Method for stress tests of the banks' liquidity risks

When the US bank Lehman Brothers went bankrupt in the autumn of 2008, banks in the United States and Europe were hit by severe liquidity problems. The entire global banking sector has since then been affected by the liquidity crisis and several central banks have taken action to mitigate the strains.

Two factors contributed to the severity of the crisis; first that the banks were dependent on short-term funding and, second, that their liquidity reserves were not sufficiently liquid. In recent years, the Riksbank has therefore increasingly focused on analysing the liquidity situation of the banks, and in this report we publish stress tests of the banks' liquidity risks. The stress tests are based on public data and the outcome is reported for each and every major Swedish bank. The aims are to highlight the banks' liquidity risks and to compare the liquidity situation of the Swedish banks with that of other European banks and to increase transparency regarding the liquidity risks in the Swedish banks.

How do liquidity risks arise in banks?

In its simplest form, liquidity means that a bank has sufficient funds to be able to meet its commitments. The risk of not being able to meet these commitments is called liquidity risk. Liquidity risk is, however, a natural part of banks' operations since they are normally funded at shorter maturities than they lend at. This means that the liabilities fall due for payment more frequently than the assets. In order to be able to fund their operations, the banks are therefore dependent on the functioning of the financial markets and on investors and depositors having confidence in them.

Given the lack of a clear regulatory framework for liquidity risk, the banks took greater and greater liquidity risks in the years preceding the financial crisis. This was manifested in several ways. In the years preceding the crisis, the proportion of deposits in the banks' total funding decreased and was replaced to a great extent by funding on the market. In addition, this market funding was often short term, which entailed a refinancing risk as the banks ran the risk of not being able to renew their debts when they fell due. At the same time, it became apparent that the banks' liquidity reserves, that is the assets of good liquidity that the banks hold as a buffer to cover unexpected outflows, were not as liquid as the banks expected.

Lack of transparency regarding the banks' liquidity risks

The banks present very little information on their liquidity risks. To the extent they provide information it is seldom comparable between banks. Increased transparency is needed for several reasons. First, it creates better conditions for investors to make a correct analysis of the banks' risks, which reduces uncertainty. Second, increased transparency gives those banks with a higher level of risk than their competitors an incentive to reduce their liquidity risks. Finally, increased transparency gives the banks themselves a chance to analyse their liquidity risks in relation to those of their competitors.

One explanation for the lack of transparency is that there has been no common regulatory framework governing the level of liquidity risk in a bank. Nor has there been any harmonized way of calculating liquidity risk. In light of this the Basel Committee on Banking Supervision has proposed, as part of the Basel III rules, two liquidity ratios; the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).[R22] These will be implemented in 2015 and 2018 respectively. The Swedish financial supervisory authority, Finansinspektionen, is currently finalising all the details of the regulatory code and the reporting requirements that will apply to the Swedish banks when the regulations are in place. The Riksbank supports and welcomes the efforts of Finansinspektionen in this area. As a means of

R22 See box "Basel III – effects on the Swedish banks and Sweden"

increasing transparency regarding liquidity risks the Riksbank already now publishes two own measures (see below). These measures should not be confused with Finansinspektionen's measures, nor should they be seen as statutory requirements to meet a particular minimum level.

The Riksbank's intention in publishing stress tests of the banks' liquidity risks

The Riksbank has two main reasons for publishing stress tests regarding the liquidity situation of the banks.

- Liquidity risks are one of the major risks in the Swedish banks. It is therefore an important part of the Riksbank's efforts to promote financial stability to measure this risk, highlight the strengths and weaknesses of Swedish banks regarding liquidity and to communicate this information.
- At present, there is a lack of transparency in the banks' reporting of liquidity risks. The Riksbank therefore wishes to act as a driving force to improve transparency and disseminate information.

In short, the stress tests are intended to accelerate the development of greater transparency and the improvement of the banks' management of liquidity risks to promote financial stability.

The Riksbank's stress tests of liquidity risk are based on public data

For almost three years the Riksbank has gathered weekly, at times daily, liquidity reports from the major Swedish banks and at the same time maintained regular contact with the banks' risk and treasury departments. This information has given the Riksbank a good picture of the banks' liquidity situation, in total and per currency. The Riksbank also has information on the types of securities the banks have in their liquidity reserves and thus on the quality of the liquidity reserves. The information that the Riksbank gathers from the banks can, however, not be communicated to the market since it is not public.

In order to be able to communicate a picture of the liquidity risks in each of the major Swedish banks, the Riksbank therefore uses public data. As the Riksbank's tests are based on public information, the results will not necessarily be entirely in line with the results that would be arrived at if the banks' own information, or the Riksbank's confidential information, were used. The results should therefore be seen as indicative. The shortcomings in the public data include the fact that there is no information on the types of security that make up the liquidity reserves, that is on the level of quality, or on the level of liquidity risk per currency.

Two measures for stress testing the banks' liquidity

It is important to investigate the banks' liquidity risks as they can cause major problems for the banks. However, it is also difficult to quantify the liquidity risk using a single measure. The Riksbank therefore publishes the results of two stress tests in this report. The first stress test measures the banks' resilience against stress of three months duration. This short-term stress test has certain similarities in principle with the LCR, but nevertheless differs so much that it should not be confused with the LCR. The second stress test measures the banks' resilience against stress that lasts one year and focuses on the structural liquidity risks in the banks. The second stress test is reminiscent of the NSFR but the assumptions are not exactly the same. It is also worth noting that the design of the NSFR is not yet complete; a lot of work remains to be done on this.

The Riksbank's measures are indications of the liquidity risks associated with the banks' different types of balance sheet and maturity structures. Thus the measurements do not take into account the underlying business model and confidence in the bank. This in turn means that the stress tests do not present a full picture of a bank's liquidity risk. A bank that scores low in the Riksbank's stress tests may nevertheless have good access to the capital markets if the markets consider it to be a stable and secure bank with a low level of business risk.

The Riksbank's short-term liquidity measure – stressed liquidity reserve

Banks normally have a liquidity reserve consisting of securities that can quickly be converted into liquidity to cope with unexpected cash outflows. Unexpected cash outflows can arise in different ways. For example, investors may lose confidence in a bank so that refinancing problems arise when the securities issued by the bank mature. Alternatively, the markets that banks are dependent on for their funding may stop functioning due to general turbulence. Unexpected cash outflows may also arise because private customers for some reason wish to withdraw money they have deposited with a banks, or companies that have been granted a credit facility by a bank may use this facility to a greater extent than the bank expected. In the Riksbank's first stress test, the bank's liquidity reserve is examined in relation to a stressed cash outflow. The aim is to ensure that the bank has an adequate liquidity reserve that can quickly be converted into liquid funds and thus cover stressed outflows over the following three months.

The banks that score high in the Riksbank's short-term liquidity measure typically have larger liquidity reserves than other banks. Banks that are deposit-funded, particularly if the deposits come from households and small firms, also have a smaller outflow, since this source of funding has historically been relatively

stable. The banks that are less dependent on short-term market funding also have a smaller outflow, since they have fewer securities that mature during the three months of the stress test compared to other banks. In the example in Figure B2, Bank 1 will score higher in the Riksbank's first stress test than Bank 2. This is because Bank 1 has a larger liquidity reserve, a larger proportion of deposits and a smaller proportion of securities that will mature over the next three months than Bank 2.

To calculate the short-term liquidity measure, the Riksbank estimates the banks' liquidity reserves and calculates the stressed outflows over the next three months. Figure B3 illustrates how the Riksbank calculates a bank's liquidity reserves. The first step is to total the funds the bank has acquired in the form of deposits, market funding and equity. All of the bank's illiquid assets are then deducted from this sum. In simple terms, the difference between funding and illiquid assets is then the funds invested in liquid assets (mostly securities).

Figure B2. Examples of two different banks in the Riksbank's short-term liquidity measure
Per cent

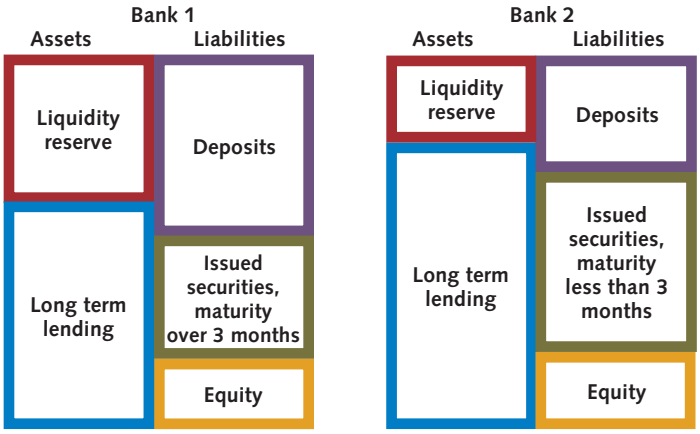
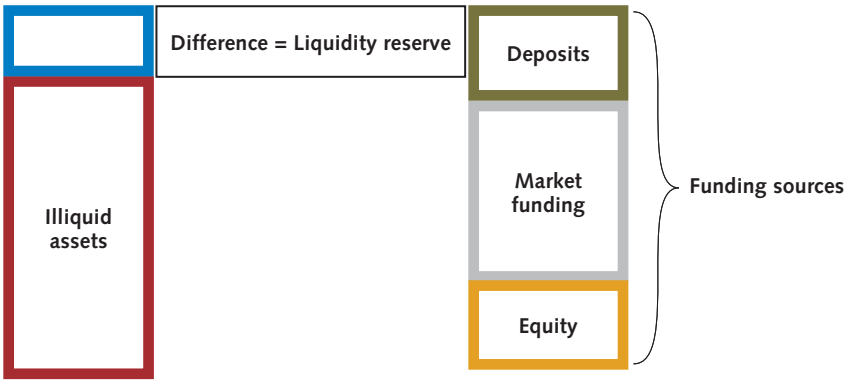


Figure B3. Method for calculating liquidity reserve



Note. Funding sources: deposits + market funding + equity – repos. Illiquid assets: total assets – cash and balances with central banks – securities – reverse repos – insurance – derivatives – pension assets. The difference between funding sources and illiquid assets equals the liquidity reserve

Source: The Riksbank

However, it is not possible for the Riksbank to determine from public data what types of security are included in the banks' liquidity reserves. The level of quality in the liquidity reserves varies from bank to bank. For example, the proportion of government securities in the liquidity reserves differs between the banks. As a conservative assumption, the estimated liquidity reserve will therefore decrease by 50 per cent before it is put against the stressed outflow.[R23] This assumption is made so that the banks' liquidity reserves are not overestimated. However, the assumption is to the detriment of banks that have a higher level of quality, for example a large proportion of government securities, in their liquidity reserves.

After calculating the liquidity reserve, the banks' stressed cash outflow for the next three months is calculated. In the stress test, it is assumed that it will only be possible to refinance half of the securities issued by the bank that will mature within three months. At the same time, it is assumed that private individuals and corporate customers will withdraw a certain proportion of their deposits. It is also assumed that the credit facilities the banks normally grant their customers are used to a greater extent than the bank expected. All of this gives a stressed cash outflow (see Table B3). To calculate the short-term liquidity measurement the estimated liquidity buffer is then divided by the stressed cash outflow.

The banks that reach at least 100 per cent have a liquidity reserve that they can sell (or repo) to acquire liquid funds that they can use to cover cash flows for a period of three months under the conditions that apply in the scenario.

$$\text{The Riksbank's short-term liquidity measure} = \frac{\text{Adjusted liquidity reserve}}{\text{3 month stressed cash outflow}}$$

Table B3. Summary of assumptions for the Riksbank's short-term liquidity measure – stressed liquidity reserve, and examples

	Factor	Example of balance sheet	Adjusted reserve and stressed cash outflow	Ratio
Liquidity reserve	decrease 50%	400	200	
Withdrawal of deposits by private individuals and small and medium-sized companies	10%	800	80	
Withdrawal of deposits by large companies	25%	160	40	200/200= 100%
Issued securities that will mature within three months	50% cannot be refinanced	150	75	
Credit facilities used	10%	50	5	
Total stressed outflow:			200	

Source: The Riksbank

R23 One of the reasons to the weak resilience of European banks during the crisis was that their liquidity reserves weren't sufficient liquid. The Riksbank has therefore made an assumption to adjust down the liquidity reserves with 50 percent.

The Riksbank's structural liquidity measurement – stable funding against illiquid assets

The structural liquidity measure is a complement to the short-term measure. Structural resilience means that the bank is better equipped to deal with a stressed situation that lasts over a long period of time. The measure aims to reveal structural imbalances from two main aspects. First, a bank should not have too great a difference between the maturities of assets and liabilities. Second, a bank should not too many illiquid assets in relation to unstable (volatile) liabilities.

In the Riksbank's second stress test, the market is marked by stress over a period of one year. A bank that is funded at long maturities and has assets that are easy to sell will be in a better position, all else being equal, to handle such a situation than a bank that is funded at short maturities and has a lot of illiquid assets that are difficult to sell.

How well a bank performs in the structural liquidity measure is partly affected by the structure of the bank's funding, that is what sources of funding it uses and at what maturities, and partly by the structure of its assets. The banks that score high in the Riksbank's structural measure are, for example, those that have a large proportion of deposits in their funding, and primarily deposits from households and small companies. The reason for this is that this source of funding is more stable than other forms of funding. Banks that have only a limited dependence on short-term market funding also score high in the test as they do not have as large a proportion of securities that will mature within the next 12 months as banks that have a greater degree of short-term market funding. Banks that fund their operations on the interbank market[R24] have a lower score than other banks in the test because this form of funding is also often short term. If one studies the asset structure in those banks that score high in the test it is typically those banks with a smaller proportion of lending to the public. This is because all lending to the public is assumed to be illiquid in the stress test.

In Figure B4, Bank 1 will score higher in the Riksbank's second stress test than Bank 2. The reason for this is that Bank 1 has a more liquid asset side, is less dependent on short-term market funding and has a higher proportion of deposits than Bank 2.

To calculate the structural liquidity measure, all of the items on a bank's balance sheet are multiplied by a factor of between 0 and 100 per cent depending on how stable the liability items are and how liquid the asset items are. The more stable the funding is the higher the factor it obtains and the more liquid the assets are the lower the factor they obtain. The stable funding consists mainly of equity, deposits and market funding, with a maturity of more than one year. Illiquid assets consist mainly of lending to the public (see Table B4). The total of the weighted stable funding is then divided by the weighted asset items which give the Riksbank's structural liquidity measurement. The banks that reach at least 100 per cent have sufficiently stable funding to cope with the assumptions in the scenario.

To summarise, the liquidity risk is one of the greatest risks that a bank is exposed to. The stress tests presented by the Riksbank provide an overall picture of the banks' liquidity risks, but due to the incompleteness of the information published by the banks they do not cover all aspects of these risks.

$$\text{The Riksbank's structured liquidity measure} = \frac{\sum \text{Funding x factor}}{\sum \text{Assets x factor}}$$

R24 Interbank means net of interbank lending and borrowing.

Figure B4. Examples of two fictitious banks in the Riksbank's structural liquidity measurement

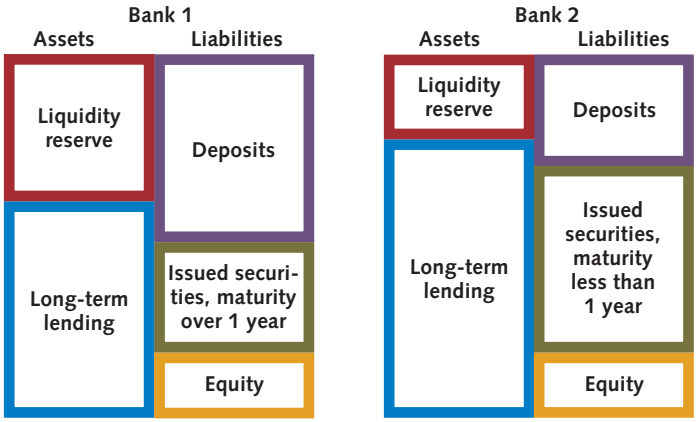


Table B4. Summary of assumptions for the Riksbank's structural liquidity measure – stable funding against illiquid assets

Funding		Assets	
Item	Factor	Item	Factor
Tier 1 and Tier 2 capital Liabilities with remaining maturity > 1 year Derivatives	100%	Cash Loans to financial institutions remaining maturity < 1 year Insurance assets Pension assets	0%
Deposits and borrowing from private customers and non-financial small corporate customers remaining maturity < 1 year	90%	Securities	5–50%
Deposits and borrowing from non-financial large corporate customers remaining maturity < 1 year	50%	Loans to private individuals and companies irrespective of maturity	85%
Repos	5%	Credit and liquidity facilities Reverse repos	5%
All other liabilities or capital not mentioned above	0%	All other assets, including derivatives	100%

Source: The Riksbank