DANMARKS NATIONALBANK

**ANALYSIS** | Financial stability and financial risks
10 April 2025 | No. 10

# Systemic risks in credit institutions and the economy

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**30 pages**

Systemic risks are vulnerabilities or imbalances in financial and non-financial companies and households that can have serious consequences for society if they develop without being addressed. If systemic risks materialise, households and companies may not be able to obtain loans to finance property or investments, which can exacerbate an economic downturn. The analysis describes what systemic risks are, what consequences they can have and how they can be identified.

**Systemic risks concern the system as a whole**

Even if individual financial companies appear robust, systemic risks can build up, for example due to an overall loose credit policy or an increased willingness among lenders and borrowers to take on new risks. If many people change their behaviour at the same time, it can cause self-reinforcing effects in the economy. Among other things, this can increase the risk and size of losses for individual credit institutions beyond what they take into account in their own risk assessments and capital reservations.

**Systemic risks can be cyclical and structural**

Cyclical systemic risks build up over time when the economy is doing well. For example, during a period of optimism, households may be willing to take out large loans, even if it means financial pressure. Structural systemic risks concern the structures of the economy. This could be a large banking sector or a high proportion of lending to certain industries.

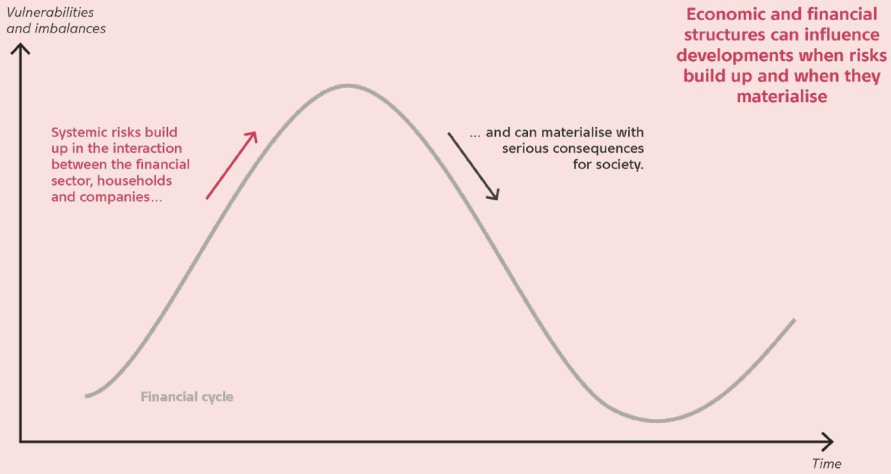
**A number of analytical tools are used in the assessment of systemic risk**

Authorities use different types of analyses to assess systemic risk. Such analyses can be based on simple indicators or more advanced economic models. The focus is on the interaction and behaviour of the financial sector and the economy as a whole – not on individual market participants. The aim is to shed light on a given development from several different perspectives and identify systemic risks as they develop, allowing the authorities to react in time.

# Why is it important?

Systemic financial crises are associated with high costs to society. This can be reflected in significant losses in the financial sector, a sharp decline in investment and consumption, and rising unemployment. Since the financial crisis, there has been increased focus in Denmark and abroad on limiting systemic risks and the risk of financial crises. To fulfil this task, it is important to understand which risks can have serious consequences for the financial sector and society – and thus constitute a systemic risk. If authorities can identify systemic risks early enough, they are better placed to address them – ensuring financial stability and a robust economy.

# Main chart
# Systemic risks can build up over time, with significant consequences for the economy




# Keywords

Banking and mortgage credit | Financial sector | Financial stability and financial risks | Macroprudential policy

# 01
# Introduction

The most recent systemic financial crisis in Denmark was the global financial crisis. In Denmark, the economic downturn in 2007-09 caused by the financial crisis was the biggest since World War II.[1] The total loss of production in 2009-13 corresponded to around 12 per cent of Denmark's gross domestic product, GDP.[2] Real house prices fell by around 30 per cent from 2007 to 2012. Systemic financial crises have serious consequences for households and companies, with long-lasting effects on the economy, prosperity and employment.[3]

After the financial crisis, *microprudential* regulation of individual credit institutions and other financial companies was tightened to increase the robustness of individual institutions. The financial crisis showed that microprudential regulation is necessary for the resilience of individual institutions, but it is not sufficient to ensure the stability of the financial system. The crisis also showed that the interconnections and dynamics of the financial system are complex. This can make it difficult or impossible for individual institutions and authorities to see risks building up and react in time before they have consequences and institutions get into trouble.

In the wake of the financial crisis, increased focus has been placed on strengthening the resilience of the financial system and the economy as a whole. New macroprudential regulation was introduced to ensure a robust financial sector so that creditworthy households and businesses can get loans, even in times of stress and unexpected losses, see box 1. For example, the countercyclical capital buffer is intended to ensure more capital in institutions so that they have sufficient lending capacity to continue lending even if they have incurred losses on their loans. Following the crisis, new regulatory authorities were also established to ensure a robust financial sector by monitoring, identifying and mitigating systemic risks.[4]

Systemic risks are vulnerabilities or imbalances that, in the event of a shock, could have significant consequences for the financial system and economy. Systemic risks can build up as a result of the collective behaviour and interactions of credit institutions – even if those institutions may be robust individually. For example, there may be an overall loose credit policy and an increased willingness to take on new risks. In addition, problems in one institution can spread to other institutions and the economy if there is a high degree of interconnectedness, for example in the form of direct credit between institutions or exposures to the same customers.

The purpose of this analysis is to describe systemic risks. It presents an approach that can be used to analyse and understand systemic risks – both those known today and new types of risks that may arise. The analysis does not aim to identify specific systemic risks or discuss measures to mitigate or reduce systemic risks.

It is based on the interaction between credit institutions, households and companies, see chart 1. In Denmark, credit institutions are key to the provision of

[1] See Spange (2010).
[2] See Abildgren et al. (2011) and the Committee on the Causes of the Financial Crisis (2013).
[3] In this analysis, the term *systemic financial crisis* is used to clarify that it is a crisis that affects multiple sectors and the economy at the same time, not just a sub-market. This is in line with the definition and description in the ESRB (2017).
[4] The European Systemic Risk Board, ESRB, was established in 2010. Based on recommendations from the ESRB, equivalent authorities were established in all EU Member States. In Denmark, The Systemic Risk Council, DSRR, was established in 2013. The Systemic Risk Council is the macroprudential authority in Denmark, as defined in ESRB Recommendation ESRB/2011/3 on the mandates of national authorities, while the Minister for Industry, Business and Financial Affairs has the power to activate and use a number of macroprudential instruments.

credit to households and businesses. Other financial organisations such as pension and insurance companies and investment funds can also be a source of systemic risk. The approach presented can be used to analyse systemic risks in these or other areas, even if they are not the focus of this analysis.

**BOX 1**

## Macroprudential policy and instruments

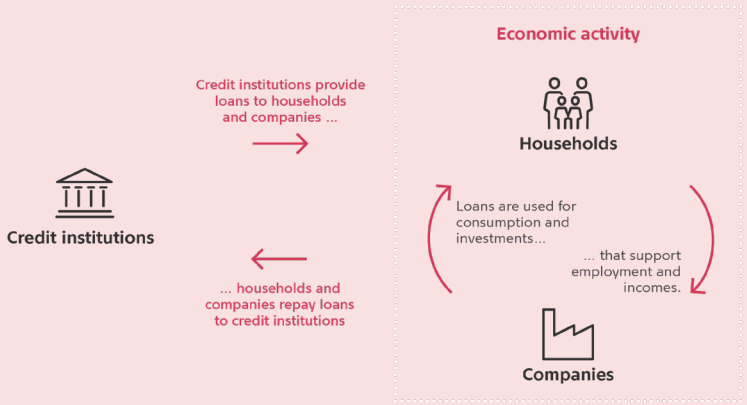
The overall aim of macroprudential policy is to ensure financial stability so that the financial sector makes a sustainable contribution to economic growth. This can be achieved by limiting the risk of a new financial crisis occurring and by minimising the damage to the economy if it does occur. Different types of instruments can be used to achieve this purpose. Those instruments can be used to address cyclical and structural systemic risks.

**Examples of instruments that can alleviate the damage caused by a crisis**
Examples of instruments that can reduce the damaging effects of a crisis include the various capital buffer requirements. They aim to ensure that institutions have greater capacity to absorb losses on their loans so they can continue lending. The different capital buffer requirements are used to address different types of systemic risk. Systemic risks related to the size and importance of individual institutions to the economy can, for example, be addressed with a SIFI buffer. The requirement can only be applied in relation to institutions identified as systemically important. Examples of other capital buffer requirements are the countercyclical capital buffer and the systemic risk buffer. The countercyclical capital buffer can be used to address cyclical systemic risks, while the systemic risk buffer can be used to address systemic risks not addressed by the other buffer requirements.

**Examples of instruments that can limit the build-up of systemic risks**
Examples of instruments that can help limit the build-up of systemic risks and thus the risk of crises are 'borrower-oriented instruments'. This could be a requirement for borrowers to make a certain down payment when buying a home, or rules for the size of a loan in relation to the borrower's income.

**CHART 1**

## Credit institutions, households and businesses influence each other, the financial system and economic developments



02

# What are systemic risks?

European and Danish legislation describes systemic risk as "*...the risk of significant disruptions to the financial system that could have serious negative consequences for the real economy*".[5] In practice, vulnerabilities or imbalances that could have a significant impact on the financial sector and the economy in the event of a shock constitute systemic risks. The likelihood of such events occurring and resulting in a financial crisis is usually small, but the consequences will be significant.

This section describes how *systemic* risks differ from *institution-specific* risks and when vulnerabilities and imbalances in the economy can constitute a systemic risk. It is the behaviour of the financial sector as a whole and its interaction with the real economy that are relevant in a systemic context, rather than individual market participants.

## The collective behaviour of institutions can pose systemic risks

Activity in society and the financial sector naturally changes over time. Financial and non-financial companies and households take on financial risks as part of their activities.

Credit institutions' business models inherently involve institution-specific financial risks, i.e. risks that each credit institution assumes due to its activities, business model and operational circumstances, see chart 2.

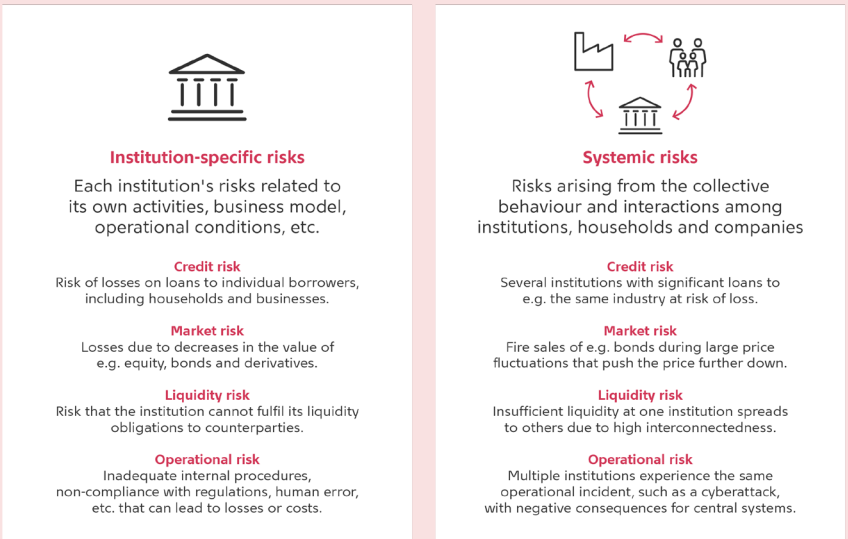
Banks take deposits from their customers and lend money to households for home purchases and business investments, among other things. When an credit institution grants a loan, there is a risk that it will incur a loss if the customer is unable to repay the loan.

Even if all institutions are exposed to the same type of shock (e.g. an increase in interest rates), such losses will materialise differently in each institution. This will depend on the individual institution's risk appetite and thus its risk profile. This may be due to differences in the geographical location of the collateral backing the loan or the individual customer's financial circumstances.

[5] See Financial Business Act and European Systemic Risk Board, 2019, Regulation (EU) 2019/2176 of the European Parliament and of the Council of 18 December 2019 amending Regulation (EU) No. 1092/2010 on European macroprudential oversight of the financial system and establishing a European Systemic Risk Board.

CHART 2

**Institution-specific risks can evolve into systemic risks due to behaviour and interactions between actors in the economy**




## Several types of behaviour and interactions can give rise to systemic risks

In addition to institution-specific risks, the interaction between the various actors in the economy and their collective behaviour can lead to the build-up of systemic risks.

*Behaviour* refers to how individual actors act in the economy, such as the willingness of institutions to lend and borrow and the terms of loans. *Interaction* means that individual actors can influence the development of the economy and the behaviour of other actors through their actions.

There are several types of behaviours and interactions that can give rise to systemic risks, e.g.[6]:

- *Herd behaviour.* Multiple institutions, companies or households act in the same way at the same time. While it may make sense for individual borrowers, lenders or investors to act in a certain way, their collective behaviour can have negative consequences for the economy. For example, institutions may relax their credit policies due to increased competition and therefore grant riskier loans. If such risky loans become widespread, it can have systemic consequences.[7]

  An example of herd behaviour in Denmark occurred in the period leading up to the financial crisis, when large, medium and small credit institutions relaxed credit standards.[8] Another example is the behaviour of home buyers in the run-up to the 2008 financial crisis. More people were willing to take on relatively high levels of debt when buying a home in anticipation of continued significant increases in house prices. The expectation of future house price increases made it attractive to buy a new (and larger) home, which contributed to increasing house prices. For a time, expectations of

[6] See also De Nicolò (2012).
[7] See Naohisa (2017).
[8] See Committee on the Causes of the Financial Crisis (2013).

continued sharp house price increases thus became self-fulfilling, pushing house prices out of line with the underlying economic development.[9]

- *Interconnectedness.* A high degree of interconnectedness between credit institutions can mean that a negative shock has a wider and faster impact in the financial system. Losses in one credit institution can quickly spread to others. For example, institutions can be interconnected if they own equity or bonds issued by another credit institution. There may also be interconnectedness if multiple institutions have loans to the same customers, customers in the same industry or own the same assets.[10] In this case, the institutions are indirectly interconnected through their common exposures, as the same types of shocks can cause risk of loss at the same time. If this is a general trend in the sector, it could be a systemic risk.

  An example of how interconnectedness contributes to systemic risk is the case of Archegos Capital Management, which went bankrupt in March 2021. The episode resulted in significant losses for a number of globally active banks exposed to Archegos.[11] Archegos' positions were concentrated in a few stocks, highly leveraged via equity derivatives with a number of counterparty banks. As the positions went against Archegos, it triggered to post extra collateral to the counterparties, which in turn triggered a sale of the same shares, and thus a self-reinforcing negative spiral that led to Archegos' bankruptcy and significant losses for the banks.[12]

- *Fire sales.* Fire sales occur when an institution is forced to sell off its assets, for example to obtain liquidity. They usually occur during periods of stress in the financial markets when several other actors also need liquidity. Due to few potential buyers, the asset will typically be sold at a low price and the seller will make a loss. This can affect the value of corresponding assets and lead to losses and decreased capitalisation for institutions. Collectively, it could lead to a new round of selling and asset price declines and end up eroding the capital of the institutions.

  One example of fire sales is the high uncertainty of the covid-19 outbreak in March 2020, which led to demand for liquidity to withstand stress ('dash-for-cash'). Equity prices fell sharply, forcing some investment funds to sell bonds and buy equities to fulfil their mandates.[13]

  Another example of fire sales relates to leveraged pension funds, or the so called liability-driven investment funds, LDI funds. Following the UK government's announcement of a series of fiscal measures in autumn 2022, yields on UK government bonds rose sharply. This caused stress in the LDI funds, which were pressured to sell UK government bonds with long maturities, amplifying further interest rate rises. A high degree of interconnectedness with the rest of the financial system meant that there was a risk of severe financial tightening, including restricting credit to the real economy. The episode caused so much turmoil in the financial markets that the British central bank, the Bank of England, stepped in with a purchase programme to support financial stability.[14]

Often, several of the above mechanisms can be at play at the same time, which can amplify potential negative effects. This can also be the case when it comes to other types of risk areas, such as climate-related systemic risks. The ECB points out that climate-related risks can affect several seemingly unrelated exposures.[15] This can increase concentration risk and indirect interconnectedness between institutions, i.e. several institutions can experience losses at the same time as

[9] See DØRS (2009), Klein, Asbjørn et al. (2016), and Hetland, Simon et al. (2021).
[10] See ESRB (2014) and NBER (2012).
[11] See Bank of England (2024).
[12] See Danmarks Nationalbank (2024).
[13] See the Danish Financial Supervisory Authority (2023).
[14] See Danmarks Nationalbank (2024).
[15] See ECB (2022).

they are exposed to the same types of events. The ECB also highlights that this may lead to reassessment of portfolio risk and fire sales if risks materialise.

**Systemic risks involve self-reinforcing and second-round effects that can increase the risk and size of losses for institutions**

What the different types of behaviour and interactions have in common is that they can lead to *self-reinforcing and second round effects* in the economy and financial system when many market participants change their behaviour at the same time. This is true both when the economy is doing well and when economic developments reverse. These self-reinforcing and second-round effects can increase the risk and size of losses for institutions. Systemic risks are thus more than the sum of risks in individual institutions.

Risks can often be both *institution-specific* and *systemic*. Market risk is an institution's risk of loss due to fluctuations in market prices of e.g. shares, bonds, currencies or commodities. Market risk is *an institution-specific risk* when it comes to each institution's risk of loss related to its specific portfolio due to decreases in market prices. *A systemic risk* may exist if several institutions hold a significant amount of the same securities and are likely to buy or sell them at the same time to a significant extent. This may reinforce rising prices when the securities are bought and falling prices when they are sold, i.e. a *self-reinforcing effect*.

Liquidity risk can also be an institution-specific or systemic risk. Deposit deficits are not necessarily a problem from an individual institution's perspective, but if there are many institutions with significant deposit deficits, it increases their vulnerability to fluctuations in access to liquidity in the financial markets. In the event of a shock, many institutions may find it challenging to obtain liquidity, as was the case during the financial crisis.

There are also examples where systemic risks are not related to the institution-specific risks. This can be the case, for example, when there are *knock-on effects* in the economy from a shock, see also section 3. An example of this type of systemic risk relates to the interaction between household borrowing and consumption. A negative shock to the economy can reduce household incomes and limit their financial flexibility. If households choose to reduce their consumption in order to pay the instalments on their loans, institutions will not initially incur losses on the loans. However, if there are many households reducing consumption, it could mean lower consumption in the economy overall. Lower consumption can mean lower corporate earnings and lower investments, which can lead to higher unemployment. This can exacerbate an economic downturn and cause losses on loans to businesses or households.

**Systemic risks may persist even if risks at institution level are addressed**

Measures that limit the risk of loss in individual institutions can to some extent limit the risk of loss in the financial sector. However, self-reinforcing and second-round effects mean that systemic risks can increase the risk and magnitude of losses beyond what institutions can account for in their risk assessments and capital reservations. Systemic risks can thus arise even if risks at the institution level are addressed. One example is the capital reservations by institutions based on internal risk models for calculating the capital requirement for credit risks or risk weights, IRB models.[16] Risk weights must reflect the credit risk in the institution's portfolio so that sufficient capital is reserved to cover any losses in the institution.

In the internal models, the risk of loss on individual customers and loans is assessed based on estimates of the probability of default, PD, the expected loss given default, LGD, and the expected amount of the exposure at the time of default, EAD[17]. Institutions use historical loss data based on data for their own

[16] The use of IRB models requires authorisation from supervisory authorities and are subject to a number of requirements and oversight.
[17] In addition to these main parameters, others may be used, such as maturity.

customers to estimate the risk of loss on individual loans within a one-year horizon. The risk weights used should thus reflect the risk of loss given default in the individual institution, i.e. institution-specific risks.

Systemic risks may result in individual institutions incurring losses that exceed their reservations, for example due to:

- The historical losses or correlations underlying estimates of the different model parameters and risk weights may not reflect the materialisation of current systemic risks. This may be the case if there are few observations of non-performing loans in the data or the existing historical data does not cover periods with losses or systemic crises. Few observations with losses can mean that institution-specific risks are underestimated. Furthermore, if institutions' data does not cover periods with losses during a systemic crisis, there is a risk of underestimating the potential losses the institution could incur in a severe economic downturn.

- The risk of contagion and self-reinforcing effects of a shock can lead to greater losses than model estimates suggest.

- The parameters included in models may not be an adequate reflection of the risk. When the economy is doing well, there will be an increase in house prices, employment and incomes, which is typically a sign of a healthy economy. Corporate profits will also reflect the positive development in the economy. However, data will not necessarily reflect whether there is an unsustainable development, excessive risk-taking or risk of significant change in these conditions. During an economic boom, there may therefore be a tendency for the estimated probability of bankruptcy to decrease. Furthermore, institutional conditions or behaviour may have evolved so that the risk materialises in a different way than it has historically. Overall, the result can be misleading risk weights during economic booms.

There are also certain types of risks that IRB models do not take into account. This applies, for example, to concentration risk in the form of significant exposures to the same industry or asset class. Based on estimates of the concentration risk in its own portfolio and asset composition, each institution will make capital reserves in the individual solvency requirement, Pillar II. However, systemic risks can still arise if there are many institutions that are particularly exposed to the same industry or asset class.

Institutions also use stress tests in their own capital planning to determine an appropriate level of capital to cover the risk of losses in severe macroeconomic stress. But such stress tests cannot reveal whether an institution has enough capital to cover losses should new shocks occur, if the economic scenario (and thus possible losses) looks different. Nor do they necessarily account for the full impact of additional losses that may occur from second-round effects in the economy.

In addition, risk weighting, individual solvency requirements and institutions' stress tests do not take into account any second-round effects that may arise due to their behaviour if they come close to the regulatory capital requirements. Institutions might choose to tighten lending standards to maintain distance to capital requirements. Tighter credit standards can result in otherwise creditworthy customers being denied loans. This can lead to a drop in consumption and investment and can exacerbate an economic downturn. This could lead to a new round of losses in the institutions.

03

# Systemic risks can disrupt the financial system and economy

Analysis of systemic risks focuses on identifying vulnerabilities and imbalances that could have serious consequences for the financial sector and the economy in the event of a negative shock, see box 2.

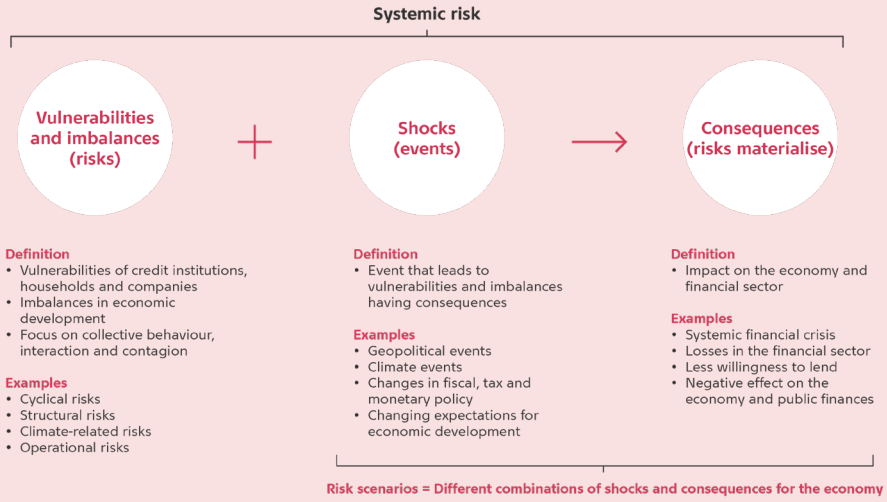
To distinguish systemic risks from other types of risks, the focus is on three main elements, see chart 3:

- **Vulnerabilities and imbalances** among credit institutions, households and businesses.
- Events or **shocks** that might mean that systemic risks materialise with serious consequences for institutions and the economy.
- The **consequences** if it happens.

An analysis that includes all three elements can form the basis for assessing whether there is a systemic risk.

CHART 3

**Analysing systemic risk often focuses on three main elements**




Note: The chart illustrates how a systemic risk can be described based on different sub-elements, drawing on the description in Sarlin (2016).

**BOX 2**

## Focus areas in oversight and analysing systemic risks

The European Systemic Risk Board, **ESRB**, focuses on ensuring financial stability in the European financial sector. The ESRB addresses systemic risks by overseeing and analysing whether there is:

- *Excessive credit growth and leverage.* According to the ESRB, excessive credit growth is central to explaining financial crises, which elevated leverage has helped to amplify.
- *Excessive maturity transformation and market illiquidity.* Excessive use of short-term and unstable funding can lead to asset sales, market illiquidity and contagion.
- *Direct and indirect exposure concentrations (interconnectedness).* Concentration in exposures makes a financial system vulnerable to common shocks, either directly through balance sheets, such as a loan from one credit institution to another, or indirectly through asset sales and contagion through markets and institutions.
- *Misaligned incentives and moral hazard.* This means, for example, whether institutions choose to take excessive risks because they believe that there are (implicit) public guarantees.
- *Robust financial structures.* This includes focus on the resilience of non-banking financial structures such as investment companies, pension and insurance companies and central counterparties, CCPs.

The Systemic Risk Council in Denmark monitors the build-up of systemic risks based on six monitoring blocks, corresponding to the areas monitored by the ESRB.

Systemic risk monitoring does not focus on individual credit institutions, unless they are systemically important financial institutions, SIFIs, whose size and function may involve systemic risks.

The Financial Stability Board, **FSB**, the International Monetary Fund, **IMF**, and the Bank for International Settlements, **BIS** (2009), point out in a joint paper that systemic risks, and specifically SIFIs, are associated with a behaviour (an externality) in which each financial institution has an incentive to manage its own risk and return, but not necessarily to consider the consequences of its risk-taking for the financial system as a whole. It points out that while this behaviour is common for all financial institutions, it is particularly important in relation to SIFIs as it will have serious consequences for the financial system and the real economy if an institution gets into trouble.

The **FSB** (2021) has updated its financial stability risk framework to focus on vulnerabilities that, in the event of a shock, could have negative consequences for the global financial system and thus the global economy. Among other things, the FSB focuses on monitoring vulnerabilities systematically and proactively, while maintaining flexibility.

The US **Federal Reserve** (2021), like the FSB, focuses on monitoring vulnerabilities that affect financial stability. The areas focused on include asset valuation vulnerabilities, household and corporate borrowing, financial sector leverage and funding risks.

The Bank of England, **BoE**, uses a similar conceptual framework to the FSB and FED in its analysis of systemic risks, including operational risk and market-based funding.

A ***vulnerability*** refers to signs of weakness or characteristics of institutions, households or companies that mean they could suffer large losses in the event of a negative development in the economy. For example, *households* may be vulnerable if their income is not sufficient to pay the instalments and interest on their housing loans after an increase in interest rates or unemployment. A vulnerability for *institutions* may be that they have large loans to individual industries or customer segments and are therefore highly dependent on developments in these industries and segments.

An ***imbalance*** is a development in the economy that cannot be sustained over time and will sooner or later require an adjustment to a more sustainable level. An imbalance might occur if house prices rise disproportionately compared to household incomes. This means that households have to spend a larger portion of their income to buy and finance a given home. At some point, income will no longer be sufficient to pay the instalments on the loans. This can lead to a decrease in demand for housing and potentially a decrease in house prices (a correction in house prices).

A ***shock*** is an event that causes vulnerabilities and imbalances to materialise and have serious consequences for the financial sector and economy.

There are two types of shocks:

- Shocks originating from the financial system or the economy – for example, sharp falls in house prices, large loan losses, etc.
- Shocks that arise independently of the financial system or the economy – for example, geopolitical events, a sudden change in economic policy, e.g. trade policies, or climate-related incidents.

Section 4 presents three illustrative examples of systemic risks related to the housing market, climate change and the green transition, as well as systemic liquidity risks in the non-banking sector.

The ***consequences*** can be severe for the financial sector and the economy when vulnerabilities or imbalances materialise. The focus is on assessing the potential consequences of a shock, how severe the consequences will be and how they spread throughout the financial system and economy (transmission channels).

The consequences can manifest themselves in ***direct*** and ***indirect losses*** for institutions:

- *Direct losses* are losses on the loans that institutions have given to their own customers, i.e. a direct impact.

- *Indirect losses* can occur in various sectors of the economy generally coming under pressure and affecting institutions and their customers, i.e. an indirect impact. Indirect losses can occur if a sector important to the economy is hit by a negative shock. A negative development in this sector can lead to higher unemployment, lower consumption and investment in the wider economy. Although institutions do not lend to businesses in this sector, they can incur losses on loans to households and other businesses. The indirect losses are thus a result of *the second-round effects* in the economy of a negative shock.

It's important to consider all the different elements when assessing whether a risk is systemic or not. Individual vulnerabilities and imbalances do not necessarily pose a systemic risk or threaten financial stability, but they can be the first signs that risks are building up and could potentially develop into systemic risks. It is precisely the interaction between the various vulnerabilities and imbalances and the overall behaviour and interaction of market participants that can give rise to systemic risks.

**Systemic risks can materialise in events of varying severity**

Different combinations of shocks and outcomes for the economy can evolve in different ways. Depending on the severity of the consequences, systemic risks can materialise in several possible scenarios:

- *Less severe episodes.* Systemic risks materialise in a sub-market or risks materialise gradually and the economy goes through a downturn without necessarily leading to a systemic financial crisis. Systemic risks can result in significant losses for institutions on their loans to customers because multiple customers and institutions are affected at the same time. Institutions can then tighten credit to avoid getting too close to the regulatory requirements for capital and eligible liabilities. This can happen even if the institutions in question have had a sound credit policy and risk management and have appeared robust. Overall, this can mean that creditworthy households and businesses cannot obtain a loan. If this happens to several institutions at the same time, it can lead to a tightening of credit in society.

- *Systemic financial crisis*. Systemic risks can, in a very serious scenario, materialise in a financial crisis. In such an event, the financial system comes under pressure. Institutions become more reluctant to lend because they experience or expect higher losses. In the worst-case scenario, institutions may stop lending altogether, creating a credit crunch. As a result, a number of otherwise creditworthy projects might be unable to obtain loans. This could exacerbate the economic downturn and contribute to even lower consumption and investment, leading to higher unemployment and further falls in household and business incomes.

There have been various examples over time of how systemic risks can materialise and, in some cases, lead to systemic financial crises, see box 3. These systemic crises differ in their causes and consequences, but also share several commonalities, including significant optimism and risk-taking in the years leading up to the crisis, increased lending by credit institutions, and increased household and corporate debt. This was followed by a period of significant losses in the institutions, cautious new lending, a decline in economic activity and rising unemployment.

**BOX 3**

## Selected historical examples of the materialisation of systemic financial risks

***The financial crisis***
The financial crisis, which began in 2007, was caused by an interplay of several global and domestic factors. In the years before the crisis, systemic risks built up in the financial system and economy. Significant economic and financial imbalances were built up, including soaring house prices, high credit growth and risk-taking in banks and other credit institutions. Access to credit was generally easy, financing costs were low and optimism was widespread. In Denmark, real house prices increased by around 70 per cent from 2000 to the peak in 2007, and credit to households and businesses increased from around 80 per cent to around 120 per cent of GDP in roughly the same period.

The international financial turmoil started in 2007 when concerns about the US housing market and loans given to borrowers with low creditworthiness (subprime lending market) gripped the financial markets. Systemic risks materialised and spread, developing into a full-blown financial crisis with global implications, including major banks getting into trouble. The crisis resulted in a severe economic setback globally, including recession in the US, EU and Denmark. House prices and equity prices fell sharply.

In Denmark, nominal GDP fell by approximately 8.3 per cent from 2007 to 2009, real house prices fell by approximately 30 per cent from 2007 to 2012, while the leading stock index fell by approximately 60 per cent from 2007 to 2009. Public intervention was needed in Denmark to ensure financial stability, including an unconditional state guarantee to all depositors and other unsecured creditors of banks (Bank Rescue Package I) and conditional state capital injections and individual state guarantees in credit institutions (Bank Rescue Package II).

***The European sovereign debt crisis, 2010-2013***
The European sovereign debt crisis followed the financial crisis. The crisis affected all EU Member States, but especially the euro area, where the single currency, the euro, came under significant pressure.

The financial crisis, the economic downturn in EU Member States and the easing of fiscal policy to support economies meant that public finances deteriorated significantly, with increasing deficits and debt. In Greece, Portugal and Ireland, for example, government debt reached approximately 180, 130 and 120 per cent of GDP respectively. Their government bond yields increased significantly due to the higher risk of debt default. In Greece, Portugal and Ireland, interest rates on 10-year government bonds reached around 30, 14 and 12 per cent respectively. In many EU Member States, banks were significantly weakened, with high levels of non-performing loans and weak capital and liquidity buffers.

Government finances and banks negatively affected each other, triggering the so-called bank-sovereign nexus, especially in the euro area. The banking sector was affected, as many banks had large holdings of government bonds from the vulnerable Member States and suffered losses on their loans due to the deteriorating economy. This had a further negative impact on public finances as banks were restricted in their lending due to their actual and expected losses, which dampened investment and consumption, further reducing economic activity.

*Continues ...*

*... continued*

Systemic risks had built up and materialised with serious consequences for public finances and the economy, so some euro area Member States (Cyprus, Greece, Ireland, Portugal and Spain) needed external loan programmes with conditions on economic reforms, financial sector reforms and fiscal austerity.

***Ireland, financial and housing market crisis, 2008-2013***
The Irish financial and housing market crisis developed as part of the global financial crisis. In the years before the crisis, significant vulnerabilities and imbalances built up in the financial system and housing market. House prices soared, supported by low interest rates and easy access to finance, leading to high credit growth. Between 2000 and 2007, real house prices increased by around 55 per cent, while credit increased from around 50 per cent to around 100 per cent of GDP between 2002 and 2007. At the same time, economic policy helped to strengthen the business cycle.

Between 2007 and 2012, real house prices fell by around 55 per cent. Banks with significant exposure to the housing market suffered significant losses as well as capital and liquidity problems. Many households and businesses were left with housing debt that exceeded the value of the property (technical insolvency). Public intervention was needed to ensure financial stability and the banking sector was partially nationalised. This led to a dramatic increase in Irish government debt, which rose from around 25 per cent in 2007 to around 120 per cent of GDP in 2012.

Source: Danmarks Nationalbank, Reinhart and Rogoff (2009), Abildgren et al. (2011), Committee on the Causes of the Financial Crisis (2013), Bank for International Settlements, BIS, and Eurostat.

04

# Systemic risks can be cyclical or structural

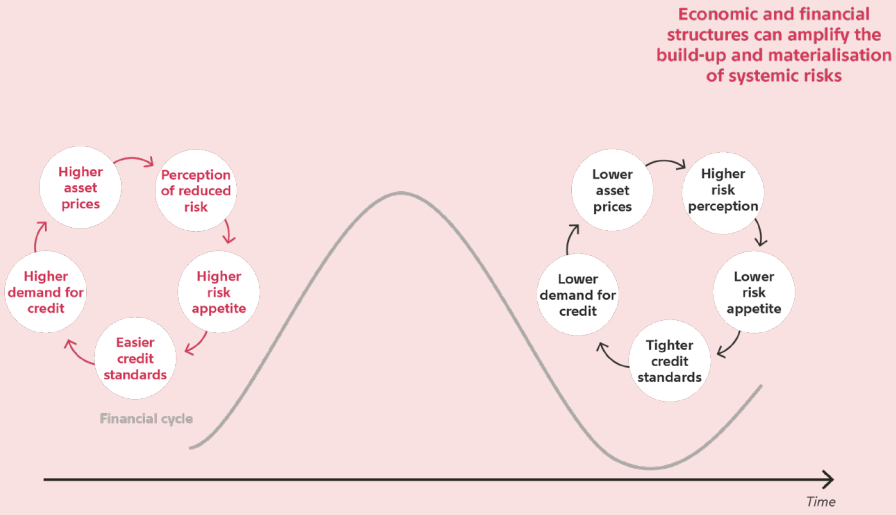
A distinction is often made between cyclical and structural systemic risks. There is not always a clear delineation between cyclical and structural systemic risks, and they are often present in the financial system and economy at the same time. Both types of systemic risk can affect the depth and length of financial crises.

### Cyclical systemic risks

Cyclical systemic risks build up in a financial and economic upswing, i.e. an upward financial cycle, see chart 4. A financial cycle is a development in general financial conditions such as the amount of lending, asset values and willingness to take risk. A financial cycle differs from an economic cycle (development in economic activity, employment, etc.) in that it typically has greater fluctuations and a longer duration.[18]

**CHART 4**

**Systemic risks build up and materialise over a financial cycle through interactions between asset prices, risk appetite and credit provision**




Note: The chart illustrates how systemic risks build up and materialise over the financial cycle.
Source: Based on Borio (2012) and Drehmann et al. (2012).

In an upward financial cycle, economic activity is on the rise, credit institution profits are high, and losses are low. Prices of homes, shares and other assets are rising, risk perception is decreasing, customer access to credit is easy and cheap and demand for loans is high, which can imply a (significant) growth in credit.

[18] Borio (2012) and Drehmann et al. (2012) point out that a business cycle has typically been measured to last between one and eight years, while in a sample of seven industrialised countries since the 1960s, a financial cycle has lasted around 16 years. Drehmann et al. (2012) also points out that a financial cycle can best be characterised by the close correlation in the development of credit and house prices, that the peak of financial cycles is closely linked to systemic banking crises, and that financial cycles and business cycles are different, albeit related, phenomena.

In an expansion, market participants are often optimistic and expect the growth in economic activity to continue. Market participants may perceive risks as low, leading them to make riskier financial decisions. For example, households may want to take out larger loans and buy more expensive homes, as there is a belief that the good times will continue. Businesses may become more willing to make investments based on favourable conditions, such as high customer demand or low financing costs on loans. Optimism can lead to institutions unintentionally loosening their credit standards. The result may be a significant increase in institutions' lending, with loans of lower credit quality and therefore a greater risk of causing losses for the institutions later on.

The perception of low risk can become self-reinforcing.[19] During an expansion, it can be difficult for individual actors to see the real risk – a kind of risk illusion. That is, a perception in which stakeholders underestimate the actual risks of, for example, a loan or investment due to over-optimistic expectations. The willingness to take on more risk may seem reasonable in the situation, even if it later becomes clear that systemic risks were present. Competition between institutions for lending can further amplify these risks in the situation.

When the trend reverses, the built-up cyclical systemic risks materialise. Falling prices of housing, equity, etc. can increase concerns about the economic development among market participants and reduce their risk appetite. This can lead to tighter access to credit, making it harder for households and businesses to finance home purchases and investments. The result can be slower economic growth or decreased lending by the institutions. The same dynamics that contributed to amplify the expansion, would now amplify the downturn.

Institutions may become more cautious in their lending even if they merely anticipate higher losses on their existing loans. This may be because they want to maintain a certain amount of head space to regulatory requirements. Thus, credit institutions could react even before risks have materialised into losses. This reaction may make sense from the point of view of individual institutions and help mitigate their risks, but it may also mean that otherwise creditworthy households and businesses struggle to obtain loans to the same extent. This in turn can contribute to a perception of greater risk in the financial system and a slowdown in the economy. This type of behaviour can make it difficult to identify systemic risks, as institutions can still appear robust and with a sound margin to capital requirements.

As in an upturn, a downturn with financially stressed institutions can be contagious and self-reinforcing. This can happen when loan losses in some institutions lead to concerns about the credit quality of loans in others.

**Structural systemic risks**

Structural systemic risks stem from the way an economy and financial system is structured. These risks are often characterised by the fact that they evolve slowly, meaning they are more persistent compared to cyclical systemic risks.

Structural conditions that may entail structural systemic risks include:

- That institutions have significant lending to individual industries or segments.
- That institutions are highly interconnected and problems in one can spill over to another.
- That the banking sector or individual credit institutions are large relative to the size of the economy.
- The level of interest rate sensitivity of household and corporate debt.
- That an economy is highly dependent on individual industries.

[19] See Borio (2009) and Borio (2011), who refer to this phenomenon as the "paradox of financial instability", i.e. the financial system and the economy appear to be most robust at a time when they are most vulnerable. For example, indicators of risk premiums and volatility are very low and signal very low risk, but in practice are signs of excessive risk-taking.

For example, high levels of debt can make households more vulnerable to an economic downturn with unemployment and loss of income, as income is needed to pay the instalments and interest. For example, if the economy is heavily dependent on certain industries and those industries get into trouble, it can have major repercussions for the economy, such as increasing unemployment, which can lead to higher debt defaults and losses in credit institutions.

Examples of sources of systemic risk can be found at table 1. A single source can pose a systemic risk in itself if it is sufficiently significant to the financial sector and economy. Even if a source is not significant enough on its own to be a systemic risk, it can become so in interaction with other sources. For example, moderate credit growth in conjunction with soaring house prices and high and interest-sensitive household debt can pose a systemic risk, even if credit growth in itself does not pose a systemic risk.

**TABLE 1**

**Examples of sources of cyclical and structural systemic risks**

| | Credit development | Liquidity and maturity transformation | Robustness and capitalisation | Economy and financial markets |
|---|---|---|---|---|
| **Cyclical systemic risks** | • Growth in lending<br>• Growth in lending to specific groups, industries, geographical areas<br>• Increase in risky loans | • Increasing deposit deficits<br>• Increasing dependence on market funding<br>• Shorter maturities on debt issuances | • Rising risks are not adequately covered by capital<br>• Low impairment charges and provisions are out of step with increasing risks | • Increase in economic activity and employment contributes to risk build-up<br>• Rising prices of housing, securities, etc.<br>• Optimism and low risk perception<br>• The search for returns |
| | **Exposure concentrations** | **Interconnectedness** | **Systemically important financial institutions, SIFIs** | **Economic and financial structures** |
| **Structural systemic risks** | • Significant lending to groups of businesses/industries<br>• Several institutions have significant loans to the same type of customer or hold the same assets | • Significant deposits/lending between credit institutions<br>• Significant dependencies between credit institutions and investment companies, pension funds, etc.<br>• Concentrated holdings of assets, e.g. mortgage and government bonds | • Single institutions are of key importance to the economy<br>• Similar business models | • Large financial sector relative to the economy<br>• Few institutions dominate the sector<br>• High level and interest rate sensitivity of debt among households and businesses<br>• One or a few industries dominate the economy |

Source: Selected risk categories based on the description in ESRB (2014).

# 05
# Illustrative examples of systemic risks

This section presents three illustrative examples of systemic risks related to the housing market, climate change and green transition, and liquidity risks in non-banks.

The examples illustrate how systemic risks can build up and materialise in different areas. Although the focus of the examples differs, there are a number of common features that characterise systemic risks:

- Risks build up over time as the economy develops.
- Risks build up in the interaction between different actors.
- Structural factors such as debt levels, interest rate sensitivity of debt and economic policy can influence how risks develop.
- The focus is not on the survival of individual institutions, but rather on the institution's behaviour before the capital headroom to capital requirements is used up.

## Example 1: The housing market

Systemic risks in the housing market can be cyclical and structural.

Housing markets in different countries have different characteristics, including financing, regulation and taxation. Historically, developments in the housing market have often played a significant role in amplifying economic activity through household borrowing, consumption, housing investment and construction activity.[20] In Denmark, housing debt accounts for the largest share of total household debt. The debt and value of the property pledged as collateral for borrowing thus has an impact on financial stability.

House prices and credit have both grown strongly in Denmark and other countries in the run-up to systemic financial crises, see chart 5. Sharp falls in house prices have also often coincided with systemic financial crises.

***Housing market growth may involve the build-up of cyclical systemic risks***

Vulnerabilities and imbalances in credit institutions and households related to the housing market can build up over the financial cycle, including through rising house prices, higher risk appetite and easier credit standards.

Rising house prices, economic growth and low interest rates can contribute to a perception of low risk in the economy, including the housing market. This can lead to increased risk-taking in institutions and households, with homes being bought for personal use, but also for investment and consumption in the expectation that rising house prices will continue. This can lead to increased demand for housing and increased construction activity.

A higher risk appetite in institutions may mean that they loosen their credit standards due to competition for new lending. This can allow more households

[20] See for example Jordá et al. (2015) and Reinhart and Rogoff (2009).

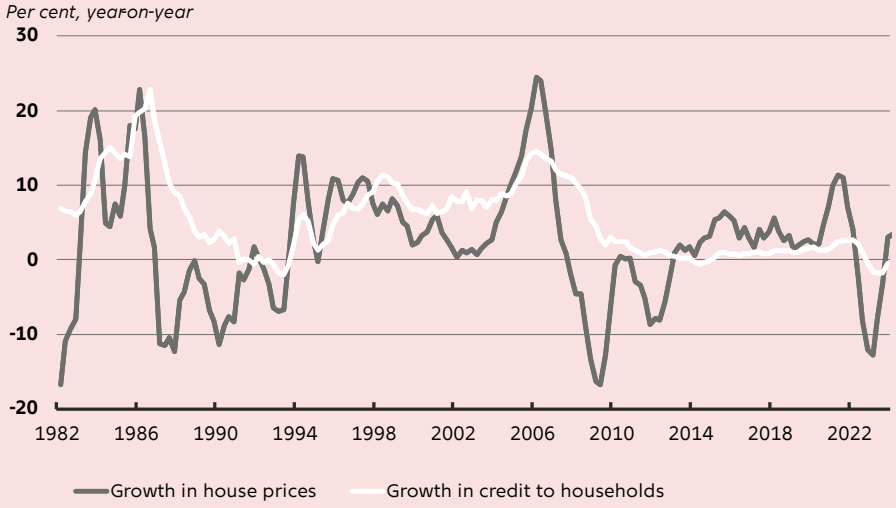
than otherwise to get a loan and buy a home. In practice, rising house prices may allow borrowers to secure larger nominal loans on their homes, even if lending rules remain unchanged.[21]

The housing market can involve risks that go beyond the institutions' immediate individual risks. This should be seen in light of the fact that developments on the housing market, including house prices, affect institutions broadly through significant mortgage loans and collateral. It is the collective behaviour and interaction of institutions and households in terms of lending, credit demand, consumption and investments that affect and are affected by the housing market and economy. Institutions' lending policies can contribute to rising house prices, which in turn, credit institutions also base their lending policies on.

An economic downturn can trigger falling house prices, causing systemic risks to materialise. For example, it will reduce property values, which can affect consumption and lead to higher unemployment. Loss of income can mean that households struggle to service their mortgages, and that the value of their homes thereby falls below the amount of debt. This can lead to higher losses for institutions, less lending capacity, and greater caution among both institutions and households when taking on new loans.

**CHART 5**

**Sharp increase in house prices and credit during previous financial crises in Denmark**




Note: House prices are the cash price of single-family houses from Statistics Denmark. Growth in credit to households is growth in credit from Danish banks and mortgage credit institutions to Danish households. Latest observation is Q3 2024.
Source: Statistics Denmark and Danmarks Nationalbank.

[21] For example, if a home has a value of 2,000,000 kr., a mortgage loan of 1,600,000 kr. can be taken out with a loan-to-value limit of 80 per cent. If the value of the home increases to 2,500,000 kr., a loan totalling 2,000,000 kr. can be taken out, i.e. 400,000 kr. more than originally. Rising house prices thus allow for a larger nominal loan in a home, even if loan limits do not change.

# Example 2: Climate-related systemic risks

Systemic risks linked to climate change and the green transition (climate-related systemic risks) have attracted increasing attention in recent years.[22] Climate-related financial risks can be related to climate change (physical risks) or green transition (transition risks).[23]

Systemic risks related to climate change include the risk of storm surges, floods and droughts. Risks linked to the green transition could include taxes on greenhouse gases or stricter requirements for the energy efficiency of buildings. Transition risks can include the risk that existing assets of businesses become redundant or lose value, such as machinery, buildings and oil extraction infrastructure i.e. stranded assets.

Climate change and transition risks can significantly reduce the value of assets and lead to higher losses for institutions if loans default.

**Climate-related risks can be systemic**
Several of the dimensions that characterise systemic risks apply to climate-related risks:

- This is a development that affects all actors in the financial system and the economy at the same time.
- Risks can be amplified by a high degree of concentration in certain exposures or in interaction with other risk factors. If credit institution exposures are similar, they are vulnerable to the same climate-related risks. They may therefore be prone to similar behaviour, which can increase the likelihood that individual risks can translate into systemic risks.

Should risks materialise, they can have negative consequences for the financial sector, for example through direct losses for affected portfolios, and indirectly through the impact on the economy.

The following is based on an illustrative example of higher energy efficiency requirements for homes, see chart 6.

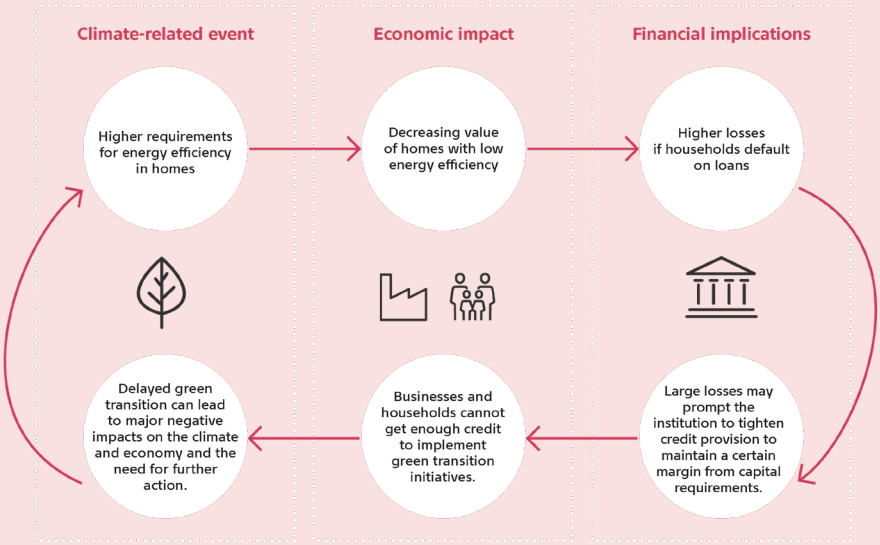
In many cases, energy efficiency upgrades of buildings is economically viable and can contribute to lower emissions. However, there is a risk that new requirements could push prices down for the least energy-efficient part of the building stock, for which energy efficiency upgrades are not implemented, for example because they are not economically viable. Lower prices reduce the value of the collateral securing loans, which can increase institutions' credit risk on these loans.

If companies or households default on their loans, it will mean higher losses for the institutions. A higher risk of losses on individual customers can mean that the impairment charges and risk weights (and thus capital requirements) applied by institutions increase, forcing them to tighten credit standards if they want to maintain a certain margin from capital requirements. If losses are high, an institution may have to tighten credit across customer segments.

[22] See e.g. ESRB (2022) and Bartsch et al. (2024).
[23] For a review of climate-related financial risks, see alsoMøllerand Oksbjerg (2024).

CHART 6

**Higher energy efficiency requirements can pose climate-related systemic risks**



# Example 3: Systemic liquidity risks in non-banks

The analysis has indicated that the interaction between credit institutions, households and businesses can pose systemic risks.

However, non-bank financial institutions, NBFIs, can also be a source of systemic risk. This is increasingly recognised at home and internationally, including in the EU, where non-banks make up a large and growing share of the financial sector. 'Non-banks' refers to a broad and diverse group of financial companies, including insurance and pension companies, asset managers, various types of investment funds, and central counterparties, CCPs. They often play an important role in the financial system and are closely interconnected with the banking sector.[24]

For non-banks, liquidity can be a key risk factor. Liquidity risks in non-banks can stem from the nature of their assets and liabilities. Liquidity risks can arise, for example, due to a high degree of maturity mismatch between non-bank assets and liabilities or due to the liquidity profile of assets.

Non-bank liquidity risks can pose a systemic risk and lead to a potential systemic liquidity crisis if multiple actors exhibit the same behaviour and take on the same liquidity risks. Systemic risk can also be amplified by strong interconnectedness with the banking sector, as this raises the risk of second-round effects across markets and through to the banking system.[25]

**Systemic liquidity risks can build up and materialise during the financial cycle**

Systemic liquidity risks can build up when the economy is doing well, see chart 7. In stable market conditions, liquidity can be ample and cheap. For example, this can be reflected in small differences between bid and ask prices (bid-ask spreads) on financial assets such as stocks, bonds and derivatives. Investors may be willing to provide capital or debt financing at a lower price (required rate of return) than they otherwise would be. Abundant and cheap liquidity can encourage non-banks and other market participants to take on greater liquidity risk and leverage their investments higher.

After a shock, systemic liquidity risks can materialise. This can lead to more difficult access to liquidity, more expensive liquidity and deleveraging. More difficult and expensive access to liquidity can manifest itself in large bid-ask spreads on financial assets, i.e. investors have to accept a larger discount in price if they want to sell a financial asset. Investors will factor a higher required return into the price and more collateral or higher interest rates for debt financing to continue providing liquidity.

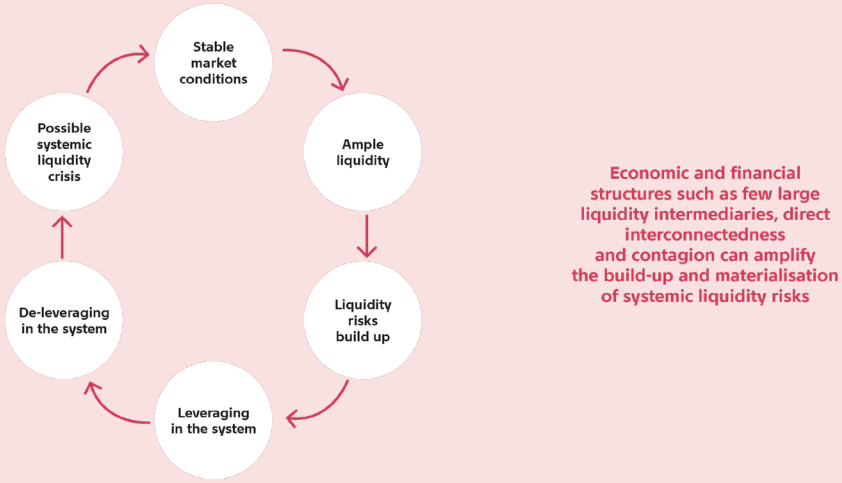
The materialisation of liquidity risks can lead to fire sales, where non-banks have to sell a significant proportion of their assets at a time when they need liquidity for their payment obligations. For example, if several investors in an investment fund choose to withdraw their invested capital at the same time, the fund may be forced to sell illiquid assets at a large discount in price. Similarly, if the fund cannot extend its loans during a period of turmoil, it may be forced to sell off assets in a falling market at a low price. These dynamics can be amplified and cause stress in financial markets if many and large actors change their behaviour at the same time. Some operators may experience liquidity problems to the extent that they go bankrupt.

[24] Non-banks carry out activities on behalf of their customers, such as lending, saving, investing or clearing financial trades.
[25] See ECB (2018).

Furthermore, when there is a strong interconnectedness with the banking sector (e.g. through holdings of bank debt issues), liquidity problems in non-banks can spread to credit institutions and through them to the economy.

**CHART 7**

**Illustration of the build-up and materialisation of systemic liquidity risks**




Note: The chart illustrates how systemic liquidity risks can build and materialise over the financial cycle and how they can be amplified by interrelated structural liquidity conditions.
Source: Based on ECB (2018) and Bank of England (2021).

06

# Identification of systemic risks

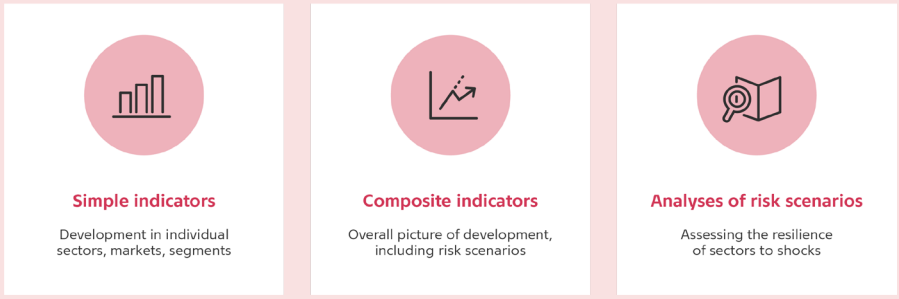
In order to address systemic risks effectively, authorities must be able to identify these risks. In recent years, both internationally and in Denmark, efforts have been made to develop frameworks and methods for identifying systemic risks, as well as to strengthen the data foundation supporting such analyses. This contributes to a sound basis for identifying systemic risks and making decisions on mitigation measures.

Monitoring and assessment of systemic risks is designed to enable authorities to implement measures to limit or address them. In general, the earlier initiatives are initiated, the more likely they are to contribute to limiting the build-up of systemic risks and thus support financial stability. If action is taken too late, there is a risk that it could amplify a downturn in the economy. The focus is therefore often on finding signs of systemic risk build-up before it's too late. This is complicated by the fact that it can be difficult to assess exactly how and when a risk potentially becomes systemic and could have negative consequences.

Authorities use a variety of tools to identify systemic risks and understand the consequences if they materialise. Such tools range widely, from simple indicators that track developments in, for example, house prices and credit, to models that shed light on the interaction between the financial sector and the economy, see chart 8 and box 4.

**CHART 8**

**Indicators and models shed light on different aspects of systemic risk**




The focus of the authorities is often on oversight and the analysis of vulnerabilities or imbalances in the overall financial sector and economy and how they may develop in different risk scenarios. Individual institutions play a limited role in the assessment of systemic risk, unless they are SIFIs.

Although the focus is on the overall development of the economy, developments in individual segments or areas can provide essential information when identifying systemic risks. A low average LTV ratio can, for example, cover large differences in LTV ratios across households in different geographical areas, or that households with a high LTV ratio have the riskier loans (e.g. variable interest rates) and therefore may be more vulnerable.

Monitoring allows the authorities to take a cross-cutting view of the financial system and the economy and examine the interactions between different market participants. This is because they have access to data from all relevant actors and can engage in dialogue with them individually. They can build an overall picture that provides a robust basis for decision-making when implementing initiatives.

The assessment of systemic risk will also take into account developments in the economy, financial and economic policies (e.g. financial sector regulation, tax policy, fiscal policy and monetary policy) and interest rate environment. For example, deductions for interest expenses and housing taxation affect the total cost of owning a home, just as interest rates affect how large a loan households can service with their incomes.

**BOX 4**

## How can systemic risks be identified?

**Simple indicators**
The starting point for identifying systemic risks is to oversee individual indicators, such as developments in credit, house prices, banking sector profits, etc. Indicators can be selected based on whether potential systemic risks are considered cyclical or structural. They can also be selected based on their ability to historically signal the build-up of vulnerabilities and imbalances, such as soaring lending and house prices.

Individual indicators can provide information about recent developments in the economy, but do not necessarily tell us whether such developments indicate the build-up of systemic risks or whether reaction to them is needed. There are several methods to assess the development of each indicator, and authorities will often use several of them at the same time to understand the observed development and interaction between indicators:

- **History**. A simple method is to look at the development of a single indicator in relation to historical trends, such as whether credit growth is high compared to the historical average or whether a trend has been observed for any length of time. However, structural changes in the economy may mean that current developments cannot be compared with historical developments.

- **Statistical trend**. Another relatively simple method is to compare the development to a simple statistical trend. This approach is behind one of the main indicators developed after the financial crisis, known as the 'loan-to-GDP gap'. The trend is estimated based solely on historical data, while developments in the economy, labour market and incomes are not taken into account. The trend could subsequently remain at a higher level for a long time, making interpretation difficult.

- **The economy**. The development of a single indicator can be compared to trends in other relevant variables, such as house prices in relation to disposable income. An increase in the indicator would signal that house prices are growing faster than disposable incomes. Over time, this can mean that incomes are insufficient to cover a household's mortgage repayments and interest.

- **Model-based assessment**. The development of an indicator can be seen in relation to a long-term or structural level or in relation to the development of several factors in the economy. For example, credit development can depend on the development of GDP, interest rates and household wealth. A model can be used that reflects the historical relationships between these factors. If the actual credit development is higher than a model suggests, it may indicate excessive credit.

**Composite indicators**
Each indicator can highlight developments in a particular area. Authorities often use composite indicators to get an overall picture of the development of possible systemic risks in the economy. Composite indicators typically draw on indicators of the development of cyclical systemic risks and structural systemic risks, such as Systemic Risk Indicators. A composite cyclical risk indicator for Denmark includes indicators for developments in stock prices, credit development, debt servicing ratio and house prices. In addition, estimates of the financial cycle are often used, which typically describe the development of loans and asset prices.

*Continued ...*

*... continued*

**Impact on the economy in different risk scenarios**
What the individual indicators, composite indicators and the financial cycle have in common is that they describe the development of the economy based on observed data, i.e. they are retrospective. It may also be relevant to look at what the development might look like in different risk scenarios, i.e. a forward-looking approach. For this purpose, various measures based on Value-at-Risk models have been developed in recent years. The purpose of these measures is to assess the likelihood of a risk scenario occurring and how large a drop in, for example, house prices or economic activity could occur in the different scenarios, taking into account cyclical and structural factors and regulatory measures.

**Analysing the resilience of the financial sector**
When assessing systemic risk, various types of stress tests and sensitivity analyses are also often used to assess the robustness of the financial sector. These can be models that assess the ability of institutions to bear losses in different macroeconomic scenarios. There are also models that highlight how resilient individual institutions are in light of their financial connections to other actors in the financial sector. It can shed light on whether problems in a single institution can spill over to other institutions and identify key actors in the system. So-called partial models and sensitivity analyses can also be used to examine the effects of individual shocks on households, companies and credit institutions. For example, it may concern whether businesses in a particular sector can continue to repay their loans if interest rates rise or their earnings fall.

**A comprehensive and cross-cutting view of potential systemic risks**
Drawing on the various methods and indicators, the authorities can take a cross-cutting view, build an overall picture, and shed light on different aspects of systemic risk. Such a picture can include interactions between indicators and actors as well as data for all institutions. This data can be combined with company and accounting data to further assess systemic risks. Qualitative information from meetings with financial institutions or other market participants can also be included.

Source: Grinderslev et al. (2017), Otte and Yordanova (2020), Cucic et al. (2022).

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Editing completed on 31 March 2025