

Occasional Studies
Volume 16 - 4

Revisiting the central bank's lender of last resort function

DeNederlandscheBank

EUROSYSTEEM

Revisiting the central bank's lender of last resort function

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1 Introduction and summary¹

During the global financial crisis which started in 2007 (henceforth: crisis), central banks provided extended liquidity support, both to individual institutions and financial markets more broadly. These measures were taken as part of the lender of last resort (LOLR) function of the central bank, which can be activated in response to various kinds of liquidity risk. In times of systemic liquidity stress, when markets do not function properly and liquidity buffers fall short, a larger intermediary role of the central bank is warranted. Extended liquidity supply by the central bank can then underpin the intermediary function of the financial system to ensure the continuation of critical economic processes. In a systemic crisis, supporting financial stability is tantamount to safeguarding the monetary transmission process and thus, ultimately, also ensuring price stability.

The LOLR function can be designed and integrated in the set of monetary policy instruments and procedures of the central bank (the operational framework) in various ways. This study explores the optimal design of the LOLR function in times of systemic liquidity stress. We empirically analyze the differences in liquidity supply in the major jurisdictions during and after the period of systemic liquidity stress. We notice that in the US and the UK the use of central bank facilities was reduced in tandem with the decline in market liquidity stress, while the demand for Eurosystem operations remained high for a prolonged period. A deeper analysis of the use of Eurosystem refinancing operations during the crisis reveals that the distribution of liquidity supply was highly concentrated in a few banks; a small fraction of Eurosystem counterparties received relatively large amounts of refinancing. Moreover, it appears that some banks have persistently used the Eurosystem refinancing facilities, even in more benign market conditions.

¹ This study has benefited from useful comments made by colleagues of the European Central Bank (ECB).

Based on these findings and on the literature in this field, we conclude that liquidity supply by the central bank should only complement the market when the market fails to properly distribute liquidity. In these situations of market failure, there should be no uncertainty about the availability of LOLR and stigma related to systemic liquidity support should be avoided. However, systemic liquidity support should only be provided temporarily, since the lack of an exit strategy for central bank liquidity supply distorts the incentives of banks and delays a return to normal market conditions and a smaller intermediary role of the central bank.

Based on these features, we compare three alternatives for the future design of the LOLR function. We argue that a *fixed rate full allotment policy* (as currently applied by the Eurosystem) is a very effective instrument when markets become dysfunctional, but can make banks dependent on central bank funding for a prolonged period of time. To prevent this, *incentives can be embedded in the operational framework* to discourage over-proportional use of the monetary policy operations and/or a designated *Liquidity Insurance Facility* could be considered. While the former keeps the LOLR function (largely) integrated in the regular monetary policy framework, the latter represents a separate facility that can be activated in times of systemic liquidity stress, with special terms and conditions. We argue that both have their pros and cons.

This study is structured as follows. Chapter 2 presents the concept of LOLR and some long-standing principles related to its use. Chapter 3 provides lessons from the crisis on extended liquidity supply and analyzes the use of Eurosystem refinancing operations during the crisis, after which Chapter 4 provides new insights on the long-standing LOLR principles. Based on this, Chapter 5 compares three alternatives for designing the LOLR function.

2 LOLR: concept and guiding principles

2.1 Value added

The LOLR function adds value in several ways. Providing liquidity support to institutions that are solvent but illiquid avoids losses associated with the insolvency of a viable institution. LOLR support can also have wider benefits, since bank failures usually come with negative externalities for the economy and the financial system. These can be mitigated if LOLR resolves market failures which may affect financial stability and monetary transmission, such as a break-down of liquidity distribution by interbank markets. The crisis was a clear example of this. High uncertainty about counterparty risk and about the availability of funding liquidity led to a massive hoarding of liquidity by banks. While this was a rational response from the perspective of individual market participants, their collective behavior led to the drying up of market liquidity and impaired the functioning of banks. Markets were no longer able to distribute liquidity through the system, which can be assumed to represent a serious market failure with potential downside risks for financial stability, monetary transmission and the economy. These conditions triggered central banks worldwide to intervene. By extending LOLR support, the ECB complemented – or to some extent even replaced – the market when it failed. Research confirms that by supporting monetary transmission and credit supply, the long-term refinancing operations of the Eurosystem contributed to economic growth (see for instance Darracq-Paries et al. (2015) and Cahn et al. (2017)).

2.2 LOLR concept

Apart from conducting monetary policy, central banks perform a vital role as LOLR, providing liquidity support to individual institutions and/or financial markets, with the aim to prevent instability of the financial system.

LOLR can be defined in a narrow and in a broad sense. According to the narrow concept, as used by Goodhart (1999), LOLR refers to *bilateral* central

bank lending to individual banks that experience liquidity problems (in the Eurosystem referred to as “emergency liquidity assistance”). He argues that liquidity provision via open market operations (OMOs), to calm markets, should not be considered as LOLR, since in practice it is not possible to distinguish to what extent the OMOs are carried out as part of the LOLR function (“LOLR-OMO”) and to what extent not (“non-LOLR-OMO”). In his view, this makes the concept effectively non-operational. Others (e.g. Bindseil, 2016) use a broader LOLR-concept and typically refer to LOLR as liquidity support to the (*banking*) system as a whole, considering bilateral liquidity assistance to individual institutions as a special type of LOLR. Some hold the view that the central bank should only provide liquidity insurance via open market operations and not lend bilaterally, which is the so called “Richmond Fed view” (Tucker, 2014). Our study assumes a broad definition of LOLR, in particular the provision of central bank liquidity (or assets that could be used as collateral in money market transactions) for the purpose of addressing exceptional, temporary liquidity shortages of financial institutions, which can be caused by market-wide or institution specific stress.

As a starting point for our analysis we use the framework proposed by Cecchetti and Disyatat (2010). They distinguish three kinds of liquidity shortages, each calling for a different type of liquidity support:

- i. *Shortage of central bank reserves at specific institutions due to frictional payment shocks.* This type of liquidity shortage occurs when banks are faced with a sudden and unexpected shortage of funds, of which the underlying cause is typically technical in nature. Banks then run the risk of being unable to fulfill immediate payment obligations, potentially creating a gridlock in the payments system. Such shortages, caused by problems which are largely transitory, can be addressed by central bank “standing facilities”.
- ii. *Acute shortage of funding liquidity at specific institutions.* This type of shortage may occur when a financial institution loses market access, which may be

related to concerns with respect to the institution itself. In such cases of idiosyncratic risk, liquidity shortages of otherwise solvent banks may be alleviated by temporary bilateral liquidity assistance by the central bank. This special type of LOLR can serve as bridge financing, buying time for a more structural solution.

- iii. *Systemic shortage of funding and market liquidity.* In this case there is market-wide liquidity stress, stemming from market failures. This may result in a sudden drying up of liquidity in financial markets, with serious consequences for both financial stability and the real economy. To prevent this from happening, the central bank can provide system-wide liquidity support. By this the central bank can safeguard the intermediary function of the financial system to ensure the continuation of critical economic functions.

These three types of liquidity shortages do not always occur in isolation and interdependencies exist: one type of liquidity shortage may trigger or reinforce another type. An idiosyncratic liquidity shock that hits one institution may turn into systemic liquidity stress through contagion effects. The (possible) failure of one bank may lead to runs on other banks with similar characteristics or interdependencies (interbank exposures). In the remainder of this study we focus on the third type of liquidity shortage, which is related to systemic risk.

2.3 Long-standing LOLR principles

Principles underlying the LOLR policies of central banks were first developed in the 19th century, leading to the “classical doctrine” of Henry Thornton (1802) and Walter Bagehot (1873). In the spirit of Bagehot, central banks should take decisive action to stem a liquidity crisis while avoiding unnecessary risks for the central bank, by (i) *lending freely* (ii) *at higher rates* (iii) *to solvent counterparties* (iv) *against good collateral*.

Although some of the details of this classical theory remain controversial, the basic principles are still widely used in some way or other:

- i. *The central bank should lend freely and without limit.* In the spirit of Bagehot the central bank should do whatever it takes to prevent a liquidity crisis. If the central bank refrains from providing liquidity, the crisis would not abate. The central bank has a natural role as LOLR: it is not liquidity constrained and has an unlimited capacity to supply reserve money.
- ii. *In accordance with the "last resort" objective, the central bank should lend at backstop rates.* This is sometimes translated into lending at "penalty rates". As set out by Goodhart (1999), this is an incorrect translation: in Bagehot's work no reference is made to "penalty rates". Bagehot proposes that as a rule "*loans should be made at a very high rate of interest. This will operate as a heavy fine on unreasonable timidity, and will prevent the greatest number of applications by persons who do not require it*". This implies that the central bank should raise the rate early in the panic and apply a higher rate than that prevailing in normal times, but not necessarily above the prevailing market rate. Otherwise this could make the LOLR function ineffective. If the central bank is not prepared to lend on reasonable terms, no one else will, aggravating the situation. In accordance with this principle, central banks should apply backstop prices when providing system-wide liquidity support.
- iii. *Central banks should only lend to solvent, but illiquid, banks.* Although Bagehot's criterion for protecting the central bank against risks did not depend on the individual borrower but on the security (in Bagehot's time the money market operated through the discounting of bills), it is in the spirit of Bagehot to only provide liquidity support to solvent banks. This prerequisite shields the

central bank's balance sheet from losses and mitigates moral hazard issues. Another argument against lending to insolvent banks is that providing solvency support is generally considered a task of the elected government (ultimately, losses are for the tax payer) and outside the mandate of the central bank. In some jurisdictions, like the European Union, central banks are legally not allowed to provide liquidity to insolvent institutions, as this would be considered non-compliant with the prohibition of monetary financing. At the same time, whereas there are good arguments to only provide liquidity to solvent institutions, such principles may be difficult to operationalize in practice. Banks generally face liquidity problems when their solvency is in question. When a bank is not able to fund itself in the market, its solvency is likely also in doubt. The question is whether the central bank is able to properly assess an institution's solvency during such periods. Goodhart (1999) argues that in practice it is often impossible to distinguish clearly between illiquidity and insolvency.

- iv. *Central banks should lend against good collateral ("safety principle"), but not tighten their collateral framework during the crisis ("inertia principle")*. Central banks should lend against good collateral to protect themselves against (credit) risk. The collateral accepted should always be sufficient to cover anticipated losses at that point in time. Central banks, however, must avoid pro-cyclicality and should not impose additional restrictions during a crisis. Bagehot himself argued that during a crisis the central bank should maintain its risk control framework inert. This implies that the central bank should not restrict the set of eligible collateral or respond to a deterioration of asset liquidity and/or quality by increasing haircuts, as private market participants would tend to do. The central bank should abstain from such restrictive measures not only for market stability reasons, but also because such measures would increase (not reduce) the financial risks of the central bank: *"Only the brave plan is the safe plan"* (Bagehot, 1873, p. 201). Some (e.g. Buiter and Sibert, 2007) even advocate

for active additional risk taking. The justification is that the marginal social returns of risk-taking by the central bank increase substantially during a crisis (Bindseil, 2014, p. 249).

Table 1 summarizes how these basic principles can be applied to the LOLR instruments that are available to address the three types of liquidity shortage distinguished in section 2.1. It shows that the principles may lead to somewhat different outcomes for the central bank's LOLR approach, depending on the type of liquidity problem.

Table 1 Applying the LOLR principles to the three kinds of liquidity shortages

Policy response	Type of liquidity shortage		
	Shortage of central bank reserves at specific institutions due to frictional payment shocks	Shortage of funding liquidity at specific institutions	Systemic shortage of funding and market liquidity
<i>Instrument</i>	Standing facility	Bilateral liquidity assistance	System-wide liquidity assistance
<i>Purpose</i>	Avoid gridlock in payments system	Avoid contagion to the financial system	Avoid breakdown of financial markets
LOLR principles			
<i>Ambiguity of access</i>	No	Yes	No
<i>Pricing</i>	Penalty rate (corridor)	Penalty rate (surcharge)	Backstop rate
<i>Collateral</i>	Assets that meet the central bank's collateral criteria for refinancing operations	Low quality, illiquid assets (or uncollateralized with State guarantee)	High/medium quality, liquid and illiquid assets
<i>Counterparties solvency</i>	Counterparties that are financially sound	Solvent financial institutions	Solvent financial institutions

2.4 Moral hazard

By acting as a LOLR the central bank de facto provides liquidity insurance to banks. As with other insurances, this may lead to moral hazard behavior. Knowing that there is always an ultimate backstop available, banks may be less incentivized to self-insure against liquidity risk. Furthermore, liquidity insurance may result in excessive risk taking and as such increase the likelihood of future crises. To avoid such behavior, central banks have generally adopted a policy of "*constructive ambiguity*", leaving some uncertainty whether and under what conditions the backstop would be activated. While this leaves LOLR support to the discretion of the central bank, it is not in line with Bagehot, who emphasized that the central bank should show that it is prepared to lend freely to prevent panic. The benefits of preventing panic, by showing its readiness to act as LOLR, will outweigh the costs of moral hazard (which might be mitigated by enhanced regulation and supervision). This is especially true for systemic risks, when there is a natural role for the central bank to lend freely. For bilateral liquidity assistance, the central bank may keep in place some *constructive ambiguity*, by signaling that it will be at the central bank's discretion to decide whether in case of institution-specific liquidity problems liquidity assistance should be provided (which may not be provided when there is no risk of contagion).

3 Experiences during the crisis

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3.1 The major central banks and their role as LOLR

During the global financial crisis, the major central banks provided large amounts of liquidity assistance, both to individual institutions and financial markets more broadly. The way liquidity support was provided differed across central banks. In a number of cases, central banks developed new facilities at short notice to deal with widespread liquidity shortages. Others made use of existing system-wide facilities available to implement monetary policy; on occasion, these facilities required some modifications to fit the expanded purpose (CGFS, 2017). The Eurosystem belongs to the latter category. It implemented a fixed rate full allotment (FRFA) policy and extended its refinancing operations in terms of maturity, collateral criteria and availability, at market rates. This aimed at addressing systemic liquidity stress in the money market and – in a later stage of the crisis – at alleviating funding strains on banks, thereby supporting banks' credit supply.

The Federal Reserve System (Fed) and the Bank of England (BoE), on the other hand, belong to the group of central banks that developed new and distinct facilities to provide liquidity support to a wider set of counterparties (see Box 1). The Fed had a relatively small set of counterparties. It introduced two new facilities to provide extended liquidity support to depository institutions as well as to primary dealers that were facing liquidity tensions in the triparty repurchase agreement market. The BoE introduced three dedicated facilities which explicitly separated liquidity insurance from the monetary policy framework. The facilities included incentives for counterparties to manage their liquidity primarily through private markets in normal times. All these facilities were used, except for the Discount Window Facility (DWF) by the BoE. Aggregate data on DWF drawings shows that it has not been used between its introduction and September 2016, possibly reflecting concerns of stigma. The BoE publishes this data with 5-quarter lags, which would reduce the potential for stigma.

Box 1: Liquidity facilities of central banks in the global financial crisis

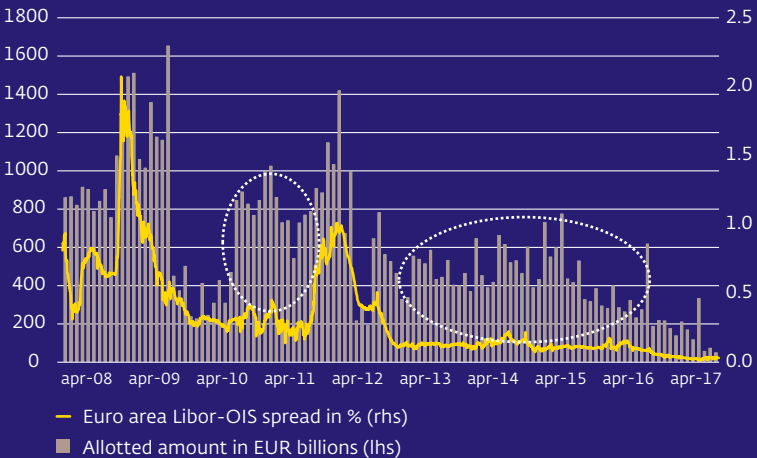
Eurosystem

In an immediate response to the stress in the money markets in 2007, ECB refinancing operations were conducted more frequently. Furthermore, the time pattern of liquidity provision was changed to enable banks to fulfill their reserve requirements earlier in the maintenance period. As the central bank still determined the total liquidity supply, banks placed bids well above the marginal rate to reduce their allotment uncertainty (Eisenschmidt et al., 2009). From October 2008 onward, the Eurosystem removed this uncertainty by carrying out the one-week main refinancing operations (MROs) and the three-month longer-term refinancing operations (LTROs) through a fixed rate full allotment policy.² This aimed at addressing systemic liquidity risk in the interbank money market, which had become dysfunctional after the Lehman collapse. In contrast to Bagehot's pricing principle, the fixed rate was not priced as a backstop. Going beyond the principle not to tighten the collateral framework during crises (see Chapter 2), the Eurosystem expanded the (already relatively broad) collateral framework to facilitate broad access to the extended liquidity supply. In later stages of the crisis the maturity of the LTROs was extended. Three 12-month LTRO's were conducted in 2009 and one 12-month LTRO in 2011, followed by 36-month very long-term refinancing operations (VLTROs) in December 2011 and March 2012. Lastly, the Eurosystem carried out a first series of 8 and a second series of 4 targeted 27- to 48-month targeted long-term refinancing operations (TLTRO-I and TLTRO-II, respectively) in order to support credit supply to the real economy. Figure 1 shows the demand driven allotted amounts in all refinancing operations (the gross cumulative monthly change

² Implementing a fixed rate full allotment policy implies that information on bidding behavior is reduced to bid volumes, since tender rates are fixed. Rising discrepancies between the marginal tender rates and bid rates can provide some valuable information on market conditions however.

in liquidity provision), together with the money market spread as an indicator for market-wide liquidity stress. The ellipses indicate that the allotted amounts remained high, even in times when the Libor-OIS spread indicator showed relatively low levels of stress in the interbank money market.

Figure 1 Eurosystem's refinancing operations and money market spread

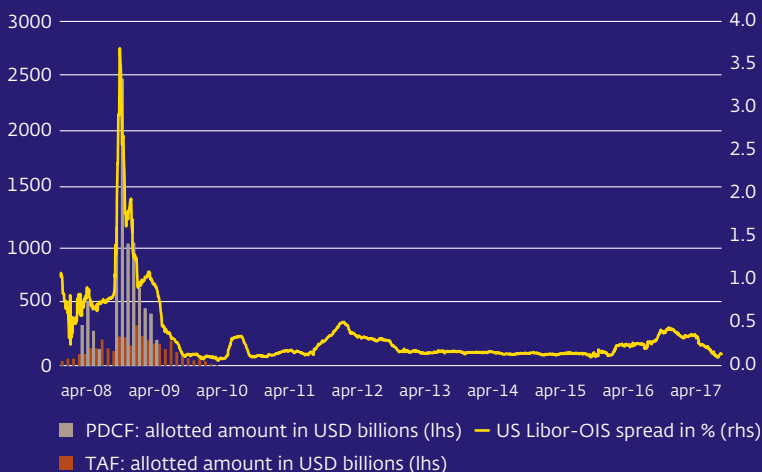


This figure presents the total allotted amounts in all Eurosystem refinancing operations, together with the Euro area Libor-OIS spread as an indicator for market-wide liquidity stress. It shows the gross cumulative monthly change in total liquidity provision by Eurosystem refinancing operations and does not net for redemptions. We consider this Eurosystem's best LOLR indicator, since it shows financial markets' gross response to market stress under a FRFA regime. The outstanding amounts are not shown, which we assume a less accurate indicator of the central bank's response to market stress, and is to a large extent driven by the credit easing operations, such as the TLTROs. All refinancing operations are plotted, because the Eurosystem fulfills the LOLR function by using its regular framework. The figure shows that the demand for Eurosystem refinancing remained high in times of low market-wide liquidity stress, as indicated by the ellipses. Source: ECB and Bloomberg.

Federal Reserve System

The Fed introduced a new Term Auction Facility (TAF) in December 2007, available to all depository institutions which previously only had access to the discount window. In addition, a Primary Dealer Credit Facility (PDCF) was set up in March 2008 to provide overnight collateralized liquidity to primary dealers that were facing liquidity tensions in the triparty repurchase agreement market.³ In response to improving financial market conditions, the TAF and the PDCF were closed in the first quarter of 2010. Figure 2 presents the allotted amounts of the TAF and PDCF, together with the US money market spread.

Figure 2 Liquidity facilities and money market spread in the US



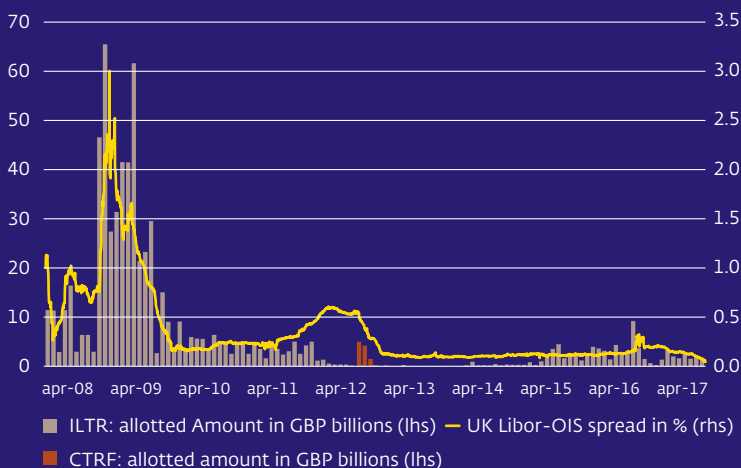
This figure presents the total allotted amounts in the TAF and PDCF of the Fed, together with the US Libor-OIS spread as indicator for market-wide liquidity stress. It shows the gross cumulative monthly change in liquidity provision by the Fed's TAF and PDCF and does not net for redemptions. The outstanding amounts are not shown, which we assume a less accurate indicator of the central bank's response to market stress. The demand for both facilities increased during market-wide liquidity stress and decreased accordingly. Source: Fed and Bloomberg.

³ These are repo markets in which all services after the trade, such as collateral selection, payment and settlement are outsourced to a third-party agent.

Bank of England

The BoE introduced three liquidity insurance facilities – the Indexed Long-Term Repo (ILTR) facility, the Discount Window Facility (DWF) and the Contingent Term Repo Facility (CTRF). The first facility involves monthly ILTR operations with a 6-month maturity established for banks, building societies and broker-dealers. The second facility provides liquidity to banks, building societies, broker-dealers, and central counterparties (CCPs) that need funding in response specific or market-wide shocks. To incentivize repayment when DWF borrowing is no longer needed and to control for overreliance of banks, the fee reflects the borrowing size of banks and building societies. The cost of borrowing from the DWF is constant up to 5% of participants' Eligible Liabilities (ELs). Above 5% the average cost of borrowing rises with the participants' ELs; the more participants borrow, the higher their rates. For broker-dealers and CCPs, the borrowing costs are bilaterally agreed upon, dependent on the collateral used and the borrowing size. The third facility, the CTRF, is a contingent liquidity facility which alleviates extreme market-wide stress and is also accessible to banks, building societies and broker-dealers. The CTRF provides liquidity against the widest collateral at any time, term and price. Figure 3 shows the allotted amounts of the ILTR and CTRF, together with the UK money market spread. The latest data published by the BoE show that there was no borrowing under the DWF between its introduction and September 2016.

Figure 3 Liquidity facilities and money market spread in the UK



This figure presents the total allotted amounts in the TAF and PDCF of the Fed, together with the US Libor-OIS spread as indicator for market-wide liquidity stress. It shows the gross cumulative monthly change in liquidity provision by the BoE's ILTR and CTRF and does not net for redemptions. It does not show the outstanding amounts, which we assume a less accurate indicator of the central bank's response to market stress. The demand for the ILTR and CTRF facilities increased during market-wide liquidity stress and decreased accordingly. There was no borrowing under the DWF between its introduction and July 2016. Source: BoE and Bloomberg.

3.2 Use of Eurosystem liquidity

During the financial turmoil of mid-2007, bids per tender in the refinancing operations of the Eurosystem rose substantially, as did, the number of bidders (Eisenschmidt et al., 2009). After this first stage of the liquidity crisis, the demand for central bank liquidity by euro area banks remained high, also in periods when money market stress diminished, such as in 2010 and from 2012 onwards (indicated by the circles in Figure 1). This was catered for by the FRFA policy and differs from the situation in the US and UK, where the use of central bank liquidity facilities decreased in tandem with diminished market stress (Figures 2 and 3).⁴ The Eurosystem's extended liquidity supply was distinct from the Fed's and BoE's operations because of two reasons: i) the sovereign debt crisis that emerged in the euro area from 2010 onwards and ii) the use of refinancing operations not just to address liquidity stress, but also to support bank credit supply (e.g. the TLTROs, which offered attractive long-term funding conditions to banks to further ease private sector credit conditions).

To analyse banks' use of Eurosystem liquidity in more detail, we explore data on the liquidity-providing operations of the Eurosystem, containing the amounts allotted to individual counterparties bidding in the tender operations.⁵ More specifically, we look at the distribution of liquidity supply and the enrolment of banks in short-term (MRO) and long-term (LTRO, VLTRO and TLTRO) operations.

⁴ This can partly be explained by the liquidity supply in the US and UK via QE programs.

⁵ The data comprises the monetary tender operations of all the national central banks of the Eurosystem. An analysis of the same type of data can be found in Eisenschmidt et al. (2009).

Two key conclusions appear from the data:

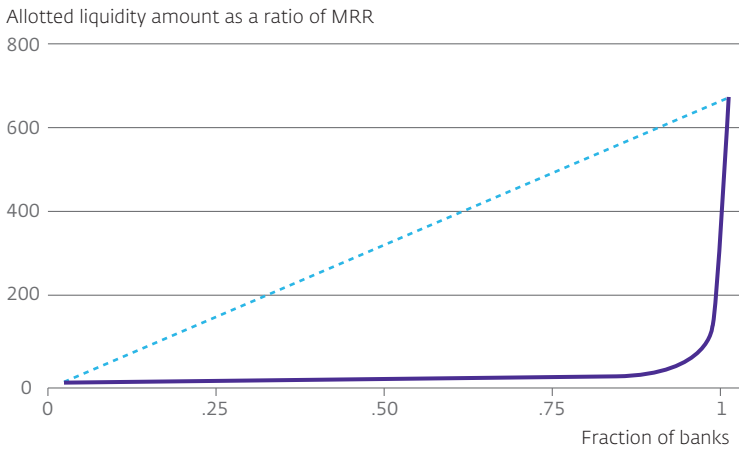
First, liquidity supply is highly skewed across banks. The data show that a small fraction of banks received very large amounts of refinancing relative to their minimum reserve requirements (the upper-right end of the curve in Figure 4 shows the small fraction of banks receiving the lion share of central bank liquidity). Figure 5 shows that this distribution remained skewed over time, as indicated by the persistently high Gini coefficient. Both graphs confirm that a few banks drew relatively large amounts in the Eurosystem's refinancing operations.⁶ In contrast to Bank of England's discount window facility, the Eurosystem did not charge higher rates for greater usage (see Box 1).

Second, short term central bank funding has been persistently used, also in benign market conditions. Since the start of the financial crisis, some euro area banks have persistently used the MROs, even when money market stress was relatively low.⁷ Figure 6 shows the percentage of all counterparties that persistently enrolled in the 7-day MROs with relatively high bid volumes. It shows that in times of high money market stress (2008-2009), counterparties bid persistently more than in times when the money market functioned relatively well (2010-2011). However, reliance on central bank funding decreased relatively faster in the first compared to the latter period. This suggests that certain banks kept taking recourse to the refinancing facilities of the Eurosystem, even under more benign market conditions.

6 One could argue that the skewness is driven by outliers in the data. For example, some counterparties consist of subsidiaries with very small MRRs which bid in the refinancing operations in the name of all their subsidiaries. This is not the case, however, since the skewness is present over the entire distribution. Conducting a quantile plot of solely the MRO shows the same skewed distribution.

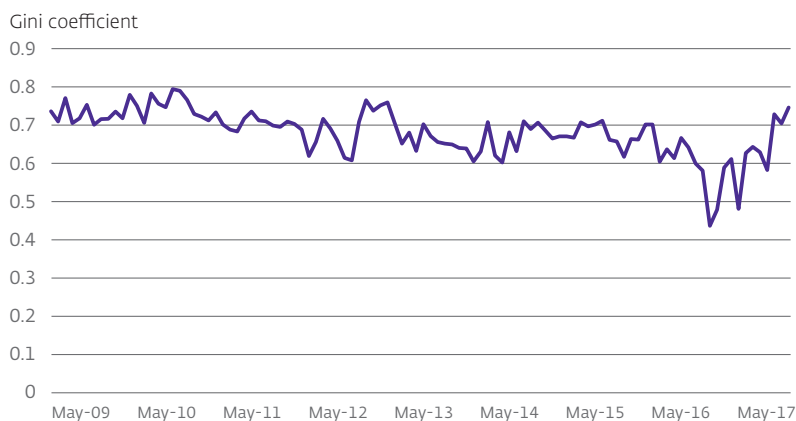
7 Before the crisis, banks persistently bid in the MROs and the average number of bids per bank was around 1.5. However, since FRFA was not implemented at that time, only those banks bidding the highest individual bid rate received allotment. Eisenschmidt et al. (2009) show that banks did not bid aggressively before the start of the financial turmoil, as the spread between the individual average bid rates and the marginal rate remained small.

Figure 4 Distribution of central bank liquidity over euro area banks



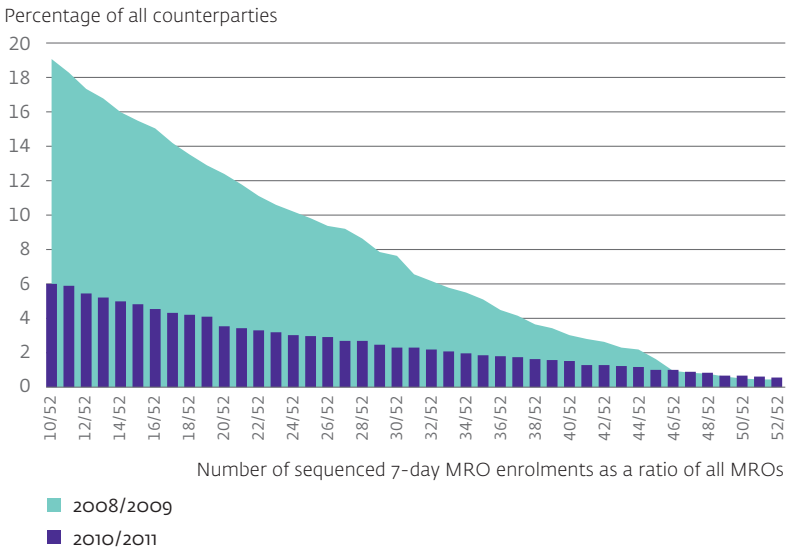
This figure shows the distribution of the total allotted amount in all refinancing operations conducted between November 2008 and July 2017 (before this period no data are available). To account for banks' bid volumes relative to their size, the allotted amount is divided by that specific bank's minimum reserve requirement (MRR) in 2012 (midpoint of the sample period). The dotted line represents an equal distribution in case of no skewness. The distribution of the variable allotted amount divided by MRR has 74,743 observations and includes 1,819 counterparties.

Figure 5 Gini coefficient of liquidity allotted by the Eurosystem



This figure shows the Gini coefficient of the distribution of allotted amounts to Eurosystem banks in all refinancing operations issued between 2008 and mid-2017. It measures the statistical dispersion of the Eurosystem refinancing distribution of all participating banks. An increase in the Gini coefficient represents a greater dispersion such that a smaller fraction of banks receives larger amounts of refinancing. The approach follows Lerman and Yitzhaki (1985) and Stark et al. (1986). To account for banks' bid volumes relative to their size, the allotted amount is divided by that specific bank's minimum reserve requirement (MRR) in 2012 (midpoint of the sample period). Figure 5 shows the coefficient for every tender starting in November 2008 as a monthly moving average. The distribution includes 1,819 counterparties.

Figure 6 Percentage of counterparties persistently bidding more than the median in all weekly MRO operations

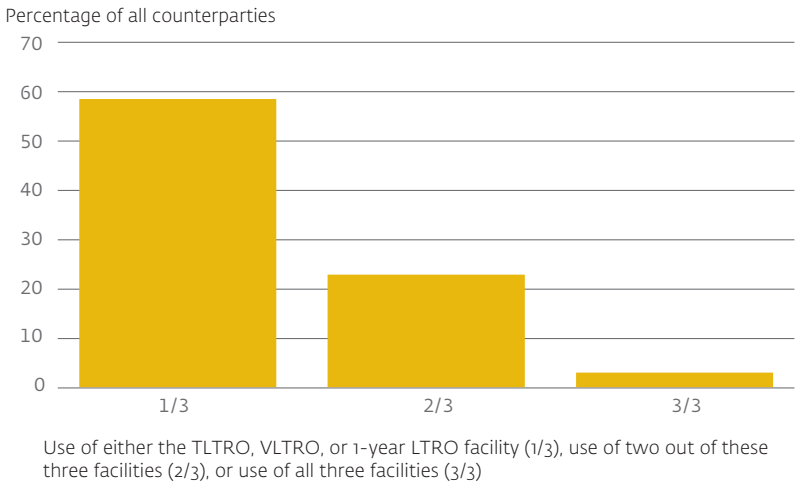


This figure illustrates the persistent use of the Eurosystem 7-day MROs in 2008/2009 and 2010/2011. The 1,819 counterparties in the sample consist of all counterparties that made use of at least one of the refinancing operations between November 2008 and July 2017. To account for persistence, the analysis looks at all sequenced 7-day MRO enrolments in specific years. To account for banks' bid volumes relative to their size, the allotted amount is divided by a specific bank's minimum reserve requirement (MRR) in 2012 (midpoint of the sample period). The reserve coefficient in the calculation of the MRR has not been adjusted in the period between 2008 and 2012 and should therefore not affect the proportionality of the analysis. Persistent enrolments are then presented for those banks bidding more than the distribution's 50th percentile in all 7-day operations, equal to a volume of 5.1 times the MRR. Due to the presence of outliers, the distribution leaves out the 99st percentile.

Furthermore, some banks have bid in more than one of the long-term refinancing facilities (the 1-year LTRO, the VLTRO, and the TLTRO facilities). Figure 7 shows that more than 20% of all counterparties have bid in at least two out of the three long-term operations. A few banks used all three facilities for their long-term funding. This confirms the conclusion from Figure 4 that a small fraction of banks relies heavily on central bank liquidity (also reflecting the roll-over from one long-term refinancing operation in another one). It should be noted that the TLTROs are not a typical LOLR instrument, but a so-called credit easing instrument, in that it offers long-term funding to banks in order to stimulate bank lending to the real economy.⁸ The TLTROs are nonetheless included in the analysis as they also represent an instrument through which banks rely on central bank liquidity for a prolonged period of time.

⁸ The TLTROs are targeted operations, as the amount that banks can borrow is linked to their loans provided to non-financial corporations and households. The interest rate applied in the second series of the TLTROs is linked to the participating banks' lending patterns. The more a bank lends to non-financial corporations and households (excluding mortgages) relative to a benchmark, the more attractive the interest rate on the TLTRO borrowing is.

Figure 7 Sequential use of TLTROs, VLTROs, and 1-year LTROs



This figure shows the sequential use of the TLTRO, VLTRO and 1-year LTRO, in particular it shows the use of either the TLTRO, VLTRO, or 1-year LTRO facility (1/3), the use of two out of these three facilities (2/3), and the use of all three facilities (3/3). To account for banks' bid volumes relative to their size, the allotted amount is divided by that specific bank's MRR in 2012 (midpoint of the sample period). Persistent enrolments are then presented for those banks bidding more than the distribution's 50th percentile in all long-term operations, equal to a volume of 3.6 times the MRR. Due to the presence of outliers, the distribution leaves out the 99st percentile.

To summarize, the empirical analysis of the use of MROs and LTROs since the financial crisis shows that i) the distribution of liquidity supplied by the Eurosystem has been highly concentrated with a few banks; and ii) some banks have persistently used the Eurosystem refinancing operations, even under benign market conditions.

3.3 Implications

Central bank liquidity support addressed systemic liquidity stress, while the provision of term funding has reduced banks' funding uncertainty. This has supported credit supply to households and non-financial corporations. However, prolonged reliance on central bank funding has drawbacks:

- *Discouragement of market funding.* Extended liquidity supply at easier conditions raises the risk that banks get used to these conditions and reduces the incentives for banks to replace central bank funding with market funding. This may delay the return to a situation where liquidity is primarily distributed by market forces. There is an endogeneity issue as well, since the dependence on the central bank increases the longer the extended liquidity support is in place. This makes it more difficult to withdraw liquidity support, even more so if withdrawal may lead to cliff-effects and funding constraints of banks. This may also negatively impact the flexibility of monetary policy, for example if tighter liquidity conditions are needed for the purpose of the monetary stance. Financial stability issues could then interfere with the monetary policy objective of price stability. Prolonged central bank funding also exposes the central bank to more risks than necessary.
- *Reduced incentives for structural adjustments.* The availability of central bank financing limits market discipline and reduces the need for balance sheet restructuring. Easy financing conditions enable banks to roll-over non-performing loans, delay necessary changes to their business models and avoid recognizing losses on exposures to non-viable enterprises. Figure 8 suggests that there is a link between non-performing loans of euro area banks and central bank finance.⁹ The risk of keeping non-viable business models afloat is at odds with the long-standing principle

⁹ The correlation between non-performing loans and central bank finance is more complex than the figure suggests, since many other factors than central bank finance may influence the non-performing loan ratio of banks (such as country-specific bankruptcy procedures and business cycles).

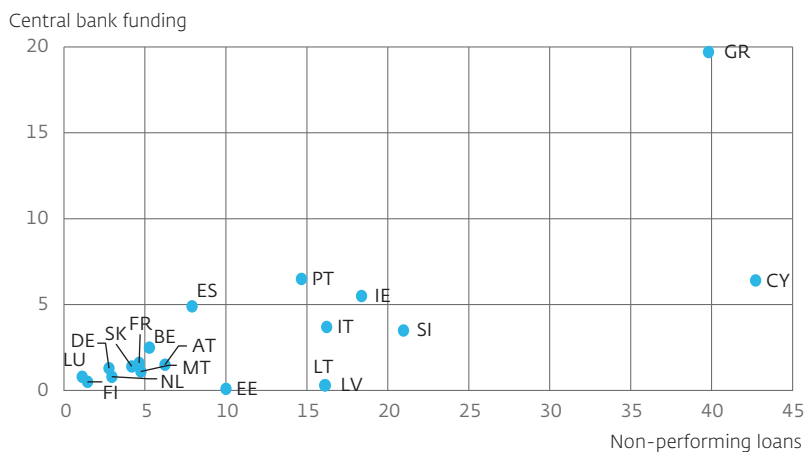
that central banks should only lend to solvent, but illiquid, banks (see section 2.2). Moreover, it reduces the potential to finance productive activities in the economy. One example of this is that ample central bank funding encouraged risk shifting and carry trades through government bond purchases by weakly capitalized banks (Acharya and Steffen, 2012; Drechsler et al., 2016).

- *Higher asset encumbrance.* Another drawback is that large dependence on central bank funding consumes a substantial part of the collateral of banks. In the past five years 7 to 10% of total assets of euro area banks has been used as collateral in refinancing operations of the Eurosystem. The asset encumbrance related to central bank credit reduces the possibilities for additional borrowing by banks, which can escalate liquidity problems faster. More generally, large dependence on central bank funding can obscure underlying liquidity or solvency problems of financial institutions. Prolonged liquidity support can also adversely interact with the resolution of non-viable banks.¹⁰

The trade-off between the intended and potential unintended effects of prolonged and extensive liquidity support is ultimately a policy choice. Underlying principles should guide such considerations, as they can contribute to an optimal implementation of the LOLR function. The next chapter elaborates on this.

¹⁰ The availability of central bank liquidity, mainly in the form of bilateral liquidity assistance, could effectively postpone the determination of 'Failing or Likely to Fail', while reducing the availability of collateral during and after resolution (Knot, 2017). Apart from asset encumbrance owing to ELA and refinancing operations, the Eurosystem has supplied high quality liquid assets (i.e. central bank reserves) to the banking system through QE.

Figure 8 Central bank finance and non-performance loans of banks, euro area



This figure presents a scatter plot of non-performing loans and central bank funding. Central bank funding is expressed as a percentage of total assets and non-performing loans as a percentage of total loans (respectively the maximum over 2008Q4 – 2017Q1 and the period average). The correlation coefficient between the relative amount of central bank funding and non-performing loans in a country is 0.74 (+0.48 excluding GR and CY). Source: ECB.

4 New insights on LOLR principles

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Against the background of the experiences during the crisis, especially with managing systemic liquidity risk, this chapter revisits the longstanding principles of the LOLR function discussed in Chapter 2. Central bank operations during the global financial crisis provided novel experiences with regard to the management of systemic liquidity risk. These experiences shed new light on some of the long-standing principles of LOLR and call for revisiting them.

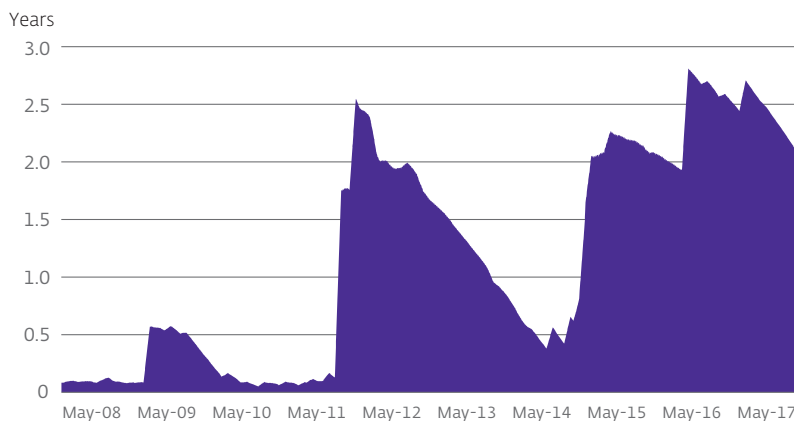
4.1 Optimal LOLR

The first reason for revisiting the long-standing principles is that the prolonged liquidity supply by the Eurosystem seems to have led to a suboptimal implementation of the LOLR function. Bindseil (2016, p. 37-38) notes that *“an optimal LOLR strengthens the ability of the financial system to provide maturity and liquidity transformation as services to society. At the same time, putting some limits to the LOLR role is beneficial for society, to have some protection against information asymmetries and moral hazard, to avoid relying excessively on the abilities of supervisors and auditors, and generally to preserve stronger incentives to maintain funding market access and thereby market discipline.”* This suggests that the optimal LOLR function is more limited than a situation in which solvent banks can refinance all their assets with the central bank, but more extensive than a minimum bound at which banks can only obtain central bank liquidity against risk free collateral.

The underlying assumption of optimal LOLR is that – in the absence of financial stress – markets are better positioned to provide an efficient allocation of resources, given the information advantages and risk management capacities of market participants. Market forces will also have a disciplining influence on borrowers, as terms and conditions of the liquidity supply will be tailored to the borrowers' risk profile. During the financial crisis, the Eurosystem has largely fulfilled its LOLR function

through stretching its regular monetary policy operational framework. It has expanded the use of monetary instruments in terms of size, duration and risk absorption, the latter for instance by relaxing the collateral standards. This has lifted the LOLR function above the minimum bound and has increased the footprint of the central bank in financial markets. This can be illustrated by the increased remaining weighted average maturity of the Eurosystem's refinancing operations in Figure 9. It shows that the central bank has taken over part of the maturity transformation function from the private market.

Figure 9 Weighted average maturity of Eurosystem's refinancing operations



This figure presents the 30-day moving average of the daily remaining weighted average maturity in years of the total allotted amounts in all Eurosystem refinancing operations. The calculation assumes that the operations mature linearly. The peaks in the weighted average maturity are caused by the VLTROs and TLTROs. Source: ECB.

While extensive LOLR support is a useful complement to the market in case of substantial market failures, in normal market conditions the central bank's footprint should be as small as possible. Indeed, according to the Treaty, the central bank should support a market-based allocation of resources (ECB, 2011). From this it follows that central bank liquidity provision should be time-varying and state-dependent.

4.2 Lessons from the crisis

The second reason to revisit the long-standing LOLR principles is that the financial system is now larger, more complex and interconnected than at the time those principles were developed (in the 19th century). In this context, the recent crisis has provided some additional lessons for LOLR support.

- *No uncertainty.* A lesson of the crisis is that in case of system-wide liquidity stress there should be no uncertainty about the availability of liquidity assistance. This confirms the long-standing principle that the central bank should lend freely and without limit to prevent or counter a crisis. The central bank's readiness to act as LOLR ex ante contributes to the ability of the financial system to provide maturity and liquidity transformation services (Bindseil, 2016). Ambiguity on liquidity support by the central bank, should the need arise, can exacerbate a crisis. It can also create time-inconsistencies if additional liquidity has to be provided in the end (Domanski et al., 2014). Moreover, owing to the measures taken during the crisis, constructive ambiguity (to mitigate moral hazard) may not work anymore, as based on past experience the market will expect the central bank to provide additional liquidity in case of a systemic crisis. When dealing with systemic risks, the central bank may therefore want to be more transparent by signaling that it will act as LOLR to avoid a systemic liquidity crisis.

- *Temporary.* Another lesson of the crisis is that LOLR support should be catalytic to restoring market functioning (Tucker, 2014). The lack of an exit strategy for the extended liquidity facilities of the Eurosystem over the past decade has distorted the incentives of banks and delayed a return to normal market conditions. To address those issues, LOLR support should be temporary, with a well-defined exit strategy and a pricing at backstop rates.¹¹ This will provide incentives for structural adjustment by borrowers, avoid prolonged and unwarranted risk shifting to the central bank.
- *Avoid stigma.* Another insight from the crisis is that stigma should be avoided in case of systemic liquidity support, as it can impede the use of central bank facilities. Stigma is most challenging when liquidity is provided via instruments outside the scope of monetary policy. An example of this is the DWF of the BoE, which has remained unused by market participants (see Box 1). Providing system-wide liquidity assistance via regular monetary operations reduces the likelihood of stigma, since most banks may access those facilities in normal times. Moreover, the literature points out that stigma can be reduced by announcing clear eligibility criteria, goals, and careful disclosure policy (Dobler et al., 2016).
- *Consider non-banks.* Today's complex and interconnected financial system, the role of non-banks in the financial system has become more systemic. Liquidity problems at these institutions may aggravate a systemic liquidity crisis. This raises the question whether liquidity insurance should be offered to non-banks, such as CCPs, see Dobler et al. (2016). Liquidity insurance to a new set of (sometimes loosely regulated) entities would raise moral hazard risk. To limit this risk, non-banks that would have access to LOLR support should be subject to enhanced supervision, to ensure that their liquidity risks are adequately managed.¹²

¹¹ While standing facilities, such as the ECB's marginal lending facility, also continuously available to banks, its use should also be temporary for the reasons mentioned in this section.

¹² In the Eurosystem, CCPs are under supervision and oversight; other non-banks such as Money Market Funds (MMFs) are loosely regulated.

5 Alternative designs of the LOLR function

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This chapter compares three alternatives for designing the LOLR function, based on the insights presented in Chapter 4. The first would be to integrate the LOLR function in the regular monetary policy operational framework by conducting fixed rate tender procedures with full allotment, as implemented during the crisis by the Eurosystem (see Box 1). This provides certainty on funding availability and limits stigma, but can make banks unduly reliant on central bank liquidity (see section 5.1).

The drawbacks associated with a (prolonged) reliance on the central bank could be avoided by embedding incentives to discourage over-proportional use (see section 5.2). In this alternative approach, the central bank finds a balance between unrestricted access and keeping in place incentives to ensure that liquidity support is temporary and more evenly distributed.

Another alternative would be to separate the LOLR function from the regular monetary policy operational framework by introducing a *Liquidity Insurance Facility*, as the Bank of England has done, with special terms and conditions that provide incentives to institutions to only make use of the facility temporarily (see section 5.3). The central bank pre-commits itself to activate the facility in case of systemic stress to ensure limited ambiguity about availability. Finally, a combination of the two alternative approaches is possible: a liquidity insurance facility with incentives to discourage over-proportional use.

5.1 Monetary policy framework with a fixed rate full allotment policy

5.1.1 Concept

A fixed rate full allotment policy provides central bank funding via the monetary operation framework in case of substantial market failures. The operations are conducted on a regular basis and the full allotment procedure gives counterparties maximum funding certainty at a fixed price.

5.1.2 Merits of a FRFA policy

By implementing a FRFA policy, the central bank fulfills the LOLR function by using its regular operational framework. The central bank is always ready to expand its liquidity supply in crisis times and counterparties are familiar with the procedures. This limits the complexity of the LOLR function design. Stigma should not be a concern, since a broad range of counterparties regularly makes use of the open market operations.

Furthermore, the FRFA policy implies no ambiguity on the availability of central bank funding, due to the unlimited liquidity supply. This eliminates funding uncertainty for banks.

5.1.3 Drawback of a FRFA policy

While a decision to switch to a full allotment procedure in times of systemic liquidity stress can be swiftly taken, the phasing out is more complicated. As long as the FRFA policy is in place, counterparties are less incentivized to make structural adjustments and reduce their borrowings. Banks can therefore become dependent on central bank funding (see Chapter 3 for the implications of overreliance on central bank funding). When a group of banks relies heavily on central bank funding, it is more complicated for the central bank to reduce liquidity support to the banking system once

market conditions improves. Institutions without market access would then be redirected to the more expensive central bank's marginal lending facility. The related higher borrowing rate could pose a serious challenge for these already troubled banks. This postpones the return to normal market conditions and impedes a smooth transition from central bank to money market funding in normal times.

Furthermore, because FRFA is implemented in the existing operational monetary policy framework, it is difficult to distinguish the multiple purposes of the regular operations (LOLR versus steering rates). One single framework is used for monetary operations in normal times and in times of stress. This creates the risk that the regular framework is stretched too much for too long.

5.2 Monetary policy framework with incentives to discourage over-proportional use

5.2.1 Concept

To prevent that banks become dependent on central bank liquidity, financial incentives against disproportional reliance on the central bank can be embedded in the design of the operational framework. This would restore some of the price incentives that disappear when the central bank provides unlimited liquidity for a fixed price below the market. Bindseil (2014, 2016) illustrates how such a framework could be designed in practice. Banks would be made subject to an interest rate surcharge based on the over-proportionality of their central bank borrowing, measured over a certain period. To measure proportionality, a bank's use of central bank liquidity would be related to its total balance sheet size (or, alternatively, to its minimum reserve requirements). This ratio is then compared to that of the banking system as a whole. For the over-proportional part of the

borrowing, a surcharge would be applied. The surcharge could kick-in after a certain period and the surcharge rate could increase over time, in order to specifically disincentivize persistent disproportional usage. To implement this, the surcharge could be calculated ex post in relation to the average recourse to central bank credit over a certain period.

5.2.2 Merits of surcharges in case of over-proportional use

By introducing surcharges in its operational framework, the central bank can disincentivize excessive and prolonged reliance of individual banks on central bank credit, without restricting the normal use of the LOLR operations.

The advantage is that the instrument by definition focuses on the problem itself, dissuading overreliance. The central bank should be less concerned with counterparties taking substantial recourse to its monetary operations in situations of liquidity stress.

To some extent the central bank may rely on regulation and supervision to avoid overreliance. The supervisor could ask questions or apply supervisory measures once the reliance on central bank liquidity/funding becomes relatively large. However, this did not prevent a number of banks in the Eurosystem becoming persistent users in the tender operations (see section 3.2). Furthermore, it could be argued that the central bank itself has its own responsibility and should have its own instruments to prevent overreliance.

When surcharges are introduced to address potential overreliance on the central bank by individual institutions, system-wide liquidity support can be provided via the regular operational monetary policy framework. This has certain advantages. There will be less uncertainty about the availability of liquidity (especially under a full allotment regime), as the liquidity provision is far less dependent on an activation procedure with an uncertain outcome. The central bank is operationally ready to extend its liquidity

supply via regular (and therefore familiar) operations. Furthermore, stigma is not a concern, since liquidity is provided via the regular open market operations, which are used by a large number of market participants.

5.2.3 Drawbacks of surcharges in case of over-proportional use

Embedding these surcharges in the regular monetary policy framework introduces more operational complexity. Central banks need to develop an appropriate methodology for measuring the over-proportionality of banks' borrowing. This requires a continuous monitoring of banks' balance sheets.

Similar to the FRFA policy, this option keeps the LOLR function largely integrated in the existing operational monetary policy framework. Integrating surcharges for over-proportional use in the regular framework strengthens price incentives for banks, but will only be effective when markets are functioning properly and banks are price sensitive.

5.3 A liquidity insurance facility for crisis times

5.3.1 Concept

Via a liquidity insurance facility, distinct from the regular monetary policy operations, the central bank would provide system-wide liquidity insurance to financial institutions in situations of systemic liquidity stress. Liquidity insurance operations would be carried out to underpin the monetary policy transmission process. The facility would be activated when the central bank sees a need for it, based on an assessment of systemic liquidity risk. For this purpose certain systemic risk indicators can be used. The terms and conditions for the insurance facility would be different from those in the regular operations. In practical terms, this implies that the central bank would operate with segregated collateral pools: for liquidity insurance operations the central bank would accept a broader collateral set. This way,

it can accommodate a larger demand for central bank reserves in times of systemic liquidity stress.

Box 2: A liquidity insurance facility in the operational framework

A liquidity insurance facility could have the following characteristics.

- *Specific purpose.* The central bank could introduce a separate liquidity insurance facility based on its current mandate for price stability. The liquidity insurance operations would be carried out to support market functioning and financial stability, thereby underpinning the robustness of the monetary transmission mechanism in times of market stress, thus serving a crucial role in the central bank's efforts to maintain price stability.
- *Availability.* As there should be no ambiguity on the willingness of the central bank to act as LOLR, the central bank would provide ex ante transparency on when the facility would be activated. The central bank would develop comprehensive indicators for systemic liquidity stress, which could be used as a trigger for activating the facility.
- *Avoiding stigma.* Communication would emphasize that the facility is there to address systemic risks (not idiosyncratic risk), to avoid undue restraint on the part of counterparties when accessing the facility. The facilities' terms and conditions would be made transparent ex ante. This helps to counter stigma and facilitates operational readiness.
- *Modalities of liquidity provision.* To provide maximum certainty to the market on the availability of central bank liquidity in times of stress, a full allotment procedure would be applied, in which the liquidity provision is determined by the demand of counterparties. The liquidity insurance facility could offer liquidity at longer terms (6 months/1 year,

exceptionally longer), against a wide range of collateral (see below). This would provide maximum certainty to counterparties on their term liquidity/funding.

- *Collateral.* In principle, all assets (incl. non-marketable assets) the central bank is able to value and risk-control could be accepted as collateral in the liquidity insurance facility. The central bank would communicate ex ante what collateral would be accepted for the liquidity insurance operations. Operating with a relatively lean balance sheet in normal times, the collateral set for the liquidity insurance facility could be broader than the regular list of assets eligible as collateral in normal monetary operations.
- *Pricing.* The facility would be priced as a backstop to incentivize counterparties to only make temporary use of the facility, as long as the market is dysfunctional. Under a full allotment regime (i.e. the central bank is rate setter), this could be implemented by adding a spread to the risk free rate, which consists of a normal liquidity/term premium and an add-on (in line with Bagehot's principle of lending at high rates). This creates built-in incentives to only use the insurance facility when market rates are elevated above normal levels. Such a design would facilitate an automatic exit when the market starts functioning again. To avoid stigma, the central bank should not penalize the use via a surcharge on the *prevailing* market rates, as this would signal that the central bank discourages usage. This does not preclude that the central bank can set more stringent conditions for counterparties that make disproportionate use of the facility (see below).
- *More stringent conditions to avoid over-proportional usage.* To avoid counterparties becoming reliant on central bank credit and to incentivize a swift return to the market as soon as market conditions improve, the central bank could set more stringent conditions for

extensive reliance on this facility. It could also set stricter governance rules for these counterparties (e.g. require funding plans) or apply a rate add-on in case of structural over-proportional borrowing (combining the liquidity insurance facility with a surcharge for over-proportional use, as presented in section 5.1).

- *Eligible counterparties.* Only solvent counterparties would be granted access to the insurance facility. For banks, the same strict counterparty criteria would be applied as in the regular monetary operations. In case it would be decided to also grant access to systemically relevant non-banks (e.g. CCPs) this would require that the institution is supervised and that the central bank can ascertain on an ongoing basis that the institution is solvent.

5.3.2 Merits of a liquidity insurance facility

One of the advantages of providing liquidity insurance via a special facility is that this can prevent the regular monetary policy operational framework from being stretched too much and too long. This could also facilitate the discontinuation of LOLR once the money market situation improves. When the LOLR function is separated from regular operations, the collateral set for the latter can be (much) narrower, since these no longer need to accommodate higher volumes of refinancing operations in stressed markets.

By applying different terms and conditions, the central bank can give incentives to counterparties to only make use of the facility as long as markets are dysfunctional. This implies that the central bank would only provide system-wide liquidity insurance in case of substantial market failures. In normal times, the footprint of the central bank in markets would be more limited, since the facility would be priced as a backstop.

With a liquidity insurance facility, the central bank would have an additional tool that can be used for specific purposes. This would avoid the regular operations from being used for multiple purposes (steering interest rates and safeguarding the transmission process) and the separation between these purposes getting blurred. A blurred separation is undesirable, since it obstructs the discontinuation of LOLR once money market are functioning again (see Chapter 3).

When liquidity support is provided via a special facility, the central bank may consider to grant access to a wider set of counterparties. Besides banks, systemically relevant non-banks (e.g. CCPs) could also be granted access. Whether there is a need to grant certain non-banks access to a liquidity insurance facility, and which type of institutions should be granted access, very much depends on the financial structure in a jurisdiction. In the UK, next to CCPs, broker dealers and building societies have also been granted access to the liquidity insurance framework of the Bank of England.

5.3.3 Drawbacks of a liquidity insurance facility

A potential drawback of a liquidity insurance facility is that counterparties may be uncertain about its availability. Taking systemic liquidity stress as a trigger for extended liquidity supply would introduce financial stability in the central bank reaction function. This may create ambiguity about the circumstances under which the facility would be activated. To counter this, the central bank should communicate that in times of systemic liquidity stress the facility will be open, and preferably go a step further and also provide clarity on what indicators will be used.¹³ The ex ante identification of systemic liquidity stress indicators is not straightforward, however,

¹³ An example of indicators of systemic risk is provided by the ESRB risk dashboard, which is a set of quantitative and qualitative indicators of systemic risk in the EU financial system (published each quarter on <https://www.esrb.europa.eu/pub/rd/html/index.en.html>).

since systemic crises differ in nature. This raises particular challenges for communication, since by activating and de-activating the facility the central bank signals its assessment on the severity of the crisis, which could influence the evolution of the crisis.

A special facility creates a greater risk of stigma (see also the DWF in section 3.1). The central bank should thus communicate that the liquidity insurance facility is not meant for individual institutions which need solvency support, and it should therefore apply solvency criteria which are as strict as those for the monetary policy operations: *“Developing a reputation, whether valid or invalid, for being prepared to lend to insolvent firms undermines the purpose and effectiveness of the LOLR. This is the essence of the stigma problem”* (Tucker, 2014, p. 20). Furthermore, not publishing data on the use of special liquidity facilities can further reduce the risk of stigma.

5.4 Comparison

The three alternatives differ in terms of the policy discretion of the central bank. While the setup and activation of the liquidity insurance facility would largely be in the hands of the central bank, the features of a FRFA policy and an over-proportional surcharge are integrated in the regular monetary operational framework. They are to a large extent pre-determined.

Table 2 shows the different LOLR-designs and their desirable features in terms of the LOLR function. The choice between the alternatives depends on the features the central bank deems most important and the jurisdiction's institutional context. A built-in LOLR function with FRFA is preferred when stigma is considered relatively problematic and availability of liquidity support should be predictable in times of systemic liquidity stress. In case disproportional reliance on central bank funding is deemed most problematic, the central bank should opt for a framework with surcharges

for over-proportional use. This limits the prolonged availability of liquidity and mitigates the risk that the framework is stretched too much and for too long. It occupies the middle ground between the FRFA framework and a separate liquidity insurance facility, in which the central bank only complements the market when it fails, as the facility would only be activated in times of systemic liquidity stress. This separate liquidity insurance facility is preferred when the central bank desires a more limited footprint in normal times, leaving allocation decisions to market forces. In this context, the facilities' design is catalytic to restoring market functioning, as it provides incentives for counterparties to only make use of the facility as long as there is stress in the market. Moreover, a separate liquidity insurance facility is also preferred in case the central bank foresees the need to provide liquidity support to systemically relevant non-banks.

Table 2: Three alternatives for the design of the LOLR function

Desirable features of the LOLR function	LOLR via monetary policy framework with FRFA	LOLR via monetary policy framework with surcharges for over-proportional use	Liquidity insurance facility
Central bank complements the market when it fails.	<ul style="list-style-type: none"> - When liquidity support is provided via the monetary policy operations, there is a risk that the normal framework is stretched too much and for too long in times of market stress. 	<ul style="list-style-type: none"> - There is a risk that the normal framework is stretched too much and for too long in times of market stress, but the over-proportional surcharge mitigates this risk. 	<ul style="list-style-type: none"> + The facility will be only be activated in times of systemic liquidity stress. + In normal times the central bank has a limited footprint in financial markets.
Liquidity insurance is catalytic to restoring market functioning. Disproportional use is disincentivized.	<ul style="list-style-type: none"> - Counterparties may not be incentivized to take structural adjustments and reduce their borrowings. This may postpone the return to normal market conditions. 	<ul style="list-style-type: none"> + Over-proportional use can be discouraged by applying a rate add-on above a certain proportionality threshold. 	<ul style="list-style-type: none"> + Back stop pricing will be applied to incentivize counterparties to only make use of the facility as long as the market is dysfunctional. + Surcharges can be incorporated in the design to prevent overreliance by individual institutions.
Stigma is minimized.	<ul style="list-style-type: none"> + As a broad range of institutions make use of open market operations (not just those with extraordinary liquidity needs), stigma should in principle not be a concern. 	<ul style="list-style-type: none"> + The framework sends a signal that over-proportional use of central bank facilities is discouraged. This should also be addressed via communication. 	<ul style="list-style-type: none"> - With a separate facility there is more risk of stigma. This should be addressed via communication: it should be emphasized that the facility is meant to address systemic liquidity risks and not for institutions in need of solvency support. Use of the facility should not be discouraged via a surcharge above market rates.
The availability of liquidity support in times of systemic liquidity stress is predictable.	<ul style="list-style-type: none"> + OMOs are conducted on a regular basis and are therefore available on a continuous basis (assuming a full allotment regime providing maximum certainty). 	<ul style="list-style-type: none"> + The framework makes liquidity available, but includes financial incentives against disproportional use. 	<ul style="list-style-type: none"> - As the facility needs to be activated, there may be some uncertainty about availability. To minimize this, the central bank should be clear on how the facility will be activated in times of stress, by providing ex ante transparency on the terms and conditions of the facility.
Non-banks contributing to systemic risk have access to liquidity support.	<ul style="list-style-type: none"> - Only banks have access to the operational monetary framework, as in normal times non-banks do not play an important role in the transmission process. 	<ul style="list-style-type: none"> - Only banks have access to the operational monetary framework, as in normal times non-banks do not play an important role in the transmission process. 	<ul style="list-style-type: none"> + Besides banks, also systemically relevant non-banks could be granted access to the liquidity insurance facility.
The framework is not too complex.	<ul style="list-style-type: none"> + The central bank is operationally ready to expand liquidity supply. Counterparties are familiar with the procedures. 	<ul style="list-style-type: none"> - An over-proportional surcharge introduces more complexity. 	<ul style="list-style-type: none"> - A separate facility and segregated collateral pools increases the complexity of the liquidity framework.

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