

ARTICLE – Stress tests of banks' liquidity

The Riksbank is the lender of last resort in the event of a crisis in the Swedish financial system and has a responsibility to safeguard financial stability. For a long time, the Riksbank has therefore been conducting stress tests of different kinds to assess the resilience of banks to liquidity shocks. This article presents the stress tests used by the Riksbank to estimate how the liquidity needs of banks could develop in scenarios of major financial and economic turmoil. The results from the stress tests show that the banks' liquidity needs increase rapidly if financial stress continues for more than a month, and that the banks have significant liquidity needs after six months. It is also clear from the results that the liquidity needs can be substantial in individual currencies. It is therefore important that the banks continue to reduce their liquidity risk by extending the maturity period of their funding, as this would limit the outflows that banks may be affected by in the event of a liquidity shock. At the same time, it is important that the banks maintain adequate liquidity reserves in all their significant currencies as these will buy the banks time in the event of financial stress.

Banks' maturity transformation gives rise to liquidity risks

Banks are central participants in the financial system. One of their main tasks is to convert savings to funding via what is known as maturity transformation. Banks do this mainly by borrowing money in the form of deposits from households and companies or by issuing securities. These liabilities often have a short maturity and are used to fund the bank's assets. These assets can consist of loans to households and companies for investment in, for example, housing or machinery and often have maturities of several years.

Even if maturity transformation is a natural and important part of a bank's operations, it gives rise to mismatches in maturities between the bank's assets and liabilities. This means that the bank's funding normally has to be repaid before the bank recuperates the money it has lent. The bank must therefore renew its funding several times during the course of a bank loan. If the bank's ability to repay is called into question, it may be forced to renew the funding at a higher cost than before, or may not manage to renew its funding at all. The bank then risks not being able to fulfil its payment obligations. This risk is called liquidity risk.

To counter short-term liquidity risks, banks maintain liquidity reserves that can be used if they are hit by a liquidity shock.

The Riksbank conducts stress tests for several reasons

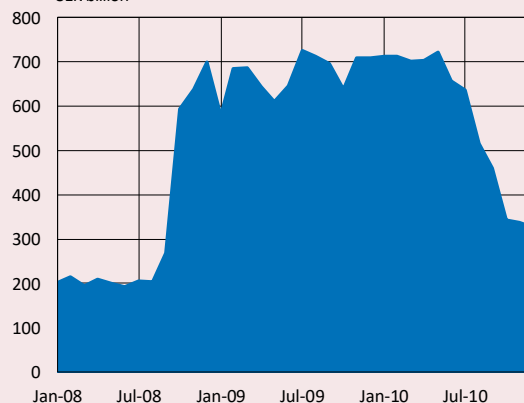
The Riksbank is entrusted with the task of promoting a safe and efficient payment system. As part of this task, the Riksbank can give liquidity support under certain circumstances to banks with temporary liquidity problems

to prevent the risks spreading to other participants in the financial system, the prerequisites for monetary policy deteriorating or the costs of a shock spreading to the economy as a whole.

For example, the Riksbank supplied liquidity to the financial system after the American investment bank Lehman Brothers went bankrupt in September 2008. At most, the Riksbank's lending in USD amounted to 30 billion during the spring of 2009 while the lending in SEK amounted to about 375 billion in the autumn of 2009. This more than tripled the size of the Riksbank's balance sheet (see chart 26).

As a part of its task, the Riksbank therefore continually analyses developments in the banking system to discover threats and vulnerabilities at an early stage.

Chart 26. The Riksbank's balance sheet between 2008-2010, total assets
SEK billion



Source: The Riksbank

Stress tests of banks' capital has long been an important tool to enable both banks and authorities to assess banks' resilience. Recently, it has become increasingly common to measure banks' resilience to liquidity shocks via stress tests.

Stress tests are also part of the Riksbank's analytical work and are used to assess resilience in individual banks and in the banking system as a whole.⁶³ At present, Handelsbanken, SEB, Swedbank and Nordea are included in the Riksbank's stress tests.

The Riksbank uses cash flow-based stress tests

Like several other central banks around the world, the Riksbank uses what are known as cash flow-based stress tests.⁶⁴ These stress tests are based on detailed data about the bank's future contractual cash inflows and cash outflows, and the liquidity reserves.

The Riksbank's conducts "top-down" stress tests, which means that all calculations are made by the Riksbank.⁶⁵ This differs from "bottom-up" stress tests, in which banks themselves make calculations under the supervision of an authority. In both cases, similar types of detailed data are used. One example of the latter type of exercise is the ECB's stress test performed in 2019.⁶⁶

Stress tests complement other measures

The liquidity stress tests, conducted by the Riksbank, complement other established standardised liquidity measures. One example of such a measure is the Liquidity Coverage Ratio (LCR), which illustrates a bank's short-term liquidity risks. Another example is the Net Stable Funding Ratio (NSFR), which measures the liquidity risks on banks' balance sheets as a whole, i.e. including both short-term and long-term assets and liabilities.

In contrast to these measures, cash flow-based stress tests make it possible to measure liquidity risk over several different time horizons. Instead of resulting in a single key ratio, the Riksbank's liquidity stress tests thereby provide the opportunity to observe how a bank's liquidity develops over time in a stressed scenario.

The stress tests set banks' liquidity reserves against stressed net cash outflows

The stress tests are based on assumptions which affect the size of banks' cash inflows and cash outflows at different points in time in the future and how much of their liquidity reserves they can use.⁶⁷

If the bank has larger outflows than inflows during the stressed period, it is assumed that it covers the deficit in liquidity by using its liquidity reserves. Banks' liquidity reserves thereby decrease over time in the stress tests.

The results of the stress tests are reported separately in SEK, USD and EUR and in an item called "other currencies". "Other currencies" include, for example, Danish krone (DKK), Norwegian krone (NOK) and British pounds (GBP).⁶⁸

The scenarios reflect extreme but plausible outcomes

The Riksbank bases its stress tests on various hypothetical scenarios stretching over six months. This time horizon is justified by the fact that a large share of banks' short-term funding is concentrated to maturities of up to six months. The ECB also uses this time horizon in its liquidity stress testing exercise.⁶⁹ At the same time, banks also have issued securities with maturities beyond six months and it is therefore important to analyse banks' liquidity risks with other types of measures and on other time horizons to capture maturity mismatches.

The Riksbank's scenarios reflect extreme but plausible outcomes. The design of the Riksbank's scenario is based on historical experiences and expert judgments but also draws inspiration from a number of other studies.⁷⁰ As there are no given truths about how a scenario should be designed, the Riksbank tests a broad set of different assumptions.

This article presents the results from the Riksbank's stress tests in a *bank-specific scenario* and a *system-wide scenario* (see the main assumptions in the scenarios in table 3). While the bank-specific scenario reflects a liquidity shock in an individual bank, the system-wide scenario reflects a shock in the financial system as a whole.

⁶³ The Riksbank has been conducting stress testing for many years. See, for example, Method for stress tests of the banks' liquidity risks, article in *Financial Stability Report 2010:2*. Sveriges Riksbank, and *Consultation response to the draft referral to the Council on Legislation regarding the Riksbank's financial independence and balance sheet*, April 2017. Sveriges Riksbank.

⁶⁴ For example, Oesterreichische Nationalbank and the European Central Bank use cash flow-based stress tests. For more information see Feldkircher et al. (2013), ARNIE in Action: The 2013 FSAP Stress Test for the Austrian Banking System, *Financial Stability Report*. Oesterreichische Nationalbank, and *Sensitivity Analysis of Liquidity Risk – Stress Test 2019*, October 2019. European Central Bank.

⁶⁵ For more details about the Riksbank's liquidity stress testing method, see Danielsson, M. and Manfredini, J. (2019), The Riksbank's method for stress testing banks' liquidity, *Staff memo*, November 2019. Sveriges Riksbank.

⁶⁶ See *Sensitivity Analysis of Liquidity Risk – Stress Test 2019*, October 2019. European Central Bank.

⁶⁷ The stress tests are carried out using data on what is known as the maturity ladder, which is part of the *Common Reporting Framework (COREP)*, a framework for standardised, regulatory reporting for financial corporations operating within the EU.

⁶⁸ Banks report data for the sum of all currencies and for individual significant currencies. A significant currency constitutes at least 5 per cent of a bank's total liabilities.

⁶⁹ In *Sensitivity Analysis of Liquidity Risk – Stress Test 2019*, October 2019. European Central Bank, the ECB describes its liquidity stress testing which includes all banks in the euro area under ECB supervision.

⁷⁰ Read more about scenario design in Danielsson, M. and Manfredini, J. (2019), The Riksbank's method for stress testing banks' liquidity, *Staff memo*, November 2019. Sveriges Riksbank.

Table 3. Main assumptions in the two scenarios

	Scenario	
	Bank-specific	System-wide
Secured wholesale funding	70 per cent is assumed to mature	100 per cent is assumed to mature
Unsecured wholesale funding	100 per cent is assumed to mature	100 per cent is assumed to mature
Deposits from general public	10-40 per cent is assumed to be withdrawn	5-15 per cent is assumed to be withdrawn
Lending to the general public	Unchanged	Unchanged
Foreign exchange (FX) swaps	100 per cent is assumed to mature	0 per cent is assumed to mature
Cover deficit with another currency	Cannot convert from one currency to another	Can convert from one currency to another
Tradable assets in liquidity reserve	0 per cent haircut	5-50 per cent haircut
Limit level for liquidity need	75 per cent LCR level in single currency	75 per cent LCR level in single currency

Note. For a complete table of assumptions, see Danielsson, M. and Manfredini, J. (2019), The Riksbank's method for stress testing banks' liquidity, *Staff memo*, November 2019. Sveriges Riksbank.

Source: The Riksbank

Banks have difficulty renewing their wholesale funding

Both scenarios assume that the bank exposed to stress has difficulties renewing its wholesale funding. This is due to investors in both cases having grounds to question the banks' economic situation. As a result, wholesale funding costs are assumed to rise to levels that are so high that it becomes more difficult for the banks to renew their funding. It is therefore assumed that a large share of, or all, wholesale funding falls due when the bonds and certificates mature. The system-wide scenario assumes that a larger share of wholesale funding falls due and creates cash flows compared to the bank-specific scenario.

The bank-specific scenario is instead based on assumptions of greater withdrawals of deposits. This is because there is greater scope for the general public to transfer money to other banks in Sweden when an individual bank encounters problems. It is therefore reasonable to expect that deposits will be transferred to other banks in such a scenario.

In the system-wide scenario, it is assumed that banks' liquid assets are more difficult to sell than in the bank-specific scenario. This is largely due to all banks being hit by stress at the same time. If banks simultaneously start to sell liquid assets to obtain funds, it will lead to a fall in the prices of these assets and consequently cause their value to decline.⁷¹ This reasoning is reflected by the assumption that liquid assets lose more value in the system-wide scenario.

⁷¹ Banks can also generate liquidity by using liquid assets for what are known as repo transactions. The amount of liquidity received by banks in these transactions can decrease, however, as a result of counterparties applying higher haircuts to liquid assets in the event of financial stress.

Banks continue to lend to the general public

The starting-point for the Riksbank's stress tests is that the banks shall be able to manage liquidity shocks without reducing their lending to the general public and non-financial corporations. Otherwise, the shock could lead to a credit crunch that will have negative effects on household consumption, corporate investment and the conditions for companies to operate. Such a development could lead to negative consequences for the real economy, which would not be compatible with the Riksbank's task. The Riksbank's starting-point in the scenarios is therefore that banks will maintain their lending to the general public and non-financial corporations even if they are hit by a severe liquidity disruption. Therefore, banks' existing lending to the general public and non-financial corporations is kept unchanged in both scenarios, which means that they issue the same amounts of new loans as the amounts repaid by their customers.⁷²

FX swaps are important for banks but also for insurance companies

One of the ways banks obtain foreign currency is by issuing short-term securities. With the help of FX swaps, the bank then exchanges the foreign currency for SEK, at the same time as they enter into an agreement to swap the currencies back at a predetermined price at a later date. An FX swap therefore involves a cash inflow in one currency and a cash outflow in another currency, both when the FX swap is entered into and when it matures.

A large share of the FX swaps made by banks are with Swedish insurance companies as counterparties. With the help of these, the insurance companies can buy foreign assets without taking an exchange-rate risk. Through the FX swap, the company obtains foreign currency, with which it can buy foreign assets. At the same time, the insurance company is obliged to repay the foreign currency in the future. In this way, the bank can be said to have borrowed SEK from the insurance company while the insurance company has borrowed foreign currency from the bank.

Even though FX swaps can remove the exchange-rate risk, the insurance company is exposed to other risks in connection with investments in foreign assets. If the maturity period of the investment is longer than for the FX swap, the insurance company must renew the swap during the investment period. This involves a risk as terms and prices can deteriorate. In the worst case, the company is unable to renew the swap at all, which may

⁷² In the scenarios, it is assumed that bank customers pay interest on and amortise their loans, and that the bank then uses these cash inflows to issue new loans so that the amount of outstanding loans is kept unchanged.

force it to sell its assets in foreign currency or take on an exchange-rate risk.

Uncertain whether FX swaps can be renewed in a stressed scenario

It is difficult to know in advance whether the bank can renew its FX swaps in a stressed scenario. The Riksbank therefore tests two extremes in the two scenarios. In reality, it is possible that the truth is somewhere in between these extremes.

In the bank-specific scenario, it is assumed that the economic standing of the individual bank is brought into question by the market. This means that uncertainty prevails with regard to the bank's debt-servicing ability and that the bank's counterparties consider the credit risk to be elevated. It will therefore be expensive for the bank to use FX swaps. This is assumed to lead to the bank not renewing its FX swaps, which instead fall due when the maturity period expires.

In the system-wide scenario, it is assumed instead that the outlook for an individual bank is no worse than for any other bank in the financial system. The bank is assumed to be able to continue to enter into FX swaps at a reasonable cost. The scenario therefore assumes that the bank continually renews its FX swaps. Consequently, no cash flows arise from these instruments.

Another assumption is that the bank, if it has a liquidity surplus in a currency, can use this to cover deficits in other currencies in the system-wide scenario. This is because the bank is assumed to still be able to exchange currencies with the help of FX swaps. Conversely, this is not possible in the bank-specific scenario as it assumes that the bank loses access to the FX swap market.

Liquidity needs arise before the liquidity reserves run out

As mentioned earlier, banks' have liquidity reserves that they can use to cover cash outflows that may arise in the event of financial stress. A feasible assumption in the Riksbank's stress tests could have been that banks can use all their liquidity reserves to cover their cash outflows. But such an assumption would not be realistic as market confidence in banks hit by liquidity shocks may very well be undermined before all their liquidity reserves are used. Furthermore, greater demand for liquidity can push up interest rates and thus the funding costs for banks and other financial institutions.

It is difficult to say exactly when a bank loses market confidence and when the costs of a liquidity shock become substantial. In the stress tests, it is assumed that banks can use their liquidity reserves down to an LCR of 75

per cent. In other words, it is assumed that banks are no longer able to cover their cash outflows themselves at a reasonable cost once this LCR level has been passed. In the stress tests, therefore, a liquidity need arises when the bank falls below this LCR level in any single currency.

The purpose of the Riksbank's stress tests is therefore to estimate the potential size of the bank's liquidity need when the bank or the financial system as a whole is hit by a liquidity shock. A description of how banks' liquidity needs develop in the system-wide and in the bank-specific scenario is presented below.

Banks have significant liquidity needs in the scenarios

Based on data reported by banks and the assumptions in table 3, banks' liquidity needs can be calculated in the two different scenarios. Chart 27 and chart 29 shows how the total liquidity needs of all banks develop over six months in the system-wide and the bank-specific scenario. At each time interval, the liquidity needs that have arisen up to that date are shown. The cumulative liquidity needs are shown in the charts. Each column shows the liquidity needs broken down into different currencies.⁷³

Chart 28 and chart 30 show a breakdown of cash flows during six months of stress and the liquidity reserves used by banks to cover the liquidity needs in the two scenarios. The charts show the sum of cash flows from various contract types broken down into different currencies. Positive values (right) lead to a reduction in the liquidity need while negative values (left) lead to an increase. The sum of the columns in the charts thus corresponds to the liquidity needs that arise during six months in each scenario respectively.

Results for the system-wide scenario

Major liquidity needs in USD and EUR

In the system-wide scenario, a prolonged liquidity need arises after about two months of stress. After that, the need will more than double after three months of stress, whereupon it will remain fairly unchanged during the following month. Thereafter, it continues to rise towards the end of the six-month period (see chart 27).

About half of banks' liquidity needs after six months consist of USD. The rest of the need is distributed between EUR, SEK and other currencies which constitute about a fifth each. After six months of stress, total liquidity needs amount to just over SEK 900 billion which corresponds to almost 7 per cent of banks' total assets.⁷⁴

One way to analyse the estimated liquidity need is to set it in relation to the extraordinary lending issued by the Riksbank to banks during the financial crisis of 2008-2009.

⁷³ Liquidity needs arise when banks' LCR levels in individual currencies fall below 75 per cent. The Riksbank can also use alternative limit levels in its stress tests, i.e. the limit level can be higher or lower than 75 per cent LCR. If a higher LCR level were to

be used, the effect would be a greater liquidity need while it would be less if the limit level were set to a lower LCR level.

⁷⁴ Banks' total assets refer to the average sum of their assets between the third quarter of 2018 and the second quarter of 2019.

At that time, the Riksbank’s extraordinary lending to banks rose rapidly from zero to almost SEK 460 billion in three months from October to December 2008. This can be compared with the estimated liquidity need of about SEK 500 billion that arises after three months in the system-wide scenario.

Banks’ short-term wholesale funding accounts for a large share of the liquidity needs

In the system-wide scenario, banks are hit by large cash outflows as they have problems renewing their short-term wholesale funding. Chart 28 shows that banks have large outflows from unsecured securities, such as bonds and certificates, that mature. In addition, banks have outflows when covered bonds mature, although they are slightly smaller. This is partly due to covered bonds being relatively long-term instruments.⁷⁵

In the scenario, outflows also arise due to banks’ financial counterparties, and to a certain extent, large non-financial corporations and the general public, choosing to withdraw all or some of their bank deposits.

In the system-wide scenario, it is also assumed that the bank’s customers may become short of liquidity as there is economic and financial turmoil. It is therefore assumed that customers use the credit and liquidity facilities made available to them by their banks, such as credit cards and overdraft facilities. This involves banks lending money to customers, causing further cash outflows.

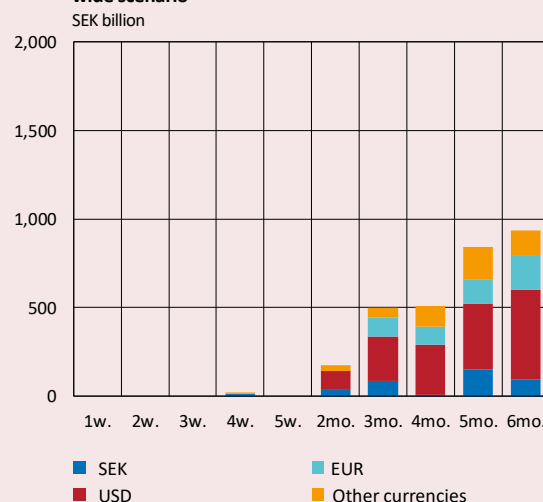
Chart 28 shows that no cash flows arise from FX swaps. This is due to the assumption that banks renew their FX swaps in the system-wide scenario. As banks typically have lent foreign currencies such as USD and EUR in FX swaps and received SEK⁷⁶, it means that they do not have any inflows of foreign currency in the scenario, but do not need to repay SEK either. This therefore contributes to banks having greater liquidity needs in USD and EUR (see chart 27).

Results for the bank-specific scenario

Large liquidity needs in SEK and other currencies

The bank-specific scenario reflects a liquidity shock in an individual bank. The Riksbank performs separate stress tests on each of the four banks included in the stress tests. As the stress tests are based on bank-specific sensitive data, the results are presented as the aggregate liquidity needs for the four banks in chart 29 and chart 30. This means that the liquidity needs are overestimated as the

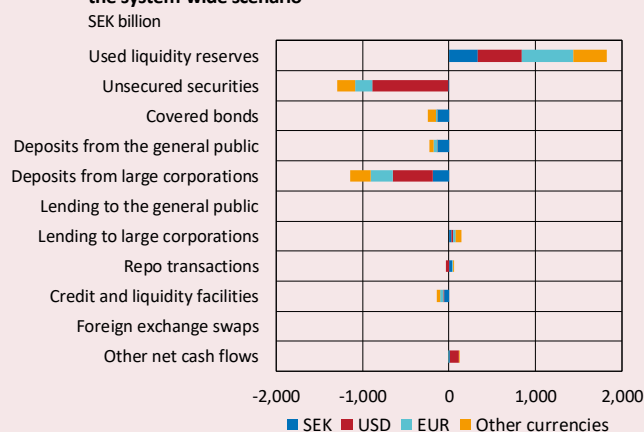
Chart 27. The sum of the banks’ liquidity needs in the system-wide scenario



Note. Accumulated liquidity needs over time. Other currencies include, among others, DKK, NOK and GBP.

Source: The Riksbank

Chart 28. Decomposition of cash flows during six months in the system-wide scenario



Note. Used liquidity reserves correspond to the excess reserves that the banks have above those reserves that are needed to keep an LCR of 75 per cent until the end of the six month period. Foreign exchange swaps refer to net cash flows. Repo transactions corresponds to net cash flows, that is, the difference between cash inflows from reverse repos and cash outflows from repos. The chart only presents the categories that will have the largest impact on the liquidity need, and the rest of the categories are summed in Other net cash flows. Note that the liquidity need, which corresponds to the sum of the bars, is expressed in negative terms, as opposed to chart 27 where it is expressed in positive terms.

Source: The Riksbank

scenario is to reflect just one bank being under stress. Presenting the liquidity need as an average for the four banks also provides an estimation of the potential liquidity need for a single bank.

If the cash flows for the four banks are added together, a liquidity need already arises in the bank-

means that only a relatively small part of the outstanding volume of these instruments mature within six months in the stress tests.

⁷⁶ Or other currencies such as DKK and NOK.

⁷⁵ The average remaining maturity on outstanding covered bonds was 3.2 years in 2018 according to statistics from the Association of Covered Bond Issuers (ASCB). This

specific scenario during the first week (see chart 29). This is due in part to the tendency of banks to have lower LCR levels in SEK and other currencies than in USD and EUR (see also the chapter “Vulnerabilities and risks in the Swedish banking system”). It is assumed in the bank-specific scenario that the banks are unable to use the surplus in individual currencies to cover deficits in other currencies. The effect will therefore be that the liquidity need arises earlier compared with the system-wide scenario, as the banks can only cover outflows with liquidity reserves in the same currency, which fall below an LCR level of 75 per cent early on.

After the first week, the liquidity needs continue to increase rapidly up to three months of stress. The needs also increase after that up to six months, albeit at a slower rate.

Just over half of banks’ total liquidity needs after six months consist of SEK while other currencies make up about two-fifths. As mentioned previously, “other currencies” include, for example, DKK, NOK and GBP. The rest consists of USD and EUR. At the end of the scenario, banks’ total needs amount to just over SEK 1,700 billion, which corresponds to about 12 per cent of their total assets.

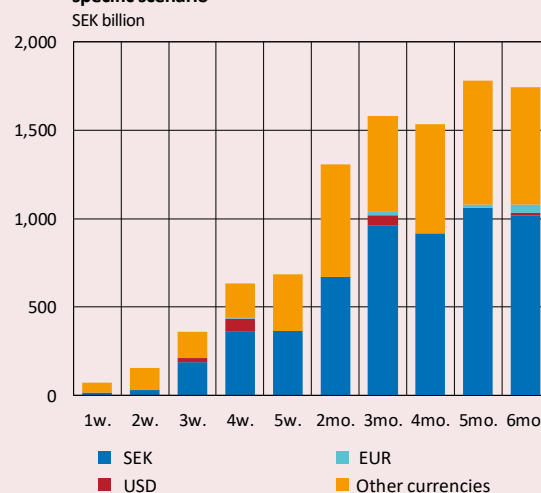
As described earlier, the bank-specific scenario aims to measure the liquidity need that arises in a bank hit by a liquidity shock. Measured as an average for the four banks, the need amounts to about SEK 425 billion, that is SEK 1,700 billion divided by four.

Large cash outflows as a result of bank runs and expiry of short-term wholesale funding

When a bank is exposed to bank-specific stress, it is assumed that it is hit by a bank run, i.e. many customers withdrawing their deposits from the bank. Chart 30 shows that the stressed banks combined (after the results of the four stress tests have been added together) have significant outflows linked to deposits from the general public and from large non-financial corporations. In addition, it is assumed as before that financial counterparties also choose to withdraw their deposits from the banks.

The bank-specific scenario assumes that the affected bank also has problems renewing its wholesale funding, due to investors questioning the bank’s financial situation. This means that the bank has to repay some of its wholesale funding. The bank has large outflows particularly when unsecured securities mature. However, it is assumed to be able to renew some of its covered bonds. Chart 30 therefore shows that the banks in total have large outflows of unsecured securities, but smaller outflows of covered bonds.

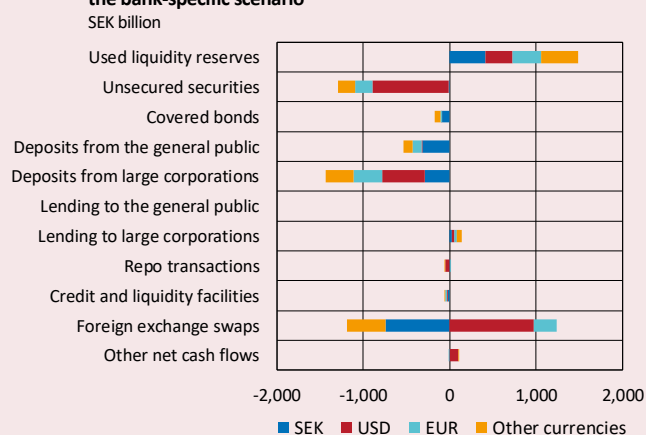
Chart 29. The sum of the banks’ liquidity needs in the bank-specific scenario



Note. Accumulated liquidity needs over time. Other currencies include, among others, DKK, NOK and GBP.

Source: The Riksbank

Chart 30. Decomposition of cash flows during six months in the bank-specific scenario



Note. See note in chart 28.

Source: The Riksbank

In the bank-specific scenario, it is assumed that the stressed bank’s FX swaps fall due when the maturity period expires. As the four banks included in the stress tests use these instruments to a large extent, the effect is that they will have both large outflows in some currencies and large inflows in other currencies. The effect of FX swaps falling due thereby helps considerably to explain in which currencies the banks have large liquidity needs. As the banks have typically borrowed SEK via FX swaps that are now assumed to fall due, this therefore contributes to banks having larger liquidity needs in SEK (See chart 29).

The assumptions about FX swaps affect the results

In conclusion, the assumptions about FX swaps have a major bearing on how the results in the different scenarios differ as regards the need in different currencies.

- In the system-wide scenario, a liquidity need arises mainly in USD and EUR. This can be partly explained by the banks in the stress tests continuing to provide their customers, e.g. Swedish insurance companies, with these currencies despite a deterioration in their own access to funding in the same currencies. Therefore, the banks receive no inflows of USD and EUR from FX swaps as these are renewed, but the banks must at the same time repay these currencies to the investors who bought their issued securities.
- In the bank-specific scenario, the needs mainly arise in SEK and other currencies such as DKK, NOK and GBP. This can be partly explained by the bank in the scenario losing access to the FX swap market and thus not continuing to provide its customers with USD and EUR. The bank therefore recuperates these currencies when the FX swaps mature, and can use them to repay the investors who have bought the bank's issued securities. When the FX swaps mature, however, the bank must pay back SEK and other currencies, which increases the need for these currencies.
- The stress tests have been calculated to demonstrate the effects of a liquidity shock on affected banks. However, the results of the stress tests also reflect that banks are closely interconnected with other participants in the Swedish economy. For example, the banks supply foreign currency to insurance companies via FX swaps so that these companies can hedge assets in foreign currency. This need arises partly because a portion of households' pension savings is invested overseas.⁷⁷ While banks have an important role in satisfying these needs, this means that a liquidity shock in the banking system can rapidly spread to other participants in the economy.

Stress tests can both overestimate and underestimate the liquidity needs

Economic and financial crises can take place in many different ways. It is therefore difficult to say what the effects of a crisis will be. Stress tests with a number of different assumptions are performed to try to manage this uncertainty.

There are a few main assumptions that can have a substantial impact on the outcomes. One is that neither

banks themselves nor authorities are assumed to take any measures to limit the effects of the liquidity shock. In practice, therefore, it is likely that the liquidity needs would be lower than indicated simply because banks and authorities implement different measures.

In addition, it is assumed in both scenarios that the conditions for banks to renew their wholesale funding deteriorate dramatically at the same time as total bank lending remains unchanged. The banks analysed in this article use a higher proportion of wholesale funding than, for example, comparable European banks (see the chapter "Vulnerabilities and risks in the Swedish banking system"). This assumption thereby has a significant impact on banks' liquidity needs in the scenarios.

In the stress tests, a liquidity need is assumed to arise when banks' LCR levels in individual currencies fall below 75 per cent. In a crisis, it is possible that banks need liquidity both at higher and at lower LCR levels. The stress tests can therefore both overestimate and underestimate the liquidity needs.

Several lessons to be learnt from the stress tests

The Riksbank's stress tests show that banks can have large liquidity needs and that these can arise in different currencies.

Banks normally exhibit relatively high LCR levels, especially in USD and EUR (see the chapter "Vulnerabilities and risks in the Swedish banking system"). This is also evident from the results of the stress tests, where the banks' liquidity needs are relatively small during the first 30 days. It can therefore be said that the LCR requirement increases banks' resilience in this time perspective. But as the Riksbank has previously highlighted, there are short-term liquidity risks that are not captured in LCR as they only measure stress within 30 days. The fact that a bank attains the minimum LCR requirement therefore says little about how it would cope with stress that lasted longer than a month.

The Riksbank's stress tests also show that banks' liquidity needs increase rapidly if financial stress continues over a few months and that the amounts are significant measured over six months. The ECB also notes in its liquidity stress testing exercise that the liquidity situations of some banks deteriorate considerably after the first month when the LCR time horizon has expired.⁷⁸

To increase their resilience, banks should therefore continue to reduce their liquidity risks by extending the maturity period of their funding. Such a change would limit the outflows that may affect banks in the event of a liquidity shock and would hence reduce their liquidity

⁷⁷ Se exempelvis, Nilsson, C. Söderberg, J. och Vredin, A. (2014), Det kollektiva pensionssparandets betydelse i det svenska finansiella systemet, *Ekonomiska kommentarer* nr 3. Sveriges riksbank.

⁷⁸ See *Sensitivity Analysis of Liquidity Risk – Stress Test 2019*, October 2019, European Central Bank.

needs. The conditions for banks to extend the maturity period of their funding partly depends on the services demanded by their customers. If bank counterparties in FX swaps, such as Swedish insurance companies, had demanded foreign currency in FX swaps with longer maturities, the banks in turn would have been able to obtain funding at longer maturities.

The stress tests also show that it is important for banks to keep adequate liquidity reserves as they buy banks more time in the event of financial stress. This consequently increases their chances of implementing measures to counter the liquidity shock. The stress tests also show that liquidity problems may arise in individual currencies and banks should therefore ensure they are protected against these problems by maintaining adequate liquidity reserves in all their significant currencies.