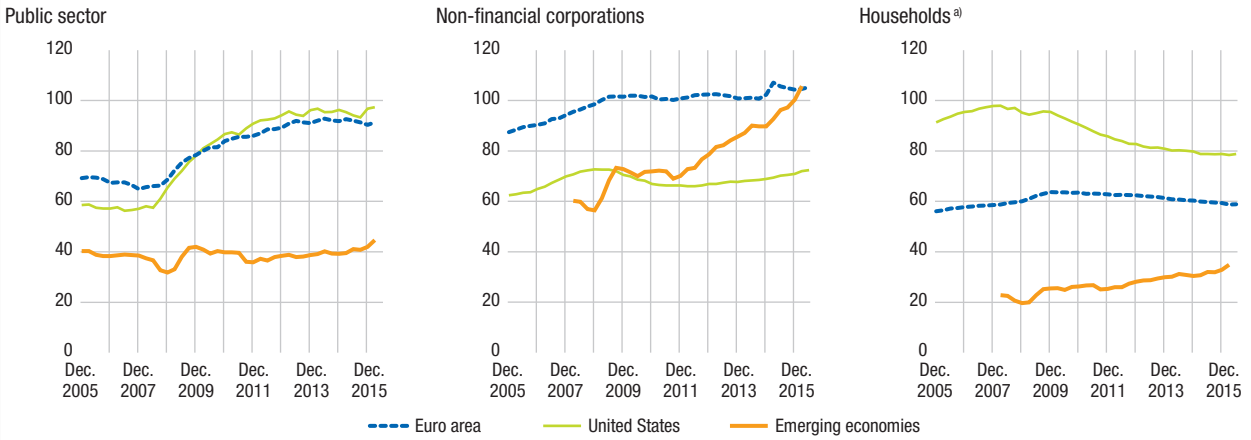
In response to the crisis, several reforms have been launched with the aim of increasing economic resilience and strengthening buffers against risks, as well as reducing distress in the financial sector. One key aspect of the reforms has been the explicit formulation of macroprudential policy as a separate policy area. Macroprudential policy aims at safeguarding the stability of the financial system as a whole. This distinguishes macroprudential policy from microprudential regulation, which aims at ensuring the stability of individual financial institutions. While micro- and macroprudential policy differ in their ultimate policy objectives, the two policies rely on similar instruments such as capital requirements.

In recent years, new policy institutions have been created that are responsible for macroprudential policies.[1] In Europe, the European Systemic Risk Board (ESRB) has the task of overseeing the financial system in the European Union (EU) as a whole and of identifying risks to financial stability. The ESRB can issue warnings, making such warnings public where appropriate, and make recommendations. In its supervisory function, the European Central bank (ECB) performs a surveillance function for risks to financial stability in the euro area and has asymmetric intervention rights in some areas. For instance, it might apply higher requirements for capital buffers than those applied by national authorities. Ultimately, however, the responsibility for macroprudential policies in Europe lies at the national level.

1 Internationally, countries have chosen different institutional arrangements to execute macroprudential powers (BIS-FSB-IMF, 2016).

C1 Public and private sector debt

(as a percentage of GDP)



Source: BIS, Bundesbank calculations.
Note: The chart shows the amount of public and private sector debt as a percentage of GDP for the euro area, the United States, and emerging economies. The household sector includes non-profit institutions serving households.
a) Including non-profit institutions serving households

When implementing macroprudential measures, financial linkages among economies have to be taken into account. For instance, cross-border bank flows might facilitate spillovers of macroprudential policies to other countries. In addition, macroprudential measures might interact with capital controls that aim to mitigate the adverse effects of destabilising capital flows.

National institutions and international organisations dealing with stability issues have to address a number of questions. One of them is how to deal with potentially destabilising capital flows using capital controls or macroprudential policy measures: under what conditions do cross-border capital flows destabilise economic activity? How can the risks associated with large and volatile capital flows be mitigated? What is the role played by capital controls and macroprudential policies? How effective are these instruments? And how can they be prevented from impairing the functioning of financial markets and market integration? To answer such questions, there is a need for a policy evaluation framework to assess the effectiveness of financial stability policies.

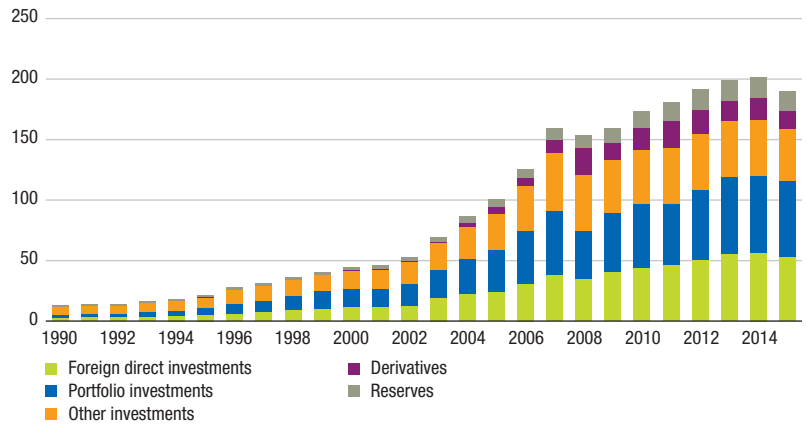
This paper has two main goals. First, it provides a brief overview of the objectives and effects of capital controls and macroprudential policies. Second, it outlines a structured approach towards analysing measures dealing with volatile and potentially destabilising capital flows. One crucial element of such a framework is the availability of sufficiently granular data. Benefits of international coordination can be exploited with respect to both data sharing and policy analysis.

2| Risks of global capital flows

The past decades witnessed a rapid increase in financial globalisation that was accompanied by a surge in global (gross) capital flows. Since 2012, the composition of international capital flows has shifted away from debt, i.e. bank credit and portfolio debt flows, towards equity, i.e. foreign direct investment (FDI) and portfolio equity flows (Bussière, Schmidt and Valla, 2016); nevertheless, aggregate levels of debt remain high. The stock of global crossborder assets increased from 13% of gross domestic product (GDP) in the early 1990s to 190% at the end of 2015 (see Chart 2).

C2 Global foreign assets [a)]

(in % of global GDP)



Source: IMF (BOP, WEO), Bundesbank calculations.
a) Overall 57 advanced and emerging market economies, if data available. Global GDP calculated from the sum of GDP of these 57 countries.
Note: The chart shows the volume of global foreign assets for 57 advanced and emerging economies (if data available) as a percentage of global GDP calculated from the sum of GDPs of these 57 countries.

Large capital flows raise the question of their risks and benefits. Capital flows can contribute to an efficient allocation of capital across countries, and they can facilitate consumption smoothing and risk sharing. But cross-border capital flows can also magnify existing distortions, contribute to the build-up of domestic imbalances, and they can be channels of propagation of shocks.

Under what conditions do cross-border capital flows do more harm than good? The traditional answer is that inconsistent macroeconomic policies and weak institutions are the main reasons why capital flows can become disruptive. Such disruptions may be more severe if capital flows are short-term rather than long-term or composed of debt rather than equity. Destabilising capital flows often mirror distortions in the domestic financial system – the same type of distortions that can lead to the amplification of shocks in the domestic financial system and that threaten financial stability.

One cause of the Asian financial crisis of the late 1990s, for example, were distortions in real estate markets triggered by mispriced deposit insurance systems (Marshall, 1998). Models explaining twin crises, i.e. the joint occurrence of banking and current account crises, focus on over-optimism on financial markets, misaligned exchange rates, and insufficient regulation (Kaminsky and Reinhart, 1999). Similar mechanisms have been at play during the global financial crisis. In an international context, misaligned exchange rates can add to the distortions at the domestic level (Engel, 2011). This suggests that analysing issues of financial stability and of global capital flows in an integrated model can yield relevant insights.

Recent literature has additionally stressed the importance of global factors as drivers of capital flows. If capital flows are driven by global factors, national policies might be insufficient to isolate countries against shocks in the short run. Yet in the longer run, national policies might play a role for the exposure of countries to these factors. Such global factors could be global monetary conditions, changes in risk aversion and uncertainty, or changes in commodity prices (Rey, 2015). Capital flows can then lead to excessive credit growth in good times or undue deleveraging in bad times. In a similar vein, a study by Eickmeier, Gambarcorta, and Hofmann (2014) points to a prominent role of global factors in liquidity conditions. According to this study, global liquidity conditions are mainly driven by global monetary conditions as well as global credit demand and supply.

3 Policies to deal with financial instability

The goal of macroprudential policy is to prevent financial crises, which have adverse impacts on the real economy. By contrast, capital controls have usually been used to preserve the independence of monetary policy or to mitigate an excessive appreciation of the exchange rate. Traditionally, the "division of labour" between prudential policies and capital controls has thus been fairly clear.

This view has been challenged more recently. Capital controls have been advocated to safeguard and strengthen financial stability if other policies are ineffective or have been exhausted (Ostry, Ghosh, Chamon, and Qureshi, 2012). The International Monetary Fund (IMF) has also taken a more balanced approach to capital flow management measures with its "Institutional View" (IMF, 2012, 2016).[2]

Both capital controls and macroprudential measures introduce new distortions. Therefore, any measure taken should be targeted, and country-specific circumstances need to be considered. Hence, capital controls have lost some of their stigma and are considered part of the toolbox that policymakers can use to mitigate risks associated with capital flows – including those to financial stability.

3.1 Capital controls

Capital controls aim at influencing financial transactions between residents and non-residents.

2 Capital flow management measures (CFM) comprise i) residency-based CFMs, i.e. traditional capital controls, and ii) other CFMs, i.e. (macro-) prudential policies that also aim at the limitation of capital flows but do not discriminate based on residency but, e.g., based on currency.

Typical measures include taxes on cross-border capital flows, non-compensated reserve requirements, or a complete ban of certain transactions. While capital controls prevailed in many developed market economies in the first half of the 20th century, they are still more widespread in emerging markets nowadays. Capital controls have traditionally been employed to mitigate exchange rate pressure and to preserve monetary policy independence.

Given their widespread use across countries and over time, many empirical studies have dealt with the effectiveness of capital controls. Overall, evidence on the effects of capital controls is still "surprisingly inconclusive" (Blanchard, Dell'Ariccia, and Mauro, 2013). Obstfeld (2009) summarises the empirical evidence on financial opening. He reports little evidence of direct positive effects of financial opening on economic welfare or growth of developing countries. There is also little evidence that financial opening promotes institutional reforms. Moreover, the frequency and severity of financial crises tends to increase when countries open up to capital flows. Klein (2012) finds little evidence to the effect that the imposition of capital controls affects financial variables, the real exchange rate, or GDP growth. By contrast, most studies surveyed by Magud, Reinhart and Rogoff (2011) find that capital inflow controls provide more room for an independent monetary policy. Aizenman and Binici (2015) document that capital controls can lower exchange rate pressure depending on the quality of institutions.

The empirical literature on the impact of capital controls and other capital flow management measures on financial stability is relatively young. Several recent studies find that capital controls can help to lower credit growth, curb bank leverage, and lead to a lower proportion of foreign currency loans in domestic bank lending (Forbes, Fratzscher, and Straub, 2015, Ostry, Ghosh, Chamon, and Qureshi, 2012, Zhang and Zoli, 2014).

Research on capital controls also shows that data are useful for empirical research that can inform policymakers. For instance, Forbes (2007) shows that effects of capital controls might be overlooked when using aggregate data. Her study of the effects of the Chilean capital controls based on firm-level evidence shows that the capital controls affected the funding conditions particularly for smaller firms that were financially constrained.

3|2 Macroprudential policies

The main goal of macroprudential policies is to mitigate systemic risk, i.e. the risk that seemingly small shocks propagate through the financial system and ultimately threaten the functioning of the real economy. Many macroprudential measures directly target the resilience of market participants by increasing capital buffers for systemically important financial institutions or by adjusting capital buffers over the financial cycle. But countries also use reserve requirements, taxes, and loan-to-value limits for macroprudential purposes, and thus instruments which resemble specific types of capital flow management measures.

In 2014, the IMF conducted a Global Survey of Macroprudential Policy Instruments covering 131 countries and 18 different types of instruments. The survey highlights the increased usage of macroprudential measures. Emerging market economies frequently introduced macroprudential instruments in response to a higher exposure to external shocks, including shocks triggered or magnified through volatile capital flows. But for advanced economies, too, macroprudential measures have become more widespread in recent years (Cerutti, Claessens, and Laeven, 2016). General macroprudential activity in the EU has increased further in the past few years (see Chart 3).

Evidence on macroprudential measures is less rich given their more limited and more recent use. First results indicate that macroprudential measures can help to strengthen financial stability (Claessens, Ghosh, and Mihet, 2014) and that macroprudential policies spill-over internationally into bank lending decisions (Buch and Goldberg, 2016).

Identifying the effectiveness of policy measures is greatly enhanced when using granular data that allow tracking heterogeneous responses. A recent initiative of the International Banking Research Network (IBRN) looking at the spillovers of macroprudential policy across borders can illustrate this point.[3] In this research initiative, 15 country teams examine domestic effects and international spillovers of prudential instruments using detailed confidential micro-banking data. Researchers from the Bank for International Settlements (BIS) and from the ECB provide cross-country perspectives. The advantage of this coordinated research is that micro-level data on exposures of individual banks can be used, thus making it possible to track heterogeneous responses of banks to shocks and regulations. The underlying datasets cannot be shared due to data confidentiality. However, as researchers apply a common research methodology, the IBRN's broadly relevant insights go well beyond the single-country case studies.

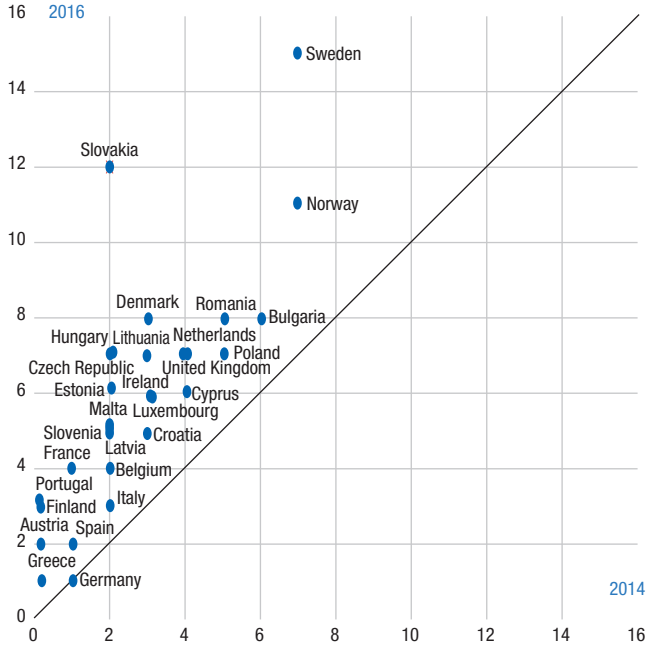
Overall, there is no channel or even direction of transmission that dominates spillovers. Spillovers can be positive or negative and differ across countries and banks. The studies' three main findings illustrate this. First, some countries observe that prudential instruments spill over internationally and through banks via lending growth. Second, bank balance sheet conditions and business models have a strong impact on the transmission of regulatory changes through lending. Heterogeneity in spillovers through lending is thus common. Stronger banks (i.e. better capitalised banks), for example, tend to be affected less by regulations and tend to increase their activities abroad by more. Third, the economic magnitudes of international spillovers of policy thus far have not been large on average, but they may increase as the macroprudential instruments are used more frequently.

4| Evaluating policy effectiveness

Establishing an effective policy framework that mitigates financial stability risks is challenging.

C3 General macroprudential activity in the European Union and Norway

(according to measures notified to and published by ESRB)



Source: ESRB, Bundesbank calculations

Note: The chart shows the total number of all macroprudential measures that (i) were notified by EU member states and Norway to the ESRB (including the reciprocation of macroprudential measures activated by other member states) and (ii) that became active until the end of 2014 or 2016, respectively.

Potential interactions between different policies have to be taken into account. Regulatory policies interact, and financial stability is affected by other macroeconomic and structural policies. In addition, the complexity of the regulatory environment and the potential time inconsistency of the implemented measure can impair the effectiveness of financial stability policies (Mendoza, 2016). Furthermore, there is the risk that policy measures may have unintended consequences. Activities might shift to less regulated sectors in response to regulatory changes, and policies that aim to reduce externalities might aggravate distortions elsewhere in the system. Finally, history tells us that capital controls often become ineffective over time and might serve to protect the interests of insiders.[4] Similar mechanisms can be at play when it comes to macroprudential policies.

3 For details, see Buch and Goldberg (2016) and Buch, Bussière and Goldberg (2016). In previous work, the IBRN has looked into the response of internationally active banks to liquidity shocks. Results of this research have been published in the *IMF Economic Review* in November 2015; results are summarised in Buch and Goldberg (2015).

4 See Rajan and Zingales (2003) for an analysis of the political economy of financial regulation and financial openness.

These risks cannot be eliminated, but strong institutions can serve to mitigate them. More specifically, a structured evaluation of policy is crucial to making the policy framework more effective, to assessing the effects of policies, and to safeguarding against unintended side effects. Such an evaluation needs to take into account that capital controls and macroprudential policies might differ with regard to their specific policy objectives and the types of instruments used. Yet, the underlying distortions in an economy or in the financial system that justify the use of these instruments are often very similar.

This suggests that elements of a framework for evaluating the effects of these policy measures are similar and that similar questions need to be addressed. How can countries insulate themselves from international spillovers of shocks through global capital flows? Should leakages of domestic policies be prevented and, if so, how? Are there trade-offs between micro- and macroprudential policies and capital controls? What might policy coordination and reciprocity achieve? Why, when, and how to use capital controls or macroprudential measures to mitigate excessive capital flow volatility? Should the measures be permanent or transitory? Incidentally, answering these questions will also require taking the political economy of different choices into account. In particular controls on capital inflows might, at first sight, be easier to implement because they affect non-residents, while the burden of macroprudential measures falls on domestic residents.

Answering these questions requires a structured framework, sufficient data of high quality, and international cooperation.

4|1 Defining a framework for policy evaluation

How should countries decide what measures to use and under what circumstances? An answer to this question must start by identifying the underlying distortion that any such policy measures should address and thus the definition of the policy goal. Policy goals such as "increased resilience", "increased monetary policy independence", or "reduced contagion" cannot be observed directly. Indicators are needed that signal the policy stance and the appropriate timing of a potential activation of instruments. Activation of regulatory instruments should, in turn, be preceded by an appropriate calibration which takes effects and side effects of policy measures into account.

4|2 Ensure availability and consistency of data

Policy evaluation requires appropriate data both on the activities of financial institutions affected and on the relevant policy measures. Such data need to be available early on in order to guide the ex ante calibration of instruments and to enable an effective ex post impact assessment. For instance, causal impact assessments are possible only if information on the behaviour of an appropriately selected "control group" of economic agents is available. This needs to be borne in mind, also when designing potentially new data templates for data collection efforts.

Global institutions have a role to play in defining data standards. The G20 Data Gaps Initiative, for example, has been instrumental in closing knowledge gaps, defining standards, and promoting data sharing and accessibility. In addition, the collection and provision of information on prudential regulations is the cornerstone of any evaluation effort. In this regard, further efforts should be made to integrate existing data sources on regulations and to track both macroprudential measures and capital controls. Some of these measures are very similar, and transparency has to be ensured. Also, policymakers need to make sure that data are available to external researchers (to the extent possible without violating data confidentiality arrangements) in order to enhance knowledge, challenge findings, and improve upon methodology.

Experience tells us that evaluating the effects (and potential side effects) of both types of policy requires use of granular data in order to detect the channels

of transmission of policy measures. Even though policymakers might ultimately be interested in the macroeconomic (or aggregate) effects of their policies, the data need to be sufficiently granular in order to look at the microeconomic impact of specific measures and assess aggregate responses on this basis.

4|3 Exploiting the benefits of international cooperation

Evaluations are costly. They require investment in data, analytical infrastructures, and, not least, people. Often lacking information on foreign markets, individual countries cannot analyse and exploit the full implications of being integrated in global financial markets. Assessing spillovers across markets, which requires disaggregated data, might not be feasible in a single jurisdiction if, for example, data confidentiality issues are binding constraints. Therefore, efforts should be made to relax those constraints, such as the recent G20 initiative for data sharing. A recent survey conducted by the Irving Fisher Committee (IFC) among its 85 member central banks has shown that central banks view external and internal sharing of micro data as an important or even very important issue (IFC, 2016). In parallel, routines have to be developed that help operating within the existing constraints. The example of the International Banking Research Network and similar institutional arrangements show how synergies in analytical work across institutions can be useful for day-to-day policy making.

Ultimately, a structured process of policy evaluation can contribute to answering the question whether policy responses to the financial crisis have been appropriate. The history of capital controls is also a history of frustrated efforts towards fine-tuning policies and leaning against the wind to mitigate distortions in financial markets. Curing the symptoms rather than addressing the causes of such distortions has often contributed to aggravating problems rather than solving them. At the current juncture, targeted macroprudential policies need to address the ultimate causes of financial crises. At the same time, however, many macroprudential policy measures are rather complex and raise issues of implementation and monitoring in their own right. Hence, a careful evaluation of reforms might result in efforts to reduce the complexity of the regulatory framework and opt for higher capital buffers in the financial system to increase its overall resilience in a world characterised by heightened uncertainty.

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Editor
Banque de France
39, rue Croix des Petits-Champs – 75001 Paris

Publishing Director
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Executive Editor
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Production
Press and Communication Department

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