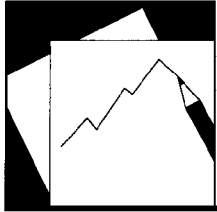


A Simple Macroprudential Liquidity Buffer



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Monetary and Capital Markets Department

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Abstract

A mechanism is proposed that aims to reduce the risk of a banking sector liquidity crisis—which is a quintessentially systemic event and thus the object of macroprudential policy—and moderate the effects of a crisis should one occur. The instrument would give banks more incentive to build up buffers of systemically liquid assets as a proportion of their total liabilities, yet these buffers would be usable in times of stress. The modalities of the instrument are considered with a view to making it effective, efficient, and robust.

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I. INTRODUCTION

A banking crisis and especially a systemic crisis often involves, and is aggravated by, strains in funding markets. Even a bank that is not initially short of capital can make large losses and thus become under-capitalized if it has to sell assets in a “fire sale” to meet short-term obligations, pay very high rates for funding, or suffer quantitative rationing. Some banking crises may consist almost entirely of an intensification of credit risk in the loan book of individual banks, but such crises may be characterized by the relative weakness of systemic feedback loops, at least among financial institutions. Liquidity strains, in contrast, are inherently systemic: One agent’s liquid asset is another agent’s liquid liability, and what is liquid is defined in terms of what can be disposed of in the market rapidly and without major price changes, that is, in terms of its properties within the financial system.² Hence, as part of efforts to strengthen macroprudential oversight, it is worth considering what instruments might be used to sustain system-wide liquidity in case of strain, and to reduce the likelihood of such strain occurring. This paper presents one such instrument, considers its functioning, and discusses some details of its specification.

The mechanisms that provoke and amplify financial crises have been much studied, but there is consensus that tightening liquidity conditions normally provides the oxygen that turns a spark into a financial sector bonfire. The size of the original shock/risk exposure may have little predictive power as to the subsequent magnitude of losses and the systemic-ness of an ensuing liquidity crisis. “Balance-sheet amplifiers” such as leverage and “information amplifiers” grounded in financial agents’ imperfect knowledge regarding cross-exposures can propagate destabilizing “liquidity spirals” (Krishnamurthy, 2009).

Brunnermeier (2008) distinguishes between two separate yet intertwined “liquidity spirals” that may, especially against the backdrop of excessive leverage of financial agents, render a comparably small and isolated shock into a systemic liquidity crisis: On the one hand, a “loss spiral” may arise when a leveraged financial institution incurs a large enough loss on some of its investments to be forced to dispose of other assets so as to maintain its initial leverage ratio (or to comply with regulatory capital requirements), thus potentially depressing the prices of those other assets.³ Other leveraged financial institutions might either be forced to fire-sell assets because they were hit by a common initial shock, or because the decrease in the price of assets due to the fire-sales of other agents constitutes a large enough shock for themselves. A “margin/haircut spiral,” on the other hand, arises when an increase in risk perception leads to a

² A distinction is often made between “funding liquidity risk” and “market liquidity risk” (Nikolaou, 2009, Kashyap *et al.*, 2011): “funding liquidity (risk)” refers to a financial agent’s (in)ability to meet liabilities on time, in full, and at a reasonable cost in case the agents needs refinancing; “market liquidity risk” refers to a financial agent’s (in)ability to trade an asset at short notice, at a fair price, and with little impact on the asset’s price. Funding liquidity risk is the first concern here, but, with a financial system’s increasing interlinkages between financial sectors, markets, and agents, the distinction becomes less relevant in the design of macroprudential policy.

³ See also Shleifer and Vishny, 2010, or Kashyap *et al.*, 2011.

rise in margins/haircuts, which may force the institution to sell even more assets, depressing prices and increasing perceived risk further.

These spirals imply that financial crises may be driven largely by uncertainty, self-fulfilling panic, and contagion, (Diamond and Dybvig, 1983), where liquidity outflow creates real losses. Certain financial crises may be characterized as “common shock” systemic liquidity events, such as where the banking sector displays generalized dependence on foreign short-term funding; the precipitous drying-up of these funds following a sharp re-assessment of (credit) risk on part of the foreign investors can then provoke a systemic financial crises. The Asian crises of 1997-98 and other crashes in emerging market economies can be interpreted this way (Sachs *et al.*, 1996, Chang and Velasco, 1998a and 1998b).⁴ Likewise, the initial shock that triggered the global financial crisis of 2008/09, i.e., direct losses due to household defaults on U.S. subprime mortgages totaling around US\$500 billion, was not overwhelming compared to the aggregate loss absorbance capacity of the U.S., let alone the global financial system, but was amplified enormously through liquidity and loss spirals.

From a macroprudential policy point of view, the loss and haircut spiral dynamics described above share important characteristics with traditional “bank run dynamics,” but with the crucial difference that the pressure to de-lever, at least in the early stage of the spiral, is caused by an event that is exogenous from the perspective of an individual institution. That event may affect either the asset side or the liability side of its balance sheet.

Furthermore, the liquidity properties of assets and liabilities can change abruptly during crisis periods; information amplifiers may render illiquid assets that are normally to be close substitutes for cash, or subject even notionally long-term liabilities to “runs.” Thus, an instrument that is useful in stopping this propagation must be robust against such instability in the liquidity characteristics of both assets and liabilities. Moreover, a prudential liquidity requirement that is primarily micro-prudential in nature, such as traditional short-term asset to short-term liability ratio, and whose required holdings of liquid asset mainly depend on an institution’s idiosyncratic run risk on the liability side, such as the liquidity coverage ratio (LCR), seems ill-suited to act as a circuit-breaker in a systemic liquidity spiral. Also, given the “de-idiosyncrization” of risk perceptions (“informational contagion”) that is a defining characteristic of financial panics, liquidity requirements that focus on the idiosyncratic run risk of individual financial institutions are likely to underestimate the required holdings of liquid assets for the system as a whole.

Countries facing crises or increasing risk arising from systemic funding imbalances in recent years have taken various measures (Box 1). Some were reactions to stress conditions, and others were more preemptive. Often action was taken through central bank reserve requirements, perhaps because they could be used in timely and flexible fashion in the absence of a full

⁴ For an alternative explanation of the Asian crises putting more weight on structural and policy distortions, see e.g., Corsetti *et al.*, (1998).

“toolbox” of macroprudential instruments, and in the context of strong balance of payments inflows or outflows.

Box 1. Recent Country Experiences with Macroprudential Liquidity Measures

Countries have adopted liquidity measures (partly) with the aim of promoting financial sector stability rather than as instruments of macroeconomic or monetary policy, or for micro-prudential purposes. Generally the measures were designed to affect credit growth as well as liquidity conditions in domestic and foreign currency (Kraft and Galac, 2011; Medina and Roldós, 2014; Montoro and Moreno, 2011; NBR, 2009; Ostry *et al.*, 2011; Tovar, Garcia-Escribano, and Martin, 2012). The evidence for their effectiveness in steering credit supply is mixed, but they are viewed as have been successful in making banks more resilient to funding risks. Some instances include:

- Brazil: LCR, reserve requirements (including on short spot dollar positions);
- China: Reserve requirements;
- Croatia: Reserve requirements, limits on currency mismatch;
- Indonesia: Reserve requirements;
- Peru: Reserve requirements on short-term external liabilities of banking institutions;
- Romania: Reserve requirements on foreign currency deposits; and
- Turkey: Reserve requirement ratio on domestic and foreign currency deposits, and remuneration rates.

In light of this analysis, an enlivened debate is needed on how to address systemic liquidity risk through macroprudential policy, as a complement to the primarily micro-prudential liquidity measures being introduced in the Basel III framework. To this end, a first attempt is made here to analyze the desirability of introducing a required Macroprudential Liquidity Buffer (MPLB), and how it might operate in practice. The proposed MPLB is analogous to the leverage ratio; both are based on relatively simple measures of financial soundness derived from unweighted balance sheet aggregates. The MPLB would complement more granular, bank-specific liquidity requirements such as the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR), much as the leverage ratio complements risk-weighted capitalization ratios.

The MPLB is not the only possible instrument for addressing systemic liquidity risk (Box 2); other approaches may offer certain advantages or disadvantages. These alternatives generally require more granular assumptions and modeling than does the instrument proposed here; in this, they are analogous to (counter-cyclical) risk-weighted capital requirements. The proposed MPLB is distinguished by

- Calibration that depends on system-wide developments;
- An explicit and automatic counter-cyclical element;

- No ex ante judgment about which funding sources are more stable than others over various time horizons and situations (except for capital); and
- A narrow conception of assets that form a reliable buffer in a generalized crisis.

A very different approach starts from the proposition that the liquidity properties of assets and liabilities are so sensitively dependent on market conditions that no stable rule is generally applicable. When one cannot at all predict with any certainty what funding will “run” and which assets will be un-realizable should a crisis hit, qualitative guidance is the best approach. A review of this range of possible approaches, including that proposed in this paper, could help in identifying and specifying the best available means to addressing macroprudential liquidity risk.

Box 2. Other Proposals for Macroprudential Liquidity Regulation

Some alternative proposals in this area are designed to ensure that banks hold adequate buffers against liquidity shocks, while others are to discourage liquidity mis-matches. The former typically include time-varying provisions. Operational aspects of these proposals are generally not developed in detail.

LCR weighting: The LCR proposed under Basel III (and embedded in EU capital requirements regulations and directives) incorporates weighting of assets: those deemed to be of highest liquidity quality receive a high weight. These weights are meant to reflect how costly it would be to realize these assets in a short time during a period of generalized stress, which is a system-related property, not a bank-specific one. It is envisaged that the LCR may be relaxed during periods of stress.⁵ If the LCR and NSFR are applied to all banks, the structure of funding should become more stable.

Time-varying LCR: The ESRB handbook on macroprudential banking policy (ESRB, 2014) contains a proposal to extend the LCR requirement to include a supplemental, time-varying buffer. In addition, the handbook discusses the possibility of a **(time-varying) liquidity ratio**, defined as the ratio of highly liquid asset over total assets that could act as a backstop to the (time-varying) LCR, and also the scope for adjusting the variables determining the LCR in order to focus on particular assets, funding sources, or sectors, of macroprudential relevance.⁶

Time-varying net Stable Funding Ratio (NSFR): In analogy to the time-varying LCR, a time-varying NSFR could be introduced, possibly supplemented by a **(time-varying) core funding ratio** and an adjustment of the determining variables of the NSFR (ESRB, 2014). Also, time variation in a **loan-to-deposit cap** (LTD) and a **loan-to-stable-funding ratio** (LTSF) could be envisaged.⁷

Explicit capital charge: Brunnermeier *et al* (2009) propose a higher capital charge for financial institutions holding assets with low market liquidity and long-maturity that are funded short term.

Pigouvian tax: To make banks internalize the negative systemic effects of fragile funding strategies, Perotti and Suarez (2009) advocate the introduction of a liquidity risk charge, defined as a Pigouvian tax, where a unit of short-term funding should be taxed in proportion to its marginal contribution to a bank's contribution to systemic vulnerability. The charges should be stable, but adjustable by the macroprudential authority in response to aggregate risk accumulation. The proceeds from the charge could either be accumulated in a fund or contribute to general government revenue.

Registration, cap and trade: Milne (2010) recommends the establishment of a central register for all domestically held financial assets and liabilities to enable the macroprudential authority to monitor the extent of the aggregate maturity mismatch and its contribution to systemic liquidity risks. The authority would then determine on a quarterly basis the upper limit of the amount of short-term liabilities in the relevant currency. (Tradable) licenses summing to this amount would be distributed to financial institutions.

⁵ A fixed LCR can offset the tendency of banks to manage their liquidity counter-cyclically, such that they seek to run down liquidity buffers in non-stress times (Aspachs, Nier, and Tiesset, 2005). However, the socially optimal degree of cyclicity may involve variation in the requirement as circumstances change.

II. OVERVIEW

Any instrument intended to reduce systemic liquidity risk should achieve several desiderata, such as

- Reducing the severity and costs of a crisis should one occur;
- Reducing the likelihood of a systemic liquidity crisis;
- Interacting suitably with other macro- and micro-prudential instruments;
- Be shielded from pressures for time inconsistency, favorable treatment of special interests, and ex post relaxation;
- Being easy to administer;
- Limiting the scope and incentives for circumvention;
- Allowing for the diversity of banks' business models;
- Not creating a major disruption to monetary and other macroeconomic policies; and
- Not be unduly costly.

The proposed MPLB is designed to meet these desiderata and would have the following key features:

1. A set of “systemically liquid assets” (SLAs) would be defined. These would consist of assets, the value of which is not correlated with the state of the financial system, and which even in a crisis situation can be used as payment, quickly sold without loss, or readily be used as high-quality collateral. Note that these assets may be claims on a foreign investment-grade sovereign, say, but not claims on the own commercial banking system.
2. Each bank (and possibly other relevant leveraged financial institutions) would be required to hold a minimum amount of SLAs to fulfill the MPLB requirement. Banks would be expected to meet the requirement on a continuous basis, failing which a penalty would be payable. In particular, the ratio of a bank's SLAs to its liabilities minus its regulatory capital (the measurement base, LMC) would have to exceed a minimum (the minimum required SLA ratio, *slar*). The requirement for bank *i* at time *t* can be written as

⁶ See also van den End and Kruidhof (2012).

⁷ See also van den End (2013).

$$\frac{SLA_{i,t}}{LMC_{i,t}} \geq slar_t$$

3. The *slar* would adjust over time (say quarterly) according to a rule based on growth in system-wide aggregate LMC, so

$$slar_t \propto g_t,$$

where g_t is the rate of growth of aggregate LMC around period t . The adjustment rule could be “tuned” to make the floor more or less sensitive to cyclical fluctuations over various time horizons while ensuring that the required ratio is stationary over the cycle. Possibly the required *slar* could be made to react disproportionately to large and persistent accelerations or decelerations. The average, through-the-cycle required ratio would be positively related to the degree of interconnectedness in the system.

4. Possibly, systemically important financial institutions (SIFIs) could be subject to a supplemental MPLB requirement.
5. A separate MPLB requirement would be established for each relevant currency, based on the development of respective liability aggregates.

With this requirement in place, banks would have to hold SLAs as a liquidity buffer against a disruption in funding, and especially in case of a system-wide shock. Banks may sell the SLAs readily and with little price markdown, or use them as collateral to obtain funding even in a crisis. Therefore, individual institutions would be better able to withstand liquidity shocks, and transmission will be dampened. Requiring banks to hold ample SLAs would also offers comfort to the central bank, which might otherwise have to provide liquidity with questionable collateral once a severe crisis hits and thereby take on quasi-fiscal credit risk.

From the viewpoint of prevention, insofar as SLAs are poorly remunerated relative to those that banks would otherwise hold, the MPLB would reduce incentives to expand the (debt-funded) expansion of the balance sheet, and therefore reduce the likelihood of excessively rapid growth. Furthermore, because SLAs “use up” some of the asset side of the balance sheet, inter-financial institution lending would, *ceteris paribus*, be discouraged, and therefore interconnectedness may be reduced. Thus, the probability of a systemic crisis occurring would be reduced.

The suggested MPLB is based on a measure of liabilities other than regulatory capital, and therefore would not discourage higher capitalization. In particular, it would not interfere with the counter-cyclical capital buffer (CCB); the CCB is targeted at cycles in disbursing credit and credit risk, and the MPLB is targeted at cycles in funding and liquidity risk.

The MPLB would be met only through asset holdings, rather than a balance between certain assets and certain liabilities, and so it does not interfere with the LCR or NSFR; the design presupposed that individual banks are subject to effective (micro-)prudential regulations

requiring them to maintain sufficient liquidity relative to their short-term liabilities. If an individual bank gets into funding difficulties—while the system as a whole is not under strain—that bank could use some of its MPLB; it would need to pay a penalty and would subsequently be subject to intensified supervision. But such an eventuality would not be problematic from a micro- or macroprudential perspective. While bank-specific prudential regulations such as the LCR and NSFR need to take into account diverse banking business models and, therefore, diverse funding structures, for macroprudential purposes the robust approach of aggregating all liabilities seems more appropriate.

The ratio of required SLA holdings to LMC would vary over the cycle depending on aggregate conditions, such that higher buffers would be promoted when funding other than capital is growing especially rapidly. Thus, the rule would be inherently macro-prudential and counter-cyclical.

The automaticity of the rule defining the minimum ratio is meant to help shield its functioning from time-inconsistency problems or interference from special interests. But the rule would be very easy to implement—indeed, using monetary aggregates rather than detailed prudential data (except easily-accessible data on regulatory capital)—and transparent. The rule does not require specification and calibration of a weighting scheme for various liabilities, and only two categories of assets are defined. Also, verification of observation of the rule would be straightforward. This simplicity and the wide definition of the measurement “base” would make the rule difficult to circumvent.

The rule would apply equally to banks that rely on retail funding as to those that rely on market funding, and to those with a concentration on retail lending and to those whose strategy focuses more on other business lines such as investment banking. For a bank that is expanding aggressively, the rule would ensure that it builds up SLA at an equal rate, and that it cannot expand its loan book quite as fast as it might otherwise. The MPLB may be most problematic for a bank that chooses to be very conservative during a boom time, that is, when its loan book and funding base are not expanding while the aggregates grow rapidly; such a bank may have to reduce holdings of other assets including loans in order to meet a rising MPLB requirement. However, as an empirical matter this effect may be small; a conservative bank may in any case wish to limit its exposure to credit risk during an extreme boom.

The MPLB may possibly slow the transmission of an expansionary monetary shock during boom times, insofar as the requirement makes monetary impulses go more into SLAs, and especially high-powered central bank money, rather than commercial lending. However, during slowdowns the MPLB should not interfere with monetary transmission and in particular not prompt a contraction in credit supply: in case aggregate liabilities decrease, the MPLB requirement will itself fall (and also the *slar* will be reduced), so banks will not be obliged by the MPLB requirement to change their portfolios.

On a more structural level, the MPLB requirement may increase demand for eligible assets, which are likely to comprise largely central bank money, claims on domestic and foreign governments, claims on IFIs, and highest-quality covered bonds. Issuers of these assets will benefit from lower relative funding costs and possibly less stringent market discipline, and in time the supply may increase.

Even so, there may be a concern over the availability of an adequate stock of SLAs, that is, assets that can reliably be counted on to be liquid or to offer a means to obtain liquidity even during times of great market stress. Smaller jurisdictions might be able to rely mainly on liquid assets obtained from larger markets.⁸ A jurisdiction with a flexible exchange rate and own central bank can focus on ensuring that banks hold enough assets that are eligible for central bank refinancing without transferring significant credit risk to that central bank. In the end it is an empirical question whether enough suitable assets are available to build a useful buffer, and a MPLB requirement may be of value also for its effect on ex ante incentives.

The cost of the MPLB for banks can be estimated; it is unlikely to be very large on a risk-adjusted basis. Suppose that the (assumed free of default risk) SLAs earn a return r , and the assets they replace earn an expected return s net of expected credit losses and taxes.⁹ Suppose also that the MPLB is binding and forces banks to hold an extra M in SLAs. Then an upper bound on the cost is $(s - r) \cdot M$. However, a risk adjustment is needed: suppose that the market expected excess return over the safe rate is $(\mu - r)$. Let β be the correlation between the returns on non-SLA assets and the market portfolio, then we define parameters α by

$$s - r = \alpha + \beta(\mu - r)$$

The net, risk-adjusted cost to the owners of banks is then αM , that is, the loss of “rent” in excess of the general market return that the MPLB makes them forego. However, the MPLB may lower overall costs: banks would benefit from lower funding costs, lower risk-weighted capital requirement, and, if macroprudential policies are successful, lower contributions to bail out and deposit guarantee funds. The optimal calibration of the rule would set the marginal cost equal to the marginal social benefit (in terms of less disruption to the nonfinancial sector, less costly government support, etc.) of fewer and less costly systemic liquidity crises.

Variations on the MPLB could be introduced: possibly, liabilities could be assigned different weights depending on their residual maturity, where liabilities with shorter residual maturity would be assigned a higher weight. Moving closer to the LCR, some SLAs might be given higher weights than others to reflect that they would remain fully liquid even in a severe systemic crisis. SIFIs may be subject to a supplementary requirement. However, these refinements may take away from the robustness—against model uncertainty and regulatory capture—of the simpler mechanism.

⁸ Some related practical considerations are discussed below.

⁹ Some of these earnings may take the form of fees rather than interest earnings.

III. SPECIFICATION

The detailed specification of the requirement requires careful balancing of considerations:

A. Cyclical Adjustment of the Required Systemic Liquid Asset Ratio

A desirable rule for adjusting the *slar* over time should be based on relevant, observable information, but also avoid excessive short-term fluctuations in the requirement. Furthermore, a conservative approach would favor a rule that tightens requirements relatively rapidly as warning signs emerge, but relaxes them slowly as conditions appear to become more benign. Also, a negative requirement should be impossible or highly unlikely in any plausible circumstances.

One rule that would meet these criteria would be based on the cumulative deviation from the trend growth rate in LMC (designated by τ):

$$slar_t = \vartheta \exp\left[\gamma \sum_{i=0} (g_{t-i} - \tau)\right]$$

where τ designates the trend growth rate in LMC, ϑ determines the desired average level of the *slar*, and γ is a “tuning” parameter that determines sensitivity to cyclical developments over a certain horizon.¹⁰ Other rules can be considered (Box 3).

Figure 1 illustrates how the *slar* fluctuates over a representative cycle for different values of the tuning parameter.¹¹ The relatively high growth rate g in the first half of the simulation period leads to a rising required ratio, which declines as growth falls. The temporary spike in the growth rate at the end of the down-turn serves largely to bring the requirement back towards trend. Due to the convexity of the exponential function, growth in LMC above trend results in a sharper increase in the *slar* than an equal shortfall in LMC growth below trend, but it never becomes negative.¹²

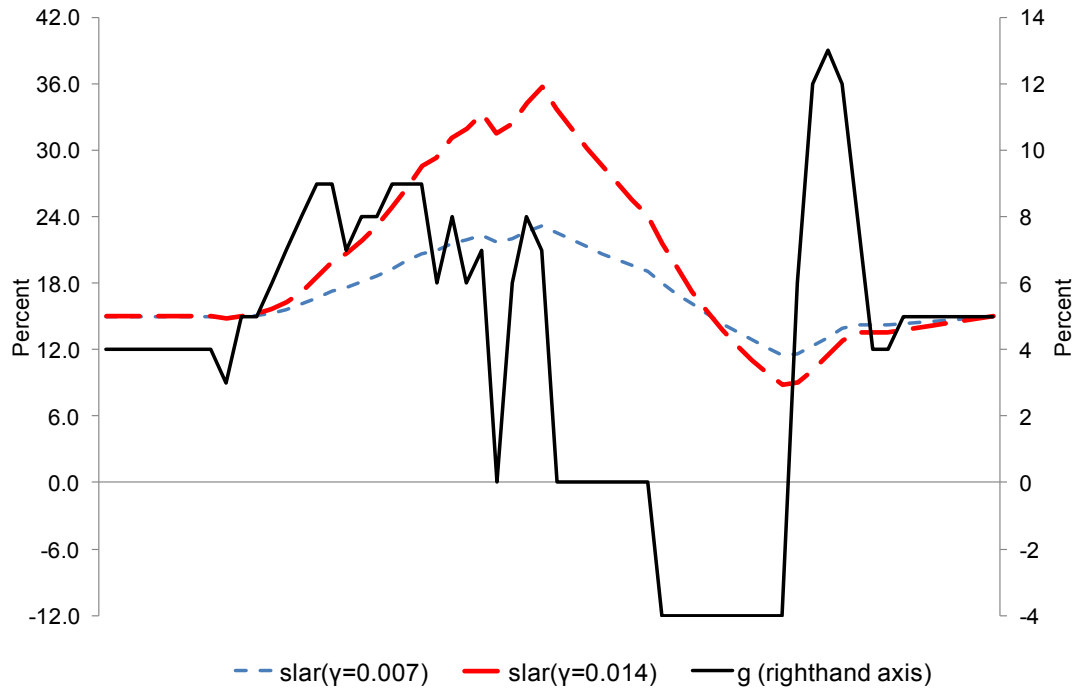
This approach is conceptually appealing because it is explicitly based on cycles around trend. However, estimating the trend growth in banks’ liabilities may be challenging, especially after a period of unsustainable growth and possible structural changes. In any case, a determination has to be made of an appropriate steady state level (ϑ in the trend deviation-based approach), as well as the sensitivity to cyclical fluctuations.

¹⁰ Because of convexity, the expected value of $\exp[\gamma \sum_{i=0} (g_{t-i} - \tau)]$ is not unity even when the trend is known perfectly. This bias can be corrected by adjusting upwards the parameter τ .

¹¹ In the illustration, $\vartheta = 15$, $\tau = 4$, and $\gamma = 0.07$ or $\gamma = 0.014$. The absolute level of the *slar* in the illustrations is chosen for clarity of presentation.

¹² An analogous rule might be devised to steer a cyclical LCR or NSFR.

Figure 1. Cyclical Variation in the *slar*: an Illustration



Box 3. Alternative Cyclical Adjustment Rules

A simple approach to set the *slar* would be based linearly on the cumulative deviation from the trend growth rate in banks' LMC (designated by τ), so that:

$$slar_t = \vartheta + \gamma \sum_{i=0}^{\infty} (g_{t-i} - \tau)$$

where again ϑ is the desired average level of the requirement and γ defines the sensitivity to fluctuations around trend. This rule (illustrated to the right) treats positive and negative deviations from trend symmetrically, and may give rise to a negative *slar*.¹³

An alternative, algebraically simple rule would be

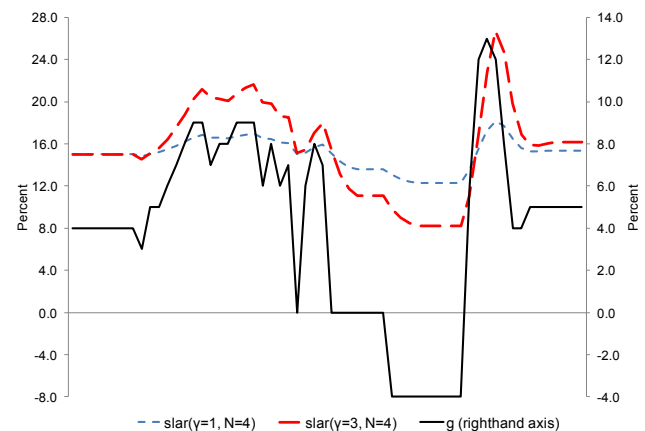
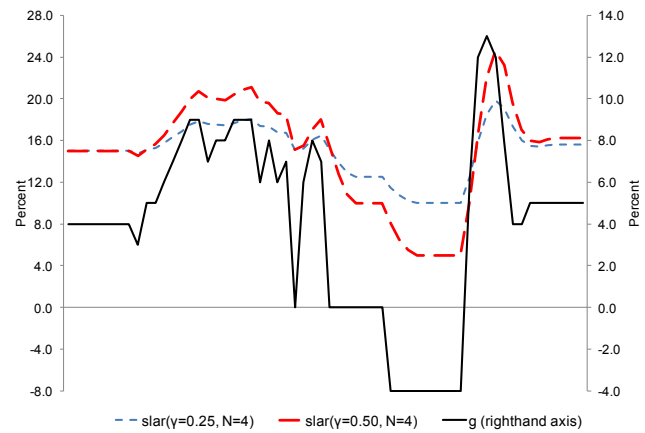
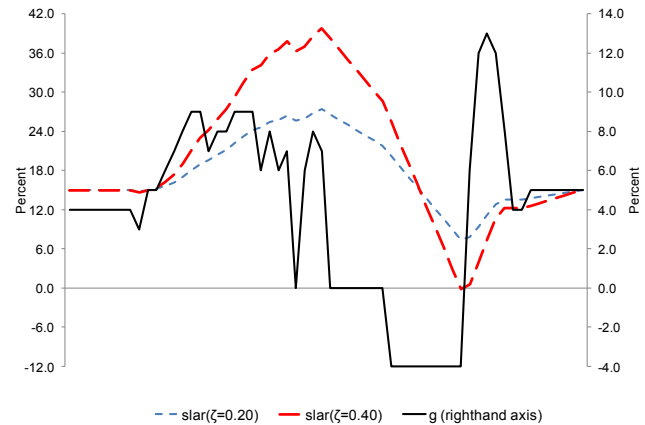
$$slar_t = slar_{t-1} + \gamma(g_t - \underline{g}_{t-1, t-N})$$

where $\underline{g}_{t-1, t-N}$ is the mean rate of growth of LMC over the previous N periods. Greater persistence could be achieved by using the average growth rate over a longer period. However, this specification may generate a negative *slar* when LMC growth is persistently negative.

Superior in this regard would be a specification such as

$$slar_t = slar_{t-1} \cdot \exp[\gamma(g_t - \underline{g}_{t-1, t-N})]$$

The convexity of the exponential function would ensure that the *slar* reacts more rapidly to increases than to decreases in LMC, and the trend level of the *slar* is positively related to the trend growth rate of LMC.



¹³ One could use a modified rule $slar_t = \max[0; \vartheta + \gamma \sum_{i=0}^{\infty} (g_{t-i} - \tau)]$ so as to exclude negative values.

B. Eligible Systemically Liquid Assets

Consideration would have to be given to aligning the definition of SLAs with that of “high quality liquid assets” (HQLAs) under the LCR, provided that only those assets that would almost surely be liquid and available for all banks during a liquidity crisis are considered to be eligible (i.e., mainly the highest level HQLAs that earn the highest weight). Moreover, assets whose liquidity characteristics have not been tested during a systemic crisis (i.e. “innovative” financial instruments) should not be eligible because they are not demonstrably systemically liquid. Conceivably, during certain period the SLA-requirement could be tightened by narrowing the definition of eligible assets, but this complication is not essential.

Short-term claims on the central bank are normally considered to be of highest liquidity, but the conditions placed on required reserves would have to be considered carefully. Especially if there is limited reserve averaging over the holding period, required reserves would not be fully available as liquidity for banks. However, longer term claims on the central bank may be considered as SLAs if the central bank has in place instruments to use these assets for repurchase operations or as collateral for loans on a very short-term basis. There may also be case for the central bank to issue its own short-term securities to augment the supply of (remunerated) systemically liquid assets.

Assets held abroad may constitute suitable SLAs if they are traded in sufficiently liquid and open markets. U.S. Treasury bills, for example, may be so readily transformable into cash that holding them effectively supports liquidity in a local currency. Indeed, claims on highly-rated foreign governments or international financial institutions may be especially suited to serve as systemically liquid assets because their value and liquidity will not be correlated with domestic conditions. However, claims on a jurisdiction that may impose liquidity ring fencing would not be suitable, because they may become unavailable just when they are most needed.

If, in a given jurisdiction, there is an (initial) shortage of eligible assets to fulfill the SLA-requirement, banks that rely on funding in this jurisdiction’s currency would, *ceteris paribus*, have to hold a relatively higher amount of central bank money. Given a higher opportunity cost for cash holdings relative to other SLAs, banks would thus be less inclined to fund operations in currencies with an insufficient supply of highly liquid assets, or they would have to invest more in highly liquid foreign assets. Such a shift in incentives would be desirable from a stability perspective: banks in a jurisdiction with a structural shortage of SLAs should generally incur relatively little funding risk.

C. Capital

There is no obvious reason to favor a very narrow definition of capital in the specification of LMC, so long as all elements making up capital cannot “run.” Hence, the sum of Tier I and Tier II regulatory capital is *prima facie* appropriate. However, for the sake of parsimony it may be worthwhile to align the definition of capital used in LMC with the tighter definition used in other regulations, such as the counter-cyclical buffer or solvency guideline. Since capital

normally makes up only a small share of banks' liabilities, this issue is of second order importance in this context.

D. Measurement Base and Aggregate Liabilities

In principle the proposed MPLB would take into account system-wide developments, but the perimeter of a system is not always sharply defined. Indeed, regulation may itself induce disintermediation between types of institutions and across jurisdictions, and thus affect the perimeter. Thus, the definition of the measurement base for the MPLB should be not so restrictive as to facilitate disintermediation, but also needs to take into account practical considerations, such as the timely availability of relevant data.

The simplest case is that of the banking system of a country with its own currency, which is not used elsewhere, where foreign currency deposits are not significant, and where domestic banks predominate. In this case, the relevant aggregate liabilities would be those of the banks operating in that country. The measurement base (and regulatory perimeter) in Saxe-Weimar, for example, is clear if just Saxe-Weimar banks operate there, entirely in Saxe-Weimar thaler, which currency is not used elsewhere.

At the other extreme, where a jurisdiction is home to an international financial group that has important operations abroad, the measurement base for the MPLB should include the total LMC of that group. Otherwise the group may be able to circumvent the requirement and, perhaps more importantly, the group may not hold enough of a MPLB to withstand liquidity shocks coming from its operations abroad.¹⁴ The Augsburg authorities, for example, would be imprudent to look only at the Augsburg activities of the Fugger bank, when much of the liquidity risk that it faces arises from its operations in Burgundy, etc.

More complex is the situation of hosted subsidiaries and branches. In relation to a hosted branch without a separate balance sheet, it makes no sense to measure the non-resident "parent" bank's total LMC, most of which will reflect activities unconnected with the host country. However, the branch may be an important absorber and conduit of liquidity in the host jurisdiction, and so it does make sense to measure the branch's (that is, the foreign bank's) liabilities vis-à-vis residents. Likewise, a subsidiary's liabilities vis-à-vis residents can be measured and counted towards the total amount of intermediation in the system. Treating branches and subsidiaries alike avoids favoring one legal form over another.

A hosted subsidiary or branch that relies mainly on parent bank or headquarters' funding may then transmit a liquidity shock to other financial institutions and the nonfinancial sector if that parent or headquarters gets into difficulty. However, coping with the latter possibility goes beyond the mandate of a national authority, and other banks in the host country will be shielded from such intermediated liquidity shocks by the SLAs that they hold.

¹⁴ It is assumed that the group would not normally abandon its subsidiaries or branches abroad.

What cannot readily be captured is off-shore activity in a country's currency between banks that are not represented in that country. Perhaps Hamburg banks, for example, deal in Saxe-Weimar thaler with each other and with the public. Yet, the Saxe-Weimar authorities will, absent coordination between the relevant authorities, have no means to measure the positions taken in Hamburg; no mandate either to impose requirements on banks elsewhere; and no responsibility to help those banks if they get into difficulties.

It would be necessary to distinguish the measurement base by currency. Money markets are normally segregated by currency, and their functioning depends on whether there is a central bank able to provide a large amount or even unlimited liquidity. Thus, a separate minimum *slar* would be imposed for each (major) currency, measured on the basis of LMC by currency.¹⁵

In this connection, it would be essential that liabilities include items related to positions in relevant derivatives, for example, where a bank can be subject to margin calls. For macroprudential purposes, liabilities may include contingent off-balance sheet items.

E. Cross-border Consistency and Spill-overs

As noted above, the perimeter of institutions that would be subject to the MPLB requirement depends on the supervisory authority's legal mandate and the economic considerations that enter into the definition of the relevant measurement base. Thus, all domestic banks on a group basis, and hosted subsidiaries and branches in relation to their liabilities to residents would be subject to the same *slar*, by currency.¹⁶

The appropriate treatment of possibly divergent *slars* across countries will depend on supervisory and economic relations between those countries. Suppose first that both home and host supervisors are confident that neither will ever "ring fence" local liquidity, that is, that no authority would restrict the flow of liquidity, and also that no functioning parent bank would cut off funding to a subsidiary abroad. In that case, the coordination and mutual recognition of required MPLBs would be unproblematic: the MPLB held by a subsidiary in jurisdiction A can count towards the fulfillment of the group requirement because all SLAs are available to act as a buffer throughout the group. Thus, if the supervisor of jurisdiction A imposes a higher *slar* on a subsidiary of a foreign bank (along with other banks operating in that jurisdiction), the extra SLAs count towards the group requirement and the overall regulatory burden would be unaffected. Hence, supervisory policy in home country B would not be affected by the actions of jurisdiction A. Nor would there be a conflict of interests if the host supervisor imposes a lower *slar* on a subsidiary, because the home supervisor is concerned with group-wide funding.

¹⁵ For example, the MPLB for U.S. dollars to be held by Augsburg banks would relate to total U.S. dollar liabilities of banks that can obtain (dollar) liquidity from the Central Bank of Augsburg.

¹⁶ Possibly an MPLB should be applied to nonbank financial institutions that are important users of liquidity, that is, those that in this regard are systemically connected the way banks are.

The possibility of ring fencing creates more scope for tensions and may increase the regulatory and administrative burden of the proposed MPLB. If either home or host supervisor fears that the other may ring-fence liquidity in case of a severe crisis, then the SLAs located in that other jurisdiction cannot be viewed as available to act as a buffer elsewhere. Hence, each jurisdiction will want to impose a separate *slar*, and the constituents of a group may have to operate more on a stand-alone basis. The total MPLB requirement is unchanged so long as requirements are consistently based on liabilities towards residents of the respective jurisdictions, but the group will lose flexibility in the management of its assets. If one supervisor includes intra-group funding as part of the measurement base, then the total MPLB requirement will increase.

The cross-border provision of financing from abroad to the nonfinancial sector is not of direct relevance to systemic liquidity risk in the way it may be to credit risk and risk associated with asset price bubbles.¹⁷ There is no reason directly connected to systemic liquidity risk why the same *slar* should be applied to banks from different jurisdictions that lend to the nonfinancial sector in the same jurisdiction; they may be exposed to correlated credit risk, but not necessarily to funding risk. However, banks coming from a jurisdiction with a low *slar* may enjoy a competitive price advantage, which asymmetry may lead to conflicts between non-prudential interests.

F. Systemically Important Financial Institutions

Any SIFI add-on would have to be justified and calibrated depending on the degree of interconnectedness. In this connection, there may be nonbanks and especially non-bank SIFIs including perhaps central counterparties that should be required to hold a MPLB if they are major players in the market for liquidity.

G. Measurement and Holding Period

The specification for the period over which the LMC base is measured is largely a practical, system-specific matter. Monthly bank balance sheet data are normally available on a timely basis, but for macroprudential purposes a longer measurement period, which smoothes out seasonal factors and short-term fluctuations, seems more reasonable. In this, as in other regards, the MPLB is similar to a (traditional) reserve requirement, but with crucial differences in design purpose, and, therefore, calibration (Box 4).

¹⁷ If the nonfinancial sector is becoming excessively indebted, possibly in order to purchase over-priced assets, and the end of the lending boom may lead to a major crisis originating in the nonfinancial sector, then the authorities should be concerned with credit from all sources, including from abroad. It is sensible to impose targeted macroprudential measures on all suppliers of credit. In what is termed “reciprocity“ in EU jargon, the cooperation of supervisors abroad may be needed in order to impose the same measures on cross-border lending as on domestic lending.

Box 4. The Macroprudential Liquidity Buffer and Reserve Requirements

Reserve requirements share certain similarities with the proposed MPLB in that they link the holding of highly liquid assets to, and some countries have adjusted reserve requirements in response to, strain in funding markets. Nonetheless there are essential differences, starting from their respective motivations: the MPLB is meant to guard against systemic liquidity risk, while reserve requirements in a modern banking system are normally meant to serve monetary policy purposes (although, as noted in Box 1, they can and have been used for macroprudential purposes). It follows that the optimal calibration is very different (the required reserve ratio is often quite small or even zero, and typically stable; the *slar* varies depending on system-wide liquidity developments); as is the measurement base (deposit liabilities versus all liabilities minus capital); and eligible assets (central bank deposits versus systemically liquid assets).

The design and purpose of a reserve requirement are, unlike the proposed MPLB, compatible with a contemporaneous requirement, and with fulfillment of the reserve requirement on a period averaging basis (sometimes even with a carry-over from one period to the next). Because a reserve requirement depends only on a bank's own balance sheet, that bank can estimate its requirement very accurately on a near-real time basis, forecast its future reserve requirements, and manage its holdings of central bank deposits accordingly. In contrast, the MPLB is not so easy for an individual institution to predict, and so banks would benefit from more lead time in knowing their respective requirements.

The choice of length of the holding period during which a particular *slar* must be met needs to recognize a trade-off: a shorter period adapts to changing circumstances and raises the cost of window dressing, but a longer period yields more predictability for banks and thus may reduce the regulatory burden. The holding period need not be the same length as the measurement period; the *slar* could apply to a bank's LMC on a quarterly basis, for example, but be calculated based on aggregate developments over the previous year.

In any case, the requirement should be met on a daily basis. It would defeat the purpose of the MPLB requirement if on some days a bank could minimize its holdings of systemically liquid assets, perhaps for idiosyncratic purposes, and hold very large surpluses on other days. While shortfalls should not incur prohibitively costly penalties (see below), the MPLB requirement aims to ensure that a bank is well-prepared consistently and on a day-to-day basis able to absorb a shock coming from outside its own operations.

H. Penalties

A penalty should be imposed in case of non-compliance with the *slar*, but the penalty rate should not be so severe that banks do not use (part of) the SLAs even when system-wide liquidity is under strain. The aim is to have incentives to build buffers when possible, but not to penalize use of these buffers as the need arises.

Suppose that the alternative to holding SLAs is to lend to corporations or financial institutions in a way that will be illiquid in a crisis. Then an appropriate yet simple rule would be to set the

penalty interest rate, applied to daily shortfalls, equal to an official central bank rate plus a fixed surcharge that is in line with a typical credit spread.

The penalty rate should not increase when the interbank rate increases relative to the central bank rate, that is, when there is strain in funding markets; it is under those conditions when the buffer should be more usable. However, the timing of any penalty payment may be made conditional on the bank concerned making operating profits, and thus may be postponed in order to avoid an intensification of liquidity and profitability strains. The authorities could even waive penalties (in effect releasing the requirement) in periods when crisis conditions prevail, in order not to burden banks unduly and to reduce incentives for liquidity hoarding, although the announcement of crisis conditions may itself be destabilizing.

The specific design and calibration of the penalty rate would have to depend on the way the *slar* is computed and calibrated, and other considerations such the balance between systemic and idiosyncratic shocks. A strict penalty can be viewed as a substitute for a high requirement: if the required MPLB is low, it is generally more important to ensure that banks meet it by imposing a costly penalty for shortfalls.

I. Publication

Individual banks' MPLB stocks (and their payment of related penalties) should not be made public, or at least not without a long lag. One central element of the MPLB is its usability in case of need, so a draw-down of a buffer should not in itself give rise to a negative signal. Also, systemic stability is served if banks with strong systemic liquidity do not attempt to accumulate liquidity at the expense of others by being able to boast of their over-fulfillment of the MPLB requirement. Hence, MPLB balances, like individual reserve requirement balances, should be treated confidentially.

The aggregate stock of (domestic) SLAs can be estimated from the monetary survey and related sources, but the estimate would not be exact: not all assets in a statistical class may be recognized as systemically liquid, and information on holdings of foreign SLAs would not generally be published.

J. Calibration

One approach to calibrating the MPLB would be to use data from many countries and over many years, and calculate what the MPLB would have been for different values of ϑ and γ . The level of the buffer on the eve of various financial crises, and over cycles, may provide a sense of appropriate values. Additionally, conducting Monte Carlo simulations of hypothetical crisis and near-crisis-situations (derived from top-down liquidity stress testing techniques, and perhaps with crises timing triggered by some random event) may be worthwhile.

In this connection, it is worth recalling that financial "cycles" tend to be of longer duration than conjunctural cycles; vulnerabilities and precarious imbalances may build up over the better part

of a decade, rather than the half-decade periodicity typically found in business cycles. Therefore, calibration should be based on a long sample, where account is taken of structural changes. For jurisdictions with a limited history of reliable data, results from other jurisdictions will be especially informative.

Intuition suggests that, the more systemically interlinked is the financial system and the more it relies on short-term funding, the higher should be the average, through-the-cycle MPLB level. At one extreme, consider a banking sector where each bank has its own “captive” source of financing, with no interbank activity or possibility for nonbank creditors to switch funding between banks. In such a case, the banking system does not function as an interlinked system, and there is scant need for macroprudential measures. At the other extreme, where banks rely very heavily on mobile funding, the scope and cost of contagion are great, higher buffers are appropriate.

IV. CONCLUDING REMARKS

Liquidity is a systemic concept, and a disruption to liquidity availability is a central element in the origination or amplification of systemic financial crises. Hence, macroprudential policy should consider how to address this risk: how to reduce the probability of a liquidity crisis, and how to dampen its effects. A macroprudential liquidity instrument would be well-targeted at a truly system-wide objective. The MPLB proposed here offers one approach to these ends, and is designed to be effective, efficient, and robust. It is thus meant to meet the desiderata for a (macroprudential) policy instrument.

A next phase of the discussion of the macroprudential approach to liquidity risk would involve a comparison of the various available proposals, including through empirical “back testing” of their possible effects across a range of countries and episodes using detailed, high frequency bank-by-bank data available to national authorities. To this end, the various approaches would need to be calibrated. Another empirical question is whether there is a sufficient supply of systemically liquid assets that can comprise the buffer, and also be available for other purposes such as acting as collateral in active financial markets. The liquidity characteristics of bank assets and liabilities are indeed dependent on circumstances, but maintaining systemic liquidity is so important for financial sector and macroeconomic stability that the search for a practical instrument to this purpose is urgent and worth the effort.

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