

# Committee on the Global Financial System Markets Committee

## CGFS Papers

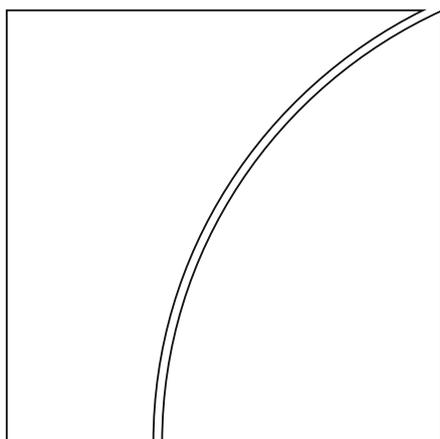
No 54

## Regulatory change and monetary policy

Report submitted by a Working Group established by  
the Committee on the Global Financial System and the  
Markets Committee

The Group was chaired by Ulrich Bindseil (European  
Central Bank) and William R Nelson (Federal Reserve  
Board)

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## Preface

Financial regulation is evolving, as policymakers seek to strengthen the financial system in order to make it more robust and resilient. Changes in the regulatory environment are likely to have an impact on financial system structure and on the behaviour of financial intermediaries that central banks will need to take into account in how they implement monetary policy.

Against this background, in February 2014, the Committee on the Global Financial System (CGFS) and Markets Committee (MC) jointly established a Working Group – co-chaired by Ulrich Bindseil (European Central Bank) and William Nelson (Federal Reserve Board) – to assess the combined impact of key new regulations on monetary policy.

This report presents the Group's findings. It is based on information from a range of sources, including central bank case studies as well as structured interviews with private sector market participants. It argues that the likely impacts of the new financial regulations on financial institutions and markets should have only limited and manageable effects on monetary policy operations and transmission. Hence, as necessary, central banks should be able to make adjustments within their existing policy frameworks and in ways that preserve policy effectiveness. These adjustments will tend to differ across jurisdictions according to the financial systems and policy frameworks in place. Specific implications, and examples of potential policy responses, are set out and elaborated in the report.

The report is a timely and important contribution to ongoing discussions about the evolving regulatory environment and its implications for policymakers.

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## Executive summary

Financial regulation aims to influence the behaviour of banks and other financial intermediaries to enhance their resilience and support financial stability. Given that those same intermediaries interact with central banks in the context of monetary policy implementation, changes to the regulatory environment are bound to have effects that central banks will need to take into account.

This report assesses the combined impacts of key new regulations on monetary policy, focusing on the effects that these regulatory changes are having on *money markets*, *monetary operations* and *monetary transmission*. The report argues that the likely impacts of the new financial regulations on financial institutions and markets should have only limited and manageable effects on monetary policy operations and transmission. Hence, as necessary, central banks should be able to make adjustments within their existing policy frameworks and in ways that preserve policy effectiveness. These adjustments, in turn, can be of various kinds and will tend to differ across jurisdictions according to their financial systems and the policy frameworks in place.

The report's findings can be characterised in terms of five distinct sets of implications. In addition, more general effects of the emerging regulatory environment that are independent of specific macroeconomic conditions can be differentiated from those that pertain in the context of the current environment of low policy rates. All of these, and examples of potential policy responses, are set out and elaborated in detail in Chapter 5 of this report.

In brief, they are as follows:

**Safer financial systems and their implications for policymaking.** The emerging regulatory environment will contribute to enhanced bank resilience, reducing the risk of spillovers from the banking sector to the real economy, and is expected to limit the extent of liquidity and maturity transformation undertaken at banks. Therefore, if the regulations are effective, bank credit will be more stable on average, because credit cycles will be less severe and less frequent.

At the same time, at some points of the credit cycle, the supply of bank credit for the non-financial sector will tend to be lower than it would be in the absence of the new regulations (and with everything else unchanged). Thus, to achieve the same economic outcomes, central banks may end up adopting a policy stance that is somewhat more accommodating during some parts of the cycle than would otherwise be the case.

**Shifting asset price relationships and their implications for policy targets.** As markets adjust to the new regulatory requirements, the equilibrium relationships between financial asset prices and central bank policy rates will shift, adding to the existing uncertainty around these relationships – at least during the transition period. As a result, central banks may need to adjust the settings of their policy instruments to achieve the same stance of monetary policy.

A complicating factor is that different regulations, considered in isolation, can have consequences that go in opposite directions. Moreover, the interaction of these regulations could add to the difficulties in predicting their overall impact. As a result, central banks will need to monitor these changes and respond to them as they manifest themselves.

**Reduced arbitrage activity and its impact on policy implementation.** New regulations, such as the leverage ratio, may disincentivise certain low-margin arbitrage activities, such as banks' matched repo book business. This reduction would tend to weaken, and make more uncertain, the links between policy rates and other interest rates, weakening the transmission of monetary policy impulses along the yield curve as well as to other asset prices relevant for economic activity.

**More difficult reserve demand forecasting.** For central banks with an operational target of steering a short-term interest rate within a corridor system, if the rate paid on reserve balances is close to the interest rate on other types of high-quality liquid assets (HQLA Level 1), small changes in interest rates could result in relatively large swings in reserve demand as banks substitute freely between reserves and these other assets.

Additionally, new limits on counterparty concentration may mean that forecasts of the level of reserve balances will depend more strongly than in the past on the distribution of those reserves across counterparties. Similarly, with periodic calculation of regulatory ratios (such as at year- or quarter-ends), window dressing behaviour and associated movements in short-term interest rates are likely to intensify.

**More central bank intermediation.** Many of the new regulations will increase the tendency of banks to take recourse to the central bank as an intermediary in financial markets – a trend that the central bank can either accommodate or resist. Weakened incentives for arbitrage and greater difficulty of forecasting the level of reserve balances, for example, may lead central banks to decide to interact with a wider set of counterparties or in a wider set of markets.

In addition, in a number of instances, the regulations treat transactions with the central bank more favourably than those with private counterparties. For example, Liquidity Coverage Ratio rollover rates on a maturing loan from a central bank, depending on the collateral provided, can be much higher than those for loans from private counterparties.

**Effects specific to the current low interest rate environment.** In addition to these more general implications, there are a number of effects for monetary policy that are specific to the current environment of low policy rates in the major advanced economies. For example, effects that tend to lower market interest rates relative to policy rates will support monetary policy in jurisdictions at the zero lower bound, but may hinder efforts to normalise the stance of policy. Effects that tend to raise market rates relative to policy rates will have the opposite consequence.

Moreover, any temporary reduction of credit supply resulting from the new regulations and their phasing-in may imply the need for additional unconventional measures for central banks operating at the zero lower bound, with the added complication that some unconventional measures may make the new regulations more binding.

## 1. Introduction and motivation

The regulatory environment and central bank monetary policy operating frameworks are evolving. Authorities have initiated a series of major regulatory reforms, which will add new measures and toughen existing regulatory requirements. These include changes in capital and liquidity/funding standards, large exposure limits, macroprudential overlays and a shift in over-the-counter (OTC) derivatives markets to standardised trades and central clearing. At the same time, in response to the financial crisis, many central banks have altered their monetary policy operating frameworks, and further adjustments may well occur as they prepare for, and eventually implement, policy normalisation. A key question is how these regulatory changes will interact with monetary policy. In particular, will changes to international regulatory standards affect the implementation of monetary policy or its effectiveness in achieving its objectives? In addition, what features of monetary policy operating frameworks, such as the liquidity facilities, markets or counterparties through which the central bank executes monetary policy, will be most affected by the emerging regulatory regime?

**Motivation.** A key motivation for this report stems from the very objective of financial regulation to alter the behaviour of banks and other financial intermediaries in a direction that renders the financial sector more robust to shocks and other adverse developments. Given that those same intermediaries interact with the central bank in the context of its monetary policy implementation, financial regulations, if effective, are thus bound to have impacts – at least of a second-order nature – that central banks will need to take into account when conducting monetary policy.

Financial regulations are typically designed to ensure that the capitalisation and funding profile of financial institutions is commensurate with the credit and liquidity risks borne by these firms. This will influence the size and composition of their balance sheets as well as their desire to engage in financial transactions. Central banks, in turn, conduct monetary policy by controlling (or otherwise influencing) the price and/or quantity of certain financial assets, often highly liquid assets, to achieve specific objectives for the macroeconomy, as defined by their mandates. They do so by buying or selling assets, on either a temporary or a permanent basis; by lending; by taking term deposits or demand deposits; and by adjusting their policy interest rates.<sup>1</sup>

As a result, monetary policy and financial regulation interact in a number of ways. Directly, regulation may affect monetary operations through any changes in the demand for central bank reserves, in used collateral, in the incentives for using particular central bank facilities, and through any impact on short-term interest rates. Other channels include any effects of regulation on the liquidity, pricing, and functioning of key markets (such as money markets) and broader changes to the monetary transmission mechanism that affect the way in which the monetary policy stance of the central bank is transmitted to the financial system and the wider economy.

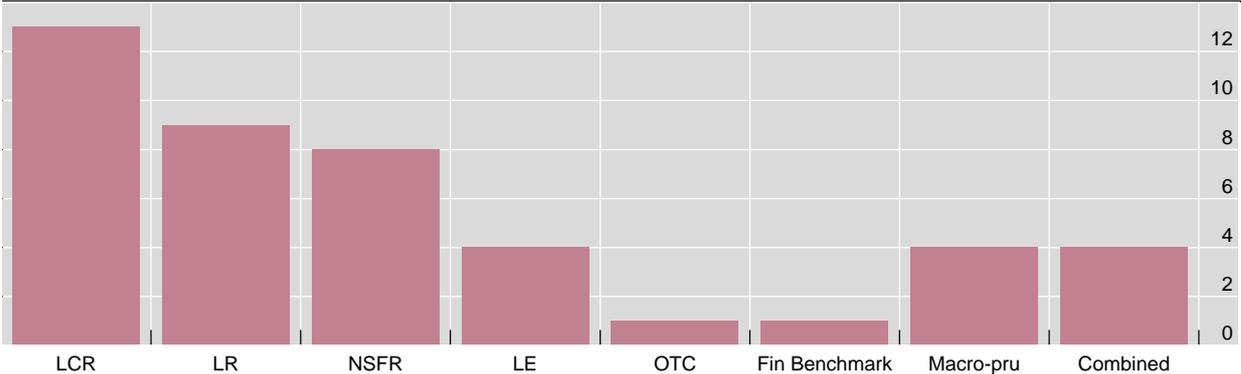
<sup>1</sup> For a recent account of the different aspects of central bank operations from the perspective of their impact on collateral asset markets, see CGFS and MC (2015).

To facilitate a better understanding of these effects, in February 2014, the Committee on the Global Financial System (CGFS) and the Markets Committee (MC) decided to establish a Working Group, co-chaired by Ulrich Bindseil (European Central Bank) and William Nelson (Federal Reserve Board). Taking the new regulations and their calibration as a given, the Group was asked to assess the implications for monetary policy (in terms of both operations and transmission), focusing primarily on the reaction of banks and markets to the new regulatory reality.<sup>2</sup>

**Process.** In addressing these issues, the Group adopted a three step approach, recognising that it would have to strike a balance between coverage and focus. As a first step, Working Group members were asked to identify new regulatory changes that their central banks assessed as being the most likely ones to significantly affect monetary policy implementation in their respective jurisdictions. As part of this identification process, the 21 participating central banks submitted a total of 44 case studies based on an agreed common template, detailing the regulations (individually or in combination) with the most significant impact and their (anticipated) effects as well as any adjustments that central banks had made or were considering in response (see Graph 1 below for an overview).

Case studies submitted by Working Group members, by regulation

Graph 1



LCR = Liquidity Coverage Ratio; LR = leverage ratio; NSFR = Net Stable Funding Ratio; LE = large exposure limits; OTC = over-the-counter derivatives reform; Fin Benchmark = financial benchmark reform; Macro-pru = macroprudential tools and regulations, including counter-cyclical capital buffers. Source: Working Group members.

Step two, in turn, was organised in the form of distinct workstreams, broadly reflecting three different aspects of monetary policy implementation: *money markets* (with a focus on regulation-induced changes to money markets relevant for monetary policy implementation), *operations* (regulation-induced changes to financial institutions’ incentives to participate in central bank operations), and *transmission* (changes to the broader monetary policy transmission mechanism). To keep the analysis tractable, the workstreams placed their main emphasis on analysing the effects of the most relevant new regulatory requirements (“key regulations”) identified during the first stage of the Group process: (i) the leverage ratio (LR), (ii) Liquidity Coverage Ratio (LCR) and (iii) Net Stable Funding Ratio (NSFR) as well as (iv) large exposure (LE) limits (see Box 1 for a short description).

<sup>2</sup> A list of Group members is attached at the end of this report. Appendix 1 reproduces the Working Group’s mandate.

## Overview of key new regulatory requirements

This box details the four key regulations identified by the Working Group as being the most likely ones to significantly affect monetary policy implementation (BCBS (2013, 2014, 2014a, 2014c)).

**Liquidity Coverage Ratio.** The stated objective of the LCR is to ensure that banks maintain an adequate level of unencumbered, high-quality liquid assets (HQLA) that can be converted into cash to meet their liquidity needs under a 30-day scenario of severe funding stress. It is defined as the ratio of the stock of HQLA (numerator) to net cash outflows expected over the stress period (denominator). The initial minimum requirement of 60%, effective January 2015, will be increased in a stepwise fashion to 100% by 2019.

The HQLA definition groups eligible assets into two discrete categories (Level 1 and Level 2). Level 1 assets, which can be included without limit, are those with 0% risk weights for Basel II capital calculations, such as cash, central bank reserves and sovereign debt (which may be subject to haircuts). Level 2 assets, which can make up no more than 40% of the buffer, include assets with low capital risk weights as well as highly rated non-financial corporate and covered bonds, subject to a 15% haircut. (Under certain conditions, supervisors may choose to include additional asset types, termed Level 2B, up to a limit of 15% of the total HQLA stock and carrying haircuts of 25% or higher.) Net cash outflows, in turn, are calculated on the basis of agreed run-off and inflow rates that are applied to different sources of cash out- and inflows (with an aggregate cap of 75% of total cash outflows).

**Net Stable Funding Ratio.** The aim of the NSFR, which will be introduced as of January 2018, is to (i) limit overreliance on short-term wholesale funding, (ii) encourage better assessment of funding risk across all on-and off-balance sheet items, and (iii) promote funding from stable sources on a structural basis.

The NSFR is defined as the ratio of available stable funding (ASF) to required stable funding (RSF), which needs to be equal to at least 100% on an ongoing basis. The numerator is determined by applying ASF factors to a bank's liability positions, with higher factors assigned for longer maturities (according to pre-defined buckets: less than six months, between six and 12 months, and higher), and more stable funding sources. The denominator reflects the product of RSF factors and the bank's assets, differentiated according to HQLA/non-HQLA definitions and by counterparty (financial/non-financial). Asset encumbrance generally results in higher RSF factors, especially for longer encumbrance periods (eg assets encumbered for a period of one year or more receive the maximum RSF factor of 100%, while central bank reserves have a factor of 0% (with discretion to apply a higher rate) and other Level 1 assets a factor of 5%). Differentiated RSF factors also apply according to whether assets are secured against Level 1 assets or not.

**Leverage ratio.** The Basel III minimum leverage ratio is intended to restrict the build-up of leverage in the banking sector, and to backstop the risk-based capital requirements with a simple, non-risk-based measure. Public disclosure of the regulatory LR by banks commenced on 1 January 2015. The final calibration and any further adjustments to the definition will be completed by 2017 with a view to migrating to a binding Pillar 1 requirement on 1 January 2018.

The LR is defined as the ratio of Tier 1 capital to total exposures. The denominator consists of the sum of all on-balance sheet exposures, derivative positions, securities financing transactions and off-balance sheet items. As such, the total exposure measure includes central bank reserves and repo positions. Netting of cash legs (ie of receivables and payables) of repo exposures (with the same counterparty) is permitted under certain conditions, but netting across counterparties or of cash positions against collateral is not.

**Large exposure limits.** The large exposures (LE) framework of the Basel Committee on Banking Supervision (BCBS) is a set of rules for internationally active banks aimed at reducing system-wide contagion risk. It imposes limits on banks' exposures to single counterparties in order to constrain the maximum loss a bank could face in the event of sudden counterparty failure. The framework is due to be fully implemented on 1 January 2019.

Under the LE framework, a bank's exposure to any single counterparty or group of connected counterparties cannot exceed 25% of the bank's Tier 1 capital. A tighter limit of 15% is set for exposures between banks that have been designated as globally systemically important. While exposure measurement is aligned with the standardised approach under risk-based capital rules, exposures to sovereigns and central banks, as well as intraday interbank exposures, are exempt from the limit.

In a third step, the combined findings were then generalised, taking account of different types of monetary policy instruments used across different policy frameworks as well as the effects of other important regulations (primarily, Basel III risk-weighted capital requirements; see Box 2 below), as necessary.

Box 2

### Basel III: stronger risk-weighted capital requirements

Basel III capital regulation includes a number of new elements to boost banks' capital base. First, it incorporates a significant expansion in risk coverage, which increases risk-weighted assets. Specifically, it targets the instruments and markets that were deemed most problematic during the crisis – that is, trading book exposures, counterparty credit risk and securitised assets. This builds on the earlier approach under Basel II, which introduced differentiated risk weights (which are either internal model-based or set by regulation). A key differentiation from the perspective of monetary policy is that central bank reserves carry a zero risk weight under the risk-weighted standard,<sup>①</sup> whereas the leverage ratio introduces an implied capital charge that is equal for all assets. Risk-weighted capital charges also differ according to whether a transaction is secured or unsecured. Second, and critically, Basel III tightens the definition of eligible capital, with a strong focus on common equity. This represents a move away from complex hybrid capital instruments that proved incapable of absorbing losses in periods of stress.

A unique feature of Basel III is the introduction of capital buffers that banks can use without compromising their solvency, and surcharges, which counter individual banks' contribution to systemic risk (Table 2.A). First, a conservation buffer is designed to help preserve a bank as a going concern by restricting discretionary distributions (such as dividends and bonus payments) when the bank's capital ratio deteriorates. Second, a countercyclical buffer – capital that accumulates in good times and that can be drawn down in periods of stress – will help protect banks against risks that evolve over the financial cycle. Finally, a capital surcharge will be applied to global systemically important banks (G-SIBs), or banks with large, highly interconnected and complex operations, in order to discourage the concentration of risk. These international standards impose lower bounds on regulators: countries may choose to implement higher standards to address particular risks in their national contexts. Combining these elements will significantly increase banks' capital requirements.

Capital requirements, as a percentage of risk-weighted assets

Table 2.A

	Basel III					Basel II
	Min	Conservation buffer	Countercyclical buffer	SIFI surcharge	Total	Min
Common equity	4.5	2.5	0–2.5	1–2.5	7–12	2
Tier 1	6				8.5–13.5	4
Total (Tier 1 + Tier 2)	8				10.5–15.5	8

<sup>①</sup> In practice, the risk weight may in fact be higher than zero for some jurisdictions, for example, if internationally active banks use sovereign ratings to calculate consolidated capital charges for exposures vis-à-vis foreign central banks.

This report documents the Group's findings, which are based on information from a range of sources, including academic research, central bank case studies, and structured interviews with central bank counterparties and other private market participants. It is organised as follows. Chapter 2 discusses the effects of regulatory change for money markets and their relevance for monetary policy. Regulation-induced effects for market participants' incentives to use central bank facilities are examined in Chapter 3, followed by a review of the broader effects of regulation on monetary transmission in Chapter 4. Chapter 5 synthesises the results.

## 2. Regulatory reforms and money markets

Monetary policy is typically implemented through central bank operations in money markets with the objective of steering short-term money market interest rates. This chapter, therefore, discusses the effects of the four key regulations identified by the Working Group for money market functioning and pricing. It starts by briefly reviewing the impact of each regulation in isolation, focusing on the likely shifts in the demand for, and supply of, cash balances across different money market segments and on the possible implications of these changes for market volumes, rates and volatility.<sup>3</sup> Based on these findings, an attempt is then made to provide an overall assessment of the cumulative effect of all four regulations on money markets. It is important to note at the outset that the expected impact on bank behaviour will depend on the extent to which the individual regulations have been implemented and the degree to which they are binding on banks. This is likely to lead to differential impacts across markets.

### 2.1 The leverage ratio

The leverage ratio (ie the ratio of Tier 1 capital to total exposures; see Box 1 above) has the potential to increase the cost of expanding bank balance sheets and, hence, reduce the demand for cash borrowings. More specifically, the implied capital requirement of the leverage ratio tends to increase the cost of banks' repo and similar secured transactions relative to other activities and may reduce their incentives to conduct money market arbitrage and provide market-making.<sup>4</sup>

**Shifting supply and demand.** Absent a binding leverage ratio requirement, a bank would generally be indifferent to the choice between keeping cash at the central bank or lending it out via repo (using government securities) at the same rate as these two transactions are both free of a capital charge. Yet, the bank would charge a higher rate to lend the cash in the unsecured money market, not only because of the greater credit risk, but also because unsecured transactions would require more capital.

On this basis, the impact of the leverage ratio on money markets works through both the demand for and the supply of cash balances. Borrowing via repos and other secured transactions will tend to become more expensive, as the leverage ratio effectively "taxes" transactions that expand the balance sheet. Other things being equal, this will reduce demand for cash in the money market (and for secured transactions relative to unsecured ones), pushing down on rates.

The corresponding effects on the supply side are more subtle, as the implied capital requirement imposed by the leverage ratio needs to be compared with the impact of Basel III risk weights, which are (essentially) zero on cash and government securities and positive for unsecured money market lending. From a lender's perspective, before the leverage ratio requirement becomes binding, a bank deciding whether to keep cash at the central bank or lend it out via repos would see the two transactions as roughly equal, because the capital requirement is the same (zero). A bank deciding between holding cash at the central bank and lending

<sup>3</sup> "Cash" is used as shorthand for money borrowed or lent, whether in physical or electronic form.

<sup>4</sup> See CGFS (2014) for more detailed coverage of recent trends in market-making.

unsecured, in turn, would require a higher rate on the unsecured transaction. After the leverage ratio becomes binding, the implicit capital requirements on cash at the central bank and repos would both increase, but would remain equal. The relative difference in capital requirements between cash at the central bank (or repo lending) and unsecured money market lending, however, would fall. Lower supply of cash should drive volumes lower in all markets, although the effect on the secured market will be bigger because the supply of secured lending would tend to fall, at the margin, relative to the supply of unsecured lending.

Abstracting from any other constraints, the resulting moves in demand and supply schedules imply that money market volumes should decrease, with market composition moving towards relatively less repo borrowing, an implication that is broadly in line with the Group's interviews.<sup>5</sup> The net impact on the level of money market rates is uncertain – the declines in demand and supply together have an ambiguous effect – although conversations with market participants suggest that rates are likely to be lower, particularly in unsecured markets, as the fall in demand is seen to dominate. The spread between secured and unsecured lending, in turn, is likely to narrow – reflecting the relatively larger fall in the supply of secured lending.

**Increased volatility.** The leverage ratio may also lead to increased rate volatility, for two reasons. First, given that activity levels are expected to fall, liquidity is also likely to be lower, which will tend to push up bid-ask spreads (and reduce the size of the contracts to be traded – “clip size”) and lead to an increase in volatility. Second, if banks seek to economise on the amount of central bank reserves that they are willing to hold at given levels of interest rates, then smaller reserve buffers may leave them needing to bid up for cash in short-term money markets in response to unexpected shocks, increasing market volatility. This may be particularly relevant for banks within a floor-based operating framework.

## 2.2 Large exposure limits

In contrast to the leverage ratio, secured transactions are likely to be largely unaffected (irrespective of term and counterparty) by the introduction of large exposure limits as their calculation permits the netting of collateral (see Box 1 above).<sup>6</sup> However, large exposure limits have the potential to affect unsecured money market activity and rates, as detailed below.

**Market activity.** Unsecured activity may be affected because LE limits effectively introduce quantity constraints on lending to individual counterparties, which have the potential to restrict the flow of cash between different entities in the money market. The scale and scope of such an impact, in turn, will depend on market structure and, specifically, the degree of concentration of money market activity among key counterparties.<sup>7</sup>

<sup>5</sup> For a discussion of the effects of the leverage ratio on unsecured markets, see Box 3 below.

<sup>6</sup> Collateral and exposures are both subject to haircuts. If these are significant, netting will not be complete and banks may choose to reduce their exposures to key counterparties or specific issuers.

<sup>7</sup> While intragroup exposures are excluded, there are a number of specific provisions (eg reporting requirements and protocols) that could also potentially affect interbank lending.

## The effect of the leverage ratio on overnight unsecured funding markets

This box discusses the effect of leverage ratio (LR) requirements on volumes and rates in the federal funds market, which forms a key component of overnight unsecured bank funding markets in the United States.

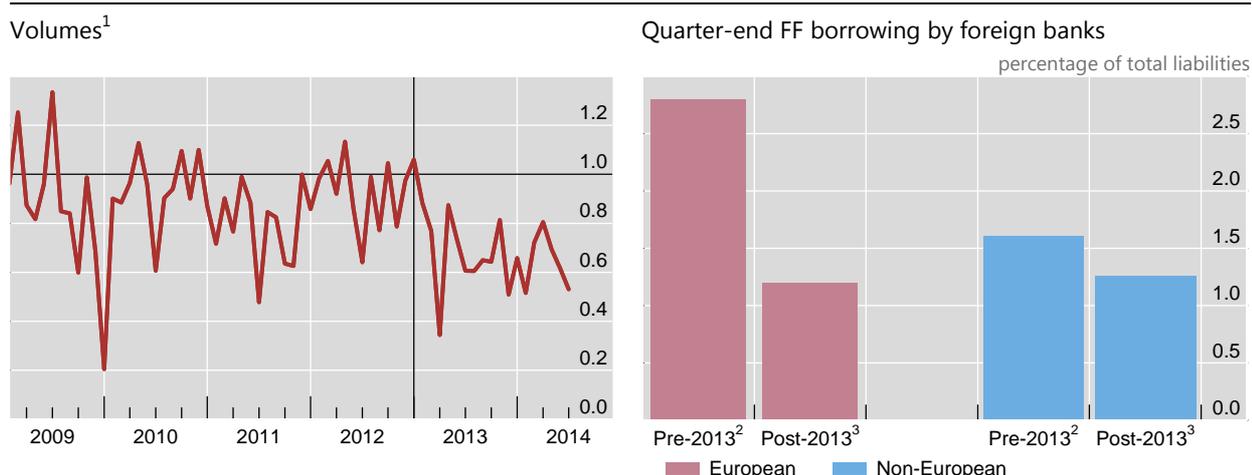
A federal funds (FF) transaction is an unsecured US dollar loan to a depository institution (DI) by another DI or other eligible entity, including government-sponsored enterprises (GSEs). FF lending activity has decreased significantly since the beginning of the financial crisis as a result of the expansion of the Federal Reserve's balance sheet and the introduction of interest payments on excess reserves (IOER). The former elevated the level of excess reserves in the banking system, while the latter reduced the incentive for DIs to lend FF at rates below IOER. Instead, participation in the FF market has been largely driven by an arbitrage opportunity in which DIs earn the spread between IOER and the rate paid on funds borrowed from GSEs, which are not eligible to receive IOER and thus have an incentive to lend federal funds. Because the introduction of the Federal Deposit Insurance Corporation (FDIC) assessment fee in April 2011 rendered this arbitrage opportunity less attractive for domestic DIs, foreign bank activity currently comprises a sizeable share of the overnight FF market.

Basel III introduces capital and liquidity requirements that are likely to affect overnight borrowing by DIs, particularly for foreign banks, on reporting dates. According to the LR, which some banks began reporting on a quarter-end basis in 2013 as part of the parallel run, FF borrowing increases a bank's balance sheet assets, thereby weakening its LR. While US banks have been subject to LR requirements consistent with levels promulgated in Basel III for decades, previous LR requirements for foreign banks were lower. Furthermore, up to the third quarter of 2014, many foreign banks calculated their reported LR based on the average of the three month-ends over a quarter.<sup>①</sup> As a result, the LR might be expected to reduce foreign banks' activity in overnight unsecured borrowing markets at month-end, as they borrow less on reporting dates in order to keep their LR above the minimum requirement.

Early evidence is broadly consistent with this expectation. Following the start of LR reporting (Graph 3.A, vertical line), the ratio of a proxy for overnight unsecured borrowing activity by foreign banks, at month-end, to the corresponding monthly average appears to have generally fallen below levels observed prior to 2013, suggesting that the LR may have reduced month-end borrowing activity by these banks (Graph 3.A, left-hand panel). The decline in borrowing at month-end since the beginning of 2013 coincides with a lower share of federal funds borrowed in total liabilities, especially for European institutions (Graph 3.A, right-hand panel).

Overnight unsecured borrowing activity by foreign banks

Graph 3.A



<sup>1</sup> Ratio of a proxy for overnight unsecured borrowing activity by foreign banks at month-end to the corresponding monthly average; the vertical lines indicate the introduction of LR in January 2013. <sup>2</sup> Pre-2013: Q1 2009 to Q4 2012. <sup>3</sup> Post-2013: Q1 2013 to Q1 2014.

Source: Federal Reserve Board.

① Beginning in January 2015, all European banks will report their leverage ratio at quarter-end.

**Rates dispersion.** If markets are relatively concentrated, both the level and the dispersion of money market rates may be affected. Banks with surplus reserves will find it harder to lend out reserves if they face binding limits against some of their counterparties, and may thus lend out surplus reserves at lower rates. Banks with a shortage of reserves, in turn, may find it harder to borrow reserves if their counterparties are constrained by LE limits. A reduced set of counterparties may thus cause them to borrow reserves at higher rates. Even though any overall effect would tend to be muted by the activity of unconstrained banks, this could result in a more dispersed set of traded rates, which would potentially lead to increased volatility of short-term unsecured money market rates and greater recourse to central bank standing facilities (as a substitute for borrowing/lending funds in the market; see Chapter 3 below). At the margin, large exposure requirements may then also lead to a shift in activity from the unsecured market to the secured market (given that the latter is largely exempt from LE limits). But, on average, this should not affect the level of money market rates.

### 2.3 The Liquidity Coverage Ratio

The effect of the LCR on money markets will differ according to the term of the transaction and the counterparty involved and according to whether transactions are secured or not.<sup>8</sup>

**Unsecured markets.** The new requirement encourages banks to term out their unsecured wholesale funding because longer-term funding (> 30 days) does not impact net cash outflows (the denominator; see Box 1 above). As a result, the demand for longer-term unsecured funding will rise and, indirectly, that for short-term unsecured funding (< 30 days) will fall. In a similar way, the LCR incentivises banks to shorten the maturity profile of their wholesale lending, implying supply shifts that are in the opposite direction to the demand shifts.

In contrast, there is generally no direct impact on the LCR from short-term cash (< 30 days) borrowing, because cash borrowed increases the stock of HQLA and net cash outflows by broadly the same amounts.<sup>9</sup> Only if this borrowing is used to fund private sector loans (or other assets that do not count fully in the stock of HQLA) does the LCR fall.<sup>10</sup> In this case, demand for short-term funding would fall, while supply would tend to increase. The net effect of these shifts in demand and supply implies a steepening of the short end of the unsecured yield curve, as longer-term rates rise and shorter-term rates fall.<sup>11</sup>

<sup>8</sup> For a general discussion, see, for example, Schmitz (2013).

<sup>9</sup> There are two exceptions to this. First, Level 2A assets only count towards a banks' total HQLA if they form less than 40% of its overall HQLA. So a bank that operates close to this cap and lends out cash may experience a reduction in its LCR. Second, the extent to which banks can count cash inflows as boosting their LCR is capped at 75% of gross outflows. So, if a bank operated near this cap and lent out cash, the numerator of the ratio would fall, but the corresponding inflow would not reduce the denominator. The LCR would then fall.

<sup>10</sup> If the bank is bound by its inflow cap, ie inflows already account for > 75% of gross outflows, then the bank will also become unwilling to lend at shorter tenors.

<sup>11</sup> Bonner and Eijffinger (2013), when assessing the Dutch experience with liquidity regulations similar to the LCR, find that banks pay and charge higher interest rates for unsecured interbank loans with

The effect on volumes is less clear, however, and will depend on the relative shifts in demand and supply as well as any impact of the regulations on the elasticity of both schedules. In particular, the impact on bank behaviour will depend on the stage of the implementation of the LCR or similar liquidity regulations across jurisdictions. In some cases, banks have already made the adjustment, and the incremental impact on money market rates and volumes may be small. In the Working Group's interviews, for example, the LCR was seen by UK market participants as not having a significant impact, partly due to the fact that a similar liquidity regime had been in place for a number of years already. In other jurisdictions, however, adjustments have not yet been made to the same degree, which generates greater scope for market impact. On balance, once other regulatory requirements are taken into account, the expectation is for a net reduction in short-term unsecured money market volumes due in part to the risk-based capital charges associated with unsecured lending, which is consistent with the survey results from market participants.<sup>12</sup>

**Secured markets.** The impact of the LCR on secured markets is somewhat more complicated. In general terms, secured borrowing will be broadly neutral, because repos are generally assumed to roll off at a rate that just compensates for the haircut applied when calculating HQLA. Yet, there can still be second order effects for secured market activity – depending on how the haircuts used in repo trades by market participants (and the central bank) compare with those embedded in the LCR.<sup>13</sup> Specifically, if haircuts on collateral in secured financing transactions are lower than those applied under the LCR, then this can result in secured borrowing being beneficial in LCR terms.

In terms of pricing, similar to the unsecured case, the LCR again increases the incentive for banks to term out their funding, which may lead to a steepening of the short-term secured yield curve.

There is also a marginal disincentive to borrow via HQLA-backed repos, because the LCR falls, as (after haircuts) the quantity of cash received is slightly less than the quantity of assets encumbered. As the incentive to transact repos against non-HQLA collateral is broadly in line with unsecured borrowing,<sup>14</sup> at the margin, HQLA secured rates may be lowered slightly relative to non-HQLA secured rates.

maturities longer than the requirement's 30-day horizon. The analysis also documents reduced lending volumes in the unsecured interbank market.

<sup>12</sup> The incentive for banks to increase their supply of cash in the short-term unsecured market will be offset, to some degree, by the risk-based capital charges associated with unsecured lending. This is likely to dampen the increase in supply relative to the fall in demand, leaving short-term unsecured volumes lower.

<sup>13</sup> Bech and Keister (2013) extend a standard model of monetary policy implementation in a corridor system to incorporate the LCR. They show that, when the run-off rate on reserves is less than 100%, reserves borrowed from the central bank can perform a double duty: they serve as HQLA for LCR purposes and, at the same time, can be applied towards the bank's reserve requirement. A bank that anticipates borrowing from the central bank for LCR purposes will tend to have a lower demand for funds in the overnight interbank market. A substantial LCR shortfall may imply that the demand curve for reserves in the interbank market lies entirely below the policy rate – if this is the case, there is no level of reserves supplied that will achieve the policy target.

<sup>14</sup> The exception is transactions against the central bank, which may receive a more favourable treatment (eg a 0% run-off rate) in some jurisdictions.

## 2.4 Net Stable Funding Ratio

The impact of the NSFR on money market rates and activity is complex and depends critically on whether transactions are collateralised or not.

**Unsecured markets.** The provision of unsecured funding out of existing cash balances reduces the NSFR, which is defined as the ratio of ASF/RSF, regardless of duration or type of counterparty (see Box 1 above). This is because the RSF factor (weight) for loans is greater than the RSF factor on cash and claims on central banks. The RSF factor applied on unsecured loans increases with the duration of the transaction.<sup>15</sup> In sum, supply of unsecured lending may fall – particularly at longer tenors and if banks rely on short-term wholesale funding from other financial institutions to finance such lending.

In terms of demand, the impact depends both on the tenor of the transaction and on the counterparty. In the short-term interbank market (< six months), the NSFR will generally not affect demand, as the RSF on cash (which is 0%) matches the ASF factor on short-term bank liabilities.<sup>16</sup> Together with the reduced supply effect derived above, this would tend to lower volumes and increase rates. In the longer-term interbank market, in contrast, the NSFR does increase demand (as the ASF factor on these longer-term (> six months) bank liabilities is positive). As supply falls, rates are likely to be higher, while the impact on volumes is ambiguous. The larger reduction in supply at longer tenors exacerbates this move in rates, such that the short end of the yield curve will tend to steepen.

### Net Stable Funding Ratio and unsecured money markets

Summary of expected impact

Table 1

Market segment	Financial sector	Non-financial sector	Total
Short term	Demand unchanged, supply lower ⇒ <b>rates up and volumes down</b>	Demand higher and supply unchanged (by assumption)	<b>Rates up and volumes ambiguous</b>
Long term	Demand higher, supply much lower ⇒ <b>rates up and volumes ambiguous</b>	⇒ <b>Rates and volumes up</b>	<b>Rates up (by more than short-term rates) and volumes ambiguous/up</b>

Source: Working Group.

Table 1 summarises these effects, differentiating the degree and mode of financial and non-financial sector involvement in the provision of bank funding. Obviously, as costs from the financial sector rise, banks can choose to borrow more from the non-financial sector, which is beneficial from an NSFR perspective as it increases banks' ASF. Assuming that the supply of funds from the non-financial sector is fixed, this would lead to a rise in rates in this market segment. Notably, the different ASF factors in the NSFR for financials and non-financials may introduce a

<sup>15</sup> For loans to financial institutions of less than six months (the tenor most important for central banks), the RSF is 15%, rising to 50% for loans between six and 12 months and 100% for loans with a maturity exceeding 12 months.

<sup>16</sup> This assumes implicitly that banks borrow a marginal unit of cash (reserves) in the market to then hold it. Clearly, if the borrower then uses the cash to make a loan, the RSF will be higher and so the NSFR will fall – as intended by the regulation.

degree of bifurcation into the structure of the money market, according to some market participants. For example, for a given amount of funding, banks may offer corporates better rates than money market funds (MMFs) that are classified as financial institutions. Corporates and other non-financials will have to trade off these higher offered rates against the diversification benefits of investing in unsecured deposits via MMFs.

**Secured markets.** Analogously to the unsecured case, the supply of cash in the secured market (providing reverse repo funding) unambiguously worsens the NSFR, regardless of the collateral, tenor or counterparty of the transaction, because the RSF factor on loan assets (repo receivables) is higher than the factor for cash. So the supply of cash by banks to the market will fall, pushing up rates and reducing volumes. Again, the effect is more pronounced at tenors exceeding six months.

Analysing the impact of the NSFR on the demand for cash (ie borrowing via repo) is more complex because, whilst cash received has a 0% RSF, the process of encumbering collateral increases the RSF on those assets. That increase, in turn, depends on the quality of the collateral and the tenor of the transaction. Broadly, the implications of obtaining repo funding are as follows.<sup>17</sup> A short-term repo operation (ie borrowing cash for less than six months) with a financial institution has no impact on the NSFR, while a short-term repo operation with non-financials materially increases it. Even though there are exceptions, longer-term repos (> six months) with all types of counterparties will tend to boost the NSFR, with the effect increasing with the riskiness of the collateral provided in the transactions. As a result, the demand for repo funding at all tenors should rise, amplifying the rise in secured rates (while offsetting the fall in volumes) resulting from reduced supply. Therefore, while the net impact on volumes is ambiguous, secured rates should rise – everything else equal (see Table 2 below).<sup>18</sup>

The NSFR is likely to have a particular impact on certain types of repo market-making, which will in turn tend to reduce volumes – implying an expected net reduction of money market volumes. This is because, for perfectly offsetting standalone transactions, the negative NSFR impact of a reverse repo exceeds the positive NSFR impact of a repo (see Appendix 2, examples 1 and 2). The same applies for short-term matched-book activity between two financial counterparties, where cash and collateral pass directly through the market-maker's balance sheet (ie without any asset encumbrance or increase in reserves; Appendix 2, example 3).

As noted above, the impact on supply of and demand for secured funding is likely to be more pronounced at longer tenors and for lower-quality collateral. The rise in rates, therefore, is likely to be larger in those segments. That said, the incentive to engage in repo activity against lower-quality collateral will depend on the haircuts applied to the transaction and whether or not the asset used as collateral is already held on balance sheet. Specifically, the NSFR provides an incentive to use lower-quality securities already held on balance sheet as collateral in repo transactions, but does not provide an incentive to acquire such lower-quality securities and fund them using repo (see Appendix 2, examples 1 and 4).

<sup>17</sup> Appendix 2 provides illustrative examples supporting the discussion presented in this section.

<sup>18</sup> Demand from the real economy for short-term funding will rise materially and supply will remain unchanged (as real economy firms are not impacted) so rates and volumes will rise in this segment.

## Net Stable Funding Ratio and secured money markets

Summary of expected impact

Table 2

Market segment	Financial sector	Non-financial sector	Total
Short term	Demand unchanged, supply lower ⇒ <b>rates up and volumes down</b>	Demand higher (in particular for risky collateral), supply unchanged <sup>1</sup> ⇒ <b>rates up and volumes up</b>	<b>Rates higher, volumes down<sup>2</sup></b>
Long term	Demand higher (in particular for risky collateral) supply much lower ⇒ <b>rates up and volumes ambiguous</b>		<b>Rates up (by more than short-term rates) and volumes ambiguous</b>

<sup>1</sup> By assumption. <sup>2</sup> Due to fall in matched-book activities.

Source: Working Group.

## 2.5 Potential combined impact on money markets

The stand-alone analysis of key regulatory reforms provided above highlights the broad directionality of the impact of these initiatives on money markets in terms of activity levels, market rates and volatility. With implementation and calibration of many of these initiatives still ongoing, it remains difficult to assess their combined impact. Nevertheless, a number of broad implications from the combined regulations can be derived, as detailed below. Table 3 summarises these findings, differentiating the expected impact on volumes, rates and volatility across different market segments and for different tenors.<sup>19</sup> In general terms, these are consistent with the views expressed during the Group's structured interviews with market participants, which tried to quantify respondents' views (Graph 2 below). That said, the interview results do not always match the broad predictions laid out in the table and are likely to be affected by sampling issues (ie results are based on a small number of responses mainly from a few jurisdictions). The main messages are:

**Activity in short-term unsecured markets is likely to contract.** Lower volumes would be driven primarily by the leverage ratio (which tends to discourage money market borrowing) and the incentives set by the LCR (which reduce demand for, and increase supply of, short-term money). The impact on rates is ambiguous, due to the fall in both demand and supply, but market intelligence gathered by central banks suggests that rates will be lower. The NSFR has the potential to at least partially offset the impact on rates (as borrowing demand rises, but supply of cash falls). Yet, market intelligence seems to suggest that, until recently, limited attention had been given to this effect of the NSFR, perhaps due to uncertainty about its calibration.<sup>20</sup>

<sup>19</sup> The final column presents the Working Group's assessment of the cumulative impact of the regulations within each of the market segments. Despite ambiguity around some of the individual impacts, an attempt was made to provide a cumulative assessment in as many cases as possible. For some unsecured markets, where the impact of the liquidity regulations is ambiguous, a bigger shift in supply has been assumed to reflect the risk-based capital requirements for unsecured loans.

<sup>20</sup> As discussed above, balance sheet regulations are likely to increase the volatility of rates in most market segments because (i) traded volumes are likely to be lower, (ii) banks are likely to economise on their holdings of central bank reserves, and (iii) exposure limits may increase the dispersion of traded rates. In contrast, liquidity regulations are likely to impact rate volatility only

## Regulatory reform and money markets

Impact on volume (V), rates (r) and volatility ( $\sigma$ )

Table 3

Market segment	Leverage ratio			LE limits			LCR			NSFR <sup>3</sup>			Cumulative		
	V	r	$\sigma$	V	r	$\sigma$	V	r	$\sigma$	V	r	$\sigma$	V	r	$\sigma$
Unsecured															
< 30 days	↓	↓	↑	↘ <sup>1</sup>	↔	↑	↓	↓	↑	?	↑	?	↓	↓	↑
> 30 days	↓	↓	↑	↘	↔	↑	?	↑	↑	?	↑	?	↓	?	↑
Secured (HQLA)															
< 30 days	↓	↓	↑	↗ <sup>2</sup>	↔	↔	?	↓	?	↓	↑	↑	↓	↓	↑
> 30 days	↓	↓	↑	↗	↔	↔	?	↑	?	?	↑	?	?	?	↑
Secured (non-HQLA)															
< 30 days	↓	↓	↑	↗	↔	↔	?	↓	?	↓	↑	↑	?	↓	↑
> 30 days	↓	↓	↑	↗	↔	↔	?	↑	?	?	↑	?	?	?	↑

<sup>1</sup> ↘ = down at the margin. <sup>2</sup> ↗ = up at the margin. <sup>3</sup> The NSFR will lead to a steepening of the unsecured and secured yield curves beyond the six-month tenure. In the secured market this steepening will increase with the riskiness of the collateral.

**The impact on longer-term unsecured markets is less straightforward**, as different regulations may work in opposite directions. The leverage ratio is likely to push volumes and rates down; but the NSFR and LCR will tend to work in the opposite direction (for >6m and >30d tenors, respectively). It is hard to calibrate at this stage which of the two effects will dominate and feedback from banks in different jurisdictions is mixed.

**It is likely that activity will migrate between the unsecured and secured markets, with the overall impact being unclear.** On the one hand, a binding leverage ratio will tend to drive up the relative cost of secured lending, encouraging activity to migrate from secured to unsecured markets. On the other hand, unsecured activity is likely to be affected by LE limits (LE rules are expected to have only a marginal impact on secured lending, due to netting of collateral). Repo market activity, in turn, may migrate outside the regulated banking sector, with a rise in peer-to-peer non-bank repo activity and the potential for repo central counterparties to emerge.

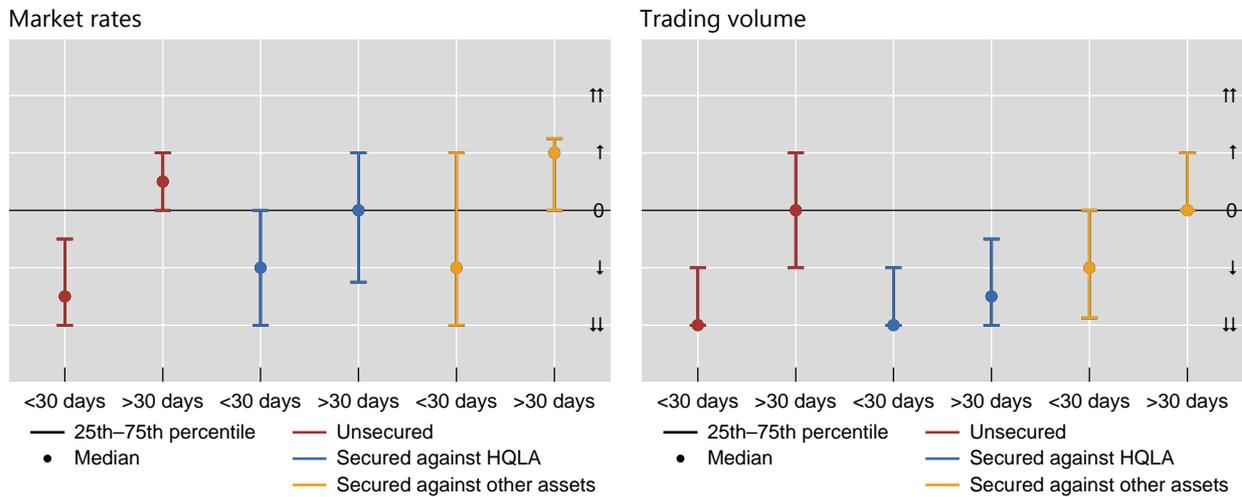
**Within secured markets, the impact of regulation on the short-term segment is likely to depend on the collateral used.** Repo activity against HQLA will tend to fall relative to that against non-HQLA because (i) the former marginally reduces the LCR as a result of the collateral applied to the transaction, and (ii) the NSFR provides an incentive to use lower-quality collateral held on balance sheet in repo transactions. Moreover, interbank repo activity will tend to decline, with growing volumes of repo and collateral swaps likely to be transacted between banks and non-banks (eg asset managers and insurance companies – traditional long-only HQLA investors).

through their effect on traded volumes. Specifically, rate volatility is likely to increase in the market segments that are expected to experience significant (non-marginal) reductions in traded volumes.

**Secured market activity may also migrate to longer-term repos.** Longer-term repos provide both LCR (at maturities greater than 30 days) and NSFR benefits (at maturities greater than six months), even if struck against HQLA. In addition, short-term repo volumes may fall as a result of the NSFR, because it tends to discourage short-term matched-book repo activity between financials.

Cumulative impact of regulatory change on money markets rates and volumes

Graph 2



↓ = significantly lower; ⇓ = somewhat lower; 0 = little impact; ↑ = somewhat higher; ⇑ = significantly higher.

Source: Structured interviews conducted by Working Group members.

**Reduced arbitrage activity across financial markets.** Overall, these changes will tend to reduce incentives for matched-book repos and similar activities and, hence, may affect the ease and amount of arbitrage across financial markets. This may weaken, and make more uncertain, the links between policy rates and other interest rates, driving wedges between those rates as well as between policy rates and other asset prices relevant for economic activity.

**Implied adjustment by the central bank.** Given the role of money markets in the implementation of monetary policy and with regard to the transmission of monetary impulses along the yield curve, the central bank can choose to either tolerate these likely effects for money market functioning or offset them. While the quantification of any adjustment need remains difficult ex ante, the main tool for such offsetting adjustments is the terms and conditions on offer for the central bank's own transactions with commercial banks. For example, the central bank can incentivise repo borrowing in private markets by changing the price and quantity of cash it offers in its repo transactions or by increasing the haircut that it applies to its own repo transactions, subject to risk management considerations. And, in a corridor system, money market volatility can be reduced if the central bank narrows the width of the corridor. Similarly, the central bank may consider interacting with a wider set of counterparties to ensure that transmission does not entirely rely on arbitrage between existing counterparties and financial institutions that are not currently eligible counterparties. In making these decisions, a key consideration is how the impact of regulations on money markets interacts with the impact on banks' incentives to transact with central banks, as discussed below.

### 3. Regulatory reforms and usage of central bank facilities

Building on the analysis of the effects of regulatory change on money markets in the previous section, this chapter discusses the implications of key new regulations for banks' demand for reserve balances as well as their incentives to use different central bank facilities. It begins with a brief summary of different central bank operating frameworks, and of the types of facilities and tools in use for each of these. It then discusses how usage of these central bank facilities as well as banks' demand for reserve balances might change under the emerging regulatory regime, highlighting the interplay between regulatory change and the terms and conditions offered by the central bank.

#### 3.1 Monetary policy operating frameworks

In broad terms, monetary policy operating frameworks can be classified into at least four different types (or systems). **Corridor systems** are widely adopted across jurisdictions, while **managed (or fixed) exchange rate systems** are often used by central banks in small open economies as well as some larger emerging market economies. **Floor systems** and **quantitative target regimes**, in turn, have been adopted by some of the major central banks as part of their efforts to expand their balance sheets to deal with the fallout of the financial crisis or in order to implement policy at the zero lower bound.<sup>21</sup>

**Corridor systems.** This regime is characterised by two key standing central bank facilities: a *lending facility* and a *deposit facility*. Typically, the central bank charges participating banks a penal interest rate on loans extended, while paying a below-market interest rate on deposits received. In other words, the central bank lending and deposit rates correspond to the ceiling and the floor of an interest rate corridor. In most cases, these rates straddle the operating policy target for the interbank rate. A key feature of such frameworks is their reliance on banks' and other market participants' ability to redistribute reserves in the system (eg in response to unexpected shocks), with the central bank aiming to provide the amount of reserves required by the system as a whole. This puts a premium on the central bank's ability to perform adequate reserve demand forecasts. Repos, deposits and other forms of collateralised lending transactions are the main tools for policy implementation under these frameworks.

**Floor systems.** The floor system is a special case of the corridor system described above, with two key differences. First, the deposit rate is set equal to the target policy rate. In other words, the central bank targets the floor of the corridor rather than a point between the lending rate and the deposit rate. Second, central banks supply reserves at a level beyond that required by banks. In contrast to corridor systems, floor systems do not necessarily require the central bank to perform reserve demand forecasts. They also rely less on interbank trading of reserves, given that banks typically do not need to acquire additional funds to meet reserve requirements. As regards policy tools, in addition to those used in the corridor system, large-scale outright purchases are the main additional instrument.

<sup>21</sup> "Zero lower bound" is used as shorthand for "low interest rate environment" throughout this report.

**Managed exchange rate systems.** In this type of framework, the primary intermediate or operating target for monetary policy is a cap, floor, peg or band for an exchange rate vis-à-vis a specific currency or basket of currencies. This target may or may not be complemented by other targets and is implemented through a variety of tools across jurisdictions. These tools include foreign exchange interventions and corresponding sterilisation measures, such as sale of central bank bills or the use of foreign exchange swaps.

**Quantitative target systems.** The operating target in this framework is some monetary aggregate (eg the monetary base or a component thereof).<sup>22</sup> Hence, the central bank's open market operations will focus on achieving the implied quantity of reserves rather than the price (ie rate) at which the reserves trade among banks.<sup>23</sup> As for policy implementation, the tools used under quantitative targeting systems are similar to those employed in floor systems, with large-scale outright purchases complementing repos and other forms of collateralised lending.

Table 4 below applies this broad classification to the operating frameworks of the central banks participating in the Working Group, reflecting information for 2014. It highlights that, most recently, a majority of these jurisdictions were operating either a floor or a corridor system. A key observation is that, due in part to the financial crisis, central banks' operational tools have become more diversified, providing them with a range of instruments to inject or absorb reserves as well as with other tools to operate in markets that have no direct impact on central bank reserves (reserves-neutral tools).<sup>24</sup> Furthermore, central banks have a number of levers that affect the demand for reserves, such as reserve requirements, and that can matter either for the impact of new regulations on central bank operations or for the responses of central banks to such changes.

### 3.2 Regulatory change and central bank operations

As new regulations tend to impose constraints on the size and composition of banks' balance sheets, they are expected to affect the demand for reserve balances held with the central bank. Moreover, to the extent that regulations distinguish across collateral types and favour longer-term funding over shorter-term sources of financing, they may affect the demand for different types of central bank operations if the terms on offer vary along these dimensions.

To explore these effects, this section first discusses key reserve-providing tools and how their usage is likely to be affected by regulatory change, before turning to the corresponding effects for reserve-absorbing and reserve-neutral ones. In all

<sup>22</sup> In the context of such a framework, the Bank of Japan, for example, is currently targeting an annual increase in the monetary base of ¥80 trillion.

<sup>23</sup> Quantitative targets are often implemented in conjunction with an interest rate floor. This allows the quantitative target to be implemented without causing undue interest rate volatility.

<sup>24</sup> For more detail on the differences between different types of central bank tools from the perspective of their impact on collateral markets, see CGFS and MC (2015).

## Central bank operations and instruments

In use during 2014 (based on classifications/information provided by Group members)<sup>1</sup>

Table 4

Central bank	Corridor system	Floor system	Quantitative target regime	Managed exchange rate regime <sup>2</sup>
<u>Reserve-providing</u>				
Repo	RBA, RiB, RBI	BoE, ECB, Fed	PBC	PBC
Against HQLA	CBB, BoC, BoK, BoM, RBI			
Against non-HQLA	–			
Other collateralised lending	BoC, BoK, RBI <sup>3</sup>	ECB, Fed	BoJ	
Foreign exchange swaps	RBA, RBI	Fed		
Outright purchases				
Government securities	RBA, BoK	BoE <sup>4</sup> , Fed <sup>5</sup>	BoJ	
Other assets	SNB <sup>6</sup>	ECB	BoJ	
Redemption of central bank bills	BoK			
<u>Reserve-absorbing</u>				
Reverse repos <sup>7</sup>	RBA, CBB, BoC, BoK, RBI	Fed <sup>8</sup>	PBC, BoJ <sup>9</sup>	MAS
Term deposits	BoK	ECB, Fed <sup>8</sup>		MAS <sup>10</sup>
Foreign exchange swaps	RBA, RBI			MAS
Outright sales				
Government securities	BoM			
Other assets				
Issuance of central bank bills	BoK, RiB		PBC	MAS
<u>Reserve-neutral</u>				
Securities lending	RBA, CBB, BoC, BoK	ECB, Fed		
Other (eg collateral swaps)		BoE, Fed		
<u>Demand for reserves</u>				
Reserve requirements	CBB, BoK, RBI, BoM <sup>11</sup>	ECB, Fed	PBC, BoJ	MAS
Reserve remuneration	RBA, CBB	BoE, ECB, Fed	PBC, BoJ	

BoC = Bank of Canada; BoE = Bank of England; BoJ = Bank of Japan; BoK = Bank of Korea; BoM = Bank of Mexico; CBB = Central Bank of Brazil; ECB = European Central Bank; Fed = Federal Reserve System; HKMA = Hong Kong Monetary Authority; MAS = Monetary Authority of Singapore; PBC = People's Bank of China; RBA = Reserve Bank of Australia; RBI = Reserve Bank of India; RiB = Sveriges Riksbank; SNB = Swiss National Bank.

<sup>1</sup> The ECB and the Federal Reserve operated in a corridor system prior to the global financial crisis. <sup>2</sup> The HKMA has adopted a currency board system and does not have any money market instrument. <sup>3</sup> Discontinued with effect from 7 February 2015. <sup>4</sup> The BoE did not conduct any outright purchases in 2014 but conducted some gilt reinvestment operations as part of QE. <sup>5</sup> This also includes agency guaranteed debt (dollar rolls). <sup>6</sup> The SNB had adopted a minimum EUR/CHF exchange rate as an additional policy target, which has since been abandoned. <sup>7</sup> Includes securities lending against cash. <sup>8</sup> Testing. <sup>9</sup> During 2014, the BoJ only used reverse repos to provide the markets with a secondary source of Japanese government securities. <sup>10</sup> Unsecured borrowing. <sup>11</sup> The BoM has reserve requirements that are set indefinitely for a fixed amount based on a percentage of banks' liabilities at a determined point in time.

cases, the discussion assumes the terms and conditions of the various central bank tools as given.<sup>25</sup>

### 3.2.1 Reserve-providing tools

The introduction of the leverage ratio, if binding or likely to bind, means that, at the margin, banks' demand for transactions that result in an expansion of their balance sheets is likely to fall, including investments in assets that have zero (such as reserves) or close to zero risk weights (see Box 1 and Chapter 2 above). This, in turn, will tend to change banks' relative preference for holdings of central bank reserves and other assets (such as interbank loans), because reserves will now attract a capital charge. In contrast, as central bank reserves are excluded from a bank's large exposure limit, this regulation is not expected to have a significant impact.<sup>26</sup>

The NSFR, in turn, is likely to have a minimal impact on the demand for central bank funding if the central bank offers operations only at short-term maturities (ie less than six months). Effects of central bank operations would therefore relate to longer maturities (ie longer than six months). Such longer-term operations – subject to certain assumptions with regard to their duration and the haircuts applied to collateral – can improve the net stable funding position of participating banks.<sup>27</sup> For given terms and conditions, this could lead to a shift in the term structure of banks' demand for central bank liquidity and,<sup>28</sup> possibly, to a reduced role for shorter-dated operations, which typically serve as the main channel for signalling and transmitting monetary policy. (See Appendix 2 for an illustration of how secured financing transactions are affected by the NSFR.)

The impact of the LCR is more complex, depending both on the quality of the assets being used in transactions with the central bank and the terms and conditions in place. To help fulfil the LCR requirement, banks would tend to use less liquid assets as collateral to borrow from central banks. Consequently, the demand for repo operations and other forms of collateralised borrowing backed by non-HQLA may increase, particularly when the borrowing is for maturities longer than 30 days or can be reliably rolled over. Specifically, as central bank reserves are designated as Level 1 HQLA, banks may try to comply with the LCR requirement by expanding their holdings of reserve balances, while financing those holdings by borrowing from the central bank against Level 2 assets or non-HQLA via the central bank's liquidity-providing operations. In the process, LCR-constrained banks may expand their central bank borrowing, crowding out other banks not constrained by

<sup>25</sup> It may be worth noting that, while the following analysis frequently discusses whether a new regulation is likely to increase or decrease demand for a given central bank operation, it remains an open question whether decreased demand is problematic or increased demand desirable. Indeed, in some instances reduced demand will amplify the impact of the operations and make them more effective, while in other instances increased demand may result in unwanted shifts in usage.

<sup>26</sup> A possible exception are corridor-based systems, given their reliance on banks' and other market participants' ability to redistribute liquidity. Exposure limits, if binding, could constrain banks' ability to interact with each other, reducing the effectiveness of central bank rate-setting – but only in settings with relatively concentrated interbank markets (see Chapter 2 above).

<sup>27</sup> Furthermore, certain exceptional central bank liquidity operations may receive beneficial treatment in terms of calculating the NSFR. Exceptional central bank liquidity operations are considered to be non-standard, temporary operations conducted by the central bank in order to achieve its mandate in a period of market-wide financial stress and/or exceptional macroeconomic challenges.

<sup>28</sup> For empirical evidence based on the ECB's three-year LTROs, see Scalia et al (2013).

the LCR and increasing the concentration of central bank lending towards the more constrained banks.

**Repos versus outright purchases.** Assessing how exactly the different regulations will impact monetary policy implementation and individual instrument choices, however, is not straightforward. A key question is the LR constraint and the degree to which a given central bank transaction is going to affect the size of bank balance sheets. This, in turn, will depend on the size of the central bank's liquidity-providing operations and the degree to which the LR requirement is a binding constraint at the banking system level.

For unchanged terms and conditions, participation in central bank repo operations as well as similar forms of collateralised lending will increase the size of bank balance sheets – at least initially, because the LR exposure measure (ie the denominator) includes both central bank reserves and repo positions.<sup>29</sup> This will tend to worsen the leverage ratio for constrained banks, which will influence the attractiveness of these operations and, hence, the transmission of the monetary impulse to other interest rates and asset prices.

Similarly, outright asset purchases will – at least initially – tend to expand bank balance sheets unless the purchased assets are all sourced directly from banks (in which case the rise in central bank reserves on bank balance sheets would be completely offset by the decline in purchased assets).<sup>30</sup> As banks constrained by the leverage ratio may thus behave differently from non-constrained banks, this will influence how the monetary stimulus is transmitted to other yields and asset prices.

In the aggregate, however, banks have no choice but to absorb the targeted level of reserves. An open question is whether there are circumstances (eg with the LR constraint binding or expected to bind effectively for the entire banking sector) under which central banks conducting unconventional measures in size may find it challenging to provide liquidity as intended, even if they are willing to adjust their terms and conditions. In particular, the question is whether there are exceptional situations in which banks would refrain from subscribing to fund-supplying operations because concerns over the LR impact of the reserves that would be added to the banking system in aggregate outweigh the financial benefits accrued by participating in the operations. If so, this lack of participation could prevent a central bank whose operating framework entailed increasing the quantity of reserves from meeting its operating target.

**Adjusting to the new equilibrium.** Beyond the initial impact of central bank repos or outright asset purchases, however, the effect on bank behaviour is hard to predict. In the new equilibrium, once the central bank has provided the intended amount of liquidity, banks will be forced to hold more reserve balances. In turn, market interest rates will need to adjust to ensure banks' willingness to hold any

<sup>29</sup> An exception are reserve-providing operations that are simply offsetting a system deficit (eg tax payments) on a given day and are not designed to increase the amount of reserves held by the banking system. Hence, there will be banks with the offsetting liquidity position vis-à-vis the central bank. If these have to raise funds, they might be indifferent between borrowing from the central bank or someone else. However, it might matter to them if the central bank is only offering term repos, as opposed to overnight repos, as this may have implications for its LR (and hence, its willingness to participate in term central bank operations).

<sup>30</sup> For a more detailed analysis of the initial impact of central bank asset purchases on banks' balance sheets, and how it depends on types of counterparties, see Christensen and Krogstrup (2014).

additional reserve balances at the interest rate offered by the central bank. At the margin, given that the LR-induced capital charge is identical for central bank reserves (which were otherwise free of a capital charge) and other assets, returns on these other assets would have to fall. This implies that the prices of any purchased assets in outright operations would have to be somewhat higher than would be the case without the LR constraint, compressing their yields – an effect that would reinforce the intended monetary impulse if reserve provision is implemented in order to ease monetary policy. It is not fully clear, however, which balance sheet-adjusting measures individual constrained banks would take, and how these would play out at the system level once the responses of non-constrained banks are taken into account.

Central banks may thus have to consider the role played by the leverage ratio when assessing their policy's transmission and impact on asset prices. When the central bank boosts reserves by a relatively small amount, or when banks' observed LRs are well above the minimum requirement, banks response to reserve-providing operations, both repos and outright purchases, would not be much affected by the LR constraint. Yet, when the central bank expands reserves by a large amount (for example, to meet increased demand for reserves during a period of financial stress or to stimulate the economy), the LR constraint is more likely to bind, which may require more of an adjustment of bank balance sheets.

Under these conditions, if the central bank finds that transactions such as repos are more likely to worsen banks' leverage ratios than outright purchases (particularly those directly from banks, due to their more limited direct impact on banks' leverage ratios) and is concerned that the lower leverage ratios will negatively impact the supply of bank credit, it could try to tilt instrument choice accordingly. A binding leverage ratio may thus remove some of the flexibility that central banks usually have in designing their operations.<sup>31</sup>

### 3.2.2 Reserve-absorbing tools

The logic applying to the impact of regulatory constraints on reserve-absorbing operations is analogous to the case of reserve-providing ones, though with the opposite sign. That is, in the new equilibrium, prices and yields will adjust in line with the lower supply of aggregate bank reserve balances, given the interest rate offered on those reserves. Thus, yields on other assets will tend to rise relative to those for central bank reserves, widening the return differential. The adjustment mechanism, however, will differ across different types of reserve-draining tools.

**Term deposit facilities.** One such tool is to take term deposits from counterparties. In principle, draining operations of this type should be unaffected by large exposure limits because banks' LE position would be unchanged (even if these constraints are binding), since the provision of term deposits is merely replacing

<sup>31</sup> Central banks carefully design their liquidity providing tools in conducting large-scale interventions – in terms of instruments, counterparties, types of assets, and maturity. For instance, a central bank may want to consider using collateralised lending instead of outright purchases because it tends to be easier to unwind; or may conduct targeted purchases of assets held by non-counterparties to acquire amounts that go beyond counterparties' own holdings.

## Breakable term deposits: the US experience

The US Term Deposit Facility (TDF) is a tool that may be used to manage the aggregate quantity of reserve balances held by banks.<sup>①</sup> <sup>②</sup> Funds placed in term deposits are removed from the reserve accounts of participating banks for the life of the term deposit, thereby draining reserve balances.

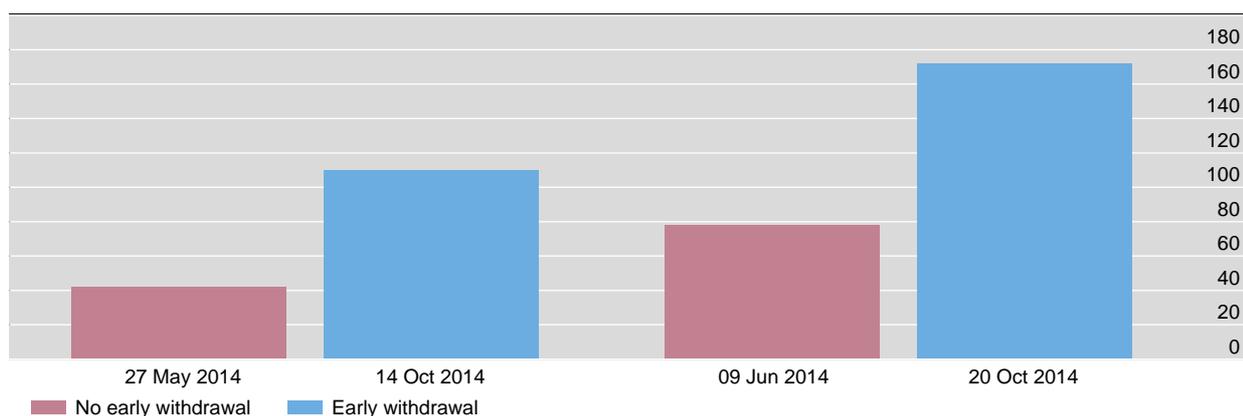
The Federal Reserve began testing the TDF for operational readiness in 2010, but more recently it has focused on assessing whether the demand for term deposits depends importantly on whether the deposits are breakable. Unbreakable deposits are not a source of immediate liquidity and so are excluded from the HQLA category in the calculation of the LCR in the United States.<sup>③</sup> Breakable deposits, by contrast, provide immediate liquidity and so are included as HQLA for LCR purposes. Term deposits with terms less than 30 days result in a cash inflow and so should leave the LCR largely unchanged, but in the United States, banks' net cash need is calculated as its maximum need over these 30 days, which often occurs within the first day or two, rather than the need at 30 days.

In a series of tests conducted in 2014 and involving one-week term deposits with various offered rates, results and feedback from banks indicated that participation was constrained because these term deposits were not HQLA. In a second series of tests, later in 2014, term deposits were offered with an early withdrawal feature, subject to a penalty set equal to the loss of all interest on the term deposit plus a 75 basis point fee (at an annual rate and applied to the principal over the life of the term deposit). This feature allowed the deposits to be counted as HQLA.

### Demand for breakable term deposits

In billions of US dollars

Graph 4.A



Source: Federal Reserve Board.

In tests with offering rates set 1 basis point above the interest on excess reserves (IOER) rate, demand for breakable deposits has ranged from \$110 billion to \$260 billion, whereas demand for deposits without this feature earlier in the year reached only \$80 billion. As the offering rate was raised to 5 basis points above IOER, demand for breakable deposits rose even further, to roughly [twice] the size of the largest take-up in the earlier tests. Because several operational parameters were adjusted over the two test series, the increase in demand cannot be attributed solely to the breakability feature.

However, comparing results from both series that had the same operational parameters, except for the early withdrawal feature, suggests that demand for breakable term deposits was more than double that for term deposits without this feature (Graph 4.A). Interestingly, banks that are not subject to the US rulemaking of the LCR have increased demand from the TDF significantly, suggesting that the increased liquidity of the investment was valued in and of itself.

<sup>①</sup> For more information on the TDF, see [www.federalreserve.gov/monetarypolicy/tdf.htm](http://www.federalreserve.gov/monetarypolicy/tdf.htm). <sup>②</sup> The Federal Open Market Committee's Policy Normalisation Principles can be found at [www.federalreserve.gov/newsevents/press/monetary/20140917.htm](http://www.federalreserve.gov/newsevents/press/monetary/20140917.htm). <sup>③</sup> Under US rules, term deposits could be classified as HQLA also if they can be pledged as collateral for term or as automatically renewing overnight advances.

one HQLA asset (central bank reserves) from the same LE-exempted issuer with another (deposits).

A similar logic applies also for the leverage ratio. Banks for which the LR is binding will now have to hold capital against term deposits, whereas they would not have had to hold such capital prior to the leverage ratio requirement. Yet, the capital charge relative to central bank reserves remains unchanged, implying that banks will remain indifferent between those two assets.

Again, effects are more complex for the liquidity regulations. While term deposits (with a maturity greater than six months) will reduce the NSFR because lending at these maturities increases required stable funding relative to holding cash, the LCR's impact on banks' incentives to use term deposit facilities depends on a variety of factors. One such factor is whether the terms and conditions of the term deposits allow them to be counted as HQLA. This will be the case, for example, if term deposits are eligible as collateral in a lending facility which is continuously available to counterparties without restrictions or if they are breakable on demand by the counterparty. If this is not the case, then depositing banks may see their LCR fall as liquid assets (reserves) are exchanged for LCR-ineligible deposits (eg by allowing their use as collateral in monetary policy operations or by adding a "breakability" feature; see Box 4 below).

**Reverse repo transactions.** The four new regulations should not materially affect the demand for central bank reverse repos with bank counterparties intended to drain reserves, because such draining will not change the size of banks' balance sheets. Analogously to the analysis of reserve-supplying repos provided above, this would leave the leverage ratio and large exposure limits unaffected.

There is also likely to be no net impact as a result of the liquidity regulations, assuming that Level 1 HQLA collateral is used. If that is not the case, however, the LCR would tend to fall, given the net absorption of HQLA by the central bank. The demand for reserve repos with the central bank from nonbank counterparties is also likely to be unaffected, because these counterparties are not subject to the new regulations, although the operations will have consequences for asset prices resulting from the reduced supply of reserves at banks.

In addition, in some cases, reverse repo (ie reserves draining) against a central bank can marginally increase the LCR. This is because the cash balances lent out are slightly lower than the collateral received, due to the haircut applied.<sup>32</sup> Conversely, reverse repo against the central bank may marginally reduce the NSFR, because swapping cash for collateral will slightly increase the amount of required stable funding, while having no impact on available stable funding (see Chapter 2 above). Overall, therefore, banks' behaviour should be largely unchanged.

**Outright sales of central bank bills and other securities.**<sup>33</sup> Various central banks have the ability to drain reserves through the issuance of their own securities

<sup>32</sup> In jurisdictions with a shortage of HQLA in local currency, the central bank might need to provide collateral denominated in foreign currency. This will change at least the LCR calculated for the domestic currency and might reduce the inclination of some banks to participate in these transactions unless the terms and conditions are adjusted accordingly.

<sup>33</sup> This includes Treasury bills issuance where the proceeds are deposited in an account with the central bank. One example is the Supplementary Financing Program in the United States used during 2008 – 2011. Another example is the Bank of Mexico's selling of government securities for

(typically in the form of central bank bills) or, to the extent that they hold adequate stocks, outright sales of other securities. Analogous to the case of outright purchases described above, the use of such sales for liquidity-draining purposes will be largely unaffected by the leverage ratio, as such operations would tend to leave bank balance sheet size unchanged or even smaller. In addition, as there are no limits on exposures to governments or central banks, large exposure limits would also be unaffected. Meanwhile, the LCR would be unaffected as well, given that central bank bills count as HQLA Level 1.

A possible exception is liquidity-absorbing operations based on non-HQLA and foreign currency assets. If the LCR is applicable to, and binding for, a large number of financial institutions in a given jurisdiction, the demand for these assets may be low and inelastic because increased holdings of these assets would reduce those institutions' LCRs. The same logic applies if liquidity is absorbed via foreign exchange swaps, which would lower banks' LCRs in local currency. This will reduce demand for such transactions in cases where the tenor exceeds 30 days or the bank has hit the 75% inflow cap (so the swap cannot be accorded a 100% inflow rate).<sup>34</sup> Yet, in equilibrium, financial asset prices will adjust so that all financial institutions are content with the assets supplied. In particular, LCR-constrained banks will adjust their balance sheets after the initial purchase transaction to remain compliant with the LCR, ie by selling non-HQLA holdings to other banks or to non-banks.<sup>35</sup>

### 3.2.3 Reserve-neutral operations

Collateral swaps and similar operations, such as securities lending operations, work in a similar way to repo operations, which implies that their impact will largely stem from the changes in asset quality involved. Specifically, collateral upgrades (where a commercial bank swaps a lower-quality asset for a higher-quality asset) are not impacted by balance sheet regulations, such as the leverage ratio, and will not themselves affect these balance sheet metrics.<sup>36</sup> It is possible, however, for such reserve-neutral tools to affect reported LCRs, because the stock of HQLA increases. Similarly, the NSFR is likely to improve, because required stable funding decreases with the quality of assets held on the balance sheet.

monetary policy purposes. This type of operations is used on a regular basis in Mexico, and with the proceeds also being deposited in an account at the central bank.

<sup>34</sup> The LCR impact will, however, be neutral on a consolidated basis, because the reverse will happen in foreign currency and for the corresponding LCR requirement.

<sup>35</sup> A similar case may arise when many of the largest commercial banks in a given economy are subsidiaries owned by international holding institutions. Global banks manage their risks and comply with capital and liquidity requirements at the consolidated level. All risk positions booked at both the subsidiary and its parent institution are consolidated and subject to home country regulation, unless the relevant supervisors agree to adjust the treatment. After consolidation takes place, assets of local governments and central banks may thus be subject to higher risk weights, which will increase the cost of holding HQLA for sovereign exposures held by the subsidiaries of international banks.

<sup>36</sup> An example is the Bank of England's Discount Window Facility, which is aimed at banks experiencing a firm-specific or market-wide liquidity shock. It allows participants to borrow highly liquid assets in return for less liquid collateral in potentially large size and for a variable term.

### 3.3 Combined impacts on the usage of central bank instruments

The main implication of the above analysis of individual central bank tools is that the changing regulatory environment will, by design, affect banks' relative demand across various types of assets and liabilities. The resulting changes in the demand for central bank reserves, in turn, will affect participation in central bank operations and facilities for given terms and conditions. Similar to the effects on money markets discussed in Chapter 2 above, it remains difficult to assess the combined impact and whether it is material or not, as this will be shaped in part by the features of the operational framework in place and, in particular, by any adjustments that central banks may make to the terms and conditions of the facilities on offer.

**Effects on reserves demand.** Table 5 below summarises the expected impact of key new regulations on the demand for different types of central bank facilities, based on the analysis provided above. As many of these impacts are expected to offset each other, net effects are either uncertain or likely to be small – an observation that is broadly in line with the market intelligence gathered by the Working Group. Nevertheless, there is significant scope for reserves demand to become both more uncertain and to shift across different facilities on offer, based on the joint effects of the new regulations and central banks' terms and conditions.

In terms of overall reserves demand, the leverage ratio might lead to a reduction, while the LCR has at least the potential to increase the demand as reserves are eligible as HQLA. Large exposure limits and the NSFR are less likely to affect the overall demand for reserves, even though the NSFR may impact the attractiveness of longer term reserve-providing operations.

Regulatory reform and demand for central bank operations						Table 5
Operations	Leverage ratio	LE limits	LCR	NSFR	Cumulative	
Reserve-providing						
Repos (HQLA)	↓	↔	↘	↑ (>6m)	↓ (<6m)	
Repos (non-HQLA)	↓	↔	↑	↑ (>6m)	?	
Outright purchases	↘	↔	↔	↗	?	
Reserve-absorbing						
Reverse repos	↔	↔	↗	↘	↔	
Term deposits	↔	↔	↔ or ↓	↓ (>6m)	↓ (>6m)	
Outright sales (HQLA)	↔	↔	↔	↘	↘	
Outright sales (non-HQLA, foreign assets)	↔	↔	↓	?	↘	
Reserve-neutral						
Collateral swaps	↔	↔	↑	↑	↑	

↓ = down; ↑ = up; ↘ = down at the margin; ↗ = up at the margin; ↔ = little impact.

Key additional factors in the demand for reserves are the size and nature of any reserve requirement and banks' reserve management practices. In this context, the new regulations may lead to added uncertainty about the banking system's demand for reserves, due to additional difficulties in adequately forecasting the demand for reserves introduced by these requirements. Especially, in corridor systems, the associated volatility in reserve forecast errors could result in short-term interest rate

volatility – depending on the tolerance bands central banks allow around their reserves targets or requirements.

More generally, reserve requirements can be either voluntary, in the sense that banks themselves choose their desired levels of reserves holdings (such as the pre-2009 reserve-averaging framework in the United Kingdom), or mandatory, where the requirement will typically depend on the size of certain bank liabilities, such as the deposit base. In the former case, regulatory-constrained banks may choose to hold a smaller buffer of reserves as the result of the regulations, and this could cause short-term interest rate volatility to increase.

**Implied adjustment by the central bank.** Banks' reserve demand and their relative preferences for participation in different central bank operations are key factors for monetary policy implementation. To the extent that these factors are subject to change due to new regulatory requirements, central banks have the choice to either accommodate these changes or not. If central banks decide not to accommodate any overall shift in demand, the system would be short and market rates would rise, though central banks could still lower the rates in their monetary policy operations (for example, those setting their interest rate corridor) to restore the previous level of market rates.

More specifically, given that the new liquidity regulations will increase the demand for reserve balances, other forms of HQLA, and short-term loans relative to less liquid assets and longer-term loans, the front end of the yield curve is likely to steepen for any given expected path for overnight rates (see also Chapter 2 above). In jurisdictions where the central bank primarily influences the overnight rate, policymakers may thus need to adjust their target rate downwards to achieve the same economic outcome.

Similarly, in jurisdictions where the new leverage ratio requirement presents a binding constraint for a significant number of banks, the implied capital charge associated with holding reserve balances will increase. Thus, the differential between the interest rate paid on reserve balances and the interest rates on near substitutes, such as interbank loans, will have to narrow in order for banks to be willing to hold the same level of reserve balances – unless the central bank was prepared to see reserve balances fall.

Finally, central banks may observe a tendency of liquidity regulation to make banks with less favourable initial regulatory ratios expand their central bank borrowing, while using more non-HQLA as collateral, without this showing in aggregate reserves as these banks crowd out other banks with stronger initial regulatory ratios. Even though broadly neutral from a monetary policy perspective, the central bank may want to limit the possibly resulting increase of concentration of its lending towards more constrained banks. In this case, it may choose to adjust the parameters of its collateral, counterparty or credit operations framework in order to limit these effects.

## 4. Regulation and monetary transmission channels

In implementing “conventional” monetary policy, most central banks focus on an operational target, such as a short-term interbank interest rate or the exchange rate of their currency (see Chapter 3 above). However, for monetary policy to achieve its macroeconomic aims with respect to, for example, inflation or employment, central banks are interested in how the operational target translates into broader financial conditions and how monetary policy may interact with other instruments, such as macroprudential policy (see Box 5 below). Drawing on the academic literature, this chapter considers ways in which the broader channels of monetary policy transmission may be affected by the changing regulatory environment.

**Overview.** While the literature on the topic is vast, it remains difficult to assess the impact of regulatory change on monetary policy transmission, partly because the current strength (or even existence) of the various transmission channels is not always easy to discern. In general, the literature implies that the lending activity of less well capitalised, higher risk-taking and/or less liquid banks will be more responsive to a tightening of monetary policy, other things equal. This suggests that more stringent regulations will tend to weaken the transmission of monetary impulses. However, the extent to which this may be the case depends on the degree to which the regulations are binding, once banks have adjusted to the new regime.

Conversely, a healthier banking sector should be better placed to respond to easier monetary policy and to withstand adverse macroeconomic shocks. This should reduce the probability and severity of future financial crises, thereby reducing the risk of spillovers from the financial sector to the real economy. Monetary policy is thus likely to face less challenging tasks once the phasing-in of the new regulations has had time to play out.

### 4.1 Impact of regulatory changes on monetary transmission

Across many jurisdictions, it is likely that recent and forthcoming regulatory changes will alter the relationship between the central bank’s policy rate and other interest rates (see also Chapters 2 and 3 above). For example, regulations that require higher levels of bank liquidity and capital suggest wider spreads between risk-free rates and rates faced by bank customers: BCBS and FSB (2010) estimates that the increase in “lending spreads” arising from a 1 percentage point increase in capital ratios would be around 15 basis points in the long run.

Consequently, in terms of its macroeconomic effect, a desired central bank policy stance may require a slightly different policy rate, other things equal.<sup>37</sup> In that regard, the problem facing the central bank may not be much different from the one faced when there are other structural changes that influence the “neutral” policy rate (such as shifts in savings behaviour). It is only if the responsiveness of other interest rates (and broader macroeconomic variables) to *changes* in the central bank’s policy setting is affected by regulatory developments that the transmission mechanism of monetary policy can be said to have been altered.

<sup>37</sup> Or, where “unconventional” tools are being used, it may imply more intensive usage of such tools for the same degree of stimulus.

## Macroprudential policy: countercyclical capital buffers

In addition to the four key regulations reviewed in this report, a further regulatory requirement that has the potential to significantly affect a central bank's monetary operations is the new countercyclical capital buffer (CCB), which supplements the broader Basel III requirements (see Box 2 above).

The primary aim of the CCB regime is to achieve the macroprudential goal of protecting the banking sector from the systemic risks that have often been associated with periods of large scale and rapid aggregate credit growth. In addressing this aim, the CCB policy may also help to raise the cost of credit and thereby dampen the build-up of excess credit. The CCB regime will have a phase-in period of three years before becoming fully effective on 1 January 2019. The CCB, measured in terms of common equity Tier 1 capital, will then be set at a maximum of 2.5% of risk-weighted assets. While many national authorities have yet to publish rules detailing the implementation of the CCB, some have recently introduced sectoral capital requirements in the spirit of the CCB, but targeting particular sectors (such as residential mortgage loans). Key issues include:

**Direct impact on monetary policy targets.** The imposition of the CCB will lead to higher capital requirements for banks, which will raise the cost of bank credit or intermediation – either in the specific sector targeted or for the economy more broadly. Banks faced with an activated CCB must either hold more capital or reduce their asset holdings (deleverage). In either case, banks may increase the spread between borrowing and lending rates to generate sufficient retained earnings so as to maintain a certain return on equity. The resulting decline in credit supply would lead to rising loan rates and reduced aggregate activity. Further, as credit-driven asset price inflation may be expected to also spill over into consumer price inflation (eg because businesses pass increased rental costs arising from real estate/property price inflation on to consumers). CCB activation would tend to alleviate such effects.

**Interactions with monetary policy transmission.** The CCB is designed to be a countercyclical macroprudential tool. However, as credit cycles are not necessarily aligned with economic cycles, there may be times during which CCB activation could complicate monetary policy implementation (eg in terms of communication). In general terms, by giving policymakers two tools with which to pursue objectives, the CCB should enhance monetary policy. Yet, macroprudential and monetary policy tools can impact on each other's objectives and give rise to policy prescriptions with opposing effects, for example when the financial cycle is booming, but the real economy is weak or the real economy is booming, but the financial cycle has turned or is about to do so (CGFS (2012)).

**Implied adjustment of monetary policy.** The CCB is due to be phased in from 1 January 2016 and only some national authorities have so far gained practical experience with the use of similar buffers. Nevertheless, central banks expect to be able to accommodate the activation of the CCB with adjustments to their existing frameworks, rather than with changes to the frameworks themselves. Yet, given the potentially complicated interactions between the CCB and monetary policy, they also emphasise the need to include an assessment of the effects of CCBs into their monetary policy analysis.

On balance, initial assessments tend to suggest that any changes to (sectoral) CCB requirements are likely to have only a small effect on monetary policy. First, in many cases, macroprudential and monetary policy measures are likely to aim in the same direction, reinforcing each other. This may require small adjustments in the monetary policy stance, but would be possible with existing tools and within the established policy frameworks. Second, in times of possible policy conflict, any impact on monetary policy would depend primarily on the impact of the CCB on the monetary policy transmission mechanism. As long as that transmission is not significantly altered, policy rates or other tools can be adjusted to offset unwanted effects from the CCB for the overall policy stance – though at the risk of working against part of the intended effect of CCB activation (CGFS (2012)).

**Interest rate channel.** This channel focuses on how changes in the central bank's policy stance flow through to the broader structure of interest rates and financial asset prices. As discussed in Chapters 2 and 3, the new regulations may alter the spreads between a central bank's policy rate and other money market rates. In turn, any effects on money market rates may feed into other short-term as well as longer-term rates. Explicit contracts in some jurisdictions link rates faced by firms and households to short-term benchmark rates. In contemplating potential changes to interest rates, the central bank may thus need to consider these contractual linkages (and their potential cash flow implications for households and other economic agents) as part of any response to a change in the relationship between its policy rate and other money market rates.

Beyond these shorter-term considerations, it is less clear that shifts in the relative levels or volatilities of rates would have material implications for monetary policy transmission across assets.

One caveat to this relates to the zero lower bound for interest rates. If broader financial and macroeconomic conditions are no more or less responsive to changes in the central bank's policy rate under the new regulatory regime, the zero lower bound will bind at an earlier stage of an easing cycle if spreads between the policy rate and other interest rates are permanently wider. While the zero lower bound does not preclude further policy action by the central bank ("unconventional" measures), the transmission of those measures can be quite different to changes in the policy rate, complicating policy implementation.

Another relevant factor relates to market functioning. If the markets for debt securities not considered HQLA are rendered less liquid by the changes in regulations (eg because banks have less incentive to make markets in them),<sup>38</sup> then the transmission of policy rate changes to other interest rates and financial asset prices may be altered. Similarly, if the functioning of repo markets is affected by the new regulations, then the speed with which (and nature of) how market participants adjust their balance sheets to changes in monetary policy may be changed, altering transmission effects via financial markets.

**Credit channels.** These channels focus on the role played by banks (and other suppliers of credit), and how their behaviour may reinforce the effect of the interest rate channel. The Basel III standards will increase the amount (and quality) of capital that banks are required to hold against a risk-weighted measure of their assets, while imposing new minimum capital requirements against an unweighted measure of bank assets (the leverage ratio). In addition, supervisors will be able to augment the risk-weighted minimum standard with a countercyclical capital buffer (see Box 5 above). In general, given the focus of these regulations on banks, any effects on monetary transmission are likely to be greater in those financial systems where firms and households are more reliant on banks for their external finance.<sup>39</sup>

Were the *bank capital channel* simply driven by the possibility of a bank finding itself constrained by capital regulations, then it is not clear that raising the

<sup>38</sup> See CGFS (2014) for a more detailed discussion.

<sup>39</sup> A decade ago, the formulation of the Basel II capital regulations triggered a debate about how such measures might affect the transmission of monetary policy via enhanced pro-cyclicality. See, for example, Kashyap and Stein (2004), Van den Heuvel (2002) and Repullo and Suárez (2009).

regulatory minimum would affect the channel, as banks may be expected to target the same-sized buffers above the new standard as they did for the old.<sup>40</sup>

Yet the literature suggests several ways in which raising minimum capital standards may affect monetary transmission. A key premise is that the Modigliani-Miller theorem does not hold (Kashyap and Stein (2000)). One consequence of this is that banks' external finance premium can depend on the extent to which they are funded by capital. Disyatat (2010) contends that the *sensitivity* of this premium to monetary policy shocks would be lower for more highly capitalised banks, as the relevance of factors such as information asymmetry is reduced.

Yet, this need not mean that the likelihood of adverse shocks (including those induced by tighter monetary policy) lowering a bank's capital level to, or below, the regulatory standard is necessarily any different when that regulatory minimum has been raised. It is more that the ability of a bank to replenish its capital would be greater at higher overall levels of capital.<sup>41</sup> The case study discussed in Box 6 below makes a similar point namely that, with lower bank leverage mandated by regulation, monetary policy shocks will have less impact on banks' funding positions, thereby weakening the credit channel.

There is also the potential for the leverage ratio to restrain the procyclicality of lending activity associated with the bank capital channel. That is, while restrictions on leverage may not prevent increases in banks' net worth from driving further bank lending, they may limit the extent to which an internal ratings-based risk weighting lowers the capital requirement on assets during an upswing. Consistent with this, Brei and Gambacorta (2014) find that the Basel III leverage ratio is significantly less pro-cyclical than a risk-weighted measure of capital; that is, the leverage ratio acts as a tighter constraint on banks during booms and a looser constraint in recessions.

In terms of whether a higher prudential standard alters monetary transmission, it is not clear that the same arguments hold for the liquidity standards embedded in Basel III as for the new capital regulations. While at least one empirical study (Kashyap and Stein (2000)) supports the idea that the impact of monetary policy on lending behaviour is greater for banks with a smaller share of their balance sheet invested in liquid assets, the rationale is that banks with higher buffers of liquid assets are better able to respond to adverse shocks by drawing on these buffers (rather than by calling in loans). However, the ability of a bank to use assets held

<sup>40</sup> For example, while Kishan and Opiela (2000) conclude their study of the bank lending channel in the United States by noting that "[i]ncreasing capital requirements] may lead to more sound bank intermediation, (but) our results suggest that it may also lead to a banking system that is less responsive to monetary policy" (pp 139–140), the differentiation between banks used in the study was based on regulatory (FDIC) categorisations of capital adequacy ("undercapitalised", "adequately capitalised", etc). It is not clear from the study whether a bank that is "undercapitalised" relative to a higher regulatory standard would be any less responsive to monetary policy. Similarly, Gambacorta and Mistrulli (2004) show that monetary policy shocks have more effect on the lending activity of banks with smaller buffers of capital relative to the regulatory standard.

<sup>41</sup> That is, any increase in the external finance premium associated with a bank's capital falling back to the regulatory minimum would probably be less when that minimum has been set at a high level. Kapan and Minoiu (2013) investigate the extent to which reductions in the supply of syndicated credit by banks following the global financial crisis were related to their degree of capitalisation. While they found no relationship with the capital measures embodied in the prevailing (Basel II) standard, they did find a relationship with tangible common equity, a measure better aligned with what is to be used in Basel III. This suggests that it is not simply a bank's position relative to the regulatory minimum that drives the bank lending channel, but that higher (and better-quality) capital, regardless of the regulatory standard, can influence the effectiveness of the channel.

against a liquidity standard depends on the size of the buffer that a bank chooses to hold and/or the supervisor relaxing that standard. Varying liquidity standards in response to changing economic conditions would be a macroprudential measure (somewhat similar to the CCB discussed in Box 5 above). If the potential for such measures is set aside, then it is only the buffers that banks hold above the regulatory standard that will be relevant, and it is not clear that the size of these buffers would increase with the level of the regulatory standard. Indeed, it is possible that the perceived cost of holding liquid assets means that banks will hold smaller buffers as the regulatory minimum is increased (even though market intelligence seems to suggest that this will not be the case).

Box 6

### Capital regulation and monetary policy effectiveness

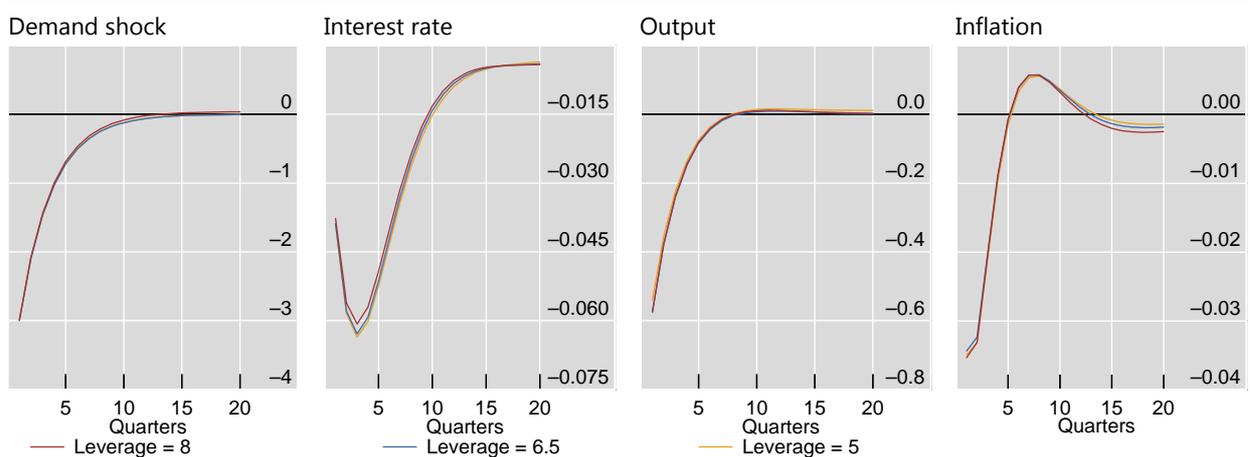
For the purposes of this study, ECB staff sought to assess the impact of higher capital requirements/tighter leverage ratios within a quantitative macroeconomic model calibrated for the euro area.<sup>①</sup> The model imposes leverage constraints within an environment where banks can replenish their equity levels only gradually. Given these nominal frictions, banks' balance sheet positions are relevant for economic activity and monetary policy in that lower levels of leverage weaken transmission via the credit channel. Tighter monetary policies will reduce the mark-to-market level of bank assets, increase leverage and, for high levels of leverage, deplete equity positions.

In the calibrated model, an assumed reduction of leverage from 8 to 6.5 reduces the impact of a contractionary monetary policy shock on output by around 10%, with leverage of 5 reducing the impact by a further 10% (not shown below). Tighter leverage constraints, therefore, mitigate the amplification effect of the credit channel and reduce the sensitivity of aggregate demand to monetary policy.

At the same time, however, lower leverage also mitigates the destabilising effect of temporary (demand) shocks hitting the economy, requiring less of a monetary policy response to stabilise economic activity. Indeed, the calibrated model suggests that, after a demand shock, the same systematic monetary policy response (modelled in the form of a Taylor rule) can achieve very similar levels of stabilisation for different levels of leverage (Graph 6.A).

Response to a demand shock

Graph 6.A



Source: ECB case study prepared for the Working Group.

The model also finds that tighter capital regulation is likely to be particularly helpful at the zero lower bound, given that lower levels of leverage will reduce the effect of demand shocks, thus helping to improve economic stability. In essence, a greater fall in the nominal interest rate would be required in order to stabilise the economy for higher levels of leverage, but this is not possible in situations where interest rates are bounded from below.

<sup>①</sup> Gertler and Karadi (2013).

Another way for liquidity requirements to affect monetary transmission is more indirect. As mentioned above, some expositions of the bank capital channel infer interest rate risk from the maturity mismatch inherent in banking and note the effect of monetary policy shocks on bank capital that comes from this.<sup>42</sup> If liquidity regulations act to reduce the gap between the maturities of banks' assets and liabilities and this translates into less interest rate risk, then monetary policy shocks may have less effect on bank capital than previously.

In part, the relevance of higher liquidity standards for monetary policy transmission may depend on which of the two capital standards proves to be more of an effective constraint on banks. Van den Heuvel (2002) argues that buffers of liquid assets cannot help offset the impact on bank capital from adverse shocks (including tighter monetary policy) under a risk-weighted capital standard, as liquid assets (such as government bonds) are 0% risk-weighted. However, where a leverage ratio is the binding constraint on a bank's capital position, selling liquid assets could help to relax this constraint. The implication is that the operation of the bank capital channel may partly depend on which capital standard is likely to bind and, if it is the leverage ratio, whether banks have surplus holdings of liquid assets that they can use to minimise any impact on their lending activity.<sup>43</sup>

The **risk-taking channel**, whereby monetary policy affects incentives for risk-taking and hence the risk premium component of interest rates, may also be impacted by regulatory changes, as one of the objectives of the new capital regulations is to reduce excessive risk-taking. Higher (risk-weighted) capital requirements and a cap on the (unweighted) leverage ratio require banks to build their capital base (either by raising new capital or retaining earnings) or by de-risking and deleveraging in the phase-in period. The evidence to date shows that global systemically important banks have adjusted by increasing capital rather than reducing their balance sheet size (BCBS (2014b)). If banks adjust by reducing risk-weighted assets, this could imply lower risk-taking in terms of credit and market risk. However, as long as (risk-weighted) capital requirements are time-invariant, they will not eliminate the procyclical feedback effect that runs from the measurement of risk to assets side activities (setting aside potential macro prudential measures, such as the countercyclical capital buffer).<sup>44</sup> A leverage ratio threshold can be more effective in limiting risk-taking through the cycle, by restraining the overall expansion of banks' balance sheets. Again, therefore, it will be important to know whether and when the leverage ratio is the binding constraint for a bank (as opposed to a risk-weighted capital requirement).

Gambacorta and Marqués-Ibáñez (2011) find that banks with greater reliance on short-term wholesale funding reduced lending activity more during the global

<sup>42</sup> Presumably, the use of interest rate derivatives (or the writing of variable rate loans) could be used to lessen the interest rate risk associated with differing maturity profiles for assets and liabilities.

<sup>43</sup> A "binding" capital standard does not necessarily mean that a bank's capital position is equal to, or below, the minimum requirement. Repullo and Suárez (2008), amongst others, point out that banks hold capital buffers precisely because they wish to reduce the risk of their capital falling to the regulatory minimum. In this sense, while the regulations may not appear to be binding, they have nevertheless influenced banks' decisions regarding their capital and their lending activity.

<sup>44</sup> Besides the leverage ratio and the countercyclical capital buffer, the Basel III regulatory framework introduces additional measures to dampen procyclicality, including the use of stressed parameters in the measurement of market and counterparty credit risk, the capital conservation buffer, and measures to promote forward-looking provisioning.

financial crisis. The new liquidity standards encourage banks to hold more HQLA and reduce their reliance on short-term funding. However, the LCR and NSFR may not entirely restrain pro-cyclical risk-taking, since they are time-invariant standards. Duijm and Wiertz (2014) show that an LCR-type of liquidity requirement does not prevent an increase in risk-taking by banks in "good" times (when short-term wholesale funding cheapens) if such risk-taking can be accommodated by a decline in the available liquidity buffer.

More indirect consequences of the new regulations for risk-taking may originate if the reduction in risk-taking among banks were to be offset by a shift of activities into the shadow banking sector. One issue related to this is whether bank lending to small and medium-sized enterprises is likely to be reduced, with banks incentivised to focus on more liquid and/or lower risk-weighted assets. If such firms become more reliant on non-bank and/or internal funding, it is possible that the transmission of monetary policy impulses to these firms' activities may be changed.

A recent study (Banerjee and Mio (2014)) on the impact of tighter liquidity regulations on UK banks, however, found no impact on lending activity. Instead, banks accommodated the requirement for greater (and more reliable) liquidity by switching assets from intra-financial loans to HQLA, with no significant changes in overall balance sheet size being observed. Nevertheless, should shadow banks become more important, this will raise several questions for central banks. Not only will there be supervisory/regulatory issues, but the scope for these entities to participate in central bank operations may need to be reconsidered.

## 5. Synthesis of results

The analysis presented in the preceding chapters suggests that the combined impact of key new regulations on monetary policy can be characterised in terms of five distinct sets of implications. In addition, more general effects of the emerging regulatory environment on monetary policy that are independent of specific macroeconomic conditions can be differentiated from those that pertain in the context of the current environment of low policy rates, with some major central banks operating at the zero lower bound (ZLB) or being in a process of preparing for the normalisation of monetary policy.

In general, as necessary, central banks can accommodate these effects by making adjustments within their existing policy frameworks. However, the nature and degree of these adjustments will tend to differ across jurisdictions and policy frameworks, as described in more detail below.

**Safer financial systems.** The emerging regulatory environment, with its increased emphasis on stronger bank capital and liquidity cushions, reduced funding mismatches and more balanced bank funding profiles, will enhance bank resilience. This increased resilience should reduce the risk of spillovers from the financial sector to the real economy. In other words, the emerging environment will tend to lower the frequency and intensity of financial booms and busts, which makes it less likely that monetary policy will need to adjust to address problems in the banking sector or the broader financial system (and that the central bank will have to be involved in lender of last resort operations).

At the same time, the new financial regulations are to a large extent intended to make it more costly for banks to take on liquidity and solvency risks, which will reduce the amount of liquidity and maturity transformation that they provide. If the regulations are effective, therefore, at some points of the credit cycle, the supply of bank credit for the non-financial sector will tend to be lower than it would be in the absence of the new regulations (and with everything else unchanged). If this is not counterbalanced by developments outside the banking sector, central banks may thus end up adopting a policy stance that is somewhat more accommodating during some parts of the cycle than would otherwise be the case. Because these cycles are likely to be less frequent and less severe (eg due to a reduced incidence of major disruptions), the supply of bank credit should in any case be more stable over time than it would have been without the new regulations, which is expected to benefit the economy (BCBS and FSB (2010)).

**Shifting equilibrium relationships between asset prices and policy rates.** As the start dates for new financial regulations pass or draw closer, the equilibrium relationships between financial asset prices and between those prices and central bank policy rates will shift. These shifts, though likely small, will tend to require the central bank to adjust its policy rates (or other intermediate policy targets, such as banking system liquidity) to achieve the same macroeconomic outcome. Yet, while the effects of individual new regulations on asset prices and rates are largely predictable (for example, the leverage ratio requirement, when binding, is likely to reduce interbank interest rates relative to the interest rate that central banks pay on reserve balances), different regulations can have consequences that go in opposite directions, or will interact with each other, making it difficult, if not impossible, to predict net effects (see, for example, Section 2.5 above).

As a result, the existing uncertainty around these asset price relationships will rise – at least during the transition period to the new equilibrium. Central banks will thus have to monitor key market metrics (such as cross-market spreads or turnover volumes) and respond to observed changes as they become manifest. For example, in jurisdictions where the new leverage ratio requirement presents a binding constraint for a significant number of banks, the implied capital charge associated with holding reserve balances will increase. Thus, for any given level of reserve balances, the interest rate paid on these balances will have to rise relative to the interest rates on those near substitutes that have positive capital weights, such as unsecured interbank loans (ie market interest rates will be lower for any given level of interest on reserve balances). In contrast, if risk-weighted capital requirements (as opposed to the leverage ratio) remain the binding capital constraint, an increase in the risk-weighted requirement would have the reverse effect: the difference in the capital charge for reserve balances and near substitutes that have a positive risk weight will rise, implying that banks will be satisfied to hold any given level of reserve balances earning a specific interest rate only when the alternative rates available on those market substitutes are higher in relative terms.

Similarly, the new liquidity regulations will increase the demand for reserve balances, other forms of HQLA, and short-term loans (with resulting cash inflows) relative to less liquid assets and longer-term loans. Those changes will have a number of consequences. One such consequence that could have important monetary policy implications will be a steepening of the front end of the yield curve for any given expected path for overnight rates. In jurisdictions where the central bank primarily influences the overnight rate, but longer-term interest rates are more relevant for economic activity, the central bank will thus need to target a somewhat lower level of interest rates to achieve the same economic outcome. Another consequence could be that the turnover in different money market segments changes, and that the central bank may thus want to consider switching its operational target variable to an instrument that is less affected by (or benefits from) any such change in market turnover (see Section 2.5 above).

**Reduced arbitrage activity across financial markets.** A related implication is that key new financial regulations may result in a reduction of the ease, and therefore in the amount, of certain types of arbitrage activity across financial markets. While there is no clear-cut evidence so far (see, for example, CGFS (2014)), such a reduction would weaken, and make more uncertain, the links between policy rates and other interest rates. This, in turn, may weaken the transmission of monetary impulses along the yield curve and to other asset prices relevant for economic activity.

For the most part, arbitrage activities require bank balance sheets to increase, often with offsetting positions on both the assets and liabilities sides (eg in the form of matched repo books). A key factor determining banks' willingness and ability to engage in such activities is balance sheet cost. If binding, tighter leverage ratio requirements, for example, will increase the cost of matched repo books in government securities and other low risk collateral, while higher risk-weighted capital charges may increase matched transactions that involve less liquid or higher risk collateral. The NSFR, in turn, will require banks to hold some longer-term funding against matched repo books (see Appendix 2 for an illustration of the mechanics behind this effect).

In reaction, to achieve the monetary conditions that they desire, central banks may find it necessary to make a number of adjustments to their operations to

deliver the interest rate levels or relevant financial asset prices that they deem appropriate. For instance, central banks could operate with a wider or different set of counterparties, so that transmission between their policy rates and other financial asset prices is less reliant on arbitrage between counterparties and other financial institutions.<sup>45</sup> Similarly, the central bank could operate directly in the relevant financial markets to improve arbitrage relationships. Alternatively, central banks could simply leave operations largely unchanged, but anticipate somewhat longer and more variable lags between policy decisions and the associated changes in economic activity.<sup>46</sup>

**More difficult forecasting of the demand for reserve balances.** Another implication of the new financial regulations is that they may make it more difficult to forecast the demand for reserve balances. For example, if the central bank is conducting policy in a way that results in the interest rate paid on reserve balances being close to the interest rate on other forms of (Level 1) HQLA, small changes in interest rates could result in relatively large swings in reserve demand as banks substitute freely between reserves and other types of HQLA. Additionally, new limits on counterparty concentration mean that predictions of the level of reserve balances can depend more strongly than in the past on the distribution of those reserves across counterparties, especially in jurisdictions where money markets are dominated by a small number of very large banks.<sup>47</sup> Similarly, with periodic calculation of regulatory ratios (eg at quarter-ends), window dressing activities and associated spikes of short-term interest rates would tend to intensify.

Depending on their operational framework (eg in case of a corridor system), central banks could respond to such an increased difficulty in predicting reserve balances in a number of ways. First, they could narrow the corridor to dampen interest rate variability (although this may exacerbate any tendency of the new regulations to increase the central bank's role as intermediary – see below). Second, they could switch to a floor or ceiling system, because such frameworks do not require precise projections of reserves. Third, central banks could also allow more reserve averaging so that daily differences between the level of reserves supplied and the demand for reserves result in more muted movements in interest rates. Finally, the central bank could decide to simply tolerate greater volatility in market interest rates, either implicitly or explicitly (ie by switching to a range for its intermediate target variable instead of a point target).

**Potential for greater reliance on central banks.** A fifth implication is that aspects of the new regulations may increase the tendency of banks to rely on the central bank as an intermediary in financial markets. This is for at least two reasons.

<sup>45</sup> See, for example, Bindseil and Lamoot (2011) and EBA (2013) for a detailed discussion of the possible interactions between liquidity regulation and central bank operational frameworks.

<sup>46</sup> Another alternative is for central banks to consider switching their operational target variable to a market less affected by changing activity levels across different market segments (eg from unsecured to secured markets or from a shorter-term to a longer-term rate). This may be relevant in particular for some EMEs, given more limited levels of market development.

<sup>47</sup> Conceptually, forecasting the demand for reserves has both backward- (eg lagged reserve accounting) and forward-looking aspects (ie government account flows). The new regulations add new forward looking components (eg the LCR covers a window over the next 30 days) and central bank operations themselves can affect the regulatory ratios of the central bank's counterparts – at least at the margin. This may create more complicated operational dynamics as well as the potential for more period-end volatility, depending on the implementation of the reporting requirements.

First, as discussed above, weakened incentives for arbitrage activity and greater difficulty predicting the level of reserve balances may lead central banks to broaden the scope of their operations (eg by interacting with a wider set of counterparties or in a wider set of financial markets) to achieve their policy objectives.

Second, in a number of instances, the regulations treat financial interactions with the central bank more favourably than interactions with private counterparties (see Chapter 3 above). For example, in the LCR, the rollover rate on a maturing loan from a central bank is 100%, whereas the maturing of an otherwise identical loan from a private counterparty could be as low as zero, depending on the collateral provided. Similarly, large exposure limits do not apply to the central bank, but may limit interaction between larger private counterparties. In these circumstances, the central bank has two broad choices: it can accommodate the increased tendency to intermediate or it can resist it. In practice, the choice will no doubt depend on the advantages and disadvantages each jurisdiction perceives in having an increased role for its central bank in financial intermediation, and on how easily the existing operating framework can be adjusted to incorporate additional incentives against increased reliance on the central bank as intermediary.

In this context, central banks may also have to consider how their interactions with banks impact the effectiveness of the relevant regulatory requirements. In doing so, one question to be taken into account is whether a given regulation treats central bank operations and identical transactions with private counterparties the same and in a manner consistent with the terms on offer. If this is not the case, then the central bank's operations could undercut the intent of the regulation. The Liquidity Coverage Ratio, for example, will increase the demand for central bank loans against illiquid collateral because such loans have higher rollover rates than alternative loans from private sector counterparties. If banks were to therefore increase their borrowing against such collateral to improve their Liquidity Coverage Ratio, and if the rollover rate applied to central bank loans used when calculating the LCR is higher than the borrower can reasonably expect in that jurisdiction, then this could result in those banks being judged to be in stronger liquidity position than they actually are.

A related issue is that central banks may observe a tendency of liquidity regulation to make banks with less favourable initial regulatory ratios expand their central bank borrowing, while using non-HQLA as collateral, without this showing in aggregate reserves as these banks crowd out other banks with stronger initial regulatory ratios. Even though broadly neutral from a monetary policy perspective, the central bank may want to limit the increase in the concentration of its lending towards more regulatory-constrained banks that may result from this behaviour. In this case, the central bank could adjust the parameters of its collateral, counterparty or credit operations framework in order to limit these effects.

**Effects specific to the current macroeconomic environment.** In addition to the more general implications of the new regulations discussed above, there are also a number of effects for monetary policy that are specific to the current environment of low policy rates in key advanced economy jurisdictions.

One of these relates to the tendency of the new regulations to change the relationships between policy rates and market interest rates and asset prices, as well as the demand for central bank reserves, as discussed above. If, in equilibrium, this raises market rates vis-à-vis policy rates, policy normalisation (during which the central bank is seeking to raise market rates) will become somewhat easier. However, these effects may complicate policymaking for central banks that are at

the ZLB, because policy rates at zero will result in somewhat higher market rates than otherwise (see Chapter 4 for a discussion of these effects in the context of different transmission channels). As a result, central banks may need to increase their use of unconventional measures when seeking to stimulate aggregate demand. Conversely, if reserve demand were to decrease (eg due to a binding leverage ratio), market rates would tend to fall relative to policy rates. That shift, other things equal, may marginally help central banks that are seeking to stimulate aggregate demand at the zero lower bound (because market rates can fall a bit further than would otherwise be the case). Yet policy normalisation would be more difficult and central banks may need to consider broadening their set of counterparties to include market participants unaffected or less affected by the leverage ratio, if they can indeed contribute to monetary policy transmission.

In addition, as already mentioned, although the new regulations will stabilise bank credit supply on average, they are also likely to lead to a reduced supply during parts of the cycle. Consequently, as the new regulations are implemented, central banks operating at the zero lower bound may need to provide additional monetary accommodation through unconventional measures. However, as discussed in Chapter 3 above, quantitative easing can put downward pressure on banks' leverage ratios and reduce their inclination to absorb large amounts of central bank reserves. In such circumstances, if large parts of the banking sector were to operate at the leverage ratio constraint, the more binding leverage ratio requirements could potentially lead to a reduction in the supply of bank credit, undercutting the objective of the non-conventional measure. On the other hand, the more binding leverage ratios are also likely to put increased downward pressure on deposit and other bank liability interest rates as asset prices adjust to leave the banks content to hold the increased quantity of reserves, which will tend to increase the stimulus provided by quantitative easing through the interest rate channel.

Another implication of the current environment is that the effect of regulation may intensify as policy normalisation proceeds, removing some of the factors that currently make compliance with the regulations easier than would normally be the case. For example, with interest rates in the relevant jurisdictions all close to zero, the supply by households and corporates of bank deposits is likely to be relatively high, because – for given levels of saving – the opportunity cost of investing in deposits is low. As interest rates increase, the supply of deposits may fall as more normal relationships between deposit rates and other market rates return. Because liquidity regulations view deposits as a fairly stable source of funding, such a decline in deposit supply would likely make it more costly for banks to comply with the new regulations, intensifying their effects (as discussed above). Similarly, in jurisdictions with very high levels of reserve balances, the yields on those reserves will tend to be high relative to other market rates to provide banks with an incentive to hold them. Because reserves are Level 1 HQLA, such an overabundance will make compliance with liquidity regulation somewhat less costly than it will be when balance sheets normalise. (Insofar as normalisation will entail selling Level 1 HQLA, however, the total net supply of these assets available to the private sector will remain unchanged).

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## Appendix 1: Working Group mandate

At their February 2014 meetings, the Committee on the Global Financial System (CGFS) and Markets Committee (MC) decided to establish a joint CGFS-MC Working Group to investigate the relationship between monetary policy operating frameworks and the emerging regulatory environment. Taking the new regulations and their calibration as a given, the Group is asked to assess the implications for monetary policy (both in terms of operations and transmission), focusing primarily on the reaction of banks and markets to the new regulatory reality.

Specifically, the Working Group will seek to identify those features of monetary policy operating and collateral frameworks that, other factors considered, might prove less effective in the new regime as well as those that might be more robust to the emerging international regulatory environment. In doing so, the Group will take into account, and build on, the work currently under way in other groupings.

Key questions:

In pursuing these objectives, the Group is asked to develop a conceptual framework for examining the impact of regulatory change on monetary policy and to identify those international regulatory initiatives that are likely to have the most significant effects for monetary policy implementation and transmission. Where possible, supporting qualitative or quantitative analysis will be provided to underpin the Group's results. Key questions include:

**Lay of the land.** What are the key international regulatory initiatives that are likely to affect monetary policy implementation? Through which channels – including monetary policy implementation (eg changes in the demand for central bank reserves or in the usage of particular central bank facilities), the transmission of monetary policy (eg structural impact on the profitability and funding conditions of banks) and, to the extent relevant, the lender of last resort function – would these effects be expected to operate? How are key markets (such as money markets or those for high-quality collateral) going to be affected, and how will these changes feed back into monetary policy frameworks?

**Comparative analysis.** Are there any differences in the importance of any of these effects across jurisdictions, financial systems or different types of monetary policy frameworks? What explains these differences, and to what extent do they depend on financial structures (which are being reshaped by the regulatory changes)? Are there differences in normal times (eg regular monetary operations and policy transmission, anticipation of central bank action in stressed times) and times of stress (eg lender of last resort operations)?

**Implications for policy and future regulations.** What are the specific features of monetary frameworks that are likely to be best suited to the emerging regulatory regime, both in terms of regular operations and liquidity provision under market stress? Which are the features that may have to be adjusted (either through changes within existing frameworks or through adjustments to these frameworks) or that may complicate the return to (or the nature of) more normal central bank operations? How would any adjustments affect the effectiveness of regulation? What are the defining characteristics of the new regulations that appear most likely to have a material impact on monetary policy? Which types of future regulatory changes are particularly likely to require input from monetary policy experts at an early stage of the design process?

#### Process:

The Working Group on *Regulatory change and monetary policy* is co-chaired by Ulrich Bindseil (ECB) and Bill Nelson (Federal Reserve Board). The first task for the Group is the preparation, starting from the Group's draft mandate, of a short note providing a workplan and a more detailed outline of the questions that the Group will address. This short note would also reflect the discussion among ECC Governors in Sydney. The draft mandate and, as necessary, the short note would be submitted for further discussion at the May 2014 ECC meeting. Substantive work will commence once the mandate is approved.

The Group will work through teleconferences and face-to-face meetings/workshops. It would aim to reach out to the private sector, academia and other central banks, as appropriate, and will comprise experts on both monetary policy and financial regulation (at middle-level manager or adviser level). The Group is expected to submit a draft final report to the CGFS and MC in March 2015. A revised version would then be discussed by Governors at the May 2015 ECC meeting to obtain guidance for any additional work on the topic (including the possible use of the Group's analytical framework in the development of future regulatory measures).

## Appendix 2: The NSFR and secured financing

This Appendix illustrates the mechanics of how a range of secured financing transactions will impact the NSFR, supporting some of the conclusions drawn in Chapter 2 above. For the sake of simplicity, all impacts are approximate and are derived through a number of examples, starting from the simplified balance sheets shown in Graph A2.1.

The left-hand panel (a) assumes that Level 1 assets are used in the secured transactions, while the right-hand panel (b) focuses on secured transactions using Level 2B assets. Deposits are assumed to be from corporate clients and the loans are to the non-financial sector and all performing.

Initial simplified balance sheets

Graph A2.1

(a) Level 1 assets				(b) Level 2B assets			
RSF	Assets	Liabilities	ASF	RSF	Assets	Liabilities	ASF
0%	Reserves	Deposits	50%	0%	Reserves	Deposits	50%
5%	L1 assets			50%	L2B assets		
85%	Loans (>1Y)	Equity	100%	85%	Loans (>1Y)	Equity	100%

To evaluate what impact certain transactions have on the NSFR, two kinds of comparisons are made. First, the change in net stable funding ( $\Delta$ NSF) is stated, where net stable funding is defined as the difference between ASF and RSF. Second, the impact on the sign of the change in the Net Stable Funding Ratio ( $\delta$ NSFR) is indicated.

The first measure gives an idea of the impact in absolute terms on the funding situation of a bank or the banking system as a whole. The second measure indicates the direction of the resulting change in the NSFR. As an example, if a bank has ASF of 1'000, RSF of 800 and, hence, an NSFR of 125%, a transaction that reduces ASF by 55 and RSF by 50 yields a  $\Delta$ NSF of -5. However, the overall impact on the ratio in this case is positive ( $\delta$ NSFR  $\uparrow$ ), with an increase from 125% to 126%.

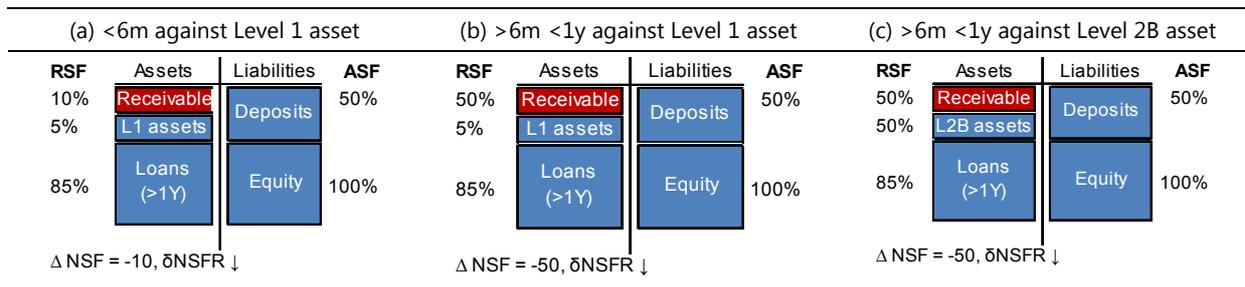
In the following, it is assumed that transactions are for the amount of 100 monetary units when calculating the  $\Delta$ NSF.

### Example 1: Reverse repo with financial institution

Reverse repos (lending cash) with financial institutions reduce the NSFR (that is, the ratio as well as the available net amount of stable funding), regardless of the collateral used. Given the maturity brackets used, the effect is more pronounced at tenors exceeding six months (Graph A2.2).

## Reverse repo with financial institution

Graph A2.2



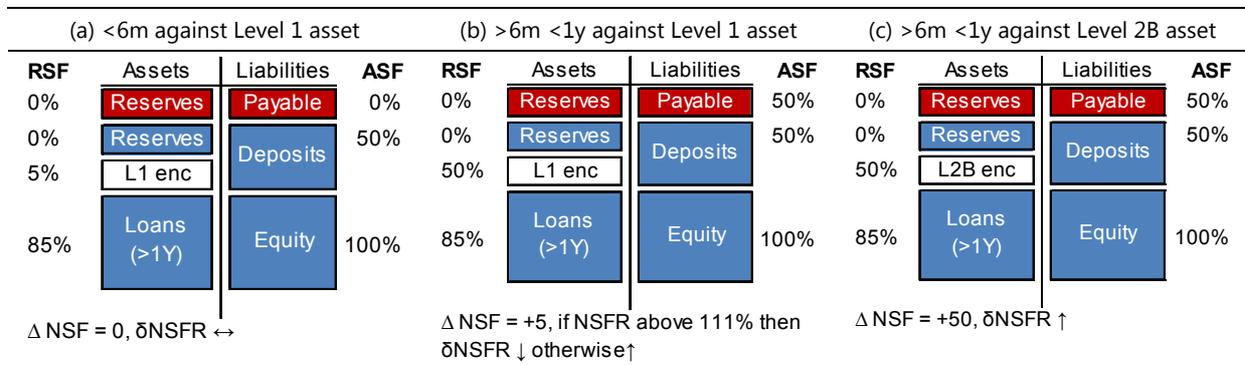
Source: Working Group.

### Example 2: Standalone repo to fund assets already held on balance sheet

Short-term repos (cash borrowing) with financial institutions have no impact on the NSFR. Longer-term repos can have an ambiguous impact depending on the initial value of the NSFR. If the initial value is below a certain threshold, then longer-term repos will boost the NSFR. The threshold is increasing in the credit riskiness of the collateral used up to the point where all transactions increase the NSFR (Graph A2.3; if Level 2A assets are used instead of Level 1, then the NSFR increases as long as it is below 142.9%). This is because the RSF on an encumbered asset exceeds the RSF on an unencumbered asset for both Level 1 and Level 2A securities.

### Standalone repo with financial institution funding asset held on balance sheet

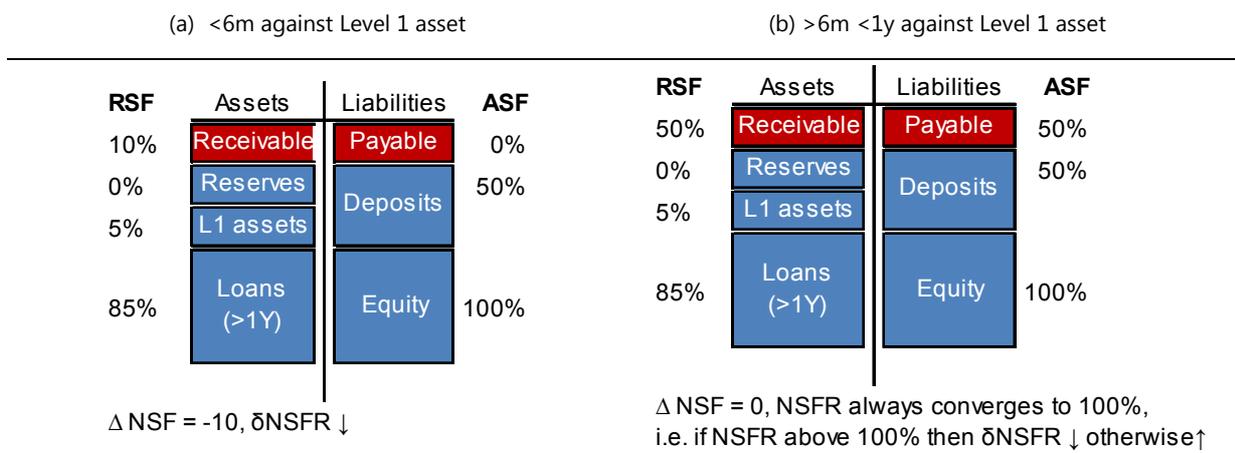
Graph A2.3



Source: Working Group.

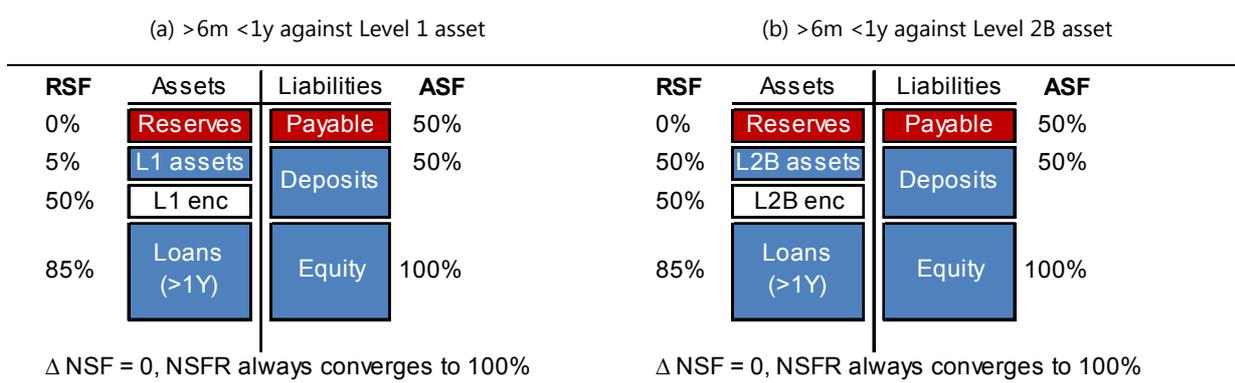
### Example 3: Matched-book repo with financial institution

Pure matched-book repo activity involves the transfer of cash and collateral through the intermediary's balance sheet without asset encumbrance – all that remains on the intermediary's balance sheet is a repo payable and receivable (Graph A2.4). The left-hand panel shows that pure matched-book repo activity between two financial counterparties with maturities of less than six months marginally reduces the intermediary's NSFR. In all other cases, pure matched-book repo activity has no impact on net stable funding ( $\Delta \text{NSF}$ ) but always reduces the ratio ( $\delta \text{NSFR}$ ), assuming that the NSFR was above 100% prior to the transactions.



Example 4: Stand-alone repo to fund new asset purchase

The balance sheet impact of funding a newly purchased asset via repos is depicted in Graph A2.5. There is an initial fall in reserves and an increase in securities held (on the assets side of the balance sheet). This is followed by a repo payable (on the liabilities side), encumbrance of the purchased securities and an increase in reserves (on the assets side). The graph shows that the NSFR does not provide an incentive to purchase lower quality assets and fund them using repo. Note, that this contrasts with the results from Graph A2.2, above, which shows that the NSFR does provide an incentive to use lower-quality assets already held on balance sheet as collateral in repo transactions. As these transactions increase ASF and RSF by the same absolute amount, their ratio (NSFR) will converge towards 100%. That is, it will marginally reduce the NSFR, assuming that it was above 100% prior to the transactions.





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