

Financial Stability Report

2019:2



The Riksbank's Financial Stability Report

The Riksbank's Financial Stability Report is published twice a year. In the report, the Riksbank gives an overall assessment of the risks and threats to the financial system and evaluates the system's resilience to them. The stability analysis is therefore an instrument that is directly linked to the Riksbank's task of promoting a safe and efficient payment system. By publishing the results of its analysis, the Riksbank wishes to draw attention to, and warn of, risks and events that might pose a threat to the financial system, and to contribute to the debate on this subject.

The Executive Board of the Riksbank has discussed the report on two occasions – 6 November and 18 November 2019. The report is available on the Riksbank's website, www.riksbank.se. The report takes into account developments up to and including 13 November 2019. The Financial Stability Report 2018:1, which is also available from the Riksbank's website, includes a glossary.

The Riksbank and financial stability

- The Riksbank has a mandate from the Riksdag (the Swedish parliament) to promote a safe and efficient payment system. Achieving this requires a stable financial system so that payments and the supply of capital function well. In practice, this task means that the Riksbank is responsible for promoting financial stability. The Riksbank defines financial stability as the financial system being able to maintain its three basic functions – the mediation of payments, the conversion of savings into funding, and risk management – and also having resilience to shocks that threaten these functions.
- The Riksbank can also provide liquidity support to individual institutions if problems arise that threaten financial stability. To be able to do this effectively, the Riksbank needs to be well prepared for crises by having an efficient crisis organisation with good information channels and tools for analysis, in addition to well-developed cooperation with other authorities.
- The Riksbank does not have the sole responsibility for promoting financial stability. It shares this responsibility with the Ministry of Finance, Finansinspektionen (FI, the Swedish financial supervisory authority) and Riksgälden (the Swedish National Debt Office). The Ministry of Finance is responsible for the regulation of financial corporations, FI for supervision and Riksgälden for central government's management of banks in crisis. The interaction between the authorities is important both in the preventive work and in the event of a crisis materialising. The same also applies internationally, as financial corporations increasingly operate across national borders.
- The financial system plays an important role in the economy. It is necessary to have a stable and smoothly running financial system for the economy to function and grow. A serious crisis in the financial system risks leading to extensive economic and social costs.
- The financial system is sensitive. This sensitivity is due to the vulnerability of central parts of the system, such as banks and markets. Banks are vulnerable mainly because they fund their operations at short maturities but lend at longer maturities. This imbalance makes them dependent on the general public and the market having confidence in them. If the confidence of market participants in their counterparties or in the financial instruments traded on the market declines, trading may suddenly come to a halt. The various parts of the financial system are also closely interconnected, for instance in that financial institutions borrow from and trade with one another to a large extent. This means that problems that arise in one institution or market can rapidly spread throughout the system. Contagion effects may also arise if there is a general fall in confidence in similar activities.
- The combination of the sensitivity of the financial system and the large potential costs of a financial crisis means that the state has a particular interest in preventing threats to financial stability. This is because banks and other market participants do not have an incentive to fully consider the risks to financial stability to which they contribute, as some of the costs of a financial crisis fall on others both within and outside the financial system. If a crisis occurs, the state also needs to be able to manage it at the lowest possible cost.
- The Riksbank analyses stability in the financial system on a continuous basis to enable the early detection of changes and vulnerabilities that may lead to a crisis. The main focus of the analysis is on the five major banks in Sweden (SEB, Swedbank, Handelsbanken, Nordea and Danske Bank) and on the markets and infrastructure that are important for their funding and risk management.
- In some cases the Riksbank recommends specific measures to counteract risks. These recommendations may be based on current economic developments. But they may also relate to more structural circumstances and stem from current regulatory issues. The recommendations can be aimed at banks and other market participants, as well as at legislators and other authorities.

Contents

STABILITY ASSESSMENT SUMMARY AND RECOMMENDATIONS 4

VULNERABILITIES AND RISKS IN THE FINANCIAL SYSTEM 7

Vulnerabilities and risks linked to international developments and low interest rates 7

Vulnerabilities and risks linked to household indebtedness 9

Vulnerabilities and risks in the corporate sector 14

Vulnerabilities and risks in the Swedish banking system 15

Vulnerabilities and risks in the financial infrastructure 22

ARTICLE – Stress tests of banks' liquidity 26

ARTICLE – Climate-related risks are a source of financial risk 34

STABILITY ASSESSMENT SUMMARY AND RECOMMENDATIONS

Slightly greater risks to financial stability

The risks to financial stability in Sweden are deemed to be slightly greater than in the spring. This is primarily because economic activity both in Sweden and abroad has slowed at the same time as many central banks have made monetary policy more expansionary during the year. Overall, this has contributed to expectations of very low interest rates in the coming years among market participants. This type of environment can lead to an increase in risk-taking, to assets being overvalued and to indebtedness increasing in an unsustainable manner. If the willingness to take risk were then to suddenly decrease, it could lead to substantial price falls and problems for financial stability.

There are already several signs of risk-taking and vulnerabilities having increased in the global financial system. For example, since the financial crisis of 2007-2009, indebtedness among households and companies has increased. Several participants have also turned to riskier and more illiquid assets to obtain higher returns. The greater risk-taking has contributed to several asset markets being highly valued in a historical perspective. In addition, many countries in the euro area are still struggling with high levels of sovereign debt and low profitability in the banking sector.

At the same time, there are several risks that could contribute to a faster economic downturn and increase turmoil on the financial markets. These include a possible escalation of the trade conflict between the United States and China, and a disorderly Brexit. Furthermore, several banks in both Sweden and the rest of Europe are being investigated for inadequate routines against money laundering. Were economic development to become significantly weaker than expected, it could expose vulnerabilities that have built up in the financial system.

Household debt poses the greatest domestic risk

Experience shows that financial crises and housing price falls have previously led to deeper and more permanent consequences if they have been preceded by sharply rising indebtedness. Similar to others, the Riksbank has therefore been warning against the risks and vulnerabilities associated with the rising indebtedness among Swedish households for a long time. It is therefore positive that debt is now growing at a slightly slower rate, new mortgagors are borrowing slightly less in relation to

their income, and that housing prices are not rising as rapidly as before. Indebtedness has been rising sharply for a long time, however, and is historically high. This means that the Swedish economy is vulnerable, especially if housing prices were to fall sharply.

Problems on the housing market require political solutions

The rise of household debt over a long period of time is not only due to interest rates having fallen but mainly to the housing market functioning poorly and the tax system not being well designed from a financial stability perspective. To address the fundamental causes of this high level of indebtedness, measures are required within housing and tax policy.

Further details of the political measures that are now planned in order to rectify the problems on the housing market were published in September. An increase in investment grants for the construction of rented accommodation and student housing is being proposed. In addition, there are plans to raise the maximum tax that can be deferred when selling a home. More comprehensive changes are required, however, in order to tackle the fundamental problems on the housing market. It is important, therefore, that politicians promptly adopt further measures.

If housing and tax policy measures are not implemented to the extent necessary and debt again starts to increase at a faster rate, macroprudential policy measures may need to be tightened. It is therefore important that FI continuously assesses the effects of its macroprudential policy measures and stands ready to act if the risks increase.

There are vulnerabilities in the Swedish banking system

There are also vulnerabilities in the Swedish banking system. These concern, above all, its size, concentration, interconnectedness, limited capital levels and, in some respects, low resilience to liquidity risks. The major banks in Sweden¹ also obtain much of their funding on international capital markets, which increases the vulnerabilities. Furthermore, the ongoing investigations into inadequate routines against money laundering could lead to a decline in confidence in the banks, which in turn may affect their ability to obtain funding.

¹ In earlier versions of the *Financial Stability Report*, the Riksbank focused on Handelsbanken, SEB, Swedbank and Nordea. This report also includes Danske Bank. The following terminological rules are used in the text: **major Swedish banks** refers

to Handelsbanken, SEB and Swedbank, while **major banks in Sweden** refers to Handelsbanken, SEB, Swedbank, Danske Bank and Nordea.

Alongside mortgages to households, the major banks in Sweden have significant lending to the corporate sector. Corporate indebtedness is high and has risen in recent years. Above all, borrowing via bonds and certificates has increased rapidly, primarily among commercial property firms. Historically, property firms have often played a crucial role in larger financial crises, both in Sweden and abroad. At present, development is strong in the sector, but this could change if economic conditions deteriorate.

Vulnerabilities in the banking system require measures

The vulnerabilities in the banking system highlight the importance of banks having sufficient capital and liquidity to be able to sustain their functions even if risks were to materialise.

The Riksbank's stress tests of the liquidity of four of the major banks show that they are sensitive to disruptions in their access to both wholesale funding and the foreign exchange (FX) swap market.

The stress tests highlight the importance of the major banks maintaining sufficient liquidity reserves, and that these reserves are held in each significant currency. The major banks in Sweden should also reduce their structural liquidity risks and continue to attain at least a Net Stable Funding Ratio (NSFR) minimum level of 100 per cent.²

The major banks also need to be transparent about the liquidity risks they take. They should therefore report their Liquidity Coverage Ratio (LCR) in each significant currency, including Swedish krona (SEK), at least once a quarter, and report their NSFR at least once a quarter.

The Riksbank is still of the opinion that the major Swedish banks need to increase their capital in relation to their total assets and that FI should introduce a leverage ratio requirement of at least 5 per cent.³ It is also important for foreign supervisory authorities to ensure that the other two major banks in Sweden are subject to equally stringent requirements.

Climate change and cyber threats create risk

Climate-related risks represent a comprehensive threat to the international financial system as they can affect both insurance companies and banks negatively. It is therefore important to include climate-related risks in the supervision of financial institutions and the oversight of financial stability. To be able to measure, price and manage climate-related risks, both financial and non-financial corporations need to improve their reporting of them.

Cyber risks are currently seen as one of the greatest threats to the international financial system and its participants. Authorities, banks and financial market infrastructures should therefore work to prevent cyber threats in their systems.

Measures needed for a safer financial infrastructure

There are currently risks and vulnerabilities in several of the financial market infrastructure systems. It is important to continue the work to reduce these.⁴

The Riksbank has previously noted shortcomings in the internal governance and control of the Riksbank's own system for large-value payments, RIX.⁵ RIX needs to be organised and governed in such a way that routines are well-documented and resources are allocated for appropriate governance and risk management. Since the spring, policy documents and work processes have been amended and clarified, but a number of changes still need to be made to operations, such as introducing regulations and routines, and starting to work in line with the new policy documents. The risks previously highlighted therefore, to some extent, remain.

Since the default of one of the participants in the autumn of 2018, the Swedish central counterparty Nasdaq Clearing has taken several measures to reduce the risk of substantial losses that can arise in such situations. Not all the planned measures have been implemented, however. It is important that the measures are implemented according to plan, and especially the one involving greater consideration of liquidation costs. Once the measures have been implemented, the risk of other participants having to meet the costs of winding down a failed participant's portfolio will also decrease.

Since 2013, the Riksbank has pointed out that Euroclear Sweden's system for the settlement of securities needs to be modernised as it has been risky to make necessary changes in the existing system. Euroclear Sweden has taken measures to reduce these risks and has also decided to modernise the system in the coming years to make it more flexible. Euroclear Sweden is also working to clarify the governance of the firm in relation to its parent company, which is important in order to enable Euroclear Sweden to complete the modernisation of the system. It is important for Euroclear Sweden to continue to prioritise the planned modernisation so that it can be implemented as safely as possible.

² An NSFR reporting requirement will be introduced within the framework of the EU banking package.

³ As a minimum requirement of 3 per cent will be introduced in mid-2021 within the framework of the EU banking package, such a requirement could be designed as a minimum requirement of 3 per cent and a national buffer requirement of 2 per cent.

⁴ The Riksbank's oversight of the financial market infrastructures is stipulated in the Sveriges Riksbank Act, as well as in CPMI-IOSCO's international principles.

⁵ The part of the Riksbank responsible for the operation of the RIX system is organisationally separate from the Riksbank's oversight of the system.

Table 1. The Riksbank's recommendations

Household indebtedness
The Government and Riksdag should, as soon as possible, take further measures within housing and tax policy to reduce the risks in the household sector. Macroprudential policy measures adopted should be retained and Finansinspektionen should stand prepared to adopt further measures.
Banks' capital levels
Finansinspektionen should introduce a leverage ratio requirement for the three major Swedish banks of at least 5 per cent. Foreign supervisory authorities should ensure that other major banks in Sweden are subject to equally stringent requirements.
Banks' liquidity risks
The major banks in Sweden should reduce their structural liquidity risks and continue to attain at least a Net Stable Funding Ratio (NSFR) minimum level of 100 per cent.
At least once a quarter, the major banks in Sweden should report their Liquidity Coverage Ratios (LCRs) in significant currencies, as well as their Net Stable Funding Ratios (NSFRs).

VULNERABILITIES AND RISKS IN THE FINANCIAL SYSTEM

The slowdown in the global economy and uncertainty surrounding the economic outlook and inflation prospects have contributed to many central banks having made monetary policy more expansionary. This development has resulted in market participants expecting continued very low interest rates in the coming years. This type of environment can lead to an increase in risk-taking, to assets being overvalued and to indebtedness increasing in an unsustainable manner. In Sweden, the high level of household indebtedness, combined with the banks' substantial exposures to the housing market make the Swedish financial system sensitive to shocks. Moreover, the Swedish banking system is large, concentrated, interconnected and cross-border, which could reinforce the negative consequences in the event of a shock. Banks and other financial institutions are also linked together in the financial infrastructure systems, which means that disruptions to these systems can rapidly spread throughout the whole financial system.

Vulnerabilities and risks linked to international developments and low interest rates

Sweden is a small, open economy with considerable foreign trade and a financial system that is dependent on international financial markets. Among other things, the major banks in Sweden obtain funding on these markets. Economic and political uncertainty abroad may affect economic activity in Sweden, and result in the banks finding it difficult to obtain funding if the uncertainty spreads to the international financial markets. High uncertainty abroad may thus also entail risks for Swedish financial stability.

Still considerable uncertainty abroad

The economy both in Sweden and abroad is slowing down after several years of strong economic activity and is heading towards a more normal economic situation.⁶ An economic slowdown need not in itself comprise any threat to financial stability. However, much poorer economic development than expected could expose vulnerabilities that have built up in the financial system. Despite some progress in recent years, many countries in the euro area, for instance, have been struggling for some time with high levels of sovereign debt and low profitability in the banking sector. This means that these countries and their banking systems are less well-equipped than others if economic development were to be much worse than expected.

There are several risks abroad that could contribute to a faster economic decline and increase turmoil on the financial

Table 2. Important developments for the financial system

The slowdown in the global economy has contributed to many central banks having made monetary policy more expansionary during the year and market participants now expect **very low interest rates** in the coming years. At the same time, **uncertainty abroad** persists, primarily as a result of the trade conflict between the United States and China, and Brexit.

Household indebtedness is high, but debt has been increasing at the same rate as income for some time. **Housing prices** are rising at a modest rate, but there is still uncertainty regarding the development.

The **banking system** has structural vulnerabilities, such as its size, large degree of interconnectedness and limited capital levels. In addition, several banks in both Sweden and the rest of Europe are still being investigated for inadequate routines against money laundering. However, profitability among the major banks in Sweden is still good and credit losses are low.

The financial infrastructure is working well on the whole and accessibility is mainly good. Measures have been taken to manage operational and financial risks, but some risks still remain until all of the measures have been fully implemented.

All in all, the risks to the financial stability of Sweden are deemed to be slightly greater than in the spring. This is primarily linked to the slowdown in the global economy, which has contributed to expectations of continued very low interest rates in the years ahead. This type of environment can lead to an increase in risk-taking, to assets being overvalued and to indebtedness increasing in an unsustainable manner.

⁶ See *Monetary policy report*, October 2019. Sveriges Riksbank.

markets.⁷ This applies in particular if several of them were to materialise at the same time. The risks include a possible escalation of the trade conflict between the United States and China, and negative effects of a disorderly Brexit. The EU and the UK government have negotiated a Brexit withdrawal agreement, which now needs to be approved by the UK parliament. However, the political situation in the UK is still uncertain and the country will have a new election on 12 December. The EU has approved the UK's request to extend the negotiations until 31 January 2020. Although the risk of a no-deal withdrawal now appears lower than before, there is still considerable uncertainty, and it is not possible to exclude a disorderly Brexit.

The international risks also include the fact that several banks in both Sweden and the rest of Europe are still being investigated for inadequate routines against money laundering.

Low interest rates can build up risk globally

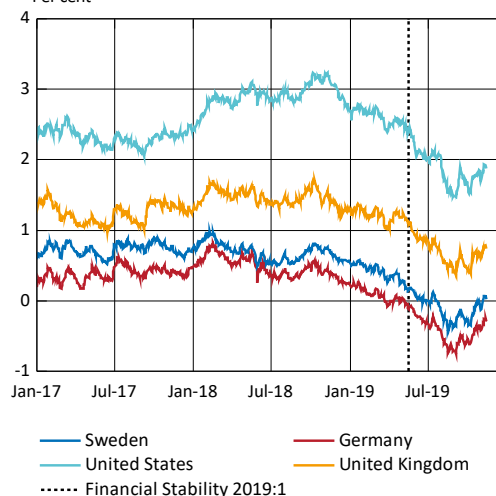
Global interest rates have been low for a very long time, due to both structural and cyclical factors. There has been a trend of increased propensity to save in many countries, at the same time as willingness to invest has declined. This has contributed to a fall in global real interest rates.⁸ After the last financial crisis, central banks around the world have also conducted very expansionary monetary policy.

The recent slowdown in the global economy has contributed to several central banks cutting their policy rates and maintaining or increasing their bond purchasing programmes. Financial market participants are also expecting central banks to conduct very expansionary monetary policy for a long time to come. Parallel to this development, government bond yields have also fallen since the spring (see Chart 1), while equity prices have risen (see chart 2).

Expectations of continued low interest rates in the coming years may lead to investors, including financial participants that are not banks, so-called non-banking financial institutions (NBFIs)⁹, turning to riskier and more illiquid assets to obtain higher returns. This risk-taking means that these participants are more sensitive to falling asset prices. In the assessment of the International Monetary Fund (IMF), vulnerability among NBFIs has increased since the spring and is now at elevated levels, primarily in the United States but also in the euro area, precisely because the NBFIs have increased their risk-taking.¹⁰

Another sign of increased risk-taking is that indebtedness is rising in the non-financial corporate sector. Loans to highly indebted companies with low or no credit ratings, so-called

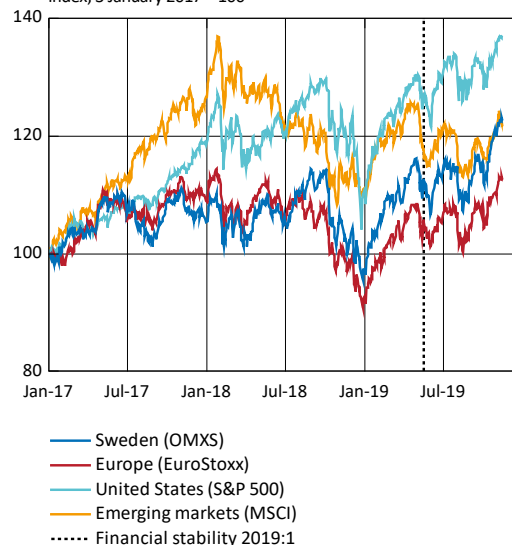
Chart 1. Government bond yields with 10 years to maturity
Per cent



Note. Implied zero-coupon yields from government bonds for Sweden, Germany and United Kingdom. 10-year benchmark bonds for the United States.

Sources: The national central banks and the Riksbank

Chart 2. Stock market movements in domestic currency
Index, 3 January 2017 = 100



Source: Macrobond

⁷ See the separate appendix for additional charts on developments on the financial markets and the situation in the major banks in Sweden and among their borrower groups (www.riksbank.se).

⁸ See, for instance, Rachel, L. and Smith, T. (2017), Are low real interest rates here to stay?, *International Journal of Central Banking* 13(3): 1-42.

⁹ Non-banking financial institutions here refers to financial institutions not counted as banks, particularly investment and pension funds, and life insurance companies.

¹⁰ See the *Global Financial Stability Report*, October 2019. International Monetary Fund.

leveraged loans, have increased in the United States (US) in particular, although the growth rate has slowed down somewhat since 2018.¹¹ If economic activity weakens or if the financial conditions worsen markedly, these companies may experience problems repaying their loans, which could affect banks with exposures to this type of loan. However, European banks are not considered to have such large exposures to these loans as US and global banks.¹² An additional sign of investors' search for yield is the high valuations on several asset markets globally. It is the IMF's assessment, for instance, that equity markets could be overvalued in the US and Japan. The European Systemic Risk Board (ESRB) has in recent years also highlighted the rapid price rises in housing and commercial property in Europe.

Climate change and cyber threats pose risks to the global financial system

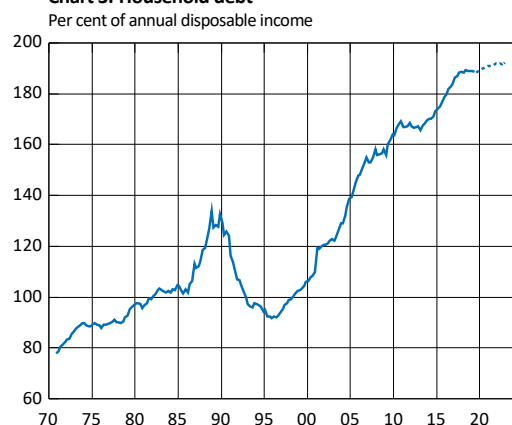
Other global risks may also affect financial stability in Sweden. One overall threat to the international financial system is climate change and the global transition to a less fossil-based economy. Both the effects of global warming and the transition itself create climate-related risks. This in turn gives rise to financial risk, which can have a negative effect on both insurance companies and banks. If there is not sufficient resilience to these risks, there can be consequences for financial stability (see the Article "Climate-related risks are a source of financial risk").

Moreover, the financial system is exposed to cyber risks, that is, the risk that it will be subjected to an attack where someone makes use of weaknesses in a participant's IT system, processes or personnel. Cyber risks are currently seen as one of the greatest threats to the international financial system and its participants, and they thereby also pose a threat to Swedish actors.¹³

Vulnerabilities and risks linked to household indebtedness

As far as Sweden is concerned, the sharp increase in housing prices and household indebtedness (see chart 3) entail a substantial risk. One indicator the Riksbank has produced shows that real house prices and rising indebtedness have contributed to historically high vulnerabilities (see chart 4).

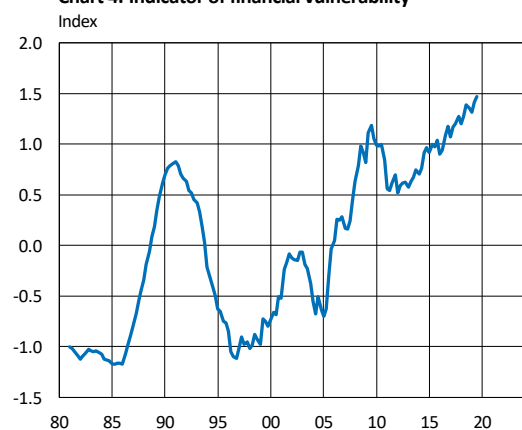
Chart 3. Household debt



Note. Total household debt as a share of disposable income summed over the past four quarters. The dashed line represents the Riksbank's forecast. Statistics Sweden has recently revised the National Accounts, which has contributed to an increase in the debt-to-income ratio. Data before 1993 has not yet been revised.

Sources: Statistics Sweden and the Riksbank

Chart 4. Indicator of financial vulnerability



Note. The indicator is based on deviations from trend in three underlying variables: lending to households and companies in relation to GDP, real house prices and the relationship between non-stable and stable financing sources for the Swedish banking sector. For more information, see Giordani, P., Spector, E. and Zhang, X. (2017), A new early warning indicator of financial fragility in Sweden, *Economic Commentaries* no. 1. Sveriges Riksbank.

Sources: Statistics Sweden and the Riksbank

¹¹ There is no clear-cut definition of what constitutes a leveraged loan. It is common to base it on a company's credit rating or indebtedness in relation to earnings before interest, taxes, depreciation and amortisation (EBITDA). A loan can also be classified as leveraged if the yield differential in relation to, for example, government rates or an average bank rate is high. Leveraged loans are often arranged by several lenders together (syndication). In addition to banks, private equity investment companies are often involved in the transaction.

¹² See Leveraged lending. Chapter in *Financial Stability Report*. July 2019. Bank of England.

¹³ For more information, see *Cyber-resilience: range of practices*, December 2018. Bank for International Settlements and *Cyber incident response and recovery*, May 2019. Financial Stability Board.

The upturn in housing prices and indebtedness has not only been due to the fall in real interest rates and expansionary monetary policy, but also to structural problems on the housing market.¹⁴ The Riksbank has for long warned of the consequences of the poorly functioning housing market, and considers there to be a continued need for structural measures on the housing market to reduce the risks linked to household debt. Individual housing policy measures and changes in tax regulations are not enough. They can moreover have distorting effects. What is needed instead is a comprehensive review of these areas and a broad reform package that creates a better balance between supply and demand. The lack of such measures being implemented has contributed to the sharp increase in household indebtedness and is thus an important reason for why there has been a need for macroprudential policy measures. If structural measures had been introduced earlier, the need for macroprudential policy measures would probably have been smaller.¹⁵

The risks linked to Swedish household indebtedness have been highlighted by both domestic and international bodies, such as the IMF, the Organisation for Economic Co-operation and Development (OECD), the European Commission and the ESRB.¹⁶ In September, the ESRB issued a recommendation emphasising the importance of Sweden taking structural measures to reduce the risks linked to household indebtedness and to achieve a better-functioning housing market.¹⁷ The ESRB also recommends that the Swedish authorities should be ready to implement new or sharpen existing macroprudential policy measures if risks are to increase.

Continued subdued price growth on the housing market and fewer housing starts

Housing prices have increased rapidly for a long time, and the rate of price increase in Sweden has also been high from an international perspective (see chart 5). However, since the fall in prices in the autumn of 2017, prices have increased at a slower rate (see chart 6). At the same time, housing construction has decreased and confidence indicators suggest weak development in the sector. Smaller housing developers have had problems with profitability and difficulties in starting new projects.¹⁸ Construction continues to be high

¹⁴ See Structural problems on the housing market. Fact box in *Financial Stability Report 2019:1*. Sveriges Riksbank.

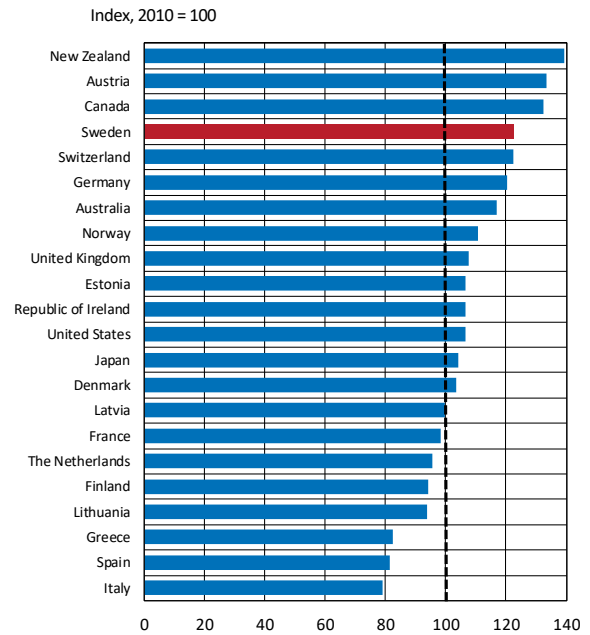
¹⁵ In 2016, the first amortisation requirement was introduced, obliging new mortgagors to amortise 1 per cent if their loans make up 50-70 per cent of the value of the home, and 2 per cent if the loans exceed 70 per cent of the value. In 2018, a stricter amortisation requirement was introduced, obliging new mortgagors to amortise a further 1 per cent if their loans exceed 4.5 times their gross income.

¹⁶ See, among others, *Country Report Sweden*, February 2019, European Commission and *Financial System Stability Assessment Sweden*, October 2016. International Monetary Fund.

¹⁷ See *ESRB/2019/09 on medium-term vulnerabilities in the residential real estate sector of Sweden*, September 2019. ESRB.

¹⁸ Even if several of the smaller companies would have problems in maintaining their operations, this would not necessarily entail any major risks for the Swedish economy, see New production of housing and financial stability. Article in *Financial Stability Report 2018:2*. Sveriges Riksbank.

Chart 5. Development of house prices in relation to disposable income

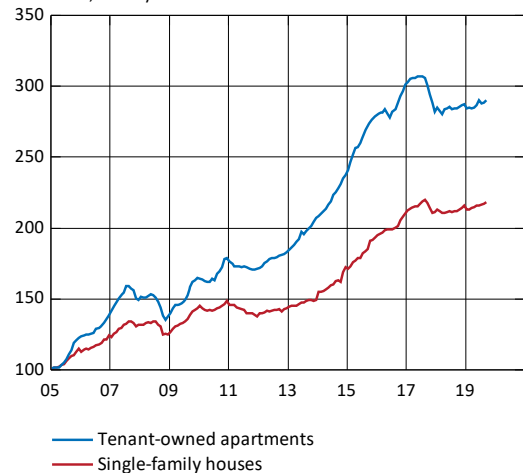


Note. The chart shows how housing prices have developed in relation to disposable income between 2010 and 2018. If the prices have developed in line with disposable income, the column will be around the dashed black line at 100.

Source: OECD

Chart 6. Housing prices in Sweden

Index, January 2005 = 100

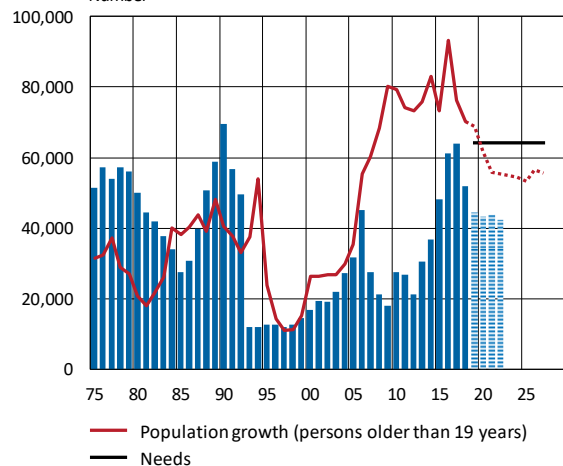


Note. Housing prices are seasonally adjusted.

Sources: Valueguard and the Riksbank

Chart 7. Housing construction and population growth

Number



Note. Need refers to the forecasts from Boverket. The columns refer to housing starts and the dashed columns refer to the Riksbank's forecast. The dashed red line refers to the population projection from Statistics Sweden.

Sources: Boverket, Statistics Sweden and the Riksbank

from a historical perspective but is still low in relation to population growth and housing needs as estimated by Boverket (National Board of Housing, Building and Planning) (see chart 7).

The number of tenant-owned apartment sales decreased slightly when the latest amortisation requirement was introduced, particularly in Stockholm. However, the number of sales increased again in 2019. In combination with increasing numbers of households expecting rising prices, this could suggest slightly greater price increases in the period ahead. At the same time, the amortisation requirements are subduing demand. In addition, the continued high supply of housing is contributing to the Riksbank's assessment that prices will continue to rise at a modest rate.

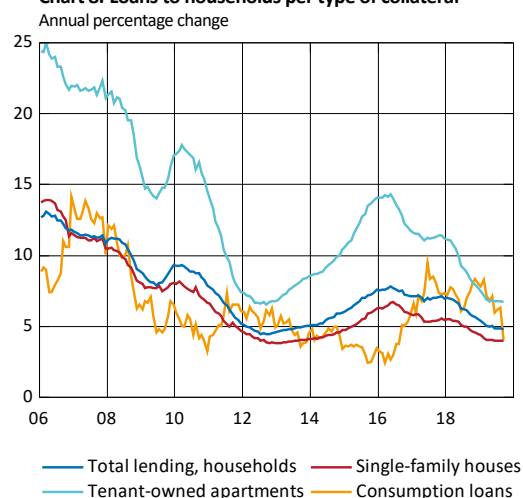
However, it is uncertain how housing prices will develop in the future. Several studies indicate that price growth in Sweden can be explained by fundamental factors such as low interest rates.¹⁹ But even if these factors can explain why housing prices have increased historically, there is nothing to suggest that the development of these factors cannot reverse and thereby cause housing prices to fall. As Sweden is a small and open economy, this means that these fundamental factors are determined to a large extent by global developments. Both households and banks have large exposures to the housing market, which means that a large fall in prices could have consequences for macroeconomic and financial stability in Sweden.

Household debt is growing at a slightly slower rate

Lending to households is growing at an annual rate of almost 5 per cent (see chart 8). The development of household mortgage debt is affected by several factors.²⁰ For example, the development of prices on the housing market, how much housing is being built and existing home-owners' willingness to raise new loans are three factors with significance for how rapidly debt increases (see chart 9).

The first of these factors is particularly important in this context. A typical home-buyer has needed to borrow a larger amount than the previous owner, in line with the increase in housing prices. The slight fall in prices in the autumn of 2017 is, therefore, leading to new mortgages being slightly smaller than they would have been had prices continued to rise. This could be one reason for lending now growing at a more subdued rate. However, as prices have risen for a long period and only a smaller share of existing homes are sold on the market every year, those homes are, on average, sold for a higher price than the seller paid when purchasing the home.

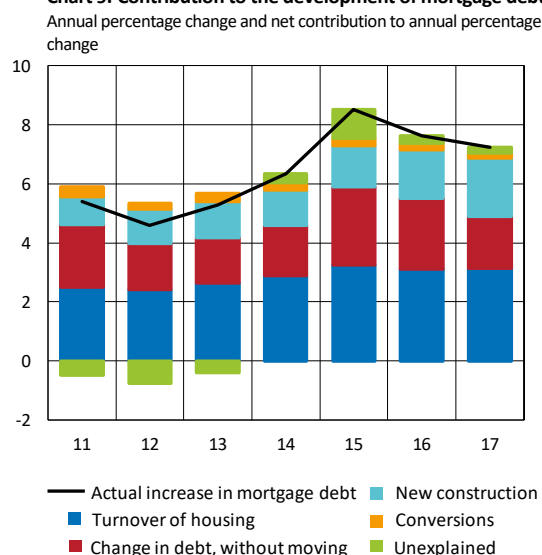
Chart 8. Loans to households per type of collateral



Note. Refers to loans from monetary financial institutions (MFI).

Sources: Statistics Sweden and the Riksbank

Chart 9. Contribution to the development of mortgage debt



Note. Change in debt refers to the net of debt increase and debt decrease among households that do not move.

Sources: Statistics Sweden and the Riksbank

¹⁹ See Dermani, E., Lindé, J. and Walentin, K., (2016), Is a bubble forming in Swedish housing prices? *Economic Review*, 2016:2. Sveriges Riksbank and Claussen, C. A., Jonsson, M. and Lagerwall, B., (2011), A macroeconomic analysis of housing prices in Sweden, *The Riksbank's commission of inquiry into risks on the Swedish housing market*. Sveriges Riksbank.

²⁰ See Emanuelsson, R., Katinic, G. and Spector, E. (2018), Developments on the housing market and their effect on household debt, *Economic Commentaries* no. 14. Sveriges Riksbank.

Housing prices thus affect credit growth among households, albeit with a clear time lag.

If housing prices continue to rise at a modest rate, this can be expected to contribute, over the longer term, to a more sustainable development of household debt.

Indebtedness is high and combined with variable interest rates

An evaluation of the more stringent amortisation requirement introduced in March 2018 shows that new mortgagors are borrowing less as a result of the new requirement.²¹ This suggests that the requirement has had the intended effect. At the same time, the debt stock in Sweden is large, in relation to both GDP and disposable household income. In addition, the debt stock has been increasing substantially for some time. If debt via housing cooperatives is included, household debt as a proportion of disposable income amounts to just over 209 per cent. This also includes consumption loans, which have grown rapidly in recent years.

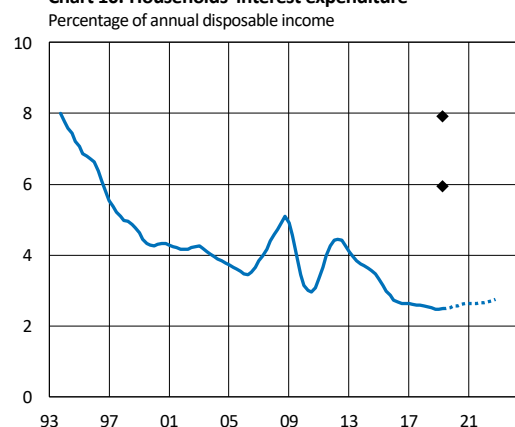
Just over 60 per cent of household mortgages have an interest-rate fixation period of up to three months. At present, households' interest payments in relation to their disposable income are historically low. However, the high level of indebtedness, combined with low and variable interest rates, means that changes in the interest rate have a faster and larger impact on disposable household income. The most heavily indebted households are particularly sensitive to changes in the interest rate and, for the 10 per cent of households that are most heavily indebted, an increase in the interest rate by one percentage point would result in an increase in interest expenditure of just over 6 per cent, according to the Riksbank's microdata from 2017.²²

The Riksbank's assessment in early 2017 of the long-run repo rate lies in the interval 2.5–4 per cent. Such a level of the repo rate would lead to a significant increase in households' interest expenses (See chart 10). Even though interest rates are expected to be low for a long time to come, the chart illustrates that the increase in indebtedness over a long time has contributed to an increased interest rate sensitivity among households.²³

The high level of indebtedness constitutes a major vulnerability in the Swedish economy

The results of the stress tests conducted by FI indicate that new mortgagors generally are well able to cope with rising

Chart 10. Households' interest expenditure



Note. Four-quarter moving average. The dashed line represents the Riksbank's forecast. The rhombuses illustrate an interval for the interest expenditures that is calculated on the current debt-to-income ratio, a long-term interval for the repo rate of 2.5–4 per cent and an assumption of a 2-percentage-point margin between the repo rate and the interest rate faced by households. Interest expenses have been adjusted for tax relief.

Sources: Statistics Sweden and the Riksbank

²¹ See Fewer vulnerable households after stricter amortisation requirement, *FI-analys 17*, March 2019. Finansinspektionen.

²² As no data is available on individual households' interest-bearing assets, the overall effect of interest rate adjustments on the disposable incomes of individual households cannot be calculated. See Gustafsson, P., Hesselman, M. and Lagerwall, B. (2017), How are household cashflows and consumption affected by higher interest rates?, *Staff memo*, December 2017. Sveriges Riksbank.

²³ In July 2019, the Riksbank's assessment was that the repo rate will therefore probably be lower than its long-term level for quite a long period to come. See The long-term repo rate. Fact box in *Monetary Policy Report*, July 2019. Sveriges Riksbank.

interest rates and losses of income in the event of unemployment. Households currently have large assets and their total savings are historically high. However, the value of real and financial assets can fall in times of economic turmoil, while the size of the debt remains unchanged. Another factor to consider is that significant parts of the savings are tied up in illiquid assets. In addition, households' own financial savings have been decreasing for a time.²⁴

The distribution of assets between households with high and low debt is also of considerable significance for the risk assessment. It is not possible, however, to analyse this at present, as data on households' assets is not gathered at the individual and household level. This makes it more difficult to assess the resilience of households. Better information on households' assets and liabilities is something that the Riksbank has been requesting for a long time.²⁵

Even if the majority of households could probably pay their debts in a scenario with falling housing prices and a more substantial economic slowdown, this could lead to a sharp fall in household consumption. Several studies based on household data from the last financial crisis show that highly indebted households reduced their consumption more than households with low debt (see the fact box "The relationship between household debt and consumption during the financial crisis, 2007-2009"). In turn, this could contribute to lower profitability for Swedish companies, rising unemployment and, ultimately, to increased credit losses for the banks. In such a scenario, confidence in the banks could decline and they could then face problems in renewing their funding.

Increasing indebtedness over such a prolonged period contributes towards making the Swedish economy more vulnerable. It also increases the risk of the economy entering a negative spiral in which consequences for macroeconomic developments, and ultimately financial stability, could be considerable. More subdued housing price and debt growth are therefore positive from the financial stability point of view of.

The relationship between household debt and consumption during the financial crisis, 2007-2009

Empirical studies show that financial crises preceded by sharp increases in debt tend to have deeper and longer-lasting consequences for economic activity.²⁶ At the same time, studies based on microdata in Denmark, the United Kingdom and the United States show that highly indebted households reduced their consumption more than less indebted households in conjunction with the financial crisis of 2007-2009.²⁷ This could indicate that the high and rising indebtedness among households ahead of the crisis provides an explanation for why consumption fell so sharply in these countries in conjunction with the crisis. However, it is difficult to determine the reason for why consumption fell in these countries or why highly indebted households reduced their consumption more than less indebted households.

The research literature discusses several feasible explanations for why highly indebted households reduce their consumption more if a crisis occurs and housing prices fall. One is that highly indebted households are forced to reduce their consumption because they have previously relied on loans in order to maintain a high level of consumption. When banks tighten their lending standards, these households are unable to maintain this level of consumption.

Another hypothesis is that highly indebted households reduce their consumption as a precaution, for example, if housing prices fall so much that their loans exceed the market value of their home.

However, the difference in consumption behaviour between highly indebted households and less indebted households during crises does not necessarily have a crisis-specific explanation. Other studies show a more general pattern where households that have increased their consumption and indebtedness tend to decrease their consumption more sharply a few years later, than those households that have not increased their debt – regardless of whether there has been a crisis or not. An example of this is when a household purchases durable consumer goods, such as a car, and finances the purchase by increasing the loan with their home as collateral or by taking on a consumption loan. Consumption then increases temporarily before decreasing in subsequent years, as the household does not need to make the same major purchase again. According to this hypothesis, the larger decrease in consumption among highly indebted households is thus not mainly due to the level of debt as such, or to anything specific that happens during the crisis.

All in all, it is difficult to reach any unambiguous conclusions as to why highly indebted households reduce their consumption more than less indebted households – there may be a number of potential explanations. It is thus difficult to work out exactly what the causal links look like. At the same time, the studies mentioned above indicate that household debt has played a significant role in several countries during various financial crises. It is in light of this, among other things, that the Riksbank has long considered household indebtedness to be a major risk for the Swedish economy.

²⁴ See chart A16 in the appendix.

²⁵ See the Riksbank's petition to the Riksdag 2018/19:RB4, *Statistics on households' assets and liabilities*.

²⁶ See Dealing with household debt, *World Economic Outlook*, April 2012, International Monetary Fund, Jordà, O., Schularick, M. and Taylor, A.M. (2015), Leveraged bubbles, *Journal of Monetary Economics*, 76: 1-20 and Jordà, O. Schularick, M. and Taylor, A.M. (2014), The great mortgaging: housing finance, crises, and business cycles, *NBER Working Paper No. 20501*.

²⁷ See, for example Dynan, K. (2012), Is household debt overhang holding back consumption?, *Brookings Papers on Economic Activity*, Brookings Institution, Bunn, P. and Rostom, M. (2014), Household debt and spending, *Quarterly Bulletin Q3*. Bank of England and Andersen, A. L., C. Duus and T. Lærkholm Jensen, (2016), Household debt and spending during the financial crisis: Evidence from Danish micro data, *European Economic Review* 89, 96-115.

Vulnerabilities and risks in the corporate sector

For several years, strong economic activity combined with low financing costs both in Sweden and abroad, has resulted in favourable conditions for non-financial corporations. Swedish companies' debt has also increased in relation to GDP (see chart 11). It is, above all, market-based financing through certificates and bonds that has increased rapidly in recent years.

In 2018, historically high volumes of corporate bonds were issued in SEK and, so far, it seems like the levels for 2019 will be as high. In recent years, property companies account for a large proportion of the issued volumes in SEK, just over 40 per cent. It is positive that companies are combining bank loans with market-based financing, as this spreads the risks. However, market-based financing itself also entails risks. For example, companies may encounter difficulties in refinancing their loans if prospects in their own sector change significantly or if turmoil arises on the financial markets.

Loan-to-value ratios have fallen in most sectors as assets have grown faster than debt. Companies' interest expenditure in relation to their net sales and to earnings before interest and taxes (EBIT) are also historically low (see chart 12). The default rate has increased slightly since the beginning of 2018, but is still on relatively low levels.²⁸

Low interest rates for a prolonged period can increase vulnerabilities in the commercial property sector

Property companies, companies that mostly own and manage properties, constitute a large share of total corporate borrowing via banks and securities. The commercial property sector, both in Sweden and abroad, has often had an important role in larger financial crises. Among other things, this is due to the sector being large and highly cyclical, and to these companies having a large share of debt. For example, the major banks in Sweden have significant lending to commercial property companies.

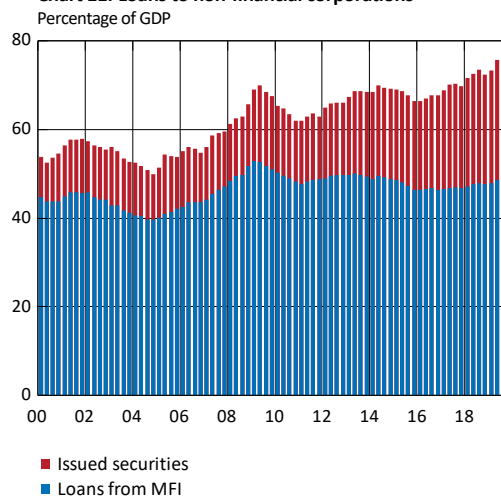
The development in the commercial property sector is currently strong. Corporate demand for premises has been good in recent years. Few premises are vacant and rents for offices have risen, particularly in central parts of Stockholm, even if there has been a certain slowdown over the last year. The high demand for premises is contributing to a higher net operating income²⁹ for property companies, which, in turn, has contributed to an increase in property values (see chart 13). The fall in income return³⁰ over time is probably partly due to the investors acquiring properties having adjusted

²⁸ See chart A23 in the appendix.

²⁹ Net operating income is defined as rental income minus operating and maintenance costs and property tax.

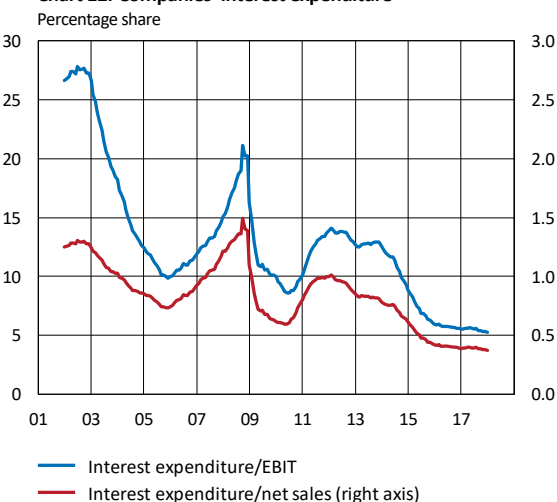
³⁰ For commercial property, income return is calculated as the difference between rental income and operating and maintenance costs for a property or property company, in relation to the price an investor has paid for the property.

Chart 11. Loans to non-financial corporations



Sources: Statistics Sweden and the Riksbank

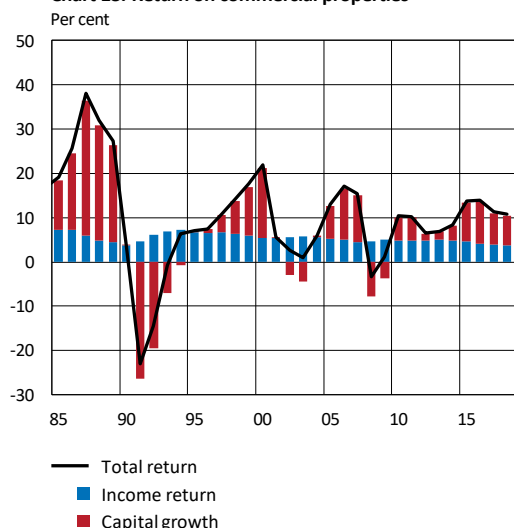
Chart 12. Companies' interest expenditure



Note. Interest expenditure is based on monthly data, while earnings before interest and taxes (EBIT) and net sales are based on annual data, which have been interpolated to monthly data so that the ratios can be calculated.

Sources: Statistics Sweden and the Riksbank

Chart 13. Return on commercial properties



Source: MSCI

down their required rate of return as interest rates have fallen.

There are, however, risks attached to the rising property values. Excessive optimism could result in investors becoming willing to pay prices above long-term fundamental market values. If expectations were to change, falling prices could thus be the result. In addition, the companies' rental income could fall if economic activity was to weaken faster than expected. Rising interest rates could also lead to a sharp increase in companies' funding costs. In general, property companies have lower income in relation to their interest expenditure than companies in other sectors, which implies that they are particularly sensitive to rising interest rates.³¹

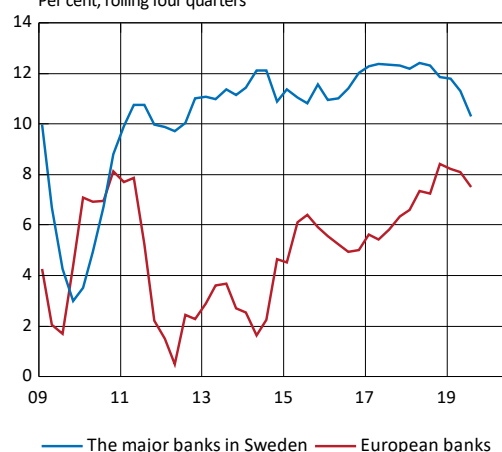
Vulnerabilities and risks in the Swedish banking system

The five major banks in Sweden have continued to show strong earnings and low credit losses, which has led to low funding costs.³² Their cost-effectiveness also remains favourable compared with that of other European banks, even though the difference has decreased (see the fact box "How is the cost effectiveness of banks measured?").³³ The relatively better cost-effectiveness is helping the major banks in Sweden to have comparatively higher returns on equity (see chart 14).³⁴ However, the low interest rates and the increased competition on the mortgage market, among other things from new market participants, could contribute towards lower profitability for the major banks going forward.³⁵

The equity prices of the major banks in Sweden have largely remained unchanged since the spring after having fallen during the summer (see chart 15). Among other things, the fall was due to continued uncertainty surrounding the outcome of the inquiries into shortcomings in the banks' anti-money laundering routines. Downwardly revised growth prospects and falling market rates, both in Sweden and globally, have also affected equity prices.

Chart 14. Return on equity

Per cent, rolling four quarters

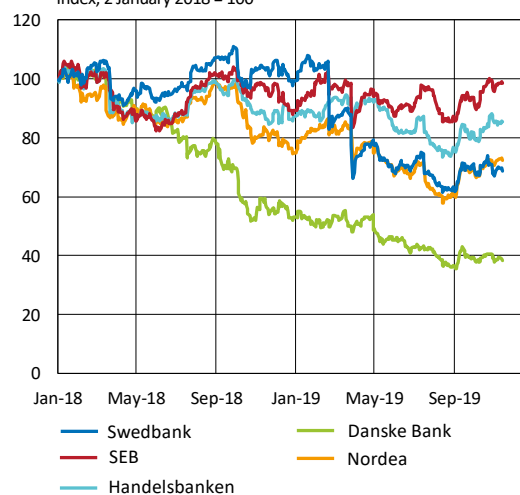


Note. Unweighted average adjusted for nonrecurring items.

Sources: SNL Financial and the Riksbank

Chart 15. Equity prices of the major banks in Sweden

Index, 2 January 2018 = 100



Source: Bloomberg

³¹ See *The Commercial Real Estate Market and Financial Stability*, May 2019. Finansinspektionen.

³² In earlier editions of the *Financial Stability Report*, the Riksbank focused on Handelsbanken, SEB, Swedbank and Nordea. This report also includes Danske Bank. The following terminological rules are used in the text: **major Swedish banks** refers to Handelsbanken, SEB and Swedbank, while **major banks in Sweden** refers to Handelsbanken, SEB, Swedbank, Danske Bank and Nordea.

³³ In the most recent figures, both return on equity and cost-effectiveness have fallen slightly among the major banks, primarily due to one of the major banks being burdened by large depreciation and higher exceptional and extraordinary expenses in the third quarter of 2019.

³⁴ The comparison banks are BBVA, Banco Santander, Barclays, BNP Paribas, Commerzbank, Crédit Agricole, Credit Suisse, DNB, Erste Bank, BPCE, HSBC, Intesa Sanpaolo, KBC, Lloyds, Raiffeisen, RBS, Société Générale, UBS and UniCredit.

³⁵ See *New players on the mortgage market*. Article in the *Financial Stability Report* 2018:1. Sveriges Riksbank.

The banking system is large, concentrated, interconnected and cross-border

The Swedish banking system is large in comparison with many other banking systems in the EU. Including foreign banks' operations, the banking system's total assets amount to just over 250 per cent of GDP.³⁶ Following Nordea's relocation to Finland, the Swedish banking sector's size as a proportion of GDP has fallen. At the same time, the element of foreign-controlled branches and subsidiaries has increased, as Nordea, like Danske Bank, is now a foreign bank with significant operations in Sweden.

The five major banks in Sweden are responsible for about 80 per cent of all lending to households and non-financial corporations with property as collateral. In addition, they are closely interconnected. For example, the major banks are some of the largest owners of each other's covered bonds. The combined holdings, by four of the major banks, of each other's securities amount to approximately SEK 150 billion on average over three years, which corresponds to about 25 per cent of their Common Equity Tier 1 (CET1). All in all, this means that a shock to a bank can spread to the entire financial system.

In addition, some banks have a significant part of their operations in other Nordic-Baltic countries. Shocks in one country can thus spread, leading to serious consequences for several countries in the region and being costly to manage. Furthermore, a large part of the banking sector's covered bonds are owned by international investors. Historically, these investors have turned out to be fickle than domestic investors and could exacerbate a financial shock if they sell large parts of their holdings at the same time.

Money laundering risks reducing confidence in the banking sector

Several Swedish and Nordic banks have previously been sanctioned and warned due to shortcomings in their anti-money laundering routines. At present, several investigations are ongoing on both the national and international level, in which alleged inadequate routines against money laundering in Swedish and Nordic banks is being examined. In addition, FI and the Estonian financial supervisory authority have decided to initiate a review procedure for sanctions against Swedbank.

The Swedish regulations against money laundering have been strengthened in recent years, but work remains to be done on securing effective regional cooperation and ensuring that the responsible authorities have sufficient resources to secure good supervision and effective monitoring.³⁷ As

³⁶ Swedish banking groups and foreign banks' operations in Sweden are included here. For further information, see the appendix.

³⁷ Several changes taking place in Sweden are part of Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing.

How is the cost-effectiveness of banks measured?

The cost-effectiveness of banks is often measured in terms of costs relative to income. This is usually called the C/I ratio. If the banks' costs increase in relation to income, the measure goes up. Conversely, the measure falls if the banks' costs decrease in relation to income.

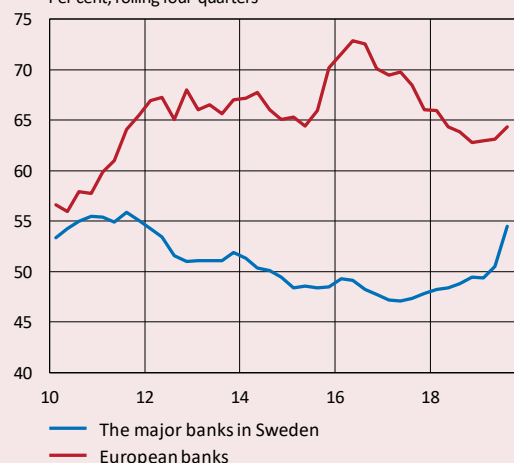
Following the financial crisis, the European banks' C/I ratios rose, at the same time as they fell for the major banks in Sweden. In recent years, the trend has been reversed, even if C/I ratios continue to be significantly lower for the major banks in Sweden than they are for European banks (see chart 16).

The downturn in European banks' C/I ratios in recent years has been driven by income having increased rather than cost having fallen. However, challenges to cost-effectiveness remain for several of the major European banks.

Since the financial crisis, the major banks in Sweden have benefited from the strong development of the Swedish mortgage market and the substantially increased growth in mortgages. This business activity has been profitable for the banks and thereby favourable for their C/I ratios. The deterioration of the major banks' C/I ratios in recent years is due to cost having increased at the same time as income has been relatively stable. Above all, increased IT investments and, to a certain extent, costs for the processes against money laundering lie behind the cost increases.

The IT investments that the banks are currently making entail higher costs in the short term but may lead to better cost-effectiveness in the long term. At the same time, a structural transformation is under way in the financial system and the banks are facing increased competition from new market participants. How this increased competition will affect the major banks will also be decisive for their future C/I ratios.

Chart 16. Banks' cost-to-income ratio
Per cent, rolling four-quarters



Note. Unweighted average.

Sources: SNL Financial and the Riksbank

several of the major banks in Sweden have cross-border operations with activities in the Nordics, Baltics and elsewhere, it is particularly important to strengthen Nordic-Baltic cooperation among authorities over these issues. At the same time, work is also under way at the EU level to strengthen the regulations concerning money laundering and increasing collaboration in this area.

The major banks in Sweden are exposed to liquidity risks

The major banks' cross-border operations mean that they have assets and liabilities in several different currencies. Their assets largely consist of loans to households and companies with long maturities, at the same time as they largely obtain funding on the financial markets at shorter maturities.

Overall, the banks are exposed to both short-term liquidity risks and structural liquidity risks in both SEK and foreign currencies.³⁸ The banks' liquidity risks need to be measured in several different ways to obtain a complete picture of them. Two established measures are the Liquidity Coverage Ratio (LCR) and the Net Stable Funding ratio (NSFR).

The major banks' liquidity reserves in SEK have increased

One way of measuring short-term liquidity risks is in terms of LCR. An LCR of 100 per cent means, put simply, that the bank can manage net cash outflows, without having any possibility of refinancing, for 30 days.³⁹

The major Swedish banks have long reported levels above the requirement of 100 per cent in total LCR, as well as in EUR and USD. On the other hand, some of the major banks have previously had very low LCR levels in SEK, at times only around 10 per cent. Since FI presented its referral proposal in March 2019 concerning the introduction of a requirement of 75 per cent in LCR in other significant currencies, the major banks' LCRs in SEK have increased to about 125 per cent on average (see chart 17).

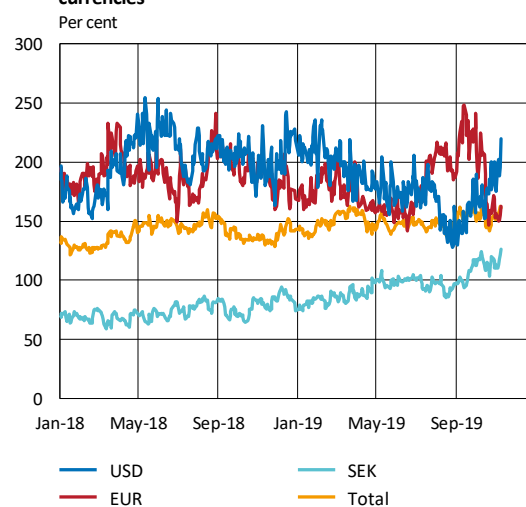
Chart 18 shows that the major Swedish banks have increased their holdings of liquid assets in SEK since the start of 2019. At the same time, the net cash outflows have decreased slightly. Put together, this means that the banks have funded the increased liquid assets with funding over longer maturities and have thereby increased the LCR in SEK.

To a large extent, the major banks in Sweden obtain funding in foreign currency, primarily EUR and USD. The banks exchange parts of this funding into SEK by entering into foreign exchange (FX) swaps with insurance companies, among others, who, in turn, wish to eliminate their exchange

³⁸ Short-term liquidity risks involve the risk that a bank becomes unable to repay liabilities that mature in the near term. Structural liquidity risks arise when there is a maturity mismatch between a bank's assets and liabilities in the longer term.

³⁹ The European Commission Delegated Regulation (EU) 2015/61 to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for credit institutions imposes a requirement of 100 per cent in LCR in total currencies. In addition, FI has introduced separate requirements of 100 per cent in LCR in euros (EUR) and US dollars (USD). Since October 2019, FI has also introduced a requirement of 75 per cent in LCR in other significant currencies, including SEK.

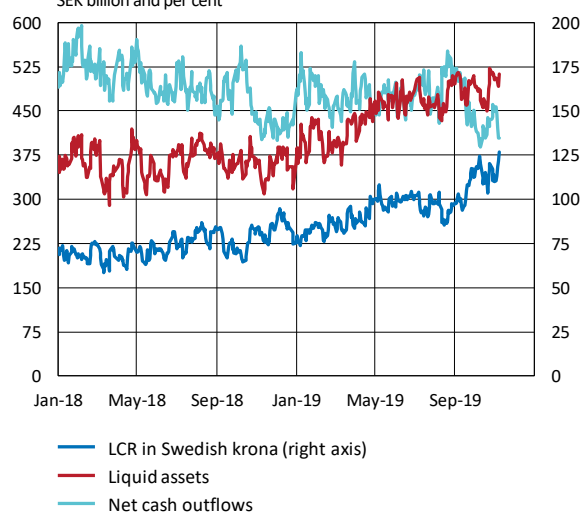
Chart 17. The three major Swedish banks' LCR in different currencies



Note. Refers to a volume-weighted average.

Source: The Riksbank

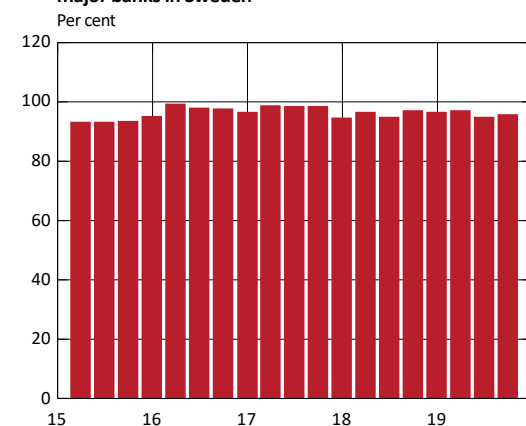
Chart 18. The three major Swedish banks' LCR in SEK, liquid assets and net cash outflows



Note. Left axis refers to SEK billion and right axis to per cent. LCR in Swedish krona is a volume-weighted average.

Source: The Riksbank

Chart 19. The Riksbank's structural liquidity measure for the major banks in Sweden



Note. Refers to an unweighted average. The measure compares a bank's stable funding with its illiquid assets. The higher a bank's results in the measure, the lower its structural liquidity risks. This chart does not include Danske Bank.

Sources: Liquidatum and the Riksbank

risk. One way for the banks to increase the maturity of their funding in SEK is to extend the maturity of these FX swaps.

Continued large differences in maturity between the banks' assets and liabilities

The international measure that the Basel Committee for Banking Supervision (BCBS) has developed to assess structural liquidity risks is the NSFR. This measure will be introduced in Sweden as part of the EU's banking package⁴⁰. The requirement will be set at 100 per cent. The NSFR measures the part of the bank's funding that is considered to be stable in relation to the bank's illiquid assets. At present, the average NSFR is 108 per cent for the major banks in Sweden.

However, the Riksbank deem that the NSFR does not fully capture the large maturity mismatch that exists between the banks' assets and liabilities. The Riksbank has therefore developed alternative measures, based on assumptions that to a greater extent capture the structural liquidity risks in the banking sector.⁴¹

According to the Riksbank's structural liquidity measure, the major banks in Sweden have not significantly reduced their structural liquidity risks (see chart 19). For example, the remaining average maturity for Swedish covered bonds is only about three years, and this has not changed to any great extent in recent years.

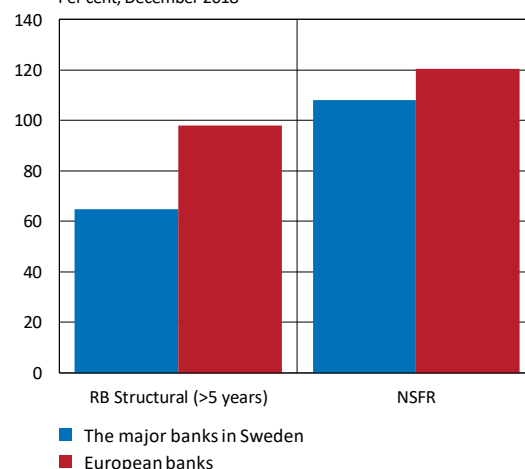
At the same time, the major banks are taking greater structural liquidity risks than many other comparable European banks (see chart 20). To some degree, this can be explained by the major banks obtaining funding on the financial markets to a greater extent and through deposits to a lesser extent. In addition, the major banks' assets largely consist of loans, unlike many other European banks, which own a larger proportion of securities. Loans usually have longer maturities than securities, which contributes to maturity mismatches between the banks' assets and liabilities.

The Riksbank's stress tests complement the LCR and the NSFR

The Riksbank's stress tests of banks' liquidity are based on detailed data on the banks' future contractual cash inflows and cash outflows, and on their liquidity reserves. It is thus possible to observe how the major banks' liquidity develops over time in a stressed scenario. The Riksbank's stress tests thereby complement the picture given by LCR, NSFR and other measures.

The results of the stress tests show that, in the event of financial turmoil, the banks may have significant liquidity needs, in both SEK and foreign currency. It thereby becomes

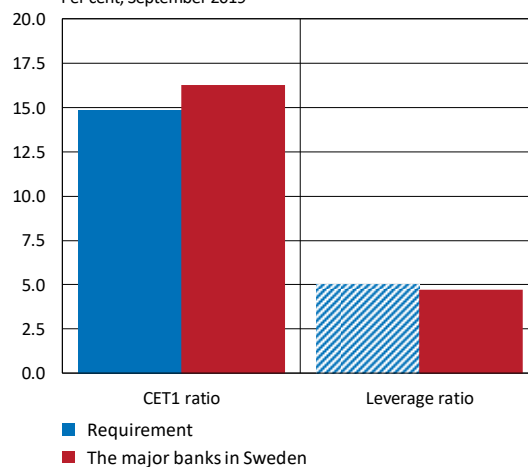
Chart 20. Measures of the major banks' and European banks' structural liquidity risk
Per cent, December 2018



Note. Both measures refers to unweighted averages. The Riksbank's structural liquidity measure is updated until December 2018 and does not include Danske Bank among the major banks in Sweden. Data for NSFR is updated until September 2019 and includes Danske Bank, although only until August 2019. The major banks' reporting of NSFR is not standardised but is instead done on the basis of two different definitions, CRR II and Basel III.

Sources: Liquidatum, SNL Financial and the Riksbank

Chart 21. Capital levels of the major banks in Sweden
Per cent, September 2019



Note. CET1 ratio is an abbreviation for Common Equity Tier 1 ratio. The requirement for CET1 is determined by FI and refers to an unweighted average for the three major Swedish banks. The requirement was determined in the second quarter of 2019. CET1 and the leverage ratio are calculated as a volume-weighted average for the five major banks in Sweden and refer to the third quarter of 2019. The minimum level of the leverage ratio has not yet been determined, so the chart shows the level recommended by the Riksbank.

Sources: Bank reports, FI and the Riksbank

⁴⁰ See What is the banking package? Fact box in *Financial Stability Report 2019:1*, Sveriges Riksbank.

⁴¹ The NSFR does not capture the difference in maturity for funding of more than one year. See also Swedish banks' structural liquidity risks, *Riksbank Studies*, November 2016. Sveriges Riksbank.

clear how important it is that the banks maintain enough liquidity reserves in all significant currencies (see the article “Stress tests of banks’ liquidity”).

The banks’ capital ratios have not changed significantly

The ratio of capital held by the major banks in Sweden to their risk-weighted assets (Common Equity Tier 1 capital ratio or CET1 ratio) remains largely unchanged since the spring.⁴² The CET1 capital ratio amounts to about 16 per cent on average, in comparison with the requirement of almost 15 per cent (see chart 21).

The leverage ratio among the major banks also remains largely unchanged since the spring (see chart 22). It is consequently still low in comparison with other banks in Europe (see chart 23). Leverage ratio measures a bank’s Tier1 capital in relation to its total exposures and thereby does not weigh the banks’ assets depending on risk. This is an important complement to the risk-weighted capital measure, as the major banks’ risk-weighted capital ratios have increased, in part due to the decrease in risk weights over time. In a previous study, the Riksbank demonstrated that a well-balanced level of the leverage ratio could be within the interval of 5 to 12 per cent.⁴³ With a higher leverage ratio, the resilience of the banking system would increase, thus meaning that the economic costs would probably decrease in a crisis.

Online lending platforms are growing

In line with technological developments, new types of companies, with other forms of funding and technical platforms than the traditional banks, have started to operate on various credit markets. One example of this is the mortgage market, where new market participants are issuing mortgages with funding from institutional investors, such as insurance companies.⁴⁴

Another new phenomenon on the credit market is online lending platforms, in which new digital technology has enabled individuals and companies to borrow directly from investors instead of through traditional banks.⁴⁵ Operations of this kind are growing rapidly in the United States, China and elsewhere, as well as in Sweden. One important reason for this is that online lending platforms have lower costs, which, in many cases, enables them to offer loans at lower interest rates.

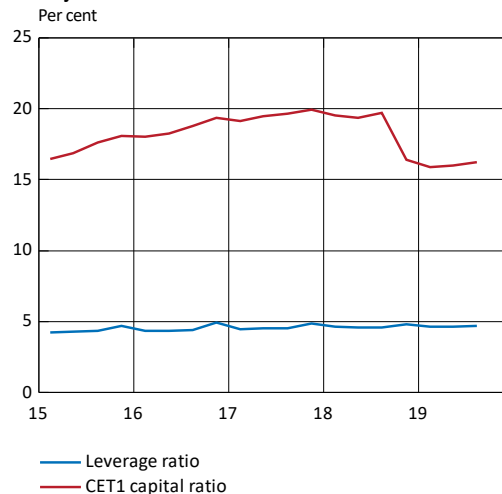
⁴² Swedish banks’ capital requirements are divided up into so-called Pillar 1 and Pillar 2 requirements. The introduction of a risk-weight floor for Swedish mortgages under the framework of Pillar 1 contributed towards reducing the banks’ reported capital levels in relation to their risk-weighted assets, but this regulatory adjustment does not affect the banks’ capital levels measured in SEK. See Risk-weight floor for Swedish mortgages to become a Pillar 1 requirement. Fact box in *Financial Stability Report 2018:2*. Sveriges Riksbank.

⁴³ See Almenberg, J. et al. (2017), Appropriate capital ratios in major Swedish banks – new perspectives, *Staff memo*, May 2017. Sveriges Riksbank.

⁴⁴ For more information, see New players on the mortgage market. Article in *Financial Stability Report 2018:1*. Sveriges Riksbank.

⁴⁵ These investors may be either private investors (implying a so-called peer-to-peer model) or institutional investors.

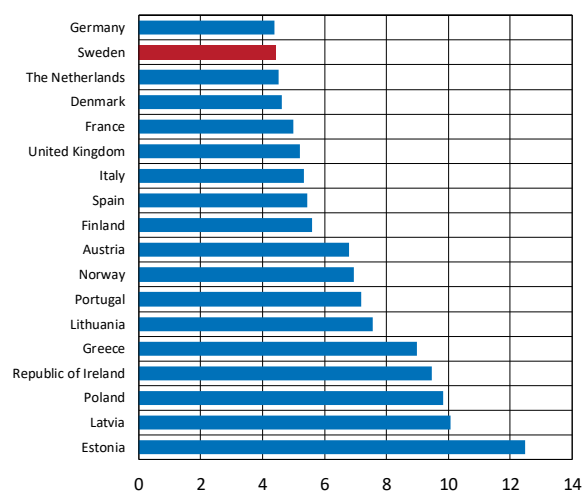
Chart 22. CET1 capital ratio and leverage ratio among the major banks in Sweden
Per cent



Note. Refers to a volume-weighted average. The substantial decrease in banks’ Common Equity Tier 1 capital ratio is due to the risk-weight floor for Swedish mortgages being moved from Pillar 2 to Pillar 1. See Risk-weight floor for Swedish mortgages will to become a Pillar 1 requirement. Fact box in *Financial Stability Report 2018:2*. Sveriges Riksbank.

Sources: Bank reports and the Riksbank

Chart 23. The leverage ratio in various countries
Per cent, June 2019



Note. Refers to weighted average per country.

Source: European Banking Authority (EBA)

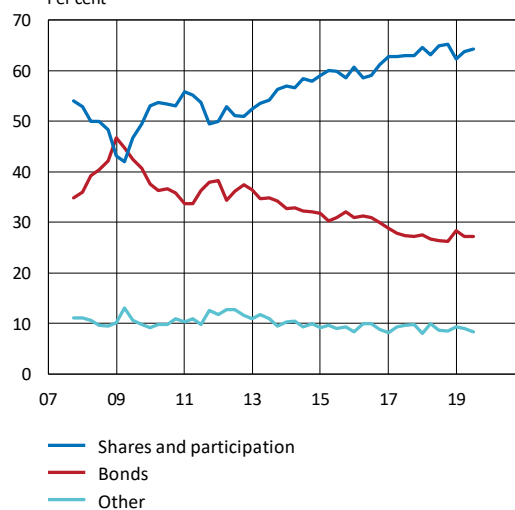
However, online lending platforms are a relatively untested technology and there is a lack of clear rules and guidelines for the supervision of lending operations like these. It is also unclear how much resilience these lending platforms would have in the event of a financial shock. However, at present, there are no clear signs that their activities in Sweden would be a threat to financial stability as the volumes of loans remain small. In 2018, new loans of just over SEK 2 billion originated from Swedish online lending platforms. However, changes are taking place rapidly and financial innovations are leading to the development of new structures. This requires ongoing knowledge-building, oversight, and analysis of potential risks.⁴⁶

Swedish non-banking financial institutions are affected by low interest rates

Swedish life insurance companies have, over a longer period, increased their shareholdings as a proportion of their total investment assets, at the same time as their interest-bearing holdings have decreased (see chart 24).⁴⁷ One reason that Swedish life insurance companies have turned to riskier assets is that they have a large proportion of outstanding products with guaranteed returns. When interest rates are low for an extended period, it becomes more difficult to maintain these guaranteed commitments to their policyholders. Overall, however, Swedish life insurance companies have relatively large assets in relation to the size of their guaranteed commitments in comparison with many other European countries.⁴⁸ In other words, Swedish insurance companies are comparatively well capitalised. At the same time, these large equity holdings make them vulnerable to a larger price fall on the equity market.

With the help of the market scenario included in the European Insurance and Occupational Pensions Authority's (EIOPA's) stress tests of the European occupational pension sector, FI has estimated the resilience of a selection of large Swedish insurance companies. A sharp equity price fall is one of the events included in these tests.⁴⁹ The results show that the companies generally manage to meet the capital requirements by a good margin. However, FI emphasises that, despite this, there is a risk of insurance companies pushing down equity prices even more if they choose to divest riskier assets.⁵⁰ This can in turn spread to other parts of the financial system.

Chart 24. Investments of Swedish life insurance companies
Per cent



Source: Statistics Sweden

⁴⁶ For a more detailed analysis of online lending platforms, see Bertsch, C. and Rosenvinge, C.J. (2019), FinTech credit: online lending platforms in Sweden and beyond, *Economic Review*, 2019:2. Sveriges Riksbank.

⁴⁷ For a more in-depth description of how low interest rates affect insurance companies, see Gibas, N., Juks, R. and Söderberg, J. (2015), Swedish financial institutions and low interest rates, *Economic Commentaries* no. 16. Sveriges Riksbank.

⁴⁸ See *Financial Stability Report*, June 2019. European Insurance and Occupational Pensions Authority (EIOPA).

⁴⁹ Equity prices fall by between 36 and 43 per cent in the scenario.

⁵⁰ See *Stability in the financial system*, May 2019. Finansinspektionen.

Low interest rates may lead to an underestimation of the long-term commitments of life insurance companies

Low interest rates for a long time can also lead to an underestimation of commitments to insurance policyholders. The assets and liabilities of Swedish insurance companies are largely valued on the basis of current market value. For the liability commitments, which particularly for life insurance companies are mostly long term, a present value calculation is performed. If the interest rates used in the present value computation fall, the companies need to set aside more capital today in order to be certain of their ability to fulfil the commitments in the future.

In the model used to compute the present value of the commitments, different types of rates are applied; swap rates⁵¹ for shorter commitments and a long-term equilibrium rate for longer commitments.⁵² If the long-term equilibrium rate is higher than the actual market rates for a prolonged period, it implies a risk that the companies are setting aside too little capital relative to their future commitments.⁵³

Stress tests improve the resilience of financial corporations to cyberattacks

Cyber risks are constantly changing and continuous work is therefore required to improve resilience. One way of improving resilience among financial corporations is to conduct tests simulating a cyberattack. These tests can be conducted in a coordinated and standardised way, for example through the European Central Bank's (ECB) framework, TIBER-EU (Threat Intelligence-based Ethical Red Teaming).⁵⁴ In Sweden, work is in progress on introducing such a framework adapted to Swedish circumstances, a so-called TIBER-SE. The next steps in the process will be to develop a guide for TIBER-SE and make a general analysis of the threat landscape regarding cyber risks in the Swedish financial sector.

⁵¹ The swap rate refers to the rate on an interest rate swap, which in turn is an agreement between two parties to exchange interest payments with each other for a certain period of time. One party pays a variable interest rate and the other pays a fixed interest rate.

⁵² For maturities in-between, the long-term equilibrium rate is interpolated. For more information, see *Stability in the Financial System*, May 2019. Finansinspektionen.

⁵³ For 2020, the EIOPA has set the long-term equilibrium rate at 3.75 per cent as far as Sweden is concerned. However, this level is much higher than the market assesses interest rates to be on average in the longer run. This type of estimate can be made using the price of a 30-year interest rate swap, which was trading in mid-November at around 0.8 per cent.

⁵⁴ See TIBER-EU tests resilience to cyber threats. Fact box in *Financial Stability Report 2019:1*. Sveriges Riksbank.

Vulnerabilities and risks in the financial infrastructure

The financial infrastructure consists of systems in which payments and transactions with financial instruments are made. The systems make it possible for individuals, companies and authorities to make payments and transactions in a safe and efficient manner. The financial infrastructure is thus a vital part of the financial system and a precondition of its functioning. At the same time, there are risks attached to the infrastructure systems.

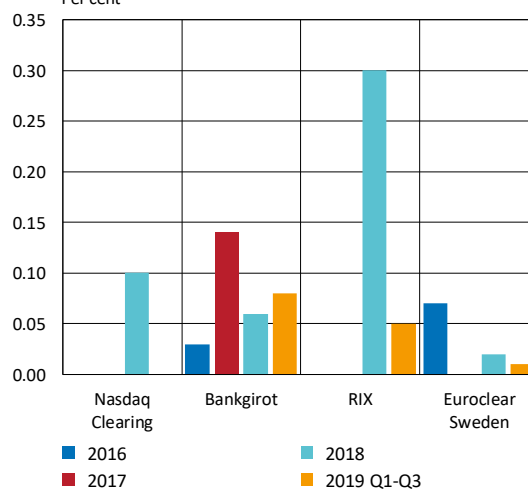
The systems in the financial infrastructure are closely interconnected. Banks and other financial institutions are participants in financial infrastructure systems and in many cases these systems also participate in each other's systems. The participants in the financial system are thereby linked together in the financial infrastructure systems, which means that disruptions can rapidly spread throughout the whole financial system. In addition, there is often only one financial infrastructure per country that can execute a certain type of transaction. For example, Euroclear Sweden is the only central securities depository (CSD) in Sweden and Nasdaq Clearing is the only infrastructure system that clears derivative transactions and repos in Sweden. This means that these market participants must have a very strong capacity to manage interruptions and risks to ensure that their systems are always available and do not spread risks.

The Riksbank deems that the financial infrastructure in Sweden overall has functioned well since the spring. Availability has been high and interruptions few (see chart 25). However, there are risks that need to be dealt with. It is therefore important to continue to improve the resilience to interruptions that could jeopardise the availability and functionality of the infrastructure systems (see the chapter "Stability assessment summary and recommendations").

New payment services increasingly important for the general public

The bank-owned payment service Swish has also had few interruptions, but customers may nevertheless have experienced problems when trying to pay via the payment app. The interruptions may originate in Swish, or other systems, providers or the participating banks needed to enable Swish payments.⁵⁵ As a customer, it is difficult to know where the cause of the interruptions lies. As more and more people use payment services like Swish and rely on such services, it becomes more serious when there are interruptions in related systems, as the general public is affected. It is therefore important that the institutions and systems that enable Swish payments minimise their vulnerabilities. It is also important that statistics on

Chart 25. Interruptions to the Swedish infrastructure systems
Per cent



Note. 0 per cent shows that the system has been available the entire time without interruption. 0.2 per cent corresponds to an interruption of 5 hours over a period of one year. For a period of three quarters, 0.2 per cent corresponds to about 3 hours and 45 minutes.

Sources: Bankgirot, Euroclear Sweden, Nasdaq Clearing and the Riksbank

⁵⁵ See *Payments in Sweden 2019*, November 2019. Sveriges Riksbank.

accessibility of and interruptions to Swish are made public. The Riksbank has access to information on the accessibility to different payment services such as Swish, and hence also information on interruptions in accessibility. Under the current regulations, however, it is not clear whether the Riksbank can retrieve or publish this information on a regular basis without the permission of the payment service providers.

Effective governance is a prerequisite for good risk management

Considering the important role of the infrastructure systems in the financial system, efficient routines are necessary for the continuous identification and management of risks that could affect operations. Similarly, it is important that the systems are governed in such a way that strategic decisions on the development of the systems can be taken in good time.

The Riksbank has previously identified shortcomings in the governance and control of the Riksbank's own system for large-value payments, RIX, which can lead to interruptions not being managed effectively and other operational risks.⁵⁶ There are shortcomings in how the Riksbank has organised the governance of RIX and in the policy documents used to support appropriate governance and risk management. Work to rectify these shortcomings is going in the right direction, but a number of changes still need to be made to operations, such as introducing regulations and routines and starting to work in line with the new policy documents. The risks previously highlighted therefore remain, to some extent.

The CSD Euroclear Sweden is subject to the EU regulation on improving securities settlement in the European Union and on central securities depositories (CSDR) and must thus fulfil the regulation's requirements (see the fact box "EU regulation introduces new requirements on central securities depositories"). The regulation requires all CSDs, new as well as old, to be authorised. Under the framework of Euroclear Sweden's application to FI for such authorisation, the Riksbank has pointed out that there are some uncertainties related to the way that the parent company, which is based in Belgium, influences the governance of Euroclear Sweden. Even though Euroclear Sweden is a wholly owned subsidiary in a group of several European CSDs, it is important that it has the ability to act independently. Euroclear Sweden is now working to clarify its independence from the parent company.

Euroclear Sweden's independence from its parent company is important to ensure long-term and robust risk management with a focus on reducing the remaining risks in the IT system for securities settlement. The Riksbank highlighted the risks related to the IT system as early as 2013, and the last Financial Stability Report emphasised that

EU regulation introduces new requirements on central securities depositories

In September 2014, Regulation (EC) 909/2014 on improving securities settlement in the European Union and on central securities depositories (CSDR) entered into force. The aim of the regulation is to harmonise requirements on central securities depositories (CSDs) and to increase safety and efficiency in the settlement of securities. The requirements of the regulation are largely based on the principles for financial market infrastructures (PFMI), developed by CPMI and IOSCO.

As a consequence of the regulation, all CSDs, new and existing, must be authorised to ensure that they fulfil the requirements of the regulation. As the only CSD in Sweden, Euroclear Sweden applied for authorisation from FI. Their application was granted on 14 November 2019. In conjunction with the authorisation process, the Riksbank has had the possibility to express its views on Euroclear Sweden's application to FI.

⁵⁶ The part of the Riksbank responsible for the operation of the RIX system is organisationally separate from the Riksbank's oversight of the system. See The Riksbank's different roles in relation to the RIX system. Fact box in *Financial Stability Report 2019:1*.

Euroclear Sweden should continue to modernise its system for securities settlement.⁵⁷ Since then, Euroclear Sweden has undertaken several measures, but more work on modernising the system's structure remains for the years ahead.

Risk management by central counterparties is important

Central counterparties (CCPs) enter into their participants' agreements as counterparties and may therefore be exposed to major credit and liquidity risks that could affect the stability of the financial system. The risk management work is therefore important. Methods and assumptions need to be updated continually so that they reflect the current risk outlook at all times. For CCPs, this means that they regularly need to review their risk management and how it can be improved.

In the autumn of 2018, a participant in Nasdaq Clearing defaulted, leading to comprehensive losses for both Nasdaq Clearing and its participants.⁵⁹ In the previous Financial Stability Report, the Riksbank, therefore, pointed out that Nasdaq Clearing should take greater account of liquidation costs⁶⁰ when calculating requirements for the capital that must be held by the CCP to cover losses. If a CCP does not take sufficient account of liquidation costs, it may give rise to major losses that can spread to participants, the CCP and the financial system, in the event of a participant default.

Since the participant default, Nasdaq Clearing has introduced an enhancement programme aimed at strengthening its resilience. One of the measures is to take greater account to liquidation costs than previously. The measure will be implemented gradually and have already been introduced for the clearing of commodities, the market in which the defaulting participant was active. The enhancement programme also includes other measures to improve Nasdaq Clearing's resilience to new defaults.

Structural changes on the payment and securities market

A structural transformation and harmonisation is taking place on the securities market, and participants on this market need to take a stance on this (see the fact box "What should Swedish securities settlement look like in future?").

At the same time, a structural transformation is under way on the payment market, where financial and technological innovations, changed behaviour and regulations are creating a new landscape. In the long run, this will change the payment and securities market.

What should Swedish securities settlement look like in future?

A structural transformation of the market for services related to the clearing and settlement of securities is under way in Europe.⁵⁸ For a long time, this market was largely unchanged and there were many obstacles for cross-border securities settlement.

Efficient and harmonised securities settlement is a key component of a single capital market. Several initiatives are therefore being conducted to remove obstacles to cross-border securities trading.

The structural transformation is taking place on the technical, as well as the legal and political, level. Both the Riksbank and other Swedish market participants need to investigate what these changes signify for developments in the Swedish securities market. Part of this investigation is the analysis of the European platform for securities settlement, Target2-Securities (T2S). T2S has been in production since June 2015 and, as of autumn 2018, 21 CSDs in 20 EU Member States are connected to the platform. Up until the autumn of 2018, only securities transactions in EUR were settled on T2S but, in 2018, the Danish krone (DKK) became available on the platform for the settlement of Danish securities.

It is now nearly ten years since the Swedish market investigated a possible Swedish connection to T2S. Now, the Riksbank is investigating whether T2S could be a safe and efficient alternative to ensure that the Riksbank can supply central bank money for securities settlement in SEK in a standardised way to several CSDs. Other market participants on the Swedish securities market also need to analyse how they are affected by T2S, both now and in the future. Both the Swedish CSD and its participants, as well as Swedish investors and issuers, would be affected by Sweden joining T2S.

⁵⁷ See *Financial Infrastructure Report 2013*. Sveriges Riksbank.

⁵⁸ For more information, see *What should Swedish securities settlement look like in the future? Riksbank Studies*, June 2019. Sveriges Riksbank.

⁵⁹ For more information, see Participant failure at Nasdaq Clearing. Fact box in *Financial Stability Report 2018:2*. Sveriges Riksbank.

⁶⁰ Liquidation costs are costs for settling a defaulted participant's portfolio. Liquidation costs can arise in the form of a risk premium over and above the market price that must be paid when a defaulted participant's portfolio is sold off.

One example from the payment market is the imminent Nordic clearing house P27 Nordic Payments Platform⁶¹, which is intended to offer a Nordic infrastructure for payments in several Nordic currencies. Its goal is for operations to start in 2021. Another example that affects existing payment structures is crypto-assets, such as Facebook's planned crypto-asset Libra. The idea is that Libra will be a global means of payment in the form of a so-called stablecoin (see the fact box "Libra – a proposed global crypto-asset"). Depending on how Libra develops and affects existing structures for payments, it may lead to stability risks in the periods ahead.⁶²

Libra – a proposed global crypto-asset

In June 2019, the Libra Association, a Facebook-led consortium of different companies, announced its intention to launch a new financial asset, with a connected financial infrastructure, intended to enable global payments. This asset is called Libra. The idea is for Libra to be what is known as a stablecoin, which is to say a crypto-asset that maintains a stable value over time. A reserve consisting of safe and liquid assets, such as government securities and bank deposits in various currencies, shall secure the value.

The organisation behind Libra is registered in Switzerland but is not completely established yet and does not follow the same structure as traditional financial market participants. Without being familiar with either Libra's structure or how well used it may be, it is difficult to know how Libra will affect the financial system and its stability. There are still outstanding questions over the reserve's contents and structure and neither is it apparent on which institution the holder of a Libra will have a claim. In addition, the regulations by which Libra would be covered are also still uncertain. However, it is likely that current international principles for financial infrastructure systems would apply, as Libra plans to act as a financial infrastructure, among other things.

In the short term, Libra will probably only have a minor impact on the Swedish payment market, even though it could become established in some segments, primarily payments between private persons and some on-line shopping. However, in the long run, increased usage could have implications for financial stability, for example if Libra were to be impacted by operational interruptions making it impossible to use.

Libra currently only exists at the planning stage, but it is important that Libra's continued development is monitored and that there is international cooperation in regulation and oversight. Global cooperation in oversight would give the authorities concerned both insight and the possibility to affect developments in Libra going forward.

⁶¹ See P27 – a joint Nordic infrastructure for payments. Fact box in *Financial Stability Report 2018:2*. Sveriges Riksbank.

⁶² See Segendorff, B. et al. (2019), What is Libra?, *Economic Commentaries* No. 9 2019. Sveriges Riksbank.

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

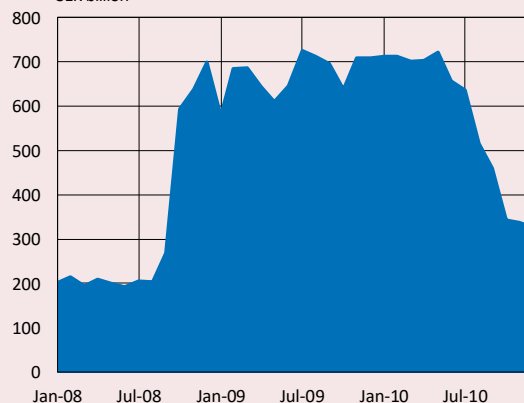
The Riksbank is entrusted with the task of promoting a safe and efficient payment system. As part of this task, the Riksbank can give liquidity support under certain circumstances to banks with temporary liquidity problems

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.

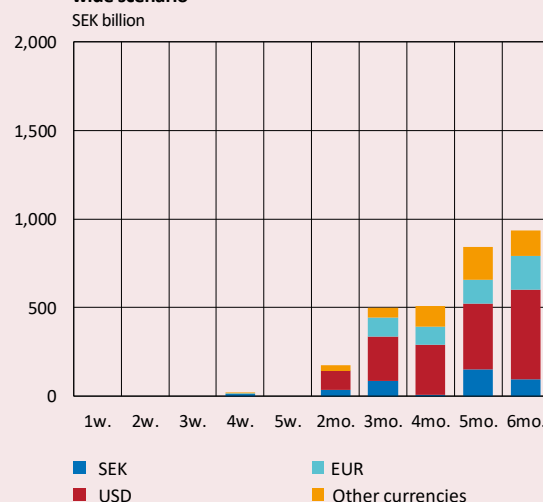
Chart 28 shows that no cash flows arise from FX swaps. This is due to the assumption that banks renew their FX swaps in the system-wide scenario. As banks typically have lent foreign currencies such as USD and EUR in FX swaps and received SEK⁷⁶, it means that they do not have any inflows of foreign currency 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

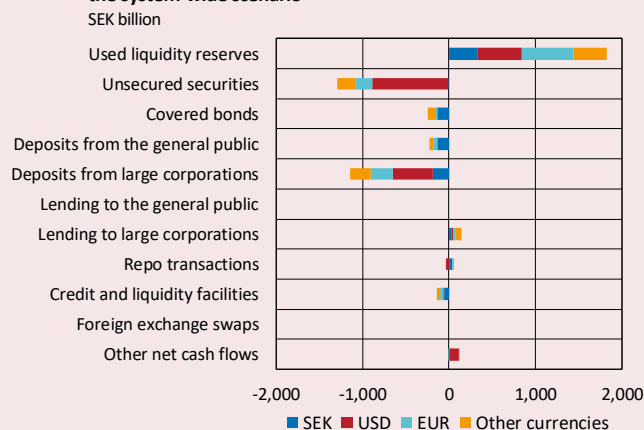
Chart 27. The sum of the banks’ liquidity needs in the system-wide scenario



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-

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

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.

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.

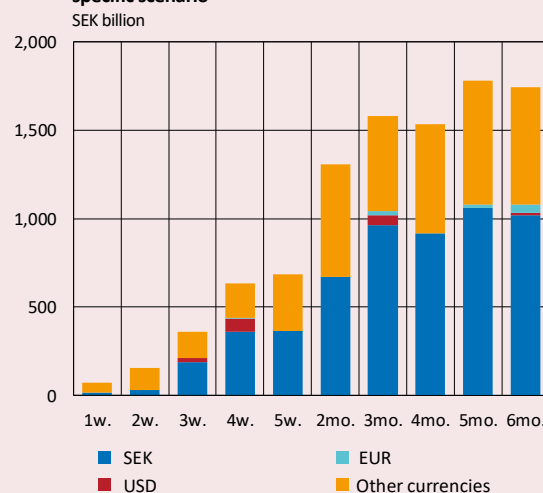
As described earlier, the bank-specific scenario aims to measure the liquidity need that arises in a bank hit by a liquidity shock. Measured as an average for the four banks, the need amounts to about SEK 425 billion, that is SEK 1,700 billion divided by four.

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.

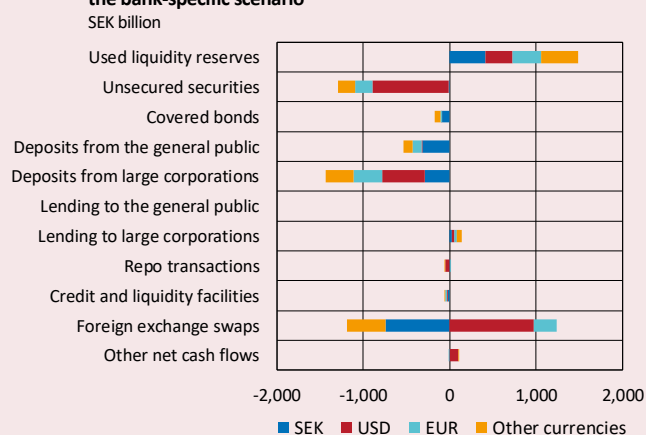
Chart 29. The sum of the banks’ liquidity needs in the bank-specific scenario



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.

ARTICLE – Climate-related risks are a source of financial risk

Climate change is one of the major challenges of our time, and it requires a global transition to a less fossil-based economy. Both the effects of global warming and the transition itself create climate-related risks. For the participants in the financial system – banks, insurance companies and other financial and non-financial corporations – climate-related risks can create financial risk. If these are not managed, they can entail risks for the financial system, which can in turn have consequences for financial stability. It is therefore part of the Riksbank's mandate to promote resilience to climate-related risks in the financial system. This article aims to describe climate-related risks and how they can give rise to financial risk and therefore why they are relevant to financial stability. Better disclosure by both financial and non-financial corporations is one of the actions required in order to be able to measure, price and manage climate-related risks.

The transition to a less fossil-based economy involves structural changes and requires political decisions

To change and to achieve the objectives of the Paris Agreement⁷⁹, significant investment and far-reaching technical innovation are required. Certain sectors and companies will benefit, including those that apply new technology that enables this transition. The sectors and companies that do not change will lose out, including sectors that are dependent on coal, oil and steel with a high carbon footprint. In addition, the large amounts of capital and the new financial products that will finance the transition to a less fossil-based economy will be a substantial challenge for the financial sector. The transition will require structural changes both in the real economy and in the financial system. To manage this transition, political decisions will be required.⁸⁰

Direct effects of climate change give rise to financial costs and risks – physical risk

It is already possible to see direct effects of climate change. Damages caused by, for example, drought, flooding, hurricanes, heatwaves, rises in sea level and changes to ecosystems reduces the values of various assets. This is called physical risk. If the assets are insured against such damage, unexpected costs for insurance companies may result. Major climate events may force insurance companies to sell off their financial assets on a large scale, resulting in price pressures on these assets and, in the worst case, leading to bankruptcy.⁸¹ If, on the

other hand, the assets are uninsured, individual companies and households will be those adversely affected. This may, for example, be due to insurance companies refusing to insure certain assets, such as new buildings in areas that are sensitive to rises in sea levels. Individual companies and households may also be affected by insurance companies increasing their insurance premiums so that it becomes more expensive to insure certain assets.⁸²

Climate change can also have a negative impact on collateral accepted by banks. The credit given by banks to households and companies often has real property as collateral. Natural disasters can destroy this property and thereby severely reduce the value of the collateral. For loans where the borrower's debt-servicing ability deteriorates and they are unable to repay the loan in full, it is important that the value of the collateral can cover the bank's claim. If the value of the collateral deteriorates, a credit loss may arise. This increase in credit risk has, in turn, a negative effect on the banking system.

Physical risk can also involve dramatic variation in the prices of financial assets and can thereby give rise to market risk. If these materialise, it may lead to participants in the financial system making losses. It may also reduce capital and impair liquidity among banks and central counterparties.

⁷⁹ In November 2016, the global climate agreement reached in Paris entered into force. One of its objectives is to keep the global temperature increase well below 2 degrees Celsius and then limit it even further to 1.5 degrees Celsius.

⁸⁰ Climate pollutants are a so-called externality in which the causative party, for example a consumer or a company, generates a cost for another party without paying for this cost. Solving the problem requires political decisions, which means that governments and fiscal policy have the main responsibility for reducing emissions.

⁸¹ See PG&E: the first Climate-change bankruptcy, probably not the last, 18 January 2019. *Wall Street Journal*.

⁸² For example, the Insurance Council of Australia has agreed that property in coastal areas is likely to become more expensive and more difficult to insure according to even the most conservative sea level rise forecasts. Another example is insurance companies in Sweden that have plans to stop insuring shoreline buildings in Skåne, for which municipalities have granted planning permission despite the County Administrative Board advising against it.

Financial risk related to the transition to a less fossil-based economy – transition risk

The actual transition to a less fossil-based economy is associated with financial risk. It may, for example, be a question of political decisions such as higher carbon taxes, road tolls or higher prices of emission rights, which are intended to gradually help reduce fossil fuel use. Such political decisions change the conditions for certain specific markets. They may also have consequences for pricing on the financial markets, such as the equity market, credit market or commodity market. The consequences can be financial risk as a result of the price fluctuations that arise when uncertainty over the future value of assets increases.

It may also be a question of political decisions, according to which certain resources such as coal, gas and oil shall no longer be extracted but left in the ground. If the use of certain assets is completely prohibited due to their potential to generate far too much toxic pollution during their extraction and use, they will become so-called *stranded assets* and completely lose their value.

Companies that own or have substantial exposure to such assets may be hit hard when the value of the assets falls sharply. If these companies have loans, this may have negative consequences for their lenders, such as banks and other investors.

Physical risk and transition risk are not independent of each other. A slow transition to a less fossil-based economy may reduce the negative consequences of the transition (transition risk) in the short term, but at the same time may intensify the physical risk in that the risk of damage will increase. If the physical risk increases, it may, on the other hand, lead to more substantial and faster changes to climate policy, which may increase transition risk in the short term.

To manage physical and transition risk, participants in the financial system need to look forward rather than backwards to a greater extent. Historical data cannot be used to predict the future. For example, historical price movements in financial assets do not capture the potential effects of climate change on future price movements. As regards models for managing risk and assessing risk resilience, such as stress tests, these need to be adapted to also include future transition scenarios.⁸³

An example of physical risk and transition risk from the electricity derivatives market

In September 2018, the German electricity price rose sharply when the prices of emission rights in Germany increased (transition risk that arose as an effect of political decisions to change over to a less fossil-based economy). At the same time, Nordic electricity prices fell sharply as a result of heavy rain in the Nordic region after a hot and dry summer (physical risk). The difference between Nordic and German electricity prices was 17 times greater than on a normal trading day. This rapid development led to the default of one of the participants in the central counterparty Nasdaq Clearing, that had large positions on the electricity derivatives market. As a result, the other participants had to share the loss.⁸⁴

Derivative instruments create a market for trading and redistributing risk. The market can either be used to try to reduce risk, known as hedging, or to speculate on risk. In the example above, the participant traded derivative instruments to speculate.

A global problem demands international cooperation

The effects of global warming and the transition to a less fossil-based economy are a global challenge that requires international cooperation, not least in the area of fiscal policy.⁸⁵ The financial system also has an important role in the transition to a more sustainable financial system, which is why there are several initiatives at the international level aimed at promoting a sustainable financial system.

NGFS – a network for central banks and supervisory authorities

The *Network for Greening the Financial System*, NGFS, has been in existence since 2017 for central banks and supervisory authorities. At the time of writing, the network has 48 members and 10 observers. The Riksbank and FI participate in this network.

In its first report, the NGFS established that climate-related risks are a source of financial risk.⁸⁶ In the network's view, therefore, the task of central banks and supervisory authorities to promote financial stability shall also consider climate-related risks.

In April 2019, the NGFS published a number of recommendations aimed at supporting the financial system in its work to achieve the objectives of the Paris Agreement (see table 4).⁸⁷ The recommendations from the NGFS are non-binding and are addressed to central

⁸³ See, for instance, *Transition in thinking: The impact of climate change of the UK banking sector*, September 2018. Bank of England.

⁸⁴ See *Financial Stability Report 2018:2*. Sveriges Riksbank and *Financial Stability Report 2019:1*. Sveriges Riksbank.

⁸⁵ See Olovsson, C. Is climate change relevant for central banks? November 2018, *Economic Commentaries* No. 13. Sveriges Riksbank.

⁸⁶ See *NGFS First Progress Report*, October 2018. Network for Greening the Financial System.

⁸⁷ See *A call for action: Climate change as a source of financial risk*, April 2019. Network for Greening the Financial System.

Table 4. NGFS recommendations

	Recommendations	Aimed at
1	Integrating climate-related risks into financial stability monitoring and micro-supervision	Central banks and supervisory authorities
2	Integrating sustainability factors into own-portfolio management	Central banks
3	Bridging the data gaps	Concerned authorities
4	Building awareness and intellectual capacity and encouraging technical assistance and knowledge sharing	Central banks, financial supervisory authorities and financial institutions
5	Achieving robust and internationally consistent climate- and environment-related disclosure	Companies issuing public debt or equity, financial institutions, policy makers and supervisory authorities
6	Supporting the development of a taxonomy of economic activities	Policy makers

Source: NGFS, adapted by the Riksbank

banks, supervisory authorities, policy makers and financial companies. The Riksbank supports these recommendations.

The first recommendation concerns integrating climate-related risks into prudential supervision. Some central banks and supervisory authorities have come further in this work and started to perform stress tests of the financial system based on various climate-related scenarios.⁸⁸

The second recommendation is aimed at central banks, encouraging them to integrate sustainability factors into their own-portfolio management.⁸⁹ This should be done to the extent possible based on each central bank's mandate and objective.

A pre-condition for being able to perform analyses and assessments of climate-related risks is the availability of standardised data. The third recommendation therefore concerns bridging existing gaps in the access to such data. This may be a question of appropriate authorities collecting and sharing data that is relevant to the assessment of climate-related risks. In addition, this data, wherever possible, should be made available in a public data base.

Another key aspect when it comes to supporting the financial system in its work to achieve the objectives of the Paris Agreement is to create awareness of climate-related risks and share information in the field. The fourth recommendation calls on central banks, supervisory authorities and financial institutions to improve understanding – both internally and among relevant parties – for how climate-related factors can be translated into financial risks and opportunities.

In the fifth recommendation, NGFS urges all companies issuing public debt or equities as well as financial sector institutions to disclose climate-related information in line with the *Task Force on Climate-related Financial Disclosures*, TCFD (see the section below). Such disclosure enables the pricing of climate-related risks and opportunities. Put simply, investors are better able to value different companies based on how they manage their climate-related risks and opportunities.

The sixth recommendation is about creating a taxonomy, or uniform classification system, that clarifies both which economic activities contribute to the transition to a green and sustainable level of fossil-based emissions, and which activities are more exposed to climate-related risks.

TCFD – disclosure by companies of climate-related risks and opportunities

TCFD was created in 2015 by the *Financial Stability Board* with the task of increasing transparency regarding climate-related risks and opportunities. To this end, the TCFD has developed non-binding recommendations for companies. The idea is for them to disclose how climate change affects their operations and how they manage their climate-related risks and opportunities.⁹⁰ The recommendations aim to give investors, lenders, insurance companies and other stakeholders access to information on how the companies manage climate-related risks and opportunities. The main elements in the disclosure are illustrated in figure 1 below and cover corporate governance, strategy, risk management and established metrics and objectives linked to climate-related risks and opportunities.

As of September 2019, over 850 companies and organisations had backed the recommendations globally. Of these, 28 are Swedish. An increasing number of banks, insurance companies and investors are asking for this kind of information from companies. More companies can therefore be expected to implement the TCFD recommendations in their annual reports.

⁸⁸ See, for instance, An energy transition risk stress test for the financial system of the Netherlands, *Occasional studies*, volume 16-17, 2018. De Nederlandsche Bank.

⁸⁹ Within the financial sector, sustainability efforts are operationalised via so-called ESG valuation of companies based on their management of environmental issues and

social aspects and on how the companies are governed. ESG is an abbreviation of Environmental, Social and Governance.

⁹⁰ See *Recommendations of the Task Force on Climate-related Financial Disclosures*, Final report, June 2017. Financial Stability Board.

Figure 1. The main elements in TCFD disclosure



Source: TCFD, adapted by the Riksbank

The European Commission's action plan on financing sustainable growth

In 2018, the European Commission adopted an action plan on financing sustainable growth.^{91,92} The main objectives are to steer capital flows to sustainable investment to achieve sustainable growth and manage the financial risks stemming from climate change.

Table 5. New European legislation in the field of sustainable growth and financial risk

The Commission's draft legislation	Purpose
New category of benchmarks for investments in securities	Provide better information to investors about the carbon footprint of their investments
Disclosure requirements for institutional investors with regard to their integration of ESG factors into their risk processes	Greater access to, for example, climate-related information from financial companies
A classification system (taxonomy) of green investments	A first step to steer investments towards sustainable activities

Source: European Commission, adapted by the Riksbank

In 2018, the Commission presented three legislative proposals that will result in EU regulations in the area (see table 5). In addition, reports have been produced on, for example, an EU standard for green bonds.⁹³

In June 2019, the Commission published guidelines to improve corporate disclosure of climate-related information.⁹⁴ These guidelines give companies practical recommendations on how they can improve their disclosure of how their operations affect the climate, as well as how climate change affects their operations. The latter is in line with the TCFD recommendations. The Commission's guidelines go further than TCFD and require

the disclosure to include the companies' own climate impact. In addition, there are special guidelines for banks and insurance companies.

The Riksbank's mandate includes promoting resilience to climate-related risks in the financial system

Climate-related risks are a source of financial risk and therefore falls within the mandate of central banks and supervisory authorities that are tasked with promoting financial stability. The Riksbank actively participates in international work in the area of climate risks, for example in one of NGFS's work streams aimed at developing various scenarios.⁹⁵ These aim to help increase understanding for how risks can develop based on various measures taken to reduce fossil-based emissions and whether or not these measures are implemented in an orderly and predictable fashion.

At present, it is difficult to know how the Riksbank's work in the area of financial stability will need to be developed and what role the Riksbank can play. But some of the work involves trying to assess the extent to which the major banks in Sweden and the Swedish financial market infrastructures are exposed to these risks and how resilient they are. The Riksbank has now begun to examine how climate-related risks can be integrated as part of stability analysis and monitoring.

As regards integrating sustainability factors into the Riksbank's management of the foreign exchange reserves, the Riksbank has had a new financial risk and investment policy in place since 1 January 2019. This states, among other things, that consideration shall be given to sustainability in the choice of assets in the foreign exchange reserves, in addition to other requirements laid down in the Riksbank's mandate.⁹⁶ Climate change can also have implications for monetary policy as economic forecasts and economic policy may be affected.⁹⁷

Since 2015, FI has worked actively on sustainability issues, both in Sweden and internationally. It is now integrating sustainability issues into its regular supervisory work.⁹⁸

Measures required to progress in analytical and preventive work

The Riksbank considers improved and uniform disclosure of climate-related financial information to be the first

⁹¹ The concept of *sustainability* is broad and includes much more than adaptations to climate change. Agenda 2030 consists of 17 global goals for sustainable development adopted at the UN summit in 2015. One of the goals relates to climate change.

⁹² See *Action plan on financing sustainable growth*, 8 March 2018. European Commission

⁹³ See *TEG report on EU green bond standard*, 18 June 2019. EU Technical Expert Group on Sustainable Finance.

⁹⁴ See *Guidelines on reporting climate-related information*, June 2019. European Commission

⁹⁵ The Riksbank has wider international commitments than those listed here.

⁹⁶ The primary purpose of the gold and foreign exchange reserves is to enable the Riksbank to provide the financial system with liquidity in foreign currency and to intervene on the foreign exchange market for monetary and foreign exchange policy reasons. The second purpose is to help safeguard the Riksbank's financial independence, which means ensuring a healthy return on the gold and foreign exchange reserves over time in relation to the risk involved in holding them.

⁹⁷ See *Monetary policy and climate change*, speech by Benoît Coeuré on 18 November 2018. European Central Bank.

⁹⁸ See *Finansinspektionens letter of appropriation for 2018*, 18 December 2017. Swedish Ministry of Finance. See also *Climate and sustainability in focus at FI*, speech by Erik Thedéen, 10 September 2019. Finansinspektionen.

building block in the work to manage climate-related risk.⁹⁹ Banks, insurance companies and other financial corporations need to identify and assess the climate-related risks they are exposed to and incorporate these into their business models and existing risk management. The Riksbank therefore wants to call on Swedish financial corporations to disclose their climate-related risks and opportunities. One way of doing this is to disclose in line with the TCFD recommendations and to take into account the Commission's guidelines.

Better access to information is a pre-condition for banks, insurance companies and other participants in the financial sector to be able to effectively measure, price and manage their exposures to climate-related risks. This is also a pre-condition for investors to be able to allocate capital to more sustainable operations more effectively.

At international level, it has been discussed whether banks' capital requirements could be eased in order to create an incentive for more sustainable investments (so-called GSF, *Green Supporting Factor*). Even though the intention is good, the Riksbank considers this to be inappropriate. Capital requirements exist for a reason – to build resilience in the financial system. Eroding these requirements risks undermining financial stability. Incentives to increase sustainable investment should be created in other ways, for example by introducing a unified classification system that specifies which investments contribute to a less fossil-based economy.

⁹⁹ According to the IMF, policy makers have a role to play in promoting increased disclosure of and transparency in climate-related risks, see *Global Financial Stability*



SVERIGES RIKSBANK
SE - 103 37 Stockholm
(Brunkebergstorg 11)

Tel +46 8-787 00 00
Fax +46 8-21 05 31
registratorn@riksbank.se
www.riksbank.se



PRODUCTION SVERIGES RIKSBANK
ISSN 1404 – 2207 (print)
ISSN 1654 – 594X (online)