

# Economics without Borders

Economic Research for European Policy Challenges

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## Chapter 11

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# Contents

<b>11 Financial Regulation in Europe: Foundations and Challenges</b>	<b>Thorsten Beck, Elena Carletti and Itay Goldstein</b>	<i>page</i> 4
11.1	Introduction	4
11.2	Recent Financial Reforms in Europe	6
11.2.1	Capital Requirements	7
11.2.2	Liquidity Requirements	8
11.2.3	Resolution Framework and Bail-in Instruments	9
11.2.4	Banking Union	10
11.2.5	Activity Restrictions and Other Reforms	12
11.3	Microfoundations for Financial Reforms	13
11.3.1	Basic Failures in the Financial System	13
11.3.2	Mapping between Basic Failures and the Reforms Enacted in Europe	22
11.4	Moving Beyond Banks and Traditional Activities: the Regulatory Perimeter	27
11.4.1	The Regulatory Perimeter	27
11.4.2	Financial Innovation	30
11.4.3	Complexity	33
11.5	Special Issues in Europe and How they Affect Future Regulation	34
11.5.1	Crisis Resolution and Macro-management in a Monetary Union	34
11.5.2	Financial Structure: Does Europe Suffer from a Bank Bias?	35
11.6	Summary, Policy Lessons and Directions for Future Research	37
	<i>Index</i>	45

# 11

## Financial Regulation in Europe: Foundations and Challenges

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### Abstract

This chapter discusses recent regulatory reforms and relates them to different market failures in banking, based on the recent theoretical and empirical literature with focus on insights from the recent crisis. We also provide a broader discussion of challenges in financial sector regulation, related to the regulatory perimeter and financial innovation as tools financial market participants use to evade tighter regulatory frameworks. We argue for a dynamic view of regulation that takes into account the changing nature of risk-taking activities and regulatory arbitrage efforts. We also stress the need for a balanced approach between complex and simple tools, a strong focus on systemic in addition to idiosyncratic regulation, and a stronger emphasis on the resolution phase of financial regulation.

### 11.1 Introduction

The recent crisis has given impetus not only to an intensive regulatory reform debate, but also to a deeper discussion on the role of financial systems in modern market economies and the role of financial innovation. While the pre-crisis consensus on the financial system had been that finance serves as the engine for modern market economies, this has been questioned since the recent crisis experience. The fragility risks of finance have claimed a much more important space in the public debate than before the crisis. The pendulum has swung from focus on self-regulation and reliance on market forces to a debate on reducing implicit subsidies and the range of permissible activities for banks.

Historically, the banking system has been one of the most regulated sectors in the

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economy. As we will discuss further below, this is due to market failures resulting in the external costs of the failure of a specific bank for the rest of the financial system and the real economy. Regulation thus has the task of minimizing the risk of bank failure and its negative effects. On the other hand, there are concerns of overregulation imposing unnecessary costs on financial service providers, reducing their efficiency and ultimately undermining economic growth. The right balance of reducing fragility and maximizing the efficiency of financial intermediation has been thus at the core of regulatory debates over the past decades, with observers pointing to regulatory super-cycles. Regulatory regimes are often tightened after major crises, with heavy emphasis on restrictions and regulatory oversight and then relaxed over time, with more emphasis on market forces and self-regulation.

The recent crises have raised doubts not only about the right regulatory balance, but more generally, about the nature of bank regulation. The experience over the past few years has shown that focusing on the stability of individual financial institutions is insufficient to understand the fragility of the overall financial system. The recent credit boom-bust cycle has also shed doubt on the separation of monetary and prudential policy, a founding principle of inflation targeting. The recent fragility and taxpayer support for many financial institutions has raised questions about the activities regulated banks should be permitted to undertake and about a financial safety net that minimises bail-out risks for taxpayers across the globe. Finally, the global nature of the recent crises has underlined the need for better cooperation mechanisms between regulators, and pointing to the need to match the geographic footprint of individual financial institutions with a corresponding regulatory perimeter. These new debates have partly arisen from the crisis experience, but partly also from underlying changes in the nature of financial intermediation over the past decade: more market-based, more interconnected, more global.

The recent crises have consequently led to an array of regulatory reform efforts, on the national, European and global level, ranging from tighter capital requirements over activity restrictions to new bank resolution frameworks. Beyond these individual reforms, however, there looms a larger challenge: how to construct a regulatory system which is safe to regulatory arbitrage. Regulatory reforms following crises often aim at preventing the last crisis, closing loopholes and addressing sources of fragility that caused that particular crisis. Ample experience, however, has shown that new regulation leads to evasion efforts by financial market participants and shifting of risky activities outside the regulatory perimeter. This feedback loop and catch-up process of regulators raises the more fundamental question of how regulation can adapt to the dynamic nature of the financial system.

On a more general level, behind the debate on the optimal degree of regulation is the growth-fragility trade-off in the financial system. On the one hand, providing liquidity transformation, creating private information and operating in payment

systems make banks and markets critical for modern economies and economic growth. On the other hand, the same activities make banks and other institutions fragile, as they force a high degree of interconnectedness and create substantial externalities from the failure of an individual institutions. Importantly, this suggests that the growth benefits are not obtainable without a certain degree of fragility and risk-taking in the financial system. Thus, the focus should be more on the optimal degree of risk-taking and – what is more feasible – on minimising the repercussions of bank failure for the overall financial system and the real economy. Critically, financial stability is not an objective in itself, but rather a condition for the sustainability of an efficient and market-supporting financial system.

The remainder of the paper is structured as follows. The next section presents the different regulatory reforms enacted and planned in Europe after the recent crises. Section 11.3 discusses the market failures in banking as micro-foundation for bank regulation and maps them to the regulatory reforms presented in Section 11.2. Section 11.4 focuses on the regulatory perimeter and efforts by regulated financial intermediaries to use financial innovation to move risky activities outside this perimeter. Section 11.5 discusses regulatory challenges specific to Europe, including the overreliance on banks, challenges related to the banking union and the governance structure more generally. Section 11.6 draws policy conclusions from our analysis and concludes by looking forward to new research challenges.

Before proceeding, we would like to point to a couple of areas that we are unable to cover in this survey, given space constraints. One such area is compliance risk, which has featured prominently in recent years with high penalty payments either being imposed by regulators or negotiated between regulators and banks. Another area is that of corporate and regulatory governance. While we will refer to the new supervisory architecture in Europe in the context of the discussion on the banking union, we will be unable to go in depth into this. Similarly, the issue of taxation will not be covered in depth. Another area is that of the relationship between competition and stability, where ambiguous theoretical predictions have given rise to a large number of empirical studies. Finally, we will focus primarily on the banking system, where regulation has traditionally been centered, but we will discuss the need for and challenges in expanding the regulatory perimeter.

## **11.2 Recent Financial Reforms in Europe**

The main financial reforms introduced after the 2007 Global Financial Crisis are contained in the new Basel III regulatory standards. The new accord introduces a stricter definition of capital, a higher quality and quantity of capital, two dynamic capital buffers, a minimum leverage ratio, and two minimum liquidity ratios. The

Basel III accord is implemented in Europe through the Capital Requirement Directive IV (CRD IV), whose objective is to create a level playing field across countries. The package contains a directive and a regulation. Key aspects of the Basel III accord such as the new definition of capital and the liquidity requirements are included in the regulation and will thus be directly applicable in the Member States. Others such as capital buffers, enhanced governance and other rules governing access to deposit-taking activities are included in the directive and will therefore need to be transposed into national laws with the usual discretion left to the national regulators to implement more stringent rules (Department for International Development (2013)).

Other important reforms in Europe concern the new rules for the resolution of banks and the creation of the Banking Union.

We will discuss each area of regulatory reform in turn. Specifically, we will present regulatory reforms of (i) capital requirements, (ii) liquidity requirements, (iii) bank resolution reforms, including bail-in rules, (iv) banking union and (v) activity restrictions. As we will point out, one theme throughout these reforms is a stronger focus on systemic rather than idiosyncratic bank risk.

### ***11.2.1 Capital Requirements***

As in the Basel III standards, the CRD IV leaves the minimum capital requirements unchanged at 8 per cent of risk-weighted assets (to which the capital buffers have to be added) but, as in the international accord, it requires banks to increase the Common Equity Tier 1 (CET 1) from the current 2 per cent to 4.5 per cent of risk-weighted assets. The regulation defines CET 1 instruments using 14 criteria similar to those in Basel III and mandates the European Banking Authority to monitor the capital instruments issued by the financial institutions. Banks are also required to maintain a non-risk-based leverage ratio that includes off-balance sheet exposures as a way to contain the risk-based capital requirement as well as the build-up of leverage.

To address the problems related to systemic risk and interconnectedness, the CRD IV also introduces size restrictions in line with the prescriptions of the Basel Committee and the Financial Stability Board. In particular, it prescribes mandatory capital buffers for global systemically important institutions (G-SIIs) and voluntary buffers for other EU or systemically important domestic institutions. G-SIIs will be divided in five sub-categories, depending on their systemic importance. A progressive additional CET 1 capital requirement, ranging from 1 per cent to 2.5 per cent, will be applied to the first four groups, while a buffer of 3.5 per cent will be applied to the highest sub-category. Each Member State will maintain flexibility concerning the stricter requirements to impose on systemically important domes-

tic institutions (D-SIIs). This means that the decision on the supplementary capital requirements for larger institutions will be left to the discretion of the respective supervisors, with potential distortions in terms of the level playing field.

Further, the CRD IV package contains a capital conservation buffer in the form of an additional common equity for 2.5 per cent of risk-weighted assets, as well as of a countercyclical buffer requiring a further range of 0-2.5 per cent of common equity when authorities judge that credit growth may lead to an excessive build-up of systemic risk. Banks that do not maintain the conservation buffer will face restrictions on dividend payouts, share buybacks and bonuses.

Member States have some flexibility in relation to the above mentioned capital buffers and also with respect to macroprudential tools such as the level of own funds, liquidity and large exposure requirements, the capital conservation buffer, public disclosure requirements, risk weights for targeting asset bubbles in property bubbles, etc. For these tools Member States have the possibility, for up to two years (extendable), to impose stricter macroprudential requirements for domestic institutions that pose an increased risk to financial stability. The Council can however reject, by qualified majority, stricter national measures proposed by a Member State.

Note also that the CRD IV leaves the possibility for European banks to have zero risk weight for all sovereign debt issued in domestic currency (Hay (2013)), while it assigns capital requirements depending on the risk of the sovereign for non-euro denominated bonds. This is the same situation as in the US currently, where Basel I, under which the sovereign debt of developed countries enjoys zero-risk weighting, still holds. Discussions are ongoing at the moment as to whether to change the favorable prudential treatment of European sovereign bonds following, in particular, the recent ESRB report (ESRB (2014)).

In summary, tighter capital requirements aim both for higher quantity and higher quality of capital. However, they also complement the originally purely microprudential approach with a macroprudential approach, both related to the cross-sectional dimension (SIFIs) and to the time-series dimension (capital buffers) of systemic risk.

### ***11.2.2 Liquidity Requirements***

In addition to changes in the capital requirements, the CRD IV package also introduces global liquidity standards. Following again the Basel accords, two ratios are envisaged: a Liquidity Coverage Ratio (LCR) to withstand a stressed funding scenario and a Net Stable Funding Ratio (NSFR) to address liquidity mismatches. The LCR is a measure of an institution's ability to withstand a severe liquidity freeze that lasts at least 30 days. Liabilities are categorised in terms of the degree of diffi-

culty in rolling them over. Each category is assigned a percentage representing the portion of the liability that remains a source of funding during the next 30 days or is replaced by funds in the same category. Assets are also sorted into categories with each category being assigned a percentage haircut representing the loss that would be incurred if the asset were to be sold in the middle of a severe financial crisis. The LCR is defined as the ratio of High Quality Liquid Assets (HQLA) to total net cash outflows over the next 30 calendar days and should exceed 100 percent so that the financial institution can survive at least 30 days.

By contrast, the NSFR is designed to reveal risks that arise from significant maturity mismatches between assets and liabilities and takes therefore a longer-term approach. It is the ratio of the available amount of stable funding to the required amount of stable funding over a one-year horizon. Stable funding includes customer deposits, long-term wholesale funding, and equity. The required amount of stable funding is calculated by weighting assets (longer-term assets receive higher weights but assets which mature within one year do not necessarily receive a zero weight). Again, the idea is that the ratio exceeds 100%.

The liquidity requirements are to be introduced over an extended period of time and the exact implementation and thus effectiveness will be a function of the classification of different funding sources.

### ***11.2.3 Resolution Framework and Bail-in Instruments***

During the Global Financial Crisis, the lack of effective bank resolution frameworks was one major impediment to effectively intervening into failing financial institutions, which left most countries with the option to either bail-out or close and liquidate banks through the corporate insolvency process. Many countries have therefore introduced or reformed their bank resolution frameworks in recent years. While there are important differences across different jurisdictions in Europe, consistent with different legal traditions and institutional arrangements of the financial safety net, the Bank Recovery and Resolution Directive (BRRD) sets minimum standards, with the objective of creating consistency across borders within the European Union. These include recovery and resolution plans to be drawn up by national resolution authorities, providing authorities with a set of early intervention powers and resolution mechanisms, including the power to sell or merge the business with another bank, to set up a temporary bridge bank to operate critical functions, to separate good assets from bad ones and to convert to shares or write down the debt of failing banks. The directive also foresees the establishment of national resolution funds, to be financed by bank contributions to cover up to 5% additional losses beyond the capital buffers of failing banks.

One important dimension of the post-crisis bank resolution reforms has been the

move from bail-out to bail-in. After the crisis, politicians pledged to ‘never’ have tax payers have to pay for bank losses again, and bail-in regimes are therefore being introduced as an additional buffer to off-set losses in worst-case scenarios. The directive therefore foresees bail-in of an additional 8% of liabilities to be converted to equity capital in case equity funding is exhausted.

In the discussion of the additional loss absorption capacity to enable such a bail-in, two concepts have to be distinguished. Specifically, the total loss absorbing capacity (TLAC) for 30 G-SIBs, as recommended by the Financial Stability Board (FSB) and the minimum requirement of own funds and eligible liabilities (MREL) for all EU banks in line with the Bank Recovery and Resolution Directive (BRRD) requirements for all EU banks and investment firms, and set by resolution authorities. In addition to own funds, this can include the needed recapitalization amount according to a resolution plan plus an estimate of possible losses to the deposit insurance fund if the bank were to be liquidated.

The TLAC is part of the pillar 1 requirements of Basel III and is defined in terms of RWA and leverage. Specifically, the proposed minimum TLAC requirements for G-SIBs is 16% to 20% of a group’s consolidated risk-weighted assets. The TLAC should consist of instruments that can be written down or converted into equity in case of resolution, including capital instruments (Common Equity Tier 1 (CET1), Additional Tier 1 (AdT1) and Tier 2 (T2)), and long-term unsecured debt. It is to be applied starting in 2019. The MREL is defined relative to total liabilities and own funds and starts in 2016 with a four year transition period. The exact amount of the MREL is to be determined by the relevant resolution authorities.

#### **11.2.4 Banking Union**

One major financial reform in Europe concerns the creation of a banking union. This comprises a single supervisory mechanism (SSM), a Single Resolution Mechanism, a Single Rulebook and a harmonised (but, importantly, still decentralised) deposit insurance scheme. The rationales for a banking union are various: (i) break the adverse feedback loop between sovereigns and the financial system; (ii) act as a pre-condition for bank recapitalization through the European Stability Mechanism (ESM); (iii) create more distance between banks and regulators, thus preventing forbearance and regulatory capture; and (iv) improve the effectiveness of supervision through the implementation of a ‘*single rulebook*’.

The SSM, which is hosted by the European Central Bank (ECB), started its functioning on November 4, 2014. In brief, the SSM is now the supervisor of all banks operating in the Euro area. It supervises directly the 133 largest banks, accounting for approximately 85% of the assets of the banks operating in the Euro-area, and, indirectly, the other remaining banks. Banks in other European Member

States may voluntarily decide to be supervised by the SSM. Moreover, the SSM should conclude Memorandums of Understanding with national authorities of non-participating Member States to set the general terms of cooperation.

The SSM operates as any other normal supervisor in that it is empowered with the supervisory tasks that can ensure the coherent and effective implementation of the prudential supervision of credit institutions, in particular concerning the application of the single rulebook for financial services. For example, the ECB has the power: to grant and withdraw banks' license authorizations, although in compliance with national laws and subject to specific arrangements reflecting the role of national authorities; assess the suitability of the purchase of significant stakes in credit institutions; monitor and enforce compliance with capital regulation rules, limits to the size of exposures to individual counterparties and disclosure requirements on a credit institution's financial situation; require credit institutions to dispose of sufficient liquid assets to withstand situations of market stress; and limit leverage.

Other measures like additional capital buffers, including a capital conservation buffer, a countercyclical capital buffer and global and other systemic institution buffers and other measures aimed at addressing systemic or macroprudential risk remain under the control of national authorities. The SSM can request stricter requirements and more stringent measures than the ones proposed by the national authorities. These rules apply only for the macroprudential tools for which there is a legal basis, which implies that at the moment all the instruments that are not included in the CRD IV package such as loan-to-value ratios, *i.e.*, the ratio of a loan to the value of an asset purchased, remain with the national authorities, without the ECB having any possibility to intervene. This can turn out to be an important shortcoming, which we will discuss in more detail.

The SSM retains powers to ensure that credit institutions have proper internal governance arrangements, and if necessary, impose specific additional own funds, liquidity and disclosure requirements to guarantee adequate internal capital. Moreover, the SSM has the tasks and the power to intervene at an early stage in troubled credit institutions in order to preserve financial stability. This should, however, not include resolution powers. Other tasks like consumer protection or supervision of payments services remain with national authorities.

Specific governance structures have been put in place to maintain full separation and avoid conflicts of interest between the exercise of monetary policy and supervisory tasks within the ECB. In particular, the SSM's Supervisory Board plans and carries out the SSM's supervisory tasks and proposes draft decisions for adoption by the ECB's Governing Council. Decisions are deemed adopted if the Governing Council does not object within a defined period of time that may not exceed ten working days. The Governing Council may adopt or object to draft decisions but

cannot change them. A Mediation Panel has been created to resolve differences of views expressed by the NCAs concerned regarding an objection by the Governing Council to a draft decision of the Supervisory Board.

The second pillar of the banking union concerns the Single Resolution Mechanism (SRM). The objective is to manage resolution efficiently with minimal costs to taxpayers and the real economy. As for the SSM, the SRM applies to all banks in the Euro Area and other Member States that opt to participate within the SRM, the Single Resolution Board (SRB) and the Single Resolution Fund (SRF). The former, which started to operate on 1 January 2015 but will be fully operational from January 2016, is the European resolution authority for the Banking Union. It works in close cooperation with the national resolution authorities of participating Member States in order to ensure an orderly resolution of failing banks according to the rules contained in the Bank Recovery and Resolution Directive (BRRD). These include harmonised rules concerning acquisitions by the private sector, creation of a bridge bank, separation of clean and toxic assets and bail-in creditors.<sup>1</sup>

The SRB is in charge of the SRF, a pool of money constituted from contributions by all banks in the participating Member States. The SRF has a target level of € 55 billion (approximately 1% of all banks' assets of participating Member States) but has the possibility to borrow from the markets based on Board decisions. It will reach the target level over 8 years.

The resolution process is quite complicated and includes various institutions. The decision to resolve a bank will in most cases start with the ECB notifying the Board, the Commission, and the relevant national resolution authorities that a bank is failing. The Board will then adopt a resolution scheme including the relevant resolution tools and any use of the Fund. Before the Board adopts its decision, the Commission has to assess its compliance with state aid rules and can endorse or object to the resolution scheme. In case of disagreement between the Commission and the SRB, the Council will also be called to intervene. The approved resolution scheme will then be implemented by the national resolution authorities, in accordance with national law including relevant provisions transposing the Bank Recovery and Resolution Directive.

### ***11.2.5 Activity Restrictions and Other Reforms***

Another important set of reforms or proposals for reforms includes activity, size and bonus restrictions. For the sake of brevity, we describe them very briefly here and refer to Allen et al. (2013) for a more detailed discussion. The enactment and

<sup>1</sup> There has been an intense debate on the coordination between the provisions concerning bail-in in the BRRD directive and those contained in the new state aid regulation. On this matter, see Kerle (2014) and Micossi et al. (2014).

implementation of these reforms has proceeded at a much slower pace than the reforms described above.

The proposals on activity restrictions in Europe are contained in two reports, the Vickers report in the UK and the Liikanen report in Europe. Both the Vickers proposal and the Liikanen proposal aim at making banking groups safer and less connected to trading activities so as to reduce the burden on taxpayers. However, the two approaches present significant differences. The Vickers approach suggests ring-fencing essential banking activities that may need government support in the event of a crisis. In contrast, the Liikanen approach suggests isolating in a separate subsidiary those activities that will not receive government support in the event of a crisis but will rather be bailed-in. Moreover, the two proposals differ in terms of what activities have to be separated/ring-fenced. For example, deposits from and loans to large corporations have to be given permission not to be ring-fenced according to the Vickers approach, while they do not have to be separated according to the Liikanen approach. Also, trading activities need to be separated under the Liikanen approach only if they amount to a significant share of a bank's business, while they are never permitted within the ring-fence in the Vickers approach.

While ring-fencing is being implemented in the UK, to date no structural reforms have been formally introduced in Europe. Following the Liikanen report, in January 2014 the Commission put forth a proposal for a regulation on structural reforms but this has not yet been approved. Some individual countries, on the other hand, have been moving ahead with their national approaches, including the UK.

A final area of reforms has been financial sector taxation, though not much progress has been made. Based on the observation that taxation of the financial system is lower than its contribution to the economy and the idea that taxation can influence risk-taking behavior as well as volatility in financial markets, additional taxes such as financial transaction taxes have been proposed. Political resistance from several large players in the European Union, most prominently the UK, however, has so far prevented such plans from moving forward. Finally, there has been an array of regulatory reforms in the non-bank sector, which we will not discuss here (see Allen et al. (2013)).

## **11.3 Microfoundations for Financial Reforms**

### ***11.3.1 Basic Failures in the Financial System***

Financial regulation is designed to address market failures in the financial system. We now review the different failures that have been proposed by the literature and then link them to the financial reforms enacted in Europe to assess the microfoun-

dations behind these reforms. We discuss three types of failures that have been widely discussed and studied:

1. Coordination problems and panics
2. Moral hazard and incentives
3. Interbank connections and contagion

### *Coordination Problems and Panics*

Banking crises have been observed for many years in many countries. One of their typical features is the massive withdrawal of deposits by depositors, often referred to as bank run. A leading view in the academic literature is that runs are driven by panics or self-fulfilling beliefs. The formal analysis goes back to Bryant (1980) and Diamond and Dybvig (1983).

In these models, agents have uncertain needs for consumption in an environment in which long-term investments are costly to liquidate. Banks provide useful liquidity services to agents by offering demand deposit contracts. But these contracts lead to multiple equilibria. If depositors believe that other depositors will withdraw, then all agents find it rational to redeem their claims and a panic occurs. Another equilibrium exists where everybody believes no panic will occur and agents withdraw their funds according to their consumption needs. In this case, their demand can be met without a costly liquidation of assets.

Banking panics are inefficient. Hence, a common theme behind government intervention in the financial system is to prevent panics and help agents coordinate towards an efficient equilibrium. Going back to Diamond and Dybvig (1983), various tools have been considered in the literature for this purpose, with deposit insurance being perhaps the main one. One issue, however, is that the traditional theory is silent on which of the two equilibria will be selected in what circumstances. Hence, policy analysis that addresses costs and benefits of different tools becomes hard to conduct given that the exact benefits of policies in terms of reducing the likelihood of crises are hard to assess.

Challenging the panic-based approach to bank runs, a second set of theories has emerged, proposing that crises are a natural outgrowth of the business cycle. An economic downturn will reduce the value of bank assets, raising the possibility that banks will be unable to meet their commitments. If depositors receive information about an impending downturn in the cycle, they will anticipate financial difficulties in the banking sector and try to withdraw their funds, as argued by Chari and Jagannathan (1988) and Jacklin and Bhattacharya (1988). This attempt will precipitate the crisis. According to this interpretation, crises are not random events but depositors' response to the arrival of sufficiently negative information on the unfolding economic circumstances.

One strand of the business cycle explanation of crises stresses the role of information-induced runs as a form of market discipline. In particular, Calomiris and Kahn (1991) and Diamond and Rajan (2001) suggest that the threat of bank liquidation induced by depositors' runs can prevent the banker from diverting resources for personal use or can ensure that loans are repaid. In this view, not only may run crises prevent the continuation of inefficient banks, but may also help provide bankers better incentives, thus inducing better investment choices and better equilibrium allocations.

The global-games literature offers a reconciliation of the panic-based and fundamental-based approaches to bank runs. This literature goes back to Carlsson and van Damme (1993), who show that the introduction of slightly noisy information to agents in a model of strategic complementarities and self-fulfilling beliefs can generate a unique equilibrium, whereby the fundamentals uniquely determine whether a crisis will occur or not. Goldstein and Pauzner (2005) take the global-games approach to a bank-run setting. First, they show how the fundamentals of the bank uniquely determine whether a crisis will occur in a model that matches the payoff structure of a bank-run model, which is quite different from other global-games models. They also link the probability of a crisis to the banking contract, showing that a crisis becomes more likely when the bank offers greater liquidity. The bank then takes this into account, reducing the amount of liquidity offered, so that the cost of runs is balanced against the benefit from liquidity and risk sharing.

This approach is thus consistent with the panic-based and fundamental-based views. Here, crises occur because of self-fulfilling beliefs, that is, agents run just because they think that others are going to run. But, the fundamentals uniquely determine agents' expectations and thus the occurrence of a run. Thus, the approach is consistent with empirical evidence pointing to the element of panic and to those pointing to the link to fundamentals. In the first line of work, analyzing the period 1867–1960, Friedman and Schwartz (1963) argued that the crises that occurred then were panic-based. In the second line of work, Gorton (1988) shows that in the US in the late nineteenth and early twentieth centuries, a leading economic indicator based on the liabilities of failed businesses could accurately predict the occurrence of banking crises. Goldstein (2012) surveys the differences between panic-based and fundamentals-based approaches and the ways of testing the hypotheses in the data.<sup>2</sup>

The global-games approach also lends itself to more extensive policy analysis, whereby a policy tool, such as deposit insurance, can be evaluated taking into consideration costs (*e.g.*, creating a moral hazard for the bank and/or having to pay the

<sup>2</sup> Other related surveys on the origins of financial crises are provided by Bhattacharya and Thakor (1993), Gorton and Winton (2003), Allen and Gale (2007) (Chapter 3), Freixas and Rochet (2008), Rochet (2008), Allen et al. (2009a) and Degryse et al. (2009).

bank in case of failure) and benefits (*e.g.*, reducing the probability of runs). In a recent paper, Allen et al. (2014) use the global-games framework exactly for this purpose.

A final important remark is due here. Some argue that modern banking systems have increased in complexity over the last two decades; thus the literature *à la* Diamond and Dybvig, with its focus on bank runs by retail depositors, is no longer applicable to today's financial institutions. We argue that this is not the case. Despite running off-balance sheet vehicles or using various financial instruments to transfer credit risk, banks have remained as sensitive to panics and runs as they were at the beginning of the previous century. As Gorton (2008) points out, in the summer of 2007 holders of short-term liabilities refused to fund banks, expecting losses on subprime and subprime-related securities. As in the classic panics of the 19th and early 20th century, there were effectively runs on banks. The difference is that modern runs typically involve the drying up of liquidity in the short term capital markets (a wholesale run) instead of or in addition to depositor withdrawals. This also implies a much stronger interplay between financial institutions and financial markets in modern financial systems, as we shall stress later in the paper. In summary, problems of runs and panics, and ways of reducing their likelihood are important, as is the challenge of the regulatory perimeter, as funding and thus sources of contagion can easily move outside the traditional banking system. The changing nature of bank runs also reflects the dynamic and rapidly changing nature of financial systems.

#### *Moral Hazard and Incentives*

The put-option character of banking provides incentives to bank owners to take aggressive risk (see, for example, the discussion in Carletti (2008)). Specifically, bank owners participate only in the upside of their risk decisions, while their losses are limited to their paid-in capital. This moral hazard problem is exacerbated by guarantees provided by governments targeted at avoiding the coordination problems and panics discussed above, which in turn might encourage bad behavior and excessive risk taking. Knowing that the government is concerned about panics (described above) and/or contagion (described below), and will take steps to make sure that banks do not fail, banks might internalise less the consequences of their risk taking, and so bring the system to a more fragile state. Hence, governments typically have to supplement any guarantees policy with restrictions on bank policies to curtail any incentive for excessive risk taking. Such restrictions include, for example, imposing capital requirements on banks, reducing their risk taking incentives. Another important restriction to excessive risk-taking would be to allow banks to fail, thus forcing risk takers to face losses.

But moral hazard, incentive problems, and excessive risk taking are not only the

result of government guarantees. Allen and Gale (2000a) study the interaction between incentives in the financial system and asset prices. The idea is that many investors in real estate and stock markets obtain their investment funds from external sources but the ultimate fund providers are unable to observe the characteristics of the investment. This leads to a classic asset-substitution problem, which increases the return to investment in risky assets and causes investors to bid up prices above their fundamental values. A crucial determinant of asset prices is thus the amount of credit provided by the financial system. By expanding the volume of credit and creating uncertainty about the future path of credit expansion, financial liberalization can interact with the agency problem and lead to a bubble in asset prices. When the bubble bursts, either because returns are low or because the central bank tightens credit, there is a financial crisis.

This is indeed consistent with the vast evidence that a banking crisis often follows collapse in asset prices after what appears to have been a 'bubble'. This is in contrast to standard neoclassical theory and the efficient markets hypothesis, which precludes the existence of bubbles. The global crisis that started in 2007 provides a stark example. In numerous countries, including the US, Ireland, the UK and Spain, real estate prices were steadily rising up to 2007 and the financial crisis was triggered precisely when they collapsed. Numerous other crises show a similar pattern of events. As documented, among others by Kaminsky and Reinhart (1999) and Reinhart and Rogoff (2011), a common precursor to most crises is financial liberalization and significant credit expansion. These are followed by an average rise in the price of stocks of about 40 percent per year above that occurring in normal times. The price of real estate and other assets also increases significantly. At some point the bubble bursts and the stock and real estate markets collapse. Given that banks and other intermediaries tend to be overexposed to the equity and real estate markets, typically a banking crisis starts about one year after the bubble burst.

There is a substantial literature attempting to understand how shocks, and in particular negative shocks, are amplified through the system and generate negative bubbles. Some theories rely on the so-called financial accelerator (Bernanke and Gertler (1989); Bernanke et al. (1996)). The idea is that negative shocks to borrowers' wealth are amplified because of the presence of asymmetric information and of an agency problem between borrowers and lenders. In a similar spirit but focusing on the role of collateral, Kiyotaki and Moore (1997) suggest that a shock that lowers asset prices may lead to a crisis. The reason is that by lowering the value of collateral, lower asset prices imply less borrowing and thus further reduction in asset prices and borrowing capacity, and triggering a downward spiral. Geanakoplos (1997, 2003, 2009) and Fostel and Geanakoplos (2008) push this analysis further by investigating the effect of asset prices on collateral value and borrowing capacity in more general equilibrium settings.

From a regulatory framework perspective, there are important lessons to be learnt about asset price cycles. Specifically, there are common trends and exposures of financial institutions; while these might make individual institutions look safe and sound when assessed on a stand-alone basis, they could also mask an increase in systemic risk. Overall, this calls for the regulatory framework to use capital requirements and other regulatory tools not just on the individual bank-level but also as a system-wide tool.

#### *Interbank Connections and Contagion*

One important source of market failures in the financial system is due to banks exerting externalities on each other. The fact that they do not internalise externalities implies that there is a need for government intervention to try and push the system towards a more efficient outcome.

Inefficiencies of this kind have been discussed in the context of interbank markets, which play a key role in financial systems. Their main purpose is to redistribute liquidity in the financial system from the banks that have cash in excess to the ones that have a shortage. Their smooth functioning is essential for maintaining financial stability. The problem is that there are externalities in the liquidity provision by banks, and so the equilibrium will typically not feature the optimal amount of liquidity provision. There are market breakdowns and market freezes that lead to insufficient liquidity provision due to the externalities among banks.

Bhattacharya and Gale (1987) provide a model where individual banks face privately observed liquidity shocks due to a random proportion of depositors wishing to make early withdrawals. Since liquidity shocks are imperfectly correlated across intermediaries, banks co-insure each other through an interbank market by lending to each other after the liquidity shocks are realised. In the absence of aggregate uncertainty and frictions concerning the structure of the interbank market or the observability of banks' portfolio choices, the co-insurance provided by the interbank market is able to achieve the first best solution. By contrast, as soon as a friction is present, the interbank market no longer achieves full efficiency. For example, given that liquid assets have lower returns than illiquid ones, banks have incentives to under-invest in liquid assets and free-ride on the common pool of liquidity.

Similarly, interbank markets appear to be inefficient also when they do not work competitively. Acharya et al. (2011), for example, analyse the situation when in times of crisis, in addition to moral hazard, interbank markets are characterised by monopoly power. They show that a bank with surplus liquidity has bargaining power vis-à-vis deficit banks that need liquidity to keep funding projects. Surplus banks may strategically provide insufficient lending in the interbank market in order to induce inefficient sales of bank-specific assets by needy banks, which results in an inefficient allocation of resources.

Full efficiency is also not achieved by interbank markets when banks are subject to aggregate uncertainty concerning their liquidity needs. The reason is that banks set their portfolio choice before the realization of the liquidity shocks. When the shocks realise, banks can obtain additional liquidity from other banks or from selling their long-term assets. As long as the liquidity shocks are idiosyncratic and independent across banks, the market works well in relocating liquidity from banks in excess to banks in shortage of liquidity. When the uncertainty concerning liquidity shocks is aggregate, the internal mechanism of liquidity exchange among banks fails. When the system as a whole faces a liquidity shortage, banks are forced to satisfy their liquidity demands by selling their long-term assets. This leads to fire sales, excessive price volatility and, possibly to runs by investors, when asset prices are so low that banks are unable to repay the promised returns to their depositors.

The malfunctioning of interbank markets provides a justification for the existence of a central bank. For example, in contexts of asymmetric information, the central bank can perform an important role in (even imperfectly) monitoring banks' asset choices, thus ameliorating the free riding problem among banks in the portfolio allocation choice between liquid and illiquid assets. When surplus banks have bargaining power over deficit banks, the role of the central bank is to provide an outside option to the deficit bank for acquiring the liquidity needed. In contexts of aggregate liquidity risk, the central bank can help alleviate the problem of excessive price volatility when there is a lack of opportunities for banks to hedge aggregate and idiosyncratic liquidity shocks. By using open market operations to fix the short-term interest rate, a central bank can prevent fire sales and price volatility and implement the constrained efficient solution (Allen et al. (2009b)). Thus, the central bank effectively completes the market, a result in line with the argument of Goodfriend and King (1988) that open market operations are sufficient to address pure liquidity risk on the interbank markets.

Other works relate the possibility of market freezes to problems of asymmetric information. For example, Heider et al. (2009) show that interbank market freezes are possible in extreme situations when banks invest in risky long-term investments and there is asymmetric information on the prospects of these investments. This is because the existence of counterparty risk increases interbank market spreads and, in extreme situations, leads to non-viable spreads. A similar mechanism but based on banks' desire to avoid fire sales is presented by Bolton et al. (2008). The idea is that they may prefer to keep assets whose value they have private information about in their portfolios rather than placing them on the market in order to avoid having to sell them at a discount. The problem, however, is that by keeping the assets on their portfolios, banks run the risk of having to sell them at an even lower price at a later stage if the crisis does not cease before they are forced to sell. This so-called '*delayed trading equilibrium*' in which intermediaries try to ride out the crisis and

only sell if they are forced leads to a freeze of the market for banks' assets but may be Pareto superior.

A related phenomenon to the interbank market freeze is a freeze in the credit market, whereby externalities among banks prevent the efficient provision of credit to the real economy. A freeze can arise when there are strategic complementarities among banks in the decision to provide credit. This has been analysed by Bebhuk and Goldstein (2011). Suppose that the success of banks' projects depends on how many banks invest in them. This can occur due to network externalities in the real economy, for example. Then, the expectation that other banks are not going to invest will make it optimal for an individual bank not to invest, thus making this a self-fulfilling belief. Bebhuk and Goldstein (2011) use this framework to compare various types of government policy aimed at assisting the financial sector and analyse which one is more effective under what circumstances.

While the above papers analyse how externalities across banks lead them to inefficient decisions, another concern is of direct contagion across banks, whereby shocks spread from one bank to another, leading to the possibility of systemic crises. Empirically, crises indeed appear to be quite systemic. This is a typical justification for central bank and government intervention to prevent the bankruptcy of large/important financial institutions so that they will not cause a chain of failures in other institutions. This was, for example, the argument the Federal Reserve used for intervening to ensure Bear Stearns did not go bankrupt in March 2008 (see Bernanke (2008)).

Contagion requires an idiosyncratic shock affecting one individual or a group of intermediaries and a propagation mechanism that transmits failures from the initially affected institutions to others in the system. Various forms of propagation mechanisms have been analyzed ranging from information spillovers (Chen (1999)) and interbank connections via interbank deposits (Allen and Gale (2000b)) or payment systems (Freixas and Parigi (1998); Freixas et al. (2000)), to portfolio diversification and common exposures (Goldstein and Pauzner (2004); Wagner (2011)), common assets and funding risk (Allen et al. (2012)), transmission of fire sales prices through interdependency of banks' portfolios (Allen and Carletti (2006)) or the use of mark-to-market accounting standards (*e.g.*, Allen and Carletti (2008)). The academic literature on contagion is vast and, for reasons of brevity, it is not fully described here. Rather, we will limit ourselves to explaining only a few key mechanisms of contagion in more detail. Interested readers may turn to more comprehensive surveys, such as Allen et al. (2009a).

In looking for contagious effects via direct linkages, early research by Allen and Gale (2000b) shows how the banking system responds to liquidity shocks when banks exchange interbank deposits. The first important result is that the connections created by swapping deposits allow banks to insure each other against id-

idiosyncratic liquidity shocks but, at the same time, they expose the system to contagion as soon as some frictions, such as a small aggregate liquidity shock, emerge. The second important result is that the resiliency of the system depends on the network structure of interbank deposits. In particular, incomplete networks, that is networks where all banks are connected but each bank exchanges deposits only with a group of other banks, turn out to be more prone to contagion than complete structures. The intuition is that better connected networks are more resilient since the losses in one bank's portfolio are transferred to more banks through interbank agreements. Similar results concerning the resiliency of more complete networks are present also in Freixas et al. (2000) and more recently in Acemoglu et al. (2015), where the resiliency of different networks is analyzed also as a function of the size of shocks.

A related question concerns the issue of network formation, that is, how banks choose to connect when they anticipate contagion risk. Based on the intuition as in Allen and Gale (2000b) that better connected networks are more resilient to contagion, Babus (2014) predicts that banks form links with each other up to a certain connectivity threshold above which contagion does not occur. In other words, banks choose the network that prevents the risk of contagion, but given that forming links is costly, they do not wish to go beyond such a connectivity threshold.

Another channel of contagion based on direct linkages among banks is based on financial innovation. The idea is that financial products, like for example credit risk transfer, allow banks to insure each other against certain risks but at the same time, under certain conditions, they may expose banks to failures and contagion. For example, credit risk transfers are beneficial as a way to insure different intermediaries or different sectors that are subject to independently distributed liquidity shocks. However, when some intermediaries are forced to sell the assets, say for idiosyncratic liquidity reasons and there is price volatility and fire sales in some states of the world, then the presence of credit risk transfers may be detrimental as they may generate contagion across intermediaries or sectors (Allen and Carletti (2006)). Similar results on the benefits and risks of financial innovations are obtained by Shin (2009) and Parlour and Winton (2013), among others. This dynamic nature of risk management and shifting poses additional challenges for the regulation and supervision of financial institutions and markets.

The second approach to modelling contagion focuses on indirect balance-sheet linkages. One possible contagion mechanism works through portfolio readjustments (Lagunoff and Schreft (2001); De Vries (2005); Cifuentes et al. (2005)). The basic idea is that the return of a bank's portfolio depends on the portfolio allocations of other banks. This implies that the decision of some banks to readjust their portfolios in response to some shocks produces negative externalities in that it reduces the returns of other banks' portfolios. This may induce other banks to

abandon the investments as well. This may happen either gradually as losses propagate through the system, or more rapidly in an attempt to avoid future contagion of losses.

Portfolio readjustments may also generate contagion if they happen at the level of investors holding claims on different banks. Such mechanisms have been analyzed by Kodres and Pritsker (2002), Goldstein and Pauzner (2004) and others. In the case analysed by Goldstein and Pauzner (2004), for example, investors hold deposits in two different banks. The crisis in one bank reduces their wealth, and so makes them more risk averse (under the common assumption of a decreasing absolute risk aversion utility function). Then, investors are more likely to run in the other bank, generating the contagion between the two banks.

In summary, there are multiple sources from which systemic risk may arise. These risks might not be obvious from analysing individual financial institutions. They only transpire from a systematic approach, focusing on the aggregate risk, distribution of risk and linkages between different market participants. It is important to realise that these linkages and thus sources of contagion might change over time, reflecting the dynamic nature of the financial landscape. If there is one common trend, it is the increasing complexity of the banking world, a theme we will return to below.

### *11.3.2 Mapping between Basic Failures and the Reforms Enacted in Europe*

In this section, we review the recent regulatory reforms described in Section 11.2 in light of the basic failures in the financial system described above. Our main question is what problem(s) each specific reform tries to address and what potential challenges still remain for financial stability. Given the complexity of the issues, we restrict ourselves to the main regulatory reforms: capital and liquidity requirements, banking union and resolution regime. Although we make use of the existing empirical evidence, our discussion is mostly of a theoretical nature.

#### *Capital Requirements*

Capital performs various functions and helps to alleviate the three basic failures in the financial system that we have discussed before. It absorbs unanticipated losses, thus reducing the risk of insolvency for a financial institution and contagion through the financial system. Moreover, by protecting uninsured investors, capital helps maintain confidence in the financial system. Finally, capital is an important tool to provide incentives to bank managers and shareholders not to expose the bank to excessive risks.

The academic literature has mostly focused on capital as a way to reduce the problem of limited liability and excessive risk taking due to high leverage and the

(implicit or explicit) support of financial institutions through widespread deposit insurance and bailouts. The general idea is that because banks have access to low cost funds guaranteed by the government, they have an incentive to take significant risks. If the risks pay off, they receive the upside, whereas if they do not, the losses are borne by the government. Capital regulation that ensures that shareholders will lose significantly if losses are incurred is needed to offset the incentive for banks to take risks. One way of capturing this is to model the effects of capital on banks' monitoring incentives (Holmström and Tirole (1998)). Using this framework, Dell'Ariccia and Marquez (2006) and Allen et al. (2011) have shown that capital regulation does improve banks' incentives to monitor, although its effectiveness depends on the presence and design of deposit insurance, credit market competition etc. Overall though, this literature supports a positive role of capital and thus of capital regulation in ameliorating banks' incentives to monitor borrowers, thus reducing the credit risk of individual banks. In this sense, the new Basel accord and its greater emphasis on bank capital is certainly a positive reform.

The focus on the macro effects of capital regulation seems to be particularly relevant. Up to the recent crisis, capital regulation was much more focused on micro-prudential considerations, the idea being that it was enough to protect the stability of the individual financial institutions to guarantee the stability of the financial system as a whole. However, the crisis has clearly shown that this presumption is incorrect. As pointed out by several economists (see for example, Brunnermeier et al. (2009)), there is a '*fallacy of composition*' in that it is not possible to make the system as a whole safe by making sure that individual banks are safe. The reason for this paradox is that in trying to make themselves safer, banks can behave in ways that collectively undermine the system. For example, when selling assets on the financial markets, banks disregard the impact their sales will have on asset prices and the possibility of fire sales, thus on the solvency of other financial institutions holding similar assets. The same applies to diversification: Banks choose their diversification strategies taking account of their own individual risk sharing and hedging motives, disregarding the potential effects of increasingly more correlated portfolios on systemic risk. In other words, there are a number of externalities that individual banks do not consider when taking their decisions. For this reason, it is important to introduce regulation and, in this case, capital requirements that also take account of the potential externalities that the actions or the failure of one particular institution may have on the rest of the system. Setting capital requirements on the basis of bank size is certainly an important step in this direction. The question remains as to whether the levels envisaged in Basel III and the various forms of TLAC and MREL are sufficient in guaranteeing the stability of the overall system.

Unfortunately, the academic literature on the macro effects of capital regulation is still in its infancy. Going forward, it is essential to develop new theories of capital

regulation based on preventing contagion and systemic risk. In general, as we argue further below, there is a need for a deeper analysis of the appropriate design of macroprudential regulation. Attempts in this direction have been made by Rochet (2004) and Acharya (2009), but much more work is needed in this area, also to provide insights and possibly useful calibrations.

The discussion on the appropriate levels of capital for macroprudential purposes and, more generally, also of macroprudential tools is especially relevant for the European Union, and even more so for the newly established banking union. While the SSM can use macroprudential tools covered under the CRR and CRD IV, it cannot use other macroprudential tools, which will remain exclusively under national authority (Sapir (2014)). Given that not only micro- but also macroprudential decisions have externalities beyond national borders, this seems an important gap in the regulatory framework constructed under the banking union. The ESRB, which does not have any formal powers beyond issuing warnings and recommendations, cannot completely fill this gap.

While it is difficult to predict the effects of the new capital regulation, we can make use of existing empirical literature studying the general effects of capital. The first question is the extent to which capital buffer helps reduce moral hazard and bank fragility. A rich empirical literature has gauged this question. Recently, Laeven and Levine (2009) have shown that the effect of higher capital requirements on risk-taking decisions might vary with the ownership structure of banks, and higher capital requirements might not always lead to lower risk. This is because of the various effects capital has on the relationships between management and shareholders and between these two groups and depositors.

Another important discussion in the empirical literature has been on the role of risk-weights for computing capital requirements. The Basel II and III accords include different models to risk-weigh assets, based on the conclusion that Basel I equalised weights for assets of very different risk profiles, inviting banks to focus on the riskiest asset classes for a given risk weight. Risk-weighted capital-asset ratios try to force banks to hold capital buffers appropriate for their level of risk-taking. The question is whether giving banks the option to calibrate these risk weights with the internal risk-based approach invites manipulation to under-report riskiness of assets, thus to overstate regulatory capital. For example, Mariathasan and Merrouche (2014) show on a sample of 115 banks from 21 OECD that the reported riskiness of asset declines upon regulatory approval of the IRB approach, an effect that is stronger among weakly capitalised banks. On a more general level, Haldane and Madouros (2012) argue for less complex rules, pointing to the costs of complexity and their limited benefits. The leverage ratio, on the other hand, can be seen as a back-stop, a rather simplistic tool, but one that cannot be easily cir-

cumvented. In this sense, the reintroduction of the leverage ratio in Basel III is also welcome.

Evidence based on the recent crisis has demonstrated that unweighted risk-capital ratios before the crisis were a better predictor for banks' performance during the crisis than risk-weighted capital-asset ratios. Specifically, Demirguc-Kunt et al. (2013) show that while capital ratios predicted the stock market performance of banks during the crisis, this relationship was driven by non-weighted rather than weighted capital-asset ratios and by higher quality capital elements, including tier 1 capital and common equity.

#### *Liquidity Regulation*

As discussed above, Basel II and the corresponding CRD IV package in Europe introduce liquidity requirements in the form of a Liquidity Coverage Ratio and a Net Stable Funding Ratio. Although there is practically no academic literature on the effects of liquidity regulation, it is plausible to argue that liquidity regulation will help mitigate the problem of fire sales, as banks will have more liquid assets in their portfolio and will therefore be in a better position to withstand liquidity shocks without resorting to the premature liquidation of longer term assets. This will help alleviate the contagion and negative externalities across financial institutions. It can also help alleviate panic in any individual institution because investors will be less concerned about runs by others if they do not lead to costly liquidation.

However, introducing liquidity requirements may also have some negative effects. The problem is that requiring banks to hold more liquid assets may reduce the longer term profitability of banks, as more liquid and shorter term assets are usually associated with lower profitability in the long run. This may become a source of concern as it may induce bank managers to take more risk in order to foster profitability and may also induce investors to respond more quickly, prompting more easily fundamental-based runs. Finally, it is also important to understand how liquidity and capital regulation interact. In fact, while capital requirements are mostly intended to preserve financial stability in the longer run, they may also represent a form of loss absorption in the shorter run and thus interact with liquidity regulation in important ways. As we will discuss below in more detail, this is certainly an important avenue for future research.

#### *Banking Union and Resolution*

As we have already mentioned, the banking union has been the response to important shortcomings that emerged during the crisis. In particular, the creation of the banking union was an attempt to break the adverse loop between sovereign stability and bank stability, curb the link between national supervisors and large financial

institutions, thus reducing the risk of forbearance, and a way to address some of the externalities stemming from cross-border banking in the Eurozone.

The banking union seems well structured to address some of these issues, such as the risk of forbearance and the internalization of externalities. The possibility of setting regulatory tools at the central level and considering the banking business in its entirety should foster the focus on the system as a whole rather than a more micro-approach to regulation, despite the problems described above concerning the setting of macroprudential tools. The lower risk of forbearance should provide better incentives to bank managers, thus reducing the problem of excessive risk taking. Finally, the central supervisor should also be better positioned to internalise the spillovers across banks, and thus taking into account issues such as contagion risk in its policy decisions.

Despite all positive developments, some aspects of the banking union remain problematic. Most prominently, only supervision has been completely centralised, while resolution is only partly centralized and there are only limited centralised funding tools. Deposit insurance schemes remain national as of now, although the coverage and other aspects are better harmonised than in the past. In spite of the Single Rule book, the Eurozone still operates with different banking laws and bank resolution regimes whose harmonization is not easy. Most importantly, despite the creation of the Single Resolution Board, the common funding scheme for resolution remains limited as described above.

The appropriate size of the resolution fund, and more generally, the need for guaranteeing fiscal backstops are important issues for various reasons. First, an appropriate fund is necessary to maintain confidence in the financial system. The idea is not that banks should continue to be bailed out or not resolved, but it is important that the system is able to guarantee an orderly restructuring as to maintain investors' confidence and also avoid problems of financial contagion. Second, whereas it is true that the new regulatory regime introduces a system of bail-in rather than bail-out so that losses will have to be imposed on bank creditors rather than on taxpayers, we think that the application of bail-in will be difficult in practice since its application still may in itself generate panic runs and adverse systemic effects, especially as it is unclear who will hold the bail-in-able debt. Third, the lack of appropriate funds to resolve banks may also lead to important incentive distortions for all agents involved in the process. We are not arguing that moral hazard considerations are not important, and therefore, bank managers and investors should not bear losses in case of bank failure. However, the separation of supervision and resolution authorities coupled with a lack of appropriate fiscal capacity at the central level may introduce distortions in the supervisory process, possibly reintroducing conflicts of interests and/or forbearance risks.

One last important issue concerns the misalignment between the Eurozone and

the European Union. While the externalities on cross-border banking are especially strong within the Eurozone and the possibilities to move towards closer regulatory cooperation are larger, many of the regulatory reform initiatives introduced above have been taken on the level of the European Union and are thus also relevant for non-Eurozone countries.

Overall, research on banking unions and the challenges they pose is still in its infancy. Considerably more research is needed to better evaluate the optimal design and size of such unions.

## **11.4 Moving Beyond Banks and Traditional Activities: the Regulatory Perimeter**

### *11.4.1 The Regulatory Perimeter*

The crisis has revealed gaps in the regulatory perimeter, as risk has been shifted outside regulated banks into shadow banks, partly connected to regulated banks and partly stand-alone. Some of this risk-shifting has been the result of long-term changes in the intermediation process and landscape of financial systems, some of it has been the result of deliberate decisions of bank management to maximise the use of existing capital and increase profitability.

To a large extent, other financial entities operating in financial markets, such as mutual funds, hedge funds, and money-market funds, etc. have been left unattended by financial-stability regulation. The idea was that they are different from banks, as they do not have the peculiar structure of demand deposit contracts and they do not have the system of vast connections among institutions, so they do not put the system at risk. A common theme is that prices should be allowed to fluctuate, people should be allowed to take risks, and institutions should be allowed to fail as long as there is no severe externality that they do not internalise, which might threaten the system. This line of thinking, however, has proven to be incomplete.

Over the years, other financial institutions have started taking on bank-like features. Perhaps the most striking example is the Long Term Capital Management (LTCM) hedge fund which failed in 1998. LTCM exposed itself to huge leverage in an attempt to enhance returns to shareholders. While doing that, it also generated large risks, and indeed collapsed in 1998. Hence, the thinking that deposit-type risk does not exist in such institutions was shown incorrect. Moreover, after that, people realised that LTCM was also at the heart of a network of vast connections to other institutions, so its failure put the system at the risk of systemic failure. Indeed, it took considerable effort on the side of US regulators to have all parties agree to a resolution to stabilise the system. The failure of Lehmann Brothers in 2008, an

investment bank outside the regulatory perimeter of the Federal Reserve and FDIC, although different from LTCM in many respects, carried some similar lessons.

More generally, the fact that banks have been so heavily regulated has limited their ability to provide credit and liquidity leading to the emergence of other institutions that had many features similar to banks, but were not treated like banks or regulated like banks. The common name for such institutions is ‘*shadow banking*’, for which the definition is somewhat unclear. It probably covers everything that is not a traditional bank. Indeed, one of the key lessons from the last crisis is that shadow banking has to be looked at and that the regulation of the financial system has to take an integrative approach and consider the potential fragility of banks alongside shadow banks rather than banks in isolation. The idea is that if you regulate only banks, other institutions will emerge and take over their functions, thus it is important to prevent such a regulatory arbitrage and regulate the system with a holistic view.

A case in point is the money-market mutual funds. These are funds that invest in bonds, treasuries, and other such assets and have a liability structure that is very similar to banks. Specifically, they promise investors the right to withdraw a fixed amount. This is known as a fixed net asset value (NAV), whereby the net asset value promised to investors upon withdrawal is fixed. Due to this feature, investors have been treating their claims in money-market funds as very safe, using them like money for different transactions. This entity emerged to a large extent as a response to regulation in the banking system: the limitations on the returns that banks can offer led investors to demand this kind of vehicle that will offer a bank-like claim with a higher return. As regulation did not treat money-market funds like banks, they were free to do many of the things banks could not.

Over the years, money market funds did not experience many problems and the perception that they are safe was validated in reality. But in the years leading to the crisis, they started investing in riskier securities, exposing themselves to the mismatch between very liquid liabilities and less liquid assets, just like banks. This whole structure led to a crisis in the fall of 2008 when, following the collapse of Lehmann Brothers, one money market fund could not honor its liabilities to investors (this is known as ‘breaking the buck’). This almost unprecedented event led to massive runs in the industry across other money market funds. (For empirical evidence, see Schmidt et al. (2014) and for a discussion on regulatory implications, Rosengreen (2014)).

The events in the money-market funds led regulators in the US and other countries to realise that regulation should not target just entities called ‘banks’, but more broadly other entities that look like banks or offer services like banks. One of the conclusions has been that the fixed-NAV structure is not sustainable and money market funds are thus moving into a structure of floating NAV, which resembles

the one used in other mutual funds. According to this structure, investors are not promised a fixed amount when they withdraw, but rather the market value of their underlying assets as of the day of redemption. This will surely decrease the extent to which money market funds look like banks and the extent to which they should be regulated like banks.

However, the shift to a model of floating NAV does not prevent runs and panics. Recall that runs are generated by the presence of a first mover advantage. Investors want to demand their money when they think others will do so if the liability structure is such that some investors' redemption reduces the value to those who do not redeem. This is certainly the case with fixed deposits or money market funds that have fixed NAV: Investors withdrawing early get the fixed amount, which reduces whatever is left for the remaining investors. But, Chen et al. (2010) have provided empirical evidence that such first-mover advantage exists also in floating NAV funds.

The idea is that when investors take their money out of a mutual fund, they get the last updated market value of the underlying assets. However, following large redemptions, the fund will have to take action and adjust the portfolio in the following days, which will affect the value that remaining investors can get. The problem is particularly severe in funds that hold illiquid assets. These are the funds that provide the liquidity transformation (in the spirit of banks), and for them the costs of portfolio adjustments following redemptions will be more pronounced. Indeed, Chen et al. (2010) have shown that there is a very different pattern in funds holding illiquid assets compared to those holding liquid assets. The former exhibit much stronger sensitivity of outflow to negative performance, indicating that investors are more likely to take their money out fearing redemptions by others.

This force has recently shifted attention to bond funds. These are funds that invest in corporate, government, and other types of bonds. They have grown tremendously in the US over the last few years. This is again likely to be a response to the tightened regulation of banks. As banks find it more difficult to lend, firms are issuing more bonds to address their financing needs, and mutual funds are holding these bonds. The problem with bonds, especially corporate bonds, is that as they are much more illiquid than equity, the liquidity mismatch for funds that hold corporate bonds is more severe. Goldstein et al. (2015) show in a recent paper that corporate bond funds indeed exhibit different flow-performance sensitivity that leads to more outflows upon poor performance and is consistent with the fact that they lead to greater first-mover advantage and fragility. They also show that this is amplified in times of aggregate illiquidity.

If indeed corporate bond funds create the trigger for panic, this can put pressure on the financial system and the real economy in times of crisis. Vast evidence from the empirical literature on financial markets has shown that outflows from

mutual funds create persistent price pressure (*e.g.*, Coval and Stafford (2007), Ellul et al. (2011) and Manconi et al. (2012)) and that these price impacts can have real effects on firms' activities (*e.g.*, Edmans et al. (2012) and Hau and Lai (2013)). Recently, Gilchrist and Zakrajšek (2012) have verified an effect of market-driven credit spread on real economic outcomes.

In summary, financial regulation should view the system as a whole and consider the fact that regulating certain parts of the system is likely to shift activity to other parts putting them at the risk of fragility. An integrative approach, which is now attempted by the Financial Stability Oversight Council (FSOC) in the US, is welcome with more of this approach to be implemented worldwide. Fragility should be measured based on the activity that is being pursued rather based on the entity pursuing it.

#### **11.4.2 Financial Innovation**

New bank-like financial institutions and deposit-like financial products are one form of financial innovation. However, financial innovation is a broader concept and can be generally defined as new financial products and services, new financial intermediaries or markets, and new delivery channels.<sup>3</sup> Examples abound, ranging from the introduction of the ATM/cash machine in the 1970s and mobile phone based financial services in the 2000s, the introduction of money market funds as an alternative to bank deposits and the emergence of venture capital funds, to structured financial products. The intermediation platforms of peer-to-peer lending and crowdfunding also fall under the category of financial innovation. Goetzmann and Rouwenhorst (2005) identify 19 major financial innovations, grouped into innovations that (i) facilitate the transfer of value through time (*e.g.*, savings accounts), (ii) enhance the ability to contract on future values (*e.g.*, venture capitalists) and (iii) increase the negotiability of contracts (*e.g.*, securitization).

The traditional *innovation-growth view* posits that financial innovations help reduce agency costs, facilitate risk sharing, complete the market, and ultimately improve allocative efficiency and economic growth, thus focusing on the bright side of financial innovation. Laeven et al. (2015) quote several historical examples where financial innovation has been critical in allowing major technological innovation to be adopted on a broad scale. For example, in the 19th and 20th centuries specialised investment banks emerged to facilitate the construction of vast railroad networks across North America and Europe, screening and monitoring borrowers on behalf of dispersed and distant investors. In the second half of the 20th century, venture capital funds arose to finance IT start-ups, characterised by limited, if

<sup>3</sup> One can also refer to this as production, process and organizational innovation.

any, tangible assets that could be used as collateral, thus requiring patient investment capital, and close screening and monitoring as well as technical advice. In recent decades, financial innovation has supported bio technology. Lerner and Tufano (2011) undertake a counterfactual exercise, a “counterfactual historiography”, comparing real development with hypothetical development in a world without (i) venture capital and private equity, (ii) mutual funds and exchange-traded funds and (iii) securitization. Their analysis points to the overall positive effects of these innovations that might not have been achieved with alternative arrangements. There is also empirical evidence of the importance of financial deepening for innovation (Amore et al. (2013); Chava et al. (2013)) as well as of financial innovation for economic growth (Laeven et al. (2015)). Beck et al. (2012) show that countries with higher innovative activity in the banking system experience faster growth in industries with higher needs for external finance and higher growth opportunities.

The *innovation-fragility view*, on the other hand, focuses on the ‘dark’ side and has identified financial innovations as the root cause of the recent Global Financial Crisis, by leading to an unprecedented credit expansion that helped feed the boom and subsequent bust in housing prices (Brunnermeier (2009)), by engineering securities perceived to be safe but exposed to neglected risks (Gennaioli et al. (2012)), and by helping banks and investment banks design structured products to exploit investors’ misunderstanding of financial markets (Henderson and Pearson (2011)). Several authors have pointed to distortions introduced by financial innovations, such as securitization and new derivative securities, demonstrating how they have contributed to aggressive risk taking, reduction in lending standards and thus fragility (*e.g.*, Rajan (2006), Keys et al. (2010) and Dell’Ariccia et al. (2012)).

Financial innovation has often been used for purposes of regulatory arbitrage or to get around regulatory restrictions. For example, Euro-accounts were established in reaction to Regulation Q, which prohibited payment of interest on sight accounts in the US. Another example is the use of Special Purpose Vehicles (SPV), investment trusts to which banks off-loaded loan portfolios, in return for securities issued by the SPV and often rated AAA. In total, banks set up conduits to securitise assets worth \$1.3 trillion, insuring the securitised assets with explicit guarantees (Acharya et al. (2011)). The objective of such securitization operation was to save capital, as guarantees were structured in a way to reduce regulatory capital requirements. Acharya et al. (2011) show that the losses on these conduits had to be taken back on banks’ balance sheets during the crisis as a consequence of wholesale runs.

Taking a broader view, Freixas et al. (2015) argue that financial innovation is one of the key drivers of systemic risk. Financial innovation allowing for better risk management and sharing might reduce idiosyncratic risk, *i.e.*, the risk of individual financial institutions considered on a stand-alone basis, while at the same time increase systemic risk, as larger parts of the financial system are exposed to the

same systematic or aggregate risk and/or increasing the appetite and capacity to take on risk. This is developed further by Wagner (2010), who shows theoretically that as banks become more similar due to diversification of risks, systemic risk increases.

Empirical research on the use of financial innovation at the bank level has provided somewhat ambiguous results. On the one hand, Norden et al. (2014) show that the use of credit derivatives reduced corporate loan spreads in the US, suggesting that banks passed on benefits of risk management. The benefits were even stronger during the recent crisis, when banks with higher holdings of such derivative positions cut lending by less. On the other hand, Nijskens and Wagner (2011) show that even before the crisis the share price beta of banks trading credit default swaps (CDS) or issuing collateralised loan obligations (CLOs) increased, suggesting higher risk from the use of these risk management tools. This effect is driven by higher correlation with the market while volatility actually decreases, suggesting that while these risk management tools serve to reduce idiosyncratic bank risk, they actually increase systemic risk.

Financial innovation might also affect the incentives of financial intermediaries. Wagner (2007a,b) shows that financial innovation that reduces asymmetric information can actually increase risk-taking due to agency problems between bank owners and managers, or because of lower costs of fragility. Keys et al. (2011), for example, show how reduced incentives to screen borrowers in the US due to the possibility of being able to securitise loans contributed to higher loan losses.

In summary, both theory and empirical work suggest that financial innovation can bring benefits but also increased risks both by the design of products and through changing incentives. While financial innovation is thus critical for the development of the financial system, it also poses significant challenges for regulators. Regulatory frameworks are designed in light of existing products and providers. They are mostly rule-based (and intermediary-based), *e.g.*, for liquidity requirements only specific clearly-defined assets are considered. Rule-based regulatory regimes have the clear advantage of providing clarity, and reduce the room for supervisory overreach. They also guarantee certain independence for supervisors, given the limited degree of freedom for interpretation. On the other hand, rule-based regulatory systems are less adequate in reacting to new products and markets, as existing rules do not refer to them. A principle-based regime is more flexible in this context, but might be more open to arbitrage possibilities.

While regulation might give rise to certain financial innovations, regulators in turn will try to catch up with innovation, a process that Kane (1977) refers to as 'regulatory dialectic'. Compared to the financial sector, regulators are at a disadvantage, as regulation (especially rule-based regulation) refers to specific institutions, products and markets. Risk-based supervision would imply regulating and

supervising all financial intermediaries that offer the same products under the same regime. For example, all institutions offering deposit services should be subject to the same prudential regulation.

### ***11.4.3 Complexity***

One striking phenomenon over the past decades has been a clear trend towards more complex financial institutions, which results in serious challenges for regulators. Specifically, Cetorelli and Goldberg (2014) report that while in 1990 only one US bank holding company had more than 1,000 subsidiaries, in 2012 at least half a dozen did. Using data both for US and non-US banks with branches in the US, they show that many of the leading banks have hundreds if not thousands of subsidiaries, making it very hard for supervisors to properly monitor them. Complexity can take on different forms, reflected not just in the number of subsidiaries, but also in the expansion across different financial activities, including investment banking, insurance, mutual funds, and even non-financial activities. In addition, banks have organised their increasing variety of activities often in multi-tiered ownership relations, with up to ten levels of ownership links. Cetorelli and Goldberg (2014) also show that while the number of affiliates and the share of non-bank activity are positively correlated with the size of the parent bank, measures of business and geographic complexity are not. Complexity is thus a bank characteristic, which is not completely correlated with size; in addition to the challenge of too-big-to-fail, there is thus the challenge of too-complex-to-resolve.

Not just financial institutions, but also the regulatory framework has grown in complexity over the past decade, with the Basel II capital regime being a watershed. Hakenes and Schnabel (2014) use a theoretical model to show that it is in banks' interest to push complex regulation, in what they refer to as 'regulatory capture by sophistication'. Specifically, in a world where regulators are less well paid than bankers and with a variation in skills across regulators, regulators might be swayed to rubber-stamp banks' risk models in order not to have to admit that they do not understand these risk models. This allows banks to hold less capital than required. This trend towards sophistication and the resultant capture have been exacerbated by the Basel II regulatory framework, which allowed the use of banks' internal risk model to compute risk weights for different asset classes. However, this phenomenon becomes more critical if the regulator has discretionary power, such as under pillar II of Basel II. It is important to note that this type of regulatory capture by sophistication is somewhat different from the regulatory capture due to conflict of interest, social connection (rotating door), political interference or lobbying activity by banks.

Related to the trend towards complexity is the increasing globalisation of banks,

with leading global banks active across a large number of regions and countries. In addition, over the past decade there has been a trend towards regional banks, *i.e.*, Latin American and African banks reaching out across their respective regions. This poses additional challenges for supervisors in terms of cooperation across borders. While this topic is somewhat outside the current survey, it is important to be flagged.

Overall, the financial sector and, with it, the financial regulation are becoming more and more complex over time. The two phenomena are related, as greater the complexity of the financial sector calls for the greater complexity of regulation, but are also driven by additional separate factors. There is also a vicious circle in that complexity of regulation leads to complexity of financial services, which leads to more complexity of regulation, and so on. This trend is not conducive for effective regulation and efficient financial systems and needs to be considered by policymakers when going forward.

## **11.5 Special Issues in Europe and How they Affect Future Regulation**

Many of the regulatory issues discussed in this paper concern all advanced countries if not the emerging/developing world as well. However, some of the challenges have a larger impact on Europe, especially on the Eurozone. This has to do with the delayed crisis resolution in many European countries, especially many peripheral Eurozone countries, the biased financial structure, also referred to as ‘bank bias’, in Europe compared to other advanced economies, and the political economy challenges facing a monetary and economic union. While this survey does not have sufficient space to go in depth into these political economy challenges, they are related to the fact that the allocation of losses after the recent crisis had a geographic distributional dimension because creditors were concentrated in the ‘core’ and debtors in the ‘periphery’ countries of the Eurozone. In addition, being able to rely on a common lender of last resort for a country’s banks may result in a ‘tragedy of commons’ problems, as it is in the interest of every member government with fragile banks to ‘share the burden’ with other members.

### ***11.5.1 Crisis Resolution and Macro-management in a Monetary Union***

While not synchronised or similarly pronounced across all European countries, large parts of the European Union and the Eurozone went through a credit bubble in the first decade of the 21st century, followed by a bust in the wake of the Global Financial Crisis. Unlike the US, most European countries have been very slow at recognizing losses incurred during the crisis and forcing or supporting banks in

their recapitalization. The sluggish credit recovery over the past years has been the backdrop on which the ECB has moved towards quantitative easing, though much later than other leading economies, including the US, UK and even Japan, a delay partly explained by political considerations.

There is an ongoing debate about the extent the current credit crisis reflects supply or demand side constraints. It seems that the recent crises have resulted in both supply constraints as well as demand reduction in the bank lending market. In spite of recapitalization by governments and through private markets and investors, seven years after the Global Financial Crisis, Europe's banking system continues to be in a rather weak position, at least compared to that of the US.

Overall, the much slower recovery can be partly explained with distributional repercussions of crisis resolution and the lack of a centralised financial safety net and macro-management. While the Eurozone has made substantial progress in building a common financial safety net in the form of the banking union (with the caveats discussed above), other elements to make the monetary union sustainable are still missing and the same political economy challenges will delay their construction in the near future (*e.g.*, Wyplosz (2016)). One other reason for the slow recovery, which we will discuss more below, is the unbalanced nature of Europe's financial systems.

### ***11.5.2 Financial Structure: Does Europe Suffer from a Bank Bias?***

Beyond concerns about the recovery of different components of the financial system across Europe, the current discussion on the Capital Market Union has again put in the forefront the discussion on the financial structure in Europe, not only within the Eurozone. While previous research has shown the irrelevance (on average) for economic growth of the degree to which a financial system was bank- or market-based, more recent research has shown that Europe's relative strong reliance of Europe on bank intermediation (both in absolute and relative terms) might explain the underperformance in growth and the stronger impact of the recent crisis (*e.g.*, Langfield and Pagano (2015)). This comes in addition to the observation that certain segments of the financial system critical for financing young and small enterprises are underdeveloped in most European countries, including the private equity industry, venture capital and angel financing. These findings also serve as motivation for a stronger focus on building sources of equity finance/capital markets in Europe, including the Capital Market Union initiative.

Contrasting markets and banks, however, might be wrong. Most finance today is intermediated, even if it goes through public markets, such as public debt and equity markets. Institutional investors, including insurance companies, pension and mutual funds play a critical role in financial markets, which is also reflected in

the prominent role of institutional investors in the ownership structure of publicly listed firms. Financial intermediaries and markets also have other complementarities. Securitisation is an important link between intermediaries and markets in the cross-section. IPOs of companies financed by venture capitalists are an important connection over time, between financial intermediaries and public markets.

The question, therefore, is not necessarily the contrast of the two specific segments, but rather the fact of having a diversified, if not complete, financial system. It is in this context that the focus should be on specific segments of the financial system that play less of a role in Europe than in other developed regions of the world, including private equity funds, venture capital funds, and corporate bond markets.

It is also important to take note of the new emerging players, including non-intermediated forms of bringing savers and entrepreneurs together, such as peer-to-peer lending and crowd-funding platforms, players who we cannot easily assign to either the bank- or market components of the financial system. These platforms work with many borrowers and lenders, with only a limited role for the platform provider, building on other social media models. Rather than building on private information acquisition, these new models of financial intermediation often rely on Big Data collected on potential borrowers based on social media. As discussed before, the emergence of new players is an important dimension of financial innovation and contributes to the process of financial deepening. However, these new players will eventually pose the question about the regulatory perimeter.

There is an array of policies and institutions that can help enhance the development of the non-banking part of Europe's financial system, some of which have been laid out in the recent Green Paper by the European Commission. They include (i) the revival of securitization markets (including the creation of standards; creation of platforms; and the important interaction with liquidity requirements under the new Basel III regulatory regime); (ii) increase in liquidity by linking corporate bond markets – where segmented insolvency laws are one major barrier; (iii) creating linkages between different stock exchanges to increase liquidity, while maintaining competition, and (iv) creating a EU-wide second tier capital market/private placement market. There are also important demand-side policies, aiming at getting more firms to accept market finance, which includes corporate governance reforms, but also reducing cost barriers, as *e.g.*, lowering prospectus costs.

It is important to understand, however, that these policies and institutions cannot work over night. They are aimed at long-term structural changes in the financial system. They certainly will not contribute to leading Europe out of the current crisis, but might contribute to long-term higher sustainable growth rate through more efficient resource allocation.

## 11.6 Summary, Policy Lessons and Directions for Future Research

In this chapter, we have described the main ingredients of the new financial policies in Europe following the global financial crisis. We have evaluated them on the background of the vast theoretical literature of market failures in the financial system, explaining the goals of different regulations and their limitations. We have highlighted some important tensions in light of the need to expand the regulatory perimeter and address the ongoing financial innovation and the ever-increasing complexity of the financial system. We have also discussed special challenges in Europe given the sluggish recovery, the particular structure of the financial system and the political issues surrounding the European Union and the Eurozone.

In conclusion, we would like to emphasise four policy lessons going forward that are directly related to our analysis so far. These policy lessons are broad and forward looking as they point to future analysis as much as they are based on past experience.

The first policy lesson is related to the tension between complexity and simplicity. As the financial system is increasingly complex and sophisticated, there is a tendency to make regulation more complex to address some of the newly emerging issues. This might backfire, however, for two reasons. First, increasing the complexity of the financial regulation might provide the industry players with stronger incentives to make their institutions more complex. Second, complex financial regulation opens the door for the manipulation of rules by financial institutions and investors. For example, when capital requirements introduced risk weights, banks could have more discretion in how they measure and report risk, and this might have led to greater risk taking. Similarly, forcing banks to hold additional capital or impose higher risk-weights for specific activities that expose the bank to higher risks and/or are not considered central to financial service provision is a pricing-based tool, whereas outright prohibition of certain activities (*e.g.*, trading on own account) is a simpler tool to achieve the same. While a pricing-based tool might be better to balance social benefits and costs, complete prohibition might be better in case of uncertainty about (the distribution of) costs and benefits. Hence, in our view, it is important to complement ever-increasing complex regulation with some simple rules. For example, going back to a simple leverage ratio in the new Basel accord in addition to risk-weighted capital requirements is a step in the right direction.

The second policy lesson has to do with the new emphasis on macroprudential policies, as opposed to the traditional micro-prudential policies. As the recent crisis made us realise, making sure that individual institutions are sound may not be enough, as they all may be taking action to secure themselves, but these can make the system as a whole less secure. New policy measures such as bank stress tests

and capital requirements that depend on the aggregate state of the economy are steps in the right direction in trying to take the systemic risk aspect into account. But, a considerable amount of work is still needed for measuring systemic risk, and assessing the effectiveness of macroprudential policy measures more precisely.

The third policy lesson has to do with the required focus on resolution. The chaos that came with the failure of leading financial institutions was arguably an important factor in how deep the global financial crisis was. It is thus critical to have frameworks in place to resolve financial intermediaries in a way that minimises disruptions for the rest of the financial system and the real economy, while allocating losses according to creditor ranking. An incentive-compatible resolution framework has therefore not only important effects *ex-post*, *i.e.*, in the case of failure, but also important *ex-ante* incentive effects for risk-decision takers. This implies that a lot of attention and preparation is needed now before the actual failure of big and complex institutions. Imposing living wills and requiring bail-in strategies in case of failures are indeed important steps that will make institutions think more about the event of the failure and internalise better the risks that they are imposing on the system. But again much more work on the effectiveness of resolution mechanisms and the legal aspects of what can and cannot work is needed.

The fourth policy lesson is that we need to have a dynamic and forward looking approach to regulation. The problem with regulatory reforms in the past was that it always addressed the regulatory gaps exposed in the most recent crises. But, as regulators tightened restrictions on institutions that have had problems before, activity and risk taking shifted to other institutions and markets. Then, new crises always caught regulators unprepared, as they happened in places outside the regulatory perimeter at the time. It is thus important to think about the system as a whole and understand new innovations as they happen. It is important to remember that regulating one type of institution will lead to the emergence of others and to design regulation in a forward looking way. This would imply that the regulatory perimeter has to be adjusted over time and that the focus of prudential regulation (both micro- and macroprudential) might have to shift over time as new sources of systemic risks arise.

In preparing for the future and designing the new financial playing field, research has a vital role, including in exploring in more depth the four broad conclusions discussed above. First, theoretical research is critical in thinking about the underlying mechanisms and how new policy measures will affect the system in light of these mechanisms. In this context, it is important to move from partial to general equilibrium analyses. Second, as new policies are implemented and new data is collected, empirical research will also be crucial to better understand in real time how policies are affecting markets and their effectiveness. An array of new data sources will become available over the next years that might support some of this

research. The SSM in Frankfurt has access to detailed data from both the directly supervised financial institutions, and other institutions within the Eurozone. In addition, there are attempts to link the different credit registries across Europe (some of which are still to be established), which will provide a wealth of information on the loan level for researchers. However, too often data across countries are not comparable, which impedes consistent cross-country comparison even within closely integrated regions such as the Eurozone. And in too many instances, researchers have no direct access to supervisory data sources due to confidentiality barriers that are higher in Europe than in other parts of the world. We should also not underestimate the methodological challenges going forward, such as moving from documenting correlations to establishing causality. The new research agenda also requires work across strict borders of sub-disciplines, such as between macroeconomics and financial economics.

The years since the crisis have seen an enormous increase in theoretical and empirical explorations in both (idiosyncratic and systemic) risk measurement and micro- and macroprudential regulation. The overhaul of regulatory frameworks across the globe was not only the result of lessons learned from the recent crises but was also accompanied by extensive academic work. We have become better at measuring risk and designing regulatory tools to reduce the build-up of systemic risk and manage it more effectively. Having said this, much of the discussion has been dominated by the last crisis – as always: regulatory reforms after a crisis are designed to prevent the last but not the next crisis. We have thus become better at analyzing the known unknowns; this, however, leaves us with the unknown unknowns, including financial innovation leading to new business models and new structures in the financial system and thus new and future sources of financial fragility. As the financial system develops, research and analysis (both academic and within central banks and regulatory authorities) have to adapt to the dynamic nature of the financial system.

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# Index

- Bail-in Instruments, 9, 10
- Bail-out, 10
- Bank Recovery and Resolution Directive (BRRD), 9
- Banking Crisis, 14, 15
- Banking Union, 10, 25, 26
- Basel III, 6, 7, 10, 23, 25, 36
- Borrowing Capacity, 17
- Capital Regulation, 23, 25
- Capital Requirements, 7, 8, 18
- Common Equity Tier 1 (CET 1), 7, 10
- Core- and Periphery Structure, 34
- Delayed Trading Equilibrium, 19
- Financial Contagion, 18, 20–22, 26
- Financial Innovations, 30, 32
- Financial Institutions, 33
- Financial Liberalization, 17
- Financial Structure, 34
- Financial System, 22, 26, 37
- High Quality Liquid Assets (HQLA), 9
- Idiosyncratic Bank Risk, 32
- Idiosyncratic Shock, 20
- Interbank Connections, 18
- Interbank Market, 18–20
- Liquidity Coverage Ratio (LCR), 8, 9
- Liquidity Regulation, 25
- Liquidity Requirements, 8
- Long Term Capital Management (LTCM), 27
- macroprudential Tools, 11, 37
- Moral Hazard, 16
- Net Stable Funding Ratio (NSFR), 8, 9
- Regulatory Perimeter, 27
- Resolution Funds, 9
- Rule-based Regulation, 32
- Shadow Banking, 28
- Single Resolution Board (SRB), 12, 26
- Single Resolution Fund (SRF), 12
- Single Resolution Mechanism (SRM), 12
- Single Rulebook, 10
- Single Supervisory Mechanism (SSM), 10, 11, 24
- Total Loss Absorbing Capacity (TLAC), 10, 23