

Banks' liquidity situation during the financial turmoil in autumn 2008

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Following the bankruptcy of Lehman Brothers on 15 September 2008, trading in international money markets was sharply reduced. Banks in nearly every country had considerable difficulty funding their portfolios. Central banks supplied liquidity on a large scale, which was key to making these problems manageable for most banks. Norwegian banks faced the same challenges as banks in other countries. In this article we describe how Norwegian banks' funding was affected in autumn 2008. We also examine the impact on banks' funding costs. We find that banks' liquid reserves rose, and that there was a clear impact on prices in funding markets. At the same time, banks were not equally affected. Some characteristics shared by banks that had the most difficulty were a lack of external owners and a large proportion of foreign currency funding.

1. Introduction

Liquidity risk for a bank is the risk that it will not meet its obligations when due, without incurring substantial additional costs. As banks have become more reliant on borrowing from wholesale markets, the liquidity of these markets has become very important for banks. It was because these markets had dried up that Norway and most advanced countries experienced a liquidity crisis in autumn 2008.

The global financial turmoil began in summer 2007 when large financial institutions and other market participants realised that it was difficult to value securities collateralised by loan portfolios. Most major banks had, and still have, considerable exposures to such securities. For that reason, investors began to doubt the solvency of the banking sector as a whole, making it harder for banks to obtain wholesale funding. The situation gradually deteriorated, and in March 2008 the US investment bank Bear Stearns was unable to finance continued operations and was taken over by JP Morgan Chase. Uncertainty regarding banking sector solvency continued through summer 2008, becoming an acute problem when the investment bank Lehman Brothers failed on 15 September 2008. This was followed by a period when it was very difficult for banks in nearly every country to obtain wholesale funding. A shortage of liquidity in one segment of the money market had developed into an acute bank funding crisis. Authorities in a number of countries implemented

extensive measures in the form of loans to banks and by attempting to improve liquidity in the money market.

There are currently few studies of how banks adapted to liquidity problems in autumn 2008. The economists de Haan and van den End (2011) conducted an analysis of the way Dutch banks reacted. Their econometric model was estimated on the basis of detailed monthly balance sheets for the biggest banks. They find that banks generally react to liquidity problems by reducing corporate lending, hoarding liquid assets and selling off some illiquid assets.

Norwegian banks that obtained wholesale funding internationally noticed problems as early as summer 2007. Following the bankruptcy of Lehman Brothers, the shortage of wholesale funding became so acute that it was impossible to fix the Norwegian interbank rate (NIBOR). NIBOR is calculated as a USD rate plus the price of a currency swap agreement from USD to NOK, which is why it was directly affected by the situation in the US money market.² Norges Bank responded by supplying more liquidity to banks than usual. In addition to increasing krone liquidity on 15 September through two extra F-loan auctions with maturities of two days, on the following day, Norges Bank also provided loans in USD to Norwegian banks. This was the beginning of a long period of extraordinary liquidity provision to Norwegian banks.³

Norges Bank conducts monthly liquidity surveys, which

¹ We are grateful to Tom Bernhardsen and Ketil Rakkestad for helpful comments. Views in this article represent the authors' assessments and may not be taken as the views of Norges Bank.

² In 2011, Finance Norway (FNO) adopted new rules for the NIBOR (see [http://www.fno.no/pagefiles/25890\(en\)download/nibor%20rules.pdf](http://www.fno.no/pagefiles/25890(en)download/nibor%20rules.pdf); unofficial translation). Under the new rules, the NIBOR shall reflect the interest rate lenders require for unsecured money market lending in NOK with delivery in two days after trade (the "spot" rate).

³ For an overview of the steps taken by Norges Bank, see <http://www.norges-bank.no/en/about/financial-turbulence-and-norges-bank/steps-taken-by-norges-bank/>. See also Bernhardsen et al. (2009).

Table 1. Banking sector balance sheet at end-August 2008. All banks, including branches and subsidiaries of foreign banks in Norway, but excluding branches of Norwegian banks abroad

Assets	As a percentage of total assets	Liabilities	As a percentage of total assets
Gross lending to customers	70.3%	Deposits from customers	43.3%
Deposits in Norwegian lending institutions	6.6%	Deposits from Norwegian lending institutions	3.2%
Deposits in foreign lending institutions	8.2%	Deposits from foreign lending institutions	19.9%
Deposits in Norges Bank	0.9%	Loans from Norges Bank	1.3%
Notes in NOK	0.7%	Notes in NOK	1.4%
Notes in foreign currency	0.1%	Notes in foreign currency	2.1%
Bonds in NOK	2.5%	Bonds in NOK	6.8%
Bonds in foreign currency	3.7%	Bonds in foreign currency	8.9%
Other assets	7.0%	Other liabilities	8.0%
		Common equity	5.2%
Total assets	100.0%		100.0%

Source: Statistics Norway, Banking Statistics

provide amounts for funding needs in the five biggest Norwegian-owned banks and Nordea⁴. In autumn 2008, data were collected twice a month, in both November and December. Short-term net funding needs within a horizon of up to one year increased from August to October. However, beginning in December, very short-term needs, within a horizon of a month, became appreciably lower. There was also a slight decline in needs within slightly longer horizons. The reversal is likely due to the entry into force of a special swap arrangement⁵ as from 24 November and banks' ability to use the Treasury bills they obtained from this arrangement to obtain more long-term funding. The acute crisis appears to be over in December.

In the following we will describe in more detail how Norwegian banks were affected by the financial turmoil in autumn 2008. We are concentrating on the phase during which liquidity problems were most severe: 15 September to 30 November 2008. We examine the banking sector as a whole and three main categories of banks and investigate whether these categories were affected or behaved differently.

2. Data

The analysis is based on various sources to which Norges Bank has access. As much of the source material used is confidential, the article does not contain figures that can be linked to a particular bank.

Statistics Norway's Banking Statistics provide balance sheet and other financial statement information for each bank. Balance sheet information at month-end allow us

⁴ The five biggest Norwegian-owned banks are DNB, Sparebank 1 SR-Bank, Sparebank 1 Nord-Norge, Sparebank 1 SMN and Sparebanken Vest.

⁵ Upon the recommendation of Norges Bank, the Ministry of Finance offered to swap Treasury bills for covered bonds (OMF).

to study the composition of balance sheets and how this composition changed during the autumn of 2008. From the financial statements we mostly use figures for deposit rates, which are available at the end of each quarter.

Stamdata is a database operated by Norsk Tillitsmann ("Norwegian Trustee"), which contains information on banks' issuances of notes and bonds. The information pertains to the actual issue and does not provide prices in the secondary market. Secondary market trading in these securities is so modest that the information would be of little relevance.

Norges Bank operates the settlement system for banks and thus has information on interbank payments. This information can be used to estimate the interest rates paid by banks for interbank loans (see Akram and Christophersen (2010)).

Norges Bank provides loans to banks against collateral. We thus have data on pledged collateral from each bank, and we know how much each bank has borrowed and at what rate.

3. Balance sheet developments, autumn 2008

3.1 Banking sector as a whole

Table 1 shows the banking sector's balance sheet at end-August 2008, that is, before the most acute phase of liquidity problems. The table includes both Norwegian-owned banks and subsidiaries and branches of foreign banks in Norway, but not the branches of Norwegian banks abroad.⁶ We have specified the items that are most relevant for assessing banks' liquidity situation.

⁶ Banking Statistics contain monthly balance sheet information for operations in Norway only.

Table 2. Changes in the banking sector balance sheet from end-August to end-November 2008. All banks, including branches and subsidiaries of foreign banks in Norway, but excluding branches of Norwegian banks abroad

Assets	Change in share of balance sheet (percentage points)	Contribution to increase (%)
Gross lending to customers	-7.8%	1.6%
Deposits in Norwegian credit institutions	+1.2%	16.8%
Deposits in foreign credit institutions	+3.3%	37.1%
Deposits in Norges Bank	+1.6%	15.0%
Notes in NOK	+0.1%	1.7%
Notes in foreign currency	-0.1%	-0.7%
Bonds in NOK	+1.1%	11.7%
Bonds in foreign currency	-2.8%	-20.8%
Other assets	+3.5%	37.6%
<i>Total assets</i>	<i>+12.8%</i>	<i>100.0%</i>

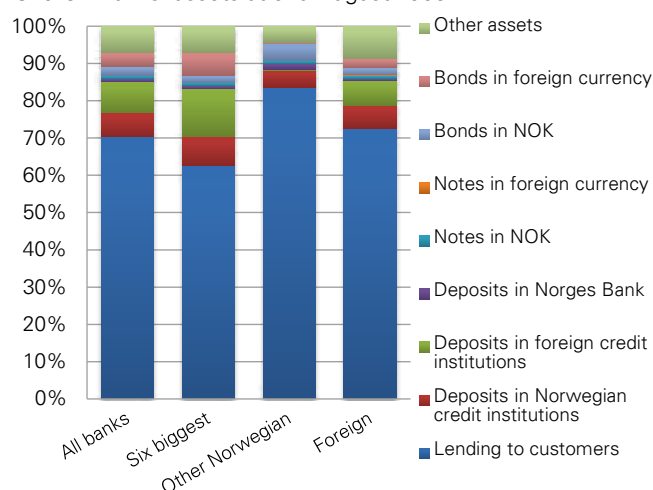
Liabilities	Change in share of balance sheet (percentage points)	Contribution to increase (%)
Deposits from customers	-4.3%	5.0%
Deposits from Norwegian credit institutions	-0.0%	2.9%
Deposits from foreign credit institutions	+1.6%	33.8%
Loans from Norges Bank	+2.5%	23.0%
Notes in NOK	-0.3%	-1.0%
Notes in foreign currency	+0.7%	8.0%
Bonds in NOK	-0.5%	2.6%
Bonds in foreign currency	-0.1%	8.3%
Other liabilities	+0.9%	16.2%
Common equity	-0.5%	1.2%

Source: Statistics Norway, Banking Statistics

The problem in autumn 2008 was primarily access to wholesale funding, i.e. notes and bonds and loans and deposits from other financial institutions. The table shows that customer deposits in August 2008 accounted for only 43%, that is, less than half of the total need for funding the balance sheet total. Deposits and loans from other credit institutions covered 23% of funding. This was largely foreign parent banks' funding of their subsidiaries and branches. Moreover, 16% of funding came from bonds that banks had issued in NOK, and a further 3% from notes. All together, more than 30% of funding was from foreign financial institutions or in foreign currency.

Table 2 shows how the shares of selected items changed in the three months from August to November 2008. The most conspicuous change is the nearly 13% increase in

Chart 1 Banks' assets at end-August 2008



Source: Statistics Norway, Banking Statistics

the balance sheet total in these three months. Some of this is due to the depreciation of the krone in autumn 2008 and subsequent revaluation of foreign currency assets and liabilities. But the increase was sharp even if we disregard changes in exchange rates (see section 3.2.1). At the same time, the absolute scale of lending to and deposits from customers changed little. The share of these core activities represented in the balance sheet total was thus sharply reduced. More than two thirds of the increase on the asset side took the form of deposits in Norges Bank and in other banks. These deposits accounted for 6 percentage points more of the balance sheet total in November than in August. Banks increased their balance sheets to ensure they had larger stocks of liquid assets.

More than half of the increase in the balance sheet total was funded by loans from Norges Bank and foreign parent banks. A further sixth came from issuance of notes and bonds in foreign currency.

3.2 Categories of banks

We shall focus on three categories of banks, namely the six biggest Norwegian banks⁷, other Norwegian banks and subsidiaries and branches of foreign banks. These are not completely homogeneous categories, yet at the same time there are clear differences between them. This provides a basis for examining differences in banks' reaction to the liquidity crisis. The three categories held 47%, 21% and 32%, respectively, of the banking sector's total assets at end-August 2008.

3.2.1 Asset side of the balance sheet

We begin by looking at the composition of banks' asset side in August 2008 (Chart 1). We see that the share of

⁷ DnB, Sparebank 1 SR-Bank, Sparebank 1 Nord-Norge, Sparebank 1 SMN, Sparebanken Vest and Sparebanken Møre.

Table 3. Changes in composition of banking sector assets from end-August to end-November 2008

Banks' assets	Change in share of balance sheet (percentage points)			Contribution to increase (%)		
	Six biggest	Other Norwegian	Foreign	Six biggest	Other Norwegian	Foreign
Lending to customers	-7.0%	-2.1%	-11.6%	-12.7%	15.6%	9.9%
Deposits in Norwegian credit institutions	+1.4%	-1.0%	+1.9%	22.8%	-27.9%	16.7%
Deposits in foreign credit institutions	+0.2%	+0.0%	+9.0%	14.6%	1.3%	55.2%
Deposits in Norges Bank	+1.3%	+1.8%	+2.0%	14.5%	59.9%	11.3%
Notes in NOK	-0.1%	-0.2%	+0.6%	-0.3%	-7.1%	3.9%
Notes in foreign currency	-0.0%	+0.0%	-0.3%	-0.0%	0.0%	-1.2%
Bonds in NOK	+2.3%	+1.1%	-0.4%	27.0%	40.7%	-0.1%
Bonds in foreign currency	+0.2%	+0.0%	-0.9%	8.0%	1.2%	-2.5%
Other assets	+1.8%	+0.4%	-0.3%	26.1%	16.5%	6.8%
Total assets	+10.3%	+3.1%	+22.7%	100.0%	100.0%	100.0%

Source: Statistics Norway, Banking Statistics

lending to customers differs widely between groups, with a very high share in the category of smaller Norwegian banks and as much as 20 percentage points lower in the category large Norwegian banks. Subsidiaries and branches of foreign banks are approximately in between. This reflects the fact that the larger banks have substantial other business in addition to lending activities.

At the same time, the biggest banks have a considerably larger share of their balance sheets as deposits in foreign banks and bonds in foreign currency than smaller banks. The smaller banks have more of their liquid reserves in Norges Bank and in NOK bonds.

Table 3 shows how the composition of the asset side changed in the three months from August to November 2008. Balance sheets appear to have increased in foreign banks in particular, while the increase in the balance sheets of smaller Norwegian banks was relatively modest. The six biggest Norwegian banks' balance sheets also increased substantially, but considerably less than for foreign banks.

Some of the increase in balance sheets is due to changes in exchange rates. The Norwegian krone fell by approximately 12% against the euro and around 30% against the US dollar during these three months. At the end of August, foreign currency items accounted for 18.6% of the asset side and 28.5% of the liability side of the banks' balance sheet.⁸ There were also derivative positions that probably eliminated most of the exchange rate risk for banks' earnings. Even so, exchange rate developments are important for developments in balance sheet items. Since we do not know the currency breakdown of foreign currency items, we are unable to adjust for this accurately. But if we assume equal shares of EUR and USD of all foreign currency items, the result is an overall balance sheet increase of 8.7% for all banks, broken down as

follows: 4.6% for the six biggest banks, 2.7% for the other Norwegian banks and 18.5% for the foreign banks. Thus, a substantial portion of balance sheet growth is due to changes in exchange rates, but the rest of the increase is also considerable for a three-month period.

The six biggest Norwegian banks posted a slight decline in lending volume. The decline would be more pronounced if adjusting for changes in exchange rates. More than half of the increase in the balance sheet total was an increase in deposits in other banks and Norges Bank. Moreover, there was a substantial increase in the volume of bonds in NOK and in the item Other assets. The latter probably reflects a reclassification of securities from current assets to non-current assets, after banks were permitted in October 2008 to reclassify securities that had fallen sharply in value, thus avoiding having to mark these securities to market⁹. The smaller Norwegian banks posted only a modest increase in their balance sheet, with little increase in lending volume. The increase primarily took the form of increased deposits in Norges Bank and a larger stock of NOK bonds. Exchange rate variations are of little relevance for this category.

Subsidiaries and branches of foreign banks also recorded a slight increase in lending volume, though this can be fully explained by changes in exchange rates. Deposits in other banks accounted for nearly the entire increase in the balance sheet, most of which were deposits in foreign banks. In NOK terms, these deposits increased by NOK 133 billion in the period. This indicates that these banks transferred large amounts to their parent banks abroad in order to boost parent banks' liquid reserves. The volume of bonds in foreign currency fell, but the item Other assets increased. The explanation may be reclassification of bonds to non-current assets, as in the biggest Norwegian banks.

⁸ The six biggest banks had 27.3% of their assets and 39.2% of their liabilities in foreign currency. For the other Norwegian banks, the figures were 1.7% and 4.2%, and for foreign banks, 17.8% and 28.7%.

⁹ Regulation of 16 October 2008 amending the Regulation relating to implementation of EEA rules concerning adopted International Financial Reporting Standards (IFRS).

A common characteristic for all three categories of banks is that they increased their deposits in Norwegian banks and in Norges Bank as a share of their balance sheet total. All categories boosted NOK liquid reserves in this manner.

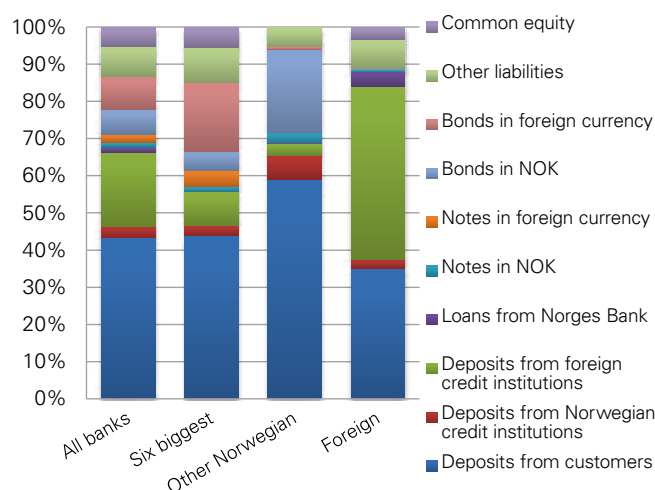
3.2.2 Liability side of the balance sheet

Chart 2 shows the composition of the liability side for the various bank categories in August 2008. The category Foreign banks had a smaller share of customer deposits than the other banking groups but a larger share of foreign funding, in particular from their parent banks abroad. Moreover, foreign banks had a larger share of funding as loans from Norges Bank than Norwegian banks.

The category “smaller Norwegian banks” had a considerably higher deposit-to-loan ratio than the six biggest Norwegian banks. The other main source of funding for the smaller banks was NOK bonds. Less than four per cent of funding came from foreign banks or in the form of foreign currency bonds. The biggest banks had a substantially larger element of foreign funding, with more than 30% either from foreign banks or in the form of notes and bonds in foreign currency. We note a clear difference in reliance on foreign sources of funding.

Table 4 shows the changes that took place during the most acute phase of the liquidity crisis in autumn 2008. The biggest Norwegian banks recorded a slight increase in deposits from customers, which can be fully explained by changes in exchange rates. Deposits from customers declined as a share of the balance sheet. Much of the increase in the balance sheet was funded by issuances of notes in foreign currency. A considerable amount was also from an increase in Other liabilities, which contains increased subordinated loan capital and an assortment of minor liability items.

Chart 2 Banks' liabilities at end-August 2008



Source: Statistics Norway, Banking Statistics

The smaller Norwegian banks experienced a substantial decline in deposits from customers. This suggests that they lost deposits to the other two categories of banks. This was compensated for by increased borrowing from Norges Bank and deposits from other Norwegian banks. There was also a slight shift from bonds in foreign currency to bonds in NOK.

Foreign banks posted an increase in deposits from customers, even after exchange-rate adjustments. But as a share of the balance sheet total there was still a sharp reduction in deposits. More than half of the strong growth in the balance sheet total was funded by increased deposits from foreign banks, probably parent banks. At the same time, as indicated in Table 3, a much larger flow of funds went in the opposite direction, from foreign banks in Norway to other foreign banks. Foreign banks also substantially increased their borrowing from Norges Bank;

Table 4. Changes in the shares of banks' liabilities from end-August to end-November 2008, measured in percentage points of the balance sheet total

Banks' liabilities	Change in share of the balance sheet (percentage points)			Contribution to increase (%)		
	Six biggest	Other Norwegian	Foreign	Six biggest	Other Norwegian	Foreign
Deposits from customers	-3.7%	-2.0%	-5.3%	4.6%	-10.7%	6.7%
Deposits from Norwegian credit institutions	+0.3%	+0.1%	-0.4%	6.2%	10.5%	0.1%
Deposits from foreign credit institutions	-0.4%	+0.3%	+1.6%	4.4%	12.7%	55.3%
Loans from Norges Bank	-0.0%	+2.0%	+4.4%	-0.2%	65.1%	27.5%
Notes in NOK	-0.4%	+0.1%	-0.1%	-3.0%	6.1%	-0.2%
Notes in foreign currency	+1.6%	0.0%	0.0%	21.0%	0.0%	0.0%
Bonds in NOK	+0.0%	-0.3%	-0.1%	5.3%	12.5%	-0.1%
Bonds in foreign currency	+0.5%	-0.4%	+0.0%	23.5%	-12.2%	0.1%
Other liabilities	+2.4%	+0.5%	+0.4%	35.7%	19.8%	10.0%
Common equity	-0.3%	-0.4%	-0.5%	2.5%	-3.9%	0.7%
Total assets	+10.3%	+3.1%	+22.7%	100.0%	100.0%	100.0%

Source: Statistics Norway, Banking Statistics

the increase in borrowing from the central bank amounted to nearly NOK 60 billion. A considerable share of this borrowing was probably deposited in parent banks.

Both the smaller Norwegian banks and the foreign banks became more dependent on loans from Norges Bank in the course of autumn 2008. The biggest Norwegian banks were instead able to boost the share of funding from notes issued in foreign currency. Aside from the increased borrowing from the central bank, there is little to suggest that banks had been strictly rationed in funding markets. How much it cost to arrange wholesale funding is another matter. We will examine this below.

3.3 Specifics on particular balance sheet items

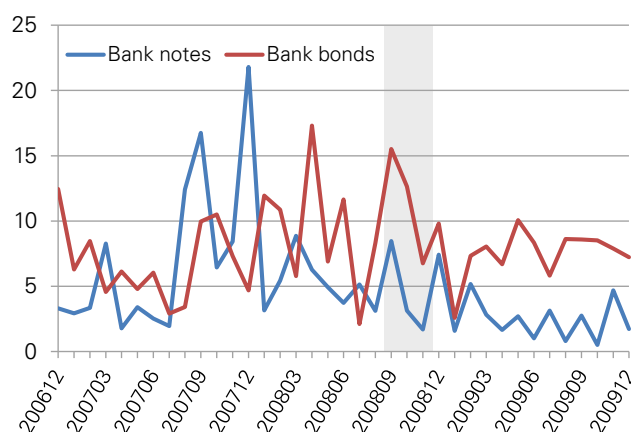
3.3.1 Norwegian bank notes and bonds

Chart 3 shows total issuance each month of bank notes and bank bonds registered in the Norwegian Central Securities Depository (VPS) from the beginning of 2007 through 2009. Volumes increased and varied more beginning in summer 2007. The new, higher issuance level was sustained through 2008, but still with pronounced fluctuations. The three months from August to November 2008 differ little from the remainder of 2008. Beginning in 2009, however, the level appears to be lower. Although the chart shows gross issuance, the picture is approximately unchanged if we had looked at net issuance instead, i.e. by deducting securities that mature.

The chart also shows that the ratio of issued volumes of notes to bonds changed little during the crisis period. Moreover, Table 5 shows that the average maturity of the bank notes and bonds issued in the crisis period was generally slightly longer. This reinforces the impression that banks obtained both the volumes and maturities they sought in this market. Nor did banks' share of total issuance in the Norwegian markets change much.

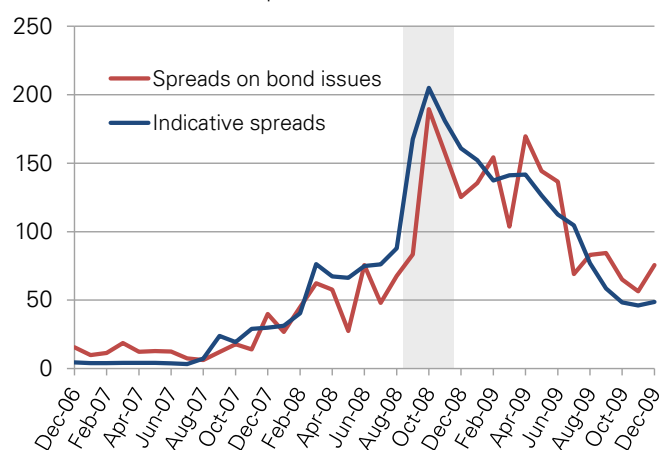
However, the picture changes slightly when we look at the rates banks had to pay. Chart 4 shows the average spread over NIBOR that banks paid each month on their issuances of floating rate notes and bonds from 2007 until end-2009. The average maturity of these securities was around three years (see Table 5). The average spreads are well in line with the indicative spreads published by DNB in the same period for securities with three year maturity: There is a substantial impact on the prices banks had to

Chart 3 Issuance of bank notes and bank bonds registered in the Norwegian Central Securities Depository (VPS) 2007-2009. In NOK billions



Source: Stamdata

Chart 4 Spreads of floating rate bank bonds over 3-month NIBOR. Spreads of bonds registered in VPS at the time of issuance and indicative spreads from DNB Markets



Sources: DNB and Stamdata

pay, with a widening of the spread over the NIBOR from just over 60 basis points in August 2008 to over 150 basis points in October. Thereafter, spreads declined somewhat, but did not return to pre-crisis levels.

Chart 4 shows the average of spreads for all banks. There had long been only minor differences between banks in the period before the liquidity problems arose, differences that largely remained small also during the

Table 5. Average maturity of newly issued bank notes and bank bonds

	1 January 2006 – 14 September 2008		15 September 2008 – 30 November 2008	
	Average maturity	Number of issues	Average maturity	Number of issues
Six biggest	3.2 years	35	3.9 years	31
Other Norwegian	2.9 years	406	3.6 years	168

Source: Stamdata

Table 6. Spread over NIBOR on issue date for floating rate bonds

	2006 1 – 2007 6		2008 9 – 2008 11	
	Spread over NIBOR	Issues	Spread over NIBOR	Issues
Six biggest banks	9.6 basis points	35	156.1 basis points	31
Other Norwegian banks	12.5 basis points	406	164.9 basis points	168

Source: Stamdata

crisis. Table 6 shows the average spread over NIBOR. Both for the six biggest banks and for the other Norwegian banks, the average spread in the three months from September to November 2008 was above 150 basis points.

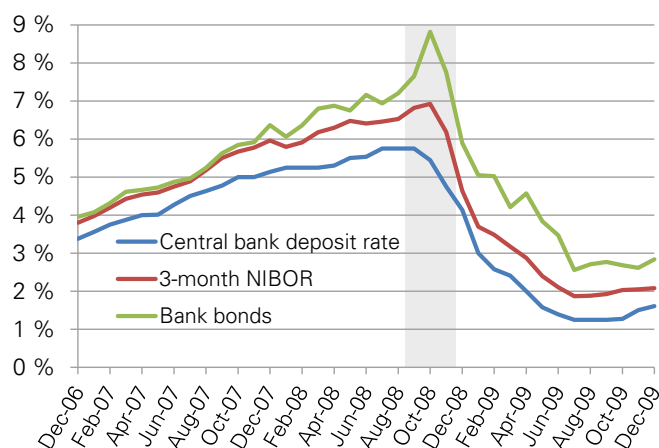
The difference between big and small banks increased somewhat, but it is important to note that the observed average spread depends on the dates of actual issues in each category. The number of issues suggests that the average is more representative for the smaller banks than for the six biggest, and the increased difference cannot be qualified as significant. Foreign banks are not included in the tables, because they did not issue any floating rate bonds after 16 September. Nor did they have many bond issues in NOK prior to the crisis.

This confirms the view that even if volumes had not changed substantially, the spread over NIBOR banks had to pay was considerably higher. At the same time, the spread between the key policy rate and NIBOR also widened considerably, to more than one percentage point during the crisis months September to November 2008. But through autumn and winter, the impact of rates was softened by substantial reductions of the key policy rate by Norges Bank (see Chart 5). Beginning in 2009, banks were able to issue bonds with very low rates.

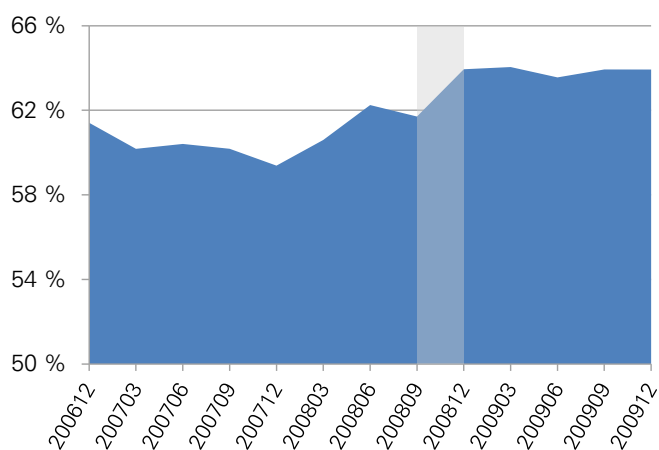
3.3.2 Customer deposits

We have seen that there were no substantial changes in the volume of total customer deposits in the banking sector during the crisis. However, there was a slight decline in the volume of deposits in the smaller Norwegian banks, but not in the bigger banks or in the foreign banks. Large deposits may have been moved from smaller to bigger banks because the latter are assumed to be safer in a crisis.

There may have been other interbank transfers of deposits where, for example, customers with large deposits distributed the amount among several banks so as not to exceed the deposit guarantee limit of NOK 2 million per customer per bank. In principle, the deposit guarantee scheme covers banks' retail customers only, but Banking Statistics provides figures for total customer deposits. This also includes enterprises, but not the public sector or financial corporations. Chart 6 shows guaranteed deposits as a proportion of total customer deposits. We see a slight tendency for large deposits to be spread

Chart 5 Key policy rate, NIBOR and floating rate on bank bonds registered in VPS at the time of issuance. 2007-2009

Sources: Norges Bank and Stamdata.

Chart 6 Guaranteed customer deposits as a proportion of total customer deposits

Source: Statistics Norway, Banking Statistics

among several accounts that are covered by the deposit guarantee, since the percentage of customer deposits covered by the Norwegian Banks' Guarantee Fund edged up in the fourth quarter of 2008.

Chart 7 shows that there were differences across categories of banks. The share of deposits covered by the Fund increased the most in the smaller Norwegian banks, but there were only slight changes in the biggest Norwegian banks and in the foreign banks. This is consistent with the explanation that some depositors moved large deposits from smaller to bigger banks.

Banking Statistics compiles figures for the average deposit rate at the end of each quarter. Chart 8 confirms that deposit rates followed the key policy rate in autumn 2008, but beginning in the fourth quarter of 2008, the deposit rate went from being below the key policy rate to being above it in all categories of banks. Since this situation has persisted, this cannot be explained by banks being slow to lower deposit rates. A more reasonable explanation is more intense competition for deposits.

There are also differences between categories. While the smaller Norwegian banks had the lowest average deposit rate until the third quarter of 2008, beginning in the fourth quarter they had by far the highest, reflecting smaller banks' greater reliance on deposits as a funding source. Note that these banks lost deposits from customers in the fourth quarter of 2008 (see Table 4 above).

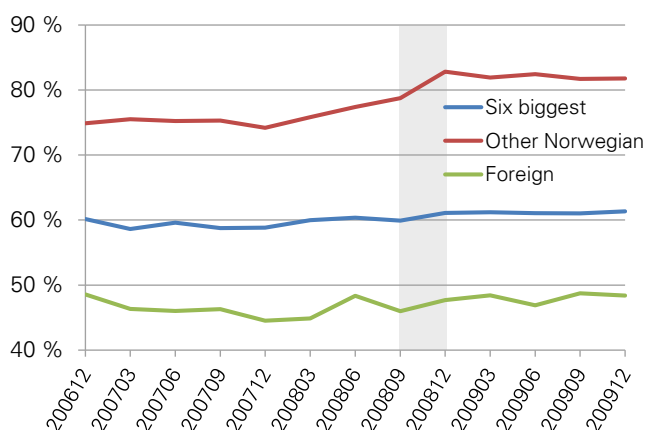
3.3.3 Interbank market in NOK

Norwegian banks also borrow from one another in a NOK market for overnight loans. These loans are channelled through Norges Bank's settlement system, which makes it possible to calculate the volume of these loans and the interest rates paid (see Akram and Christophersen (2010)). The biggest banks are the most active in this market, and in autumn 2008, only around 30 banks participated at least once. More than 100 banks did not participate. For that reason the figures are not particularly suited to elucidating differences between the three categories of banks.

Charts 9 and 10 are based on Akram and Christophersen's calculations. Chart 9 shows interbank loan volumes each day from 2007 to the beginning of 2009. We see a tendency for volumes to be reduced beginning in October 2008. This is consistent with the explanation that banks sought to retain as much liquidity as possible and were less willing to lend available funds to others.

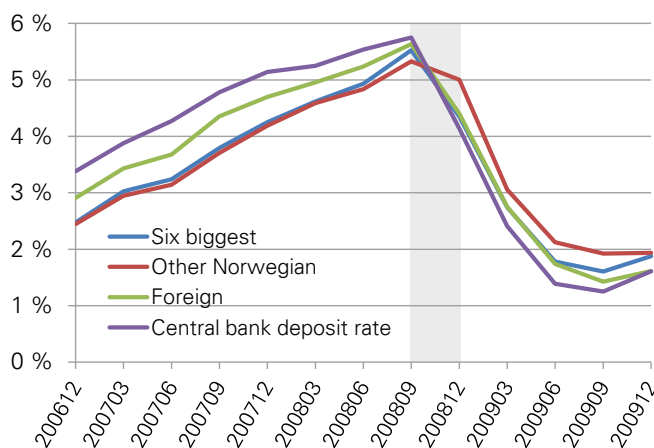
Chart 10 shows the interbank overnight rate. While there is considerable variation, the rate generally follows

Chart 7 Proportion of guaranteed customer deposits by bank category



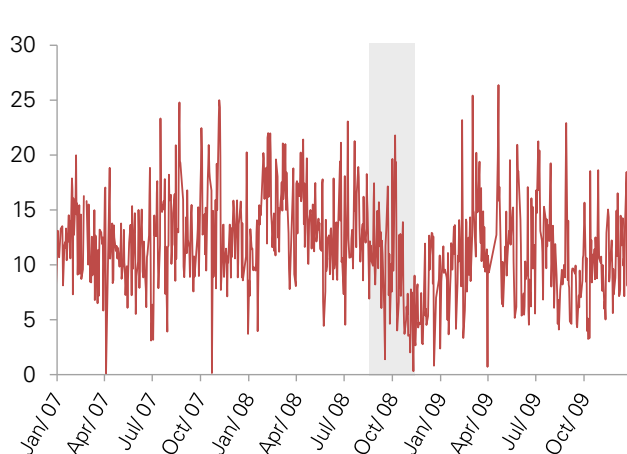
Source: Statistics Norway, Banking Statistics

Chart 8 Average deposit rate by bank category compared with the key policy rate



Source: Statistics Norway, Banking Statistics

Chart 9 Volumes of interbank overnight loans. In NOK billions



Source: Akram and Christophersen (2011)

the key policy rate and NIBOR. When the divergence between the key policy rate and NIBOR becomes particularly wide in September/October 2008, many overnight loans are closer to NIBOR.¹⁰

3.3.4 Banks' positions in Norges Bank

In section 3.2 we saw that all three categories of banks increased both their deposits and their borrowing from Norges Bank from August to November 2008. The increase in gross positions inflated Norges Bank's balance sheet. Banks' total net position vis-à-vis Norges Bank is changed only when Norges Bank trades foreign exchange, or when there is a central government surplus or deficit for a period¹¹. But its distribution among the categories can change. Chart 11 shows the net positions with Norges Bank for each category of banks from 2006 through 2009 as a percentage of total assets. We see that there were minor changes in the six biggest banks' net position, while the other Norwegian banks improved their net position. For the subsidiaries and branches of foreign banks, the change was in the opposite direction: they reduced their net position and thus increased their share of funding from Norges Bank.

Borrowing from Norges Bank requires banks to pledge sufficient collateral. The requirements for securities accepted as collateral were relaxed in October and again from 3 November. This was intended to enable banks to borrow more from Norges Bank. Chart 12 shows banks' borrowing in the form of F-loans as a percentage of total assets.

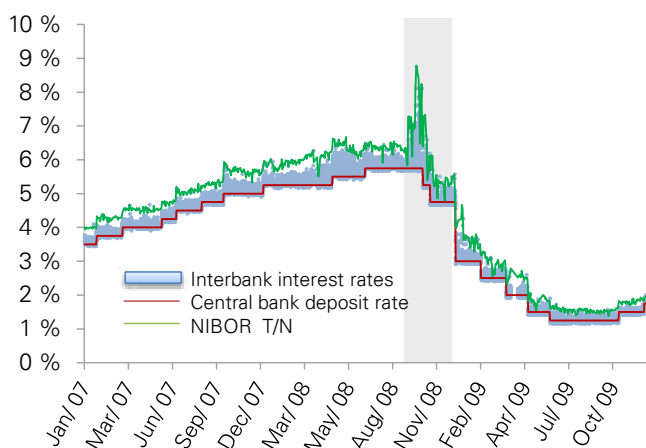
Both in absolute amounts and as a percentage of total assets, foreign banks borrowed the most in the form of F-loans from Norges Bank. This category had F-loans equal to 7.6% of total assets at end-November. The two Norwegian bank categories borrowed only modest volumes in the form of F-loans in the period under review.

Lists of collateral pledged in 2008 have been kept only for a few selected dates. Chart 13 shows collateral pledged towards the end of March and the end of October 2008, as a percentage of total assets. For comparison, we also include a randomly chosen date in May 2009. In section 3.2, we saw that all categories of banks increased total

¹⁰ Following the financial crisis in 2008, Norges Bank has quoted a new overnight rate, NOWA (Norwegian Overnight Weighted Average). See <http://www.norges-bank.no/en/price-stability/interest-rates/>

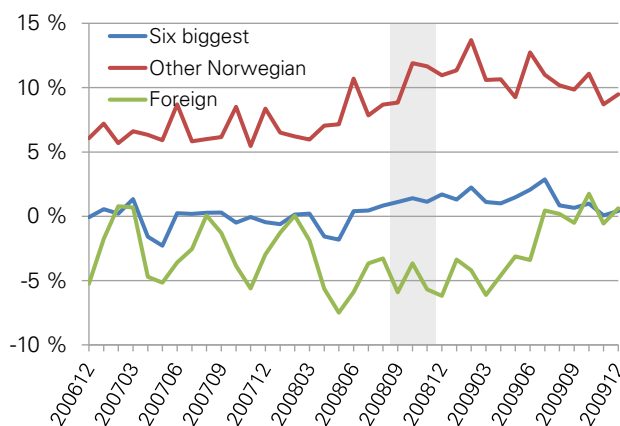
¹¹ For example, when Norges Bank purchases foreign exchange, Norges Bank pays with central bank reserves, increasing banks' net position vis-à-vis Norges Bank. The same occurs when the central government transfers funds to the banking system in the event of central government deficit. Norges Bank introduced a new liquidity management system in 2011. See Syrstad (2011) for a more detailed discussion of the impact of various factors on the reserve position of the banking system.

Chart 10 Interbank overnight rate. Per cent per annum



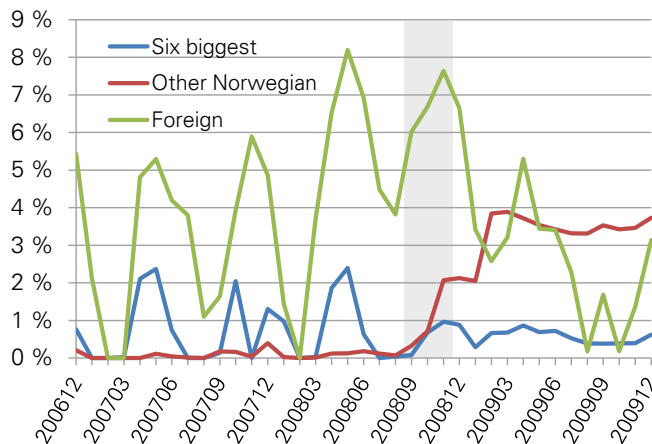
Source: Akram and Christophersen (2011)

Chart 11 Net positions with Norges Bank. Percentage of total assets by bank category



Source: Statistics Norway, Banking Statistics

Chart 12 Banks' borrowing from Norges Bank. F-loans as a percentage of total assets



Source: Statistics Norway, Banking Statistics

assets in autumn 2008. The chart shows that collateral increased as a share of these growing total assets, increasing the most in the biggest banks. However, in these banks, this increase had been reversed by May 2009.

Of course, the collateral exceeded the amounts borrowed as F-loans. The foreign banks pledged the most collateral and thus borrowed the most. The Norwegian banks pledge considerably more collateral than they used. This can be interpreted as a form of securing future access to loans from Norges Bank

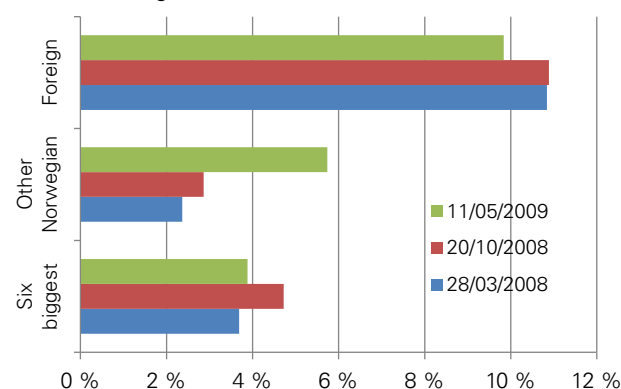
4. Which banks had the most serious problems?

We have also looked at individual banks in an attempt to quantify the problems they encountered and explain why some banks had more serious problems than others. The analysis is documented in *Staff Memo 16/2011*¹². Hence, this article contains only a brief summary of the results.

We have some idea of which banks experienced the most serious liquidity problems in autumn 2008. We have attempted to rank banks by the extent of their problems by using six quantitative indicators that in our opinion provide information on the scope of the problems in each bank. These indicators describe probable causes and expected outcomes of liquidity problems. The cause will normally be sudden unavailability of funding, especially from other credit institutions. The usual impact of this is greater needs for funding from the central bank. Furthermore, problem banks are often forced to pay higher interest rates and to accept shorter maturities for funding. Therefore we use the following indicators:

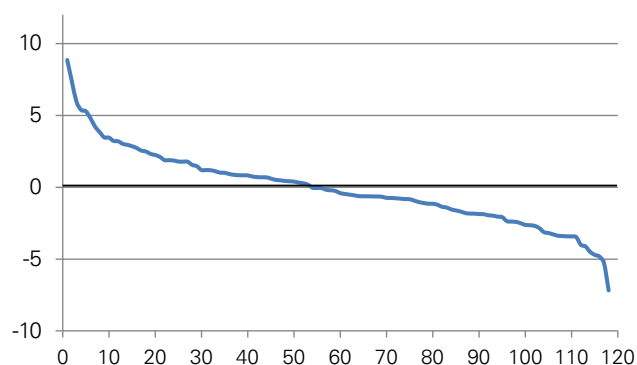
- Banks with the greatest percentage point reduction in customer deposits as a share of total assets from 8/2008 to 11/2008
- Banks with the greatest percentage point reduction in deposits and borrowing from credit institutions as a share of total assets from August 2008 to November 2008
- Banks with the greatest increase in collateral pledged with Norges Bank as a share of total assets from 23/03/2008 to 20/10/2008 (dates determined by availability of data)
- Banks with the greatest percentage point increase in liabilities (excluding deposits) with remaining maturity under 3 months as a share of total assets from 2008 Q2 to 2008 Q4.
- Banks with the greatest percentage point increase in the average interest rate on deposits other than transaction accounts from 2008 Q2 to 2008 Q4

Chart 13 Collateral pledged to Norges Bank. Percentage of total assets at given dates



Sources: Norges Bank and Statistics Norway, Banking Statistics

Chart 14. Individual banks' total score for liquidity problems in autumn 2008



- Banks with the greatest increase in the volume of F-loans as a share of total assets from 8/2008 to 11/2008

These indicators have low correlation and may be said to describe various possible impacts of liquidity problems. We have given each bank a score on each indicator by calculating how many standard deviations the bank is from the mean for all banks. In this way, each indicator has equal weight. Each score is given a sign, so that a higher positive value indicates more serious liquidity problems. We use the sum of the six scores to rank the banks by how serious their liquidity problems were. This is a crude method, and we cannot be certain how correct it is. We can only argue that the results appear to be reasonable in the light of what we otherwise know about the problems in autumn 2008.

As the data on which the analysis is based are confidential, the list cannot be published. Chart 14 shows the distribution of the total scores for the 119 banks we believe are fairly comparable and for which we have sufficient data. We have excluded DNB and subsidiaries and branches of foreign banks, because their balance sheets

¹² <http://www.norges-bank.no/no/om/publisert/publikasjoner/staff-memo/2011/16/> (only in Norwegian)

deviate without any link to liquidity risk. However, we do include BNBank/Glitnir, which we perceive as more independent than the other subsidiary banks. We note that relatively few banks clearly stand out with a high total score.

The next step in the analysis was to find variables that might explain why some banks had more serious problems in autumn 2008 than others. We compiled a list of possible variables and measured values at the end of the second quarter of 2008, i.e. before serious liquidity problems arose. The list represents variables that we believe may have been of importance for whether individual banks experienced liquidity problems. We assume that bigger and more solid banks, with external owners and more stable funding, are better positioned. We chose to investigate whether the following variables may have been of importance:

- Cumulative impairment losses as a share of total lending
- Total assets
- External owners (binary variable with value 1 for subsidiary banks and banks with common equity or primary capital certificate capital)
- Tier 1 capital ratio
- Customer deposits as a share of total assets
- Liabilities with remaining maturity less than 3 months as a share of total assets
- Funding from credit institutions as a share of total assets
- Funding in foreign currency as a share of total assets
- Funding from abroad as a share of total assets
- Interest rate on deposits other than transaction accounts, 2008 Q2

Many of these variables are correlated. However, the correlations are not high enough for us to omit any in advance.

We performed a set of regression analyses in which we tested whether these variables increased the probability of experiencing liquidity problems. The analyses were based partly on the entire sample of banks and partly on the half of the banks with a positive overall score. We used various estimation techniques to determine whether this made any difference for the results.

Three of the variables on our list proved to be statistically significant explanatory factors in most of the regressions, both those that included all banks and those restricted to banks with a positive score. Hence, we believe it is reasonable to conclude that these three helped to explain which banks experienced the most severe liquidity problems in autumn 2008.

Banks without external owners had a higher probabili-

ty of experiencing problems. By external owners we mean shareholders, owners of primary capital certificates and parent banks. The explanation may be that in some cases, external owners might be able to provide assistance when a bank got into trouble. Most savings banks lacked this option.

Banks that paid low interest on deposits other than transaction accounts had a higher probability of experiencing problems. This may be related to the fact that these banks did little to obtain reserves before the crisis arrived. Other banks offered higher rates and thus managed to raise more liquid assets at an early stage.

Banks with a large proportion of funding in foreign currency had a higher probability of experiencing problems. This is a natural consequence of the external origins of the liquidity crunch and its contagion to the Norwegian banking industry through foreign funding.

A fourth result is somewhat less robust. But it seems reasonable that a low Tier 1 capital ratio prior to the crisis is an explanatory factor that contributed to a higher probability of problems. It is easier to borrow liquidity, the more solid the bank is at the outset.

These results provide a certain basis for concluding what banks and regulators ought to be concentrating on when the objective is limiting liquidity risk, namely funding in foreign currency (or from abroad) and the Tier 1 capital ratio. We also see that mutually owned savings banks may be at risk. These are all factors that were recognised previously and that therefore cannot be surprising.

What is surprising, however, is that the deposit-to-loan ratio and extent of short-term funding do not appear to be of great importance. These are factors that we originally believed would be important. However, these results may also illustrate the limitations of our analysis: It is uncertain how accurate the ranking of liquidity problems is using our indicators, and it is also uncertain whether variables other than those examined before the crisis may have been important explanatory factors.

5. Summary

A liquidity crisis is nearly always dominated by fear and uncertainty, where all parties seek to hold more liquidity than otherwise. The Nobel Prize winner Paul Samuelson (1948) has described a traditional bank run as follows:

“As long as they know they can have their money from the bank, the depositors don’t want it. As soon as they know (or suspect) that they can’t withdraw their money, they insist on having it ... When all act upon fear or suspicion, they unwittingly transform it from unfounded rumor into actual reality.”

That fear and uncertainty played a major role in autumn 2008 was also evident from the phasing-in of the special swap arrangement. The very announcement of the arrangement in mid-October seems to have quelled a good deal of the fear in the market, even if the arrangement did not affect liquidity conditions until end-November.

The crisis in autumn 2008 was not a deposit flight, but a flight from interbank markets. Banks responded primarily by increasing their liquid reserves. To achieve this, banks borrowed more, especially from Norges Bank and from other banks. The borrowed funds were then deposited in Norges Bank and other banks. This inflated banks' balance sheets, without changing net positions vis-à-vis Norges Bank and other banks. Deposits from and lending to customers were little affected.

However, banks had to pay to achieve the volume adjustments they desired. The spread between the key policy rate and the interest rate on bonds and notes banks issued widened sharply in autumn 2008. The spread between the average deposit rate and the key policy rate also widened. But Norges Bank quickly lowered the key policy rate, and the absolute interest rates banks paid therefore declined towards year-end.

The inflation of balance sheets was most pronounced in subsidiaries and branches of foreign banks, especially due to substantial borrowing from Norges Bank. This category also stood out by depositing large portions of borrowed funds in foreign banks, which were probably their parent banks in most cases. This suggests that foreign banks used loans from Norges Bank to finance operations in the entire group.

Deposits from customers up to NOK 2 million per customer and bank are guaranteed by the Norwegian Banks' Guarantee Fund. The proportion of deposits that was guaranteed increased in the fourth quarter of 2008. At the same time, there was a slight shift between categories of banks. Both the biggest Norwegian banks and the foreign banks reported a slight increase in the volume of deposits, while the smaller Norwegian banks saw a slight decline. Overall, this suggests that some deposits were transferred in order to be covered by the guarantee scheme and that these transfers were most frequently made from the smaller banks. It was also the smaller

banks that increased their deposit rates the most in autumn 2008.

The review above is based largely on monthly observations. This means that we are unable to see the most acute liquidity problems in the immediate aftermath of the Lehman bankruptcy on 15 September. Nor do we cover the effect of the swap arrangement, which primarily impacted liquidity conditions after the period under review. However, we do obtain a picture of the main features of developments in autumn 2008. Banks gave priority to building up liquid reserves, and with the authorities' support, succeeded.

The analysis of individual banks yields some reasonable results regarding conditions that made banks more susceptible to liquidity problems. These were mainly a lack of external owners and a large proportion of foreign currency funding. These are well known vulnerability factors.

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