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ECB Task Force on Systemic Liquidity

Systemic liquidity concept,
measurement and macroprudential
instruments

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Abstract

This study provides a conceptual and monitoring framework for systemic liquidity, as well as a legal assessment of the possible use of macroprudential liquidity tools in the European Union. It complements previous work on liquidity and focuses on the development of liquidity risk at the system-wide level. A dashboard with a total of 20 indicators is developed for the financial system, including banks and non-banks, to assess the build-up of systemic liquidity risk over time. In addition to examining liquidity risks, this study sheds light on the legal basis for additional macroprudential liquidity tools under existing regulation (Article 458 of the Capital Requirements Regulation (CRR), Articles 105 and 103 of the Capital Requirements Directive (CRD IV) and national law), which is a key condition for the implementation of macroprudential liquidity tools.

Non-technical summary

In December 2010 the Basel Committee on Banking Supervision (BCBS) announced the introduction of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) to be put in place in 2015 and 2018, respectively. In the European Union (EU), the LCR became a binding requirement in October 2015, while for the NSFR there is currently no fixed implementation date. These requirements are important steps to improve banks' resilience to liquidity shocks. However, they focus on individual banks, without taking into account liquidity risks and mitigation from a macroprudential perspective. Therefore, the Financial Stability Committee of the European Central Bank (ECB) agreed in 2016 that work on systemic liquidity would be carried out by a dedicated group.

The Task Force on Systemic Liquidity (TFSL) was set up to examine systemic liquidity risk and potential policy responses. Its objective was to develop a framework that measures systemic liquidity and helps to identify the need for macroprudential liquidity instruments from both a risk and a legal perspective. The TFSL focused on the macroprudential level to provide a broader view of liquidity developments and to facilitate the monitoring of potential build-ups of liquidity risks at system level. The following report is split into four main parts that provide the necessary foundation for assessing systemic liquidity risk.

The first part establishes a concept of systemic liquidity and develops a case for considering macroprudential liquidity instruments. It builds upon the definition of systemic liquidity developed by the International Monetary Fund (IMF, 2011), explaining that systemic liquidity risk occurs when multiple financial institutions experience financial difficulties at the same time. This concept stresses the idea that when liquidity problems are systemic, they can have adverse consequences on the stability of the financial system and on the real economy. This situation is often characterised by firms taking on excessive liquidity risk through over-reliance on short-term wholesale funding. In this report, systemic liquidity risk is defined from a macroprudential perspective, meaning that it is considered an endogenous response by the system, rather than a given exogenous event. Because of the possibility of public intervention (i.e. bailouts) in the event of a crisis, this concept is also strongly related to a collective moral hazard issue, as banks do not fully internalise the risks of a systemic event by holding more liquidity buffers.

The second part of the report discusses the microprudential liquidity tools available and the potential to use them for macroprudential objectives. Existing microprudential measures such as the LCR and NSFR are not completely suitable for mitigating systemic liquidity risk. In particular, they ignore the importance of the cross-sectional dimension of systemic liquidity risk: interconnectedness and contagion effects. The liquidity buffers are likely to increase concentration risks and the

interconnectedness of the system during the upswing.¹ The increasing pressure on asset prices and the required build-up of liquidity buffers, as specified by the LCR and NSFR, may result in severe asset fire sales. In response, stricter capital requirements have been introduced by regulators to reduce interconnectedness. However, this does not address the issue of concentration or the role of liquidity hubs. In addition, these measurements only apply to the banking sector, and therefore do not prevent systemic liquidity risk from building up in other parts of the financial system (i.e. non-bank intermediaries). As a result, new macroprudential liquidity measures that directly target systemic liquidity risk may be warranted.

The third part of this report analyses the legal basis for macroprudential liquidity requirements under current regulation. An examination of the legal basis of macroprudential liquidity tools is a key contribution of this report, which aims to provide clarity on the availability of macroprudential tools from a legal perspective. To answer this complex question, the TFSL consulted various parties on the interpretation of Article 458 of Regulation (EU) No 575/2013 (CRR) and national law. However, some open questions, which are beyond the mandate of the TFSL, still remain. Therefore, the TFSL proposes to conduct a formal legal assessment of these issues.

Article 458 of the CRR is considered to provide the primary legal basis for macroprudential liquidity tools. According to Article 458 of the CRR, national authorities can introduce any measure that mitigates the intensity of risk and, concerning the liquidity requirements laid down in Part Six of the CRR, as long as the measure is stricter than those in Part Six and the risk cannot be addressed by Articles 124 and 164 of the CRR and Articles 101, 103, 105, 133 and 136 of Directive 2013/36/EU (CRD IV).

In principle, Article 458 of the CRR allows national authorities to introduce measures that are different from the already existing liquidity requirements.

However, the scope for new macroprudential liquidity tools is likely to be limited since: (1) it might be difficult to prove that alternative measures are stricter (i.e. new measures might not be comparable to the LCR and NSFR and it might therefore be difficult to determine if they are stricter, which is a necessary condition for applying Article 458 of the CRR); (2) modifications to the LCR and NSFR could cover most of the liquidity spectrum, thereby reducing the need to introduce new measurements; (3) a level playing field must be maintained within the Internal Market, as recommended by the European Banking Authority (EBA, 2014), which could make it difficult for different countries to introduce new measures. Therefore, any potential new measure would most likely be a stricter version of the LCR or the NSFR.

While maintaining a level playing field is important, it is also necessary for national authorities to have sufficient flexibility to target systemic liquidity risks. Owing to the complexity of systemic liquidity risk, the TFSL considers that some flexibility in the implementation of Article 458 of the CRR is crucial to ensure that

¹ Concerning the interconnectedness of financial intermediaries, these liquidity requirements are designed to reduce the incentives for banks to hold long-term intra-financial assets and to be funded by intra-financial short-term liabilities.

national authorities have the legal power to mitigate systemic liquidity risk that requires immediate action. Furthermore, the lack of experience regarding the use of the LCR and NSFR and the risks that may arise, which may not be covered by these instruments, may warrant new macroprudential liquidity measures. Therefore, the possibility of maintaining and introducing national liquidity or funding measures to safeguard financial stability is essential to enable national authorities to take timely action to prevent crisis situations. To ensure consistency, the TFSL recommends carrying out an additional legal assessment of Article 458 of the CRR and of the potential for national authorities to apply national measures on liquidity other than those laid down in Part Six of the CRR and therefore outside the scope of Article 458 of the CRR.

Furthermore, the lengthy and onerous activation and notification procedure under Article 458 of the CRR may not allow for a proactive and timely use of instruments, thereby hampering the effective use of macroprudential policy.

This is pointed out in the ECB's contribution to the European Commission's consultation on the review of the EU macroprudential policy framework.² The TFSL recognises that the lengthy activation of Article 458 of the CRR might not always be needed, as in the case of Cyprus, where only a minimal alteration to the LCR was required.³ However, this process might be significantly longer for proposals with greater alterations to the existing liquidity instruments under Part Six. Therefore, Article 458 of the CRR should be amended in such a way as to ease the burden of notification to facilitate implementation and accelerate the mitigation of risk.⁴

In addition, the TFSL considers that clarification on the separation of Pillar 2 and macroprudential measures is also needed to reduce the overlap of macroprudential and microprudential objectives. However, it is important to note that a clear-cut distinction between the microprudential and macroprudential use of instruments may not be always possible and Pillar 2 can effectively be used for the same types of risks at several institutions at once. To fully mitigate systemic liquidity risk, regulators must have a solid legal base that allows for the seamless implementation of macroprudential liquidity measures that target both the cyclical and structural dimensions of liquidity risk.

The fourth part of this report develops a set of indicators for measuring system-wide liquidity risks. The focus is on the cyclical dimension of systemic liquidity to support policy discussions about potential countercyclical elements of existing liquidity measures or the need for new instruments. A total of 20 indicators were developed. Four criteria were used to analyse the indicators: (1) ability to capture systemic liquidity; (2) scope; (3) crisis signalling; (4) data availability. The indicators focus on developments in systemic liquidity risk in the bank and non-bank financial

² ECB (2016b). ECB contribution to the European Commission's consultation on the review of the EU macroprudential policy framework.

³ Cyprus introduced an LCR add-on under Article 458 of the CRR at the beginning of 2018 to contain excess liquidity, which could arise from the abolition of stricter national liquidity measures due to the full phase-in of the LCR at the beginning of 2018. This add-on is expected to be phased out during 2018.

⁴ However, the fact that there have already been four cases in which macroprudential measures have been activated under Article 458 of the CRR (Belgium, Cyprus, Finland and France) readily demonstrates that these measures can effectively be used.

sectors at country level. As liquidity risks can build up both within the national perimeter and across borders, a national focus does not necessarily enable the origin of liquidity risk to be determined. In this regard, future work should also consider including indicators measuring the cross-border dimension of liquidity risk. For example, ECB (2016a) shows that bank intragroup transactions represent the majority of cross-border lending and thus merit particular attention.

The fifth part of this report illustrates, via several case studies, the usability of the dashboard and presents possible extensions to the indicators created.

Since the dashboard shown is most useful when compared across time, long time series data showing the change in liquidity risk across different market conditions and different points in the business cycle are essential. Therefore, although the dashboard indicators are deemed useful at this stage, they are generally hampered by the lack of long time series and data granularity. Another issue is that, in some cases, qualitative background information on national circumstances and developments is required to complement the interpretation of the indicators. In addition, the dashboard is more likely to reflect vulnerabilities in the banking system rather than in the non-banking sector. Finally, systemic liquidity risks might be masked by the current accommodative monetary policy stance in the euro area, as it could contribute to the emergence of a liquidity illusion, therefore impairing the timely identification of risks. Thus, the fourth part of the report also discusses possible extensions to the dashboard indicators.

Taking into account the usability of the dashboard with its current limitations, the TFSL proposes using the dashboard as a reference tool for monitoring liquidity risk conditions and monitoring its effectiveness in the next two years.

While a case for new macroprudential liquidity tools cannot yet be made from a risk perspective, primarily due to the lack of data availability and granularity, as well as the current highly accommodative monetary policy stance, the TFSL is of the opinion that the dashboard can be used to provide quantitative evidence of changes in the intensity of systemic liquidity risk conditions while improving the set of indicators.

1 Systemic liquidity

1.1 The general concept of systemic liquidity

The IMF (2011) defines systemic liquidity risk as the “risk of simultaneous liquidity difficulties at multiple financial institutions”. These difficulties can prevent institutions from refinancing debt and/or obtaining new funding, which may disrupt the functioning of financial intermediation and impair the provision of credit to the real economy, warranting the intervention of the central bank. Systemic liquidity has four main features: (i) it is conditioned by the phase of the financial cycle and as a result is an endogenous concept; (ii) it is characterised by a liquidity illusion effect in the upswing phase of the financial cycle; (iii) it is driven by the interconnectedness within the financial sector and financial markets, which amplifies the consequences of liquidity shortfalls; and (iv) it is highly correlated with capital leverage (Houben et al., 2015).

Excessive liquidity risk-taking by multiple financial intermediaries can have adverse consequences on financial stability and the overall economy.

Over-reliance on short-term wholesale funding, as well as common (i.e. correlated) balance sheet exposures can result in liquidity shocks at one bank spilling over to other financial institutions and markets, thereby aggravating system-wide liquidity stress. This systemic component was arguably underestimated in the period before the global financial crisis. Going forward, a comprehensive macroprudential approach may therefore be necessary to mitigate systemic liquidity risk and minimise the propensity for banks to collectively underprice this risk in good times.

A high level (significant increase) of intra-financial assets (i.e. securities holdings issued by other financial institutions) in the balance sheets of financial institutions could indicate a deterioration in their liquidity risk-bearing capacity. Large holdings of debt instruments issued by other financial institutions make a bank more interconnected with other banks. First of all, reliance on entities of the same sector implies faster-spreading contagion effects in a difficult market situation. Banks could simultaneously face difficulties in issuing debt and declining asset prices, i.e. problems with both market and funding liquidity. In the event of systemic liquidity stress (i.e. a liquidity stress situation affecting the financial sector as a whole), concentrated asset holdings may make the situation worse.

In addition to funding liquidity risk, systemic liquidity risk also includes market liquidity risk. Funding liquidity and market liquidity risk are directly linked, as traders' ability to provide market liquidity is completely dependent on the availability of funding (Brunnermeier and Pedersen, 2009). Without the necessary funding, traders are less likely to take on capital-intensive positions, lowering market liquidity as a result. This contributes to systemic liquidity risk, as financial institutions are more likely to experience financial difficulties when liquidity in markets completely evaporates owing to their inability to easily exit positions.

Systemic liquidity risk is strongly related to a collective moral hazard issue.

Owing to public intervention to prevent the collapse of the financial system, banks do not fully internalise the risk of a systemic event by holding more liquidity buffers (IMF, 2011; Farhi and Tirole, 2012). Bonfim and Kim (2014) stress the incentives for collective liquidity risk-taking in banking (i.e. herding behaviour) as a result of the explicit or implicit guarantees provided by the lender of last resort. Silva (2016) finds that banks' liquidity and maturity mismatch decisions are indeed strongly affected by the respective choices of competitors and shows that these strategic funding liquidity decisions increase both individual banks' default risk and overall systemic risk.⁵

From a macroprudential point of view, liquidity is endogenous. From the perspective of a single financial institution, market liquidity and asset liquidity, and their corresponding prices, are exogenously given. Banks therefore take refinancing and investment decisions based on these. However, from a macroprudential point of view, liquidity is endogenously determined, and market and asset liquidity, as well as the price of liquidity and liquidity risk are functions of the state of the financial system. Conceptually, (systemic) liquidity risk can be divided into two dimensions: a time and a cross-section dimension.

1.2 Time dimension of systemic liquidity risk

Along the time dimension, periods of abundant liquidity can increase institutions' liquidity risk-taking (see Figure 1). During a boom phase, the financial system can suffer from a liquidity illusion. At this stage, indicators of funding and market liquidity tend to suggest low liquidity risk, causing investors to regard their own liquidity risk exposure as low. Issuers also regard it as low because funding and market liquidity are abundant. In response, individual investors and issuers increase their liquidity risk exposure, reducing their liquidity risk-bearing capacity.

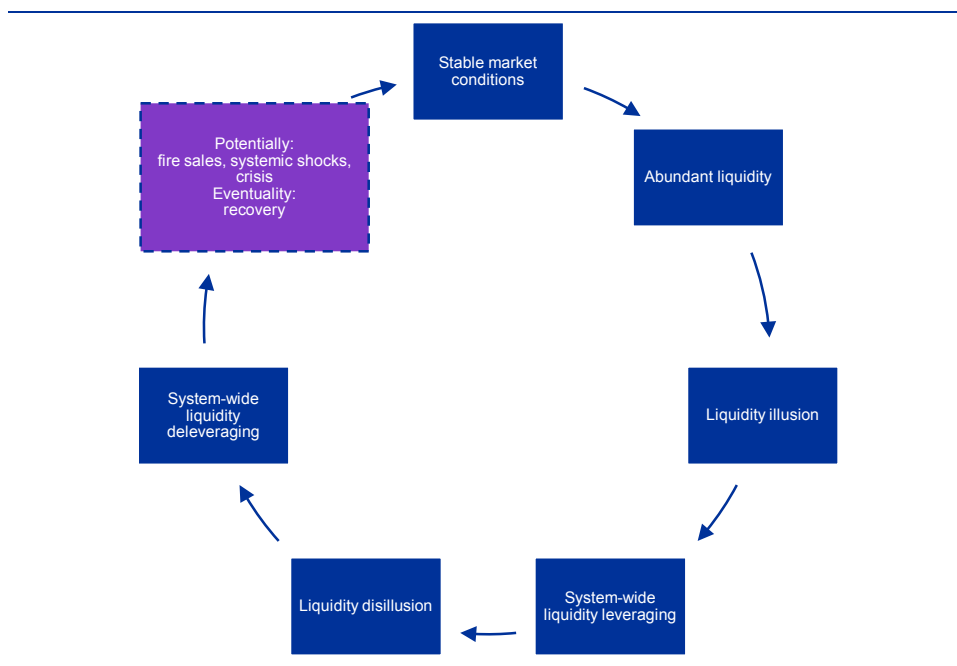
The liquidity illusion affects both sides of the balance sheet. As behavioural maturities are much longer than contractual maturities – at least, for as long as the upturn lasts – banks' liabilities are affected. This leads to increasing “liquidity leverage”, as a shrinking share of stable (i.e. under stress) liabilities finance an increasing share of illiquid assets. Owing to benign market liquidity conditions, banks' internal models signal higher liquidity risk-bearing capacity and the composition of internal liquidity buffers shifts towards assets that are less liquid under stress. The build-up of liquidity risk exposure follows similar dynamics to capital leverage.

Systemic liquidity risk increases throughout the financial system and may materialise when the liquidity illusion evaporates. Issuers and investors aim to reduce liquidity leverage, which forces them to increase liquidity reserves, lengthen own funding, and shorten debt maturities. At the same time, financial institutions want to increase solvency to improve their funding conditions and investors want to de-risk

⁵ As theoretically shown by Allen et al. (2012), common bank exposures may have a huge adverse impact on the stability of the financial system owing to the higher correlation of defaults and the amplification of the impact of liquidity shocks.

(Brunnermeier and Pedersen, 2009). These opposing reactions reduce liquidity leverage, which may prompt asset fire sales that precipitate losses in the financial intermediation chain, therefore fuelling systemic risk. As liquidity shocks have an impact on solvency and vice versa, liquidity leverage and capital leverage interact, which increases the vulnerability to shocks (Puhr and Schmitz, 2014; Schmitz et al., 2016).

Figure 1
Stylised liquidity cycle



Indicators and analytical tools that capture the systemic liquidity cycle are essential to gauge and monitor the time dimension of systemic liquidity risk.

Indicators should include banks' contractual and behavioural cash-flow data, as well as the length of the re-hypothecation chain, the level of haircuts in repo transactions, margin calls on derivatives exposures and the spreads of bank funding in unsecured markets (money market, unsecured bond markets). A possible next step is to run integrated stress tests. Macroprudential liquidity stress tests provide insights into the liquidity risk exposure and liquidity risk-bearing capacities of banks (and other financial intermediaries) under scenarios of sudden deterioration of systemic liquidity (Schmitz, 2015). Well-designed stress tests uncover the underlying variation in liquidity leverage over the cycle, as they provide an integrated view of the various components of systemic liquidity (i.e. funding and market liquidity) and their interaction in a common framework.

1.3 Cross-sectional dimension of systemic liquidity risk

There is an important cross-sectional component in the build-up of systemic liquidity stress and its materialisation. Markets are often characterised by

centralised networks with few liquidity hubs, to which the rest of financial institutions are directly linked (e.g. Upper and Worms, 2004; Inaoka et al., 2004; Soramäki et al., 2006; Van Lelyveld and Liedorp, 2006). Liquidity shortages in liquidity hubs can disrupt the flow of liquidity throughout the financial system. Their reactions to liquidity problems, such as stops to roll-over funding, have a larger impact than similar actions by smaller, less connected institutions. In the extreme, the action of those systemic liquidity providers may translate into asset fire sales.

Systemic liquidity providers might not account for the externalities they impose on the rest of the system. They choose their liquidity risk exposure and risk-bearing capacity without necessarily taking into account the costs that they might impose on other market participants. System-wide contagion occurs more frequently when “core liquidity providers” are affected (Gai et al., 2010). The failure of banks as liquidity providers was the central reason for the financial system fragility during the 2007-09 financial crisis (Acharya and Mora, 2015). The ability of “key players” to provide liquidity during a financial stress situation is thus central to avoid a systemic liquidity crisis.

Direct interconnectedness, often via reliance on short-term unsecured funding, constitutes another source of systemic liquidity risk. Direct interconnectedness is defined as all the linkages between financial institutions via loans, commitments, ownership, financial transactions or other forms of direct relationships. The unsecured or secured money markets are the predominant modes of interlinking different financial institutions (nodes) in terms of funding liquidity. The changing behaviour of an individual node in the market can have repercussions beyond its direct counterparties. The unsecured money market, in particular, is fragile under stress. Specifically, when the structure of the market changes, breadth and depth decrease, which in turn can lead to the withdrawal of further market participants (Schmitz, 2013; Halaj and Kok, 2015). Similarly, common exposures to particular asset markets can constitute a source of systemic risk. If most banks hold asset-backed securities in their counterbalancing capacity and the market dries up, the impact is likely to be systemic.

Finally, indirect contagion is a powerful component of a systemic liquidity crisis. Indirect contagion occurs when the failure of a financial institution triggers financial distress at other financial institutions with no direct linkages. It might thus make it more difficult to assess systemic liquidity risk, as the failure of a small market – e.g. the US sub-prime credit market in 2007 – can sometimes develop into a systemic crisis. Several factors explain how indirect contagion might occur: exposure to common assets, fire sale externalities, information spillovers, margin calls and haircuts (Gorton and Metrick, 2012; ESRB, 2016a). Another form of indirect contagion can materialise via asset concentration, which may be caused by existing microprudential requirements (i.e. many institutions holding the same assets). When several banks want to simultaneously liquidate (even the most liquid) assets, they might not always be able to do so because the markets might not be deep enough at that point of the liquidity cycle.

The cross-sectional and time dimensions are likely to reinforce each other, making liquidity buffers less effective. The liquidity illusion during boom phases incentivises financial institutions to fund more activities with short-term wholesale

funding. According to the LCR and NSFR, banks are required to offset increased risks on the liability side with more liquid assets. However, short-term wholesale funding increases the level of interconnectedness and the role of liquidity hubs. Moreover, the build-up of liquidity buffers may fuel systemic liquidity risk when these buffers are insufficiently diversified, giving rise to indirect contagion. Hence, while the LCR and NSFR are not pro-cyclical on their own, they do not address the cyclical build-up of the cross-sectional dimension. An “inflated” cross-sectional dimension makes liquidity buffers less likely to be effective, presumably leading to more severe fire sales with adverse consequences for financial stability.

1.4 Interaction between capital and liquidity

The interaction between capital and liquidity is relevant in the macroprudential context (BCBS, 2015; BCBS, 2016). Before the financial crisis, regulators relied on capital regulation to safeguard the safety and soundness of banks. The focus on capital was based on the view that capital and liquidity are substitutes. According to this view, the availability of a broad set of capital-based macroprudential tools may thus suggest that macroprudential liquidity tools are redundant. The financial crisis, however, demonstrated that capital and liquidity are complementary and that capital regulation alone is insufficient to ensure the soundness of a bank. The next two sections provide an overview of the literature on the interaction between capital and liquidity to facilitate a better understanding of the need for liquidity-based macroprudential tools.

1.4.1 Link between capital and liquidity risks

A sudden decrease in asset prices causes margins and haircuts to spike when they are posted as collateral, which increases funding requirements for banks, precisely when their capital leverage is high (Brunnermeier and Pedersen, 2009). The latter increases their funding costs and/or reduces their access to funding markets. In response, they will decrease liquidity and capital leverage and sell assets. This will decrease prices further and increase margins, creating a vicious cycle. Moreover, the weaker (i.e. more leveraged) bank balance sheets are, the greater the impact of a price decrease and the larger the downward pressure of further sales on asset prices.

The vulnerabilities are built up during good times through an increasing reliance on short-term funding. The crisis showed that banks that relied heavily on short-term funding suffered from the rapid reversal in the availability of liquidity, with collective withdrawals triggering generalised funding disruptions (Huang and Ratnovski, 2011). These banks built up leverage during good times; as asset prices increase, leverage decreases and banks have an incentive to take on additional (short-term) debt to invest. Hence, the relation between liquidity and leverage is accompanied by increasing leverage during good times and decreasing leverage during bad times (Adrian and Shin, 2010). This cycle occurs mostly through secured wholesale funding, such as repos, as leverage becomes more procyclical during times

of increased liquidity in the short-term wholesale funding market (Damar et al., 2013). During market disruptions, it becomes more likely that banks will be unable to roll over those funds. As a result, they will be forced to fire-sell illiquid assets and contract lending. The over-reliance on short-term wholesale funding makes banks more vulnerable to a loss of market confidence, creating the potential for a bank to fail in an extraordinarily rapid manner. Because other financial firms (banks and non-banks) are important providers (inside liquidity) of this type of funding, the over-reliance on short-term wholesale funding creates a channel through which the effects of individual failures are widely propagated throughout the broader financial system.

Banks' capital positions can influence their liquidity risk positions and vice versa. Pierret (2015) models the nexus between solvency and liquidity risk of banks and finds an asymmetric relationship: higher solvency risk limits the access of the firm to short-term funding but a firm with more liquidity risk exposure has a higher risk of insolvency in a crisis. Similarly, De Haan and van den End (2013) find that Dutch banks reduce wholesale lending, take on more liquid bonds and sell securities in response to negative funding shocks. In addition, Duijm and Wierdsma (2016) find a pro-cyclical pattern in the liquidity ratio of Dutch banks that strongly correlates with leverage. Both the regulatory (risk-weighted) capital ratios and the liquidity ratio did not signal the build-up of aggregate risks around the years 2007/2008.

Neglecting the interaction of solvency and liquidity can severely underestimate the impact of stress on the stability of individual banks and the banking system. In Pühr and Schmitz (2014), the liquidity to solvency link runs through both a cost of funding shock and asset fire sale losses. Simulations of an illustrative credit and financial market scenario show that the overall impact would have been underestimated by one-third if the solvency stress test were run in isolation. Asset fire sales turn out to be the main interaction channel from liquidity to solvency, contributing 25% to the total loss in the solvency stress test. However, parameter uncertainty is high with regard to asset fire sales. In the liquidity stress test, the isolated impact of liquidity shocks accounts for about 54% of the decline in banks' counterbalancing capacity. A loss of market access is the most important interaction channel from liquidity to solvency.

Higher leverage makes the impact of a turning cycle more severe. During an upswing, higher liquidity risk exposure coincides with increasing leverage. When the cycle turns ("liquidity disillusion"), highly leveraged institutions are more likely to be forced to deleverage and hence to conduct fire sales. Such an accelerating effect becomes even more severe when there is an additional interaction with the cross-sectional dimension (e.g. the institution in question is a liquidity hub).

1.4.2 Substitutability of capital and liquidity-based instruments

Liquidity and capital requirements complement each other closely due to the asset quality effect of capital requirements. Covas and Driscoll (2014) consider a model where banks provide loans to entrepreneurs and hold riskless assets, both financed by equity and deposits. In their set-up, imposing liquidity requirements

triggers an increase in banks' equity (as well as an increase in holdings of riskless assets), and capital requirements increase holdings of riskless assets (as well as increasing banks' equity). The directional impact on loan provisions of the two types of requirement is similar. Walther (2016) and Kara and Ozsoy (2016) investigate the optimal design of bank regulation and the interaction between capital and liquidity requirements in models characterised by fire sale externalities. They show that liquidity requirements that complement capital regulations can ensure efficiency and improve financial stability. Several empirical papers show that increased holdings of high quality assets reduce credit risk.⁶

The US framework for global systemically important banks (G-SIBs) implicitly assumes that capital can address liquidity risks. One of the indicators in the US G-SIB framework is based on banks' reliance on short-term wholesale funding.⁷ As banks' reliance on particular types of funding is addressed with capital, it is implicitly assumed that capital can address liquidity risks.

The introduction of the LCR and NSFR was motivated by the fact that capital cannot fully mitigate liquidity risks. In the aftermath of the financial crisis, it became clear that shortcomings in liquidity risk management and supervision were a key cause of the crisis. Financial institutions had experienced difficulties when markets shut down, some despite having appropriate capital levels since they could no longer attract new funding. As a result, the ECB, in its role as the LOLR⁸, provided ample liquidity to the interbank market. While the LOLR is best placed to deal with liquidity risk in a situation where banks are solvent but liquidity risk is driven by a deterioration in the liquidity of the markets that these institutions depend on for funding, it can create moral hazard issues if the solvency of institutions cannot be determined with certainty. Typically, liquidity shortfalls are a combination of both of these shocks, making it hard to distinguish between institutions that are illiquid and insolvent since the quality of a bank's balance sheet is difficult to assess during stress.

Therefore, liquidity regulation is needed to reduce banks' reliance on the LOLR and mitigate some of the distortions of public liquidity backstops. Otherwise, LOLR interventions might end up bailing out insolvent banks and encouraging excessive risk-taking *ex ante*. Hoerova et al. (2018) provide empirical evidence that show that the proposed policy tools after the financial crisis, namely the LCR and the NSFR, could have reduced the amount of public liquidity given to banks during the financial crisis. However, they also highlight that the existence of liquidity regulation, although beneficial and low-cost, would not have entirely prevented the need for public liquidity assistance, thus the function of the LOLR is still considered relevant and complementary to liquidity regulation. This complementary relationship is illustrated in Carlson et al. (2015), where the authors argue that liquidity regulations are valuable since they provide banks with an incentive to internalise some of the externalities associated with a liquidity crisis but at the same time emphasise that the role of the

⁶ See, for instance, Banerjee and Mio (2015), Duijm and Wierds (2016) or Bonner (2015).

⁷ See Federal Reserve System (2015).

⁸ Lender of last resort.

LOLR remains necessary in the presence of systemic shocks when sound institutions get into liquidity problems due to problems with market liquidity.

Moreover, in the absence of liquidity regulation, minimum capital requirements would have to be higher to achieve the same level of bank shock resilience, which is very costly. In Puhr and Schmitz (2014), the effect of a sudden loss of short-term wholesale funding on capital is lower for banks that hold relatively higher shares of their counterbalancing capacity in the form of high quality liquid assets (HQLA) (i.e. central bank reserves and sovereign bonds) compared to banks that hold it in the form of less liquid assets (i.e. credit claims). In order to adjust to the liquidity shock in the model, banks sell assets in their counterbalancing capacity. The P&L effects are relatively lower for HQLA, especially for CB reserves and sovereign bonds than for non-HQLA assets. They are also lower when there is less reliance on unsecured wholesale funding. Thus, the introduction of the LCR reduces the risk of solvency shocks due to asset fire sales, and banks can operate relatively lower capital levels, *ceteris paribus*.

In a related paper, Schmitz et al. (2017) focus on the interaction between funding costs and solvency. They find that solvency shocks are likely to increase funding costs, which, in turn, negatively affect the solvency ratio. The effect is higher for banks with larger maturity mismatches and more unsecured short-term wholesale funding. This finding is corroborated by the findings of the euro area FSAP 2018 (p. 119)**: “The impact of the feedback effect of funding costs on the CET1⁹ ratio is heterogeneous across banks in the sample. It is higher for banks with: (i) a higher asset liability mismatch; (ii) a higher share of unsecured wholesale funding; (iii) a lower risk density; (iv) a lower volume of repriceable loans; (v) with less pricing power in loan markets (a lower pass-through rate of higher funding costs on loans).” All other things being equal, the LCR and the NSFR reduce the maturity mismatch as well as the share of unsecured wholesale funding and thus reduce the likelihood of such negative feedback effects at a given level of capitalisation. Overall, in the absence of minimum liquidity requirements, bank capitalisation would have to be substantially higher to absorb negative feedback effects between liquidity and solvency.

1.5 Systemic liquidity and monetary policy

Monetary and macroprudential policy complement and need each other.

Monetary policy is best implemented during stable financial market conditions without liquidity shortages or excesses. To ensure such an environment of financial stability, a macroprudential liquidity policy is necessary. In a crisis situation, monetary policy could, in turn, play an important role in contributing to financial stability.

The use of macroprudential policy tools for liquidity may have effects on the implementation of monetary policy and on the transmission mechanism.¹⁰

These effects may be supportive of the implementation but may also alter the

⁹ Common Equity Tier 1.

¹⁰ See European Systemic Risk Board (2014).

transmission mechanism due to the incentives set by potential tools to hold more liquid assets and to rely on more stable sources of funding. For example, Choi and Velasquez (2016) argue that liquidity regulation could revive the bank lending channel given the limitations to replace deposits with wholesale funding during monetary tightening.

The central bank policy rate and asset purchase programs affect systemic liquidity. The level of the interest rate, as determined by the central bank, has an impact on asset prices and the availability of liquidity. An accommodative monetary policy stance can contribute to the emergence of a liquidity illusion, which could impair the timely identification of systemic liquidity risks. At the same time, an accommodative monetary policy stance can dampen the negative impact of a liquidity illusion. Similarly, asset purchase programs can have a positive impact on the liquidity of an asset and thus counteract fire sales. In addition, asset purchases increase the liquidity of certain assets when selling but reduce the options to buy others. When monitoring the liquidity cycle, it is therefore important to do so in conjunction with current monetary policy measures. If applicable, it should be aligned with monetary policy, and an impact assessment should be conducted prior to the use of macroprudential liquidity tools.

During a liquidity crisis, central banks can provide the last source of exogenous liquidity and thereby support macroprudential policy. Central bank money is the most liquid asset in the economy. Thornton (1802) argued that central banks can provide exogenous liquidity to the market to prevent contagion of liquidity problems at individual banks. Thornton assumed that other market participants could not exploit the underpricing of assets in asset fire sales due to liquidity constraints. Once these were eased by the central bank, the illiquid bank would exit the market, but the negative repercussions on the financial system and the real economy would be addressed by enabling the remaining, solvent banks with sufficient high quality collateral to buy the assets of the failing banks. This would limit the price effects of asset fire sales, reduce the losses of the creditors of the failing banks, and reward the more prudent remaining banks. However, the lender of last resort can also lead to important moral hazard issues (Farhi and Tirole, 2012).

While bank bailouts can alleviate stress during a liquidity crisis, they have unintended negative consequences. An alternative to liquidity provision is a bailout of the failing institution (Bagehot, 1873). In theory, under restrictive assumptions, the bailout of individual financial institutions that face liquidity problems can lead to efficiency gains (e.g. by preventing asset fire sales). However, there are a number of arguments against such bailouts (BCBS, 2014a). First, they conflict with the *raison d'être* of liquidity regulation. The latter aims to internalise the externalities associated with liquidity risk by forcing banks to self-insure against liquidity risk. If the central bank provides that insurance for free, liquidity regulation is redundant. Second, the effectiveness of a central bank bailout can be quite low, for example when there is a substantial share of debt denominated in foreign currency.

2 Systemic liquidity tools

2.1 Macroprudential liquidity tools in the literature

In recent years, several proposals have been made by institutions and academics to design indicators and policy instruments that emphasise a macroprudential perspective to regulating liquidity in the financial system.

These proposals fall into two categories: first to extend existing microprudential instruments such as the LCR or the NSFR to make a macroprudential view more explicit by incorporating countercyclical elements that could prevent significant imbalances in the financial system and the real economy (see ECB (2014)). The suggestions in the second group are not directly related to existing microprudential measures but comprise stand-alone macroprudential instruments that are typically meant to complement microprudential regulation.¹¹

Proposals that extend or accompany existing microprudential measures focus on introducing time-varying elements or simplified, supplementary indicators.

The ESRB¹² proposes an extension of the LCR and NSFR requirement to include time-varying buffers. The idea is analogous to the countercyclical capital buffer: during a cyclical upturn, an additional macroprudential buffer could be added on top of the minimum microprudential requirements. In times of institution-specific or market-wide periods of stress, institutions may draw on their liquidity buffers, such that, for instance, the 100% LCR requirement can be relaxed at these times. Similarly, an additional liquidity buffer could be mandatory for systemically important institutions.

In addition, ESRB (2014) and van den End (2016) discuss macroprudential policies that target the loan-to-deposit (LTD) ratio as a simple alternative indicator of liquidity mismatch.

Van den End (2016) argues that the LTD ratio is less prone to interpretation and simpler to understand given that it is a ratio between the unweighted values of loans and deposits. The LTD ratio includes the intrinsic characteristics of loans and deposits, regardless of their contractual or assumed maturities. This is particularly useful in times of stress, when market participants are more likely to trust straightforward indicators. ESRB (2014) suggests time-varying limits on the LTD ratio. This is analysed in more detail by van den End (2016), who suggests an upper limit of about 120% and examines policy rules that regulators could employ to steer the LTD ratio. He first shows that for eleven euro area countries loan growth has been a dominant driving factor for the LTD in an upturn, raising the LTD to the upper bound. In a downturn, deposit growth has been dominant, reducing the LTD ratio to the lower bound. The interaction effect between loans and deposits has been statistically significant and is stronger in upward phases of the LTD cycle. Next, he formulates two rules. The first rule discourages banks from using market funding when it is easily available. The second rule deals with situations in which banks have

¹¹ This division of the existing literature is mainly based on the overview given in Hardy and Hochreiter (2014); see Box 2 on page 8.

¹² European Systemic Risk Board.

abundant retail savings owing to a flight to quality. The rule encourages banks to lend their deposits to households and non-financial firms. Furthermore, he suggests that the trend of the LTD ratio can be influenced by structural policy measures which influence market structures or the financial intermediation process more fundamentally. Nevertheless, this metric needs to be interpreted with caution, as empirical evidence suggests that, under conditions of acute systematic liquidity risk, a significant deposit reduction can substantially increase LTD, *ceteris paribus*.

Hardy and Hochreiter (2014) propose the Macroprudential Liquidity Buffer (MPLB), which is intended to be a simplified version of the LCR. However, this instrument requires the definition of a set of systemically liquid assets that can be sold or used as collateral, which can be difficult to determine (investment grade bonds are mentioned as an example). In addition, it involves a ratio, which has the systemically liquid assets in the numerator, and the liabilities minus regulatory capital in the denominator. This ratio needs to exceed a minimum requirement, which may be time-varying. Time variation is achieved by making the minimum requirement proportional to the growth rate of the aggregate denominator, which is monitored in each quarter. Hardy and Hochreiter (2014) present and compare concrete functional forms that link the minimum requirement to this growth rate. Note that the MPLB focuses on sufficient holdings of highly liquid assets and does not address maturity mismatch *per se*, which is an important aspect of the NSFR. In this sense, the MPLB has a similar goal to the LCR and can be viewed as complementary to the NSFR.

Brunnermeier et al. (2009) suggest introducing higher capital charges for institutions that operate with a larger mismatch in the maturity of assets and liabilities. This proposal is intended to provide incentives for institutions to rely to a greater extent on longer-term funding. In concrete terms, the authors suggest additional capital charges for multiples of up to two on current capital requirements for institutions with a substantial mismatch. As a reference, they propose a multiple of one for a mismatch of about six months. An important problem with this approach could be the accurate measurement of maturity mismatch between assets and liabilities in real time, which is necessary to implement these additional capital charges.

Ferrara et al. (2016) argue that liquidity requirements should be skewed towards systemically important banks. In other words, systemic liquidity risk is minimised by requiring liquidity SIFIs (liquidity systemically important financial institutions, i.e. banks that are important in the interbank network) to hold more liquid assets. Using a unique data set on UK banks' daily cash flows, short-term interbank funding and liquid asset buffers, the authors show that as long as average liquidity requirements across the banking system are kept at the same level, this can achieve a substantial reduction in systemic risk.

In a setup by Perotti and Suarez (2011), each individual bank takes into account its own exposure to refinancing risk and does not internalise the system-wide effect of its decision. The basic market failure is due to an externality, which results in too much short-term funding. Banks differ in their ability to extend credit and their incentives to take risk. Depending on which of these types of heterogeneity is dominant, the socially efficient allocation can be obtained with some combination of Pigovian taxes and quantity regulations. When banks differ in credit opportunities,

Pigovian taxes are best. However, when they differ in their risk-taking incentives, net funding ratios are best.

Milne (2013) discusses a licensing scheme where a central register of financial assets and liabilities is established, monitored and updated in real time.

Regulators define an upper limit on short-term liabilities of financial intermediaries and tradable licences that are consistent with this amount, which is then distributed among financial institutions. During subsequent quarters, short-term liabilities are monitored; if they exceed the amount of the licences, a fine is due. This scheme applies to short-term funding for each currency. Clearly, this suggestion involves a substantial upfront investment in a short-term funding register and requires a concerted effort to provide the necessary legal and operational infrastructure.

Nicoletti-Altimari and Salleo (2010) propose contingent bonds as a possible simple measure to address banks' liquidity risk. Under the proposal, a new class of securities with a roll-over option facility is introduced. The type of security would allow the issuer to keep the funds if, at maturity, a readily observable variable correlated with systemic liquidity risk (e.g. the LIBOR¹³-OIS¹⁴ spread) is above a trigger threshold. The authors argue that this type of security can reduce aggregate liquidity risk without creating a substantial deadweight loss.

Van den End and Kruidhof (2012) simulate the systemic implications of the LCR by a liquidity stress-testing model, which takes into account the impact of bank reactions on second round feedback effects. They find that in extreme scenarios the LCR becomes a binding constraint, and the interaction of bank behaviour with the regulatory rule can have negative externalities. A flexible approach to the LCR – one which recognises less liquid assets in the buffer during stress – can be a useful macroprudential instrument to mitigate its adverse side effects during times of stress. At extreme stress levels, the instrument becomes ineffective and the lender of last resort has to underpin the stability of the system.

2.2 State of play: existing regulatory requirements

Microprudential liquidity regulation aims to internalise the externalities of individual banks' liquidity risks. Lengthening the maturity of funding and holding liquidity buffers is costly. Banks have incentives to limit these costs and minimise their liquidity risk-bearing capacity, thereby shifting liquidity risks to the public balance sheet. As a consequence, banks hold socially sub-optimal levels of liquidity, which can lead to the breakdown of markets and asset fire externalities, as they all simultaneously “hoard” liquidity, thereby fuelling systemic liquidity risk. Owing to information asymmetries, external monitoring of liquidity risk management is very difficult. Requiring banks to limit or cover liquidity risks reduces individual banks' moral hazard in their liquidity risk management.

¹³ London Interbank Offered Rate.

¹⁴ Overnight indexed swap.

The LCR requires banks to hold enough market-liquid assets to cover their assumed net cash outflows over a 30-day stress period (BCBS, 2013). The LCR is specified as the sum of all liquid assets minus haircuts (including caps for certain lower-quality assets), divided by the difference between cash outflows and inflows over a 30-day stress period. The requirement specifies the criteria that must be met to consider assets as liquid and eligible for inclusion in the liquidity buffer; it also differentiates between more and less liquid assets by applying specified haircuts. Different weights are applied to different categories of liabilities, by defining run-off rates, reflecting their perceived stability during a crisis – e.g. it is assumed that only 5% of household deposits will be withdrawn during stress, while deposits placed by other financial institutions are expected to be fully withdrawn and therefore have a 100% weight.

There is only limited differentiation between flows to the regulated and the less regulated financial sectors. Since banks are typically more regulated than other financial entities, it is important to also understand the treatment of cross-sectoral flows, as liquidity risk outside the banking sector may spill over to the banking sector. However, with the exception of committed facilities that receive outflow rates of 40% in the case of banks (or other regulated entities) and 100% in the case of other financial institutions, microprudential regulation does not seem to distinguish between financial entities.

The more neutral the LCR is towards monetary policy, the better it fits its objectives of internalising liquidity risk. The interaction of liquidity regulation and monetary policy has a long history.¹⁵ Eventually, the general view that the two should be neutral prevailed, meaning that banks should not be able to increase their LCR by participating in monetary policy actions. However, in some jurisdictions the discussion has re-emerged, with some arguing that there should be extended preferential treatment of central banks during systemic stress episodes i.e. by allowing banks to count assets that were received by the central bank in exchange for a non-LCR eligible asset as part of their LCR.

The LCR became effective in the EU in October 2015. According to Article 38 of the Delegated Act on the LCR,¹⁶ the requirement is subject to a phase-in period. The minimum requirement is set to 60% in 2015, 70% in 2016, 80% in 2017 and 100% starting from 2018. Member countries have the option to require a faster phase-in. Countries that choose to do so are, *inter alia*, the Netherlands, United Kingdom, Lithuania, Norway and Sweden.

An impact assessment by the EBA showed that the majority of institutions already fulfil the LCR at the 100% level and that the requirement is unlikely to have a detrimental impact on the real economy (EBA, 2016). A more recent EBA data collection exercise confirms this finding and does not indicate that other prudential requirements constitute constraints on banks' adjustment to the LCR (EBA,

¹⁵ See Bonner and Hilbers (2015).

¹⁶ Commission Delegated Regulation (EU) 2015/61 of 10 October 2014 to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for credit institutions.

2017). Hence, the majority of both the largest internationally active banks and the remaining banks currently have LCRs of at least 100%.

The NSFR is a structural indicator that requires banks to finance their activities in a stable manner (BCBS, 2014b). In contrast to the LCR, which is a stressed metric, the NSFR requires banks to finance long-term less liquid assets with long-term stable liabilities on a constant basis. To achieve this, each category of assets and liabilities is assigned a weight, depending on their liquidity (assets) or funding stability (liabilities). The most liquid assets (cash or short-term claims on central banks) do not require any funding, while long-term loans (above one year) and other similarly illiquid assets are expected to be fully covered with stable funding. On the liability side, the highest weights (indicating that an item is the most stable) are assigned to capital, long-term liabilities and retail deposits.

The NSFR is not formally implemented in the EU yet but the European Commission published a proposal in November 2016.¹⁷ In 2015, the EBA recommended the introduction of the NSFR in the EU both on a consolidated and solo basis using the calibration proposed by the BCBS with adjustments for trade finance, pass-through models, central counterparties, centralised regulatory savings and residential guaranteed loans (EBA, 2015).

The findings of the EBA's impact assessment of the NSFR are similar to the findings for the LCR (EBA, 2015). The analysis found that 71% of the largest internationally active banks (Group 1 banks) are already compliant, while for the remaining banks (Group 2) this is even higher, at 82%. Evidence suggests that the introduction of the NSFR will not create distortions in the financial asset markets. It appears that banks are able to increase their NSFR without decreasing trading activities in parallel. However, both EBA reports (on the NSFR and the LCR) focus mainly on the impact of regulations on individual banks and the real economy, rather than how they need to be modified to serve macroprudential purposes. Lallour and Mio (2016) show that the NSFR has value in detecting weak banks due to excessive funding risks. Consistent with this idea, Vazquez and Federico (2015) find that banks with a weaker NSFR in the pre-crisis period were more likely to fail during the crisis.

2.3 Other macroprudential liquidity regulations

A number of EU jurisdictions have implemented additional microprudential liquidity tools. In line with the provisions of the Article 412 of the CRR, such measures can be maintained until full introduction of the LCR in the EU in 2018. In the Netherlands, a requirement similar to the LCR with a somewhat wider definition of liquid assets but stricter outflow assumptions has been in force since 2003. Poland implemented short- and long-term liquidity norms in 2007, requiring banks to

¹⁷ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 575/2013 as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements and amending Regulation (EU) No 648/2012.

effectively fulfil three ratios: the short-term liquidity gap, which requires that banks' liquidity reserves are greater than unstable external funds (M1 ratio) and two longer-term liquidity requirements defined as own funds over illiquid assets (M3 ratio) and the sum of own funds and stable external funds over illiquid assets (M4 ratio).¹⁸ Germany, Luxembourg and Ireland also had some form of quantitative liquidity regulation in place since the 1990s (Bonner et al., 2015).¹⁹ In France, the Ministerial Order of May 2009, which came into effect on 30 June 2010, required banks to maintain a liquidity ratio of at least 100% at all times. The ratio was calculated as the sum of market-liquid assets and assumed cash inflows as a share of assumed cash outflows over one month.²⁰ Belgium approved a new liquidity regulation by Royal Decree on 3 September 2010 and the new rules came into force on 1 January 2011. Compared with the LCR, the requirement is generally less severe with regard to the definition of the liquidity buffer, but this is compensated for by stricter assumptions on the stress scenario and liquidity outflows.²¹ In Slovakia, two limits came into force in 2000, requiring banks to cover certain liabilities with liquid assets.²² In Greece, a liquid asset ratio along with a maturity mismatch ratio, have been in place since 2005. Both metrics address the banks' ability to cover short-term liquidity needs. Other countries have also used loan-to-deposit ratios and core funding ratios as microprudential liquidity tools.

In addition to liquidity measures related to banks, a number of microprudential regulatory requirements are in place for the non-banking sector (mainly investment funds). For example, the Alternative Investment Fund Managers Directive (AIFMD)²³ requires alternative investment funds to have an appropriate liquidity management system and effective procedures that also take into account the liquidity profile and the redemption policy of each fund. The Undertakings for Collective Investment in Transferable Securities (UCITS) IV Directive²⁴ sets a detailed list of eligible assets, requires funds to invest in liquid assets, and expects the ability to demonstrate that liquidity management processes are in place. Moreover, the current regulatory proposals for money market funds (MMFs) stipulate requirements for a fixed share of daily and weekly maturing assets in order to reduce liquidity risks in the MMF sector. Similar to the liquidity regulation for banks, the measures for the

¹⁸ See [Komisja Nadzoru Finansowego](#).

¹⁹ Germany's liquidity requirement was introduced in 1969 and has been subject to significant updates in 1997 and 2006. Since 1997, banks were required to hold liquid assets at least equal to total liabilities falling due within one month. The requirement in Luxembourg specifies that banks should have a ratio of liquid assets to current liabilities of at least 30%. In Ireland, banks had to maintain a minimum ratio of liquid assets to total borrowing of at least 25%. This requirement was introduced in 1995 and updated in 2009.

²⁰ See [Comité Consultatif de la Législation et de la Réglementation Financières](#).

²¹ See [Gestion du risque de liquidité](#).

²² See [National Bank of Slovakia, Annual Report 2000](#).

²³ Commission Delegated Regulation No 231/2013 of 19 December 2012 supplementing Directive 2011/61/EU of the European Parliament and of the Council with regard to exemptions, general operating conditions, depositaries, leverage, transparency and supervision.

²⁴ Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) and Commission Directive 2010/43/EU of 1 July 2010 implementing Directive 2009/65/EC of the European Parliament and of the Council as regards organisational requirements, conflicts of interest, conduct of business, risk management and content of the agreement between a depositary and a management company.

non-banking sector are targeted at individual entities. While there are additional tools for investments funds available such as redemption gates, fees or side pockets, these tools typically have an *ex post* character and are available to asset managers only, which are likely to be reluctant to use these tools for reputational reasons.²⁵

In addition to the national microprudential liquidity tools mentioned above, the EBA has developed Pillar 2 guidelines for liquidity in the EU. The purpose of Pillar 2 is to move beyond the one-size-fits-all approach to identify institution-specific risks that are not covered by micro and macroprudential requirements. The EBA Pillar 2 guidelines published in December 2014 are based on three building blocks: 1) short-term liquidity risk; 2) long-term funding risk; 3) liquidity risk management. The guideline emphasises the need to assess time horizons not covered by the LCR and NSFR, especially in the context of stress testing. Furthermore, the EBA suggests focusing on asset and funding concentration, asset encumbrance, market access and currency risks.

The ECB Banking Supervision is in the process of implementing these guidelines in the Supervisory Handbook. For Liquidity Risk Pillar 2, an ECB working group has developed the following items: 1) risk indicators and proxies for liquidity risk; 2) a harmonised assessment framework of banks' Internal Liquidity Adequacy Assessment Processes (ILAAP); 3) supervisory stress-testing framework. So far, the working group has not decided on specific risk-mitigating measures that can be imposed on the institution.

2.4 Macroprudential liquidity tools and their (possible) use

Article 458 of the CRR governs the macroprudential use of liquidity instruments i.e. LCR and NSFR in the EU. Under certain conditions, these liquidity requirements may be applied by national designated authorities to combat the systemic dimension of liquidity risk.²⁶ Measures applied under Article 458 of the CRR are subject to a number of procedural, as well as regulatory conditions. They may only be used if national designated authorities can justify that they are necessary to address systemic liquidity risk and that this risk cannot be adequately addressed by certain other instruments. Furthermore, using the liquidity instruments under Article 458 of the CRR is subject to a notification/approval process, involving notification by the national authority, the provision of opinions by the ESRB and EBA, a proposal from the European Commission and a European Council decision.²⁷

For emerging market economies, in particular, but also in some developed countries such as Cyprus and Greece, a variety of measures known as capital flow measures have been used as prudential policies that could promote the holdings of liquidity reserves at banks. From a financial stability perspective, these

²⁵ See European Systemic Risk Board (2016b).

²⁶ The systemic dimension of liquidity risk refers to banks' not internalising the benefits of having stable liquidity structures and hence failing to achieve stable liquidity profiles.

²⁷ For further details, see section 4.3.

measures aim to dampen foreign exchange-denominated credit booms (Ostry et al., 2010). For example, unremunerated reserve requirements in the respective currencies induce domestic financial institutions to limit their short-term foreign exchange borrowing and increase their liquidity reserve (Forbes, 2007). The effectiveness of capital flow measures is controversial in the literature. Habermeier et al. (2011) provide a more extensive discussion of capital flow measures such as reserve requirements and prudential measures to influence cross-border capital flows. Reserve requirements have also been used in mature economies to ease liquidity stress in the financial system. For example, the Eurosystem lowered the minimum reserve ratio from 2% to 1% in January 2012. This reduced banks' liquidity needs and fostered money market activity, mainly because it increases the incentives of cash-long banks to offer their liquidity to other banks, as they can no longer deposit it with the fully remunerated reserve account.²⁸

The Financial Stability Board (FSB) developed a framework for haircuts on non-centrally cleared securities financing transactions that could prevent excessive lending during booms (FSB, 2015). It provides both qualitative standards for market participants to calculate haircuts and numerical floors on haircuts. The report explicitly considers a potential macroprudential role for the floors on haircuts, which could be used as countercyclical tools to prevent excessive lending during benign market conditions. This framework is to be fully implemented by end-2018.

In an indirect way, the G-SIB capital surcharge could also account for systemic liquidity. The G-SIB score calculation is made of five criteria, one of which is "interconnectedness", based on the intra-financial system assets and liabilities held by a bank. Since it encompasses all maturities, it is not purely a liquidity measure. Nevertheless, since most interbank lending and money market transactions are short term and provided for liquidity purposes, it is thus a measure of the liquidity a bank brings in and takes from the financial system. Therefore, a higher role in funding liquidity (providing or using it) triggers a higher G-SIB score and thus a capital surcharge. Moreover, in the United States, the G-SIB surcharge takes more explicit account of the role of short-term funding, as they implemented the G-SIB capital surcharge linking a bank's reliance on short-term funding to the G-SIB surcharge.²⁹

Actual country experience regarding the macroprudential use of liquidity instruments is somewhat limited at this point. As it is not always possible to make a clear-cut distinction between the microprudential and macroprudential use of instruments, only measures that explicitly aim to contain the build-up of systemic liquidity risk or make the whole banking system more stable are considered macroprudential for the purpose of this report.³⁰ The ESRB (2014) reports the use of

²⁸ See ECB (2012).

²⁹ See Federal Reserve System (2015).

³⁰ For example, the increase in the required minimum level of the LCR (set at 100% as from April 2016) in Hungary is classified as a macroprudential measure according to the ESRB's website. However, the notification by Magyar Nemzeti Bank does not explicitly contain any references to systemic liquidity risks, which this measure is supposed to address.

the LTD ratio in Portugal³¹ and South Korea,³² the introduction of two macroprudential quantity-based liquidity measures similar to the LCR and the NSFR in New Zealand,³³ and the introduction of the LCR of at least 100% in Sweden in 2013, for all currencies combined, as well as for the euro and US dollar, respectively.³⁴ In addition, Hungary introduced macroprudential regulation designed to regulate systemic currency and maturity mismatches in the balance sheets of credit institutions.³⁵ In Slovenia, a gross LTD flow was introduced in 2014.³⁶ Lastly, Cyprus introduced an LCR add-on under Article 458 of the CRR at the beginning of 2018 in order to contain excess liquidity, which could arise from abolishing stricter national liquidity measures due to the full phase-in of the LCR at the beginning of 2018. This add-on is expected to be phased out during 2018.

The LCR in the United States deserves special mention because it contains a systemic dimension. The Federal Reserve adopted in September 2014 an LCR based on the Basel III framework but with more stringent aspects, such as a shorter transition period with a fully phased-in LCR planned for 2017 instead of 2019, and fewer eligible asset categories. The US LCR implicitly encompasses a macroprudential dimension by differentiating the LCR requirement according to the systemic importance of banks. The US LCR applies differently to banks depending on

³¹ In the context of the programme of economic and financial assistance agreed upon in 2011, a set of measures aiming to achieve a more balanced funding profile for the banking system was introduced. One of the measures was an indicative target of 120% for the LTD ratio of the eight largest banking groups to be reached by 2014. Since the purpose of using this instrument was to achieve an orderly and gradual deleveraging of the entire banking system and the non-financial sector without constraining access to bank financing too much, it can be considered a macroprudential measure. It was deemed to be successful as a decrease in the LTD ratio has been achieved, mainly through an increase in deposits, and the banks' reliance on Eurosystem refinancing operations has been significantly reduced (see ESRB, 2014; IMF, 2015).

³² In the financial crisis, South Korean banks had difficulties rolling over their maturing short-term liabilities as the global liquidity conditions deteriorated. One of the measures introduced by the Korean authorities in the aftermath of the financial crisis was a mandatory 100% cap on banks' LTD ratios that came into force in 2012. Along with the cap on the LTD ratio, a levy on short-term debt and caps and limits on foreign currency denominated transactions and derivative positions were set. These measures are deemed macroprudential because they focused on containing the build-up of systemic vulnerabilities (see ESRB, 2014; IMF, 2014). The measure is believed to have successfully decreased banks' share in wholesale funding (see Lim et al., 2011), interconnectedness in the financial sector, and the procyclicality of lending (see Park et al., 2015). According to an IMF country report (2014) resilience to liquidity shocks has been increased through this measure.

³³ A one-week and one-month mismatch ratio and the one-year core funding ratio came into effect in 2010. Both these instruments are supposed to address banks' individual liquidity risk but also have a systemic focus. They are meant to explicitly address the systemic liquidity risk of banks that are not internalising any system-wide costs that may be incurred, should individual banks be hit by a liquidity shock (see [Regulatory Impact Assessment, RBNZ Liquidity requirements for locally incorporated banks](#), June 2016).

³⁴ One of the reasons for the early introduction of the LCR was a high degree of concentration and interconnectedness in the Swedish banking system. Liquidity problems of one bank could easily spread to other banks and become systemic (ESRB, 2014).

³⁵ The set of macroprudentially oriented measures consists of the Mortgage Funding Adequacy Ratio and the Foreign Exchange Funding Adequacy Ratio. The Mortgage Funding Adequacy Ratio requires banks' share of HUF-denominated mortgage-backed liabilities to be at least 15% of the amount of residential mortgage loans with at least one year of residual maturity. The mortgage-backed liabilities are believed to be a long-term source of funding. The Foreign Exchange Funding Adequacy Ratio requires that banks' FX denominated assets correspond to either FX-denominated funds or long-term FX swaps.

³⁶ The gross loans-to-deposit flow refers to changes in loans to the non-banking sector relative to changes in non-banking sector deposits. The new regulation requires banks with positive changes in the non-banking sector deposits to have a non-negative gross loans-to deposit flow as from 30 June 2014 and a positive change of at least 40% of the increase in deposits as from 1 April 2015. It stipulates corrective measures for banks with negative changes in the non-banking sector deposits. The measure aims to stabilise the banking system funding structure and mitigate system-wide funding liquidity risk as well as limit the contraction of credit activity.

their size: while the largest have to comply with the full LCR, those holding between \$50 billion and \$250 billion in assets are subject to a modified, less strict version of the LCR, and the smallest banks are not subject to an LCR requirement at all. In addition, the US framework for the G-SIB capital buffers uses a measure of short-term wholesale funding to measure a bank's systemic footprint.³⁷

2.5 Are macroprudential liquidity requirements needed?

The question arises whether there is a need for macroprudential liquidity instruments. Taking into account the state of current microprudential and macroprudential liquidity requirements, as well as the possible interaction with (macroprudential) capital instruments and monetary policy, there is the possibility that systemic liquidity risk will arise and that this risk will not be covered by any existing requirements.

There are a number of areas that may give rise to systemic liquidity risk. Systemic liquidity risk develops in a similar way to an excessive build-up of leverage. In good times, financial institutions and investors regard liquidity risk as low (as markets are liquid and funding is easily available), leading market participants to increase their exposures. When the cycle turns, a sentiment of de-risking emerges, which potentially leads to fire sales and negative feedback loops. This time dimension is reinforced by cross-sectional factors (the existence of hubs, interconnectedness, common exposures, etc.) and lower levels of capital.

While the LCR and NSFR address important risks, they may not fully mitigate the risks arising during a liquidity cycle. When institutions increase their reliance on short-term wholesale funding, the LCR and NSFR will require banks to increase the amount of liquid assets. However, high levels of short-term wholesale funding may result in higher interconnectedness and greater importance of hubs. At the same time, larger liquidity buffers are likely to increase concentration risks. When the cycle turns, an individual institution might be able to liquidate its liquidity buffer.

However, owing to the increased interconnectedness and importance of hubs, simultaneous actions of several financial institutions may put a lot of pressure on asset prices. In an upswing, interconnectedness tends to increase and so does the role of a few large financial institutions (hubs). In such a situation, simultaneous de-risking actions by several institutions may put pressure on asset prices, and banks' liquidity buffers (as required by the LCR and NSFR in response to the build-up of short-term wholesale funding) are likely to be ineffective, as the volumes exceed the market size. Severe fire sales are a likely consequence.

Existing macroprudential capital requirements are unlikely to mitigate systemic liquidity risk. The G-SIB and the countercyclical capital buffer are the most important macroprudential instruments. Although the G-SIB buffer takes into account interconnectedness, it does not cover issues such as systemic asset concentration

³⁷ See [press release](#).

and the special role of liquidity hubs. The countercyclical capital buffer is meant to limit the build-up of risks over the financial cycle when risk weights are low and lending abundant. In case of a mild crisis (i.e. funding markets remain open) the additional capital might avoid fire sales, as banks are better able to raise new funding. In addition, the NSFR will limit an excessive shortening of maturity profiles.

Less regulated parts of the financial system may be more prone to an excessive build-up of liquidity risk. Even if the LCR and NSFR partially limit systemic risk in the banking system, other parts of the financial system may still be prone to an excessive build-up of liquidity risk where microprudential rules may not be sufficient to address such risks and macroprudential instruments are not available.³⁸ This may present a gap in the macroprudential framework, which could be addressed with both cross-sectoral and cyclical interaction of instruments.³⁹ Regarding securities financing transactions, liquidity regulations under the LCR and NSFR are still untested, therefore making it difficult to understand the adequacy of these rules in the case of a run on repos. However, these requirements can be complemented by haircut floors, which further reduce procyclical liquidity risk-taking.⁴⁰ Another avenue to explore is the countercyclical use of haircuts for securities financing transactions, which may be more effective in avoiding the shifting of risks to other sectors of the financial system, given that they target the activities of all entities.⁴¹

In sum, these aspects suggest that macroprudential instruments that address systemic liquidity risk may be warranted. Before deciding on possible macroprudential instruments, however, it is necessary to create indicators that can detect systemic liquidity risk. The next part of the report presents liquidity risk indicators which aim to assess the materiality of liquidity risk in the cross-section (i.e. across market segments and/or market participants) and time dimensions. The TFSL created a total of 20 indicators that examine liquidity risk in the following areas: (1) the financial system as a whole; (2) banks; (3) non-banks. This analysis focuses on the systemic aspects of liquidity risk, in particular, the cyclical dimension and the interconnectedness of the financial system.

³⁸ In addition, the current liquidity requirements may lead to a development of alternative methods of liquidity and maturity transformation, effectively pushing the associated liquidity risk to outside the banking system e.g. Wall (2015).

³⁹ See Financial Stability Board (2016) and ESRB (2016b).

⁴⁰ See Financial Stability Board (2014).

⁴¹ See European Central Bank (2016c).

3 Available macroprudential tools from a legal perspective

The aim of this section is to provide clarity on the availability of macroprudential tools from a legal perspective. To answer this question, the TFSL consulted various parties on the interpretation of Article 458 of the CRR and national law. However, because some open questions still remain, the TFSL proposes to conduct a formal legal assessment of these issues.

Article 458 of the CRR provides the legal basis for introducing macroprudential liquidity instruments. This article applies when macroprudential or systemic risk is identified at the level of a Member State. In particular, the designated/competent authority can propose “stricter national measures” that mitigate the intensity of risk and concerning the liquidity requirements laid down in Part Six of the CRR when it has identified a “change in the intensity of macroprudential or systemic risk in the financial system” that may result in negative consequences for the financial system and is not fully addressed by Articles 124 and 164 of the CRR and Articles 101, 103, 105, 133 and 136 of the CRD IV. In this case, the designated/competent national authority must provide quantitative or qualitative evidence that justifies this claim. Furthermore, any negative impact of the proposed measure on the Internal Market must not outweigh the financial stability benefits that reduce the macroprudential or systemic risk identified.

In principle, Article 458 of the CRR allows national authorities to introduce measures that are different from the already existing liquidity requirements. However, the scope for new macroprudential liquidity tools is likely to be limited since: (1) it might be difficult to prove that alternative measurements are stricter because of the cumbersome comparison (i.e. new measures might not be comparable to the LCR and NSFR and it might therefore be difficult to determine if they are stricter, which is a necessary condition for applying Article 458 of the CRR); (2) modifications to the LCR and NSFR could cover most of the liquidity spectrum, therefore making it unnecessary to introduce new measurements; (3) a level playing field must be kept within the Internal Market, as recommended by the EBA (EBA, 2014), which could make it difficult to introduce new measures for different countries. Therefore, the newly proposed measure would mostly likely be a stricter version of the LCR or the NSFR (i.e. applying stricter weighing to the existing categories).

It is important to note that national measures can only be adopted for a period of up to two years or until the macroprudential or systemic risk ceases to exist if that occurs sooner. This highlights the short-term focus of Article 458 of the CRR, which is intended to mitigate “changes” in macroprudential or systemic risk, rather than existing risks. However, an extension can be requested one year at a time in consultation with the ESRB and EBA. Taking into account the cyclical nature of systemic liquidity risk, a short-term measure that can be extended will be most effective at targeting the build-up of risk in the system.

An additional aspect to take into account when national authorities want to implement new national macroprudential liquidity measures is that triggering Article 458 of the CRR requires a long and formal procedure. This process involves a notification by the designated/competent national authority (as well as submitting quantitative/qualitative evidence justifying the claim), provision of an opinion by the ESRB and EBA, a proposal from the European Commission and a decision by the European Council. Therefore, this process might prove to be cumbersome in a situation where immediate action is required. The ECB points this out in its contribution to the European Commission consultation on the review of the EU macroprudential policy framework,⁴² stating that the lengthy and burdensome activation and notification procedure under Article 458 of the CRR does not allow for a proactive and timely use of instruments, therefore hampering an effective use of macroprudential policy. The TFSL recognises that lengthy activation of Article 458 of the CRR might not always be needed, as in the case of Cyprus, when only a minimal alteration to the LCR was required. However, this process might be significantly more cumbersome for proposals with greater alterations to existing liquidity instruments under Part Six; additional flexibility under Article 458 of the CRR may, therefore, be warranted.

In addition to Article 458 of the CRR, Article 103 of the CRD IV provides an opportunity to introduce measures at national level if the competent authorities determine that institutions with similar risk profiles are exposed to similar risks or pose similar risks to the financial system. This allows competent authorities to apply the supervisory review and evaluation process referred to in Article 97 of the CRD IV to the institutions identified as “similar”. The evaluation process under Article 97 allows authorities to evaluate the risks that an institution or several similar institutions pose to the financial system, taking into account systemic risk as defined under Article 23 of Regulation (EU) No 1093/2010. Under this article, authorities must address systemic risk that: (1) causes an impairment of all or parts of the financial system; (2) may have serious consequences for the Internal Market and the real economy. Therefore, if national competent authorities identify that the banking sector is exposed to systemic liquidity risk, they may introduce macroprudential liquidity measures at national level to mitigate this risk.

Under Article 103 of the CRD IV, one of the options available to competent authorities is to introduce macroprudential liquidity measures through the use of supervisory powers as laid down in Article 105 of the CRD IV. A proposed liquidity requirement under this article is intended to capture liquidity risks to which an institution is or might be exposed, taking into account (among other things) systemic liquidity risk that threatens the integrity of the financial markets of the Member State concerned. A challenge to consider when implementing this article is the overlap between macroprudential and microprudential liquidity measures. In the event that the European Commission decides to move forward on the separation of Pillar 2 measures and macroprudential tools, national authorities will no longer be able to use Article 103 and 105 of the CRD IV for macroprudential purposes. Therefore,

⁴² European Central Bank (2016b).

Article 458 of the CRR will have to be enhanced to provide additional flexibility for macroprudential liquidity measures, especially in a situation where immediate action is required.

National law can also play a role in setting liquidity requirements. For instance, since 2015 Magyar Nemzeti Bank has introduced macroprudential tools aimed at regulating the currency and maturity mismatches of credit institutions. Nevertheless, its interaction with the European regulatory framework is unclear. Regarding the LCR, Article 412(5) of the CRR made it possible for national authorities to maintain or introduce national provisions in the area of liquidity requirements during the LCR phasing-in period (2015-2017). However, the CRR requires all national liquidity requirements to be removed as of 1 January 2018 with the full introduction of the LCR (Article 413 of the CRR).

However, the CRR is not explicit on the possibility of national law after the implementation of the LCR and NSFR. The current wording of Articles 412(5) and 413(3) could be interpreted as setting limits on maintaining or introducing any type of national liquidity or funding measures after the implementation of the LCR and the NSFR. On the other hand, Recital (18), Articles 412(5) and 413(3) refer to liquidity requirements and stable funding requirements, which can be interpreted as referring exclusively to the LCR and NSFR, especially as the CRR has used these expressions for LCR and NSFR requirements interchangeably on several occasions.⁴³ Thus, the restrictions on maintaining or introducing any further measures after the entry into force of the LCR and the NSFR may refer only to LCR- and NSFR-related requirements, but not to overall liquidity or funding-related measures. Consequently, it could be argued that the area which is not covered by these terms is not regulated by the CRR and – in accordance with Recitals (3) and (13) – national provisions can be carried out in these areas. To ensure consistency, the TFSL proposes a formal legal assessment of the possibility to introduce national macroprudential measures.

The CRR allows Member States to maintain or introduce national provisions in the area of stable funding requirements before binding minimum standards for net stable funding requirements are specified and introduced.⁴⁴ The CRR introduced a reporting obligation and a general requirement that long-term assets have to be adequately met with a variety of stable funding instruments (liabilities) under both normal and stressed conditions. These requirements are the only ones currently in place for stable funding under the CRR. In this respect, it should be noted that the European Commission's banking reform package published in November 2016 includes a proposal on the implementation of a harmonised binding requirement for the NSFR at EU level.

⁴³ For example, the definition of the liquidity requirements can be derived from Article 1 of the CRR. The Article states that the CRR lays down uniform rules about liquidity requirements relating to entirely quantifiable, uniform and standardised elements of liquidity risk after the delegated act referred to in Article 460 entered into force. Accordingly, the term "liquidity requirements" is specifically meant to be the LCR in the context of the CRR, since the delegated act elaborates exclusively on the LCR. Additionally, when the [Proposal for a regulation amending CRR](#) refers to stable funding requirements in the context of replacing Article 413(3), it states that the provisions of Title IV shall apply for specifying the stable funding requirement set out in paragraph 1. This means that "stable funding requirement" is meant as the NSFR in the context of the CRR.

⁴⁴ Article 413(3) of the CRR.

A number of questions remain open with regard to the possibility for national authorities to apply national measures on liquidity different from those laid down in Part Six of the CRR and therefore outside the scope of Article 458(2)(d)(v) of the CRR. In areas not covered by the CRR, competent authorities or Member States should be able to impose national rules, provided that they are not inconsistent with it.⁴⁵ Also, the most important recommendations advocated in the de Larosière report and later implemented in EU law were the establishment of a single rulebook and a European framework for macroprudential supervision where both elements in combination were intended to ensure financial stability. While the single rulebook ensures a robust and uniform regulatory framework that facilitates the functioning of the Internal Market, preventing regulatory arbitrage opportunities, the CRR recognises that macroprudential risks may differ in a number of ways and with a range of national specificities within the Internal Market.⁴⁶

While maintaining a level playing field is important, it may also be necessary for national authorities to have the legal power to mitigate systemic liquidity risk that requires immediate action. The TFSL considers that some flexibility in the implementation of Article 458 of the CRR is needed. Article 458 of the CRR should be modified to ease the burden of notification and to facilitate implementation and accelerate the mitigation of risk. Finally, given the lack of experience regarding the use of the LCR and NSFR and the risks that may arise which may not be covered by these instruments, additional liquidity tools may be warranted. Therefore, it is essential to have the option of maintaining and introducing national liquidity or funding measures with the aim of safeguarding financial stability to enable national authorities to take timely action to prevent crisis situations. This is also important from the point of view of ensuring the smooth functioning of the LOLR, which remains the responsibility of national central banks. To ensure consistency, the TFSL recommends a formal legal assessment of both Article 458 of the CRR and of the possibility for national liquidity measures other than those laid down in Part Six of the CRR – and therefore outside the scope of Article 458 of the CRR – to be implemented.

In addition, the TFSL considers that clarification on the separation of Pillar 2 and macroprudential measures is also needed to reduce the overlap of macroprudential and microprudential objectives. To fully mitigate systemic liquidity risk, regulators must have a solid legal base that allows for the seamless implementation of macroprudential liquidity measures that target both the cyclical and structural dimensions of liquidity risk. However, it is important to note that a clear-cut distinction between the micro- and macroprudential use of instruments is not always possible and Pillar 2 can be effectively used for the same types of risks at numerous institutions.

The existing legal basis for macroprudential liquidity tools might have to be extended for systemic liquidity risk that arises outside the banking sector. Currently, no macroprudential measures have been applied to the non-banking sector. This is partly due to the lack of tools available to policy makers. At international level,

⁴⁵ Recital (13) of the CRR.

⁴⁶ Recital (14) of the CRR.

the FSB has published a set of recommendations to address structural vulnerabilities from asset management activities.⁴⁷ The recommendations also aim to address the vulnerability coming from liquidity mismatches between assets and liabilities.⁴⁸ In particular, the FSB recommends that authorities provide guidance on the use of exceptional liquidity risk management tools in stressed conditions. On 14 February 2018, the ESRB published a recommendation on action to address systemic risks related to liquidity mismatches and the use of leverage in investment funds. It pointed out the potential financial stability risks stemming from liquidity mismatches of investment funds such as fire sales to meet redemption requests in times of stress.⁴⁹ As a result, the ESRB recommends additional liquidity management tools, additional provisions to reduce likelihood of excessive liquidity mismatches and tighter liquidity stress-testing practices. In line with the ESRB, the TFSL supports these recommendations as a further step towards developing macroprudential liquidity tools beyond banking. Additional liquidity management tools are key to mitigate systemic liquidity risks stemming from redemption pressures during times of stress that could exacerbate asset price falls.

It is important to take into account the policy trade-offs of introducing new macroprudential liquidity tools. While stricter liquidity requirements can limit systemic liquidity risk, holding additional liquidity is costly as it prevents investments in more long-term profitable assets. As a result, there is a trade-off between profiting from lending and incurring greater liquidity risk, which must be taken into account by regulators designing macroprudential liquidity tools. Owing to the importance of credit provision for financial stability, the potential benefits of introducing new tools needs to be weighed against the costs.

Lastly, it is important to understand the interaction between the role of the central bank as a lender of last resort and macroprudential liquidity tools to facilitate their functioning as complements. During the financial crisis, central banks injected extraordinary amounts of liquidity into the system. This function was crucial in order to mitigate the impact on the financial system once systemic liquidity risk materialised. In particular, the LOLR function is best fitted once liquidity risk materialises in sound institutions due to runs or a deterioration in the liquidity of the markets they depend on for funding. In this case, the LOLR function does not pose any moral hazard issues since the institutions that are involved do not have any solvency concerns. On the other hand, macroprudential liquidity regulation is best fitted to address liquidity risk during the build-up phase. Therefore, flexible macroprudential liquidity regulation is necessary to reduce the likelihood of a systemic liquidity crisis

⁴⁷ Financial Stability Board (2017b).

⁴⁸ At EU level, the AIFMD allows regulators to impose macroprudential leverage limits on alternative investment funds; however, so far, no authority has implemented this tool. To operationalise macroprudential policy beyond banking, the ECB and De Nederlandsche Bank have worked together to create a framework for macroprudential leverage limits in Europe that assesses financial stability risks from leverage in investment funds. This initiative represents a significant step forward in addressing financial stability risks stemming from the excessive use of leverage for non-banks.

⁴⁹ The ESRB recently published a [recommendation on leverage and liquidity in investment funds](#) which aims to address systemic risks related to liquidity mismatches e.g. via redemption fees and temporary suspensions.

occurring, as it will aid authorities in providing an incentive for banks to internalise externalities associated with liquidity risk, thereby reducing moral hazard.

4 Materiality of systemic liquidity risk

This part of the report discusses indicators for a dashboard and sources of data for a monitoring framework of systemic liquidity risk. Descriptions of all indicators with more detailed information on the rationale for each indicator, its calculation and data source can be found in the Annex.

After the global financial crisis, supervisors substantially increased the reporting requirements for the financial (banking) sector, strongly enhancing the availability of new data sources. The dashboard presented in this report relies on previously unused data sources such as the Securities Holdings Statistics and the supervisory data collected under the FINREP⁵⁰ and COREP⁵¹ frameworks. This report highlights new sources of data that can be used to calculate indicators for the purpose of monitoring systemic liquidity risk. However, suggestions for new indicators based on these data sources are preliminary and require a more in-depth assessment of their usefulness. Moreover, time series for these new data sources are relatively short, thus limiting the indicators' predictive capacity to assess the materiality of systemic liquidity risk.

In theory, suitable indicators should cover key providers and receivers of liquidity, as well as relevant markets through which liquidity is allocated and through which liquidity risk can build-up over time. To adequately capture the two dimensions of systemic liquidity risk, the indicators should be available at an entity and sector level over a long enough time period. However, long time series are not available for most indicators since a large portion of the data was gathered in response to the financial crisis.

The TFSL created a dashboard containing indicators for assessing the materiality of systemic liquidity risk. It includes a total of 20 indicators. The decision to include indicators was guided by four criteria:

1. Systemic liquidity: Does the indicator capture systemic liquidity and specifically endogeneity, interconnectedness and concentration?
2. Scope: How much of the financial system does the indicator cover?
3. Crisis signalling: Would the indicator have been useful to signal past stress events?
4. Data availability: Can the indicator be built for all countries and does it include a time series?

The indicators focus on the systemic aspects of liquidity risk: the cyclical dimension, the interconnectedness of the system and the endogeneity of

⁵⁰ Reporting of financial information.

⁵¹ Common Reporting Framework.

liquidity risk. Owing to the short time series for these new data sources and the fact that they do not include a stress event, the indicators have been primarily chosen utilising criteria 1, 2 and 4. At this moment, the indicators cannot be evaluated on their ability to signal past stress events (criteria 3) since the time series is not long enough to determine when indicators deviate from their “normal” behaviour and a crisis event is not included. However, looking forward, the indicators can be evaluated for this criterion once a longer time series can be obtained with a crisis event.

The TFSL selected the indicators as carefully as possible; however, a few caveats must be mentioned. Currently, the dashboard focuses primarily on banks. This is driven by the scarcity of data for the non-banking sector, as well as the importance of the banking sector in most countries. Because of the rather short time series, the current dashboard does not contain critical values. The frequency of the data is mostly quarterly. Despite this low frequency, timely detection of systemic liquidity risk is still possible in some cases, as it can take many years for liquidity risks to build up. Furthermore, the dashboard focuses mostly on national systems and individual countries, i.e. the indicators take a locational perspective. However, the location of a financial entity does not necessarily indicate that systemic liquidity will materialise in the same location. For example, while the asset management sector is highly concentrated in a few euro area countries, the materialisation of systemic liquidity will also impact investors and markets elsewhere.

4.1

The dashboard

			2014				2015				2016				2017	
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Financial system	(1)	Liquidity leverage ratio (system-wide)	0.91	0.91	0.91	0.90	0.91	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.94	0.94
	(2)	Self funding	0.54	0.55	0.54	0.52	0.51	0.52	0.50	0.50	0.50	0.50	0.50	0.50	0.49	0.50
	(3)	Bid/ask spreads of sovereign bonds*	0.50	0.51	0.50	0.51	0.55	0.52	0.79	0.66	0.61	0.52	0.54	0.52	0.51	0.42
	(4)	Investor base concentration	0.71	0.70	0.70	0.69	0.68	0.67	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.64
Banks	(5)	Liquidity leverage ratio (banks)	0.99	0.98	0.98	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.98
	(6)	Investor base concentration (banks)	0.62	0.62	0.61	0.61	0.60	0.60	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.57
	(7)	Self funding (banks)	0.31	0.31	0.30	0.28	0.27	0.28	0.27	0.26	0.26	0.26	0.26	0.26	0.25	0.26
	(8)	Total central bank-eligible counterbalancing capacity (CBC) to total LCR net cash outflows											1.55	1.48	1.47	1.47
	(9)	Total central bank-eligible CBC to total assets									0.14	0.15	0.15	0.15	0.15	
	(10)	LCR outflows to total assets											0.09	0.10	0.10	0.10
	(11)	Short-term wholesale funding to total assets	0.68	0.68	0.68	0.70	0.72	0.73	0.74	0.70	0.72	0.71	0.64	0.61	0.63	0.61
	(12)	Asset encumbrance				0.24	0.24	0.24	0.23	0.23	0.23	0.24	0.24	0.23	0.24	0.24
	(13)	Market asset encumbrance				0.93	0.93	0.92	0.91	0.91	0.92	0.92	0.91	0.92	0.89	0.89
	(14)	Collateral re-use				0.62	0.60	0.61	0.61	0.58	0.62	0.64	0.63	0.62	0.65	0.65
(15)	Distance to liquidity stress indicator (DLSI)**								1.20							
Non-banks	(16)	Liquidity leverage ratio (non-banks)	0.81	0.82	0.83	0.82	0.85	0.85	0.85	0.85	0.84	0.85	0.86	0.87	0.88	0.88
	(17)	Investment funds liquidity transformation				0.23				0.24				0.25		
	(18)	Investor base concentration (non-banks)	0.54	0.54	0.53	0.53	0.52	0.52	0.51	0.51	0.51	0.52	0.52	0.52	0.52	0.52
	(19)	Self funding (non-banks)	0.23	0.23	0.23	0.22	0.23	0.22	0.22	0.22	0.23	0.23	0.24	0.23	0.23	0.24
	(20)	Shadow banking indicator	364.44	383.61	400.06	403.93	416.88	424.15	403.09	421.63	394.92	416.32	437.10	444.76	450.74	471.52

* The euro area values are averages of country values. The country values are quarterly medians of daily observations.

** The euro area value is an average of country values.

4.2 The dashboard indicators

The complete definitions and descriptions of the indicators can be found in the Annex. A brief summary is given below.

4.2.1 Financial system

1 Liquidity leverage

This indicator captures liquidity risk exposure (short-term liabilities) relative to available liquidity (“liquidity leverage”) across all financial sectors within one country. Its main advantage is its broad coverage and long time series that allows for an overall indicator of liquidity risk within a particular country.

The indicator considers short-term liabilities as categories that are relevant for banks (deposits, (contractual) short-term securities, loans and other accounts payable), as well as other categories of instruments for non-banks which may be considered to have the same behaviour as short-term liabilities of banks (i.e. demandable at short notice), such as open-ended investment fund shares. Deposits from domestic households are excluded from the calculation of the banking system’s liquidity leverage.⁵² An increase of the funding share from such deposits should not be seen as risk-taking behaviour. On the contrary, those deposits have proved to be much less prone to runs than wholesale funding, at least in some countries.

The indicator considers liquid assets to be currency, deposits, short-term loans, and debt securities, except those from banks and listed shares. The objective of removing debt securities from banks is to exclude endogenous liquidity (i.e. liquidity generated within the financial sector) from the liquidity buffer. If endogenous liquidity is not excluded, the building up of systemic risk in the upswing may be masked, as liquidity leverage may not increase due to a growing liquidity buffer supported by this type of securities.

2 Self-funding

This indicator measures the share of the securities excluding equities issued by a sector held within the same sector. Since sectors often fall jointly under pressure, the indicator signals the risk of large fire sales, as well as the availability of possible buyers. A potential problem (for some countries) with this indicator could arise from the fact that the share of own issued debt could still be significant.

⁵² While the exclusion creates a certain bias towards specific business models (funding received from retail depositors) to the detriment of others (wholesale funding), this choice reflects the view that insured retail deposits are less likely to be subject to runs. This notion is also incorporated in the LCR framework where insured retail deposits obtain significantly lower outflow factors.

3 Bid/ask spreads of sovereign bonds

The bid-ask spread is a popular measure of transaction costs (a proxy of market liquidity) in the market place. In general, a high spread will indicate lower liquidity, while a lower spread will signal higher liquidity in the market. Given the importance of sovereign bonds in the LCR, the indicator provides a measure of the actual market liquidity of HQLAs.

4 Investor base concentration

This indicator provides information on the investor structure of the bonds on the balance sheet of the domestic banking sector. This adds a dimension to the size of the buffers held by the banks (captured by e.g. LCR regulation). To illustrate, when an asset held by a bank is to a large extent held by other domestic banks, this asset will have more limited usefulness as a buffer when a systemic crisis affecting all banks in a country occurs (as all banks will simultaneously try to sell the asset and none of them will be willing to buy it). Conversely, when a particular asset held by a bank is additionally held by other types of investors (pension funds, insurers etc.) or by banks in other countries, it can be expected that the asset will be easier to liquidate in times of stress.

4.2.2 Banks

5 Liquidity leverage

See the description of indicator 1 above.

6 Investor base concentration

See the description of indicator 4 above.

7 Self-funding

See the description of indicator 2 above.

8 Central bank-eligible share of CBC to total LCR net cash outflows

This indicator measures the extent to which the total central bank-eligible CBC of a bank can cover its stressed 30-day outflows. A high ratio would indicate that the total central bank-eligible CBC surpasses the bank's stressed 30-day outflow, ensuring that the bank can survive during a severe 30-day liquidity shock. On the other hand, a low

ratio might suggest that the bank has an insufficient liquidity buffer in the case of a shock. Furthermore, it extends indicator 1 by implicitly taking the bank's business model into account and by considering residual rather than original maturities.

9 Central bank-eligible share of CBC to total assets

This indicator measures the proportion of total assets that comprises a bank's counterbalancing capacity that may be used to obtain liquidity in central bank credit operations. These are assets that are highly "liquid" and can be used in times of a liquidity shock, therefore mitigating systemic liquidity risk. The ratio relates the stock of unencumbered assets or other funding sources which are legally and practically available to an institution's total assets. Specifically, it uses the central bank-eligible part of the CBC, as defined in Regulation 2016/313.⁵³

10 LCR net outflows to total assets

This indicator complements the LCR and the indicators on banks' CBC by offering a different view of the liquidity risk profile of banks. High levels or sharp increases in the value of this indicator may indicate systemic liquidity risk, as banks may come under significant liquidity stress in the following 30 calendar days.

11 Short-term wholesale funding

The indicator focuses on the maturity risk stemming from high reliance on short-term wholesale funding. A high ratio indicates increased rollover risk and lower risk-bearing capacity in the case of a systemic stress event.⁵⁴

12 Asset encumbrance

High levels and sharp increases in banks' asset encumbrance ratios (AER) may indicate systemic liquidity risk, as banks' ability to alleviate liquidity shortages via collateralised borrowing is greatly reduced.

13 Market asset encumbrance

This indicator complements the asset encumbrance ratio (AER) by including the sources of encumbrance (market vs central bank). Its interpretation is dependent on

⁵³ Commission Implementing Regulation (EU) 2016/313 of 1 March 2016 amending Implementing Regulation (EU) No 680/2014 with regard to additional monitoring metrics for liquidity reporting.

⁵⁴ All dashboard indicators must be considered together for assessing liquidity risks in the banking sector. For example, focusing on wholesale funding alone would put any business model that does not rely on funding from retail depositors at a disadvantage. The liquidity risk of short-term funding should also be assessed in comparison to short-term assets, which may alleviate liquidity risk.

the level and changes in the AER and should not therefore be looked at individually. Even if the AER remains stable, a rise in the proportion of central bank funding might signal increasing difficulties to access market funding. Likewise, increases in the AER accompanied by rises in central bank funding might signal banks' difficulty in obtaining secured market funding. In the worst case, this would severely restrict funding for banks within the financial system, therefore contributing to a liquidity shock.

14 Collateral re-use

High levels of collateral re-use may pose systemic risks in at least three ways:

Collateral re-use may: (1) contribute to interconnectedness and higher risks of contagion; (2) contribute to the build-up of leverage; (3) increase procyclicality in the financial sector. Note that this indicator should only be used if collateral re-use is material in a given country, e.g. it makes up 1% of total assets.

15 DLSI

DLSI for a bank corresponds to the stress level that equates its funding shortfall from the liability side to its counterbalancing capacity from the stressed asset side. The higher the DLSI the higher the stress level a bank can withstand. A stress factor of one is calibrated to correspond roughly to the Lehman event. DLSI can also be averaged to capture short-term counterbalancing capacity of bank clusters.

4.2.3 Non-banks

16 Liquidity leverage

See the description of indicator 1 above.

17 Investment funds liquidity transformation

This indicator captures liquidity transformation (measured as total assets less liquid assets, deposits, sovereign bonds, debt securities issued by monetary financial institutions (MFIs) and equity and investment fund shares) as a share of total assets in the investment fund sector. The choice of the investment funds sector relies on the fact that it represents circa one-third of the broad shadow banking sector in Europe and it is a sector which is subject to more harmonised regulation across Europe (namely through UCITS and AIFMD) as opposed to the diverse cross-country nature of the remaining shadow banking entities. Liquidity transformation coupled with the leverage present in some investment funds' business models could amplify financial stability risks.

18 Investor base concentration

See the description of indicator 4 above.

19 Self-funding

See the description of indicator 2 above.

20 Shadow banking indicator

The metric can be read as a liquidity transformation or inverse liquidity coverage ratio. It measures the extent to which short-term liabilities exceed the amount of liquid assets. The larger the amount of short-term liabilities relative to liquid assets, the more difficult it will be to meet investor redemption requests without selling illiquid assets.

5 Using the systemic liquidity risk indicators

5.1 Summary and conclusions from the case studies

To analyse the usability of the dashboard, a number of case studies were conducted based on the dashboard indicators. However, it is important to note that the dashboard proposed in this report is intended to be primarily used over time for each country. Therefore, long time series data that shows the change in liquidity risk across different market conditions and different points in the business cycle is essential for each country. In this part, the key takeaways from the case studies are presented. The purpose is to provide further guidance on how the dashboard can be used under different market conditions to identify systemic liquidity risk and to highlight potential areas for future improvement.

The case studies showed that substantial expert knowledge is needed to explain changes in the indicators for the banking sector. For example, this is the case in countries where a large part of the banking sector consists of subsidiaries and branches of cross-border banking groups. Because of this market structure, issues related to group-level liquidity management may blur the analysis of other indicators. Another example where expert knowledge may be needed is when banks are primarily subsidiaries of internationally-oriented banks which transfer some of their deposits to their foreign parents for liquidity management purposes, therefore obscuring the total amount of outstanding liabilities.

The funding structure of the banking sector, as well as the liquidity profiles and maturity characteristics of assets and liabilities, are key components to factor into the risk assessment. In some countries, some indicators may show elevated levels if the funding structure of banks is not taken into account. If, for example, banks are not active participants in the interbank or bond markets but obtain funding from parent banks in other countries, liquidity measures such as the self-funding ratio may be near the minimum threshold. Liquidity profiles and maturity characteristics are particularly relevant for countries where wholesale funding is used to finance highly liquid assets. Therefore, in such countries a high value of the wholesale funding indicator does not necessarily reflect high liquidity risk. Furthermore, the level of wholesale funding may be related to the importance of intergroup transactions in the banking system.

Since country specificities play a major role in the infrastructure of each financial system, feedback from national authorities can decisively help reach a more comprehensive assessment of systemic liquidity risk, including a more accurate interpretation of some of the indicators. For example, the self-funding indicator for the banking sector requires additional information on issued debt retained on banks' balance sheets. The information on the composition of the liquidity buffer is also an important piece of information for a comprehensive risk assessment of

systemic liquidity risks, especially if it is possible to relate this information to the investor base indicator. The adjusted liquidity leverage ratio developed for some countries based on national data is also proof of how judgement by members can help improve the current dashboard.

A key aspect to keep in mind when analysing the indicators is the structure of the financial system (bank-based or market-based). This is especially important for countries with a market-based system, as the dashboard indicators are more likely to reflect vulnerabilities in the banking sector for two main reasons. First, aggregate indicators are mainly driven by the banking sector, which represents the largest part of the financial system. Second, it is not easy to assess systemic liquidity risks arising from the non-banking sector using a common subset of indicators, since this sector comprises financial entities with a high degree of heterogeneity of business models and risks. Ignoring these structures could result in incomplete risk assessments. Therefore, it would be important to take into account investment and money market funds and their links to the banking system, in case they represented a considerable part of the financial system.

Owing to the increasing importance of non-banks, the TFSL proposes to expand the dashboard indicators for the non-banking sector once sufficient data becomes available. FSB (2017a) points to an increase of 48% in global financial assets for non-banks and an aggregate growth of 1.6% in lending in 21 jurisdictions and the euro area from 2011 until 2016. The FSB highlights that non-banks can become a source of systemic risk if they perform bank-like activities such as maturity and liquidity transformation and leverage creation. Therefore, in order to fully capture systemic liquidity risk, it is important to incorporate liquidity risks stemming from the non-banking sector in the dashboard.

Indicators are complementary and the risks of overlapping information can be considered low. For example, while the “investor base concentration” and the “self-funding” indicators appear similar, the combination of measuring the concentration of securities holdings in the financial system and over-reliance on funding from the financial system makes it possible to detect complex feedback loop effects should a crisis occur.

Overall, the indicators are useful but are generally hampered by the lack of longer time series and data granularity. Furthermore, in some cases, qualitative background information on national circumstances and developments is required to complement the interpretation of the indicators. In addition, the current accommodative monetary policy stance could impair the timely identification of systemic liquidity risks through the liquidity illusion. The differences in data availability, the relatively short time series, the possibility of new risks arising in the future and the sometimes limited insight of the dashboard indicators suggest that the dashboard should be supplemented by an analysis of systemic liquidity and funding risks by national experts. This would add the necessary level of flexibility to the dashboard’s unified risk monitoring approach, similarly to the work of the ESRB and the ECB on risk assessment in commercial real estate markets, where the scoreboard is supplemented by expert surveys. In addition, further expansion of indicators for the non-banking sector is recommended once there is sufficient data available.

5.2 Possible improvements to the indicators

The case studies brought to light a number of potential improvements to the dashboard. These enhancements would benefit the dashboard by: (i) improving the ability of indicators to capture the build-up of risks; and (ii) helping with the correct interpretation of the content of some of the indicators. However, these improvements were not incorporated for three main reasons: (i) they would require a degree of detailed data currently not available to the ECB; (ii) their incorporation, although feasible at ECB level, is costly in terms of resources; and (iii) taking them on board could result in an excessive expansion of the current version of the dashboard. In this subsection, these remaining issues are explained in detail and a way forward is proposed.

A possible improvement can only be done with national data for the liquidity leverage indicator. The aggregate for the financial system considered to calculate the indicator should exclude the central bank and sub-sectors of the non-banking sector that relate to entities that are not typical financial intermediaries (such as holding companies). In particular, the aggregate for the non-banking sector should include: (i) insurance corporations and pension funds (sectors S.128 + S.129 = S12Q);⁵⁵ (ii) investment funds (sectors S.123 + S.124 = S12L); (iii) financial intermediaries excluding investment funds and excluding holding companies (sectors S.125 + S.126 + S.127 – S.127A). Additionally, short-term liabilities may exclude deposits from the central bank. An increase in central bank funding, although probably signalling higher risk, does not reflect agents taking more liquidity risk (in a context of liquidity illusion/excess) but the fact that liquidity risk is materialising, with the banks losing access to market funding. Furthermore, the dashboard already includes asset encumbrance indicators that focus on central bank dependence and loss of market access. The liquidity leverage indicator may also be calculated in an alternative way that enables the liquidity illusion to be quantified. The liquidity illusion is the gap between the observed liquidity leverage and the “true” liquidity leverage. True liquidity leverage takes into account the conflicting expectations of issuers and investors and aims at correcting for inconsistent expectations at the systemic level. It corresponds to the liquidity leverage ratio in which endogenous liquidity (i.e. created within the financial sector, namely claims and assets within the financial sector and equity) is excluded.

Other improvements could also be considered but would significantly expand the size of the dashboard. For example, additional information on the funding structure of the financial and/or banking sector could be retrieved. The indicator may have a high value but it may refer only to a small share of the banking sector total assets. In addition, a measure of the changes in the weight of deposits in the funding structure could be considered. In addition to self-funding indicators within each sub-sector (self-funding between banks and self-funding between non-banks), measures of cross-funding could be added, highlighting the role of non-banks in the provision of funding to banks and vice versa. Such measures would explicitly measure

⁵⁵ Sector classification in accordance with the European System of Accounts (ESA) 2010.

the interconnectedness between the banking sector and the non-banking sector (which is not explicit in the current self-funding indicator for the financial sector). It might also be useful to have information on the debt securities that are driving this investor base concentration. This information might be especially relevant if combined with that about the composition of the liquidity buffer of the banks and the exposure to domestic sovereign debt. In fact, a common point of the case studies presented was the role of exposures to domestic sovereign debt in the liquidity buffer and the role of the domestic financial sector as a holder of these debt securities.

Foreign currency (FX) funding risks should also be considered as banks are exposed to foreign exchange rate movements, which might impact their access to foreign funding. High reliance on foreign currency borrowing (particularly with a short-term maturity) exposes banks to exchange rate movements and foreign currency funding reversals. Experience from the recent crisis has shown that establishing central bank swap lines is necessary to provide smooth access to FX liquidity. Banks with severe maturity mismatches in foreign currencies are particularly exposed to disruptions similar to those observed in 2008. At that time, the swap lines between different central banks had to be arranged to ensure access to FX liquidity. As noted in the ESRB Recommendation ESRB/2011/1,⁵⁶ the existence of such liquidity lines plays an important role in stabilising FX swap markets, even if they are not used. In countries where banks have significant FX-denominated assets on their balance sheets (mainly FX mortgage loans) they need to obtain funding in foreign currencies to close the resulting net open FX position. Unless banks have access to direct funding in foreign currencies (e.g. from the parent group in the case of multinational banking groups), they must use FX swaps or CIRS to convert deposits denominated in national currency into FX-denominated funding.

However, constructing an FX funding indicator is not straightforward. One possibility for assessing FX funding risks is to use the ALMM⁵⁷ reporting⁵⁸ (COREP template C61) submitted for significant currencies. However, it is not clear whether euro area banks report the euro as a significant currency in this template, which renders the computation of the FX funding indicator from template C61 incorrect, at least for some countries. Computing banks' FX funding by summing up all foreign currencies is very time-consuming, prone to computational errors and subject to reporting mistakes. Furthermore, some banks may erroneously report FX positions converted into EUR, further complicating the calculation. Thus, alternative data sources need to be considered.

Other possible improvements relate to the non-banking sector. The dashboard includes a section of indicators calculated for the aggregate of the non-banking sector. Since this sector comprises financial entities with a high degree of heterogeneity of business models and risks, it might be challenging to assess systemic liquidity risks arising from the non-banking sector using a common subset of indicators. In addition,

⁵⁶ Recommendation of the European Systemic Risk Board of 21 September 2011 on lending in foreign currencies (ESRB/2011/1).

⁵⁷ Additional liquidity monitoring metrics.

⁵⁸ Commission Implementing Regulation (EU) 2016/313 of 1 March 2016 amending Implementing Regulation (EU) No 680/2014 with regard to additional monitoring metrics for liquidity reporting.

the relative importance of the components of the non-banking sector differ across countries and for that reason an aggregated indicator is not easy to interpret and compare without further information. Accordingly, indicators could be calculated separately for the sub-sectors of the non-banking sector.

The TFSL considers it important for national authorities to play a role in analysing the dashboard. For the cases identified above, where the degree of data detail is not available at the ECB, to take those proposals on board would require the participation of national authorities in the dashboard to revise and update indicators. The additional information identified as useful for a correct interpretation of some of the indicators or of additional indicators considered relevant for a comprehensive risk assessment could be collected via a survey to national authorities whenever the dashboard is updated.

6 Conclusions and way forward

The TFSL recommends that systemic liquidity risk should remain high on the macroprudential agenda, especially during changes in monetary policy. This report has shown the importance of macroprudential liquidity tools. The first part of this report defines systemic liquidity and explains why microprudential liquidity requirements are unlikely to be suitable for addressing macroprudential liquidity risks.

Taking into account the usability of the dashboard with its current limitations, the TFSL recommends using the dashboard as a reference tool for systemic liquidity risk, to monitor its effectiveness and revise the indicators in the coming two years, taking into account the growing role of the non-bank financial sector. The report cannot currently make a case for new macroprudential liquidity tools from a risk perspective. The second part of this report analyses the development of indicators with a view to assessing the materiality of system-wide liquidity risks. While the indicators have proven useful in various case studies, data quality and availability issues in various dimensions make it difficult to construct a compelling case for considering the activation of macroprudential liquidity instruments from a risk perspective. Since the time dimension of the dashboard presented in this report is more useful than the cross-sectional dimension (comparing across time rather than across countries), long time series data that show the change in liquidity risk across different market conditions and different points in the business cycle is essential.

In addition, the TFSL supports the ESRB recommendations of 14 February 2018 to address systemic liquidity risk in the form of additional liquidity management tools for fund managers, additional provisions to reduce the likelihood of excessive liquidity mismatches, as well as tighter liquidity stress-testing practices. These recommendations represent a step forward towards mitigating systemic liquidity risk arising outside of the banking sector. In particular, adequate liquidity management tools (i.e. redemption fees, redemption games and suspension of redemptions) can limit systemic liquidity risk arising from redemption pressures during times of declining asset prices.

The TFSL recommends conducting a formal legal assessment of Article 458 of the CRR and the possibility of introducing national macroprudential measures. The last part of the report sheds light on the legal basis for macroprudential liquidity requirements but uncertainties remain. There are various ways in which macroprudential authorities can introduce liquidity tools. However, no straightforward option exists and all options are hampered by varying degrees of legal uncertainty.

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Annex

A Practical experiences from liquidity crises

Box 1

The impact of simultaneous shocks to funding costs and funding requirements increases exponentially via the impact on solvency

In 2008 an EU bank experienced a spread shock which spiralled out of control and led to the banks' insolvency. The bank initially held predominantly public debt, which it funded by covered bonds and unsecured wholesale funding. The bank did not have retail deposits. The banks' shareholders were other banks until one of them bought out the other shareholders. To boost profitability, the bank then adapted its business model and started writing credit default swaps (CDS) on sovereign and sub-sovereign public debt.

With the outbreak of the liquidity crisis in August 2007, the bank's funding costs increased in line with those of other banks. Given the narrow margins on its exposure to the public sector, the bank made losses on its assets, despite still-high asset quality. When the crisis evolved, CDS spreads increased sharply. That led to additional margin calls for the CDS it had written. Given the deteriorating profitability and the ongoing financial crisis, the bank could not raise the funds required to cover these additional margin calls and became illiquid in November 2008.

Box 2

Solvent banks may not always have expanded access to money and debt markets

In the fourth quarter of 2015 the banking system of an EU Member State recorded an increase of 38% in total equity (leading to an average CET1 ratio of 16%), which nevertheless did not lead to an improvement in its funding costs. Interbank borrowing, debt securities issued and customer deposits remained fairly stable, thus resulting in continuous reliance on central bank funding. To sum up, addressing solvency issues does not necessarily remove liquidity strain. The prevailing macroeconomic conditions and impaired operating environment at that time crowded out the improvements in the capital structure and the solvency ratios of the banking system, leading to stringent access requirements to money and debt markets. The improvement in the capital structure of the banks has not been reflected in the LCR estimates, since at the beginning of 2015 the aggregate LCR stood at 70%, falling to approximately 0% in the fourth quarter of 2015. This decline can be mainly attributed to the use of the liquidity buffer to cover increased liquidity needs owing to the macroeconomic environment. Another factor that influenced LCR was the unwinding mechanism, as a result of the use of non-HQLA in the central bank's refinancing operations.

B Dashboard indicators

B.1 Financial system

B.1.1 Liquidity leverage

This indicator captures liquidity risk exposure relative to available liquidity (“liquidity leverage”) across all financial sectors within one country. Its main advantage is its broad coverage and long time series that allow for an overall indicator of liquidity risk within a particular country. A lower value of the indicator signals lower liquidity risk.

$$\text{Liquidity leverage} = \frac{\text{Short – term liabilities of all financial institutions}}{\text{Short – term assets + long – term liquid assets of all financial institutions}}$$

The indicator is computed as follows:

$$\frac{\begin{aligned} &(\text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F22.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F89.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F52.Z.Z.XDC.T.S.V.N.T} - \\ &\text{QSA.Q.N.XX.W2.S12K.S1M.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T}) \\ &/ \\ &(\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F21.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F22.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S124.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12O.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S128.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S129.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F3.L.Z.XDC.T.S.V.N.T} + \\ &\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F511.Z.Z.XDC.T.S.V.N.T} - \\ &\text{QSA.Q.N.XX.W2.S12.S12K.N.A.LE.F3.T.Z.XDC.T.S.V.N.T}) \end{aligned}}$$

Data source: Flow of Funds data (Quarterly Sector Accounts). Data are available for all countries.

Criteria:

- *Systemic liquidity:* This indicator adds a dimension not present in current regulation or other indicators.
- *Scope:* This indicator captures all financial sectors.
- *Crisis signalling:* Crisis signalling is present for some countries.
- *Data availability:* Time series are available from 1999, on a quarterly basis. The ratio can be built for all euro area countries.

B.1.2 Self-funding

This indicator is a measure of the extent to which securities issued by financial institutions in one country are held by financial institutions in the same country. A relatively high fraction points to various possible risks: 1) the financial sector might have structural issues in finding outside investors; 2) contagion risks are elevated; 3) institutions could have trouble issuing new securities.⁵⁹

$$\text{Issuer base indicator}_{i,s,t} = \frac{\text{Securities held by sector } s \text{ in country } i \text{ at time } t}{\text{Securities issued by sector } s \text{ in country } i}$$

Data source: Securities Holdings Statistics (SHS) by Sector data.

Criteria:

- *Systemic liquidity:* Periods of stress in the financial system can cause banks to default, which in turn affects their ability to provide liquidity to the real economy. In addition, due to bank defaults, other market participants might also incur losses if they hold securities in the banks that failed.
- *Scope:* This indicator captures potential difficulties in the entire financial sector to issue new securities/potential losses resulting from shocks to a country's banking system.
- *Crisis signalling:* Low. Data are unavailable prior to the last financial crisis.
- *Data availability:* In principle, this indicator can be constructed for (1) the banking sector in every euro area country; (2) the investment fund and the insurance sectors in every euro area country, and (3) all other countries from 2013 onwards.

B.1.3 Bid/ask spreads of sovereign bonds

Given the relevance of sovereign bonds in the HQLA stock of LCR, it is important to have an indicator that signals possible stress in the market liquidity of this kind of assets. The bid-ask spread⁶⁰ is a popular measure of transaction costs (proxy of market liquidity) in the marketplace. In general, a high spread will indicate lower liquidity, while a lower spread will signal higher liquidity in the market. Given that the degree of cross-country heterogeneity for these instruments is very high, this indicator might be particularly useful over time rather than in the cross-sectional dimension.

$$\text{Bid_ask spread (\% of par value)} = \text{ASK price} - \text{BID price}$$

Data source: Market data from a commercial provider (Thomson Reuters).

Use 10-year on-the-run central government securities to obtain bid and ask prices.

⁵⁹ However, debt securities do not contain ordinary interbank liabilities and hence only represent a fraction of bank debt.

⁶⁰ The bid price is the highest price that a buyer is willing to pay for a bond while the ask price is the lowest price that a seller is willing to accept in order to sell it.

Criteria:

- *Systemic liquidity:* This indicator shows a clear distinction between periods of stress and periods of more benign market conditions. It shows important variations at country level (profound during the sovereign crisis, as expected). It is a good complement to the indicators on the liquidity risk exposure and the liquidity risk-bearing capacity of banks, as it considers the liquidity of financial markets.
- *Scope:* This indicator captures market liquidity for banks.
- *Crisis signalling:* Two main episodes of stress are identified, coinciding with the global financial crisis and the sovereign debt crisis.
- *Data availability:* No data for some small countries. Available time series start well before the global financial crisis.

B.1.4 Investor base concentration

This indicator provides the investor structure of the bonds on the balance sheet of the domestic financial sector. When an asset held by a financial institution is, to a large extent, held by other domestic financial institutions banks, this asset will have more limited usefulness as a buffer when a systemic crisis affecting all institutions in a country occurs (as they will simultaneously try to sell the asset and none of them will be willing to buy it). The magnitude of this indicator is driven by both the importance of each asset in the financial sector balance sheet and how the amounts held relate to total outstanding amounts (that is, the role of the financial sector as an investor for that asset).

$$\text{investor base concentration} = \frac{\text{Value of bonds held by domestic financial sector}}{\text{Total outstanding market value of these bonds}}$$

Data source: The data on debt securities holdings are obtained from SHS data, in particular, sheet F31 (short-term debt) and F32 (long-term). The data are available for a wide range of institutions, including banks and investment funds. In the following example, the banking sector is used. Instead of banks, the indicator can also be calculated for any other financial sector.

Criteria:

- *Systemic liquidity:* This indicator adds a dimension not present in current regulation or other indicators.
- *Scope:* This indicator can capture the investor base concentration of any financial sector, such as banks, investment funds or insurers.
- *Crisis signalling:* For now, expert judgement is necessary. There is considerable time and cross-country heterogeneity.

- *Data availability:* Time series are available since 2013, on a quarterly basis. The ratio can be built for all euro area countries, subject to agreement of Member States.

B.2 Banks

B.2.1 Liquidity leverage (banks)

See Indicator 5.3.1.1. This indicator captures liquidity risk exposure relative to available liquidity (“liquidity leverage”) across the banking sector within one country. A lower value of the indicator signals lower liquidity risk.

$$\text{Liquidity leverage} = \frac{\text{Short – term liabilities of MFIs}}{\text{Short – term assets} + \text{long – term liquid assets of MFIs}}$$

The indicator is computed as follows:

$$\frac{\begin{aligned} & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F89.T.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S1M.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T} \end{aligned}}{\begin{aligned} & (\text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F21.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F2M.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F3.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F511.Z.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S12K.N.A.LE.F3.S.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S12K.N.A.LE.F3.L.Z.XDC.T.S.V.N.T}) \end{aligned}}$$

Data source: Flow of Funds data (Quarterly Sector Accounts). Data are available for all countries.

Criteria:

- *Systemic liquidity:* This indicator adds a dimension not present in current regulation or other indicators.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* Crisis signalling is present for some countries.
- *Data availability:* Time series are available from 1999, on a quarterly basis. The ratio can be built for all euro area countries and some non-euro area EU countries.

B.2.2 Investor base concentration (banks)

The rationale for this indicator is the same as that for indicator 7.3.1.4 applied to banks.

B.2.3 Self-funding (banks)

The rationale for this indicator is the same as that for indicator 7.3.1.2 applied to banks.

B.2.4 Total central bank-eligible share of CBC to total LCR net cash outflows

This indicator measures the extent to which the total central bank-eligible CBC of a bank can cover its LCR stressed 30-day outflows. A high ratio for a given bank would indicate that the total central bank-eligible CBC surpasses the bank's stressed 30-day outflow, ensuring that the bank can survive during a severe 30-day liquidity shock. On the other hand, a low ratio might suggest that the bank has an insufficient liquidity buffer in the event of a shock. Furthermore, it extends indicator 9 (Total central bank-eligible CBC to total assets) by taking into account the short-term liquidity risk exposure of the banking system, and implicitly the business model of banks and the LCR ratio, by considering a broader definition of liquid assets.

$$\begin{aligned} & \text{Total central bank eligible CBC to total LCR net cash outflows} \\ &= \frac{\text{total central bank eligible CBC}}{\text{stressed 30 day outflow}} \end{aligned}$$

Data source: The data on CBC is obtained from ALMM template C71 under COREP. The data on net outflows is collected from the LCR calculation template C76, also within the COREP framework. The reporting starts with Q3 2016.⁶¹ Data are reported on a quarterly basis. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

Total central bank eligible share of CBC to total LCR net cash outflows =

Criteria:

- *Systemic liquidity:* This indicator captures broader liquidity elements than the LCR. It is an important element to be combined with the other indicators in the report.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* This indicator currently cannot signal any crisis and more data points are needed.
- *Data availability:* The ratio can be built for all countries but data starts only in Q3 2016.

⁶¹ For previous periods, before the LCR became a Pillar 1 requirement, there was no harmonised guidance on how to calculate the LCR. According to Article 460 of the CRR: "Member States may maintain or introduce national provisions in the area of liquidity requirements before binding minimum standards for liquidity coverage requirements are specified and fully introduced in the Union in accordance with Article 460."

B.2.5 Central bank-eligible CBC to total assets

This indicator measures the proportion of total assets comprising a bank's CBC that may be used to obtain liquidity in central bank credit operations. These are assets that are highly "liquid" and can be used in times of a liquidity shock, therefore mitigating systemic liquidity risk. The ratio relates the stock of unencumbered assets or other funding sources which are available legally and practically to an institution's total assets. Specifically, it uses the central bank-eligible part of the CBC, as defined in the law.⁶² A lower ratio suggests higher risk.

$$\text{Central bank eligible CBC to total assets} = \frac{\text{Total central bank eligible CBC}}{\text{Total assets}}$$

Data source: The data on CBC is obtained from ALMM template C71 under COREP. The data on total assets is collected from template F01 of the FINREP framework. Data are reported on a quarterly basis. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

$$\text{CBC to total assets} = \frac{C_71.00, R010, C090 + C_71.00, R120, C090}{F_01.01, R380, C010}$$

Criteria:

- *Systemic liquidity:* Central bank-eligible CBC captures broader liquidity elements than the LCR.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* This indicator cannot signal any crisis unless more data points become available.
- *Data availability:* The ratio can be built for all countries but data are only available since the second quarter of 2016.

B.2.6 LCR net cash outflows to total assets

This indicator complements the previous two indicators by providing a measure of short-term stressed net liquidity needs and by offering a different view on the liquidity risk profile of banks compared to the CBC indicators. High levels or sharp increases in the value of LCR net cash outflows may indicate systemic liquidity risk, as banks may come under significant liquidity stress in the following 30 calendar days.

$$\begin{aligned} & \text{Total net cash outflows to total assets} \\ & = \frac{\text{Total net outflows over the next 30 calendar days}}{\text{Total assets}} \end{aligned}$$

⁶² Commission Implementing Regulation (EU) 2016/313 of 1 March 2016 amending Implementing Regulation (EU) No 680/2014 with regard to additional monitoring metrics for liquidity reporting.

Data source: The data on net outflows is collected from the LCR calculation template C76, within the COREP framework. The first reporting period is Q3 2016.⁶³ The data on total assets is collected from template F01 of the FINREP framework. Data are reported on a quarterly basis. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

$$\text{Total net outflows to total assets} = \frac{C76.00, R370, C010}{F01.01, R380, C010}$$

Criteria:

- *Systemic liquidity:* This ratio provides a measure of short-term stressed net cash outflows, and therefore delivers a more complete view on the extent of systemic liquidity risks stemming from cash outflows over a time horizon of 30 calendar days.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* This indicator cannot signal any crisis unless more data points become available.
- *Data availability:* The ratio can be built for all countries but the time series only starts in Q3 2016.

B.2.7 Short-term wholesale funding to total assets

The indicator focuses on the maturity risk stemming from the high reliance on short-term wholesale funding. A high ratio indicates increased rollover risk and a high level of interconnectedness within the financial system and therefore high exposure to liquidity risk should a systemic stress event occur.

$$\text{Short term wholesale funding to total assets} = \frac{\text{Short term wholesale funding}}{\text{total assets}}$$

Short-term wholesale funding includes liabilities of credit institutions from financial customers with a residual maturity of up to one year and the liabilities resulting from the issuance of debt securities with a residual maturity of up to one year.

Data source: The data used come from the stable funding template C61.⁶⁴ The template is reported quarterly and the first reporting period is Q1 2014. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

⁶³ For previous periods, before the LCR became a Pillar 1 requirement, there was no harmonised guidance on how to calculate the LCR. According to Article 412(5) of the CRR: "Member States may maintain or introduce national provisions in the area of liquidity requirements before binding minimum standards for liquidity coverage requirements are specified and fully introduced in the Union in accordance with Article 460."

⁶⁴ In the future, once implemented, the maturity ladder template of the ALMM reporting may be a better source of data.

$$\text{Short term funding to total assets} = \frac{C_{61}, R140: R230, C010: C040}{C_{61}, R040: R250, C010: C050}$$

Criteria:

- *Systemic liquidity:* The high level of short-term funding could indicate the elevated risk-taking behaviour of the economic agents preceding a systemic crisis, possibly signalling a liquidity illusion building up phase when rollover risk is underestimated.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* An increase in the indicator can signal elevated risks stemming from higher reliance on unstable short-term wholesale funding.
- *Data availability:* The ratio can be built for all countries, with a short time series starting in 2014 Q1.

B.2.8 Asset encumbrance

High levels and sharp increases in banks' asset encumbrance ratios (AER) may indicate systemic liquidity risk. The increase in encumbrance may reveal difficulties in accessing unsecured funding in the market and results in a reduced ability for banks to alleviate liquidity shortages via collateralised borrowing. A lower AER suggests a lower level of risk.

$$AER = \frac{\text{Total encumbered assets} + \text{Total collateral received and reused}}{\text{Total assets} + \text{Total collateral received available for encumbrance}}$$

Data source: Data are collected from the Asset Encumbrance templates, tables F32, within the FINREP framework. The first reporting period is the fourth quarter of 2014. Data are reported on a quarterly basis. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

$$\frac{F_{32.01, R010, C010} + F_{32.02, R130, C010}}{F_{32.01, R010, C010} + F_{32.01, R010, C060} + F_{32.02, R130, C010} + F_{32.02, R130, C040}}$$

Criteria:

- *Systemic liquidity:* The increase in this indicator signals less availability of assets to act as buffers for potential liquidity crises. But it should be noted that the indicator also includes assets encumbered in central bank operations, and therefore the increase might already be the result of a liquidity crisis. This indicator should, therefore, be complemented with the information from the indicator on market funding encumbrance.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* This indicator signals liquidity stress in some countries during the observation period.

- *Data availability:* AERs can be built for all countries but with a relatively short time series starting in Q1 2014.

B.2.9 Market funding encumbrance

This indicator complements the AER by detailing the proportion of asset encumbrance that is related to market funding. Its interpretation is dependent on the level and changes in the AER and should therefore not be looked at individually. Even if the AER remains stable, a decrease in the proportion of market funding (an increase in the proportion of central bank funding) might signal increasing difficulties to access market funding. Likewise, increases in the AER accompanied by decreases in market funding proportion (increases in central bank funding) might signal banks' difficulty in obtaining market funding (secured or unsecured funding). Nevertheless, it should also be noted that, especially during periods of accommodative monetary policy, decreases in market funding encumbrance ratio may also be due to cheaper access to central bank liquidity rather than difficulties in accessing market funding. A lower ratio suggests higher risk.

$$\text{Market funding encumbrance} = \frac{\text{Total encumbrance} - (\text{repos with CB} + \text{collateralised deposits with CB})}{\text{Total sources of encumbrance}}$$

Data source: Data are collected from the Asset Encumbrance templates, tables F32, within the FINREP framework. The first reporting period is Q4 2014. Data are reported on a quarterly basis. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

$$\text{Market funding encumbrance} = 1 - \frac{F_{32.04, R060, C010} + F_{32.04, R80, C010}}{F_{32.04, R170, C010}}$$

Criteria:

- *Systemic liquidity:* This indicator complements AER helping to signal systemic liquidity risks as it may reveal banks' difficulties in obtaining new secured funding in the market.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* This indicator signals liquidity stress in some countries during the observation period.
- *Data availability:* This indicator can be built for all countries but with a short time series starting in 2014.

B.2.10 Collateral re-use

High levels of collateral re-use may pose systemic risks in at least three ways: Collateral re-use may (1) contribute to interconnectedness and higher risks of

contagion; (2) contribute to the build-up of leverage; and (3) increase procyclicality in the financial sector. Note that this indicator should only be used if collateral re-use is material in a given country, e.g. it makes up 1% of total assets.⁶⁵

$$\text{Collateral reuse rate} = \frac{\text{Total collateral reused}}{\text{Total collateral received eligible for reuse}}$$

Data source: Data are collected from the Asset Encumbrance templates, Tables F32, within the FINREP framework. Data are reported on a quarterly basis from Q4 2014 onwards. The data used are on a consolidated basis. The following cells were used, coded as table, row, and column:

$$\text{Collateral reuse rate} = \frac{F\ 32.02, R130, C010}{(F\ 32.02, R130, C010 + F\ 32.02, R130, C040)}$$

Criteria:

- *Systemic liquidity:* The collateral re-use rate can be used to approximate its contribution towards interconnectedness and contagion. Larger values of this measure reflect a higher degree of interconnectedness and the longer chains of intermediation that are created when a specific type of collateral is reused more frequently. In combination with the total size of collateral re-use (in terms of total assets), this measure may provide a useful indicator for systemic liquidity risk.
- *Scope:* This indicator captures the banking sector.
- *Crisis signalling:* The re-use rate has been a useful indicator for signalling liquidity risk for very large banks with a business model of an investment bank.
- *Data availability:* The collateral re-use rate can be built for all countries but with a short time series starting in 2014.

B.2.11 Distance to liquidity stress indicator (DLSI)⁶⁶

This is a stress test-based indicator where a series of simulations is performed. DLSI for a bank corresponds to the stress level that equates its funding shortfall from the liability side to its counterbalancing capacity from the stressed asset side. The higher the DLSI, the higher the stress level a bank can withstand. A stress factor of one is calibrated to correspond roughly to the Lehman event. DLSI can also be averaged to capture short-term counterbalancing capacity of bank clusters.

Scenarios of increasing severity are defined on the basis of run-offs and haircuts. Assuming a pecking order (which can be parametrically selected) in the way that banks use their unencumbered liquid assets, a system-wide estimate of the overall supply of collateral and total fire sales can also be produced to account for system-wide contagion and endogenous amplification mechanisms.

⁶⁵ Otherwise, a country may have a very high collateral re-use rate, but it refers to non-material amounts.

⁶⁶ A more detailed description of the DLSI indicator can be found in Chapter 14 of Halaj and Lalotios (2017), "A top-down liquidity stress test framework".

Data source: Supervisory data on asset and liability structure and Asset Encumbrance templates within FINREP are used to inform the bank balance sheet on a quarterly basis. More granular data on the composition of sovereign and available-for-sale/fair-value-option portfolios from the most recent EBA stress test exercise are also used to enhance the granularity level of the liquidity buffer and to estimate banks' counterbalancing reactions. The DLSI indicator can be calculated retrospectively on the basis of historical datasets, provided that a selection of modelling parameters and options is finalised and kept constant over time.

Some parameters are arbitrarily selected as some of the available system modules are disabled. Average DLSI grouped by country or cluster can identify significant differences in the relative capacity of clusters to withstand a liquidity crisis. An aggregate value above one suggests excessive capacity to withstand severe funding outflows, while values below one are suggestive of potential shortfalls in the event of a severely adverse scenario. More granular analysis can be performed to identify the main drivers of a low reading in DLSI.

Criteria:

- *Systemic liquidity:* This indicator contributes to a dimension not present in current regulation or other indicators, mainly due to its ability to capture endogeneity and system-wide amplifications.
- *Scope:* This indicator focuses predominantly on banks.
- *Crisis signalling:* Supervisory data are available since end-2014, on a quarterly basis. Cross-sectoral and cross-temporal heterogeneity could signal potential vulnerabilities or even a crisis event assuming that DLSI converges to historic lows.
- *Data availability:* This indicator can be calculated for all banks for which supervisory data are available; however, calculations require significant validation and quality assurance effort.

B.3 Non-banks

B.3.1 Liquidity leverage (non-banks)

This indicator captures liquidity risk exposure relative to available liquidity ("liquidity leverage") across the non-bank financial system within one country. Its main advantage is its broad coverage and long time series that allow for an overall indicator of liquidity risk within a particular country. A lower value of the indicator signals lower liquidity risk.

Liquidity leverage

$$= \frac{\text{Short term liabilities of all non bank financial institutions}}{\text{Short term assets} + \text{long term liquid assets of all non bank financial institutions}}$$

Because of limitations in data availability, the indicator is computed as follows:

$$\frac{\text{Short term liabilities of all financial institutions} - \text{Short term liabilities of MFIs}}{(\text{Short term assets} + \text{long term liquid assets of all financial institutions}) - (\text{Short term assets} + \text{long term liquid assets of MFIs})}$$

Accordingly, the indicator is computed in practice as follows:

$$\begin{aligned} & \text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F22.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F89.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.L.LE.F52.Z.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S1M.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T} - \\ & (\text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.L.LE.F89.T.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S1M.N.L.LE.F2M.T.Z.XDC.T.S.V.N.T}) \\ & / \\ & (\text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F21.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F22.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S124.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12O.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S128.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S129.S1.N.A.LE.F29.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F3.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F3.L.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12.S1.N.A.LE.F511.Z.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12.S12K.N.A.LE.F3.T.Z.XDC.T.S.V.N.T} - \\ & (\text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F21.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F2M.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F3.T.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F4.S.Z.XDC.T.S.V.N.T} + \\ & \text{QSA.Q.N.XX.W0.S12K.S1.N.A.LE.F511.Z.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S12K.N.A.LE.F3.S.Z.XDC.T.S.V.N.T} - \\ & \text{QSA.Q.N.XX.W2.S12K.S12K.N.A.LE.F3.L.Z.XDC.T.S.V.N.T}) \end{aligned}$$

Data source: Flow of Funds data (Quarterly Sector Accounts).

Criteria:

- *Systemic liquidity:* This indicator adds a dimension not present in current regulation or other indicators.
- *Scope:* This indicator refers to the whole non-bank financial sector, including, inter alia, investment funds, special-purpose vehicles and other financial institutions.
- *Crisis signalling:* Crisis signalling is present for some countries.
- *Data availability:* Time series are available from 1999, on a quarterly basis. The ratio can be built for all euro area countries.

B.3.2 Investment funds liquidity transformation⁶⁷

The increasing size of the EU investment fund sector as a proportion of the financial system, coupled with the liquidity transformation and leverage present in some investment funds' business models, can amplify financial stability risks. The most relevant categories of investment fund are open-ended investment funds which offer frequent redemption opportunities for investors. Open-ended investment funds can be subject to redemption (liquidity) risk, typically when they offer daily liquidity to their investors while investing in assets which cannot be liquidated as quickly without a material price impact. This indicator intends to capture the fact that the demandable equity of open-end investment funds should be compared with the illiquid assets in which they invest.

IF liquidity transformation

$$= 1 - \frac{\text{deposits} + \text{sovereign bonds} + \text{debt sec. issued by MFI} + \text{equity} + \text{IF shares}}{\text{IF Total assets}}$$

Liquidity transformation by investment funds expressed as total assets minus liquid assets (deposits, sovereign bonds, debt securities issued by MFIs and equity and investment fund shares), as a share of total assets. Closed-ended funds are not included. Estimates are made for holdings of non-euro area securities and funds not resident in the euro area.

The indicator is computed as follows:

$$\begin{aligned} & \text{IVF.Q.XX.N.TA.A20.A.1.U2.1000.Z01.E} + \\ & \text{IVF.Q.XX.N.TA.A20.A.1.U4.0000.Z01.E} * (\text{IVF.Q.XX.N.TA.A20.A.1.U2.1000.Z01.E} / \\ & \text{IVF.Q.XX.N.TA.A20.A.1.U2.0000.Z01.E}) + \\ & \text{IVF.Q.XX.N.TA.A30.A.1.U2.2100.Z01.E} + \\ & \text{IVF.Q.XX.N.TA.A30.A.1.U2.1000.Z01.E} + \\ & \text{IVF.Q.XX.N.TA.A30.A.1.U4.0000.Z01.E} * (\text{IVF.Q.XX.N.TA.A30.A.1.U2.1000.Z01.E} + \\ & \text{IVF.Q.XX.N.TA.A30.A.1.U2.2100.Z01.E}) / \text{IVF.Q.XX.N.TA.A30.A.1.U2.0000.Z01.E} + \\ & \text{IVF.Q.XX.N.TA.A50.A.1.Z5.0000.Z01.E} \\ & / \\ & \text{IVF.Q.XX.N.TA.T00.A.1.Z5.0000.Z01.E} \end{aligned}$$

Data source: ECB Investment Funds Balance Sheet Statistics.

Criteria:

- *Systemic liquidity:* This indicator adds a dimension not present in current regulation or other indicators.
- *Scope:* This indicator refers to open-ended investment funds.
- *Crisis signalling:* Crisis signalling is present for some countries.
- *Data availability:* Time series are available from Q4 2008, on a quarterly basis. The ratio can be built for all euro area countries.

⁶⁷ Indicator calculated according to the methodology used in ESRB (2017).

B.3.3 Investor base concentration (non-banks)

The rationale for this indicator is the same as that for indicator 7.3.1.4 applied to non-banks.

B.3.4 Self-funding (non-banks)

The rationale for this indicator is the same as that for indicator 7.3.1.2 applied to non-banks.

B.3.5 Shadow banking indicator

The metric can be read as a liquidity transformation or inverse liquidity coverage ratio. It measures the extent to which short-term liabilities exceed the amount of liquid assets. The larger the amount of short-term liabilities relative to liquid assets, the more difficult it will be to meet investor redemption requests without selling illiquid assets.

Short-term liabilities relative to liquid assets for the broad shadow banking sector, defined as MMFs, non-MMF investment funds, financial vehicle corporations, and other financial institutions which cannot be identified by entity type.⁶⁸ Liquid assets include currency, deposits, and securities with an original maturity of less than one year, and listed shares. Short-term liabilities include debt securities with an original maturity of less than one year, deposits and fund shares.

Data source: euro area accounts and balance sheet items statistics

Criteria:

- *Systemic liquidity:* The indicator is based on an aggregate balance sheet concept covering a broad array of non-bank, non-insurance financial institutions. The ratio is calculated for the sector as a whole, and does not allow for the identification of distributional effects.
- *Scope:* The indicator captures liquidity transformation by the non-bank, non-insurance financial sector – i.e. broadly defined shadow banking sector, which comprises MMFs, non-MMF investment funds, financial vehicle corporations, and other financial institutions which cannot be identified by entity type.
- *Crisis signalling:* This indicator has not been used as a signalling device.
- *Data availability:* No data at country level.

⁶⁸ This indicator could be further broken down for different types of shadow banking entities to obtain a more detailed overview of liquidity transformation.

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