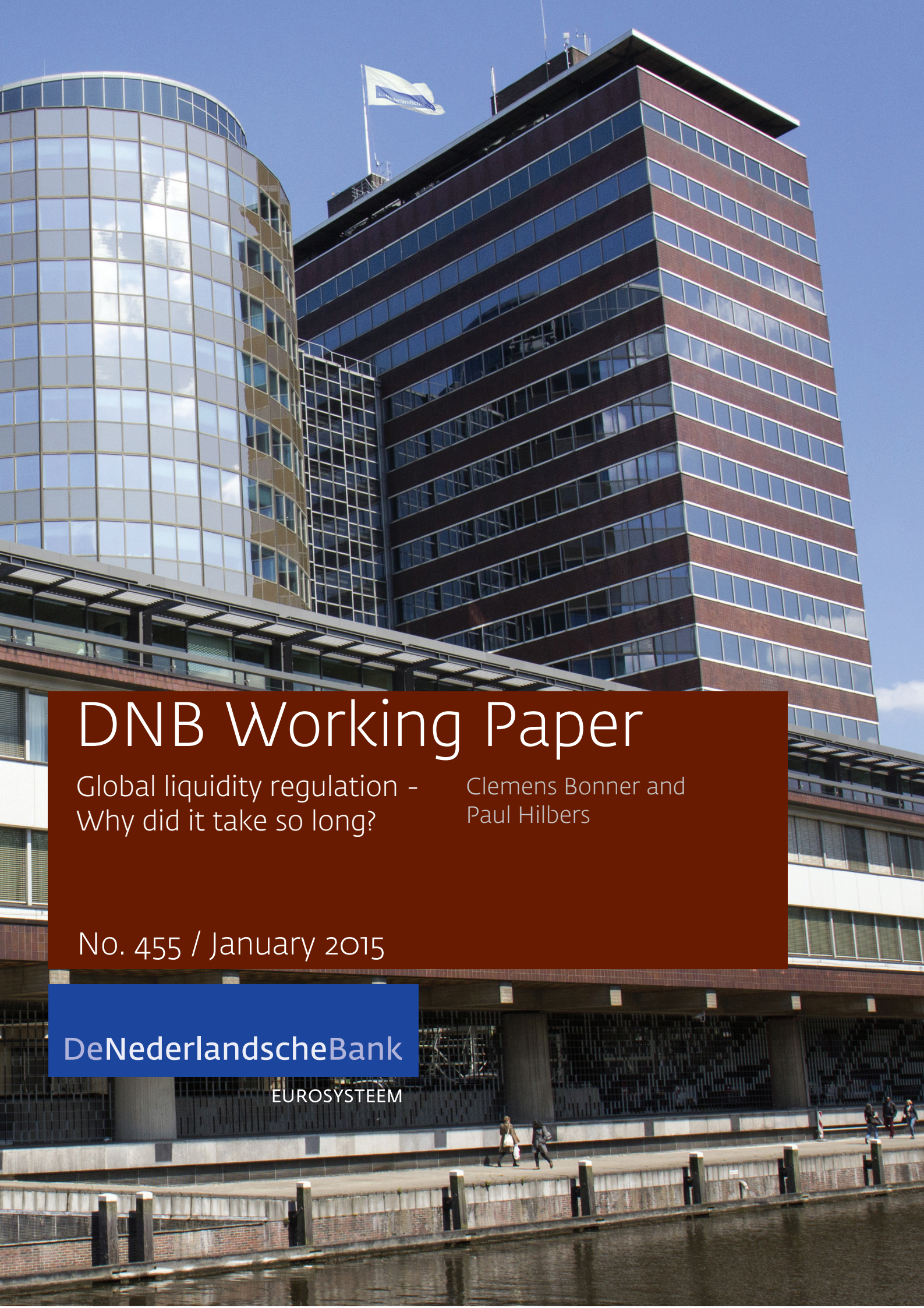

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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Global liquidity regulation - Why did it take so long? *

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Abstract

The purpose of this paper is to assess the history of global liquidity regulation until the revised Basel III proposals in 2013 and to analyze the interaction of capital regulation and banks' liquidity buffers. Our analysis suggests that regulating capital is associated with declining liquidity buffers. The interaction of liquidity regulation and monetary policy as well as the view that regulating capital also addresses liquidity risks were important factors hampering harmonized liquidity regulation. It appears that crisis-related supervisory momentum is an important factor behind most agreements on regulatory harmonization.
In line with that, the drying up of funding and the subsequent liquidity problems during the 2007-08 financial crisis played a large role in the development of the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).

Keywords: Regulation, Policy, Liquidity, Banks.
JEL classification: G18, G21, E42.

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1. Introduction

Bank capital and liquidity are two intrinsically linked concepts and important mitigants of the risks included in banks' core business to "borrow short and lend long". While capital is part of banks' liabilities and therefore a source of funding, liquid assets appear on the other side as a use of funding. Capital can absorb losses; liquid assets can be used to absorb the risk of bank runs or of other funding sources drying up.[1] Although they are usually considered separately, bank capital and liquidity interact in a number of direct and indirect ways or as Goodhart (2009) puts it: "*An illiquid bank can rapidly become insolvent, and an insolvent bank illiquid.*"

It should therefore not come as a surprise that the then chairman of the Basel Committee on Banking Supervision (BCBS) George Blunden stated at its initial meeting in 1975 that the Committee's aim is to ensure adequate capital and liquidity levels of the main international banks. As a matter of fact, the incident that prompted the establishment of the BCBS was a combination of several types of risks: The German-based Herstatt Bank received Deutsche Marks from a number of banks in exchange for USD payments to be made in New York. Due to the failure of the bank and the time difference, the counterparty banks did not receive their payments causing them to suffer from heavy losses on their unsettled trades.

Despite the initial objective to harmonize both liquidity and capital regulation, capital adequacy (specifically in relation to credit risk) soon became the main focus of the Committee's work after its establishment in 1975. Eventually this led to the adoption of Basel I in 1988, while the Committee failed to harmonize liquidity regulation.

BCBS (2013a) argues that since it raised concerns that the capital ratios of the main international banks were deteriorating at a time of growing international risks, the onset of the Latin American debt crisis was the main reason for the Committee to shift its focus towards capital. Looking at the events during this crisis, the Committee's initial bias towards capital seems justified.

The 2007-08 financial crisis, however, showed how quickly liquidity can evaporate and how rapidly even well capitalized banks can loose their access to funding markets. As argued by Brunnermeier (2009), the lending boom that laid the foundation for the 2007-08 financial crisis was financed by banks' increased issuance of asset-backed securities (ABS) and reliance on short-term funding from institutional investors.[2] Both of these financial

[1] See Farag et al. (2013).
[2] See Acharya et al. (2013).

industry trends severely increased banks' individual but also system-wide liquidity risk.[3]

Many of the risks that led to the financial crisis were not detected during the previous period characterized by high economic growth, low interest rates, low inflation and high employment rates. However, when default rates on subprime mortgages rose, investors became nervous about the value of ABS, which either turned illiquid or banks could only sell them with high haircuts.[4] In such a situation even well capitalized banks are forced into firesales which reduce the value of other banks' assets. Against this background, Cifuentes et al. (2005) argue that liquidity buffers may be more helpful to prevent systemic stress because they internalize the costs of selling into a falling market. More generally, it is likely that requiring institutions to increase their liquidity buffers would restore confidence of investors, avoid fire sales, reduce banks' reliance on central banks and give supervisors time to react. The 2007-08 financial crisis therefore showed that capital and liquidity requirements are not substitutes but complements.

While Goodhart (2009, 2011a) provide a comprehensive summary of why the earliest attempts failed, the purpose of this paper is to provide a historic overview of why after the first attempts in the 1980's, regulators continued to struggle with the introduction of global liquidity regulation and why in the end, they did succeed. We also provide an analysis regarding the impact of capital regulation on banks' liquidity buffers.

The remainder of the paper is organized as follows: Section 2 provides an overview of the history of global liquidity regulation while Section 3 illustrates why the initial attempts regarding the harmonization of liquidity regulation failed. In Section 4, we sketch the interaction of capital and liquidity and analyze whether the harmonization of capital regulation had an impact on banks' liquidity holdings. Sections 5 to 8 illustrate the path to Basel III as well as the Basel III liquidity standards and explain the role of the 2007-08 financial crisis. Section 9 concludes.[5]

2. The history of liquidity regulation from 1975 until 2008

As indicated during its first meeting, the BCBS started to work on both capital and liquidity in 1975.[6] Although initial discussions were more focused on the question which authority - home or host - should be responsible for supervision as opposed to ways of

[3] Franklin and Carletti (2008) provide an overview of the role liquidity played during the financial crisis.

[4] See Brunnermeier (2009) or Acharya and Merrouche (2013).

[5] While the paper focusses on the developments around liquidity, a summary of the Basel I, II and III Capital Accords can be found in the appendix.

[6] The presented facts until 1997 are largely based on Goodhart (2011a). The interpretations and opinions are the authors'.

measuring the risk, liquidity remained prominent on the agenda until the 19th meeting of the BCBS in June 1980, where the then Chairman Peter Cooke proposed to discuss liquidity and capital adequacy of international banks.

The Latin American Debt crisis, however, pushed liquidity off the agenda until 1984.[7] In that year, the BCBS established a subgroup on liquidity which was mandated to answer a number of conceptual questions regarding the measurement and management of liquidity risk as well as specific questions about the role of interbank markets and the supervision of liquidity risks of foreign branches.

After first discussions, the work started with the BCBS Secretariat providing a summary of member countries' approaches to monitor banks' liquidity as well as the subgroup issuing a questionnaire regarding the prudential supervision of liquidity risks.

In February 1985, the subgroup presented a full report, which pointed towards a potential over-reliance on money market funds, foreign currencies and central bank facilities. Remarkably, the report recommended the BCBS to take a similar approach for liquidity as it did for capital adequacy: a harmonized minimum standard.

Until then, most policymakers considered liquidity to be too complex as well as bank-specific and therefore it was seen as more appropriate to issue general guidelines as opposed to a harmonized minimum standard. Another important conclusion was that most international banks raise deposits through foreign branches and that, therefore, the overall assessment of liquidity adequacy should be carried out by the home supervisor. Up to this point, the general opinion was that the supervision of liquidity falls under the responsibility of the host supervisor. The initial report was later amended with a new chapter, which introduced the concept of a survival time, reflecting the time an institution can withstand stress without central bank intervention.

Although the conclusions of the report suggested further work on liquidity, there was no appetite in the BCBS to develop harmonized liquidity principles or to further investigate the concept of a survival time. Rather, the Secretariat concluded that liquidity issues are a matter for national authorities. A likely reason for this decision was the common view that banks were already under high pressure to reach capital adequacy. A particular problem during that time was the view that liquidity regulation could only be harmonized if central bank collateral frameworks are harmonized as well. Many members considered it essential to closely link the eligibility of an asset in the context of liquidity regulation to its central bank eligibility. Since the definition of central bank eligibility significantly differed

[7] While this paper focuses on the developments around liquidity, an overview of the Basel I, II and III capital Accords as well as information regarding the Latin American Debt crisis can be found in the appendix.

across countries, a harmonization of liquidity regulation was considered unfeasible.

Soon after the decision against harmonized liquidity standards, the BCBS still decided to establish another liquidity subgroup, which delivered a new report in 1987 with a focus on assessing the feasibility of a survival period concept. Due to large differences in approaches and the limited availability of data, the report was rather sceptical regarding the introduction of this concept.

Despite this conclusion, the group was still mandated to develop a simple framework for liquidity measurement, which had to be based on existing data and the idea of a survival concept. Interestingly, the described framework showed a number of parallels to the later Basel III LCR. The subgroup recommended to 1) focus on a one and three month horizon; 2) compare the stock of readily marketable securities to net cash outflows, and 3) distinguish between stable retail deposits and more volatile wholesale funds.

Due to other events - especially the introduction of Basel I and issues encountered by the NYSE - the liquidity proposal was never discussed in detail. Even more so, the subgroup then changed its position and recommended against harmonized liquidity standards. While the key arguments were the lack of harmonized data and the large differences in national approaches, several members questioned whether liquidity regulation is needed in general. Specifically, *"some members (...) questioned whether there was the same (...) need to seek convergence of liquidity regulation compared with capital. They suggested that (...) capital adequacy would itself tend to raise standards of liquidity by inducing banks to hold low-weighted assets."*[8]

Although the critical view on harmonizing liquidity regulation remained within the Committee, the subgroup continued doing some work between 1990 and 1992. The group produced two papers on similar topics as before. Specifically, the group provided a more systematic approach on how to measure and manage liquidity risks and how home and host supervisors should coordinate the liquidity risk assessment in foreign branches.[9] In 1992, the group was dissolved.

Although both papers were discussed in several international fora and there seems to have been some appetite for further work, no other papers on liquidity were produced until 2000. After some further discussions between 1997 and 1999, in February 2000 the BCBS published an updated version of its paper from 1992, which outlined 14 principles. Apart from providing guidance on how banks can improve their internal liquidity risk management, the principles in BCBS (2000) also referred to public disclosure and the role

[8] See Goodhart (2011a).
[9] See BCBS (1992).

of supervisors.

The focus of the paper was put on incentivizing banks to develop internal structures and processes for managing liquidity risk, measuring and monitoring net funding requirements, managing market access, contingency planning and foreign currency risks.[10]

After the publication of BCBS (2000), liquidity risk had a less prominent role on the BCBS agenda until - in 2004 - the Joint Forum agreed that liquidity risk management was an issue to be studied in more detail.[11] The initial focus was put on reviewing how financial institutions in different sectors manage liquidity risks and the regulatory standards adopted by various jurisdictions. A second focus was the impact of institutions' and supervisors' response to stress events and their impact on systemic risk.

By 2005, the Joint Forum signalled several findings about liquidity risk management. Regarding management policies and structures, it was found that there was a trend towards centralization of liquidity risk management. Also, firms seem to have improved their ability to provide quantitative indicators of their liquidity risk. The most common measures used were liquid asset ratios, cash flow projections and stress tests. Since most indicators only referred to idiosyncratic stress, the Joint Forum suggested that supervisors should explore the reasons why firms did not consider market-wide shocks.

Around the same time, the Institute of International Finance (IIF) established a Special Committee on Liquidity Risk.[12] The objective of this committee was to develop guidelines on liquidity risk management, monitoring, measurement and governance at financial institutions.[13] The main motivation was that *"the liquidity characteristics of international markets have been undergoing significant changes at a time when the industry and the regulatory community have been giving relatively greater attention to other issues."*[14] IIF (2007) further states that the increased concentration among firms that provide liquidity, the reliance on secured funding markets and the lack of harmonized liquidity regulation suggests that liquidity risk deserves a closer look.

[10] A more detailed summary of BCBS (2000) can be found in the appendix.

[11] The Joint Forum was established in 1996 under the aegis of the Basel Committee on Banking Supervision (BCBS), the International Organization of Securities Commissions (IOSCO) and the International Association of Insurance Supervisors (IAIS) to deal with issues common to the banking, securities and insurance sectors, including the regulation of financial conglomerates. The objective of the Joint Forum is to support banking, insurance and securities supervisors in meeting their regulatory and supervisory objectives and, more broadly, to contribute to the international regulatory agenda in particular where risks exist across or in gaps between the three supervised sectors.

[12] The IIF is the global association of the financial industry. Its members include almost 500 financial institutions (commercial banks, asset managers, hedge funds etc.) from 70 countries.

[13] The guidelines developed by the Special Committee on Liquidity Risk are therefore roughly in line with BCBS (1992, 2000).

[14] See IIF (2007).

IIF (2007) provides a number of recommendations to financial firms regarding the governance and organizational structure for managing liquidity as well as a framework to measure and monitor the risk. The report also includes guidance regarding stress testing and contingency funding. Interestingly, IIF (2007) also states that the increasing importance of globalized markets and the substantial amount of institutions conducting their business across borders motivates the introduction of harmonized liquidity regulation, including efficient communication between home and host supervisors. However, IIF (2007) also states that *"liquidity regulations should be based on qualitative approaches designed to foster sound enterprise risk management, not prescriptive, quantitative requirements."*

Given the role of the IIF and the close links between IIF (2007) and BCBS (2000), members of the IIF and the BCBS held a meeting to discuss a first draft of IIF (2007). At this meeting, the Committee was asked to provide feedback on IIF (2007) and more specifically regarding the need for liquidity requirements, the impact of complex financial instruments on liquidity risk management, and liquidity risk management's impact on secured funding. Following the meeting with the IIF as well as parallel work of the European Central Bank (ECB) that pointed towards a divergence of approaches to liquidity risk management, both at the level of financial institutions and supervisors, the BCBS set up a new Working Group on Liquidity (WGL), which scheduled the submission of a report for the Committee's meeting in December 2007.

In this meeting, the WGL provided an overview and the main conclusions of their report. First, while there was broad agreement that liquidity supervision is important, practices and objectives varied widely across jurisdictions. Second, contextual factors, such as deposit insurance and central bank lending facilities, greatly influence the level of desired liquidity resilience.[15] Third, there are additional business costs for cross-border banks that arise from nationally determined liquidity regimes. Additionally, in light of the financial turmoil of mid-2007, the WGL emphasized the need to further review liquidity risks in the banking system. In particular, the WGL recommended to update BCBS (2000).

The BCBS agreed to this and the updated version was published in June 2008. BCBS (2008) is based on the same principles as BCBS (2000) but includes a few additions.[16]

Specifically, BCBS (2008) recommends the inclusion of liquidity costs and risks in the process of product pricing, performance measurement, and new product approval. Additionally, BCBS (2008) gives a more detailed outline on how to manage liquidity risks

[15] See Bonner et al. (2014) for more details regarding the role of these contextual factors in determining banks' liquidity buffers.

[16] See the appendix for a more detailed description of BCBS (2008).

of specific items, such as correspondent, custody and settlement activities as well as off-balance sheet commitments and exposures in foreign currencies. Another addition to BCBS (2000) is the guidance on how to assess the health of banks. Suggested measures include both static ratios and forward-looking instruments as well as a few early warning indicators of liquidity risk.

Another new element in BCBS (2008) was the recommendation that banks should not only manage liquidity risk at the individual entity level, but also form a group-wide view of liquidity risk. Additionally, banks are prompted to differentiate between encumbered and unencumbered assets in order to appropriately manage their collateral positions. Finally, BCBS (2008) provides some more detail with respect to stress tests and contingency plans as well as the role of supervisors.

3. Key obstacles regarding harmonizing liquidity regulation

With BCBS (1992, 2000, 2008), the BCBS made important progress in the area of harmonizing liquidity regulation for internationally active banks. While these three guidelines aim to improve banks' liquidity risk management, there has also been some appetite throughout the years to introduce minimum standards for liquidity on the same footing as those for capital. The issue of developing minimum liquidity standards has been brought to the table several times and while there were many different reasons, there seem to be three obstacles that have repeatedly hampered the harmonization of liquidity regulation: 1) The lack of supervisory momentum; 2) the view that capital addresses liquidity risks, and 3) the interaction of liquidity regulation and monetary policy implementation.

3.1. Lack of supervisory momentum

The emergence of the Latin-American debt crisis and the subsequent shift towards capital was a first indication regarding the importance of a crisis exposing a particular risk for its regulation.[17] Also the fact that the BCBS neglected one of the earlier proposals regarding liquidity with the argument that banks are already under pressure to reach capital adequacy shows that succeeding in the harmonization of a particular risk seems to at least partially depend on supervisory momentum.[18]

The issue of a lack of supervisory momentum becomes particular apparent by the events during the late 1980s. The feasibility of the survival period concept was partially questioned because of limited data availability. With the supervisory momentum of a crisis,

[17] Please see the appendix for somewhat more information on the Latin-American debt crisis and the role it played in the development of Basel I.

[18] Also see Goodhart (2009).

regulators are likely to be more comfortable regarding burdening banks with additional requests to overcome issues such as limited data availability.

3.2. The view that capital addresses liquidity risks

Related to the lack of a global liquidity crisis was the common perception that ensuring capital adequacy also addresses liquidity risks. Two arguments were brought forward to support this hypothesis: First, as long as an institution holds sufficient capital, it will be able to refinance itself in the market or via the central bank at any time and will therefore not face excessive liquidity shortages.[19] Second, requiring banks to hold sufficient capital relative to risk-weighted assets directly incentivizes banks to hold more assets with lower risk-weights which usually have better liquidity quality. Considering liquidity risk to be a subcomponent of capital risk, reduces the need for liquidity-specific minimum standards.

3.3. Central banks and monetary policy

An important determinant of an asset's liquidity is whether or not it is central bank eligible. An asset is central bank eligible if it can be used as collateral for central bank credit operations. For a long time, the BCBS considered fully harmonized collateral frameworks an essential subcomponent of harmonized liquidity regulation. Due to the long tradition and different sentiments concerning central bank policies in all countries, it is easy to imagine that the harmonization of collateral frameworks is an almost impossible task. Consequently, Goodhart (2011a) argues that the different collateral frameworks of the various central banks around the globe were the main stumbling block in the liquidity negotiations during the 1980s. Being already exhausted by the efforts to find a common approach to capital adequacy, the BCBS considered it unfeasible to additionally harmonize the definition of central bank eligibility. In later years, another issue was the concern of liquidity regulation hampering interbank money markets and therefore monetary policy transmission.[20]

Before turning to the more recent events around the harmonization of liquidity regulation and the role of the 2007-08 financial crisis, however, it is important to first understand the interaction of liquidity buffers and capital regulation.

4. The interplay of capital and liquidity regulation

Although there are many different views on the interaction between liquidity and capital regulation, it is possible to classify these views into two broad categories. The first

[19] See Admati and Hellwig (2013).
[20] See Bonner and Eijffinger (2013).

category considers capital regulation to substitute liquidity regulation. Capital regulation incentivizes institutions to hold more assets with low risk-weights. Since assets with low risk-weights usually have good liquidity quality, regulating capital would also address liquidity risk. Related to this is the view that well capitalized banks are better able to attract funding and that high capital levels reduce the risk of bank runs. Again, regulating capital would reduce liquidity risks. Admati and Hellwig (2013), for instance, argue that if institutions are solvent, meaning that the value of the bank's equity remains positive during stress, the central bank can provide liquidity to help the bank overcoming liquidity problems and therefore regulating liquidity might not be necessary.[21]

On the other hand, one might argue that capital and liquidity are both costly and therefore regulating capital might incentivize banks to shift risks to the asset side. The rationale behind this view is that banks will optimize their balance sheets in order to reduce costs. Requiring higher levels of capital is likely to reduce banks' profits, in turn incentivizing banks to adopt riskier strategies and to reduce the holdings of costly liquid assets.[22] The 2007-08 financial crisis suggests that this might have been the case.[23]

Supervisory attention is another factor that might cause negative correlation. When new requirements for one risk are implemented it is likely that banking supervisors pay more attention and provide more resources to this risk, potentially leading to imprudent behavior with regard to other types of risks.

Due to the important role of capital and liquidity for banks' activities and their connectedness with the various risks a bank is facing, it is challenging to develop an analytical view on their interaction. Nevertheless, before turning to the more recent events concerning the harmonization of liquidity regulation, the following sections take an analytical approach aiming at understanding the interaction of liquidity buffers and capital regulation, especially during times of regulating capital more tightly.[24]

[21] Note though that the authors argue in favor of a non risk-weighted equity ratio (leverage ratio) between 20% and 25%, which is significantly higher than current levels.

[22] Also see Hellmann et al. (2014).

[23] See the Introduction for more details.

[24] Due to data constraints, the definition of capital and liquidity in the following sections is very narrow. Ideally, one would want to use a risk-weighted capital ratio as opposed to an unweighted ratio akin to the leverage ratio. The definition of liquidity seems appropriate for the Dutch sample, while in the cross-country analysis it would be preferable to also include marketable securities as opposed to only cash and central bank reserves.

4.1. Capital and liquidity holdings of Dutch banks from 1900 to 1990

Figure 1 is based on data from DNB (2000) and shows liquidity buffers and capital levels of the Dutch banking sector from 1900 to 1990.[25] Liquidity is defined as the sum of central and regional government debt, central bank reserves, cash and covered bonds (minus a 15% haircut) as percentage of all interbank deposits and 10% of all retail deposits while capital reflects the percentage of equity in total assets.[26]

Figure 1: Capital levels and liquidity buffers of Dutch banks, 1900-1990

a: Liquidity ratio in % b: Capital ratio in %

Note: The figure presents capital levels and liquidity buffers of the Dutch banking system from 1900 to 1990. Liquidity is defined as the sum of central and regional government debt, central bank reserves, cash and covered bonds (minus a 15% haircut) as percentage of all interbank deposits and 10% of all retail deposits while capital reflects the percentage of equity in total assets.

Figure 1a shows that banks held small liquidity buffers at the beginning of the 20th century. Between 1920 and 1940, liquidity buffers increased by a factor of 10. This sharp increase is caused by the Great Depression, which led to a rapid expansion of government debt on banks' balance sheets. After 1945, liquidity buffers declined relatively steadily until 1980. From 1985 to 1987, a slight increase can be observed followed by another sharp decline from 82% to 60% between 1987 and 1990.

In contrast to liquidity, Figure 1b shows that banks have the highest capital levels at the beginning of the 20th century and apart from an increase between 1930 and 1940, banks' capital ratios decline steadily until 1980. Particularly sharp are the declines during

[25] Note that 1990 is chosen because it is the last year available in this dataset. For all subsequent sections, the latest available data points are used.

[26] The measure for capital is therefore closer to a leverage ratio as opposed to the risk-weighted capital ratio. For the purpose of this analysis, however, the leverage ratio is equally suitable. The definition of liquidity aims at replicating the LCR, which is the rationale behind the used haircuts on covered bonds and the outflow rates of retail and interbank deposits.

both World Wars. From 1986 until 1990, however, banks' capital ratios rise again.

Looking at Figure 1, it becomes evident that both liquidity and capital holdings have declined between 1950 and 1990. However, they do not seem to be highly correlated with each other. This can also be seen in Table 1 which shows that there were periods of high correlation (e.g. between 1960 and 1980) but also periods during which this was not the case. Although one needs to be cautious to draw conclusions in this regard, the graphic analysis shows some evidence that the beginning of the implementation period of Basel I in 1988 stopped the decrease of capital while liquidity buffers declined further.

Table 1: Capital and liquidity over time

Period	1900-1920	1920-1940	1940-1960	1960-1980	1980-1990
Liquidity	83	221	593	162	72
Capital	26	24	15	7	4
Correlation	-0.12	0.36	0.30	0.95	-0.07

Note: Liquidity aims at replicating the LCR as precisely as possible. It is calculated as the sum of central and regional government debt, central bank reserves, cash and covered bonds (85%) as percentage of interbank deposits and 10% retail deposits. Capital is calculated as equity in percentage of total assets. Correlation reflects the correlation coefficient of liquidity and capital during the respective period.

4.2. Capital and liquidity holdings of Dutch banks from 1982 to 2011

DNB's detailed reporting of capital and liquidity began in 1982. Figure 2 presents liquidity buffers and capital levels of Dutch banks from 1982 to 2011. Liquidity is calculated as the sum of cash and government bonds as percentage of retail and wholesale liabilities while capital is calculated as equity in percentage of total assets.

While the previous section mainly discussed some general patterns, the focus of this section is the correlation between capital and liquidity after the Basel I (left vertical line, 1988) and Basel II (right vertical line, 2004) Accords.

Figure 2a shows that after the Basel I proposal in 1988, banks' liquidity buffers start to decline until the final implementation in 1992 where they seem to stabilize. For capital, the opposite can be observed. Figure 2b shows that after a dip, banks' capital ratios continuously rise from 4.2% in 1988 to 5.5% in 1997. In the boom years during the late 1990s and early 2000s, banks significantly increased their balance sheets while capital remained constant, causing capital ratios do decline. Only after Basel II was proposed, capital starts once again to rise from 3.9% to 5.1% in 2007 while liquidity buffers decline from 177% to 165% in the same period.

While Figure 1 shows some signs of capital and liquidity being negatively correlated in case only one is regulated, Figure 2 provides additional indication supporting this hypothesis. While this pattern is rather clear for the Dutch banking sector, it is useful to complement these findings with a cross-country analysis.

Figure 2: Liquidity and capital of Dutch banks from 1982 to 2011

a: Liquidity b: Capital

Note: The figure presents capital levels and liquidity buffers of the Dutch banking system from 1982 to 2011. Liquidity is calculated as the sum of cash and government bonds as percentage of retail and wholesale liabilities while capital is calculated as equity in percentage of total assets. In 2003, DNB strengthened its formal Pillar 1 liquidity requirement from 1977, which caused regulatory liquidity to drop. The dashed line is an approximation for the liquidity buffer under the old standard.

4.3. Cross-country capital and liquidity from 1980 to 2009

Figure 3 shows capital holdings for four representative countries from 1980 to 2009. Capital describes aggregate equity over total assets. The data stems from the International Financial Statistics (IFS) database. The vertical lines represent the Basel I proposal in 1988. To make numbers fully comparable across countries, all figures are normalized with 1988 being defined as the base value set to 100.

Starting with Germany, Figure 3a shows that capital holdings increase from 100 in 1988 to 110 in 1993. Italy's capital ratio (Figure 3b) rises by 30% to 130 between 1988 and 1993 and therefore shows significantly larger increases than that of Germany. Figure 3c, describing Spain's capital levels, shows more similarities to the developments in Germany. Spain's capital ratio increases by 17% between 1988 and 1990 but then falls again to reach 107 in 1993. Finally, the US capital ratio (Figure 3d) shows the largest jump and increases by 50% between 1988 and 1993. Figure 3 therefore shows that banks in many countries significantly increased their capital ratios between the Basel I proposal in 1988 and the actual implementation in end-1992.

Turning to liquidity, Figure 4 shows liquidity buffers from 1980 to 2009 for the same four countries. Liquidity is defined as cash and central bank reserves as percentage of the sum of interbank deposits and 10% retail deposits. The variable is normalized with the value in 1988 being set equal to 100. While the pattern is not always fully clear, Figure 4 seems to confirm that regulating capital is correlated with declining liquidity buffers.

Figure 4a shows that German banks' liquidity buffers decrease by 48% to 52 in 1993.

Figure 3: Capital levels across countries, 1980-2009 (1988=100)

a: Germany

b: Italy

c: Spain

d: United States

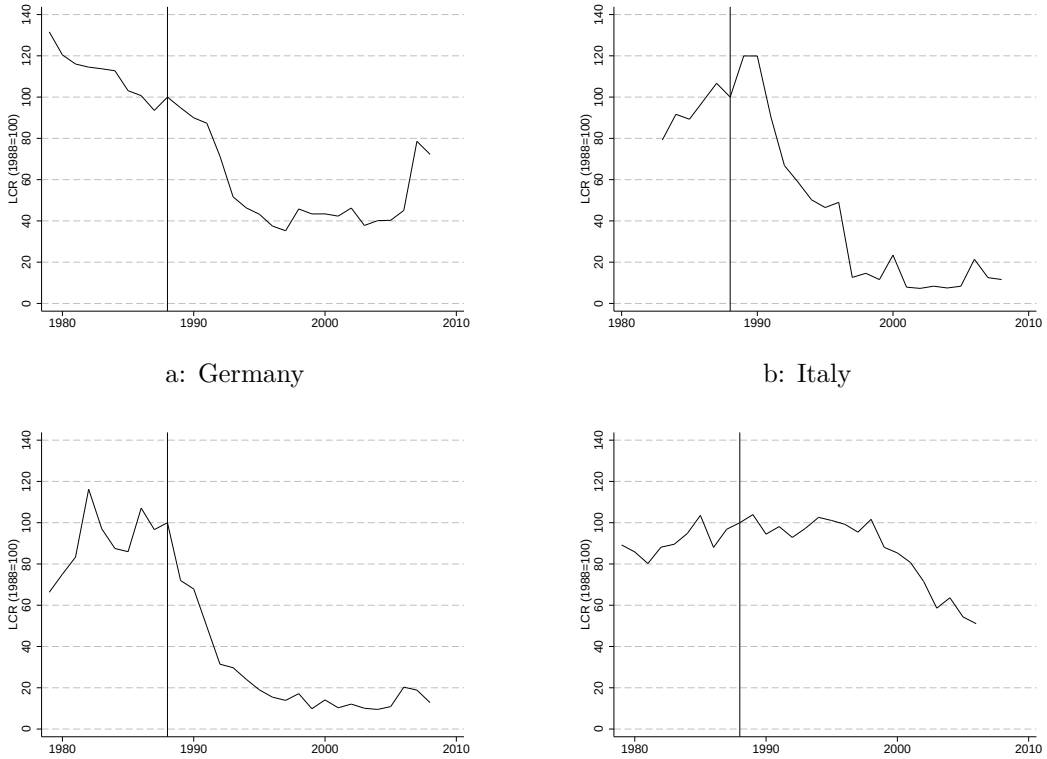
Note: The figure presents capital levels of four representative countries from 1980 to 2009. Capital describes aggregate equity over total assets. The vertical line represents the Basel I proposal in 1988. All figures are normalized with 1988 being defined as the base value set to 100.

Similarly, Figure 4b suggests that Italy's liquidity buffers decrease from 100 to 59, albeit with an increase between 1988 and 1990. Like capital, the pattern for Spain (Figure 4c) looks somewhat similar to the one of Germany. Spain's liquidity ratio shows the largest decrease (-70%) from 100 in 1988 to only 30 in 1993. Finally, Figure 4d (United States) shows a less clear pattern but still a decrease by 7% between 1988 and 1992.

While the graphic analysis should not be considered fully conclusive, the evidence from the three data sources is rather clear. Both the analysis specifically referring to the Netherlands as well as the cross-country comparison suggest that regulating capital is associated with a decrease in liquidity holdings.

The graphic analysis points to a negative correlation between capital and liquidity as capital was regulated more tightly. To further understand this link, Table 2 shows correlation coefficients of liquidity, capital, GDP growth, inflation and long-term interest rates. The data covers 27 countries and the years 1980 to 2008.

Figure 4: Liquidity buffers across countries, 1980-2009 (1988=100)



a: Germany

b: Italy

c: Spain

d: United States

Note: The figure presents liquidity buffers of four representative countries from 1980 to 2009. Liquidity is defined as cash and central bank reserves as percentage of the sum of interbank deposits and 10% retail deposits. The vertical line represents the Basel I proposal in 1988. All figures are normalized with 1988 being defined as the base value set to 100.

Table 2 confirms the conclusions from the graphic analysis. Over the entire sample from 1980 to 2008, capital is somewhat positively correlated with liquidity (0.06). During the implementation period of Basel I from 1988 to 1992, however, the correlation is significantly negative (-0.38). The correlation coefficients of the other variables, however, are fairly similar during the two periods.

This section suggests that regulating capital reduces banks' liquidity buffers. As such, there seem to be arguments to consider them jointly in regulation. With the Basel III proposals, the BCBS recommends to both tighten capital requirements and to introduce new liquidity standards. The following sections will discuss how the BCBS continued after the publication of BCBS (2008) and which role the financial crisis played in this process.

Table 2: Correlation coefficients over the entire sample (1980 to 2009) and from 1988 to 1992

Entire sample	Liquidity	Capital	Interest rates	GDP growth	Inflation
Liquidity	1				
Capital	0.06	1			
Interest rates	-0.17	-0.22	1		
GDP growth	0.05	0.16	-0.11	1	
Inflation	-0.05	-0.15	0.74	-0.22	1
1988-1992					
Liquidity	1				
Capital	-0.38	1			
Interest rates	-0.12	-0.12	1		
GDP growth	0.09	0.22	-0.24	1	
Inflation	-0.08	-0.03	0.61	-0.25	1

Note: The table shows correlation coefficients of liquidity and capital as well as a number of macroeconomic variables. As in the graphic analysis, liquidity and capital are normalized with 1988 being set equal to 100.

5. Basel III, the financial crisis and supervisory momentum

5.1. A chronology of the crisis and the role of liquidity

As many other crises, the 2007-08 financial crisis has its origins in the real estate market. Making a historic comparison, Calomiris (2009) argues that similar to previous real estate-related crises, the 2007-08 financial crisis has been the result of government policies incentivizing excessive real estate risk taking. According to Brunnermeier (2009), this was supported by low interest rates caused by the Federal Reserve Bank's fear of deflation after the bursting of the internet bubble.[27]

Apart from these policy-related factors, two financial industry trends laid the foundation of the lending boom and housing frenzy that eventually led to the financial crisis: banks' increased issuance of asset-backed securities (ABS) and the reliance on short-term funding from institutional investors.[28]

The process of securitizing is often described as the "originate and distribute" model and begins with a bank originating regular loans.[29] To turn illiquid, individual loans into tradable securities, "sponsoring" banks sell pools of loans to specifically established off-balance vehicles, usually referred to as Special Purpose Vehicle (SPV). The SPV has no employees or physical location and is not subject to banking regulation. However, since SPVs finance their asset purchases by issuing short-term paper in the capital markets,

[27] The chronology of the 2007-08 financial crisis is outlined in many papers. The following paragraphs mainly draw on Brunnermeier (2009), Gorton (2009) and Gorton and Metrick (2012).
[28] See Brunnermeier (2009).
[29] For more details, see Gorton and Souleles (2007).

they act similar to banks ("borrow short, lend long"). For this reason, SPVs have been described as "shadow banks".[30] To securitize, SPVs slice their purchased asset pools in so-called, qualitatively different tranches, which can be sold to investors. The exact cutoffs between tranches are chosen to ensure a specific rating for each tranch. The top tranches, for instance, are structured to be assigned a AAA rating. This is possible because, unlike other securities, securitizations depend on the cash flows from a specified pool of assets rather than the credit worthiness of the issuer.

Securitizations allow banks to distribute the credit risk from issuing mortgages over different investor groups that wish to bear it. Brunnermeier (2009) argues that this has led to lower mortgage and corporate lending rates. Additionally - as shown by Keys et al. (2010) - securitizations led to reduced lending standards. Since a bank only faces the risk of holding issued loans for some months, its incentives for screening are reduced. However, since banks retained large amounts of their issued securitizations and granted credit lines ("liquidity backstop") to ensure that the SPV has sufficient liquidity in case investors stop buying short-term paper, the majority of securitization never left the banking system and therefore rather than leading to better risk diversification, securitizations increased the interconnectedness among banks.

Since there were insufficient retail deposits to finance the housing boom, banks became dependent on short-term wholesale funding, especially asset-backed commercial paper (ABCP) and repurchase agreements (repo).[31] Both of these trends were directly related to the rise of ABS.[32] The marketability of ABS created a large pool of assets, banks could use as collateral for secured financing transactions. At the same time, nonfinancial corporations and institutional investors looked for options to place their growing cash reserves. Gorton (2009) argues that ABCP and repos were ideal instruments because they showed characteristics similar to deposits. They could be withdrawn on short notice, were secured by high quality collateral and offered market return.

The period preceding the 2007-08 financial crisis was characterized by low interest rates spurred by accommodative monetary policy, government subsidies related to real estate, financial innovation in the form of securitizations, reduced lending standards, increased reliance on short-term wholesale funding, and a credit boom. On top of that and in

[30] See Gorton (2009).

[31] See Demirgüç-Kunt and Huizinga (2010), Perotti and Suarez (2011) and Acharya et al. (2013).

[32] The rise of ABS has commonly been associated with four driving forces: 1) Regulatory arbitrage: Moving a pool of assets off-balance to the SPV reduces banks' capital requirement; 2) Banks' increased need for collateral to finance the housing boom with short-term secured wholesale funding; 3) Minimization of bankruptcy costs due to off-balance financing, and 4) Favorable ratings compared to bonds with similar yields or risk characteristics. See Gorton (2009), Calomiris (2009) or Kowalik (2013).

contrast to initial expectations, securitizations did not transfer risks out of the banking system but rather increased the interconnectedness among financial institutions. Most of these factors have also been present prior to previous financial crises.[33] But what triggered the 2007-08 financial crisis?

A significant number of mortgages prior to the crisis was granted under the premise of steadily increasing house prices and therefore under the expectation that borrowers could refinance loans with the increased value of their houses. When house prices stagnated and even dropped, default rates on subprime mortgages increased.

The shock to the subprime mortgage market was revealed by the ABX index. The ABX index was the only observable market in the nexus of derivatives and structured finance. It is based on the price of credit default swaps referencing twenty equally weighted securities containing subprime mortgages. The index reflects the costs of insuring a basket of mortgages against default.

In early 2007, the ABX index started deteriorating, which led to a drop in prices of mortgage-related products. Brunnermeier (2009), for instance, shows that concerns about subprime mortgages led the market for ABCP to dry up. Most other asset classes, on the other hand, did not show increasing spreads until in August 2007, when the Libor-OIS spread sharply increased.[34] The increase of the Libor-OIS spread led the value of other securitized asset classes to deteriorate.

Gorton (2009) argues that the reason for the shock in the subprime market being transmitted to other parts of the banking system was asymmetric information. With a number of institutions being reportedly in difficulties in July 2007, investors got nervous.[35] Similar to previous crises, depositors "ran" on banks because it was not clear which banks were most exposed to subprime-related assets and investors did not trust banks' equity cushions.[36]

The flight to quality in repo markets - all firms wanted to hold cash or government bonds - reduced the demand for banks' collateral and therefore their price. An increase of haircuts in the repo market is akin to a withdrawal. If haircuts rise, the banking system either has to shrink, borrow or needs an equity injection. After some first equity injections

[33] See for instance Calomiris (1998), Reinhart and Rogoff (2009) or Claessens and Kose (2013).

[34] The Libor-OIS spread is the spread between Libor (estimated average interest rate in UK interbank markets) and OIS (overnight indexed interest rate swap). The Libor-OIS spread is a commonly used measure of the health of the banking system.

[35] Institutions in difficulties were, for instance, BNP Paribas, the German IKB or the American Home Mortgage Investment Corp.

[36] Note that this was not a classic retail bank run, as described by Diamond and Dybvig (1983). Instead of cash withdrawals of retail clients, this crisis was reflected by haircut increases in repo markets.

in the fall 2007 though, the source dried up and so did the possibility to borrow. The only option were asset sales. If everyone wants to sell, prices have to fall. Gorton (2009) argues that the developments in repo markets were the force behind the transmission of turmoils in the relatively small subprime market to the entire banking system.[37] An additional difficulty was that market participants lost their trust in securitizations and thus tried to obtain more information. However, most market participants could not cope with the sudden need to understand, value and trade these new products. Securitizations turned illiquid.[38]

Similar to previous crises, the 2007-08 financial crisis was caused by a shock to the housing market.[39] Being unsure about which counterparties were at risk, investors requested more collateral from all banks. Eventually this forced most institutions into severe fire sales and a significant number of them into failure with adverse consequences for the entire financial system.

There were many factors that led to the outbreak of the financial crisis and observers differ on the weight given to individual aspects. There is, however, wide agreement that liquidity risks and lapses in liquidity risk management were key factors leading to the outbreak of this crisis and especially its rapid expansion.[40] The financial crisis also showed that capital regulation does not (fully) mitigate liquidity risks. To better understand why this is the case, it is useful to classify liquidity into two categories: market liquidity and funding liquidity.[41]

Funding liquidity refers to the ease with which an institution can attract funding. An institution's funding liquidity is high if it can easily raise money at reasonable costs. When financial institutions purchase an asset, they often use it as collateral for short-term borrowing. The haircut - the difference between the value of an asset and the amount one can borrow against it - needs to be financed by the institution's equity. Funding liquidity risk can take three forms: 1) Changes of margins and haircuts; 2) cost increases or the impossibility of rolling over short-term borrowing, and 3) withdrawal of funding. The

[37] Due to several downgrades, some banks also experienced large margin calls from their derivative positions.

[38] Gorton (2009) explains this problem (also referred to as the "lemons problem") as follows: *"Think of it as like electricity. Millions of people turn their lights on and off every day without knowing how electricity really works or where it comes from. The idea is for it to work without every consumer having to be an electrician (...). [However] when the shock hits, suddenly the electricity stops working. When that happens, an event no one really contemplated, it is too late for everyone to become an electrician."*

[39] See, for instance, Hilbers et al. (2008) on the relevance of the housing market for financial stability.

[40] See Brunnermeier (2009) or Franklin and Carletti (2008) for overviews regarding the role of liquidity during the financial crisis.

[41] See Drehmann and Nikolaou (2009) and Brunnermeier (2009).

three sources of funding liquidity risk have a severe adverse impact if assets can only be sold at fire sale prices. Funding liquidity is therefore closely linked to market liquidity.[42]

Market liquidity is high when it is easy for institutions to raise money by selling the asset, instead of borrowing against it. If market liquidity is low, selling the asset would depress its price. Kyle (1985) distinguishes three forms of market liquidity: 1) the bid-ask spread, which measures the difference between buying and selling the same asset at the same time; 2) market depth, referring to the amount one can sell without causing the price of an asset to move, and 3) market resiliency, describing the time it takes for prices that have temporarily fallen to bounce back.

The shock in the subprime market had a direct impact on banks' funding liquidity risk. Being unsure about their quality, investors increased haircuts on securitizations used in secured borrowing transactions. Since banks were already highly leveraged, they could not finance the increasing haircuts with their equity. As a consequence, many of them needed to sell their assets at the same time. These sales depressed prices even further, which in turn led to more sales and hence to a downward spiral. The risk and magnitude of downward spirals is larger for assets with lower market liquidity. By definition, sales of less liquid assets cause larger price drops than selling more liquid assets.

Another issue directly related to banks' funding risk were the credit lines banks granted to SPVs. When the markets for ABS and ABCP dried up, it became clear that many SPVs will draw on their credit lines, increasing banks' concerns about their own funding needs. Since there was uncertainty whether other banks faced the same issues, banks hoarded liquidity with adverse consequences for the functioning of interbank money markets.

The financial crisis has shown how quickly liquidity can evaporate and how rapidly this can transmit stress in one market to other markets.[43] Banks held too little market liquid assets to compensate for their increased funding liquidity risks. Against this background, Cifuentes et al. (2005) argue that liquidity buffers may be a useful instrument to prevent systemic stress. During severe crises, even well capitalized banks are forced into fire sales which reduce the value of other banks' assets. Apart from reducing the risk of fire sales, requiring institutions to increase their liquidity buffers can be expected to restore confidence of investors and therefore reduce the likelihood of bank runs, reduce banks' reliance on central banks and give supervisors time to react in case institutions experience difficulties.[44]

[42] See Brunnermeier and Pedersen (2009).
[43] See Adrian and Shin (2009, 2010).
[44] Also see Schnabel and Shin (2004), Franklin and Gale (2004, 2005), and Diamond and Rajan (2005).

5.2. Harmonized liquidity regulation and the financial crisis

The events prior to and during the financial crisis had a direct impact on a number of factors that previously hampered the harmonization of liquidity regulation.

Firstly, the financial crisis exposed poor liquidity management and insufficient liquidity buffers which led a number of institutions - despite appropriate capital levels - to experience severe problems. The financial crisis showed that capital regulation does not substitute liquidity regulation.

As argued by Goodhart (2011a), another important implication of the 2007-08 financial crisis was that it forced most central banks to rethink their monetary policy frameworks. While the large differences in these frameworks significantly hampered the harmonization of liquidity regulation in the past, the financial crisis showed that there is probably not one best framework but that the right way of central bank liquidity provision depends on contextual factors. While liquidity regulation should take into account monetary policy frameworks, complete coordination between the two might not be necessary. Related to this, the financial crisis also motivated regulators to reduce the reliance of financial institutions on central banks and therefore harmonizing liquidity regulation might require an agreement on a set of market-liquid assets rather than a harmonization of monetary policy frameworks.

Analyzing the discussions at the level of the BCBS during the 1980s and 1990s, it is evident that regulators were hesitant to additionally burden banks, for instance, with data requests regarding liquidity. The 2007-08 financial crisis clearly led the BCBS to overcome these hesitations. The crisis gave supervisory momentum, making the harmonization of liquidity regulation more likely.

Indeed, about a year after the publication of BCBS (2008) and a few months after the failure of Lehman Brothers, the BCBS started working on the Basel III proposals.[45] There was a fundamental difference between capital and liquidity requirements. With regards to capital, the Committee could build on the existing standards, and make the necessary adjustments in terms of the definition of capital and the determination of risk-weighted assets, which resulted in a sizeable strengthening of the capital framework, including the establishment of a number of additional capital buffers: the capital conservation buffer, the countercyclical buffer and the systemic risk buffer. In addition, the Committee developed a proposal for a separate leverage ratio.

In order to develop estimates for the new capital requirements, the Top-down Calibration Group (TCG) was established. This group analyzed the financial crisis in detail, with

[45] Prior to that, the BCBS also proposed Basel 2.5. More details can be found in the appendix.

the objective to determine which levels of capital would have better prevented the problems that had occurred. Although certainly not an easy exercise, it was at least possible to develop a rough estimate for the level of capital that could be considered sufficient in this context. Together with the results of the first data-driven quantitative impact study (QIS) and the analyses of the Macroeconomic Assessment Group (MAG), the calculations of the TCG became the basis for the new capital requirements.

On the liquidity side, however, things were more complex. To begin with, there was no existing global standard and therefore no basis to start from. In addition and in contrast to capital, it is very difficult to conclude from failed institutions how much liquidity they would have needed to withstand the shock they experienced. Once an institution is unable to meet its obligations as they come due, the institution is considered illiquid. However, it is not possible to conclude in this situation how much liquidity the bank would have needed as it is not clear how many additional deposit withdrawals and calls on off-balance sheet commitments the bank would have experienced in the coming days or weeks. Against this background, it was decided to choose a more theoretical approach for liquidity compared to capital. A specialized workstream was mandated to determine outflow rates for banks' liabilities and based on these outflows, how much liquidity banks would need to survive a certain period of extreme liquidity stress without having to resort to the central bank. In light of the funding difficulties experienced by banks, this workstream also developed a framework reflecting banks' structural funding profile. These standards became the basis for the final determination of the Basel III liquidity requirements. Soon after the development of these first standards, the workstream also started working on a QIS for the initial liquidity standards. The goal of the QIS was to assess the impact of the draft liquidity requirements on banks.

The main conclusion from the QIS was that the liquidity standards, included in the July 2009 proposal, would have a large impact on banking activity and financial markets. Although the Committee's intention was to change bank behavior, the report prompted a number of adjustments, which eventually led to the "International framework for liquidity risk management, standards and monitoring" published in December 2010. Specifically, BCBS (2010b) proposed the introduction of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The following sections will discuss these two requirements in turn.

6. The Liquidity Coverage Ratio

The primary objective of the LCR is to ensure that banks hold sufficient liquid assets, commensurate with their funding liquidity risk, to withstand a stress period of 30 days. This would put banks in a better position to perform their function even during crises and

reduce early reliance on central bank facilities.[46] The LCR is based on classic liquidity "coverage" considerations used by banks and some national authorities and is defined as follows:

$$LCR = \frac{High\ Quality\ Liquid\ Assets}{Net\ Cash\ Outflows} \geq 100\% \tag{1}$$

High Quality Liquid Assets (HQLA) are comprised of two types of assets. Level 1 assets are of highest liquidity quality and include cash, central bank reserves and a number of marketable securities issued or backed by sovereigns and central banks. Based on BCBS (2010b), Level 2 assets include lower-rated government securities, high quality covered bonds and some corporate debt securities. In contrast to Level 1 assets, Level 2 assets can only be included to a limited extent (40% of total HQLA) and are subject to a haircut of 15%.[47]

Net cash outflows reflect the difference between stressed outflows and assumed inflows. Stressed outflows are calculated by multiplying the size of certain liabilities and off-balance sheet commitments with an assumed outflow percentage. This leads to a moderate outflow of retail and operational corporate deposits as well as significant losses of most types of wholesale funding. Additionally, the LCR assumes significant calls on off-balance sheet exposures.

Cash inflows are defined as weighted contractual inflows. It is assumed that banks can only rely to 50% on their maturing retail and operational wholesale assets while relative inflows from maturing financial assets are higher. To limit banks' reliance on uncertain inflows, banks need to cover at least 25% of their outflows with HQLA.

As shown by Equation 1, banks can meet the LCR standard either by increasing liquid assets or by reducing their exposure to liabilities with higher runoff risks (e.g. short-term wholesale funding). To understand the LCR better, Table 3 shows the BCBS (2010b) LCR of a hypothetical bank.[48] It can be clearly seen that the 15% haircut on Level 2 assets compared to the 0% haircut on Level 1 assets reduces a bank's stock of HQLA only to a limited extent. The stronger incentive to hold Level 1 assets is caused by the cap on Level 2 assets (40% of total HQLA), which reduces the LCR of the hypothetical bank from 226% to 197%. The rationale behind the cap is to limit banks' reliance on less liquid assets. The weights of banks' in- and outflows, on the other hand, are an important driver

[46] There are a number of studies providing overviews of the LCR, e.g. Bech and Keister (2013).
[47] Note that this section refers to the LCR defined in BCBS (2010b). The revised version in BCBS (2013b) is discussed in Section 8.2.
[48] A similar example for the BCBS (2013b) LCR is discussed in Section 8.2.

of the LCR's denominator. For instance, the hypothetical bank's stable retail outflows are less than its interbank outflows although their total position amounts to 1.000 and 100 respectively. The cap on inflows reduces the bank's LCR from 226% to 109%. Taking into account all caps, the hypothetical bank does not comply with the LCR requirement of 100%.

Table 3: Illustrative BCBS (2010b) LCR example

	Market value	**Weight**	**Weighted value**
Total Level 1 assets			**65**
Cash and central bank reserves	25	100%	25
0% RW government bonds	40	100%	40
Total Level 2 assets			**60**
Covered bonds AA- or higher	25	85%	21.3
20% RW government bonds	25	85%	21.3
Corporate bonds AA- or higher	20	85%	17
Total HQLA			**125**
Total Inflows			**400**
Retail loans	300	50%	150
Interbank loans	250	100%	250
Total Outflows			**455**
Stable retail deposits	1000	5%	50
Less stable retail deposits	1000	10%	100
Operational corporate deposits	100	40%	40
Non-operational corporate deposits	100	75%	75
Interbank deposits	100	100%	100
Committed undrawn liquidity facilities to banks	50	100%	50
Committed undrawn credit facilities to banks	40	100%	40
Net cash outflows			**55**
Calculation			
LCR without caps	226%		
LCR with Level 2 cap (maximally 40% of total HQLA stock)	197%		
LCR with cap on inflows (inflows cannot exceed 75% of outflows)	109%		
Actual LCR with both caps	**95%**		

Note: The table shows the LCR calculation of a hypothetical bank. For simplicity, it is assumed that all loans and deposits have remaining maturities of less than 30 days so that they fall within the 30 day horizon of the LCR. If remaining maturities exceed 30 days, neither inflows nor outflows emerge. Regarding HQLA, the LCR takes a stock approach and is therefore independent of maturities. The figures are only hypothetical and specifically chosen in such a way that both caps are binding. In practice, the impact of the various caps is likely to be small. For empirical evidence, see EBA (2013).

7. The Net Stable Funding Ratio

After discussing the LCR, this section aims at providing a more detailed description of the second measure, the NSFR. The NSFR has a 1-year horizon and aims at ensuring a sustainable maturity structure of assets and liabilities.

The NSFR is supposed to incentivize banks to fund their activities with more stable sources of funding and is defined as follows:

$$NSFR = \frac{Available\ Stable\ Funding}{Required\ Stable\ Funding} \geq 100\% \tag{2}$$

Available Stable Funding (ASF) is funding on which banks are likely able to rely on for a period of one year or longer. Similar to the LCR, ASF is calculated by multiplying balance sheet positions with assumed stability factors. A bank is assumed to be able to rely fully on its regulatory capital and to a large extent on retail deposits. Funding provided by wholesale clients, on the other hand, is assumed to be less stable.

Required Stable Funding (RSF) is the part of a bank's balance sheet that could not be monetized within a year. The funding requirement of a specific asset is determined by its marketability, maturity and duration of encumbrance. Unencumbered high-quality securities and bonds receive therefore very limited funding requirements while institutions' long-term loans have to be funded to a large extent.

Table 4: Illustrative BCBS (2010b) NSFR example

	Market value	**Weight**	**Weighted value**
Available Stable Funding			**2195**
Tier 1 and 2 capital	30	100%	30
Stable retail deposits	1200	90%	1080
Less stable deposits	1200	80%	960
Wholesale funding from corporates, PSEs, central banks	250	50%	125
Other liabilities	320	0%	0
Required Stable Funding			**1871**
Cash	25	0%	0
Unsecured actively-traded instruments <1 year	500	0%	0
0% RW Government bonds	25	5%	1.25
20% RW Government bonds	50	20%	10
Residential mortgages with a 35% RW	1000	65%	650
Other retail loans <1 year	1000	85%	850
All other assets	350	100%	350
Undrawn credit and liquidity facilities	200	5%	10
Calculation			
NSFR	**117%**		

Note: The table shows the NSFR calculation of a hypothetical bank.

Similar to Table 3, Table 4 shows an illustrative example for the BCBS (2010b) NSFR. Although the NSFR takes into account the entire balance sheet, its calculation is less complex compared to the LCR. As can be seen in Table 4, the NSFR is simply calculated

as the ratio of weighted ASF as percentage of RSF. Again, the weights considerably differ across asset and liability classes. While a bank can take into account 90% of its stable retail deposits, it can only rely on 50% of the funding provided by corporates. Similarly on the asset side, a bank needs to fund government bonds only to 5% while retail lending is assigned a RSF factor between 65% and 85%.

8. After the first proposal

8.1. Public debate

Already during its consultation but certainly after its publication, BCBS (2010b) started an intense public debate about the potential impact of the new reforms.

Taking a more general view, MAG (2010a) and MAG (2010b) analyze the impact of tighter capital and liquidity requirements on an aggregate level. Assuming that the introduction of a liquidity rule leads to an increase in both liquid assets (25%) and maturities of banks' wholesale liabilities, the study finds an increase of 14 basis points in the median lending spread and a fall in lending volumes of 3.2%. BCBS (2010c) follows MAG (2010a) and MAG (2010b) while it additionally takes into account the benefits of the new reform in the form of the emergence of a more stable banking system, leading to a lower probability of banking and financial crises.[49]

Bindseil and Lamoot (2011) discuss the interaction of the LCR with monetary policy implementation. Although the authors acknowledge the rationale behind not drawing a direct link from the LCR to the various monetary policy frameworks, they point out several interactions and argue that care needs to be taken so that the LCR does not hamper monetary policy implementation. While also analyzing the same interaction, Bech and Keister (2013) specifically focus on the impact of the LCR on money market rates and hence on monetary policy transmission. Increasing banks' demand for long-term funding, the LCR might lead to a steepening of the yield curve, potentially making the overnight rate a less useful target rate for monetary policy implementation. To account for this, Bech and Keister (2013) argue that central banks should use long-term interest rates as additional target when implementing monetary policy.[50]

Using country-specific datasets, De Haan and Van den End (2013), Schertler (2010) and Banerjee and Hio (2014) analyze the impact of a liquidity requirement on banks in the Netherlands, Germany and the UK, respectively. While all studies find some evidence of

[49] For completeness it needs to be mentioned that MAG (2010a) and MAG (2010b) focus on the transition phase while BCBS (2010c) assumes that the economy is in its steady state.

[50] See Bonner and Eijffinger (2013), who empirically analyze the impact of the Dutch quantitative liquidity requirement on interbank money markets.

banks changing their behavior, the introduction of liquidity requirements does not seem to have had a detrimental impact on lending to the real economy or monetary policy transmission.

Apart from these analytical studies, several key monetary policymakers held speeches on the subject.[51] ECB Board member Coeuré (2012) highlighted that the LCR should *"not hamper the functioning of funding markets. This applies in particular to the calibration of the run-off rates for interbank funding and to the asymmetrical treatment of liquidity facilities extended to financial firms."* Governor Noyer (2010) from the Banque de France was more explicit when stating that *"the new liquidity ratios (...) cannot be applied as they stand as they do not take into account all their consequences and interactions beyond the prudential objectives themselves, which include in particular the functioning of the interbank market, the level of intermediation or the conditions of monetary policy implementation."*

In the public debate, which developed after BCBS (2010b), some old patterns can be recognized. While most studies found little evidence of liquidity regulation hampering the real economy or monetary policy, as indicated above, monetary policymakers nevertheless showed concerns about the implications of the LCR. This, however, did not result in abandoning the new liquidity standards, although some adjustments were made.

8.2. Developments in Basel

Figure 5: Overview BCBS publications regarding liquidity

Parallel to the public debate, soon after BCBS (2010b) a workshop took place in Basel in which several issues around the LCR and NSFR were discussed. Attendants to this

[51] Also see Schmitz (2012).

meeting included representatives from a large number of central banks as well as the co-chairs of the WGL. The main purpose of the workshop was to understand how banks in the various jurisdictions react to the implementation of Basel III. The general impression was that banks already started to shift towards more stable funding and more liquid assets. At the same time, however, some participants expressed concerns that banks might further increase their government bond holdings and issue innovative products, which resemble ABCP. Regarding implementation, regulators were concerned that there was little explicit guidance. Two interesting questions raised were how to design an appropriate penalty regime, and how to handle issues such as measurement, reporting and transparency in order to avoid liquidity hoarding.[52]

To further analyze the issues raised during the workshop and to observe banks' migration to the new requirements, a second QIS was carried out in late 2011. The main conclusion drawn from this exercise was that banks had improved their LCR while the NFSR remained stable. The Committee pointed out that further analysis was required to assess the impact of excluded assets, the 40% cap on Level 2 assets, and the differences between those banks that already meet the requirements and those that do not.
In light of this, the WGL prepared several notes regarding different features of the Basel III agreement. Specifically, the WGL aimed to clarify issues around the treatment and usability of HQLA. The group recommended to expand the current language regarding the qualitative criteria, to provide additional guidance on the diversification of the HQLA buffer as well as to include language that the LCR requirement has some degree of flexibility, allowing banks to temporarily breach the requirement in times of stress. The rationale behind the latter proposal was to avoid self-fulfilling prophecies and to ensure that banks are actually able to use their HQLA buffer in times of stress.[53]

During the remainder of 2012, the WGL worked mainly on recalibrating the standards as well as to solve issues regarding their practical implementation. Particular attention was given to the interaction of the LCR with monetary policy and a potential widening of the HQLA buffer.

After several months of negotiations within the WGL, the Committee discussed the final package of policy proposals regarding the LCR in September 2012. Apart from the softening of a number of outflow assumptions, the most significant change was the

[52] In the early stages of the discussions, some policymakers were concerned that the LCR will decrease rather than increase available liquidity in the system. The argument was that strictly requiring banks to maintain a minimum liquidity ratio at all times would prohibit banks to actually use their liquid assets when needed. Also see Goodhart (2011b).

[53] During that time, the WGL also worked on LCR disclosure requirements. See BCBS (2014b).

introduction of a new asset category, called Level 2B. The rationale behind the inclusion of Level 2B assets was to address concerns regarding the observed tendency of banks to hoard liquidity, especially in markets with less liquid assets. Level 2B assets include corporate bonds rated A+ to BBB-, listed equities of non-financial corporations and high quality RMBS. Level 2B assets are subject to a 15% cap and also count towards the 40% of the overall Level 2 cap. Apart from RMBS, which receive a 25% haircut, Level 2B assets are subject to a haircut of 50%. Table 5 shows the BCBS (2013b) LCR of a hypothetical bank.

Table 5: Illustrative BCBS (2013b) LCR example

	Market value	**Weight**	**Weighted value**
Level 1 assets			
Cash and central bank reserves	25	100%	25
0% RW government bonds	40	100%	40
Level 2A assets			
Covered bonds AA- or higher	25	85%	21.3
20% RW government bonds	25	85%	21.3
Corporate bonds AA- or higher	20	85%	17
Level 2B assets			
RMBS AAA	10	75%	7.5
Corporate bonds between A+ and BBB-	10	50%	5
Inflows			
Retail loans	300	50%	150
Interbank loans	120	100%	120
Outflows			
Stable retail deposits	1000	3%	50
Less stable retail deposits	1000	10%	100
Operational corporate deposits	100	20%	20
Non-operational corporate deposits	100	40%	40
Interbank deposits	50	100%	50
Committed undrawn liquidity facilities to banks	50	100%	50
Committed undrawn credit facilities to banks	100	40%	40
Calculation			
LCR	**122%**		

Note: The table shows the LCR calculation of a hypothetical bank. For simplicity, it is assumed that all loans and deposits have remaining maturities of less than 30 days so that they fall within the 30 day horizon of the LCR. If remaining maturities exceed 30 days, neither inflows nor outflows emerge. Regarding HQLA, the LCR takes a stock approach and is therefore independent of maturities.

Finally, although monetary policy concerns did not lead to abandoning the LCR, the Committee recognized the issue and included a Restricted Committed Liquidity Facility (RCLF) as Level 2B asset. Initially, the RCLF was designed for countries with a structural

insufficiency of liquid assets, like for instance Australia. Eventually, however, it was decided to include two different central bank facilities in the LCR standard: 1) A central bank facility specifically designed for countries with a structural insufficiency of liquid assets. It is the intention that banks in countries that fall under the Alternative Liquidity Approach (ALA) can structurally rely on the central bank facility, while 2) the RCLF is intended to address cyclical shortages. The purpose of the RCLF is to allow central banks to support the LCR during stress. Due to restrictive conditions of this facility, including punitive pricing, it can expected that drawing on the RCLF is only efficient in case banks are not able to attract other HQLA. The RCLF balances the intention to reduce banks' dependence on central bank support during normal times while still recognizing central banks' role as liquidity providers during stress.

In January 2013, the Committee published a final document with the new Basel III Liquidity Coverage Ratio. The final NSFR standard was published in October 2014. With the publication of BCBS (2013b) and BCBS (2014a), as well as the additional guidance for additional monitoring metrics and intraday liquidity risks, the BCBS has set a milestone for global liquidity standards. As has been the case for capital standards, a big challenge will be the implementation of this new set of standards.

8.3. Remaining issues - Home-Host supervision

The first discussions on liquidity in 1975 discussed who would be responsible to supervise the risk as opposed to ways of measuring it. For liquidity, the accepted regulatory position was that host authorities - familiar with local market conditions and discount facilities - could judge the liquidity position of a bank. Additionally, there was the presumption that each host central bank can create liquidity in its own currency.

Goodhart (2011a) argues that in the absence of harmonized liquidity regulation, most international banks have started to manage their liquidity in a single pool. While this might be more efficient and less costly, there is the risk that liquidity gets trapped at one place and is therefore not available where it is needed.

As Goodhart (2009) states, with large banks being international in life but national in death, harmonized liquidity regulation is likely to lead regulators in host countries requiring banks to hold local liquidity buffers. The tensions between banks managing their liquidity in a centralized manner and the likely intention of host-regulators to require local liquidity buffers is a remaining issue. BCBS (2014c) provides clear guidance for effective supervisory colleges, intended to improve home-host coordination. The practical implementation of this guidance is now in the hands of regulators in the individual countries.

9. Conclusion

This paper analyzes the development of global liquidity standards, their objectives as well as their interaction with capital standards. Starting with the Committee's first meeting in 1975, this paper presents the discussions of the BCBS regarding liquidity and specifically focuses on the question of why earlier attempts regarding the harmonization of liquidity regulation failed. We also discuss the potential impact of harmonizing capital regulation on banks' liquidity buffers and assess which role the 2007-08 financial crisis played in overcoming previous obstacles regarding liquidity regulation.

The analysis suggests that regulating capital was associated with declining liquidity buffers. The fact that capital and liquidity are costly for banks is a potential reason for this effect. Another potential explanation is that under the pressure of reaching capital adequacy, both banks and regulators neglected liquidity risks. Finally, declining liquidity buffers might partially be caused by banks' rational choices. While capital alone does not address liquidity risks, it does improve banks' opportunities to fund themselves in the market and makes bank runs less likely. However, the financial crisis showed that, independent of the specific circumstances, banks' liquidity buffers were too low. Even high capital levels were not a substitute for prudent liquidity risk management and buffers.

While there were a number of different reasons, there are three interlinked factors which have significantly hampered the harmonization of liquidity regulation. The first stumbling block was the view that central bank eligibility is the most important determinant of an asset's liquidity. Therefore, it was thought that harmonizing liquidity regulation would require a harmonization of collateral frameworks. Since banks and regulators were already under pressure to enhance capital adequacy, an additional harmonization of collateral frameworks was considered unfeasible. Another important point was the view that regulating capital would also address liquidity risks since it incentivizes banks to hold assets with lower risk-weights, which often coincides with high liquidity quality. On top of that, better capitalized banks are better able to refund themselves in the market. Finally, and related to the previous two issues, there was the lack of supervisory momentum. For many years, regulators were hesitant to burden banks with additional (reporting) requirements regarding liquidity.

Throughout its history, the BCBS has been on the verge of harmonizing liquidity regulation a few times. With many different interests around the table, it seems to be that external pressure and supervisory momentum are needed to truly succeed in introducing completely new regulatory frameworks. The Latin American Debt crisis had a major impact on capital adequacy while the 2007-08 financial crisis provided enough supervisory momentum to reach harmonized liquidity regulation. The proposal for the LCR and NSFR was a major step for the BCBS in terms of enhancing the effectiveness of supervision. Their

practical implementation by banks and supervisory authorities is one of the big challenges for the coming years.

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Appendix

The Basel I, II and III Capital Accords

Despite the initial objective to harmonize both liquidity and capital regulation, capital adequacy (specifically in relation to credit risk) soon became the main focus of the Committee's work after its establishment in 1975. Eventually this led to the adoption of Basel I in 1988.

BCBS (2013a) argues that since it raised concerns that the capital ratios of the main international banks were deteriorating at a time of growing international risks, the onset of the Latin American debt crisis was the main reason for the Committee to shift its focus towards capital. Looking at the events during this crisis, the Committee's focus on capital seems justified. When oil prices sharply increased, petroleum-exporting countries - then rich in cash - invested their money in international banks, which in turn issued short-term loans to Latin American governments. When interest rates increased in 1979 the respective countries struggled to repay their debt, eventually leading to Mexico declaring default in August 1982.

After Mexico's default, most commercial banks stopped rolling over their assets to Latin American governments. Since these loans were typically short-term, several Latin-American countries ran out of funding very quickly. A borrower not being able to repay its loan, like Mexico, is a classic case of credit risk, which in turn calls for sufficient levels of capital to absorb these losses. Increased attention to capital adequacy caused by the Latin-American debt crisis seems therefore justified. From a liquidity perspective, it is notable that banks had issued short-term loans, allowing them to stop lending relatively quickly, thereby avoiding major losses on non-performing loans. Liquidity supervision usually incentivizes banks to issue short-term loans.

After several years of negotiations and public consultation, the BCBS issued the Basel Capital Accord in July 1988 that was supported by its 11 member countries and Luxembourg.[54]

Basel I proposed a minimum capital ratio (capital to risk-weighted assets) of 8%. With a view on swift regulatory convergence, national authorities were expected to prepare frameworks allowing a final implementation for their internationally active banks by the end of 1992. Right before the implementation in national frameworks, however, the Capital Accord was amended aiming at improving the definition of loan loss provisions.

[54] Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom and United States.

In 1995 and 1997, the Accord was subject to further changes, which focused on the recognition of the effects of netting agreements in derivative contracts as well as a widening of the initially narrow focus on credit risk, reflected by the Market Risk Amendment.

In June 2004, the Committee released the Revised Capital Framework, commonly referred to as "Basel II". The new framework consisted of three pillars: Pillar 1) The minimum standards from Basel I; Pillar 2) Supervisory review of an institution's capital adequacy and assessment processes, and Pillar 3) disclosure requirements.[55]

The new framework aimed at addressing financial innovation but also encouraging continued improvements in banks' own risk measurement and control processes. In June 2006, the BCBS extended the initial Basel II framework - which focussed on the banking book - by a trading book perspective (Basel 2.5). In December 2010, the BCBS proposed a new capital framework "Basel III: A global regulatory framework for more resilient banks and banking systems", which was updated in June 2011. Apart from raising the required capital levels (e.g. with an increase of the common equity ratio to 4.5%), Basel III aims at increasing the quality of banks' capital. Against this background, BCBS (2010a) specifies that the predominant form of Tier 1 capital must consist of common shares and retained earnings. The remainder of Tier 1 capital can be comprised of subordinated instruments with simple coupons. Hybrid capital instruments (previously limited to 15% of the Tier 1 base) and Tier 3 capital instruments will be phased out.

Finally, Basel III also includes a non risk-based leverage ratio that is calculated as capital in percentage of total exposure (includes off-balance sheet exposures). The minimum Leverage ratio was set to 3%.

Sound Practices for Managing Liquidity in Banking Organisations

BCBS (2000) outlines 14 principles providing guidance on how banks can improve their internal liquidity risk management as well as principles on public disclosure and the role of supervisors.

The paper focusses on incentivizing banks to develop internal structures and processes for managing liquidity risk, measuring and monitoring net funding requirements, managing market access, contingency planning and foreign currency risks.

In developing a structure for liquidity management, the BCBS stressed the importance of an agreed strategy outlined by banks and adequately communicated throughout the organization. A board of directors ought to approve this strategy and ensure its im-

[55] Labeling these three components of the regulatory framework as Pillar 1, Pillar 2 and Pillar 3 became general supervisory practice.

plementation. The specifically appointed individuals in charge of managing the liquidity strategy should set liquidity risk limits in accordance with the bank's size and complexity, which in turn should be reviewed by supervisors. Banks should analyze their stress resistance under different scenarios and are expected to have information systems in place, which should be used to check whether the bank complies with its own policies and limits.

Regarding the measurement and monitoring of net funding requirements, the BCBS urged banks to carefully assess cash inflows against outflows to identify potential shortfalls. Banks should make sound assumptions about future funding needs. The BCBS suggested a maturity ladder as a device to compare cash inflows and outflows within different time horizons. Moreover, banks should use several scenarios in order to evaluate the behavior of cash flows under different conditions. For this task, the BCBS outlined some guidelines as to how to treat different assumptions made about different parts of the bank's balance sheet. The BCBS also pointed to the need for a careful assessment of off-balance sheet activities, which can constitute a significant drain on liquidity in times of stress.

With respect to managing market access, the BCBS stressed the importance of maintaining sound relationships with liability holders, and to appropriately diversify liabilities, as to provide the bank with a line of defense against liquidity problems.

Banks were also expected to develop contingency plans outlining a strategy of action in case of emergency situations. The contingency plan should set out clear responsibilities and identify ways to attract funding in adverse situations. Secondary sources of funding should be outlined and the bank should calculate as accurately as possible the amount of funds that could be drawn from these sources. However, the BCBS warned banks not to rely too much on these secondary sources of funding.

In addition to ongoing liquidity management, and in light of the currency market problems of the 1990s, the BCBS pointed out the importance of foreign currency liquidity management. The paper suggested that banks should appropriately measure and monitor its positions in the currencies in which they operate. Exchange rate risk can be a significant threat on the bank's liquidity. The BCBS recommended that banks reduce currency mismatches.

After having outlined the general principles of liquidity risk management, the BCBS suggested that banks put in place internal control systems to ensure the liquidity risk management process is being executed flawlessly. Such internal controls should promote reporting to the relevant authorities and compliance with laws and regulations. Additionally, banks should have a mechanism for the appropriate disclosure of information, both to the general public and to particular creditors and counterparties. Dealing with the press in times of stress is of utmost importance to manage market perceptions of the bank.

BCBS (2000) concludes by outlining the role of supervisors. Supervisors should eval-

uate banks' strategies and policies independently, and verify that the 13 principles are followed. In addition to assessing liquidity risk, the supervisor must of course examine the capital adequacy of the bank. Finally, the BCBS recommended that the supervisors also have their own contingency plans in case of stressful situations being experienced by a particular bank or by the market as a whole.

Principles for Sound Liquidity Risk Management and Supervision

BCBS (2008) is based on the same principles as BCBS (2000) but includes a few additions. First, BCBS (2008) recommends the inclusion of liquidity costs and risks in the process of product pricing, performance measurement, and new product approval. This ought to be done for all significant business activities, including those that may not have an immediate effect on the balance sheet. The analytical framework should be reviewed in line with changing market conditions.

Second, regarding the measurement and management of liquidity risk, BCBS (2008) gives a more detailed outline on how to manage liquidity risk for specific positions. These include: all future cash flows of assets and liabilities, off-balance sheet positions, all currencies in which the bank is active, and correspondent, custody and settlement activities.

Another addition to the original text is the guidance on how to assess the health of banks. Suggested measures include both static ratios as well as forward-looking instruments. Such measurements should be adapted to the size, risk profile and business strategy of the bank. Additionally, BCBS (2008) outlined a few early warning indicators of liquidity risk. A few examples are rapid asset growth, increase in currency mismatches, a decrease in the average maturity of liabilities, negative publicity, credit downgrades, or increasing retail deposit outflows.

A very important augmentation compared to BCBS (2000) is the suggestion that banks should not only manage liquidity risk at the individual entity level, but also aggregate data to give a group-wide view of liquidity risk. Banks with branches and subsidiaries in third countries face additional contagion risks across borders. Banks should be aware of country-specific circumstances and set internal limits on intragroup liquidity risk.

Additionally, banks are prompted to differentiate between encumbered and unencumbered assets in order to manage their collateral positions. Banks should assess the central bank eligibility of each asset class and have a thorough understanding of the amount of time it would take to liquidate certain assets.

BCBS (2008) also provided some more detail with respect to stress tests and contingency plans. It was recommended that stress tests are performed regularly, and that the results are actively integrated in banks' liquidity risk management strategies. Stress tests should take into account several time horizons and banks should use a range of assump-

tions adequate to the size and business structure of the bank. Banks should also consider the potential behavioral response of counterparties under the assumed stress situations, and be aware of the fact that a stress event could affect their customers' use of intraday liquidity, potentially threatening the liquidity position of the bank.

Regarding public disclosure, BCBS (2008) extends BCBS (2000) by outlining some suggestions on the qualitative information to be disclosed by banks, such as the aspects of liquidity risk in which the bank is involved, the assumptions used in the measurement of risk and the limits imposed on liquidity positions.

Finally, with respect to the role of supervisors, BCBS (2000) was augmented in three main pillars. First, supervisors are required to not only perform independent evaluations, but also to supplement their assessments using banks' internal and prudential reports as well as market information. Second, supervisors are prompted to intervene, demanding that the bank carries out remedial action if necessary. And third, supervisors should communicate regularly with each other but also with other public authorities, such as central banks. This communication ought not to be restricted to their jurisdiction, but also performed across borders.

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