The Impact of the Basel III Liquidity Standards on the Implementation of Monetary Policy

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This paper analyses the impact of the new Basel III liquidity standards, in particular the liquidity coverage ratio (LCR), on the implementation of monetary policy in the Euro area. I develop a conceptual framework to investigate the interaction between the money market and monetary policy implementation. Based thereon, I argue that the Eurosystem papers tend to underestimate the future challenges to monetary policy implementation for two reasons: first, negative network dynamics and feedback loops exacerbate the impact of the standards; second, the on-going crisis itself challenges monetary policy implementation in the Euro area by its impact on the (perceived) arbitrage relationship between open market operations and the unsecured money market rate. Finally, I discuss potential policy reactions.

JEL classification: E 40, E 50

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1. Introduction

The Basel III liquidity standards constitute a cornerstone of the international regulatory reaction to the on-going economic and financial crisis. While capital regulation at the international level dates back to the 1980s, liquidity regulation remained fragmented across borders. Thus, the international regulatory and central banking community has less expertise concerning the potential negative side-effects of international liquidity standards, e.g. on money markets and monetary policy implementation. In addition, the mandate of the Basel Committee on Banking Supervision (BCBS) and its sub-group Working Group on Liquidity (WGL) focused on financial stability. The potential impacts

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of the standards on monetary policy were not taken into consideration until the standards were agreed. In a number of presentations since 2009 I pointed out that the standards could have a negative impact on monetary policy implementation in the Euro area (e.g. Schmitz 2009, 2010). Since mid-2010 the topic also enjoys more attention from central banks. While I agree with most of the conclusions of the respective papers, I argue that they tend to focus on the static, technical impacts. In this paper I point out that the impact is exacerbated by the negative network dynamics set free by the Basel III liquidity standards and by the impact of the on-going crisis per se.

Despite the potential negative side-effects of the standards on monetary policy implementation, there is broad agreement that the Basel III liquidity standards constitute an important improvement of financial regulation. While they have some conceptual shortcomings, they are broadly in line with a functional approach to liquidity regulation. The burden of adjustment, thus, rests on monetary policy implementation in the various currency areas rather than on fundamental changes to the standards themselves.

The note is structured along the following lines: In section 2 I review a number of ECB papers on the potential impact of the standards on monetary policy implementation. In section 3 I develop a conceptual framework to investigate the interaction between the money market and monetary policy implementation. In section 4 I study the negative network dynamics and feedback loops that exacerbate the impact of the standards; in section 5, I integrate the impact of the on-going crisis itself on monetary policy implementation in the Euro area. In Section 6 I discuss potential policy reactions. In the appendix I summarise the definition of the LCR and the NSFR. In addition, I provide a short overview over the QIS results to indicate the size of the liquidity gap of banks under the LCR and NSFR.

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2 For the functional approach to liquidity regulation see Schmitz/Ittner 2007.
2. **Opinions concerning the impact of the Basel III liquidity standards on the implementation of monetary policy**

2.1. **Summary of the relevant literature**

First, the available literature is scarce. A recent ECB study (ECB 2010a) criticised the definition of liquid assets under the Liquidity Coverage Ratio (LCR) as being too narrow and suggested that non-financial corporate bonds and covered bonds should be included, at least. They have since been included with minimum ratings of AA- as Level 2 liquid assets with 15 per cent haircuts and a limit of 60 per cent of liquid assets (BCBS 2010b).

Schmitz (2009, 2010) and Bindseil/Lamoot (2011) argued that the narrow definition provided incentives to submit eligible assets which are not included in the definition of liquid assets at the national central banks (NCBs) in long-term refinancing operations (LTROs). The market depth and breadth of these markets would further deteriorate and the Eurosystem would have to bear the additional market liquidity risk. While the incentive was reduced by the inclusion of covered bonds and non-financial corporate bonds, it still pertains to assets that are central bank eligible, but not eligible under the LCR. This is particularly relevant for (uncovered) bank bonds, asset backed securities (ABS), and of course credit claims.

Third, they suppose that banks would face strong disincentives to lend and/or borrow on the unsecured money market. The breadth and depth on these markets would further shrink and the market would lose its allocation and distribution function for liquidity in the Euro area. The reduction of volumes and tenors in money markets would be stronger than desired and might have negative repercussions on the liquidity risk management, the liquidity risk exposure, and the liquidity risk absorption capacity of banks. Banks would further lose confidence in the unsecured money market and in segments of the secured money market. The system of pooling collateral would be under pressure. Banks would prefer an “ear marking” system which would allow them to single out the assets that are available to cover the LCR. That would also enable banks to further arbitrage between the definition of liquid assets and the Single List.
Forth, *more banks participate in the main refinancing operations in non-LCR eligible liquid assets*, as these do not receive a 100 per cent run-off under the LCR like interbank deposits, but only a 25 per cent run-off factor (if collateralised by assets not eligible under the LCR), 15 per cent (if collateralised by level 2 assets), and 0 per cent (if collateralised by level 1 assets). Thus, banks can repo central bank eligible, but not LCR eligible assets for central bank reserves which are LCR eligible. The corresponding reverse transaction one week later receives a run-off factor of only 25 per cent, which leaves the bank with a 75 per cent increase in LCR coverage (cet. par.). *The decreasing quality of the collateral pool increases the risk exposure of the Eurosystem*. Banks would increasingly bid for long-term refinancing in LTROs, that more banks would participate in open market operations, and that banks would bid more aggressively.

Fifth, *liquidity in the unsecured money market could be reduced and the role of EONIA in monetary policy implementation is questioned.*

Holthausen/Bindseil (2010) argue that the *spread between interest rates on the secured and the unsecured money market would increase*. The *slope of the yield curve would increase at the short end*. The *interest rates at the short end would become more volatile* and, thus, their information content concerning the liquidity stance of the system would decrease. The yield of eligible sovereign debt would decrease somewhat, while that of non-eligible assets would increase.

While I agree with these conclusions, I would argue that they tend to underestimate the overall impact of the Basel III liquidity standards on monetary policy implementations for two reasons: first, they do not take into account the second-round and feedback-effects the new standards have on the money market and on banks; secondly, they do not take into account the potential repercussions for the structural liquidity deficit; finally, they disregard the impact of the crisis itself on the implementation of monetary policy.
3. **The conceptual framework - the money market and monetary policy implementation in the Euro area**

In order to integrate the second-round effects, feedback effects, and the consequences of the money market crisis that commenced in August 2007 in the investigation of the impact of the Basel III liquidity standards on monetary policy implementation, I develop a comprehensive framework. In this section, I present a conceptualisation of the instruments employed by the Eurosystem to implement monetary policy, based on Schmitz (2006a).

Bindseil (2004) presents a historical account of monetary policy implementation at the Bank of England, the Deutsche Bundesbank (formerly Deutsche Reichsbank), and the US Federal Reserve System. Throughout most of their histories the Bank of England and the Deutsche Bundesbank focused on the money market rate as their main operating target rather than quantity variables. The Fed on the other hand favoured targeting quantity variables until the 1990s. In recent years the ECB, the Fed, and the Bank of England all rely on interbank money market interest rates as operating targets in monetary policy implementation.³ Also Borio (2001) shows that central banks in industrial countries implement monetary policy by manipulating interbank money market interest rates through open market operations (OMOs)⁴. Central banks implement monetary policy by manipulating the relative price, the opportunity costs of holding the medium of final settlement, i.e. the spread between the rate of interest on central bank money held on accounts with central banks and the rate on the optimal alternative investment.

I will restrict the analysis to five instruments of monetary policy implementation, namely (1.) the communication strategy of central banks – the announcement of a specific level

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³ For the role of excess reserves in the implementation of monetary policy in the Euro-area see Bindseil/Camba-Mendez/Hirsch/Weller (2003), for the framework for monetary policy implementation in the Euro-area, the UK, and the US see ECB (2004), Wetherilt (2002), and Edwards (1997), respectively.

⁴ For details concerning OMOs of the ECB, the Fed and the Bank of England see also ECB (2004), Bartolini/Prati (2003), and Allen (2002).
for the operating target (the main policy variable), (2.) minimum reserve requirements,
(3.) open market operations, (4.) intraday credit\(^5\) and (5.) standing facilities.

The starting point of the analysis is the *announcement of a level for the main operating target*
directly (e.g. Federal funds target rate) or indirectly (e.g. via the rate at which OMOs are
conducted such as the minimum bid rate). The credibility of the announcement and its
impact on the interbank money market rate are a consequence of the capacity of central
banks to increase aggregate reserves at zero marginal costs. Despite the relatively small
size of their OMOs, central banks can manipulate the main policy rate very well. Central
banks employ a number of additional instruments, in order to actually implement the
intended market rate and to contain the volatility of the operating target around its
announced level.

At the intended level of the main policy variable (i.e. the overnight interest rate \(- r_{\text{pol}}\) in
diagram 1 a structural liquidity deficit in the banking system prevails. It is defined as the
difference between demand \(D(r_{\text{pol}})\) and supply \(S(r_{\text{pol}})\) of overnight reserves at the intended
level of the main policy rate.\(^6\) The structural liquidity deficit implies that money market
participants demand more central bank reserves on aggregate than are available on the
market. In principle, the variation of *minimum reserve requirements* (MRRs) would be an
additional instrument for central banks to manipulate aggregate demand for central bank
reserves \(D\) and its volatility throughout the maintenance period. MRRs are averaged over
a fulfilment period and the same account at the central bank can be employed to
administer settlement balances, to fund and defund in the interbank settlement process,
and to fulfil reserve requirements. But minimum reserves requirements change very

\(^1\) In fact, intraday credit is not an instrument of monetary policy implementation. I have included it in the current discussion
as it forms an important feature of the wider implementation framework.

\(^5\) Minimum reserve requirements do play an important role in determining the size of the deficit, but they are not a necessary
precondition for one to exist, as is demonstrated inter alia by the New Zealand framework of monetary policy
implementation. For a description of the relevant features of the institutional framework operational in New Zealand see
Woodford (2001), Sellon/Weiner (1997). Whitesell (2003) argues that even though the implementation of monetary policy
also works without reserve requirements, the systems would benefit from adding reserve requirements.
infrequently and their role in containing the volatility of \( D \) rests largely on averaging arrangements during the fulfilment period. MRRs are intended to stabilise the demand for central bank money. For this they must be binding, i.e. they must exceed the demand for transactions and precautionary demand and they must be available – at least for a short period of time – for transaction purposes. They are backward-looking (past values of short-term liabilities are the base for their calculation). The Eurosystem calculates MRRs after the closure of the payment system each night and over an averaging period of four weeks. MRRs can be estimated/calculated easily and, thus, excess reserves were close to zero before the onset of the crisis.

[Diagram 1]

Central banks estimate the (expected) level of the structural liquidity deficit and set the volume of refinancing operations \( \Delta R^s \), in a way that the aggregate supply of reserves \( S(r_{pol}) + \Delta R^s \) equals their (expected) aggregate demand \( D(r_{pol}) \) at the intended overnight rate \( r_{pol} \), in other words central banks determine the volume of OMOs according to \( \Delta R^s = D(r_{pol}) - S(r_{pol}) \). The manipulation of aggregate supply by OMOs is the instrument to actually implement the intended market rate on the market. The equilibrium will only prevail temporarily, as central banks conduct refinancing operations which are reversed after a prespecified period (repos), such that the structural liquidity deficit is covered only temporarily.\(^7\) The structural liquidity deficit ensures that at least some market participants have to bid for additional aggregate reserves each time their outstanding debt with the central bank matures. The opportunity costs of holding reserves are determined by the stock of the aggregate supply of reserves rather than by the interest rate on excess reserves lent or deficiencies borrowed in the overnight market.\(^8\)

\(^7\) The maturity of the main refinancing operations in the Euro area is one week and in the UK it is two weeks.

\(^8\) Comparing the small size of OMOs and the liquidity deficit to turnover in interbank markets is therefore misleading as it relates the continuous redistribution of aggregate reserves among market participants to one off changes in aggregate reserves.
The aggregate volume of overnight reserves consists of the sum of the overnight reserves of commercial banks. The level of aggregate overnight reserves is manipulated by open market operations (OMOs). The slope and position of the demand curve $D$ are not known to central banks with certainty, neither is the size of the structural liquidity deficit. The precise demand for central bank reserves varies within the band indicated by $\Delta R^D$. The demand for central bank reserves at OMOs depends on the level of minimum reserve requirements, autonomous factors, the expected transactions and precautionary balances over the maintenance period (if they exceed MRRs), the averaging arrangements in place, and the expected future overnight interest rates. The MRRs are backward looking; thus, their level is known throughout the maintenance period. As such they are very easy to estimate for the central bank. In equilibrium, the expected discounted marginal costs of borrowing in the overnight market until the next refinancing operation must equal the discounted expected marginal costs of borrowing from the central bank via OMOs at the current refinancing operation. In principle, this arbitrage relationship exists between the secured overnight market and open market operations (which are always collateralised, but have a term of 7 days;⁹). However, until August 2007 secured and unsecured money market operations were (almost) perfect substitutes in the economic sense, as their relative price was close to one and very stable (Diagram 2). From March 2002 until August 2007 the mean spread between the unsecured O/N rate EONIA and the shortest repo rate T/N was -0.007 percentage points with a variance of 0.006 percentage points and EONIA was similarly close to the minimum bid rate in the main refinancing operations.¹⁰

[Diagram 2]

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⁹ Due to the option to intertemporally substitute reserves within the maintenance period, the difference between the terms of O/N and the main refinancing operations had (almost) no impact on relative prices (especially since the maintenance period was realigned with the frequency of the Governing Council meetings at the beginning of the month).

¹⁰ The spread between the 3M Euribor and the 3M Eurepo featured a mean of 26 basis points and a variance of 6.6 basis points. The respective values for the 6 months tenor were 56 and 11 basis points, those for the 12 months tenor 72 and 11 basis points.
The relatively small size of OMOs compared to daily volume is irrelevant, as price formation works at the margin and the central bank is in the unique position to manipulate the supply at the margin at zero marginal cost. Unless the liquidity situation between OMOs deviates substantially from expectations (e.g. August 9, 2007, a Friday), market participants have no incentive to borrow or lend at rates substantially over and under the intended level of the main operating target.

Central banks can address this uncertainty by auctioning off aggregate liquidity $\Delta R^S$, in order to allow some degree of flexibility. Diagram 3 illustrates that $\Delta R^S$ is endogenised between the bounds $[0, \Delta R_{\text{max}}]$, which are determined by central banks, as is the minimum bid rate $r^{\text{OMO min}}$. If the aggregate demand for refinancing $D_{2\text{ OMO}}$ is below the maximum volume of a specific refinancing operation, all bids will be satisfied at the respective bid rates\(^\text{11}\) and the volume will equal the sum of the bids $\Delta R_{2\text{ S}} < \Delta R_{\text{max}}$. If the sum of the bids $D_{1\text{ OMO}}$ exceeds $\Delta R_{\text{max}}$, not all bids will be satisfied and the allotment of additional funds and the marginal allotment rate will depend on the allotment mechanism in place.

The overnight rate remains close to the target level also between OMOs, as central banks determine the maximum operational volume of OMOs precisely with the intention to cover the estimated structural liquidity deficit in the money market at the announced level of the operating target. The implementation process is designed in a way to ensure that aggregate supply and aggregate demand intersect at the announced level of the operating target, unless central banks’ estimates of the structural deficit are wrong and/or conditions in the money market change unexpectedly. In equilibrium, commercial banks bidding for overnight reserves have no incentive to pay overnight rates substantially above the target level, as they arrange their bidding behaviour at OMOs accordingly. In addition, the effects of temporary liquidity shocks on aggregate demand for overnight reserves are (partly) absorbed by averaging arrangements for reserve requirements over the fulfilment period. The longer the remaining fulfilment period, the

\(^{11}\) If the participating banks anticipate that demand will be below $\Delta R_{\text{max}}$, the respective bid rates will be $r^{\text{OMO min}}$.  

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more of a temporary shock can be absorbed by intertemporal substitution. Given that the frequency of OMOs is relatively high with respect to the fulfilment period market participants can to some extent intertemporally substitute bidding at OMOs for overnight credit.

[Diagram 3]

After refinancing operations are concluded, the supply of aggregate reserves is determined and beyond the discretion of the participants of the interbank market and the payment system. They are active on the intraday and the overnight money market and supply and demand on both markets are interdependent. In order to address larger liquidity shocks or those occurring towards the end of the fulfilment period, central banks have additional instruments at their discretion that enable them to stabilise the operating target in the period between OMOs: intraday credit and standing facilities.

Individual banks’ demand and supply of intraday liquidity on the intraday market are determined by their initial central bank reserves at the beginning of the trading day, the processes of payments credited and debited, their degree of synchronicity, and the target level of overnight central bank reserves as well as the institutional structure of the payment system. Intraday reserves yield a decreasing marginal liquidity service yield and the demand schedule $D^{\text{int}}$ is downward sloping (Diagram 4). The sequence of incoming and outgoing payments is largely a stochastic process and beyond the discretion of individual banks in the very short run. Hence, individual banks’ demand and supply on the intraday market are to some extent stochastic and so are their aggregates. In a net

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12 Ewerhart/Cassola/Ejerskov/Valla (2003) present evidence that both the level and the volatility of the money market rate in the Euro-area increase towards the end of the maintenance period (for the US see Woodford 2001, 30).

13 While the institutional structure is exogenous to the decisions problems of payment systems participants, the degree of synchronicity of payment flows can be increased at increasing marginal costs to the payment system participants to some extent in the medium term, e.g. by clustering credits and debits at pre-arranged points of time. But even under such arrangements exogenous factors – payments initiated by banks’ customers – play a crucial role in determining the liquidity positions of participants.
settlement system these short run liquidity shocks are likely to average out during the day as participants grant each other implicit credit.

Most interbank payment systems in industrialised countries are RTGS with *intraday credit* provided by central banks. In RTGS the dynamics can lead to a liquidity gridlock and an increase of aggregate demand for intraday liquidity from $D_1^{\text{int}}$ to $D_2^{\text{int}}$ and to an increase in the intraday market rate from $r_1^{\text{int}}$ to $r_2^{\text{int}}$. In order to contain the volatility in the intraday market, which would imply welfare costs due to payment delays and potential payment gridlock and obscure market signals on the liquidity situation, central banks can provide intraday credit, which absorbs very short term temporary liquidity shocks, to market participants and shift the supply curve from $S_1^{\text{int}}$ to $S_2^{\text{int}}$. Intraday credit also increases the stability of the interbank payment system vis-à-vis net settlement systems by making payment obligations more visible and enhancing risk management. Hence, the supply of aggregate intraday liquidity is endogenised to some extent. In addition, intraday credit reduces the liquidity costs in RTGS. It is usually collateralised to decrease the credit risk of central banks and has to be retired at the end of the day, in order to prevent spill over into the overnight market, where it would exert downward pressure on the main operating target.

[Diaagram 4]

As intraday credit has to be repaid at the end of the trading day, the aggregate supply of overnight reserves is independent of intraday liquidity management by central banks. The demand for overnight central bank balances is determined by a number of related factors: predominantly by minimum reserve requirements, end-of-day balance of banks’ settlement accounts (banks usually targeted zero O/N excess reserves), autonomous

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15 Leinonen (2009).
16 In the Euro area, intraday credit (daylight overdraft) that is not repaid at the end of the day is treated as credit from the lending facility.
factors, the remaining duration of the fulfilment period, and the expectations concerning future overnight interest rates until the end of the fulfilment period.\textsuperscript{17}

Given the remaining duration of the fulfilment period, banks’ expectations concerning the future overnight interest rates until the end of the maintenance period, and their expectations concerning the overnight interest rate at the end of the day, banks formulate their targets for their overnight reserves. Given this target banks try to utilise their (limited) room for manoeuvre during the day to reach end-of-day balances equal to their targets (mainly MRRs). After realisation of end-of-day balances banks lend excess reserves or borrow to cover deficiencies in the overnight market. Their lending and borrowing decisions are not mechanically determined by end-of-day balances relative to the overnight reserve target, but also reflect deviations of the overnight rate from expectations. Given banks’ expectations concerning future overnight rates, increases in current overnight rates provide an incentive for banks to decrease their overnight reserve target and to increase lending or decrease borrowing in the market. The elasticity of supply and demand with respect to overnight rates depends on banks’ risk preferences.\textsuperscript{18}

Due to the decreasing marginal liquidity service yield of central bank overnight reserves, their aggregate demand is a decreasing function of the overnight rate. Their aggregate supply is determined exogenously.

Changes in expectations of future overnight rates over the maintenance period shift the demand and supply curves in the current overnight money market. Increases in expected future rates shift the current demand schedule upwards as current reserves can be substituted for future reserves over the averaging period. Correspondingly, decreasing expected future rates shift the demand schedule downwards.

In addition to OMOs and intraday credit central banks usually grant access to (some sort of) standing facilities to park (deposit facility) or to raise liquidity (lending facility) at a premium relative to the minimum bid rate. The rates charged on these \( r^{DF} \) and \( r^{LF} \) in

\textsuperscript{17} For a survey of the literature on models of banks’ reserve management see Ewerhart/Cassola/Ejerskov/Valla (2003).

\textsuperscript{18} Ho/Saunders (1985).
set a floor and a ceiling for the overnight money market rate. The zero marginal cost of providing central bank reserves and the function of central bank money as generally accepted medium of exchange are preconditions for the ability of central banks to define floors and ceilings for money market rates. Central banks do not face budget constraints with respect to $r^{DF}$ and $r^{LF}$ at the margin. In diagram 5 the deposit facility $DF$ and the lending facility $LF$ ensure that the main operating target remains within the bounds $[r^{DF}, r^{LF}]$ despite shifts in the demand from $D$ to $D_1$ or to $D_2$.

As $r^{DF}$ and $r^{LF}$ constitute penalty rates deviating from the interbank money market rate, participants have an incentive to borrow and deposit funds on the overnight market before turning to standing facilities. A more liquid market is an additional intermediate policy objective for central banks as it constitutes an important feature of an environment conducive to smooth monetary policy implementation and financial market stability. Standing facilities are not employed to steer market liquidity at large, but to reduce the volatility of the overnight rate in cases of temporary liquidity shocks exceeding the absorptive capacity of minimum reserve requirements.19

4. Potential impact of Basel III liquidity standards on monetary policy implementation

The main focus of the analysis rests on the impact of the LCR which I expect to have a stronger impact on monetary policy implementation. While I agree with the results in ECB (2010a to d), I expect the impact of the LCR to be larger due to network dynamics and negative feedback loops. The following sections are based on Schmitz (2009) and Schmitz (2010):

19 Standing facilities are the main instrument of monetary policy implementation under the “channel”-approach. The spread between $r^{DF}$ and $r^{LF}$ is substantially smaller.
4.1. The LCR reduces the volume of and the participation in the short-term money market (≤ 30 days)

All components of the LCR (cash-inflows, cash-outflows, and the value of the counterbalancing capacity) are non-deterministic. Assume a bank experiences an unexpected outflow. Can the bank cover this by an O/N interbank loan to protect its cash-position and its LCR? No, all else equal, the O/N loan increases its net cash-outflow over the next 30 days by the full amount due on the next day (including interest rates), and consequently the LCR requirement of liquid assets. In sum the O/N loan would not have an impact on its absolute liquidity shortage under the LCR. Ceteris paribus, the full amount of any interbank loan with a maturity of up to 30 days must be fully backed by liquid assets. This increases the costs of these interbank loans substantially and makes them very unattractive for the borrower.

For the lender the very same interbank loans are attractive, as they would reduce its liquid assets, but 1:1 also its net cash-outflow over 30 days – the loan is fully recognised as inflow. Thus, the LCR has little impact on the marginal costs of such an interbank loan for the lender.

The picture is inverted for interbank loans with a maturity exceeding 30 days. Initially, the LCR increases the relative benefit at the margin of such a loan for the borrower, as it does not increase net cash-outflows but can improve the borrower’s LCR, if it increases the cash-position or is invested in a liquid asset; otherwise, it is neutral. (Once the residual maturity drops to 30 days, the loan has to be fully backed by liquid assets and its marginal costs again increase for the borrower vis-à-vis a world without LCR, ceteris

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20 Although it will reduce the percentage shortfall: given a bank with net cash-outflows of 10 billion currency units and LCR eligible liquid assets of 7 billion of the same currency units, the absolute liquidity shortfall is 3 billion currency units and 30 per cent of the LCR. If the bank borrows 10 billion short-term (below 30 days with an interest rate of 0.01 currency units) and invests the full amount in Level 1 LCR eligible assets with low haircuts, its new LCR amounts to, say, 16.95/20.01 = 84.7 per cent. Is this a relevant improvement? No, the P&L impact of covering the liquidity shortfall is a function of the absolute liquidity shortfall and not a function of the percentage shortfall. The absolute shortfall increases from 3 billion to 3.06 billion currency units.
Initially, the LCR reduces the marginal benefit of such a loan to the lender; it does not impact its net cash-flow position, but reduces its cash position and, thus, the LCR. Where does this impact stem from? The cash-flows and their impact on stocks are unaffected by the introduction of the LCR. Before the introduction of the LCR the lender would provide an interbank loan, if it was comfortable with its liquidity situation. Until August 2007, this was largely driven by minimum reserve requirements (MMR) which are deterministic, since they are backward looking. The bank knows the average amount of the MMR over the maintenance period. If it is hit by a shock to its cash position, it can cover the MMR by a short-term interbank loan (e.g. an O/N loan). The objective variable MMR is unaffected by this new liability. The bank takes a slightly higher liquidity risk exposure at the margin to buy time to readjust its liquidity position to the shock (e.g. by replacing the run-off liability with a similar liability). The difference now is that the binding constraint, the LCR, is immediately binding at the margin. The primary effect is that, both, the volume and the participation in the short-term interbank market decreases. While this is in line with the objectives of the LCR, it also has unintended consequences.

4.2. Network dynamics and negative feedback loops reinforce the impact of the LCR

The LCR will reduce volumes in the unsecured interbank market. But it will also unleash negative dynamics that exacerbate the initial impact. The interbank market can be interpreted as a network of participating banks. Positive network externalities and dynamics apply: the more banks participate and the higher market volume, the easier it is to obtain funding, the lower the risk of market dislocations due to idiosyncratic risk at one market participant. However, once the LCR sets in motion a reduction of volumes and participation, this could lead to a negative feedback loop based on a shrinking and disintegration network with decreasing volume: the LCR increases incentives for banks to self-insure against liquidity shocks and to hold excess reserves, due to the reduction of the insurance function of the unsecured interbank market with respect to idiosyncratic liquidity shocks. Two forces are at work here: due to the reduction of the insurance function of the

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21 See also ECB (2010a, 5).
unsecured interbank market, banks hold higher liquidity reserves and due to the arbitrage opportunities provided the deviation between the single list and the LCR definition of liquid assets, banks face incentives to hold this liquidity cushion in the form of central bank money (excess reserves). With fewer banks participating in the market and volumes being lower, idiosyncratic shocks have a stronger impact on the market – both, on volumes and rates. Thus, the market becomes more prone to liquidity shocks, which further reduces its (perceived) “insurance value” exactly when this is needed. This in turn further incentivises banks to self-insure against liquidity shocks, which again reduces participation and volume. Classical network dynamics emerge, which reinforce the initial impact of the LCR. These dynamics had already been set in motion by the crisis itself: Banks had regarded the unsecured money market as a reliable source of funding (until August 2007) and, thus, the market fulfilled a perceived insurance function. But the crisis itself highlighted that banks’ perception of reliable excess to unsecured short-term funding was misguided and banks started to hoard liquidity (self-insured against liquidity shocks); these dynamics will be reinforced by the negative feedback-loop emanating from the LCR. A return to the pre-crisis perception is not a policy objective. To the contrary, the LCR aims at preventing banks’ to return to that false sense of security regarding the reliability of unsecured short-term funding.

4.3. The relevance and information content of EONIA decreases, its volatility increases

The reduced volume on the short-term money market reduces the role played by EONIA in the monetary transmission mechanism.\textsuperscript{22} \textit{EONIA does no longer provide a reliable indication of the liquidity stance of the Euro area banking system.} In addition, the decreased volume and participation is exacerbated by the negative network dynamics which hampers the price discovery mechanism of the O/N money market.\textsuperscript{23} The volatility of EONIA and other

\begin{footnotesize}
\textsuperscript{22} See also Holthausen/Bindseil (2011).
\textsuperscript{23} Would higher levels of excess reserves reduce the volatility of EONIA? No. Fewer banks might be directly affected by dislocations in the money market due to their self-insurance capacity. But since price-discovery operates at the margin, those banks that actually try to tap the market are likely to face higher volatility.
\end{footnotesize}
unsecured short-term rates increases. This is in line with the findings of ECB (2011). The LCR and negative network dynamics increase the size and volatility of the structural liquidity deficit. Since banks cannot cover shocks to their liquidity position by tapping the short-term money market, they have to hold higher transaction and precautionary balances. Before August 2007 banks held very little excess reserves (i.e. in excess over the MMR). The structural liquidity deficit could easily be estimated by the Eurosystem, as its main driver – the MMR – was backward looking. Under the LCR the excess reserves will increase substantially and they will be influenced by banks’ perceptions of uncertainty with respect to future cash-flows which drive the demand for transaction and precautionary balances. Both change continuously with the reassessment of the probability of net cash-outflows and changes of banks’ uncertainty aversion. As these factors are unobservable contemporaneously the estimation of the structural liquidity becomes much harder.

Substantial excess reserves point to a more fundamental challenge: minimum reserve requirements were introduced precisely with the intention to stabilise the demand for the central bank money. If they do not constitute a binding constraint anymore, they cannot fulfil this function.

One important caveat to this scenario remains: the above deliberations assume that banks adjust their liquid assets to changes in their net cash outflows under the LCR. However, it is also possible that they adjust their net cash outflows. In particular, they might do so via their exposure to the unsecured short-term money market, although I regard this as unlikely, given the high opportunity costs (excess reserves yield no interest). This demand might, in theory, be sufficient to maintain a sufficiently high and stable volume and a sufficiently stable network structure to forestall the negative network dynamics highlighted above.

4.4. Bidding behaviour will be more aggressive and more volatile

In addition, some banks would bid more aggressively in open market operations, because a bank that does not receive the planned volume in open market operations would have to turn to the short-term money market: if it borrows unsecured or in a repo in non-LCR-
eligible assets, its liquidity requirements under the LCR would quadruple for the same volume (given the same tenor; 100 per cent run-off instead of 25 per cent). The greater volatility of bidding behaviour stems from the fact that the demand excess reserves are more volatile than that for MMR. Both lead to a higher volatility of the allotment rate. In particular, it might deviate substantially from the policy rate. Its signalling and transmission function of the monetary policy stance of the Eurosystem will be impaired.

4.5. Banks face incentives to participate in Eurosystem open market operations and to post non-LCR-eligible assets

The LCR incentivises participation in Eurosystem open market operations directly.24 But the impact is exacerbated by the unintended consequences of the LCR on the allocation and distribution function of the unsecured money market: Before the onset of the current crisis, a relatively small number of banks participated in Eurosystem open market operations (OMOs). These then redistributed the liquidity in the system via the money market. This allocation and distribution function of the money market is hampered: while repos with level 1 assets are not affected (0 run-off) and repos in level 2 assets receive a 15 per cent haircut, unsecured short-term money markets loans are unattractive for borrowers as are short-term repos with non-eligible assets (both have 100 per cent run-offs). In contrast, participation in central bank open market operations in non-eligible assets faces only a 25 per run-off. Thus banks face strong incentives to participate in open market operations and to post non-LCR-eligible assets as collateral with the Eurosystem; level 1 and 2 liquid assets will be used to fulfil the LCR and to substitute market repos in non-LCR-eligible assets with those in level 1 and 2 liquid assets. As a consequence this increases credit, market, and liquidity risk born by the Eurosystem.

4.6. Summary of section 5

The main challenge for monetary policy implementation stems from the negative network dynamics and feedback loops unleashed by the LCR which increase the size and

24 See also ECB (2010a, 5).
the volatility of the structural liquidity deficit. Diagram 6 extends diagram 2 to investigate the impact of the LCR on the framework of monetary policy implementation in the Euro area. The diagram displays the aggregate demand for central bank money before the onset of the crisis $D$ and a level for the policy rate $r^{pol}$. The outstanding amount of central bank money is $S$. At the target level of the policy rate $r^{pol}$ the initial structural liquidity deficit is denoted by $\Delta R^S$. $S$ is controlled by the central bank; $D$ is (largely) backward looking and can be estimated very accurately. The central bank implements monetary policy by providing $\Delta R^S$ in open market operations. The deposit and the lending facility, $DF$ and $LF$, provide boundaries for the effective target rate in the face of substantial shocks to the structural liquidity deficit.

[Diagram 6]

The introduction of the LCR and the negative network dynamics and feedback loops unleashed thereby shift $D$ to the right to a new demand schedule $D^2$ (in red). For the central bank the increased uncertainty with respect to the demand for excess reserves would implies that $D$ cannot be estimated with sufficient accuracy, but would be somewhere between the schedules $D^{2*}$ and $D^{2**}$ (in red). The structural liquidity deficit increases to somewhere around $\Delta R^{S2}$ with the lower and upper bounds defined by $\Delta R^{S2*}$ and $\Delta R^{S2**}$. For the central bank this poses the problem that the volume of the open market operation can be determined ex-ante only with considerable uncertainty to be somewhere between the two schedules $S^{2*}$ and $S^{2**}$. For the target rate this implies that it would be determined only with considerable uncertainty, as well as, somewhere between $r^{pol*}$ and $r^{pol**}$. In the simplified diagram 5 both boundary rates lie outside the channel defined by the standing facilities, $DF$ and $LF$.

Furthermore, more aggressive bidding would lead to a decrease of the interest rate sensitivity of the new demand schedule under a situation of heightened uncertainty on the money market, i.e. when some banks face idiosyncratic shocks and/or want to increase their self-insurance capacity against idiosyncratic shocks and shocks to the money market. Not only is the intercept of the demand schedule prone to uncertainty but also its slope. The steeper demand schedules are depicted in diagram 5 as $D_{U^2}$, $D_{U^{2*}}$ and $D_{U^{2**}}$ (in light
blue). The consequence is that – at given supply schedules \( S^{2*} \) and \( S^{2**} \) – the policy rate can fluctuate even further between \( r_{U}^{\text{pol}} \) and \( r_{U}^{\text{pol**}} \) and the implementation of monetary policy in the current framework even less accurate.

In the current framework the recourse to the standing facilities would increase. Frequent quick tenders would have to be employed to realign the estimated structural liquidity deficit with its actual materialisation. In sum, the framework of monetary policy implementation will have to be adapted.

While cumbersome and costly, this would not pose an insurmountable challenge per se. Other central banks operate in the money market much more frequently than the Eurosystem. But it presupposes two conditions: first, that the (perceived) arbitrage relationship between the tools of the central bank and the target interest rate remains operational; second, that the transmission mechanism from \( r^{\text{pol}*} \) to the actual objective variable inflation could be estimated with sufficient accuracy.

In section 5, I leave it deliberately ambiguous to which money market rate \( r^{\text{pol}} \) refers. Currently, the framework of monetary policy implementation targets the unsecured O/N rate EONIA. But the relationship between EONIA and monetary policy implementation presupposes an arbitrage relationship between the unsecured money market and central bank policy tools (i.e. open market operations, standing facilities, quick tenders). However, all policy tools are collateralised. In the following section I will investigate the impact of the on-going crisis on this arbitrage relationship and suggest that also the target interest rate will have to change.

5. The impact of the current crisis on the implementation of monetary policy in the Eurosystem

The (perceived) arbitrage relationship between open market operations and the unsecured money market was a cornerstone of monetary policy implementation before the onset of the crisis. But it was a spurious relationship. Technically, open market operations under the set-up described in section 4 establish arbitrage opportunities for banks between collateralised open market operations and collateralised money market
operations. But the policy rate was an unsecured rate (EONIA). But since the unsecured and the secured had featured very small spreads and minimal variance, the market treated them as (almost) perfect substitutes. The (perceived) arbitrage relationship between open market operations and the unsecured overnight market was severely disrupted by the on-going crisis (Diagram 7).

[Diagram 7]

While the mean spread between the unsecured O/N rate EONIA and the shortest repo rate T/N was -0.8 basis points (with a variance of 0.5 basis points) before the onset of the crisis (sample: January 1, 2003 to August 8, 2007), it increased to 3.9 basis points, but its variance jumped by a factor of 3.1 since August 9, 2011 (to April 4, 2012). The mean of the spread between the unsecured and secured 3 month rate increased by 792 per cent and the variance jumped by a factor of 931; for the 6 months tenor they are 856 per cent and a factor of 1,358. Soares/Rodrigues (2011) provide evidence that the ECB faced greater challenges in steering the spread between EONIA and the minimum bid rate; their results suggest that longer tenors of OMOs, full allotment and quick tenders contributed to stabilising money market conditions. It is questionable whether the spreads between the unsecured and the secured money market rates will return to pre-crisis levels in the foreseeable future.

The crisis resulted in a steeper and more volatile yield curve of the unsecured short-term rates than of secured rates, which becomes apparent in diagram 8. Before the crisis the slope between the 1W and the 3M EURIBOR was 8 basis points with a volatility of 123 basis points (January 1, 2003 to August 8, 2007). It then jumped to 46 basis points with a volatility of 303 basis points (from August 9, 2007 to April 4, 2012). The slope of the 1W and 6M tenors increased even further from 14 to 65 basis points but its volatility actually

In addition to the increasing volatility of market rates and indices, there is more than enough anecdotal evidence that the dispersion of individual bid rates increased sharply; even to the extent that many banks were shut-out of the market, regardless of their bid-rates. Individual bid-rates of panel banks were published for the first time in September 2008, so that there is no pre-crisis data available for our analysis.
decreased from 319 to 268 basis points. This was a result of the very stable expectations of an extended period of low short-term interest rates.

[Diagram 8]

It is interesting that the impact of the crisis on the spread between EONIA and T/N Eurepo is much less than that on the longer tenors. To some extent this is a consequence of the liquidity policy of the ECB (occasional quick tenders between August 2007 and October 2008 and fixed rate tenders with full allotment thereafter). In addition, I interpret this as further evidence that liquidity risk and not just market risk plays a fundamental role in explaining the dislocations on the money markets.26 Given that the impact of the Basel III liquidity standards is highest for unsecured money markets, I would expect the volatility differential between the unsecured and the secured segments of the money market to increase, ceteris paribus. With demand and supply for excess reserves being driven to a larger extent by transactions and precautionary demand, I would also expect the volume of unsecured interbank transactions to be more volatile. This follows from the fact that the latter is a residual position of the former, at a given liquidity positions of the banks in the market. Thus, the introduction of the LCR is unlikely to reduce the volatility differential between the unsecured and the secured segment (rather to the contrary)27. The transmission of monetary policy along the unsecured yield curve is prone to shocks and higher volatility.

To sum up, independently of the Basel liquidity standards, EONIA is unlikely to remain a good target rate for monetary policy implementation in the future. This is a consequence of the larger and more volatile spread between the unsecured and the secured money market rates which disturbs the (perceived) arbitrage relationship between the unsecured money market and open market operations.

26 For an empirical investigation of this hypothesis see Eisenschmidt/Tapking 2009. Based on their data liquidity risk can contribute to the explanation of the increase in unsecured term interbank rates and the decrease in volumes.

27 See also Holthausen/Bindseil 2011.
6. Potential policy reactions

In sections 5 and 6 I argue that, both, the framework and the target interest rate of monetary policy implementation will have to adapt as a consequence of the introduction of the LCR and the legacy of the crisis on money markets in the foreseeable future. In this section I review the potential policy reactions suggested in Bindseil/Lamoot (2011) to address the technical effects of the LCR on monetary policy implementation.

6.1. Potential policy reactions discussed in the Eurosystem

In order to address the potential shift of banks’ demand from MROs to LTROs, Bindseil/Lamoot (2011) presents three potential policy actions:

1. Introduction of a 0% run-off factor for all central bank refinancing operations: In principle, this solution eliminates the incentive to shift from MROs to LTROs. For the current set of banks that participate in OMOs and for the demand for central bank funds needed to cover the minimum reserve requirement, this is an agreeable solution. But it would also incentivise more banks to draw on central bank funding and to do so beyond the volume required for MRRs.

2. Introduction of different collateral sets for MROs (single list) and LTROs (LCR eligible level 1 assets only): This would remove incentives for banks to switch from MROs to LTROs, as long as all banks have access to three months market repos in level 1 assets. That does not only depend, however, on the quality of collateral (which is high) and on the resulting low counterparty risk, but also on banks willingness to lend for three months at prices close to the expected marginal allotment rate in LTROs. The volume and the interest rate in money market operations are also influenced by banks’ perceptions of liquidity risk in the market and their respective liquidity risk tolerance. Thus, even with a narrow set of collateral banks might face substantial incentives to bid aggressively in LTROs auctions, which would again to higher spreads at the short end of the curve.

3. Also shift the volume supplied from MROs to LTROs: This would address the symptom (increasing spreads) but not the underlying incentive for banks to
arbitrage liquidity regulation via central bank operations rather than improving their liquidity positions. Banks would become more dependent on central bank refinancing. In addition, Eisenschmidt/Holthausen (2010) point out that this might increase the potential negative effects of more aggressive bidding in MROs.

In order to reduce the incentive for banks to post less liquid collateral with the Eurosystem Bindseil/Lamoot (2011) suggests adjusting, both, the parameters of the Basel III liquidity standards and the single list. In particular, the note proposes to consider the inclusion of corporate and covered bonds in the set of LCR-eligible liquid assets. Since the publication of the note in May 2010, the BCBS has adjusted the set of LCR-eligible assets. In the light of the results of the first QIS non-financial corporate bonds and covered (both with a minimum rating of AA-) in the set of liquid assets (level 2) were included.

Lower volumes in unsecured short-term markets could impair the implementation of monetary policy based on the target rate EONIA. Bindseil/Lamoot (2011) and Holthausen/Bindseil (2011) suggest considering the move to a secured short-term rate. This could also address the problem of a potentially steeper short-term unsecured yield curve. The note suggests assessing the costs and benefits of such a move carefully, which is certainly a good idea. Especially, the questions needs to be addressed which secured rate should be targeted; will the LCR impact Eurepo? Currently, there is one secured rate for repos and it is independent of the underlying collateral. Differences in the quality of collateral are addressed via different haircuts. This might change in the future, since the opportunity costs in terms of liquid assets to be held against different repos (in level 1, 2 assets and non-LCR-eligible assets) differ substantially.

6.2. Potential policy reactions derived from sections 5 and 6

The main conclusions from sections 5 and 6 are in line with the conclusions of Bindseil/Lamoot (2011) and Holthausen/Bindseil (2011): first, monetary policy implementation in the Eurosystem will have to adapt with respect to, both, the target rate and the implementation framework. Section 6 shows that the target rate also needs to change as a
consequence of the crisis which reinforces the conclusions based on the Basel III liquidity standards. A move to a secured short-term rate (i.e. T/N Eurepo or a newly emerging O/N Eurepo) would re-establish an arbitrage relationship between the target rate and the operational framework which was disrupted by the crisis. In the future more banks will participate in central bank operations than before August 2007. While this will have an impact on operational routines and systems, it will not pose a fundamental challenge to the framework. (Furthermore, it might be temporary, if a new framework and target rate will re-establish a mechanism that effectively allocates and distributes central bank reserves.) Second, the burden of adjustment clearly rests on the Eurosystem, because Basel III is applicable in many currency areas with different frameworks for monetary policy implementation and the main challenges are posed by the intended reduction of banks’ reliance on short-term (unsecured) funding which is also in the interest of central banks. The detailed analysis of further policy options is beyond the scope of this note. But some proposals for further investigation can be put forth:

Section 5 argues that the instability of the demand for central bank reserves partly stems from expected high excess reserves which are inherently less stable than the backward looking minimum reserve requirements. So, would increasing minimum reserve requirements stabilise demand? No, because the demand for excess reserves stems from the bifurcation of reserve demand, rather than the higher level per se. At the beginning of the maintenance period balances held to fulfil the MRRs can partly be employed as transactions and precautionary balances as well, as banks have to option to intertemporally substitute balances in the future for balances today. But in principle the transactions and precautionary balances will be held as excess reserves. [If the MRRs are very high relative to excess reserves, the impact of aggressive bidding for the latter would have a smaller impact on the volatility of the allotment rate. But the costs on terms of high MRRs (which are not LCR-eligible) and high collateral needs (which would increase the overall demand for collateral) are likely to outweigh the uncertain and small benefits.]

__28 Schmitz/Ittner 2007.__
The higher uncertainty in the level and slope of $D^*/D_{U}^*$ at OMOs could also be addressed by a substantial increase of the maximum volume auctioned in OMOs. However, this approach cannot address changes in the structural liquidity deficit between OMOs.

Alternatively, the bifurcation of demand for central bank reserves in OMOs could be reflected in individual maximum amounts for eligible bids based on single list assets. Excess demand would then have to be collateralised by level 1 and level 2 assets. MRRs per bank remain backward looking and predictable. The Eurosystem could establish maximum eligible bids per bank for OMOs that are based on individual banks’ MRRs. However, this would of course impede the allocation and distribution function of participating banks for those that do not directly participate in OMOs. This would reinforce the impact of the LCR on direct participation and lead to a very large number of direct participants. This approach would increase the demand for level 1 and level 2 assets.

The above options focus on marginal adjustments of the prevailing framework, but it seems that a more fundamental reform is warranted. One option would entail a shift to a channel system of monetary policy operation with low MRRs: Given that non-binding MRRs are unlikely to fulfil their main purpose – stabilising demand for central bank money – MRRs could be reduced substantially. As the MRRs are not LCR-eligible liquid assets (or only to a limited extent), high MRRs effectively withdraw liquidity from the banking system. Channel systems of monetary policy implementation operate with zero or low levels of MRRs. This would counterbalance the increase in the structural liquidity deficit, shift the demand schedule back to the left to $D^*$ and reduce the base demand for collateral (Diagram 9). However, it would neither address the uncertainty with respect to the level of the structural liquidity deficit at each rate of interest (somewhere between $D^*$ and $D^{**}$) nor would it provide a solution to the uncertainty with respect to the slope of the demand schedule (e.g. $D_{U}^*$).

[[Diagram 9]]

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The uncertainty of the level and slope of demand could be addressed by two measures: more aggressive bidding for larger volumes can be endogenised by larger maximum volumes of the tender operations; this would limit the fluctuations of allotment rate at the expense of larger variations in allotted volumes. The latter could lead to larger variations of the market rate between tenders, if uncertainty decreases. A more systematic approach would focus on the narrowing of the channel defined by the standing facilities (shift from $LF$ to $LF^3$ and $DF$ to $DF^3$) to, say, ±25 basis points. This would also endogenise the outstanding volume of central bank money, but could also address variations of demand between tender operations.

The channel approach presupposes that the usage of the standing facilities penalises banks, e.g. by interest rate spreads over the prevailing market rate. That would require the market rates to be stable, but their potential instability is very problem here. Banks would simply take recourse to the standing facilities whenever the market rate deviates by more than ±25 basis points from the centre of the channel. Furthermore, the approach would not address the arbitrage opportunity emerging from the different LCR-run-off rates for market repos and central bank repos.

*Lower MRRs reduce the liquidity withdrawn from the banking system.*\(^{30}\) Thus, the Eurosystem could also narrow the range of collateral. Open market operations and standing facilities collateralised in level 1 and 2 assets would ensure that recourse to the standing facilities would not be incentivised vis-à-vis tapping the market. In addition, this would also address the increased risk exposure of the Eurosystem. Only substantial deviations of the secured target rate from the intended level would lead to recourse to the standing facilities (i.e. when the structural liquidity deficit changes), but not arbitrage opportunities for banks. The behaviour of the target rate (e.g. T/N Eurepo) will then be governed by “…the fundamental equation of monetary policy implementation …”

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\(^{30}\) A reduction of, say, about ½ (roughly 150 bn EUR) could substantially reduce the economic costs of the LCR and could ease the pressure on liquid assets markets by increasing the float without compromising its financial stability objective. This would correspond to about 15 per cent of the estimated liquidity shortfall.
Market participants expect the market rate to correspond to the weighted average of the rates of the standing facilities; the weights of the deposit facility is the probability that the system has an aggregate excess supply of liquidity at the end of the day, while the weight of the rate on the lending facility is the probability that the system faces an aggregate shortage of liquidity at the end of the day. How smooth these probabilities and consequently the market rate evolve cannot be predicted. But given that I expect transactions and precautionary demand components to take precedence under the LCR, I would expect market rates to be more volatile and standing facilities, in particular the lending facility, to play more of a role. I would not expect the deviations of the market rate to follow a symmetric distribution, let alone a normal distribution; one the one hand, this could be addressed by an asymmetric channel, one the other, the Eurosystem would simply have to adapt to a new normal of a more active role.

7. Conclusions

First, monetary policy implementation in the Eurosystem will have to adapt with respect to, both, the target rate and the implementation framework. Second, the burden of adjustment clearly rests on the Eurosystem, because Basel III is applicable in many currency areas with different frameworks for monetary policy implementation and the main challenges are posed by the intended reduction of banks’ reliance on short-term (unsecured) funding which is also in the interest of central banks.

The impacts of the LCR on the current framework can be summarised along the following lines:

1. The LCR disincentivises banks to lend and/or borrow on the unsecured money market.

2. More banks participate in the open market operations. Banks under pressure will bid more aggressively. Furthermore, banks face incentives to submit eligible assets which are not included in the definition of liquid assets at the national central banks (NCBs) in long-term refinancing operations (LTROs). The decreasing quality of the collateral pool increases the risk exposure of the Eurosystem.
3. The spread between interest rates on the secured and the unsecured money market would increase. The slope of the yield curve would increase at the short end. The interest rates at the short end would become more volatile. Beyond the impact on monetary policy implementation, this would affect the transmission of monetary policy.

Additional challenges for monetary policy implementation stem from (i.) the negative network dynamics and feedback loops unleashed by the LCR which increase the size and the volatility of the structural liquidity deficit and (ii.) the breakdown of the (perceived) arbitrage relationship between the unsecured money market and open market operations. I believe that the framework of monetary policy implementation requires a fundamental reform rather than quick-fixes to various details of the existing framework; not least because the costs of high minimum reserve requirements (likely not to be LCR eligible) increase for banks, while their benefits for monetary policy implementation decrease. Though a detail analysis of reform options is beyond the scope of this paper, I suggest that a channel approach to monetary policy implementation with substantially reduced minimum reserve requirements is worthy of further analysis.

8. Literature


Appendix

A1. The Basel III liquidity standards

A1.1. The Liquidity Coverage Ratio (LCR)

The Liquidity Coverage Ratio (LCR) aims at increasing the resilience of banks under stress over a 30 day period without special government or central bank support (BCBS 2010).\textsuperscript{31} The LCR is a minimum requirement. As such it pertains to large internationally active banks on a consolidated basis. In the EU it will be implemented in the CRD IV, albeit with some deviations from the Basel standards to take into account EU specificities, in particular the implementation for all banks as well as the application on a solo and consolidated basis. The severe stress scenario combines a market wide and idiosyncratic stress including a three notch rating downgrade, the run-off of retail and wholesale deposits, the drying up of primary and secondary markets (repo, securitisation) for many assets and large cash-outflows due to off-balance sheet items.

The LCR is defined as the ratio of liquid assets over the net cash-outflows over the 30 day horizon. Cash, excess central bank reserves (to the extent that these deposits can be withdrawn in times of stress; i.e. reserves exceeding the minimum reserve requirements), and government bonds with 0 per cent risk weight under Basel II (incl. government guaranteed bonds, debt of central banks and public sector entities etc.) are considered Level 1 liquid assets.\textsuperscript{32} Level 2 liquid assets consist of government bonds with a 20 per cent risk weight under Basel II, covered and non-financial corporate bonds (rating at least AA-). However, additional conditions concerning the debt and breadth of the underlying markets, a haircut of at least 15 per cent, and a maximum ratio of 40 per cent of liquid assets (after haircuts) apply to Level 2 assets.

Net cash-outflows are calculated by applying binding run-off parameters to the contractual outflows of liabilities as well as off-balance sheet items and roll-over assumptions to the contractual inflows from assets. Repos in Level 1 assets (0 per cent run-off), stable retail (incl. SMEs) deposits (5 per cent run-off), and less stable retail deposits (10 per cent run-off) are considered the most stable funding sources under severe stress. Repos with Level 2 assets and with central banks (also in non-LCR-eligible assets) are assigned run-off rates of 15 and 25 per cent, respectively. The latter also applies to operational balances irrespective of the counterparty (but for the part of these balances covered by deposit insurance

\textsuperscript{31} For the economic rationale of a functional approach to liquidity regulation see Schmitz/Ittner 2007.

\textsuperscript{32} Government bonds with a 20 per cent risk weight under Basel II are eligible as Level 1 assets, if they are issued in the country in which the bank is domiciled or if they are used to cover net cash-outflows in the respective foreign currency.
the CRD IV foresees a 5 per cent run-off rate). Other unsecured wholesale funding from non-financial corporates, central banks, and public sector entities receives a 75 per cent run-off rate. Contractual outflows from most other balance sheet positions are assumed to run-off completely as are all off-balance sheet items except credit lines granted to non-financial corporates, central banks, and public sector entities (10 per cent) and credit and liquidity lines granted to retail clients (5 per cent). (For some derivatives outflows national discretions apply.)

Contractual cash-inflows over the 30 day period are capped by 75 per cent of total outflows. No inflows are recognised from operational balances at other banks, receivables from reverse repos in Level 1 assets, and undrawn liquidity lines and similar facilities. Reverse repos in Level 2 assets are treated symmetrically as well, so that 15 per cent of the contractual inflows effectively count as inflows. Planned inflows from performing retail loans and loans to non-financial corporates are capped at 50 per cent. Full recognition of contractual inflows is granted to reverse repos in non-eligible assets and performing wholesale loans to financial institutions.

A1.2. The Net Stable Funding Ratio (NSFR)

The objective of the Net Stable Funding Ratio (NSFR) is reducing the maturity mismatch between assets and liabilities with remaining contractual maturities of one year or more. The ratio is defined as Available Stable Funding (ASF) over Required Stable Funding (RSF). The Basel Standard prescribes a minimum ratio of 1.

Required Stable Funding is calculated as weighted sum of assets. The weights are loosely linked to the run-off rates in the LCR: Cash, Commercial Paper, bonds with a maturity of below 1 year and non-renewable interbank loans receive a weight of 0; government bonds (incl. Public Sector Entities, multilateral development banks, European Commission, Bank for International settlements and central banks as well as government guaranteed debt) with a 0 per cent risk weight under Basel II are assigned a weight of 5 per cent; corporate bonds and covered bonds with a rating of AA- or better with a residual maturity of one year or more have a 20 per cent weight; corporate bonds and covered bonds with a rating of below AA- but at least A- and a residual maturity of at least 1 year as well as loans to non-financial corporates with a residual maturity of below one year get a 50 per cent weight; unencumbered mortgages with a risk weight of up to 35 per cent under Basel I receive a 65 per cent RSF weight; retail loans with a residual maturity of below 1 year get a 85 per cent weight; the rest a 100 per cent weight.

Available Stable Funding (ASF) is calculated in the same fashion: capital and hybrids, and liabilities with a residual maturity of more than 1 year have a 100 per cent weight, stable deposits and less stable deposits are weighted by 90 and 80 per cent, respectively. Wholesale funding from non-financials is weighted by 50 per cent; the rest is not recognised as stable funding.
Diagrams

Diagram 1: Aggregate overnight reserves and the structural liquidity deficit in the overnight market
Diagram 2: The spread between unsecured and secured money market rates before the onset of the current crisis (January 2003 – August 2007)
Diagram 3: The maximum volume of OMOs, demand for additional CB reserves, and the realised increase in aggregate CB reserves

\[ \Delta R^S_{\text{max}} = \Delta R_1 \]
Diagram 4: The intraday money market and the availability of intraday credit from CBs in RTGS

Diagram 5: The overnight market for CB reserves and standing facilities (between OMOs)
Diagram 6: The impact of the LCR on the implementation of monetary policy

Diagram 7: The spread between unsecured and secured money market rates (January 2003 – March 2012)

Source: EBF, Bloomberg.
Diagram 8: The slope between the 1W and 3M EURIBOR and 1W and 6M EURIBOR, respectively (January 2003-March 2012)

Source: EBF, Bloomberg. The solid lines provide the 60 day moving averages of the respective slopes of the yield curve.
Diagram 9: The impact of a reduction of MRRs and a channel approach on monetary policy implementation