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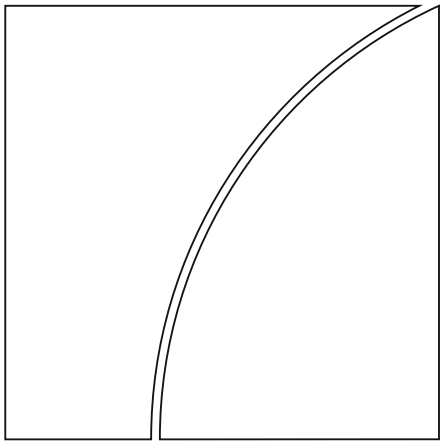

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Post-crisis international financial regulatory reforms: a primer

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Keywords: bank regulation, CCPs, asset managers, macroprudential.

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Post-crisis international financial regulatory reforms: a primer[1]

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Bank for International Settlements

Abstract

This paper reviews post-crisis financial regulatory reforms, examines how they fit together and identifies open issues. Specifically, it takes stock of the salient new features of bank and CCP international standards within a unified analytical framework. The key notion in this framework is "shock-absorbing capacity", which is higher when (i) there is less exposure to the losses that a shock generates and (ii) there are more resources to absorb such losses. How do the reforms strengthen this capacity, individually and as a package? Which areas merit further attention? We argue that, given the political economy pressures and technical obstacles that the reforms have faced, as well as the inherent uncertainty about the reforms' effects, it is important to maintain a conservative regulatory approach. A higher cost of balance sheet space is a healthy side effect of the backstops underpinning such an approach.

Keywords: bank regulation, CCPs, asset managers, macroprudential.

JEL classification: G21, G23, G28.

[1] ***This paper was written before the Covid-19 outbreak.*** That said, it sheds light on the financial system's behaviour during these unprecedented events and on the policy challenges that the authorities have faced, including in boosting credit supply.

The views expressed in the paper are those of the authors and not necessarily those of the BIS. We thank Frédéric Boissay, Stijn Claessens, Benoît Cœuré, Neil Esho, Wenqian Huang, Ulf Lewrick, Fernando Restoy, Takeshi Shirakami, Előd Takáts and Kostas Tsatsaronis for valuable comments and discussions and Alan Villegas for excellent research assistance..

Contents

Abbreviations

AT1	Additional Tier 1
BCBS	Basel Committee on Banking Supervision
CET1	Common Equity Tier 1
CCP	central counterparty
CCyB	countercyclical capital buffer
CLS	Continuous Linked Settlement
CPMI	Committee on Payments and Market Infrastructures
EMIR	European Market Infrastructure Regulation
EtL	exposure to losses
FSB	Financial Stability Board
FX	foreign exchange
GFC	Great Financial Crisis of 2007–09
G-SIB	global systemically important bank
HQLA	high-quality liquid assets
IASB	International Accounting Standards Board
IFRS	International Financial Reporting Standards
iLAR	going-concern loss-absorbing resources
IOSCO	International Organization of Securities Commissions
LAR	loss-absorbing resources
LCR	Liquidity Coverage Ratio
nLAR	gone-concern loss-absorbing resources
NSFR	Net Stable Funding Ratio
OIS	overnight index swap
OTC	over the counter
PFMI	Principles for Financial Market Infrastructures
RWA	risk-weighted asset
SAC	shock-absorbing capacity
SIB	systemically important bank
SITG	skin in the game
TBTF	too big to fail
TLAC	total loss-absorbing capacity
TR	trade repository

Introduction

The Great Financial Crisis (GFC) of 2007–09 marked a defining moment for the global financial system and the world economy. Unsurprisingly, the scale of the regulatory response is comparable only to that in the aftermath of the Great Depression. But in contrast to the 1930s, international cooperation has been of the essence, setting the basis for complementary initiatives in domestic jurisdictions.

The wide-ranging international financial regulatory reforms – spanning agreed standards and principles – have sought to buttress financial stability through both improved and new standards. That is, they have enhanced safeguards against risks that pre-crisis regulation had already covered; and they have expanded regulatory coverage to encompass previously unaddressed entity- and system-level risks.

We develop a unified analytical framework to examine how post-GFC reforms contribute to the stability of the financial system. To that end, we discuss both individual "trees" and how they come together to shape the regulatory "forest". We also identify "barren patches" in the forest, or areas that warrant further attention.

Our approach is fundamentally different from that in a vast and rapidly growing literature on the evaluation of regulatory reforms.[2] Much of that literature focuses on specific banking standards and estimates their impact on the cost and availability of financial services. By contrast, we use our framework to explain regulators' motives behind a large number of standards and discuss how these standards interact – in some cases reinforcing each other, in others giving rise to tensions. Based on our analysis, in particular of the areas warranting further attention, we argue that there is great merit in a conservative approach to regulation, notably through backstops.

Inevitably, given the breadth of the reforms, we need to limit coverage. We to do so on the basis of two criteria. The first delineates the scope of the reforms: we cover only those that modify or develop *international* standards or guidance for the regulation of financial entities, as opposed to markets.[3] The second limits the coverage of financial entity types: the ones we discuss face a *finalised* and *comprehensive* international reform package. These criteria lead us to focus on international regulatory reforms affecting banks and central counterparties (CCPs) for the clearing of derivatives. Since banks and CCPs are at the core of the financial system and are intimately linked, they are critical for financial stability.

Admittedly, this coverage leaves out of scope important prudential issues related to non-bank financial intermediation, financial markets and the broader economy. This is a key simplification. Stress at banks can lead them to reduce intermediation services, which can weaken the non-bank financial system, real activity and ultimately the banks themselves. Moreover, non-bank intermediaries are prominent players in the financial system. And some of them, notably mutual funds and hedge funds, have

[2] See Aikman et al (2018) for a review, Boissay et al (2019) for an overview and a repository, and BCBS (2010a) for an initial macroeconomic assessment of Basel III. .

[3] The focus on international reforms means that we will leave out domestic reforms that may, and typically do, also have an international impact. Notable examples are structural bank reforms (eg Vickers and Volcker-type measures), money market fund reforms in the United States and the European Union, national resolution regimes, and national initiatives related to stress testing, data reporting and new financial technologies.

been gaining ground since the crisis.[4] In addition, capital markets can originate, propagate and greatly amplify financial stress. Cognisant of these issues, we refer to them in parts of our discussion and illustrate how our analysis could be extended to the asset management sector.

Given our restricted coverage and, more importantly, our interest in exploring *qualitatively* the relationship between reforms and regulators' financial stability objectives, we stay away from a cost-benefit analysis. Such an analysis requires a broader coverage of financial entities in order to study the migration of risks across the system. It also puts the spotlight on economic agents' incentives, which are rarely regulators' primary target. Ultimately, the analysis would require a careful empirical examination of financial stability-economic growth (welfare) trade-offs, and hence a paper on its own.[5]

Scope of the post-crisis financial reforms covered

Table 1

Entity (standard-setting body)	International standard / guidance	Other reforms (non-exhaustive examples)
Banks (BCBS, FSB)	• Basel III • Total loss-absorbing capacity • International Financial Reporting Standard 9 • Key attributes of effective resolution regimes	• Structural reforms • Market functioning • Stress testing • Corporate governance • Remuneration • Data harmonisation • Cyber resilience
CCPs (CPMI-IOSCO, FSB)	• PFMI • Guidance on resolution	
Asset managers (IOSCO)*	• Recommendations for money market funds • Framework for assessing leverage in investment funds	
Insurers (IAIS)	• ICS 2.0 (under monitoring) • Holistic framework	
Pension funds (IOPS)	• Guidelines and good practices	
Credit rating agencies (IOSCO)	• Code of conduct	
Auditors (IAASB)	• Framework for audit quality	

Reforms not covered explicitly in our paper.
* Partly covered in Box D and Section 5.3.5 below.

BCBS = Basel Committee on Banking Supervision; CPMI = Committee on Payments and Market Infrastructures; FSB = Financial Stability Board; IAASB = International Auditing and Assurance Standards Board; IAIS = International Association of Insurance Supervisors; IOPS = International Organisation of Pension Supervisors; IOSCO = International Organization of Securities Commissions; ISC = Insurance Capital Standard; PFMI = Principles for Financial Market Infrastructures.

[4] For a discussion of the destabilising market dynamics that can stem from the fund management sector, see BIS (2018).

[5] The Basel Committee on Banking Supervision and the Financial Stability Board have taken on the responsibility of performing evaluations of post-crisis reforms, covering a large number of issues and countries; see eg Hernández de Cos (2019) and FSB (2018a,b, 2019).

Table 1 outlines the reforms we focus on. The Basel III framework of the Basel Committee on Banking Supervision (BCBS) is at the core. Its overarching objective is to ensure that the "banking sector serves as a shock absorber" (BCBS (2011b)) in order to "support the real economy and contribute to sustainable economic growth over the medium term" (BCBS (2017a)).[6] In parallel, the International Accounting Standards Board (IASB) has, among other things, aimed to improve banks' recognition of credit losses – a key element of the International Financial Reporting Standards (IFRS) on financial instruments (IFRS 9). The Financial Stability Board's (FSB's) Key Attributes of Effective Resolution Regimes for Financial Institutions set out "the core elements to allow authorities to resolve institutions in an orderly manner without [resorting to the] taxpayer" (FSB (2014)). Orderly resolution rests on "sufficient loss-absorbing and recapitalisation capacity", which is the objective of the FSB's total loss-absorbing capacity (TLAC) standard for global systemically important banks (G-SIBs) (FSB (2015)). In turn, the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) has issued Principles for Financial Market Infrastructures (PFMI) to establish robust CCPs that can withstand financial shocks (CPMI-IOSCO (2012)). Finally, the FSB has issued guidance to improve CCPs' recovery and resolution planning (FSB (2017b)).

At the heart of our framework is the notion of *shock-absorbing capacity*. How can banks and CCPs avoid losses or withstand them when they materialise? And, in case the entities enter resolution, how can regulators ensure that there are enough prefunded resources for a smooth process that minimises spillovers to the rest of the system? In exploring this, we are not just interested in the stability of individual institutions – what has come to be known as the "microprudential" perspective – but also in that of the financial system as a whole – the so-called "macroprudential" perspective.[7]

Focusing on shock-absorbing capacity has the merit of using a *single metric* to analyse the otherwise multifaceted concept of financial stability. It also means that, in contrast to much of the academic literature, we do not need to take a stand on the specific "market failures" that regulatory measures should seek to address – an area where disagreement reigns.[8] For the assessment of post-crisis reforms, we refer to the underlying objectives that regulators were pursuing. While these objectives need not always coincide with specific financial frictions identified by a specific strand of the academic literature, they invariably relate to shock-absorbing capacity.

The main takeaways of our analysis are as follows.

First, the post-crisis reforms have made decisive strides to enhance the shock-absorbing capacity of the system. The reforms have improved the timeliness, quantity and quality of the resources that support financial stability. They have also enhanced their robustness to misestimating or misreporting risks. Importantly, the new

[6] We do not elaborate on enhancements to the supervisory review and the disclosure requirements designed to facilitate market discipline. These leave a lot of room for discretion and, as a result, they are largely jurisdiction-specific. Of course, this is not to say that the initiatives are unimportant – far from it: in particular, without effective supervision supported by high-quality data, any standard is toothless. Under Basel III, these enhancements relate, respectively, to Pillar 2 and Pillar 3 of banking regulation. For CCPs, they have to do, for instance, with the supervisory stress-testing framework.

[7] For the distinction and analysis of the two perspectives, see eg Crockett (2000) and Borio (2003).

[8] Even though we do not take a stand on the specific rationales for prudential regulation, Box A provides a brief and non-exhaustive review as put forward in the academic literature. See also Rajan (2018) for a related classification of reasons for bank regulation.

macroprudential orientation of regulation seeks to generate resources in tranquil times, when there are signs that financial imbalances are growing, and to deploy them when most needed, in a systemic event. It also seeks to ensure that loss-absorbing resources match institutions' systemic footprint.[9]

Second, key benefits of the reforms stem from the *interaction* among standards. While some standards reduce banks' exposure to losses (eg liquidity requirements, exposure limits), others help build loss-absorbing resources (eg bank capital and CCP margin requirements). While some uphold the principle of "more risk, more capital" (eg new risk-weight mapping), others create complementary backstops to the mismeasurement or misreporting of risks (eg leverage ratio requirements). While some seek to ensure enough resources for a smooth resolution (eg minimum requirements for loss-absorbing capacity), others support the continuity of banking services in the face of shocks (eg regulatory buffers).

Third, the interaction among standards can also give rise to tensions that warrant attention. It is possible that a standard partly transforms one risk into another or simply redistributes risk within the system. For example, addressing counterparty risk typically creates liquidity risk: the counterparties involved face a higher risk of having to raise funds to meet payment obligations. Similarly, making a CCP safer through larger prefunded resources increases the risk exposures of its members, largely banks, which put up the resources. Proper identification and assessment of such trade-offs requires a macroprudential perspective.

Fourth, the major achievements of the reform help identify specific areas of the regulatory package that merit further attention. From a microprudential perspective, the main ones in the realm of banks and CCPs include: (i) the valuation of assets, through provisioning and charge-off practices, which could lead to an overstatement of banks' capital strength; (ii) the differential regulatory treatment of functionally similar transactions (eg FX swaps and repos); (iii) the privileged regulatory treatment of sovereign exposures; and (iv) the treatment of interest rate risk in the banking book. In turn, a macroprudential perspective underscores that: (i) the systemic impact of small banks taken as a group has remained out of regulatory scope; (ii) no standard enforces countercyclical CCP margining practices or addresses explicitly the CCP-bank nexus; and (iii) the recognition of a portion of interbank claims as regulatory capital could weaken the resilience of the banking system as a whole. Furthermore, the barren patches are not specific to bank and CCP standards: for instance, a macroprudential perspective is absent in the regulation of asset managers.

These areas would benefit from future work and can inform the current regulatory stance. In most cases, their existence does not reflect lack of awareness, but either the complexity of the underlying problem or political economy difficulties in reaching a global consensus. As a result, any progress will take time – not least given that the current priority is, and should be, to implement the agreed reforms in a full, timely and consistent manner. This puts a premium on a conservative regulatory approach that may use multiple metrics for similar risks.[10] Such a belt-and-braces

[9] Consistent with the scope of reforms outlined in Table 1, we focus only on macroprudential instruments developed at the international level. For a discussion of a broader set of macroprudential instruments and jurisdictions' experience with them, see BIS (2018) and IMF-FSB-BIS (2016).

[10] In addition, a conservative approach could influence the calibration of regulatory standards. It could, for instance, raise the capital and liquidity requirements for given measurements of the underlying risks. Since we abstract from the rationales for and a cost-benefit analysis of regulation, we do not derive a benchmark against which to judge whether standards are calibrated conservatively or not.

approach helps ensure a minimum amount of loss-absorbing resources for any level of measured risk and to contain risk exposures.

The rest of the paper is organised as follows. The first section outlines the analytical framework. It defines key concepts and describes their relationship – ie it lays out the perimeter of the forest and provides a compass to explore it. The second and third sections consider, respectively, individual regulatory standards for banks and principles for CCP – that is, the trees. The overarching objective of these sections is to explain how policymakers sought to correct deficiencies in pre-crisis regulation. The fourth section steps back to examine interrelationships among regulatory measures – that is, the forest. The fifth discusses remaining uncertainties and gaps that warrant further policy attention – that is, barren patches – focusing mainly on bank and CCP regulation but also drawing parallels with that for asset managers. The last section concludes.

Box A

Rationales for financial regulation

Frédéric Boissay

This box provides a selective review of rationales for subjecting financial institutions to prudential regulation, as put forward in the economic literature. It classifies these rationales in two categories: microprudential and macroprudential (Borio (2011)).

Microprudential

Left to their own device, unregulated financial firms may take risks and shift them onto their depositors, the central bank, or taxpayers, ie create "moral hazard". Moral hazard arises when there is insufficient market discipline on financial intermediaries.

One source of moral hazard is asymmetric information. Financial markets exhibit asymmetric information in the sense that some participants are in a better position to make an informed decision than their counterparties. For instance, having superior information about opaque long-term risky loans is the main feature of a viable commercial banking model (eg Gorton and Pennacchi (1990), Dang et al (2017)). Banks exploit their superior information, by demanding that creditors accept a discount (eg the difference between the risk-adjusted lending rate and the deposit rate) as compensation for the screening and monitoring of borrowers. To the extent that creditors cannot ascertain the quality of borrowers, though, banks have an incentive to do less monitoring than of what they charge creditors (Holmström and Tirole (1997)) and to take more risk. There is thus moral hazard. Aware of it, uninsured creditors may require higher risk premia, which could in turn induce banks to take even more risk (Stiglitz and Weiss (1981)). This type of adverse dynamics can expose financial firms' short-term funding to panics, thus undermining financial stability (Gorton (2009), Gorton and Metrick (2012)).

Another important source of moral hazard is limited liability. A bank's shareholders, for example, are not personally liable for any of the bank's debt – they can lose only what they already invested in the bank. Granted, limited liability provides an important impetus to entrepreneurship. But, with unlimited potential upside gain and limited downside, shareholders have an incentive to encourage risk-taking by management, thus giving rise to moral hazard. Essentially the same mechanism is at play when banks have access to underpriced safety nets – be they implicit or explicit – such as deposit insurance. In this case, depositors have little incentive to monitor banks' activities, thus enticing banks to leverage up and take risks in excess of what would be in the interest of the deposit insurance fund.

When market discipline fails to prevent excessive risk taking at the level of individual banks, microprudential regulation protects those bank stakeholders that are at risk. The literature considers two approaches. The direct approach consists of requiring banks to invest in relatively safe assets and to increase their loss-absorbing resources. Liquidity and capital requirements "de-risk" balance sheets by, respectively, forcing banks to hold high-quality liquid assets and constraining the amount of risk they can take for a given amount of equity. This results in banks holding assets that are less subject to the asymmetric information problem (ie "information-insensitive" assets), which reduces

the scope for moral hazard and strengthens confidence in banks. In addition, more capital allows a bank to absorb larger shocks and stay afloat. Under the indirect approach, more equity capital serves to impose a greater share of losses on financial institutions' shareholders, which in turn helps to align their incentives with the interests of other stakeholders (eg creditors, taxpayers). While Rajan (2018) sees the merits of the direct approach, he argues that experience during the Great Financial Crisis casts doubt on the validity of the incentives channel.

Macroprudential

Even when individual incentives are aligned, regulation is still justified by system-wide – or "macroprudential" – considerations. The reason is that financial institutions do not fully internalise the social costs of their actions or failure. The macroprudential approach of regulation has two dimensions. There is a cross-sectional dimension, dealing with how risk is allocated within the financial system at a given point in time. And there is a time dimension, dealing with how aggregate risks in the financial system evolve and materialise over time.

In the cross-sectional dimension, system-wide risks emanate from the common exposures and interlinkages in the financial system. Bank runs and asset fire sales (Diamond and Dybvig (1983), Schleifer and Vishny (2011)) are two examples of how such risks may materialise, resulting in the joint failures of financial institutions. When banks hold (or are perceived to hold) the same type of assets or lend to each other, difficulties at one bank can induce depositors of other banks to withdraw en masse. The resulting need to deleverage could lead banks to shed assets on short notice. And to the extent that banks' assets do not have natural buyers, this could quickly degenerate into a fire sale, with banks having to accept large price discounts and ultimately default, even though they are genuinely solvent. Fire sales are amplified during panics because other financial intermediaries, who would normally be natural buyers of the assets on sale, are likely to be in distress as well. As individual firms do not internalise these effects, they tend to hold too much illiquid assets and to issue too much demandable debt, compared to what would be consistent with financial stability.

Another key systemic risk arises from the possibility that financial institutions which play a pivotal role in the economy become insolvent (Claessens et al (2010)). There is time inconsistency in the provision of public support to such institutions. Take, for instance, those that manage the payment system. The optimal ex ante policy is to unconditionally deny them public support so that they adopt a conservative approach to risk management. However, since disruptions in payment services could greatly disrupt the financial system as a whole, the institutions providing the services are perceived as too big to fail (TBTF). They thus anticipate that they would benefit from public support ex post, when they come under stress (Stern and Feldman (2004)). Such time inconsistency calls for regulation that induces TBTF institutions' risk management to internalise the overall economic costs of their public assistance.

In the time dimension, financial instability stems from procyclicality, or amplifying mechanisms that operate within the financial system and between the financial system and the real economy and that can cause financial instability (eg Kindleberger (1996), Minsky (1982)). During the boom phase of financial cycles, imbalances may surface as asset price bubbles, leverage cycles, and credit booms, which sow the seeds for the eventual bust. These symptoms may emerge when agents – even though rational – do not fully internalise the costs of the unravelling of imbalances (Lorenzoni (2008), Korinek (2011), Bianchi and Mendoza (2010)). They may also arise from agents irrationally overreacting to good news while neglecting tail risks (Gennaioli et al (2012, 2015)).

While policy measures with a primary microprudential focus could help mitigate system-wide risks, measures calibrated directly to such risks – that is, macroprudential measures – would have the strongest impact (Claessens (2015)). An example of the first type is liquidity buffers: these help stem fire sales and the attendant system-wide repercussions. As an example of the second type, in the time dimension, countercyclical capital buffers are designed to force banks to build up loss-absorbing resources (LAR) during unsustainable financial expansions. Another example, in the cross-sectional dimension, has to do with requirements for LAR and resolution planning that target specifically global systemically important banks.

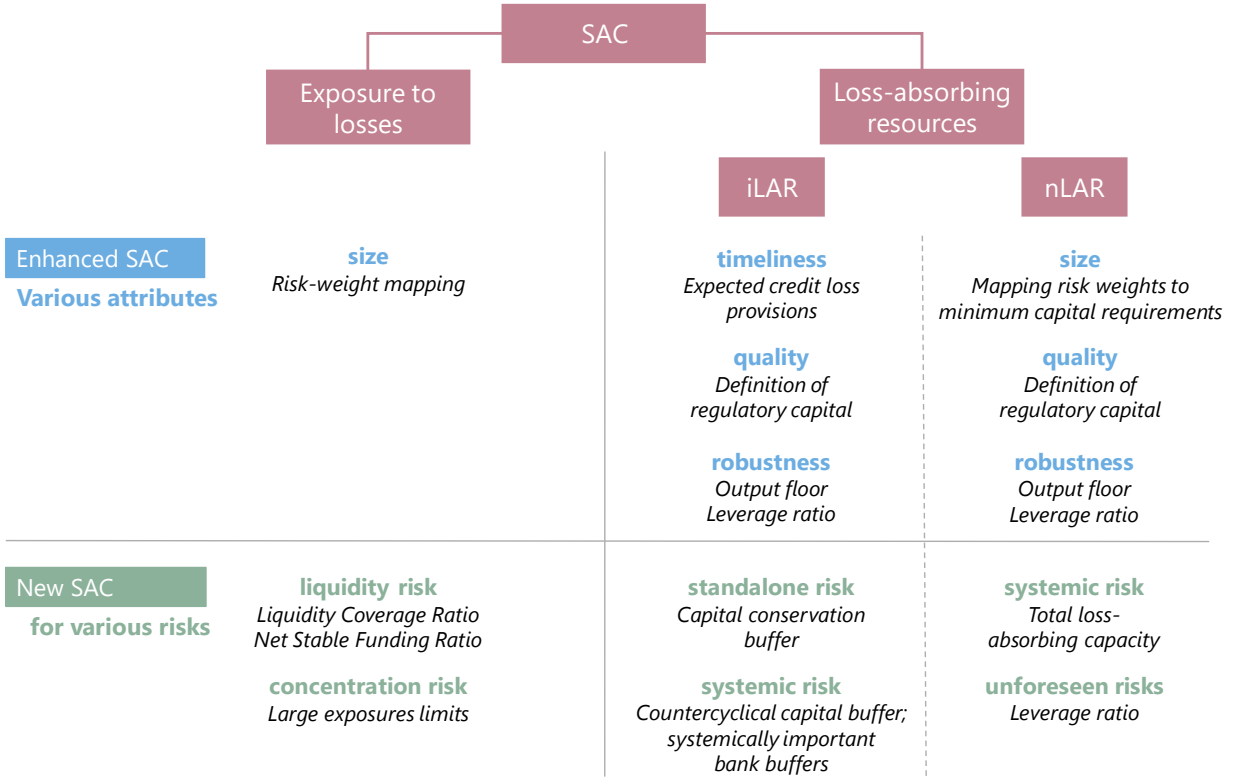
1. An analytical framework[11]

Our analytical framework consists of three elements: the system under study; a metric to capture this system's stability; and a set of regulatory standards that influence the degree of stability as measured by this metric.

The **system**, which defines the perimeter of our analysis, comprises banks and CCPs. Our choice of system reflects two simplifying assumptions. First, given that CCPs' main and most important clearing members are banks, we assume that all its members are banks. Second, we largely abstract from the rest of the real-world financial system and the broader economy.

Shock-absorbing capacity (SAC) is the measuring rod, or metric, that gauges the system's degree of stability. It is analogous to the unit of account in a monetary system – eg dollars or euros – although our analysis is largely qualitative. Our objective is to outline how regulatory standards and principles – individually or jointly – affect SAC (Graph 1).

Shock-absorbing capacity (SAC) and its components — Graph 1



nLAR and iLAR = loss-absorbing resources for gone and going concerns, respectively.

Source: Authors' elaboration.

The **regulatory standards** that result from the post-crisis reforms differ in terms of their novelty. Some of them seek to *enhance SAC* by improving existing regulatory

[11] Claessens and Kodres (2014) provide an alternative way of framing financial stability issues, designed to support cost-benefit analyses of the regulatory reforms from a normative system-wide perspective.

standards. Others aim to generate *new SAC* for risks that were out of regulatory scope pre crisis, including risks that regulators fail to measure or foresee.

In discussing the effect of regulatory standards, we "slice" SAC – be it enhanced or new – in two different ways. First, we think of SAC as having two components – *loss-absorbing resources* and *exposure to losses*. Second, we distinguish between *standalone SAC* and *systemic SAC*.

1.1 Loss-absorbing resources vs exposure to losses

SAC rests both on measures that generate resources for absorbing losses and on measures that shield entities from the losses that a shock could generate.

Loss-absorbing resources (LAR) comprise the amount that the claimants on an institution are contractually prepared to lose. This may appear a simple concept but it is not. The purest example of LAR is an entity's *equity capital* – the difference between the value of its assets and that of its liabilities. Provisions complement capital by accounting for expected losses. By contrast, deposits and senior debt do not typically have absorbing functions for credit losses. Importantly, however, a black and white characterisation would be an oversimplification. There are various gradations in the loss-absorbing properties of junior debt and hybrid instruments and these properties may change with the intensity of distress.

This leads us to distinguish two types of LAR, which differ with respect to who is in control of the financial entity when the resources are being drawn down. The first type comprises resources that absorb losses when shareholders are in control, meaning that the entity is a go*i*ng concern. We refer to these resources as *iLAR* ("i" for "go*i*ng"). The second type comprises those resources that come into play when control shifts to public bodies – eg supervisors or other resolution authorities – and the institution becomes a go*n*e concern. We refer to these resources as *nLAR* ("n" for "go*n*e").

The distinction between iLAR and nLAR maps into another one, which has not quite received the attention it deserves – that between *buffer* and *minimum* requirements. The spirit of regulation associates regulatory buffers with iLAR and minimum requirements with nLAR. Buffers are intended to help an entity avoid breaching its minimum requirements so that it can continue to function normally. In turn, minima seek to ensure that enough resources are available for an orderly resolution, whether by closing down a gone concern or by restructuring it in order to preserve its critical functions. In practice, however, this distinction is not always clear cut. Market dynamics and supervisory expectations may influence the extent to which buffers behave as intended as opposed to as minimum requirements. We elaborate on this fuzziness in Box B.

Exposure to losses (EtL) is defined as the potential for an entity to incur losses because of damaging events ("shocks").[12] EtL could stem from either the asset or the funding side. An entity shields itself from losses by reducing the sensitivity of its assets to either defaults (credit and counterparty risk) or valuation changes (market risk). It may also do so by strengthening internal procedures and systems (operational risk).

[12] The term "shock" is partly misleading, as it could be interpreted to refer only to an exogenous event that results from forces external to the financial system. In fact, a shock may be the result of the previous behaviour of the financial institutions themselves, ie be endogenous. For example, a common element of financial crises is the unwinding of financial imbalances that have accumulated as a result of previous risk-taking.

In addition, EtL declines with the ability to raise liquidity swiftly in order to meet cash calls or ward off runs. In turn, such "funding liquidity" depends on the capacity to borrow and/or sell assets in a timely manner and with little impact on their price – that is, on "market liquidity" (Borio (2009), Brunnermeier and Pedersen (2009)). Ultimately, funding liquidity reduces the likelihood of default.

1.2 Standalone SAC vs systemic SAC

From what alternative perspectives should one examine SAC? Here, an important distinction is between SAC at the level of individual entities, treated on a standalone basis, and SAC at the level of the system as a whole, or systemic SAC, taking into account interrelationships. We are primarily interested in systemic SAC, which can differ from the sum of the standalone SACs for at least two reasons.

The first is that there may be balance sheet interlinkages across entities, giving rise to intra-system or "inside" positions. If one entity reduces its EtL through contractual arrangements with other entities in the system, any losses would be simply redistributed, not reduced. Likewise, if the capital of banks and CCPs is held by other banks or CCPs, then it need not contribute to the LAR of the system. An inside position enhances financial stability only to the extent that it redirects the effect of shocks to those entities that absorb losses by shifting them onto households, businesses and/or governments – that is, by offloading the losses outside the system. This offloading capacity is what ultimately determines *systemic* SAC.[13]

This points to a fundamental difference between banks and CCPs. Banks have large assets and liabilities vis-à-vis other banks and counterparties *outside* the system. By contrast, CCPs are mutualising schemes and have mostly *inside* positions. As a result, unlike in the case of banks, treating CCPs as standalone entities cannot tell us much about systemic stability. We develop further this point below, where we review CCP prudential measures and highlight limitations of drawing parallels with seemingly analogous ones for banks.

The second reason why systemic SAC may differ from the sum of standalone SACs has to do with the synchronicity of losses across entities. Even absent any balance sheet linkages, losses may be correlated and occur together as a result of common exposures to the same "shock". This shock could either be external to the system – eg originating in the real estate sector – or stem from endogenous amplifying mechanisms – eg a run reflecting the behavioural contagion among holders of bank liabilities.

The **microprudential** and **macroprudential** approaches to regulation target, respectively, standalone and systemic SAC. International regulatory standards were entirely microprudential pre-crisis and continue to be largely such. That said, an explicit macroprudential approach has been gaining ground post crisis.

The macroprudential approach operates along the cross-sectional and time dimensions. Along the first, it calibrates prudential standards by considering individual institutions' contribution to systemic risk at a given point in time. By analogy with a portfolio of securities, this is akin to considering not the variance of each security but its covariance with the other securities (Borio (2003), Tarashev et al (2016). Along the time dimension, the approach seeks to address the evolution of risk

[13] Relatedly, see Holmström and Tirole (2011) on inside and outside liquidity.

Box B

nLAR and iLAR in practice

This box is in two parts. The first explains that, in practice, the link between minimum requirements and nLAR is fuzzy. The second discusses factors that could impair the usability of regulatory buffers as iLAR. The box refers to three different types of regulatory capital instruments. Ranked from highest to lowest loss absorbency, these are: common equity Tier 1 (CET1), Additional Tier 1 (AT1) and Tier 2 capital. The sum of these instruments, which are discussed further in Section 2.1 below, is equal to total regulatory capital.

Point of non-viability and resolution

The Basel capital framework refers to the point of non-viability (PONV) as the point at which a bank may no longer be considered viable as a going concern. At this point, non-CET1 capital can be converted into equity or written down. Authorities can enforce the writedown or conversion at the PONV based on either statutory powers or contractual features of capital instruments (BCBS (2011a)).

Resolution regimes aim at preserving the critical functions of a failing bank. A bank is said to enter resolution when the public authorities start the corresponding administrative resolution proceedings. The FSB's Key Attributes set out that resolution should be initiated when a bank is no longer viable or likely to be no longer viable, and when it has no reasonable prospect of becoming viable again. In practice, resolution may be limited to a subset of banks in a jurisdiction (eg typically the larger banks), with the others being subject to a standard insolvency proceeding or liquidation.

The PONV is impossible to pin down ex ante. No regulatory text postulates that a breach of a minimum requirement is equivalent to passing the PONV. Even after such a breach, the bank could remain a going concern if its supervisors judge that there is a sufficiently high likelihood that it would summon enough private resources to avoid failing on its contractual obligations and continue to function normally. Conversely, if supervisors perceive a bank to be heading irreversibly to failure that would generate material externalities, they could try to contain them by placing the bank in resolution even before it has actually breached a requirement. Thus, the size of nLAR could be higher or lower than what the minimum requirements imply.①

The treatment of PONV and resolution triggers varies across jurisdictions. In several jurisdictions, the PONV and the point of entry into resolution coincide, ie resolution proceedings begin once the relevant authorities deem that a bank is no longer a going concern. In other jurisdictions, the two points do not coincide. For these jurisdictions, additional LAR generated at the PONV could in principle be sufficient to improve a bank's CET1 position – thus, restore the bank's viability – without having to undertake further recovery and resolution measures.

Graph B provides a stylised illustrative example of the spectrum of a bank's LAR and shows the range of potential regulatory responses and trigger points as the bank incurs losses. Given the various early-intervention regimes, resolution regimes and insolvency proceedings across jurisdictions, there is in principle a wide and "fuzzy" range of LAR where a bank could be subject to PONV-related triggers and/or resolution/liquidation proceedings.

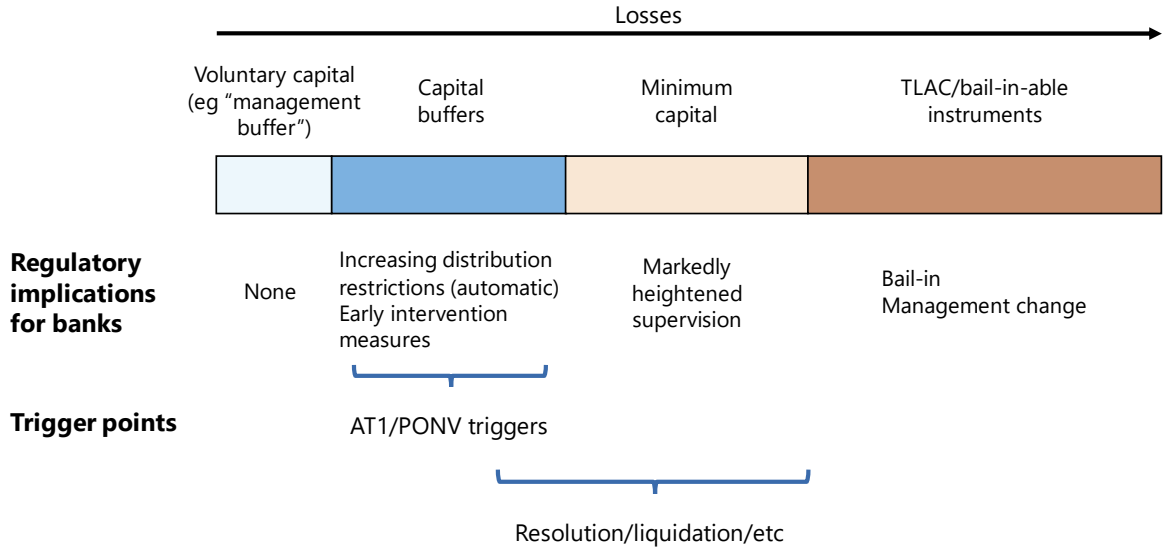
To a large extent, supervisors' actions would be guided by the market. The market influences asset values and determines the cost and availability of funding. Thus, it could allow a supervisor to be lenient or, conversely, could force a resolution.

It makes a difference which minimum a bank has breached or is about to breach. Since the loss-absorbing properties of CET1 capital are the strongest, approaching a CET1 minimum is likely to trigger a greater market – and, consequently, supervisory – reaction than approaching a total-capital minimum. Likewise, a breach of the NSFR requirement need not call for a forceful and immediate regulatory response as long as the bank is satisfying its capital requirements and is not facing debilitating liquidity shortages.

The Basel regulatory framework intends minima to be signposts for supervisory intervention rather than mechanistic triggers of resolution proceedings. Indeed, the framework states that "supervisors should seek to intervene at an early stage to prevent capital from falling below the minimum levels required to support the risk characteristics of a particular bank and should require rapid remedial action if capital is not maintained or restored" (BCBS (2006)).The framework then lists examples of interventions, including "intensifying the monitoring

of the bank, restricting the payment of dividends, requiring the bank to prepare and implement a satisfactory capital adequacy restoration plan, and requiring the bank to raise additional capital immediately". Given the high attendant costs, bank managers have incentives to avoid supervisory interventions by staying clear of breaching regulatory minima.

Spectrum of loss-absorbing resources and potential regulatory responses (an illustrative example) Graph B



AT1 = Additional Tier 1; PONV = point of non-viability; TLAC = total loss-absorbing capacity.

Source: Authors' elaboration.

Buffers only on paper?

The rationale of the Basel III capital buffers is threefold: (i) to provide an additional layer of usable iLAR to absorb losses in times of stress; (ii) to prevent imprudent depletion of capital resources; and (iii) to mitigate negative systemic "externalities" (eg fire sales or deleveraging). Objectives (i) and (ii) essentially reflect a microprudential perspective, objective (iii) a macroprudential one.

With the buffer framework largely untested in practice, these objectives may conflict in some circumstances. The usability of a buffer as iLAR depends on the extent to which a bank is allowed or willing to draw on it. This, in turn, could depend on three broad factors.

First, the nature of stress could affect the buffers' capacity to act as iLAR. A bank may be more reluctant to use its buffer in an idiosyncratic stress episode, as its capital position would weaken more visibly relative to its peers. In contrast, a system-wide stress could alleviate some of the bank-specific stigma.

Second, the supervisory response to a buffer drawdown would matter. Supervisors that place more weight on the microprudential objectives may be more prone to requiring a distressed bank to shore up its capital base promptly, thereby minimising the use of buffers as iLAR. In contrast, supervisors that place more weight on the macroprudential objective may be more tolerant, to the extent that doing so would help minimise systemic disruptions. In jurisdictions where two different authorities are in charge of microprudential and macroprudential regulation, respectively, coordination between them would be necessary in order to avoid sending conflicting messages to banks.

Third, the reaction by market participants to a buffer drawdown – and the associated distribution restrictions – could be a serious constraint. The potential stigma or signalling effects of cutting back dividend or coupon payments may induce market participants to perceive the bank as more risky, which would lead to higher funding

costs and/or a run on the uninsured portion of the bank's debt. Ultimately, the deterioration of the bank's liquidity position could endanger its solvency.

① Even though minimum requirements apply at the consolidated level, this issue has a cross-border dimension. The available level of nLAR may be lower than it appears to be if differences across national resolution regimes and insufficient trust between home and host authorities results in resources being trapped behind national boundaries. See Restoy (2019).

over time and, more specifically, the disruptive procyclicality of the financial system (Borio et al (2001), FSF (2009)). Here, the approach recognises that risks build up during financial booms and materialise during financial busts, which means that the bust is largely a consequence of the boom that precedes it. Along each dimension, macroprudential regulation treats risk as influenced by the collective behaviour of institutions (endogenous) rather than as independent of it (exogenous). The collective behaviour exacerbates the build-up of risks and magnifies their fallout.

2. The trees: elements of the banking reforms

Global banking standards originated in the serious stress in international currency and banking markets in the mid-1970s. Bankhaus Herstatt's failure in 1974 is perhaps the most notable example (BCBS (2018a)). The main policy response sought to "close gaps in international supervisory coverage so that: (i) no banking establishment would escape supervision; and (ii) supervision would be adequate and consistent across member jurisdictions" (BCBS (2018a)).

The initial global framework of minimum standards for internationally active banks – Basel I – was finalised in 1988. Recognising that banks perform critical functions – payments and settlements, financial intermediation and deposit-taking – this framework formulated three main objectives. First, ensuring that banks maintain an adequate level of capital – that is "own funds" – at all times (BCBS (1988)). Second, enforcing a regulatory level playing-field for cross-border banking. Third, increasing the comparability of banks' capital positions (BCBS (2013a)).

Under Basel I, banks were required to meet a minimum ratio of capital to risk-weighted assets (RWAs). The calculation of RWAs was based on a relatively simple standardised approach. This approach assigned different risk weights to different asset classes on account of their relative riskiness. It also captured some of banks' off-balance sheet exposures through a simple methodology for converting these exposures into on-balance sheet equivalents.

While Basel I represented an important milestone in global bank regulatory and supervisory cooperation, it did not stand the test of time. The limited differentiation of risk created incentives for potentially destabilising risk-taking behaviour. In fact, the underlying standardised approach quickly became outdated in light of the rapid development of banks' risk management and modelling approaches. In addition, the scope of Basel I was largely limited to credit risk. Risks that Basel I did not cover explicitly, such as market and operational risk, became increasingly prominent during the 1990s (BCBS (2013a)).

Accordingly, the Basel II framework – finalised in 2004 – sought to develop a more "risk-sensitive" approach. Specifically, for the calculation of capital requirements for credit, market and operational risk, the framework allowed banks to use internal models, subject to meeting certain conditions. It also encouraged banks to strengthen

their internal risk management by deliberately reducing capital requirements for those institutions that obtained approval to use internal risk models for regulatory purposes. Put differently, the authorities 'subsidised' banks in order to improve their risk management. The underlying premise was that supervisors would be capable of validating the models so as to apply proper safeguards.

However, the GFC revealed that Basel II had not met its objectives: the banking system's SAC was inadequate. For one, banks had too little LAR relative to the credit, market and operational risks they were facing. In addition, the EtL, notably that associated with liquidity shocks, put serious strain on banks' LAR.

Banks' LAR proved deficient for several reasons. First, the underlying instruments' capacity to absorb losses was smaller than assumed. Second, the size of required LAR – exclusively, nLAR at the time – was too small: the losses during the crisis would have dwarfed banks' LAR even if the optimistic pre-crisis assumptions had been valid. Third, the authorities had relied excessively on banks' internal models, underestimating the potential for mismeasuring and misreporting risks, and on an exclusively microprudential approach, thereby missing the pre-crisis build-up of system-wide risks. Finally, left to their own devices, banks had generated limited amounts of iLAR, which forced them to scramble for resources in the midst of the crisis, ie at the most inopportune time.

In addition, the authorities had underappreciated important aspects of banks' EtL. International standards did not address the concentration of credit exposures. Nor did they target liquidity risk.

Thus, the post-crisis regulatory reform had to address a wide-range of issues. It sought to address systematically all of the above shortcomings, from both a microprudential and, for the first time, a macroprudential perspective. The overall banking reform comprised Basel III as well as several related regulatory and accounting standards.

We next consider specific aspects of this reform at the "trees" level, as listed in Table 2. We examine, sequentially, measures designed to strengthen nLAR, iLAR and EtL. In each case, we discuss the issue at stake from the regulators' perspective and explain how the reforms sought to address it.

List of post-crisis banking reforms covered

Table 2

Reform	What was the issue?	What was the response?	Assessment of direct impact
		Enhancing nLAR	
Definition of capital	Regulatory capital did not absorb losses	Enhance loss absorption, mainly via CET1 capital requirements	Quality of iLAR and nLAR
Minimum risk-weighted capital requirements	Insufficient capital. Inadequate risk capture. Overreliance on models.	Higher minimum requirements. Greater risk sensitivity. Constrained use of internal models.	Size and robustness of nLAR and size of EtL
Minimum LR	Unsustainable build-up in leverage	Risk-insensitive backstop to risk-weighted framework	Size and robustness of nLAR and iLAR
Total loss-absorbing capacity	Inability to resolve large banks in an orderly manner	Subject G-SIBs to nLaR add-on. Enhance resolution regimes.	Size of nLAR
		Enhancing iLAR	
Expected loss provisioning	"Too little, too late" provisioning	Forward-looking approach	Timeliness of iLAR
Capital conservation buffer	Lack of usable capital to absorb losses and maintain lending	Capital buffer for all banks	Size of iLAR
G-SIB buffer (risk-weighted and LR)	Externalities resulting from G-SIB distress	Buffer add-on for G-SIBs	Size of iLAR
Countercyclical capital buffer	Build-up in system-wide risks not reflected in regulatory framework	Time-varying buffer to protect banking system from fallout from excessive credit growth	Size of iLAR
		Reducing EtL	
Large exposure limits	Excessive concentration to single counterparty	Quantitative exposure limits	Size of EtL from concentration risk
Liquidity Coverage Ratio	No international standard for funding liquidity risk	Requiring liquid assets for short-term liquidity stress	Size of EtL from liquidity risk
Net Stable Funding Ratio	No international standard for excessive maturity mismatches	Align funding stability with asset liquidity along maturity structure	Size of EtL from liquidity risk

CET1 = Common Equity Tier 1 EtL = exposure to losses;; G-SIB = global systemically important bank; LR = leverage ratio; nLAR and iLAR = loss-absorbing resources for gone and going concerns, respectively; TLAC = total loss-absorbing capacity.

2.1 Reforms enhancing banks' nLAR

A key objective of the regulatory reform has been to enhance banks' nLAR. Most of the corresponding measures are part of the Basel III framework: (i) revisions and enhancements to the definition of regulatory capital and to the risk-weighted capital framework; and (ii) the introduction of a new standard that abstracts as far as possible from risk estimates – the leverage ratio. Another set of nLAR measures, falling outside Basel III, require for the first time that systemically important banks have a minimum amount of loss-absorbing capacity in resolution. When applied to banks present in several jurisdictions, the measures face important cross-border challenges, which we discuss in Box C.

Box C

Usability of nLAR in resolution

This box discusses sequentially the accessibility of nLAR generated by Basel III minimum requirements and by TLAC requirements.

Basel III minima

In principle, the Basel capital standards are applied on a consolidated basis. As such, nLAR accumulated at the subsidiary level of a banking group is fully eligible at the consolidated group level. Capital is considered fungible across the group.

In practice, jurisdictions may impose additional capital requirements at a solo or subconsolidated level. This could include higher minimum and/or buffer requirements, more stringent RWA calculations, or structural requirements to set up intermediate holding companies. On the one hand, such conservative requirements could constitute a reasonable supervisory response to differences in incentives and degrees of control across home and host supervisory authorities. On the other hand, they could also result in nLAR being "trapped" at a subsidiary level and unavailable to absorb losses elsewhere. The extent to which this poses challenges to access nLAR in resolution depends on the degree of cooperation and collaboration between home and host authorities.

TLAC

TLAC arrangements face similar issues. New internationally agreed standards require that global systemically important banks (G-SIBs) hold a minimum amount of TLAC for resolution. Since G-SIBs typically operate in multiple jurisdictions, the location of their TLAC matters above and beyond the total amount. In principle, the location is largely determined ex ante, as part of the G-SIB's resolution plan ("living will"). But reality is more complicated.

There are two polar resolution schemes that prescribe different locations for TLAC and depend to different degrees on the coordination of national regulators: single point of entry (SPE) and multiple points of entry (MPE).

Under MPE, a bank holding company has several resolution entities. In turn, each resolution entity has its own TLAC and is resolved according to the local (host) resolution regime. When a gone-concern subsidiary is resolved with a conversion of debt into equity, the ownership of this subsidiary may change and the bank holding company may break up into separate entities. Whether there is a break-up or not, gone-concern subsidiaries are resolved independently from the rest of the group. Thus, in effect, the MPE approach requires national ring-fencing of loss-absorbing capacity.

Under SPE, the parent of a banking group issues the entire TLAC and absorbs all the losses within the group. Thus, the group enters resolution only if the parent does and subsidiaries remain going concerns as long as the parent has sufficient loss-absorbing capacity. An implication is that the creditors of an SPE G-SIB's subsidiaries are senior to the creditors of the parent. In turn, the parent's home authorities lead the resolution process with foreign subsidiaries' host authorities providing assistance. If it works as intended, the SPE approach avoids a scenario in which a distressed subsidiary cannot access resources trapped in a healthy subsidiary. Resources would be perfectly fungible within the group.

In its purest form, each scheme has advantages and disadvantages, related to resource sharing and reliance on international coordination. On the one hand, the SPE strategy allows for pooling loss-absorbing capacity across borders, avoiding resources being "trapped" in some group's subsidiaries. In comparison to an MPE setup, this provides better protection to subsidiaries in the face of idiosyncratic losses. On the other hand, SPE relies on the coordination of regulators from multiple jurisdictions. This coordination would be put to the test if resolution-related cross-border transfers toward subsidiaries threaten to weaken the parent or its home economy. In such a case, the home regulators may prefer to ring-fence the assets of the parent company, even if this goes against the spirit of an SPE and creates inefficiencies from a global perspective. Anticipating this, a host authority could trigger a resolution before the subsidiary has reached the point of non-viability. Ultimately, the home and host authorities' strategic behaviours could lead to a disorderly resolution. Ring-fencing under MPE reduces the probability of such an outcome.

The merits of the two versions of TLAC depends on the combination of two factors: (i) the chosen resolution scheme; and (ii) the G-SIBs' business model. An SPE strategy will typically be more suitable for a G-SIB that operates in a highly integrated manner, eg with shared liquidity, trading, hedging and risk management facilities. In this case, a disorderly resolution would jeopardise the integrity of the group and carry particularly high costs for both the parent and subsidiaries, thus disincentivising ring-fencing. In contrast, an MPE strategy may be suitable for G-SIBs with a decentralised structure and operations, improving individual subsidiaries' capacity to function on a standalone basis.

The Financial Stability Board's (FSB's) TLAC requirements promote a hybrid approach. On the one hand, G-SIBs that adopt an MPE approach are encouraged to ensure some level of cross-border resource sharing. Concretely, in the case of MPE G-SIBs, the parent holds certain debt instruments issued by subsidiaries and recognised as TLAC. On the other hand, since fiscal responsibility is at the national level, the FSB requires resolution entities to pre-commit a minimum amount of "internal" TLAC to their foreign subsidiaries regardless of whether the underlying approach is MPE or SPE. By contractually prepositioning part of the parents' (or resolution entities') loss-absorbing capital to subsidiaries, this enhances ex ante ring-fencing while reducing the scope for discretionary ex post ring-fencing, when an institution has entered or is on the verge of entering resolution. TLAC requirements thus induce a mixed resolution strategy that blurs the difference between MPE and SPE arrangements: it seeks to preserve some benefits of resource sharing while ensuring a minimum amount of resources at the level of each subsidiary.

2.1.1 Minimum risk-weighted capital requirements

What was the issue?

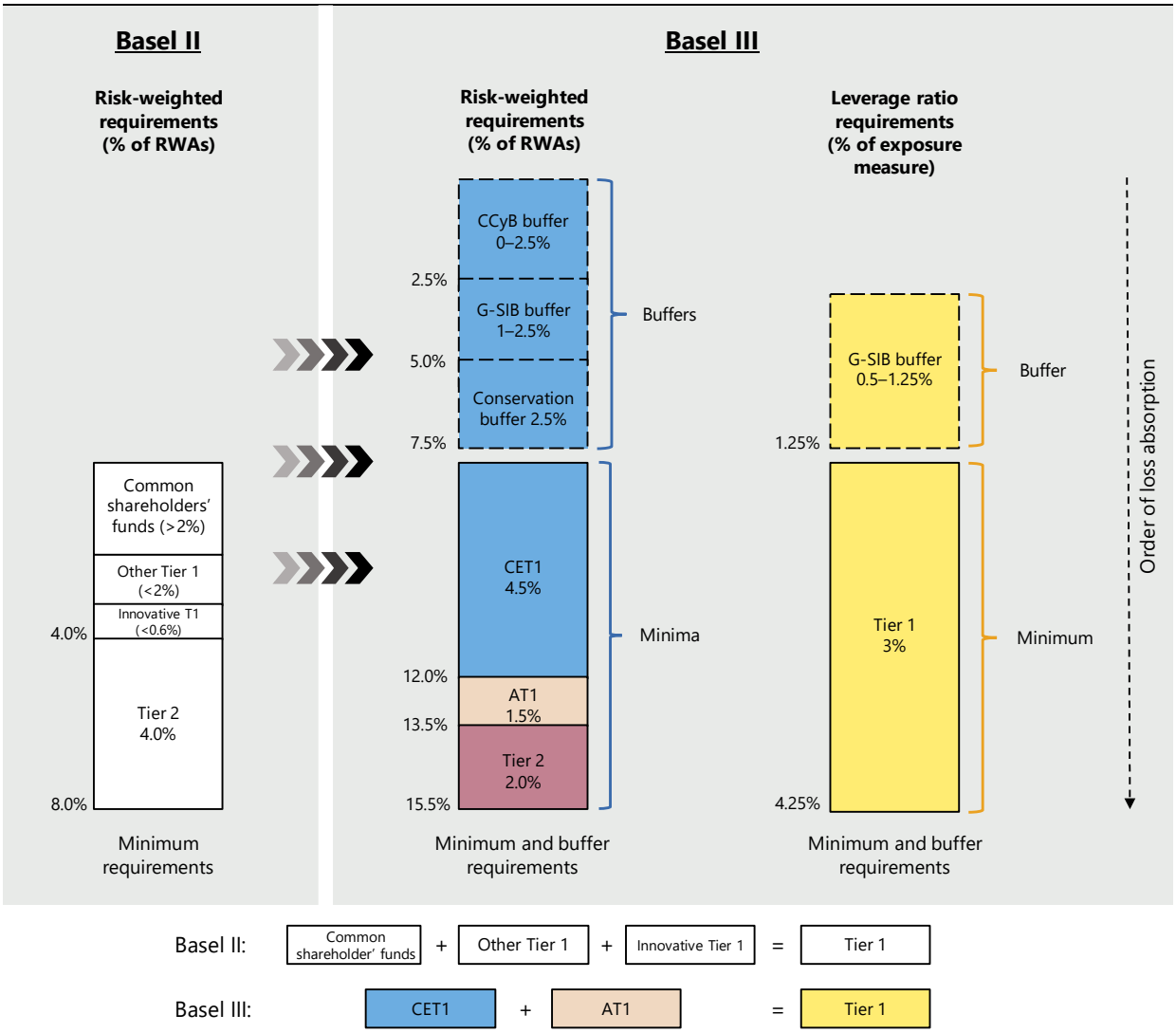
During the GFC, the Basel II risk-weighted capital requirements proved to be inadequate in two respects. First, they generated too little LAR. Certain "innovative" and "hybrid" debt-like instruments used to qualify as Tier 1 (or top-quality) capital but turned out to have smaller loss absorption capacity than initially anticipated. For example, Northern Rock continued to pay out coupons on some of its Tier 1 instruments even after it was nationalised (Yu and Luu (2012)). Importantly, such payouts were common in the midst of the GFC. Second, banks' internal models delivered flawed risk estimates, thus resulting in LAR that was insufficient to cover the losses incurred in the GFC. In fact, these losses were about *twice* the minimum required amount of common shareholders' funds (BCBS (2010b)).

What was the regulatory response?

The Basel III minimum risk-weighted capital requirements seek to improve four attributes of nLAR: its quality, quantity, adequacy and robustness (BCBS (2011b), (2017a)); see Graph 1 and Table 2.

To improve the *quality* of nLAR, Basel III pays particular attention to the explicit loss-absorbing features contractually embedded in the underlying instruments. The instruments with greatest loss-absorbing capacity, eg ordinary shares, constitute Common Equity Tier 1 (CET1) capital (blue bars in Graph 2). Some, but not all, of the common shareholders' funds – the most loss-absorbing instruments under Basel II – qualify as CET1 under Basel III. Strict requirements also apply to a new type of regulatory capital: Additional Tier 1 (AT1) capital. AT1 instruments need to be perpetual, include an automatic trigger to convert to ordinary shares (ie to CET1 instruments) or be written down and confer the bank full discretion to cancel the corresponding distributions or payments (yellow bars in Graph 2). In addition, Basel III specifies a more explicit set of criteria for recognising supplementary subordinated debt instruments as Tier 2 capital (red bars in Graph 2).

Evolution of quantity and quality of capital requirements from Basel II to Basel III Graph 2



AT1 = Additional Tier 1; CCyB = countercyclical capital buffer; CET1 = Common Equity Tier 1; G-SIB = global systemically important bank.

(i) Graph does not reflect the quantitative impact of the Basel III reforms to the denominator of the risk-weighted capital ratio. That being so, the quantitative ratios between Basel II and Basel III are not directly comparable (eg the 8% Basel II total minimum requirement is lower than the 8% Basel III total minimum requirement since the latter is based on revised / higher risk-weighted assets). (ii) The G-SIB buffers apply to designated G-SIBs only. (iii) In principle, the CCyB can be set above 2.5%, but the mandatory reciprocity mechanism is limited to that level.

Source: Authors' elaboration.

To improve the *quantity* of nLAR per unit of RWAs, Basel III strengthens the corresponding minimum requirements. As shown in Graph 2, the minimum amount of CET1 capital that Basel III requires is more than twice the amount of common shareholders' funds required under Basel II.[14] In principle, a bank's nLAR includes this minimum amount, the corresponding Tier 2 capital and any AT1 instruments.

To improve the *adequacy* of nLAR, Basel III seeks to improve the mapping from certain risk estimates to regulatory risk weights. The clearest example is the increase

[14] The post-crisis Basel Framework also requires banks to have additional CET1 resources in the form of various capital buffers. We discuss this below.

in the granularity of risk weights in the standardised approaches. For example, whereas Basel II applied a single standardised risk weight to all residential mortgages, the corresponding risk weights under Basel III vary with the underlying loan-to-value ratios.[15]

These changes are in line with the "higher risk, higher capital" principle. Whenever risk differences are easily observable – eg between a speculative grade asset and a highly rated government bond – they should translate into corresponding LAR differences. Risk sensitivity of capital requirements is necessary to avoid excessive risk-taking.

At the same time, with the *robustness* of nLaR in mind, Basel III recognises the limitations of model-based risk estimates. It disqualifies internal models for risk categories that give rise to particularly unreliable estimates (eg operational risk) and constrains banks' discretion to set regulatory capital through models. Concretely, 'output floors' set a limit to the differences between (i) banks' internally modelled capital requirements and (ii) the capital that would be required under a standardised regulatory formula.[16] This helps reduce the degree of excessive risk-weight variability that may arise from a lack of robust modelling techniques, incentives to "game the system", or jurisdictional differences in supervisory oversight.

2.1.2 Minimum leverage ratio requirements

What was the issue?

A key assumption underpinning the risk-based capital framework is that risk weights adequately reflect the risk of banks' assets. In practice, this need not be the case. Deviations could stem from internal model approaches, which can give rise to misestimation or misreporting, or from standardised approaches, which combine long-term empirical analysis with judgment and involve compromises in international negotiations.[17] As a result, without additional safeguards, a risk-weighted capital framework may not provide adequate LAR.

What was the regulatory response?

To backstop the risk-weighted capital framework, Basel III introduces a minimum leverage ratio requirement. Banks must support a percentage of their on- and off-balance sheet assets (referred to as "exposures") with Tier 1 capital (Graph 2). The starting point of the leverage ratio's exposure measure is accounting valuations. But, as discussed in Section 5.2.3 below, the exposure measure also includes a degree of "risk-based" adjustments (BCBS (2017a)).

The introduction of the minimum leverage ratio in Basel III enhances nLAR in two ways – one is microprudential, the other macroprudential. From a microprudential perspective, the leverage ratio reduces the likelihood of nLAR becoming too low relative to the true underlying risk. This enhances the robustness of existing nLAR. From a macroprudential perspective, it counteracts the natural tendency of risk-based

[15] Loan-to-value and debt service-to-income caps are important jurisdiction-specific macroprudential tools for containing the build-up of imbalances. Since these borrower-level restrictions have not been part of internationally agreed standards, they remain beyond the scope of our analysis.

[16] To enhance comparability, banks must disclose their capital requirements under the standardised approaches.

[17] For a quantification of unavoidable estimation errors, see Tarashev (2010).

regulatory capital to fall during financial booms, that is, when measured risk typically declines while actual risk typically builds up (Borio et al (2001)). This can help limit banks' overstretching. Thus, while the minimum leverage ratio was calibrated from a microprudential perspective, it also delivers macroprudential benefits by creating new nLAR for hard-to-measure or unforeseen systemic risk (recall Graph 1).

2.1.3 Total loss-absorbing capacity (TLAC)

What was the issue?

The limitations of pre-crisis resolution regimes, where in place, and bank insolvency procedures were twofold. The regimes focused narrowly on ensuring orderly exit: their primary objective was not to preserve critical functions, except through the sale of the failing institution to a larger one. And they focused on individual legal entities: they lacked effective procedures for complex banking groups.

The GFC highlighted challenges in managing bank failures while safeguarding financial stability. In particular, the exit of *systemically important banks* (SIBs) could not be orderly and sales to larger institutions were well-nigh impossible. They were "too big to fail". Faced with obsolete resolution and insolvency regimes, several jurisdictions made use of public funds to support the banks and maintain their critical economic functions.

What was the regulatory response?

The first step was to identify *global* SIBs (G-SIBs), ie those for which resolution would require international agreement. The BCBS developed a pragmatic indicator-based approach (BCBS (2013c)).[18] The indicators capture a bank's size, interconnectedness, complexity, substitutability and global scope – that is, attributes reflecting the system-wide damage the institution's failure can cause.[19] Together with expert judgment, the BCBS applies these indicators to a group of roughly 70 G-SIB candidates. From this group, it designates banks as G-SIBs on an annual basis, which have thus far consisted of roughly 30 banks, and allocates them to different G-SIB buckets, corresponding to different levels of systemic importance.

The second step was to ensure G-SIBs have sufficient nLAR without recourse to public funds. To that end, the FSB imposed minimum TLAC requirements. These requirements set an additional layer of loss-absorbing resources over and above that arising from risk-weighted and leverage ratio requirements. As a result, G-SIBs have an extra layer of nLAR (FSB (2015)).

As a side benefit, TLAC could reduce G-SIBs' risk-taking incentives, thus reducing their EtL. While all Basel III-eligible regulatory capital instruments can be used to meet TLAC requirements, the converse need not be true. Some debt instruments that can be "bailed in" at times of stress are eligible only for TLAC. The holders of such instruments benefit neither from the upside risk of equity prices nor from the implicit

[18] This approach built on academic literature that measures systemic importance in a more rigorous way but does not lend itself directly to practical applications. One part of this literature proposed methods for the allocation of system-wide risk to individual institutions in an additive fashion (Brownlees and Engle (2016), Drehmann and Tarashev (2013), Tarashev et al (2016)). Another part derived non-additive measures of impact (eg Adrian and Brunnermeier (2016)).

[19] A similar methodology underpins the buffer for domestic SIBs, which is at the discretion of national authorities (BCBS (2012)).

or explicit guarantees on more senior bank debt. Thus, they are particularly likely to play a disciplining role and constrain risk-taking (BIS (2015)).

Nonetheless, absent a sound resolution regime, the amount of resolution-earmarked resources could be insufficient. Thus, the FSB has issued the Key Attributes (FSB (2014)), whose objective is "to make feasible the resolution of financial institutions without severe systemic disruption and without exposing taxpayers to loss, while protecting vital economic functions". The key attributes refer to resolution authorities and their powers. They also provide guidance on recovery and resolution planning ("living wills"), resolvability assessments and crisis management groups.

Even though post-crisis resolution regimes are jurisdiction-specific, they share a common philosophy. They all seek to address deficiencies that came to light in the GFC. The new regimes focus on the preservation of critical functions and on facilitating the resolution of *groups* rather than legal entities only. In addition, they offer resolution authorities additional tools, such as bail-in instruments, to achieve financial stability objectives (Restoy (2018)). This common philosophy is a prerequisite for effective cooperation across jurisdictions, not least when they strive to contain cross-border spillovers of distress at an internationally active bank.

2.2 Reforms enhancing banks' iLAR

Two types of reform aim to strengthen banks' capacity to weather losses and remain going concerns. The first comprises accounting standards targeting iLAR for *expected* losses. The second covers new banking standards seeking to create iLAR for *unexpected* losses, stemming from either idiosyncratic risk (microprudential perspective) or system-wide risk (macroprudential perspective).

2.2.1 Expected loss provisioning

What was the issue?

All bank assets are subject to risks. For example, a mortgage is subject to the risk of the borrower defaulting (credit risk). A stock or bond is subject to valuation (market) risk. And a derivative contract is subject to the risk of a counterparty's default (counterparty risk, a form of credit risk). Each of these risks can translate into losses.

Losses have an "expected" and "unexpected" component. Expected losses – those perceived as typical – could be reflected in pricing: for instance, a bank could charge a higher spread as compensation for the losses it expects to make. But this need not be the case, either for business reasons or because of changes to the loss outlook after contract terms are set. Expected losses can be viewed as the cost of 'doing business' (BCBS (2005)). In turn, "unexpected" refers to a loss amount that is over and above the expected level and that can be exceeded with only some small probability.

As regards *credit* losses, banks rely on two different types of resources to absorb the expected and unexpected components. For the former, they set aside provisions; for the latter, they draw on capital (see below). From a purely economic perspective, these two resources are fully fungible, as the sum of the respective amounts determines a bank's solvency.

The timely recognition of, and provision for, credit losses is a prerequisite for the safety and soundness of the banking system. However, the "incurred loss" approach banks followed before and during the GFC tended to result in provisions that were

"too little, too late" (BCBS (2016c)). They were too little in normal times, as banks had an incentive to postpone acknowledging credit deterioration and accounting standards required "objective evidence" of impairment. And they came too late, as banks took them at times of stress. Thus, banks' behaviour in both booms and busts exacerbates procyclicality.[20]

What was the regulatory response?

In response to a G20 Leaders' call, accounting standard setters amended loan loss provisioning to address the "too little, too late" problem. For example, the International Accounting Standards Board set out a new standard, based on expected credit losses – IFRS 9. Under this standard, provisions should increase/decrease as soon as banks estimate a rise/fall in the riskiness of their credit exposures. In parallel, the US Financial Standards Board developed a similar standard, which differs from IFRS 9 in terms of the horizon over which banks need to calculate expected losses (Cohen and Edwards (2017)). These reforms aim to improve the timeliness of resources banks can use as going concerns. In our terminology, they are designed to enhance iLAR.

2.2.2 Regulatory capital buffers

What was the issue?

Basel III aims to ensure that banks not only act as shock absorbers but can also continue to provide key services in the face of adverse financial developments. Yet supervisors would typically not allow banks to breach minimum capital requirements and remain going concerns. Hence the need for additional requirements to create new loss-absorbing resources that banks can use as iLAR. Left on their own, banks could have an incentive to sail too close to the wind.

What was the regulatory response?

To create iLAR, Basel III introduces three capital buffers that sit above minimum requirements (Graph 2). These buffers capture different risks but share similar design features: they must all be met with CET1 capital only and be drawn down without automatically breaching the point of non-viability.

Capital conservation buffer: microprudential perspective[21]

The capital conservation buffer provides a common layer of usable capital for a bank. The underlying standard was designed from a microprudential perspective, as it does not vary with a bank's systemic importance or at different points of the financial cycle. Banks that draw this buffer down face certain restrictions regarding the dilution of their capital resources, eg they need to restrict dividend payments or bonuses. This helps incentivise them to recapitalise over time, although possibly at the expense of buffer usability (see Section 5.1.3 below).

[20] On these issues, including the inevitable tension between accounting standards, prudential requirements and risk management, see Borio et al (2001), Borio and Lowe (2001) and Borio and Tsatsaronis (2004. 2005) as well as references therein.

[21] Similar to the leverage ratio requirement, buffers designed with a microprudential objective in mind (eg to conserve a bank's LAR) would also perform a macroprudential function to the extent that they can be drawn down in a systemic event.

G-SIB buffer: macroprudential perspective, cross-sectional dimension

This buffer seeks to increase the iLAR of a G-SIB in order to reduce its systemic footprint. The key input to the calibration is the systemic impact of the bank's failure, as determined by the G-SIB designation methodology (see above).[22] This impact can be regarded as the G-SIB's systemic loss-given-default (LGD), ie the loss or damage that the system incurs when the institution fails. The higher the systemic LGD of a G-SIB, the higher the attendant G-SIB buffer and hence the lower the probability of default (PD). The ultimate objective is that the expected systemic impact – that is, PD times LGD – be roughly equal across G-SIBs and a comparator group of non-G-SIBs.

The G-SIB buffer is set both in terms of RWAs and the leverage ratio exposure measure. Thus, it adds macroprudential elements to both risk- and size-based requirements. The risk-weighted buffer variant is simply an extension of the capital conservation buffer. Drawing down the G-SIB buffer – in either of its two variants – entails the same distribution restrictions as drawing down the conservation buffer.

Countercyclical capital buffer: macroprudential perspective, time dimension

The countercyclical capital buffer (CCyB) is also an extension of the conservation buffer but aims to address the financial cycle – a key aspect of the time dimension of a macroprudential approach. The buffer's key objective is to protect the banking sector from periods of excess aggregate credit growth, which have often coincided with the build-up of system-wide risk.[23] The buffer should be activated and possibly increased during the build-up phase of a financial cycle, and subsequently released in a downturn. This would help ensure that banks maintain the flow of credit to the economy without their solvency coming into question.

The CCyB has two additional unique features (BCBS (2010c)). First, authorities are required to calculate an internationally consistent common buffer guide, based on the aggregate private sector credit-to-GDP gap.[24] This guide provides a common anchor for calibration. That said, the Basel framework stresses that decisions could reflect other indicators that national authorities regard as relevant as well as expert judgment.

Second, the countercyclical capital buffer includes a novel framework for jurisdictional reciprocity. An authority that activates the buffer in jurisdiction A is expected to promptly inform its foreign counterparts in jurisdictions B and C. In turn, these authorities should require the banks domiciled in their jurisdictions to apply the buffer on exposures in jurisdiction A. This reciprocal mechanism seeks to minimise the degree of cross-border spillovers and regulatory arbitrage.

2.3 Reforms reducing banks' EtL

While the new risk-weight mapping in Basel III could strengthen banks' incentives to reduce EtL, the regulatory framework has also introduced new standards that target

[22] Similar to any other Pillar 1 requirement, the G-SIB buffer leaves room for supervisory judgment to impose a higher estimate of the systemic impact.

[23] See Drehmann et al (2010) for an analysis of the buffer and the choice of benchmark financial cycle indicator. While raising the CCyB could also help contain the financial boom, this is not the buffer's primary function.

[24] The gap measures the deviation of the credit-to-GDP ratio from a long-term trend.

EtL directly. One of those standards seeks to limit chunky losses from concentrated credit exposures. Others target exposures to liquidity risk.

2.3.1 Large exposure limits

What was the issue?

The risk-weighted capital framework implicitly assumes that a bank holds an infinitely granular portfolio, ie that the portfolio comprises many very small exposures. In practice, exposures to individual counterparties can be quite large and drive bank failures, such as that of Johnson Matthey Bankers in 1984 and those during the Korean banking crisis in the late 1990s (BCBS (2014b)). While the Basel Committee had recognised the need for banks to measure and limit exposure concentration for a long time, there was no uniform approach prior to Basel III.

What was the regulatory response?

Basel III introduces a harmonised set of prudent limits on large exposures. The limits seek to ensure that the "maximum possible loss a bank could incur if a single counterparty or group of connected counterparties were to suddenly fail would not endanger the bank's survival as a going concern". By reducing banks' EtL, this creates new SAC for both going and gone concerns.

2.3.2 Liquidity-related reforms

What was the issue?

Since its inception in 1974, the BCBS has sought "to help ensure bank solvency *and liquidity*". Indeed, in its early years, the BCBS conducted work on the level of liquidity a bank would need to withstand a run. Pre-Basel I, the discussion referred to "survival time, or the length of time following the start of a run during which [a bank] could draw on its resources before collaps[ing]".[25]

However, Basel I and II rode on a political momentum for capital requirements but not for liquidity requirements. "Solvency and capital adequacy concerns had come to the fore with the Latin American debt crisis in the 1980s. There was no such equivalent crisis then in bank liquidity." Thus, while Basel I and II succeeded to reverse a decline in banks' capital ratios, liquidity ratios continued to plummet through 2007.

The GFC created a sense of urgency on the liquidity front. It provided strong evidence that "many banks – despite adequate capital levels – still experienced difficulties because they had not managed their liquidity in a prudent manner" (BCBS (2011b)). The maturity and liquidity transformation that banks engaged in was widely perceived as excessive.

What was the regulatory response?

Basel III delivered the first ever international agreement on liquidity requirements. The two new requirements – the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) – reduce banks' funding needs at times of stress. Thus, unlike

[25] For the quotes in this paragraph and the next, see Goodhart (2011), pp 317, 322, 334 and 333, respectively.

capital requirements, which generate loss-absorbing resources, the LCR and NSFR reduce banks' exposure to losses from liquidity shocks.

The LCR requires that banks hold a buffer of high-quality liquid assets (HQLA) to accommodate "outflows" over a one-month stress period. Eligible assets include outright cash, central bank reserves or securities issued by highly rated sovereigns. Outflows could relate to either retail or wholesale funding and materialise when a portion of "on-demand" funding is withdrawn or a percentage of term funding is not rolled over. Alternatively, outflows could reflect collateral calls, committed credit lines or derivatives transactions.

When working as intended, the LCR reduces the EtL of going-concern banks. In the face of a liquidity shortage, a bank is expected to draw down the LCR's HQLA in order to avoid fire-sale losses and failure.[26] Ultimately, when the liquidity shortage dissipates, the bank would take appropriate corrective actions in order to restore its compliance with the LCR requirement. Moreover, a high level of HQLA provides a powerful signal: it reassures market participants that the bank is resilient and, ultimately, it dissuades runs.

In turn, the NSFR limits liquidity transformation along the entire maturity spectrum. The objective is to "create incentives for a bank to fund its activities with stable sources of funding on a structural basis" (BCBS (2011b)). Concretely, the NSFR assesses the funding's stability over a one-year horizon and requires more stable funding from a bank that holds longer-maturity and less liquid assets.

The SAC that the NSFR creates for going concerns is conceptually similar to that stemming from LCR. Similar to the LCR, the NSFR seeks to reduce EtL by enhancing banks' capacity to both avoid fire sales and dissuade runs. That said, its objective is to prepare banks for more sustained stress. In addition, the NSFR targets specifically lending to the real economy: it requires more stable funding from banks with larger loan books.

The NSFR also seeks to enhance SAC for gone concerns. Working as intended, it would facilitate the resolution of a failed bank by ensuring a manageable funding structure. Such a structure minimises the need for resolution authorities and, potentially, a new management team to scramble for liquidity. It also limits the need for lender-of-last-resort funding of banks in resolution.

3. The trees: principles for CCPs as standalone entities

Derivatives can be traded on exchanges, where they are cleared centrally or over the counter (OTC), in which case they could be cleared either bilaterally or centrally. The single most important post-crisis reform in derivatives markets has been the drive to increase the share of centrally cleared OTC derivatives. This reform responded to pre-crisis deficiencies in OTC derivatives markets and sought to strengthen CCPs' role as pillars of financial stability.[27]

[26] In addition to the systemic/macroprudential externalities linked to fire sales, there are also standalone/microprudential effects on bankruptcy costs (eg Gale and Gottardi (2015)).

[27] For a recent account of the effects of the OTC derivatives market reform, see Aramonte and Huang (2019).

What was the issue?

The crisis revealed that bilateral OTC derivatives markets are prone to mismanaging counterparty credit risk and that this could have system-wide consequences. The proper management of a myriad of bilateral exposures requires large quantities of readily available liquid resources. This proved costly to participants and created incentives for cutting corners, which remained largely undetected because of the opacity of the web of bilateral trades. During the GFC, this opacity stoked a crisis of confidence amid growing concerns about counterparty credit risk.

What was the regulatory response?

Policymakers adopted measures to encourage central clearing – which involves the transfer of bilateral derivatives contracts to CCPs, their so-called "novation" – and to strengthen CCPs' stability. G20 Leaders (2009) committed to ensure that "all standardised OTC derivative contracts should be cleared through central counterparties by end-2012 at the latest". And CPMI-IOSCO built on previous recommendations (CPSS-IOSCO (2004)) to develop new and stricter principles for CCPs. These principles became part of the PFMI (CPMI-IOSCO (2012)), alongside updated principles for payment systems, central securities depositories and securities settlement systems, and new ones for trade repositories (TRs).[28]

The CCP principles seek to hardwire the potential benefits of novation while containing the possible attendant risks to financial stability. Novation can enhance the transparency of the underlying risks and facilitate their management through multilateral netting, possibly reducing overall collateral needs.[29] To ensure transparency, the PFMI include a principle for market data disclosure by TRs (Principle 24) and guidance for CCPs' quantitative disclosures.[30] At the same time, the rise of central clearing increases the systemic importance of CCPs (Cunliffe (2018)), which is at the root of the PFMI's objectives to strengthen CCPs' resilience, recovery planning and resolution arrangements.

The PFMI aim to enhance three general aspects of CCPs' SAC. The first has to do with EtL from clearing members. To help CCPs manage EtL, the PFMI provide guidance on how to grant access to clearing services (eg Principle 18). The second aspect relates to EtL from investments. Here, the PFMI provide guidance about the type of assets in which prefunded resources should be invested and the institutions that could be trusted to hold these investments in custody (eg Principles 5, 7 and 16). The third one is the amount of LAR for counterparty credit risk and the sequence in which the LAR become available – the so called "default waterfall" (eg Principles 4 and 6).[31] We will henceforth focus on the prudential "trees" that generate LAR and draw parallels with banks'.

[28] Supplementary guidance and coordination among standard-setting bodies seek to support the PFMI. There is guidance on resilience (CPMI-IOSCO (2017)) and recovery planning (CPMI-IOSCO (2014)) as well as on resolution (FSB (2017b)). And a joint workplan promotes CCP resilience, recovery planning and resolvability (FSB-BCBS-CPMI-IOSCO (2015)).

[29] That said, the efficiency gains are not guaranteed; see Section 4.4.2 below.

[30] Benos et al (2018) have found that the greater transparency at CCPs increases market liquidity; see also Cecchetti et al (2009).

[31] In addition, there are principles for resilience in the face of non-default losses (Principle 15 for general business risk, which is a new principle that sets a requirement for liquid assets in terms of operating expenses) or operational events (a two-hour recovery-time objective for critical systems).

It is important to stress that – even more so than in the case of banks – the LAR of an individual CCP does not translate one to one into systemic LAR. Since CCPs are not intermediaries in the real economy but schemes for mutualising counterparty risk, they have effectively only *inside* positions. These positions redistribute SAC among the banks that are clearing members, with additional intra-system redistribution resulting from interactions between CCPs and non-member banks.

In order to underscore the difference between CCP LAR and systemic LAR, we proceed in two steps. We first consider CCPs from a microprudential perspective, ie as institutions in their own right. We then discuss them from a macroprudential one, ie as an integral part of the broader system. And in order to highlight the limitations of the microprudential perspective in this context, we argue that direct parallels between CCP and bank LAR are misleading.

3.1 CCPs: resilience, recovery and resolution

CCPs are financial market infrastructures that seek to keep a matched book, standing in between the original counterparties in a trade. As such, they do not take on market risk directly but remain exposed to counterparty credit risk (Faruqui et al (2018)).

For its *resilience* in the face of counterparty risk, a CCP draws on resources from its clearing members and owners. These two sources largely overlap in the case of user-owned CCPs but not in that of for-profit CCPs. The resources are calibrated with respect to a CCP's current as well as potential future exposure (PFE) – the maximum exposure over a specified period at a specified confidence level.[32] They constitute iLAR for the CCP: they are designed to ensure that the default of some clearing members does not affect surviving members (at the prespecified confidence level).

Since it is difficult to anticipate and inefficient to cover all contingencies, it is possible that losses from clearing member defaults exhaust available resources. When this happens, the CCP enters *recovery* mode (Graph 3). The PFMI lay out an enhanced CCP recovery plan to address uncovered credit losses and/or liquidity shortfalls. Since a going-concern CCP would implement this plan, recovery resources constitute iLAR. Ultimately, the CCP could either recover, by obtaining enough additional resources from surviving clearing members, or be put in *resolution* by the authorities, who would draw on the CCP's nLAR to close outstanding positions or transfer them to another CCP. As in the case of banks (recall Box B), CCPs' point of non-viability is fuzzy and, thus, the transition from recovery to resolution is at the authorities' discretion.

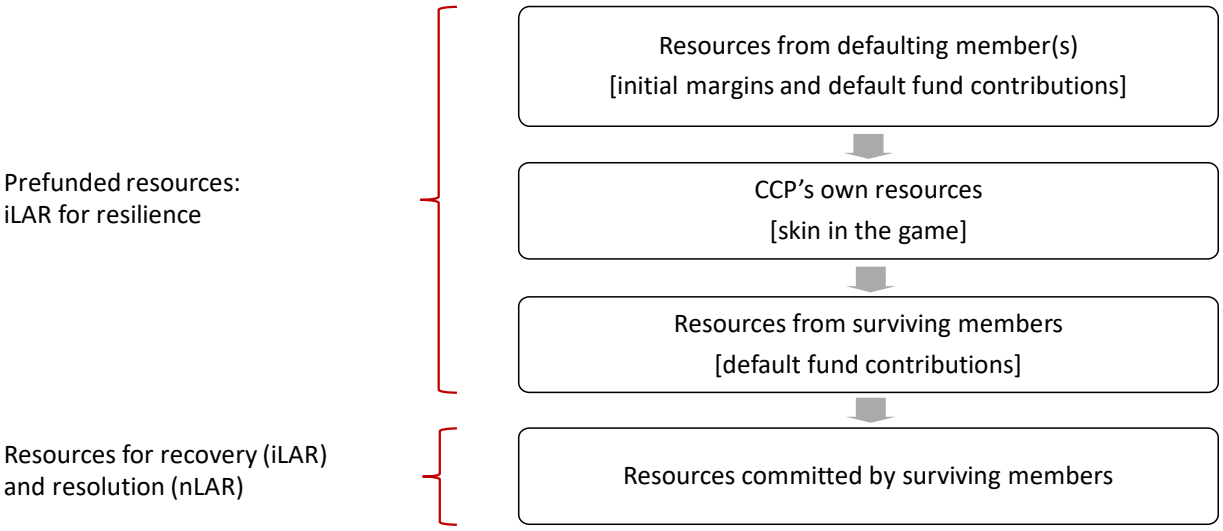
In contrast to a bank's LAR, notably capital, a CCP's is only partly prefunded (Graph 3). A CCP's prefunded resources account for only that portion of the CCP's iLAR that underpins resilience. The CCP would deploy this portion under relatively mild realisations of counterparty credit risk. Only when it is already under severe stress would a CCP draw on the other component of iLAR, for recovery, and on the entire nLAR, for resolution.

Our focus will henceforth be on the resilience of CCPs as going concerns and the underlying *prefunded* resources. We abstract from recovery and resolution for two reasons. In comparison to actions that build resilience, recovery planning relies more heavily on CCP-specific rulebooks. In addition, the FSB's guidance notwithstanding,

[32] Principle 14 – which has no analogue in pre-PFMI principles – reduces CCPs' EtL by setting standards for the segregation of a clearing member's customer positions and attendant collateral and their portability to another clearing member.

the transition from recovery to resolution is at the discretion of national authorities, which need to manage the systemic repercussions of CCP stress subject to local legal frameworks.

Stylised default waterfall — Graph 3



nLAR and iLAR = loss-absorbing resources for gone and going concerns, respectively.

Source: Authors' elaboration.

The PFMI provide guidance on prefunded resources from both micro and macroprudential perspectives. In particular, Principle 3 states that CCPs should build these resources on the basis of comprehensive and integrated risk management, considering interdependencies in a holistic approach. We now turn to salient examples from each perspective.

3.2 Prefunded resources: microprudential perspective

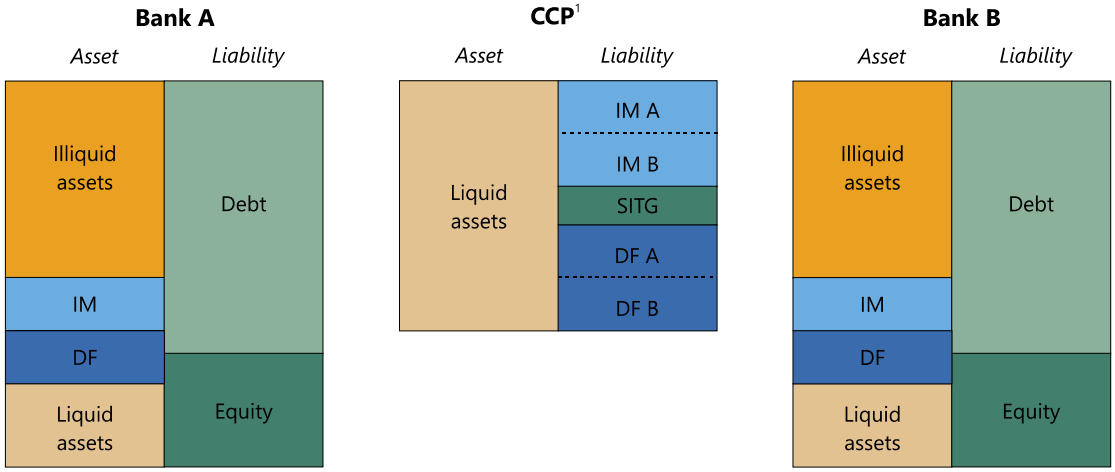
CCPs' prefunded resources have three general components (Graph 4). The first two – initial margins and the default fund – comprise clearing members' contributions. The third consists of the CCP owners' funds. All these resources are for *potential* losses. To enhance the adequacy of the prefunded resources, the CCP settles participants' *incurred* losses with variation margin calls.

In the event of a clearing member's default, its *initial margin* should cover the CCP's attendant mark-to-market losses at a high level of confidence. The CCP issues initial margin calls to each counterparty at the inception of each transaction. It can then re-issue initial margin calls daily, in line with the evolution of perceived risks.

The *default fund* is a mutualised resource. It comprises clearing members' contributions, which are akin to a membership fee. It is determined on the basis of stress tests, such as those outlined in CPMI-IOSCO (2018), ESMA (2019a) and CFTC (2019). If a clearing member defaults, the default fund should cover losses that arise when the variation margins that this member would have had to pay exceed the combined amount of its initial margin and the relevant part of the CCP's own funds

(see below). Faced with a partly depleted default fund, the CCP would issue replenishment calls to surviving members.[33]

CCP and bank balance sheets at origination of cleared transaction — Graph 4



DF = default fund; IM = initial margin; SITG = CCP skin in the game.

A CCP's prefunded resources have three general components: (i) initial margins from clearing members (IM A and IM B in light blue); (ii) default fund contributions from clearing members (DF A and DF B, in dark blue); and (iii) the CCP's own funds (SITG in dark green).

[1] CCPs can draw on additional committed resources, such as cash calls and variation margin gains haircutting (VMGH). These resources are not prefunded and thus do not appear on balance sheets. CCPs may also have some operational assets in the form of buildings and equipment, which are not shown here as they are not relevant to the issues under discussion.

Source: Faruqui et al (2018).

The CCP's *equity* completes the prefunded resources.[34] It has two components. The first, referred to as "skin in the game" (SITG), provides LAR for default losses. Depending on the CCP's rulebook, the SITG may comprise several layers. Some of these could be junior to surviving members' default fund contributions, coming into play as soon as losses exceed prefunded resources from defaulting members. Other SITG layers could be drawn only after the depletion of the entire default fund. The second component of the CCP's equity is for losses other than those stemming from a member's default, notably investment, operational or cyber losses (CPMI-IOSCO (2016)).

Finally, the CCP seeks to protect its prefunded resources by settling all counterparties' incurred losses as they materialise. Specifically, the CCP mitigates settlement risk by issuing at least daily *variation margin* calls to all non-defaulted clearing members that experience a mark-to-market loss.[35] These calls force these

[33] A bank's initial contribution to a CCP's default fund is an asset of the bank and a liability of the CCP (as illustrated in Graph 4). Any subsequent replenishment of the fund is booked as a financing cost and is thus *not* on the bank's balance sheet. As a specific example, see here a report by a surviving member (Fortum) of Nasdaq Clearing, written after the default of another clearing member.

[34] The default fund and SITG are distinguishing features of CCPs: they have no analog in bilateral trades.

[35] Settlement risk arises primarily whenever two legs of a transaction (eg a security for cash or cash in two different currencies) do not occur simultaneously and/or in the presence of long settlement lags (eg Borio and Van den Bergh (1993)). The fact that this risk has not been the focus of post-crisis reforms does not mean that it is unimportant. For instance, while the introduction of CLS reduced

counterparties to transfer the lost amount to the CCP, which then passes on this amount to the counterparties with a gain. Effectively, variation margin calls reset each transaction's value to zero, thus ensuring that prefunded resources need to cover only future mark-to-market losses if a clearing member defaults.

3.3 Prefunded resources: macroprudential perspective

Similar to bank regulation, the macroprudential perspective in the PFMI address both the cross-sectional and time dimensions.

3.3.1 Cross-sectional dimension: CCPs as nodes in systemic LAR's network

As in the case of banks, CCPs can increase the likelihood and severity of system-wide distress by increasing financial system interconnectedness and risk concentration. Correspondingly, the PFMI include detailed and specific principles for links across CCPs, recognising them as key nodes of the financial network. The PFMI pay particular attention to CCPs' global footprint and expects them to adopt a macroprudential approach when managing exposures to their members.

Concretely, the PFMI call for stricter standards for CCPs that are systemically important in more than one jurisdiction or are involved in complex activities. In particular, such CCPs should have enough resources to withstand the failure of their two largest members (the "Cover 2" principle), whereas the corresponding requirement for other CCPs continues to refer to the single largest member. And in order to enhance the usability of their LAR at a time of severe stress, CCPs that are systemically important in multiple jurisdictions should comply with stricter liquidity requirements. These relate to the market liquidity of the assets (when a CCP owns them) and funding liquidity (given prearranged repo facilities or credit lines).

The PFMI also expect CCPs themselves to adopt a macroprudential perspective. For example, it recommends that CCPs require extra collateral from a member that is especially active in some market segment (CPMI-IOSCO (2017), paragraph 5.2.12). If such a member were to subsequently default, the CCP would find it particularly difficult to swiftly transfer the member's large and numerous contracts to other counterparties. The extra collateral would serve to alleviate these difficulties and shield other surviving members from the fallout of the default. It would also help authorities maintain the functioning of the markets where the defaulted member operated.

3.3.2 Time dimension: CCPs' LAR and banks' EtL

Along the time dimension, CCPs can generate procyclical dynamics by competing for scarce resources. At times of heightened volatility, a CCP mitigates its exposure to counterparty credit risk by making variation and initial margin calls just as clearing members may find it difficult to summon the corresponding funds.[36] Thus, the pressure on banks to generate LAR for CCPs could exacerbate market stress.

the risk associated with foreign exchange transactions, this risk has grown again in recent years (Bech and Holden (2019)). The BCBS and the CPMI have begun to address the issue.

[36] The procyclicality of a CCP's behaviour would be stronger when a counterparty and its collateral are exposed to similar risk factors. In such a case, it is likely that a counterparty defaults exactly when the attendant collateral loses value, inducing the CCP to tap liquidity from a market that is under stress. The PFMI address such wrong-way risk through Principle 3.

Ultimately, in managing counterparty risk, a CCP would increase its clearing members' EtL from liquidity shocks.

To address this challenge head-on, the PFMI encourage countercyclical behaviour (pp 53–4), akin in spirit to banks' CCyB. The PFMI recommend that in tranquil times CCPs apply stable and conservative haircuts to the value of collateral, thus generating more loss-absorbing capacity than what risk assessments call for. Then, if a systemic event materialises, smaller margin calls would still allow the CCP to manage risks prudently.[37] This would limit clearing members' need to make costly adjustments and draw on iLAR during periods of heightened market volatility.

4. The forest: a bird's eye view of interactions in the reform package

Stepping back from individual standards (the trees) allows a view of the overall reform package (the forest). This view reveals interactions across standards – overlaps and reinforcing or offsetting effects. The interactions occur within the banking sector as well as in the bank-CCP nexus.

4.1 Redundancies or complementarities?

A key feature of the Basel III framework is its reliance on multiple capital and liquidity standards. The pre-GFC framework effectively relied on a single metric – the risk-weighted capital ratio – to reduce banks' EtL and generate LAR. In contrast, the proliferation of post-crisis standards (recall Graph 1) has aimed at a framework that "is more robust to arbitrage and erosion over time, as [one standard] offsets the shortcomings and adverse incentives of the others" (Ingves (2016b)).

While some recognise these benefits (eg Aikman et al (2018), Stein (2013)), others criticise the overlaps. For instance, some observers have asked whether there is a need for both the leverage ratio and the output floor.[38] There have also been questions about the usefulness of the NSFR over and above the LCR. In discussing these criticisms, we report evidence that the apparent redundancies have indeed been useful.

4.1.1 Leverage ratio and output floors

The leverage ratio requirement and output floors seek to complement each other in enhancing banks' SAC through backstops to banks' internal risk models (Table 3). In contrast to the leverage ratio, output floors retain a high degree of risk sensitivity, thereby constraining risk-taking. Output floors are designed to be similar for banks with similar exposures, thus contributing to risk-weight comparability. That said, being underpinned by regulatory models, output floors are subject to model risk. Largely free of modelling assumptions, the leverage ratio is a complementary mitigant of such risk.

[37] While the CCyB is activated/released by prudential authorities, time-varying margin requirements could in principle be set by either CCPs or the authorities.

[38] As noted in Adrian and Narain (2017).

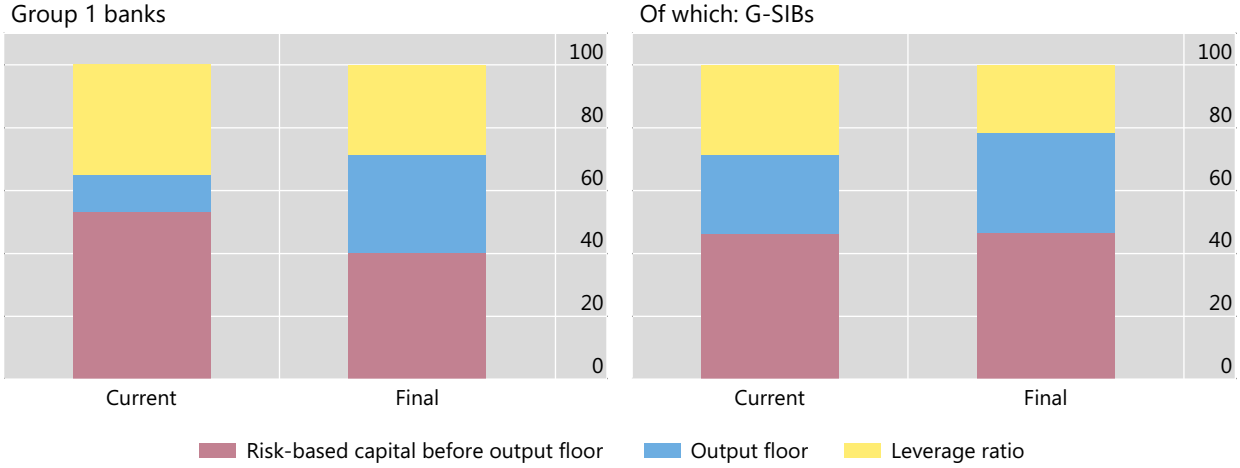
Relative impact of capital floors and the leverage ratio Table 3

Issue	Targeted mitigant	Indirect mitigant
Risk-weighted assets' variability	**Output floor** – allows risk-sensitive capital ratios, aiming for comparability across banks.	**Leverage ratio** – by design, differentiates less risks across banks.
Gaming risk	**Output floor** – ensures a minimum level of risk weights; level differs across asset classes.	**Leverage ratio** – by design, differentiates less across asset classes.
Model risk	**Leverage ratio** – guards against model risk under internally modelled and standardised approaches.	**Output floor** – by design, does not mitigate model risk under standardised approaches.

Empirical evidence confirms the complementarity of these capital metrics. Graph 5 shows the percentage of internationally active banks that are constrained, respectively, by the risk-weighted capital requirement, the output floor or the leverage ratio. The graph reveals that each standard is binding for a subset of the banks and that different standards constrain different banks. This suggests that each standard is useful in the sense that it generates complementary and mutually reinforcing SAC. Put differently, if a capital metric was redundant, it would not constrain any bank, by definition.

Share of banks constrained by different capital metrics[1]

In per cent Graph 5



Current = existing Basel III standards; Final = Basel III standards that will be implemented as of 1 January 2022.
G-SIBs = global systemically important banks; IRB = internal ratings-based approach.

[1] For a sample of 106 banks with Tier 1 capital of more than €3 billion (Group 1) as at 30 June 2018. "Constrained" refers to the capital metric that generates the highest capital charge for a bank.

Source: BCBS (2019c).

4.1.2 LCR and NSFR

Similar arguments apply to the interaction of the LCR and the NSFR.

Cecchetti and Schoenholtz (2017) assert that a bank that meets the LCR is very likely to meet also the NSFR, so that the latter is redundant. This argument, however, does not recognise the partly different objectives of the standards. It hinges on a

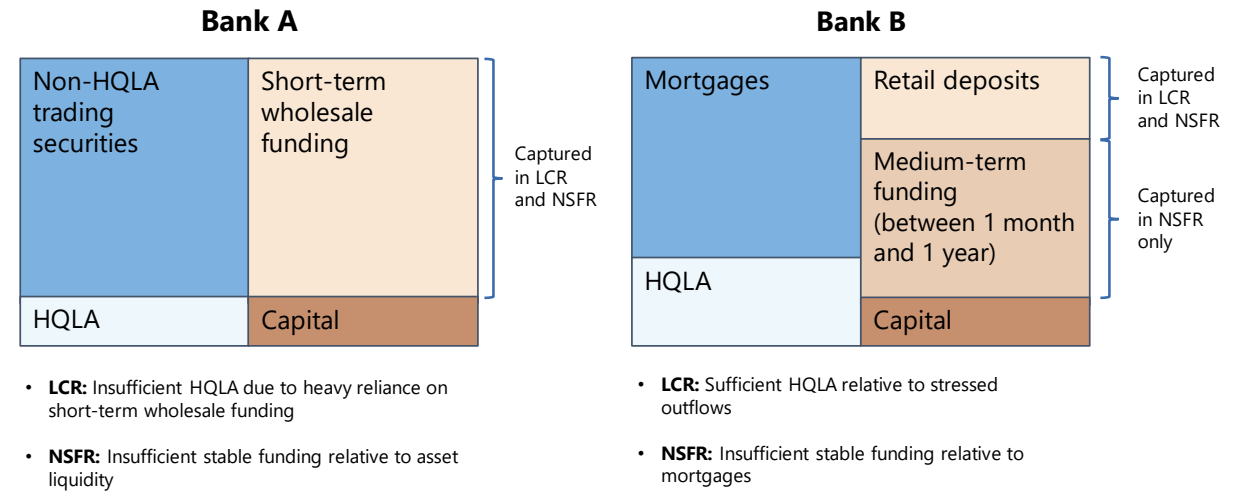
framework that does not differentiate between (i) standards seeking to create short-term buffers for going concerns (the LCR) and (ii) those seeking to ensure structurally stable liquidity positions that would be useful, inter alia, during protracted resolution proceedings (the NSFR).

By design, the two standards target different risks. As noted above, the LCR reduces banks' EtL from short-term liquidity stress. In contrast, the NSFR seeks to prevent excessive reliance on unstable funding sources, particularly those backing illiquid assets, along the entire maturity spectrum. And it is the only Basel III standard that takes account of the *extent* to which banks have already encumbered, or pledged, their assets, as this determines the assets' usability at times of stress.

Accordingly, the NSFR is better placed than the LCR to: (i) prevent banks from being excessively reliant on wholesale funding that is short term even if its maturity is longer than one month to one year;[39] (ii) enhance banks' resilience to sustained funding stress; and (iii) ensure a robust liquidity position during a protracted resolution process.

Considering two stylised bank business models helps illustrate the complementarity between the two standards (Graph 6). Bank A is an investment bank that relies heavily on short-term wholesale funding (with less than 30 days to maturity), and invests and trades in securities that are not eligible as HQLA. Bank B specialises in mortgage lending, relies on stable retail deposits and medium- and long-term funding, and has an HQLA buffer. Both the LCR and NSFR are likely to constrain Bank A: it has neither HQLA to satisfy the LCR nor enough stable funding for the NSFR. By contrast, Bank B may be able to meet its LCR but may not be able to meet its NSFR, eg if its medium-term funding has a shorter maturity than its mortgages.[40]

Impact of LCR and NSFR on different stylised balance sheets/business models — Graph 6



HQLA = high-quality liquid assets; LCR = Liquidity Coverage Ratio; NSFR = Net Stable Funding Ratio.

Source: Authors' elaboration.

[39] The NSFR considers funding of greater than one year as stable.

[40] In practice, comparing the extent to which the LCR and NSFR are binding is not as straightforward as for capital metrics. This is because both the numerator and denominator of the liquidity ratios are different (unlike, say, the numerator of capital ratios).

There is also empirical evidence for the complementarity of the LCR and NSFR. A recent study suggests that the two liquidity standards constrain different types of bank differently (Behn et al (2019)). Which of the two binds depends on the risk profile of banks' liquidity positions (Bénassy-Quéré et al (2018)).[41]

4.2 Interaction between regulatory standards

A binding regulatory standard would either require costly equity funding or rule out profitable investments to promote less risky and more liquid positions. When several standards influence different parts of a bank's business, their interaction can make it easier or harder to implement the regulatory package. We discuss such interactions in conceptual terms, leaving the quantification of their impact to future research.

4.2.1 Satisfying one requirement makes it easier to satisfy another

Satisfying the LCR and/or NSFR makes it easier to meet capital and TLAC requirements, and vice versa. The LCR forces banks to hold liquid assets. Since such assets typically load little on market and credit risk, holding them facilitates compliance with risk-based requirements. Indeed, a number of recent studies find that banks with higher capital ratios also tend to have high liquidity ratios (Boissay et al (2019)). Likewise, since non-regulatory capital TLAC instruments are of relatively long maturities and thus less subject to runs, they reduce the cost of satisfying NSFR and LCR. In turn, the stable funding required by NSFR should reduce the likelihood of fire-sale losses and, all else equal, reduce the cost of raising capital or TLAC instruments.

4.2.2 Virtuous circle

The combination of LCR and capital requirements also creates SAC by reducing the incentives of (wholesale) funding providers to run on the bank. A decline in run risk and a thick cushion of core equity make it cheaper for banks to issue long-term debt. And the higher long-term debt further decreases the risk of a run and the attendant fire sales. Thus, the LCR and capital requirements jointly lower banks' exposure to funding and market risks.

Historical evidence underscores the complementary functions of banks' capital and liquidity. For example, Calomiris (2011) studies a series of US bank failures in the 1920s that could have been avoided with higher capital. These were not accompanied by panics squeezing bank liquidity. By contrast, the period between the US Civil War and World War I encompassed several banking panics that surfaced as sudden and large withdrawals of funding sources. The same paper reports that these did not translate into significant bank failures thanks to strong liquidity positions.

4.2.3 Satisfying one standard makes it costlier to satisfy another

By contrast, the combination of TLAC and the LCR may make it harder to meet the overall requirement. While TLAC raises banks' supply of assets on the riskier part of the spectrum (loss-absorbing instruments), the LCR raises banks' demand for assets on the safer part (HQLA). This may result in an increase in the price of safe debt (ie

[41] A separate issue relates to the potential impact of post-crisis reforms, such as the Basel III liquidity standards and margin requirements for non-centrally cleared derivatives, on the demand for "safe" assets and, more broadly, on the functioning of monetary policy. This topic is beyond the scope of our paper. See IMF (2012) for a summary of the debate.

the price that a bank would need to pay) relative to that of risky debt (ie the price that the bank would receive). All else equal, this would make it costlier for banks to build SAC for credit, market and funding risks.

4.3 Parallels between bank and CCP LAR

What are the key similarities and differences between the LAR stemming from CCPs' prefunded resources and that of banks'? To illustrate, we draw parallels between specific parts of the two LARs and summarise the discussion in Table 4. While the similarities might tempt one to treat CCPs as *institutions in their own right*, differences serve as reminders that CCPs are in fact *mutualisation schemes*.

Parallels between prefunded resources: banks vs CCPs Table 4

Banks	CCPs		
		Similarities	**Differences**
Expected loss provisioning	**Variation margins**	Timely recognition of valuation losses/gains	Recognising valuation losses/gains affects banks' iLAR but CCP's EtL
Regulatory capital buffers	**Initial margins** **Default fund**	iLAR with macroprudential elements	Usability by going concerns
Equity capital	**Skin in the game (SITG)**	Impact on risk management	Primary function: loss absorption (capital) vs risk-management incentives (SITG)

iLAR = loss-absorbing resources for going concerns; EtL = exposure to losses

4.3.1 Variation margins and bank provisions

Variation margin calls are akin to provisions in so far as they target timely recognition of valuation losses and gains. Through provisions, banks translate changes in expected credit losses/gains into writedowns/ups of equity capital. Through variation margin calls, a CCP forces its counterparties to settle the losses/gains that result from changes in the market prices of the assets underlying OTC derivatives.

That said, provisions and variation margins differ in how they affect SAC. In the case of a bank, higher provisions translate into lower capital and, thus, less iLAR for unexpected losses. By contrast, variation margins increase (decrease) the iLAR of the counterparty with a gain (loss), but do not affect the CCP's iLAR. From the standpoint of the CCP, variation margins reduce EtL from settlement risk.

4.3.2 Initial margins, default fund and bank capital buffers

There are similarities between that part of CCPs' iLAR that stems from initial margins and default funds and the part of banks' iLAR that stems from regulatory capital buffers. If a clearing member defaults, a CCP can draw on this member's initial margin and the default fund while remaining a going concern. Then, similar to a bank that has drawn on its regulatory buffer, the CCP needs to act quickly in order to replenish its depleted default fund. The similarities extend to macroprudential considerations: initial margin and default fund requirements for CCPs that are systemically important in more than one jurisdiction parallel G-SIB buffers (recall Section 3.2).

A key difference between the two types of iLAR is their usability. As discussed in Section 5.1.3 below, regardless of the regulatory intention, various factors may impair the usability of banks' regulatory buffers in practice. This leaves non-regulatory (or discretionary) buffers as the main line of defence to ensure full loss absorption for going concerns. By contrast, in the case of CCPs, the initial margins of defaulting members and the default fund dwarf SITG and constitute effectively the entire iLAR underpinning resilience. In the face of credit losses, the use of these resources in accordance with the specified waterfall does not trigger any automatic restrictions on the CCP.[42]

4.3.3 CCP and bank equity capital

The separation of CCP equity capital into two distinct components, each targeting a specific type of loss (recall Section 3.2), stands in contrast to the fungibility of bank capital. Moreover, the two components differ in how closely they parallel the functions of bank capital. Consider these parallels in more detail, focusing each component in turn.

As regards investment and operational, ie non-default, losses, the dedicated CCP equity is qualitatively similar to bank capital buffers. Namely, in the face of such losses, it provides the first line of defence, thus constituting iLAR that keeps a CCP afloat. It reflects the CCP's management clear responsibility for investment decisions and operational risk. Clearing members could step in only as a second line of defence for non-default losses (CPMI-IOSCO (2014)).

As regards losses default losses, the CCP's SITG performs only some of the functions of a bank's equity capital. Representing own resources, a higher SITG generates stronger incentives for proper management of credit risk (Huang (2019)). But this is where similarities with bank capital end. Besides not being the first line of defence in the default waterfall (Graph 5), SITG does not need to satisfy any size requirements.[43] This is because, in contrast to bank capital, own resources are by far *not* the main part of CCPs' LAR for default losses. In the face of member defaults, CCPs rely mainly on resources already provided or committed by members, and on surviving members' active participation in the auctioning of a defaulter's positions (CPMI-IOSCO (2019)).[44]

The differences extend to the implications of depleting LAR more generally. While a bank with no equity capital defaults, a CCP may continue to operate as a going concern even after depleting its SITG (Cunliffe (2018)). This is because arrangements to bail-in clearing members are built in CCP rulebooks (Cœuré (2015)).[45] By making use of such arrangements, the CCP would enter recovery mode. And it may never enter resolution unless adverse market developments prevent a

[42] For reputational reasons, a CCP may offset some of the depletion of the default fund by increasing its SITG and using the new resources to cover some of the default losses. Such offsets serve mainly to signal CCP owners' goodwill, not to cover a material portion of large losses.

[43] The European Market Infrastructure Regulation (EMIR) states that SITG should be at least 25% of a CCP's operational capital. However, it does not state a requirement on the size of operational capital.

[44] One would expect that clearing members would have stronger incentives to contribute to successful auctions in the case of user-owned CCPs than that of for-profit CCPs. However, a for-profit CCP could in principle compensate for the unfavourable member incentives through a properly designed rulebook, thus obtaining observationally equivalent auction outcomes as a for-profit CCP.

[45] More generally, Cœuré (2015) provides a concise but comprehensive analysis of the economics of CCPs and of the broad range of policy issues they raise.

successful recovery, in the sense of restoring the CCP's matched book without threatening financial stability.

4.4 Interaction between bank regulation and CCP principles

What happens when two banks novate a transaction – so that it becomes subject to CCP risk-management principles? And how does bank regulation handle this? Novation would typically reduce the banks' counterparty risk, but the impact on their liquidity risk is a priori ambiguous. In each case, bank regulation aims at adequate risk coverage.

4.4.1 Counterparty credit risk

There are several ways in which novation reduces banks' counterparty credit risk. CCPs enhance LAR for such risk through collateral calls that follow stricter rules than those governing bilateral transactions. Likewise, the mutualisation of losses across clearing members further boosts LAR, at least from the perspective of individual banks. And, provided that there is a higher incidence of netting in CCPs, EtL would drop accordingly.

This is reflected to different degrees in different parts of bank capital regulation. Banks' *risk-based* regulatory capital is lower when the underlying OTC transaction is centrally, rather than bilaterally, cleared, in particular when the CCP's supervision is consistent with the PFMI (BCBS (2014c)).[46] By contrast, the leverage ratio requirement is, unsurprisingly, less sensitive to novation. That said, since policymakers judged that the leverage ratio requirement discouraged excessively central clearing, they revised this standard in a targeted fashion (BCBS (2019a)).

4.4.2 EtL from liquidity shocks

The novation to central clearing has an a priori ambiguous effect on the liquidity risk to which collateral calls expose clearing members.

All else equal, the CCPs' stricter rules for collateral calls imply higher funding liquidity risk for clearing members (Cont (2017)). The CCP could place in default banks that fail to raise enough liquidity to meet variation or initial-margin calls. Likewise, not meeting default fund replenishment calls could result in forfeiting one's CCP membership. This is similar to the implications of Continuous Linked Settlement (CLS), which addresses counterparty risk in part by putting more pressure on liquidity needs.[47]

But not all else need be equal, as novation holds the potential of more netting. The incidence of netting would increase if fewer CCPs clear a given class of derivatives (Duffie and Zhu (2011)) but would decline under stronger market fragmentation (FSB Chair (2019)). If there is indeed more netting, CCPs would require less collateral to manage counterparty credit risk. On its own, this would lower clearing members' exposure to liquidity risk.

[46] In this context, see also Duffie (2018, p 28) on regulation that has improved OTC market competition.

[47] For instance, LCR recognises that contracts governing derivatives often require the posting of additional collateral upon the bank's downgrade.

The impact of novation to central clearing on collateral demand is still an open empirical question. On the one hand, Duffie et al (2015) find that, on balance, mandatory central clearing substantially reduces system-wide collateral demand in the realm of CDS contracts.[48] And they argue that this will continue to be the case provided there is no significant proliferation of CCPs. However, Sidanius and Zikes (2012) argue that inherent uncertainty about netting efficiency translates into a highly uncertain impact of central clearing on collateral demand. By extension, more evidence is needed in order to reach a conclusion about the impact of central clearing on banks' exposure to liquidity risk stemming from collateral calls.

In line with this, bank regulation does not treat the *source* of potential liquidity pressure as a proxy for the likelihood or intensity of this pressure (BCBS (2013a)). Specifically, the corresponding standards call on banks to estimate their liquidity needs in the same way, irrespective of whether the underlying derivatives position is centrally or bilaterally cleared. And, in either case, the estimates translate in the same way into liquidity requirements.

5. Barren patches: areas warranting further attention

As in any real-world policy, some areas in the existing regulatory package warrant further attention. For one, there are uncertainties as to whether the approach chosen to tackle certain complex issues will deliver desirable outcomes and whether key assumptions behind the reform will be borne out. In addition, certain compromise solutions may have weakened the quantity, quality and robustness of LAR. And finally, some issues remain open because of fundamental technical difficulties in finding a solution. In what follows, we focus on a select set of such "barren patches" in the regulatory forest and argue that they underscore the value of a conservative approach to regulation. We consider in particular a specific feature of this approach: regulatory backstops that ensure a minimum level of LAR and constrain EtL by compensating possible shortcomings in individual standards.

5.1 Uncertainties

While there are always doubts as to how standards would work in practice, policy discussions have pointed specifically to uncertainties stemming from five broad aspects of the regulatory package. First, there may be insufficient safeguards against the risk that banks' asset valuations materially overstate bank capital and hence LAR. Second, the increased complexity of regulation may amplify the uncertainties about the magnitude and robustness of SAC. Third, impediments to the usability of capital and liquidity buffers may reduce the benefits of the reforms in terms of higher iLAR and lower EtL. Fourth, key assumptions underpinning liquidity requirements may overstate the actual reduction in EtL. Finally, a number of factors could undermine the stabilising effect of increased reliance on central clearing.

[48] That said, the paper also finds that collateral requirements vary significantly across market participants.

5.1.1 Asset valuation and capital

A fundamental feature of banks is their ability to adequately assess and monitor asset risks. Banks can be viewed as a "delegated monitor" for depositors and investors: they 'must not only [understand] a transaction [that they are] asked to finance and how it is likely to turn out, but [they] must also know the customer, his/her business, and even his/her private habits' to get "a clear picture of the situation" (Schumpeter (1939)).[49] And yet banks' own asset portfolios are larger and more complex than other companies', and give rise to a wide range of risks and uncertainties (Haldane (2011)).

This is important, because asset valuations directly affect the level of banks' LAR. Because of high leverage, overstating asset values can result in substantial under-capitalisation. For a bank that is leveraged 10 times, a mere 5% overstatement of asset values would *halve* its reported capital (Zamil (2011)).

While Basel III has overhauled key parts of the risk-based capital framework, it has focused far less on addressing misestimation and misreporting. Admittedly, Basel III includes high-level guidance on the prudent valuation of fair-valued exposures in the absence of reliable market prices or observable valuation inputs. The guidance also applies to illiquid positions and non-performing exposures (BCBS (2016a)). The jury is still out, however, on whether this has helped reduce inconsistencies in banks' asset valuation approaches and the materiality of misreporting, so that differences in reported estimates are due only to desirable model diversity and unavoidable estimation errors (Restoy and Zamil (2018)). In this regard, the use of prudential backstops can help ensure that provisioning considerations are taken into account in the calculation of regulatory capital (Borio and Tsatsaronis (2004), Coelho et al (2020)).[50]

Another source of uncertainty related to asset valuation stems from the introduction of expected credit loss accounting. More forward-looking valuations are a welcome step. The key question, however, is how much discretion is appropriate. While the Basel III reforms seek to constrain banks degree of discretion in estimating regulatory capital requirements, the new accounting standards will significantly increase the discretion and judgment in estimating credit loss allowances. As a result, the corresponding iLAR could vary substantially across banks. And iLAR could continue to be highly procyclical – that is, low during booms and high during downturns – if the allowances reflect forecasts that fail to detect turning points of financial losses with sufficient lead time (Abad and Suárez (2017), Covas and Nelson (2018)).

5.1.2 Complexity

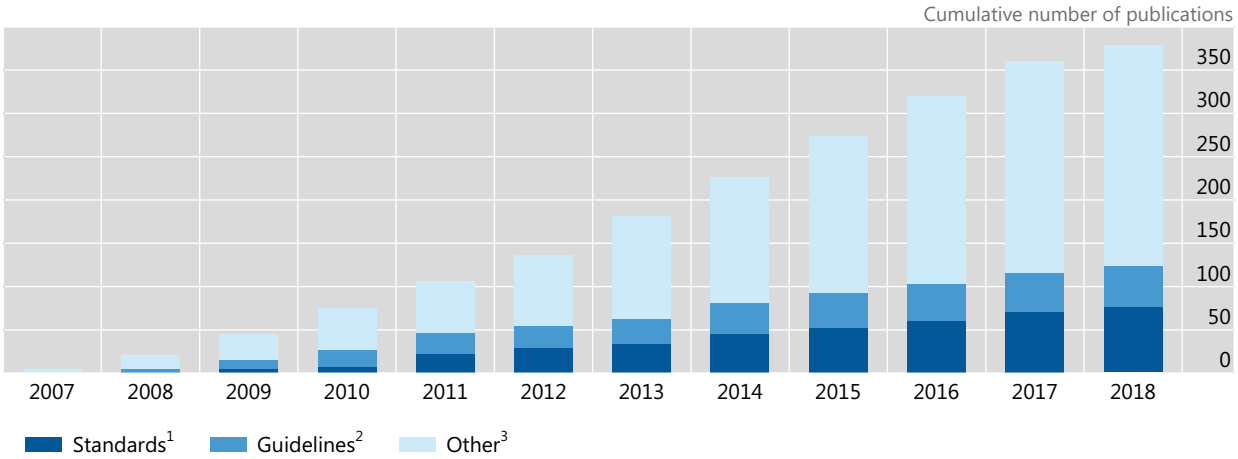
Despite its great merits, Basel III has also resulted in an increasingly voluminous and complex set of standards and guidance (Graph 7). This complexity reflects in part the intricacies in the design of regulatory measures. For example, the standardised approach to commercial real estate exposures now requires banks to consider a dozen scenarios when estimating the relevant risk weight. Another example is the revised market risk framework, which has increased the number of computations

[49] See also Dewatripont and Tirole (1999).

[50] More generally, Borio and Tsatsaronis (2006) explain why, owing to different perspectives, accounting principles cannot be fully consistent with good risk management.

required to estimate capital requirements by an order of magnitude relative to the pre-crisis framework.

Cumulative number of publications by the Basel Committee — Graph 7



[1] Proposed and finalised standards. [2] Sound practices. [3] Implementation and monitoring reports, working papers and newsletters.

Source: International Conference of Banking Supervisors (2018).

Undue complexity can undermine the SAC-generating properties of Basel III (BCBS (2013b)). First, it could weaken a board's and senior management's ability to fully understand the bank's risk profile and to perform adequately their oversight functions. Second, it can complicate supervision, as "increasingly high demands are placed on a relatively small pool of supervisors with expert knowledge" (BCBS (2013b)). Third, it could not only hinder market participants' ability to monitor banks' solvency and liquidity positions but also provide a false sense of security, thereby weakening market discipline.

5.1.3 Usability of buffers

For a buffer to act as a buffer, banks must be able to draw it down freely. That said, the degree to which buffers are indeed usable in this sense remains uncertain. This casts some doubt on the actual amount of iLAR (in the case of capital) and the actual reduction of EtL (in the case of liquidity requirements). We consider two broad reasons for the uncertainty.

Managers may be reluctant to draw down capital or liquidity buffers. One possible reason is that the depletion of buffers would expose the bank to future credit or liquidity shocks (Tarullo (2019)). This is akin to the "last taxi at the station that cannot take a customer so as not the leave to taxi line empty" (Goodhart (2008)). Moreover, the restrictions associated with drawing down capital buffers could create stigma (Box B). The upshot is that banks' true iLAR may be lower and their EtL higher than intended.

In a similar vein, the expected supervisory response to a buffer drawdown may also affect the extent to which the intended iLAR is available in times of stress. Banks may believe that their supervisor will not tolerate the use of such buffers. To that end, the Basel Committee has recently reiterated its view that "buffers are designed to be usable" (BCBS (2019d)).

In addition, it remains to be seen whether supervisors will ensure that buffers generate exclusively iLAR. Regulation defines "point of non-viability" and "point of

resolution" in intentionally loose terms. This allows supervisory flexibility but also blurs the line between iLAR and nLAR, generating uncertainty (Box B). In addition, it is sometimes unclear when the use of a buffer triggers regulatory restrictions. A case in point comes from Deutsche Bank, which witnessed a sell-off of its bonds as it approached the trigger of an AT1 instrument in 2016 (KPMG (2016)). In addition to natural hedging dynamics, this sell-off reflected market uncertainty regarding the effect of Pillar 2 requirements on the timing of any potential distribution restrictions. Overall, uncertainty about supervisory treatment of buffers would lower banks' true iLAR.

Another source of uncertainty relates to the assumed relative liquidity of different assets. For example, the LCR treats government bonds and central bank reserves equally – both are recognised as "Level 1" high-quality liquid assets. But, in practice, banks prefer to hold reserves instead of government bonds for internal liquidity risk management purposes and resolution planning. This preference for reserves over government bonds was one of several factors behind the September 2019 tensions in the US repo market, when interest rates spiked unexpectedly.[51]

5.1.4 Will key assumptions behind liquidity requirements always hold true?

The degree to which the liquidity requirements will be effective in reducing banks' EtL rests on key assumptions about the robustness of market liquidity. However, because of the endogenous nature of this liquidity, it is uncertain whether designated HQLA would live up to their name at all times.[52] At times of stress, the evaporation of market liquidity for any such asset could have systemic repercussions. A case in point is the recent episode of heightened volatility in US money markets, where the market for repos backed by government bonds did not behave as assumed in the regulations (Williams (2019), Avalos et al (2019)).

5.1.5 Will greater central clearing work as intended?

The full financial stability implications of novation will take time to emerge. The shift represents a major change in the financial landscape that puts the spotlight on CCPs' risk management practices.

One area deserving particular attention is CCP's ownership structure. The largest CCPs are listed for-profit entities whose primary objective is to maximise shareholder value. Similar to banks, their incentives are to manage risk in a way that upholds this objective, not necessarily in a way that enhances financial stability (Huang (2019)). Thus, these CCPs' high profits – indeed, multiples of concurrent bank profits – beg important questions. Are they solely the result of monopoly rents in a highly concentrated market segment (Faruqui et al (2018)), which is detrimental for market efficiency but may buttresses franchise value and thus temper risk-taking? Or are they also the result of excessive risk-taking that in turn stems from a loose enforcement of the PFMI and perceptions that CCPs enjoy a TBTF status? If the latter, then there would be a premium on tightening PFMI implementation and on following CPMI-IOSCO (2018) guidance to develop robust stress testing methodologies that account for

[51] See eg Andolfatto and Ihrig (2019), Avalos et al (2019), Bush et al (2019) and Quarles (2020).

[52] Brunnermeier and Pedersen (2009) argue, inter alia, that market liquidity is inherently fragile.

system-wide risks.[53] And a positive answer to either question would underscore the benefits of transforming CCPs into utilities designed to promote the public good (Tucker (2014)).

Structural factors add to the challenges of CCPs' risk management. For one, in the case of non-standardised derivatives contracts, there is some evidence that counterparty credit risk may concentrate at CCPs. This could be consistent with CCPs being at an information disadvantage relative to clearing members.[54] From a financial stability perspective, the potential concentration of risks in a TBTF entity would be concerning to the extent that there was no commensurate increase in prefunded iLAR. In addition, advances of financial technology present new challenges that are here to say. For instance, they have increased the relevance of cyber risk that comes with difficult to anticipate losses. This has made it increasingly challenging to determine ex ante if CCPs have adequate own funds for non-default losses.

5.2 Compromises

In developing international regulatory standards, jurisdictions may have different views on the issues at stake, including on the design and calibration of specific reforms. Yet the collective willingness of jurisdictions to forge agreements overrides these differences, leading to concessions that generate a compromise. As a former Chairman of the Basel Committee once put it: "in order to achieve something, everyone must be willing to give up a little" (Ingves (2016a)).

While compromises help avoid a stalemate, they typically result in weaker SAC than the "first best" outcome. We discuss three compromises that were essential for the finalisation of standards on: the definition of capital, risk-based capital requirements and leverage ratio requirements.

5.2.1 Interbank exposures qualifying as capital

From a systemic perspective, bank capital's loss-absorbing capacity depends on the holders of the underlying instruments. For instance, if these holders are "real money", non-leveraged investors, then the instruments would be truly loss-absorbing "outside equity": they would shift losses outside the system. By contrast, if the holders are other banks – or non-banks (partly) owned by, or with other legal or reputational ties with, banks – it represents 'inside equity': it would simply redistribute losses within the banking system and thus heighten the degree of contagion during stress. In practice, such inside equity could be part of headline numbers because Basel III does not require its full deduction for regulatory purposes, both with regards to regulatory capital instruments and TLAC instrument holdings (BCBS (2011b, 2016d)).

5.2.2 Treatment of sovereign exposures

The regulatory treatment of sovereign exposures has remained largely unchanged. In assessing whether any revisions were warranted, regulators adopted a "holistic" perspective. In particular, they acknowledged important benefits of sovereign debt

[53] Useful information in this respect would come from analyses of central clearing interdependencies, such as that in BCBS-CPMI-FSB-IOSCO (2018).

[54] See Bellia et al (2019) for an analysis of clearing members' strategic choice as to whether or not to clear single-name CDS contracts. For a theoretical study of CCPs' information disadvantage, see Koeppl (2013).

beyond the risks it generates for banks. These include, in particular, its role in monetary policy implementation, and in the smooth functioning of financial markets. In addition, regulators noted that in periods of economic stress banks' purchases of sovereign debt are an important stabilising force (BCBS (2017b)).[55]

Thus, regulators have maintained, inter alia, two aspects of pre-crisis regulatory standards. One is the zero risk weights of sovereign debt denominated and funded in the sovereign's *domestic* currency. The other is the exemption of banks' sovereign exposures (denominated in either a domestic or a foreign currency) from large exposure limits (BCBS (2017b)). This treatment stands in contrast to the approach taken in banks' internal models, which generally call for positive capital requirements for sovereign exposures (BCBS (2017b)).

That said, sovereign exposures do pose risks to banks, both directly and indirectly. Directly, while sovereign defaults on domestic currency debt are rather rare, they have happened (Reinhart and Rogoff (2008)) and have become more frequent over time (Moody's (2019)). And even in the absence of defaults, the numerous sovereign downgrades over the past decade have put pressure on banks holding sovereign debt (BCBS (2017b)). While banking crises have often preceded sovereign crises, they have also coincided or followed them (Laeven and Valencia (2018)).

Indirectly, a favourable regulatory treatment provides an incentive to increase public borrowing. While prudential regulation should not encourage or constrain fiscal policy actions as such, it should recognise that too much public debt makes a country, and its banking system, more vulnerable to stress. This highlights the importance of balancing prudential objectives against the broader economic reasons for removing obstacles to banks' investment in sovereign debt.

5.2.3 Risk-based adjustments to the leverage ratio

The regulatory framework notes that a "credible leverage ratio is one that ensures broad and adequate capture of both the on- and off-balance sheet sources of banks' leverage" based on a "simple, non-risk based" measure (BCBS (2014a)). Indeed, the starting point of the leverage ratio exposure measure is accounting valuations and the exclusion of risk-mitigants such as collateral and guarantees.

In practice, the calculation of the measure involves 'risk-based' adjustments. Examples include the netting of certain securities financing transactions, the reduction of derivative exposures through cash variation margin, and only a partial inclusion of off-balance sheet items instead of their gross value (BCBS (2014a)). Such adjustments are the outcome of balancing prudential objectives with broader economic and political objectives. Nevertheless, it is important to keep in mind that they are deviations from the "simple, non-risk based" approach, with the potential of weakening the robustness of banks' SAC.[56]

[55] The example sometimes mentioned is banks' purchases of domestic sovereign securities in some euro area countries during the sovereign crisis in 2010–14. Of course, these ex post benefits should be set against the ex ante costs of the large exposures that are responsible for the so-called doom loop in the bank-sovereign nexus (eg CGFS (2011)).

[56] Based on the latest publicly available Pillar 3 disclosures, G-SIBs' reported Basel III leverage ratios would decrease on average by over 70 basis points if they included the gross value of their off-balance sheet commitments instead of applying the risk-based standardised approach credit conversion factors. The impact on specific G-SIBs' reported leverage ratios ranges from around 35 basis points to as much as 170 basis points.

5.3 Technical difficulties

Despite the breadth and depth of the regulatory package, many open issues remain. One example concerns the differential accounting treatment of economically equivalent transactions. Another example is the design of a standardised treatment for interest rate risk in the banking book. Yet another relates to the design of macroprudential standards for individually inconsequential banks or the CCPs. This issue is quite general, as it also underpins slow progress in applying a macroprudential perspective to the asset management sector.

5.3.1 Treatment of FX swaps and repurchase agreements

FX swaps and repurchase agreements for foreign currency funding are equivalent economically. In the case of swaps, two parties exchange two currencies and commit to reverse the transaction at some pre-agreed future date and price. This is the same as borrowing one currency on the repo market while using the other as collateral (Borio et al (2017)). Yet accounting standards imply that swaps do not appear on balance sheets while repos do.

Owing to such differences in accounting treatment, regulatory standards treat the two transactions very differently despite their economic equivalence (Borio et al (2020)). Most notably, borrowing through swaps rather than through repos vastly reduces the capital requirement in the leverage ratio. This inconsistent treatment can be a source of regulatory arbitrage, with banks seeking to lower their capital requirements by ramping up FX swap transactions without reducing risk-taking.

This differential treatment is particularly relevant given the pivotal role FX swaps paly in the global financial system. Between 2016 and 2019, the turnover on this market increased by 35%, to $3.2 trillion, and accounted for 54% of the overall turnover increase in the global FX market (Schrimpf and Sushko (2019)). The lion's share of the FX swap turnover is at very short maturities, up to one week, where substitutability with repos is greatest.[57] In addition, estimates indicate that at end-June 2019 the US dollar debt in the form of FX swaps of *non-banks* (financial and non-financial entities) outside the United States was some $18 trillion or so. This was actually *larger* than the equivalent amount of on-balance sheet dollar debt, estimated at $11.9 trillion.[58] It is not difficult to imagine that, should stress at the global level re-emerge, this market would come under strain, just as it did during the GFC (Baba et al (2008)).

5.3.2 Interest rate risk in the banking book

Interest rate risk in the banking book is currently part of the Pillar 2 supervisory review process, with no minimum quantitative capital requirements to mitigate it. In principle, banks are exposed to losses driven by changes in spreads underpinning the pricing of instruments in the banking book. The Basel Committee consulted on a possible Pillar 1 framework to help ensure banks have enough capital to cover potential losses from exposures to changes in interest rates, and to limit capital arbitrage between the trading and banking book (BCBS (2015)). However, the Committee concluded that formulating a standardised Pillar 1 banking book measure

[57] Aldasoro et al (2019) find that developments in the repo market can spill over to the FX swap market.

[58] See Borio et al (2020). This figure also includes forwards, which are not broken down separately in the statistics. The authors also discuss in detail the relationship between FX swaps and forwards and some of the data limitations.

for interest rate risk would be too complex, in light of the heterogeneous nature of this risk. Accordingly, it decided to only update the Pillar 2 pre-crisis principles (BCBS (2016b)).

While these revised principles strengthen supervisory expectations for banks' identification, measurement, monitoring and control of interest rate risk, they have shortcomings. In contrast to Pillar 1 standards, they create potential issues related to the consistency, transparency and comparability of SAC across banks. Moreover, the Pillar 2 principles do not fully capture certain sub-categories of interest rate risk, such as credit spread risk and basis risk.

These shortcomings matter. There is evidence that interest rate-induced valuation changes within the banking book can be a material source of losses.[59] The combination of interest rate risk and credit risk has been the source of widespread distress, most notably in the case of the Savings and Loan crisis of the 1980s (White (1991)). And it is of special relevance today, following the historically unique prolonged phase of extremely low interest rates post-GFC. Indeed, in some countries, such as Denmark and Switzerland, banks have even granted mortgages at negative nominal interest rates.

5.3.3 Systemic importance of small banks

Basel III does not recognise explicitly that, as a group, even small banks can generate systemic risk. When a large number of banks have common exposures to similar risks – eg credit exposures to the household sector in a given country or region – then there is a high likelihood that they would get under pressure at the same time. Granted, the system can absorb the failure of a few small banks if their activities are picked up by healthy banks. But beyond a critical mass of (small) bank failures, there would simply not be enough remaining capacity to restore key financial services.[60]

Indeed, history has shown that common exposures can generate a systemic event. For example, the early 1990s "small banks" crisis in the United Kingdom saw the failure of a large number of small banks with common exposures to the property market. Although each individual bank was not systemically important, "the episode was serious enough for the Bank of England to provide emergency liquidity assistance to a few [banks] in order to prevent contagion" (Bullack et al (2016)). More recently, the experience with the Spanish cajas has underlined the same point (Garicano (2012)).

It goes without saying, designing regulation to address this issue would be challenging. A key difficulty is the measurement of relevant common exposures. This would require a "systemic data set", on the basis of which authorities would identify and quantify exposures and run system-wide stress tests. The data available to any single bank would not suffice.

These challenges notwithstanding, policymakers should at a minimum remain vigilant about the systemic risk of small banks as a group. Because of this risk, a weakening of these banks' supervision could be detrimental to financial stability.

[59] For example, in 2008, HSBC reported in its annual report that "the sensitivity of equity to the effects of movements in credit spreads on the Group's available-for-sale debt securities was US$1,092 million", which amounted to just over 1% of the bank's total shareholders' equity at year-end.

[60] See eg Varotto and Zhao (2014) and OFR (2017).

5.3.4 Macroprudential elements in CCP principles

Since CCPs are designed to weather the vast majority of adverse market developments, signs of stress – such as that involving Nasdaq Clearing in 2018 – have been largely episodic. This makes it difficult to identify latent weaknesses at this stage. Nonetheless, three gaps stand out from a macroprudential perspective.

Risk concentration

The default of a systemically important clearing member would generate a massive drain on the CCP's resources (Systemic Risk Council (2019)). And the default of two such members would generate broad-based stress, with a double whammy for CCPs. Just as the defaults translate into large variation- and initial-margin shortages, market players would be scrambling to minimise losses, thereby impairing the liquidity of CCPs' resources. In turn, this would hamstring CCPs in their efforts to compensate for the shortages, potentially setting in motion a vicious circle.

Thus, despite the "Cover 2" principle (recall Section 3.3.1), any realistic amount of prefunded resources may fall short of ensuring the resilience of a CCP at the epicentre of a systemic event. Admittedly, published stress test results have been reassuring in this respect (ESMA (2017), CFTC (2017)). In interpreting these results, however, one needs to keep two points in mind. To the extent that stress tests abstract from, or capture only imperfectly, the second-round effects of asset sales and assume functioning markets, they understate the resources a CCP may need to weather a systemic event. In addition, CCPs would have strong incentives to dodge the overwhelming size of costly prefunded resources that dislocated financial markets would call for.

Acknowledging that prefunded resources cannot ensure CCPs' resilience would help avoid a false sense of security. It could spur policy measures that seek to limit the build-up of exposures to large counterparties, even in the presence resources that appear sizeable in tranquil times. It would also put a premium on recovery and resolution planning and, ultimately, on the design of contingent public support. Such support would provide liquidity relief – instrumental in keeping CCPs afloat and maintaining the functioning of critical markets.[61]

Procyclicality

The PFMI do encourage CCPs to behave in a countercyclical fashion (recall Section 3.3.2). That said, it envisages no requirement akin to the CCyB in Basel III. And to date, there has been no evidence of CCPs' systematic countercyclical behaviour.

By emulating the spirit of the CCyB, a countercyclical standard for CCPs would enforce the current principles. Concretely, such a standard could incorporate indicators of generalised overheating, during which market risks build up and which tend to precede periods of broad-based stress. In turn, these indicators could guide the accumulation of margin buffers during the overheating phase, so that the release of the buffers could shield banks from having to scramble for liquidity when stress materialises.

Channelled through a CCP, countercyclical policy actions could be particularly powerful. For instance, during the 1987 stock market crash, Japanese authorities

[61] Policymakers have stressed that, in order to mitigate moral hazard, central banks cannot pre-commit to provide liquidity assistance to CCPs. That said, they have also indicated that there should be no technical obstacles to providing such assistance ex post (Cœuré (2015)).

imposed a countercyclical *cut* on the cash margin calls issued by the large domestic securities houses (BIS (1988)). This helped reduce "forced" selling, thus generating SAC for a wide range of market participants at an opportune time. Similarly, in the past, during the wool crisis of 1900 in France, a CCP played an active role in coordinating market participants in order to mitigate the propagation of fire sales (Vuillemey (2019)). Such a coordinating role is in line with the one clearing houses used to play before the advent of formal banking regulation (Gorton (1985)).

CCP-bank nexus

Despite the tight CCP-bank nexus, no existing regulation targets explicitly banks and CCPs as a group. The conceptual difficulties that such regulation would need to overcome are daunting. We have already highlighted that the direct CCP-bank links partly transform counterparty risk into funding liquidity risk (recall Section 4.3.2). From a macroprudential perspective, this leads to the challenging task of determining which of the two types of risk would result in a more resilient financial system, all things considered.[62] In addition, exposures to common external risks create important indirect links, which could manifest themselves as banks and CCPs coming under stress at the same time. The possible implications of indirect links are very hard to measure, as they require comprehensive information on the financial system and a good understanding of the underlying dynamics.

In addressing the CCP-bank nexus, the ultimate regulatory question is where to allocate scarce LAR for credit risk: to CCPs or to banks? Given that CCPs are typically more systemic than banks, one might be tempted to prioritise the allocation of LAR to CCP SITG. However, this need not be the optimal approach. The reason is that SITG has a rather senior position in the default waterfall (recall Graph 3) and may thus come in play only after banks' LAR has declined and generated generalised stress. This is an important trade-off that, although difficult, warrants policymakers' attention.

5.3.5 Macroprudential regulation for the asset management sector

Post-GFC, the asset management sector has expanded very rapidly, accounting for the bulk of the FSB's "narrow measure" of non-bank financial intermediation. This measure comprises non-banks posing risks to financial stability and has grown from 60% of GDP in 2011 to 75% in 2017 (FSB (2019)). Part of this expansion reflects longer-term structural forces, such as financial deepening,[63] ageing societies and the shift from government-run pay-as-you-go pension schemes to prefunded ones. But the expansion no doubt also reflects tighter bank regulation, which has contributed to the shift of some intermediation activity outside the banking sector.

Such a shift was an intended outcome of regulation, but it has also added urgency to the need to address the migration and morphing of risks. The shift was intended because the majority of investment vehicles in the asset management sector cannot default: the risks they take on are borne by end-investors. Thus, the impact of these vehicles' losses on financial stability is expected to be smaller than that of similar bank losses. Still, liquidity transformation can induce fire sales and sudden surges in the demand for funding, which can have indirect but powerful destabilising effects on the financial system as a whole. And the banking system remains closely

[62] Key information in this respect would stem from stress tests that consider explicitly the impact of CCPs on banks; see ESMA (2019a).

[63] For an analysis of shadow banking in China, see Ehlers et al (2018).

connected to the asset management sector. For example, the committed amounts of credit from large banks to nonbank financial institutions in the United States has nearly doubled since 2013, exceeding $1.4 trillion (Board of Governors of the Federal Reserve System (2019)).[64] And this amount does not include more indirect and opaque exposures.

International initiatives to address vulnerabilities in the asset management sector have focused largely on market integrity (eg fair and efficient markets) and investor protection (FSB (2017a)). Such an approach reflects in part the mandates of securities regulators, which do not always include preserving systemic stability (Tucker (2016)). As a result, there is regrettably no *international* regulatory *requirement,* as opposed to *high-level recommendations*, that can contain funds' risks directly, eg those stemming from liquidity mismatches between assets and liabilities. And regulation in the asset management sector has largely avoided a macroprudential perspective. See Box D for further detail.

That said, policymakers have recognised the importance of measuring the potential systemic impact of collective selling by funds and other investors. This has led to the development of macro-type stress tests, which assess the size of fund redemptions that would lead to a market dislocation, trying to take into account second-round effects through asset prices (ESMA (2019b), Baranova et al (2018)).

It would seem useful to build on the example of these stress tests to explore more systematically the possibility of developing macroprudential safeguards. To be sure, some microprudential measures can have beneficial systemic effects. For instance, just like banks' liquidity requirements, those applied to investment funds can help mitigate fire sales. But system-wide stability requires closer engagement of securities supervisors in the macroprudential dialogue among authorities (BIS (2018)), calibrating policy tools from an explicit macroprudential perspective, and establishing mechanisms for their deployment.

By analogy with banks, macroprudential tools in the asset management sector would need to address both the cross-sectional and time dimensions.

Cross-sectional measures could take at least two forms. One would be to apply more stringent restrictions to those family of funds that are managed on a centralised, group-wide basis, as is more common in the fixed-income sector. For instance, besides imposing specific risk limits on a fund-by-fund basis, management companies could require each fund to recognise the negative externalities that its risk-taking could inflict on affiliated funds. Another possibility would be to sever legal links with banks, eg by prohibiting external support from a bank sponsor, thus preventing investment fund losses from permeating the rest of the system. While important steps in this direction have been taken in Europe (European Union (2017)), the global nature of asset managers warrants a more coordinated international effort.

Measures along the time dimension could also be helpful. As in other areas of the financial system, procyclicality is pervasive and can be quite disruptive. There is evidence that fund redemptions tend to be procyclical, mainly those by individuals, and that asset managers' own liquidity management amplifies their impact on the system (Morris et al (2017)). To address this issue, one option could be to develop arrangements that encourage the build-up of internal buffers in tranquil times and the use of these buffers in bad times, eg when implied volatility spikes up. Of course,

[64] Such commitments have been instrumental in supporting the post-crisis surge in the markets for leveraged loans (Aramonte and Avalos (2019)) and private credit (Aramonte (2020)).

design challenges abound. Just as in the case of bank countercyclical measures, these challenges relate to the appropriate size of the buffer, the timing of its accumulation and draw-down phases, and the signal that its release might convey. Furthermore, again as in the case banks, countercyclical measures in the asset management sector would be meaningful only if supported by effective international cooperation. That said, to the extent that solvency is not at stake, buffer usability issues should be less challenging than in the banking sector.

Box D

Post-crisis regulatory standards in the asset management sector

Ulf Lewrick

The build-up of systemic risks is not confined to the banking sector. Runs on US money market funds (MMFs) at the start of the Great Financial Crisis (GFC) prompted policy intervention in order to contain spillovers to the broader financial system (Kacperczyk and Schnabl (2013)). Post-crisis, regulatory reforms have sought to bolster the resilience of the asset management sector. They have done so mainly on the basis of microprudential measures, ie measures that seek to strengthen the resilience of individual funds considered on a standalone basis and whose calibration does not take into account the build-up of systemic risks. This box summarises the main reform elements by focusing first on MMFs and then on other investment funds.

Given the runs observed during the GFC, MMFs were at the centre of the post-crisis reform efforts in the asset management sector. In 2012, IOSCO published recommendations to strengthen MMF regulation and oversight (IOSCO (2012)). These recommendations focus on restricting MMFs' risk-taking and leeway in portfolio valuation, improving their liquidity management, and tightening the requirements on MMFs that offer a stable net asset value relative to those that offer a floating one. All FSB member jurisdictions have subsequently implemented the recommendations, at least to some extent, by (IOSCO (2019)).

Regulatory reforms have also targeted investment funds other than MMFs. The FSB published high-level recommendations to address structural vulnerabilities from asset management activities (FSB (2017)). These recommendations include closing supervisory data gaps and enhancing disclosure, promoting a consistent measurement of funds' leverage and strengthening liquidity management. Follow-up work by IOSCO (IOSCO (2018a,b) provided additional guidance. In the United States, the Securities and Exchange Commission tightened the requirements for funds' liquidity risk management and reporting (SEC (2016)), eg by imposing mandatory stress testing and introducing new tools, such as swing pricing (Lewrick and Schanz (2017)). In the European Union, the European Systemic Risk Board issued recommendations on how funds should manage liquidity risks and leverage (ESRB (2018)), whereas other legislative reforms (eg EMIR, MiFID II, AIFMD) enhanced disclosure requirements and strengthened investor protection. In turn, the ESMA has been developing a stress simulation framework that should guide supervisors in their assessment of investment funds' riskiness (ESMA (2019a)). While the recommendations and stress tests issued by market regulators refer to systemic risks, actual standards have – as in the case of MMFs – focused on microprudential tools.

5.4 The importance of conservatism

The previous analysis indicates that a conservative, belt-and-braces approach to regulation and supervision is appropriate.[65] Such an approach rests on multiple backstops, ie complementary standards that compensate each other's shortcomings. Backstops indirectly address some of the outstanding issues in the regulatory package (Sections 5.1 to 5.3 above).

Prototypical backstops relate to both capital and liquidity requirements. One example is the risk-insensitive leverage ratio requirement. It ensures that an exposure

[65] See eg ESRB (2019) and Bahaj and Foulis (2017).

to sovereign, interest rate or other types of risk is backed by a robust layer of capital, irrespective of how well other standards capture this risk. Another example is the relationship between the LCR and NFSR. By acting as a backstop to maturity transformation, the NSFR limits the size of the liquidity shortages that would arise if the LCR's HQLA does not perform as intended, and vice versa. Simple backstops are especially helpful when important risks are hard to measure. Going beyond existing regulation, the CCP-bank nexus would warrant such a backstop, which could simply be a specific LAR surcharge for both CCPs and bank clearing members (see above).

The greater conservatism in post-crisis regulation may be partly responsible for a widespread post-GFC development: the emergence of so-called pricing "anomalies". At first sight, such a development may appear a sign of malfunctioning. In fact, upon reflection, it is probably best regarded as a sign that regulation is having a healthy impact on markets.

Certain asset price relationships once taken for granted no longer hold: in this sense, markets appear to be more "segmented". As one example of such an "anomaly", uncollateralised rates for overnight transactions among private sector parties have stayed below the risk-free rates on central bank deposit facilities (Graph 8, left-hand panel, red vs blue lines). Likewise, the Libor-OIS spread in the yen has sporadically gone below zero, indicating a negative premium for counterparty risk (same panel, yellow line). In addition, deviations from covered interest rate parity persist. Namely, functionally equivalent cross-currency transactions yield different returns depending on whether they take place in derivatives or cash markets – the widening of the so-called cross-currency basis (centre panel).[66]

These anomalies indicate that, in contrast to pre-crisis, banks assign a price to their balance sheet (Duffie (2018), Fleckenstein and Longstaff (2018)). They no longer expand it with insouciance. Such an attitude may reflect an increased awareness of the risks involved. But no doubt regulation, and some of the new backstops in particular, have played a role.

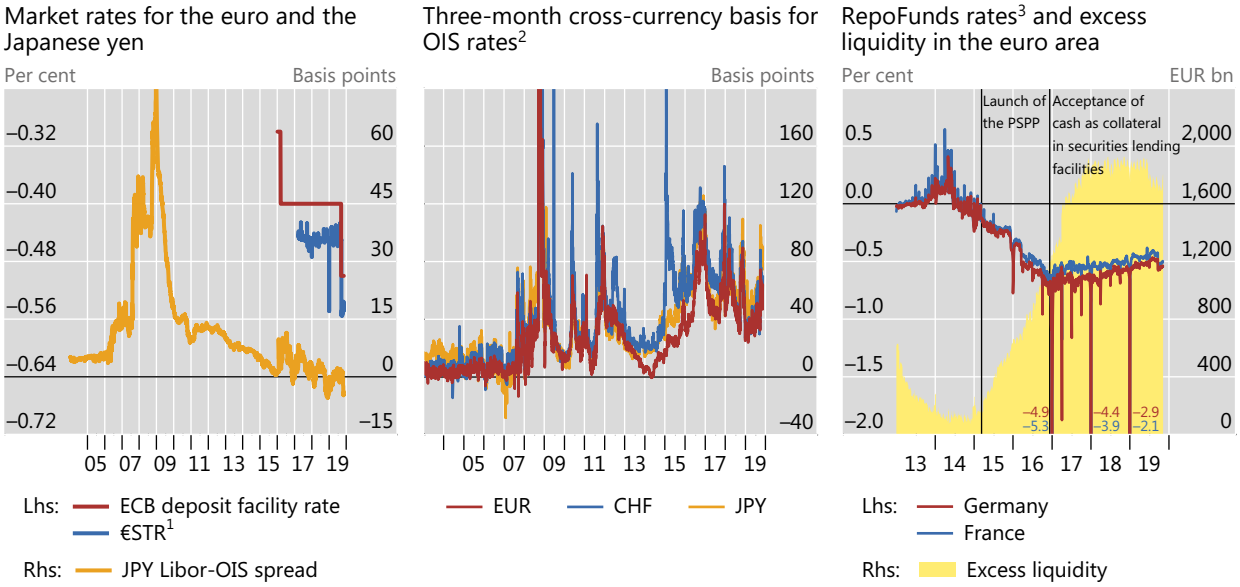
Assigning a price to the balance sheet is fundamentally healthy. It is now widely recognised that the pre-crisis period provides misleading benchmarks. It is precisely the failure to attach a meaningful price to balance sheets that led financial institutions to overstretch themselves pre-crisis, contributing to the build-up of vulnerabilities. Banks expand more cautiously now, admittedly generating more so-called "frictions" in normal times. But this can help avoid major and more costly disruptions down the road.

Market liquidity offers an instructive example. Attaching a price to balance sheet space may well mean that market liquidity is lower in good times. But this also constrains the aggressive risk-taking and overextension that tend to precede the sudden evaporation of liquidity at times of market stress. In such a situation, and amidst acute and widespread uncertainty about asset values, no entity – regulated or not – wants to "catch a falling knife". A benefit of costly balance-sheet space is that, when market liquidity does evaporate, financial institutions should be better placed to absorb the blow.

[66] On the widening of cross-currency bases, see also Avdjiev et al (2017) and Sushko et al (2016).

The link between regulation and pricing anomalies is particularly visible around the dates that trigger the application of leverage ratio requirements.[67] Some banks are required by their national supervisors to meet these requirements only on those specific dates. These banks window-dress their balance sheets, keeping them large most of the time and contracting them close to the regulation-relevant dates. This behaviour surfaces as spikes in repo rates (Graph 8, right-hand panel). By contrast, there is no similar window-dressing by banks required to meet the leverage ratio requirements on average during the relevant period. In order to discourage window-dressing, the Basel Committee has issued an official statement (BCBS (2018b)) and required additional disclosures (BCBS (2019b)).

Price "anomalies" Graph 8



[1] The preliminary pre-ESTER rate is shown before the official introduction of the €STR on 1 October 2019. [2] Difference between FX swap implied USD rate (foreign currency OIS rate swapped into US dollars) and USD OIS rate. [3] RepoFunds rates are based on effective O/N, T/N and S/N transactions against respective sovereign collateral on the BrokerTec and MTS platforms (predominantly non-GC collateral).

Sources: Markets Committee (2019); Bloomberg; author's calculations.

These general considerations should enter any evaluation of the regulatory reform. Given that they are crude measures by design, backstops are bound to appear as overly constraining for certain financial activities, preventing markets to function seamlessly. This could prompt arguments for "optimisation", eg through exemptions or a lower calibration. But weakening the standards may undermine their backstop function, opening up cracks in the regulatory package.

6. Conclusions

The post-crisis regulatory reform package has unquestionably increased the shock-absorbing capacity of the financial system. By improving the quantity, quality and

[67] Similar issues may arise with other regulatory standards that refer to specific reporting dates. The G-SIB buffer, which is calculated at year-end, is one such example.

robustness of banks' required capital and by formulating integrated and stricter principles for CCPs, it has raised loss-absorbing resources for previously covered risks. By developing long-overdue liquidity standards, it has reduced banks' exposure to losses. By embedding a macroprudential perspective, it has created for the first time dedicated loss-absorbing resources for systemic risk. And by relying on multiple regulatory standards to address similar risks, it has introduced backstops aimed at compensating the limitations of each standard taken in isolation (a belt-and-braces approach).

There is a consensus within the international regulatory and supervisory community that the priority now is the full, timely and consistent implementation of the package. This is especially important at a time when the regulatory cycle is close to its peak. With the memory of the Great Financial Crisis fading, and after a long and exhausting deliberating process, the pressures to dilute the agreed standards has naturally grown. This is one reason why we have stressed the importance of maintaining a conservative approach to regulation.

At the same time, it would be imprudent to declare victory, even once the agreed implementation of the regulatory package is finalised. The new regulatory apparatus is not perfect; none can be. We have identified a number of outstanding areas that warrant further attention. Moreover, regulation will need to evolve alongside the financial system and the broader economic environment. For example, big techs raise new important challenges (BIS (2019), Chapter III). And the same is true for climate-related risks.

More generally, it is important to bear in mind that the task of ensuring financial stability is a shared one; it goes well beyond the sphere of regulation and supervision. It encompasses policies designed to promote sustainable growth and that support prudential policy by limiting the build-up of large-scale financial imbalances, not least monetary policy (BIS (2019), Borio (2014), Crockett (2001)). Effective regulation and supervision, while essential, are and will continue to be only part of the solution.

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