DANMARKS NATIONALBANK

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Climate change can have a spillover effect on financial stability

- Climate change can pose risks to the financial sector and financial stability. Financial institutions should incorporate these risks in their risk management, and financial regulation should reflect the actual risks.
- A robust financial sector may contribute to the transition to a green economy by continuing its role in allocating capital.
- Credit institutions can be affected by physical risks, e.g. in the event that prices fall on property that may eventually become at risk of flooding. The property constitutes the underlying collateral for most mortgages.
- The financial sector has limited loans to and investments in the most carbon-emitting industries.

Climate changes

expected in Denmark, according to climate experts.

Read more

International cooperation

about climate-related risks with participation of Danmarks Nationalbank.

Read more

Green investments

have become more common in recent years.

Read more

This analysis is the first step in Danmarks Nationalbank's efforts to understand how climate change may affect economic and financial stability. The analysis reviews two examples of risks where the financial sector may have exposures.

Climate change may impact financial stability

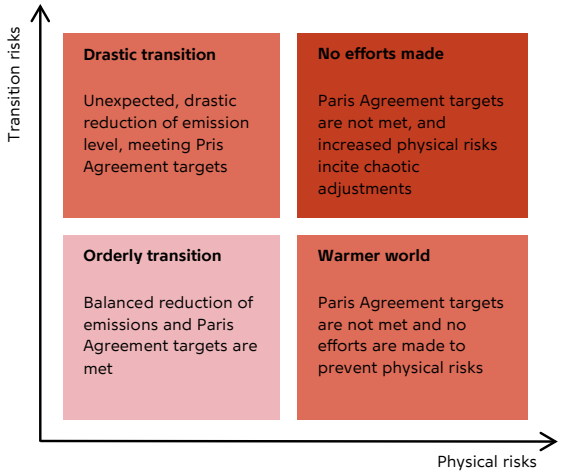
Climate change and the transition towards a carbon-neutral society may affect economic development. Climate change is associated with substantial uncertainty, but it can have considerable implications for Denmark, cf. Box 1. It is evident that addressing climate change requires political action, e.g. through fiscal or tax policy measures.

In terms of the economy and the financial system, there is uncertainty about the transition, i.e. how the challenges of climate change will be addressed, cf. Chart 1. The best scenario for the transition is an orderly and anticipated transition to a carbon-neutral economy. At the global level, a number of countries entered into the Paris Agreement in 2015 to limit the increase in the global mean temperature to 2 degrees Celsius and to pursue efforts to curb the temperature increase even further to 1.5 degrees Celsius, UN (2015).

The sooner the transition is launched, the more likely the process will be orderly with a high degree of predictability. The worst case scenario entails a situation in which there has been no action and society fails to reduce emissions in time with considerable consequences.

Regardless of how the transition to a green economy will materialise, it could affect the financial system and accordingly financial stability. A small, open economy like the Danish economy is exposed to both national and international developments. This applies not least to global supply chains.

Risks associated with climate change Chart 1



Source: NGFS (2019).

Danish banks can be indirectly exposed to developments in other countries through loans to Danish firms. As an example, firms' production or sales may be affected by new regulations or change in consumer preferences in those countries. Furthermore, the global financial markets are strongly integrated with cross-border ownership. The value of Danish financial institutions' investments may also be affected by developments in other countries.

Financial institutions and authorities should consider all relevant risks in their risk management, supervision and assessment of financial stability, respectively. Hence, they should also take climate-related risks into account in future.

Several channels for spillover effects

The implications of climate change for the financial sector are often divided into physical risks arising from the actual climate change, and transition risks[1], which may arise in connection with an economic transition, cf. Chart 2.[2]

1 Other types of risks are legal risks (or "liability risks"), which refer to the effect of firms being affected by climate change seeking compensation from whoever they hold responsible. This could either affect the bottom line of those firms or their insurance companies if they are insured.

2 See e.g. Olovsson (2018), Turtveit and Bank of England (2015).

Considerable climate implications for Denmark in case of continued carbon emissions

Box 1

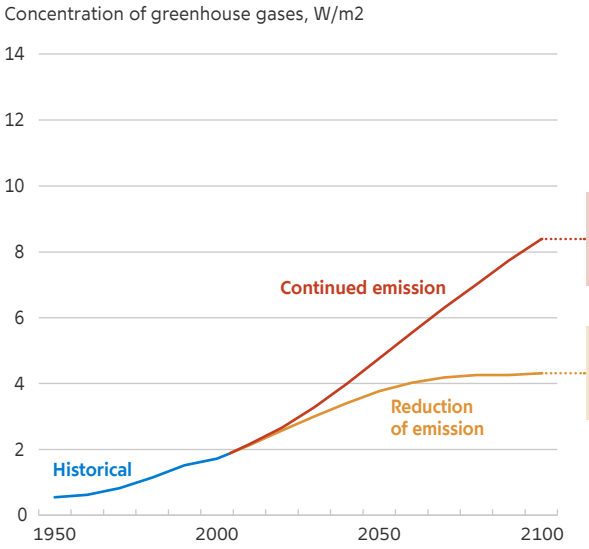
Today, there is consensus that greenhouse gas emissions to the atmosphere are drivers of climate change. The UN Intergovernmental Panel on Climate Change, IPCC, has identified two scenarios for concentration of greenhouse gases in the atmosphere, the chart (left). If emissions continue unabated, concentration in the atmosphere will rise sharply towards 2100. If, on the other hand, emissions are reduced towards 2050 or so, subsequently making the economy carbon neutral, concentration in the atmosphere can be stabilised at a lower level.

In both scenarios for greenhouse gas emissions, the Danish climate could change substantially towards 2100, cf. the chart (right). If global carbon emissions continue at the current rate, the Danish Meteorological Institute (DMI) expects the mean temperature in Denmark to increase by approximately 3.6 degrees Celsius. However, these projections are associated with a high level of uncertainty implying a wide range of possible estimate outcomes. For example, DMI indicates that in the scenario of continued emissions, the probability of a temperature increase of 4.4 degrees Celsius or more is 10 per cent. At the same time, DMI expects the sea levels around Denmark to rise and extreme weather events to become more frequent. This is also subject to great uncertainty. For example, in the scenario of continued carbon emissions, there is a 10 per cent probability of sea levels rising by 1.05 metres or more.

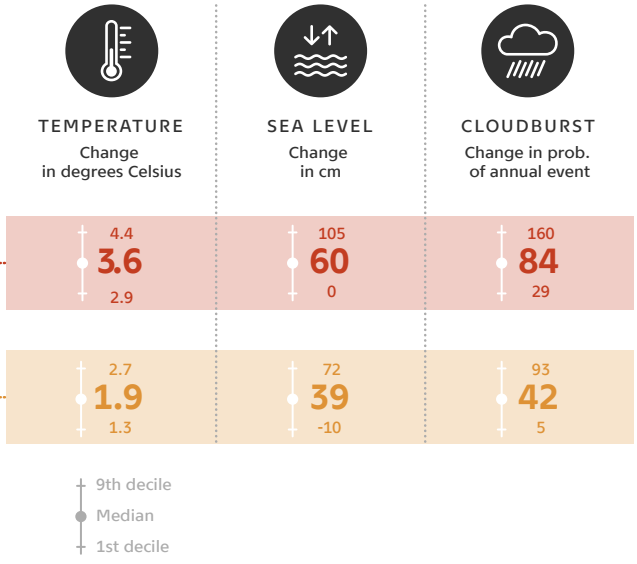
At the global level, a number of countries entered into the Paris Agreement in 2015 to limit the increase in the global mean temperature to 2 degrees Celsius and to pursue efforts to curb the temperature increase even further to 1.5 degrees Celsius, UN (2015). In Denmark, the government and a number of other political parties across the parliament intend to introduce binding climate targets for Denmark with a 70 per cent reduction in 2030 compared to 1990.

Denmark is heading towards substantial climate changes

IPCC scenarios for concentration of greenhouse gases in the atmosphere



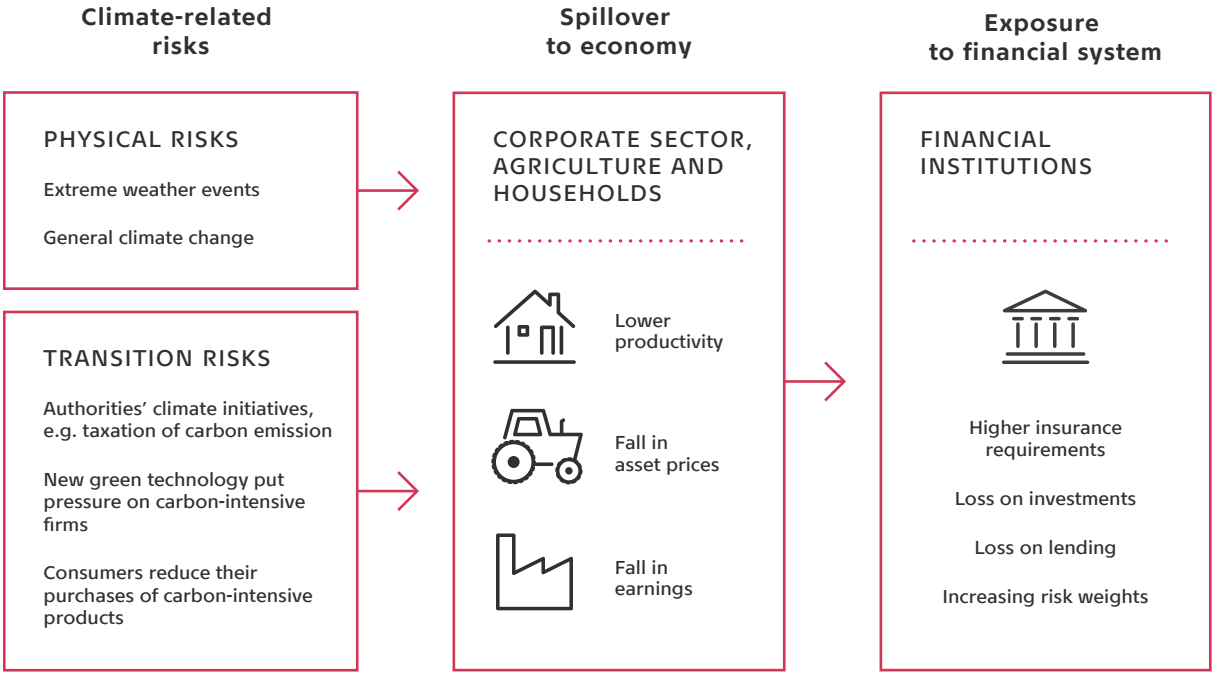
Possible changes in the Danish climate in 2100 for each scenario



Note: Left-hand chart: The red line shows the IPCC scenario with continued greenhouse gas emissions and increasing concentration in the atmosphere (scenario RCP 8.5). The orange line shows the IPCC scenario reducing greenhouse gas emissions (scenario RCP 4.5) where the concentration in the atmosphere stabilises by approximately 2050. The concentration of greenhouse gases in the atmosphere is calculated by the average energy in the atmosphere (watt per m^2). A larger concentration of energy in the atmosphere will, other things equal, lead to a higher average temperature.
Graphics on the right: The changes in temperature, sea level and the probability of cloudburst show predictions from DMI's 'Climate Atlas' for Denmark in 2100. The changes are relative to the average for the period 1981-2010. For each metric in both scenarios, the small number at the bottom shows the 1st decile in the distribution of possible outcomes in the given scenario. The large number in the middle is the median and the small number at the top is the 9th decile.

Source: ICCP database (2019) and DMI (2019).

Transmission channels for spillover effects from climate-related risks on financial stability Chart 2



Note: Inspired by Bank of England (2017). One exposure to the financial system is through increased risk weights on loans by credit institutions. Regulators set capital requirements for credit institutions expressed as a share of their risk-weighted assets. When expected loan losses increase, so will the risk-weighted loans. In that case, the capital adequacy of the credit institutions will fall.

Physical risks are related to costs and losses resulting from the degree and frequency of extreme weather changes or long-term changes following from climate change. This includes, but is not limited to heatwaves, landslides, floods, wildfires and storms, cf. NGFS (2019). These may affect insurance firms (claims) and credit institutions (deterioration of assets' credit quality).

Transition risks may arise from e.g. new regulation, technological advances and changes in consumer preferences in response to climate change. The longer time without climate policy action, the smaller the window to act requiring more substantial measures. The combination of these elements in a transition towards a carbon-neutral economy could affect business of firms unable to adapt their business models and ultimately lead to loan losses for credit institutions.

The transition could also reduce the value of infrastructure and other assets in carbon-intensive industries. This could lead to stranded assets, i.e. assets whose value declines because of their reduced lifecycle as a result of the transition to a green economy.

It is imperative to understand how and to what extent the financial sector is exposed to these risks. There is a growing awareness among central banks as to how the increasing climate-related uncertainty and climate-related events may affect macroeconomic developments and financial stability.

In 2020, Danmarks Nationalbank expects to develop a stress test of Danish credit institutions related to climate-related risks. Additionally, Danmarks Nationalbank has also engaged internationally by joining the Network for Greening the Financial System, cf. Box 2.

Financial regulation to ensure a healthy financial system

The financial sector is a business like any other industry. The sector plays a role in the economy by

allocating and mobilising capital among investors and borrowers. The financial sector may contribute to the transition to a green economy by ensuring continued allocation of capital with prudent consideration to all risks.

Financial regulation should be a reflection of actual risks

In connection with the financial sector's role in a transition to a green economy, it has been proposed to adjust financial regulation in order to accelerate the transition.[3] This could include by easing capital requirements through a "green supporting factor" for credit institutions. This would reduce the capital requirements for a credit institution for a "green asset", irrespective of whether it is more or less risky compared to a non-green asset with a similar risk profile.

This is contrary to the objective of financial regulation, i.e. to ensure a sound financial system that reflects financial institutions' business risks. Capital requirements serve to ensure that the institutions have a buffer to absorb losses, and accordingly capital requirements should reflect the business risks.

Transparency and standards provide clarity

Sustainable investments have become more common in recent years. The Paris Agreement on global climate targets as well as the UN Sustainable Development Goals have contributed to bringing particular focus on climate considerations, however, the concept of sustainability[4] is very broad without consensus about what it comprises, cf. IMF (2019).

Commonly agreed standards defining what is sustainable or green could contribute to preventing "greenwashing", i.e. the risk that an investment product is classified as green or sustainable without meeting the criteria. This issue is addressed in e.g. the EU taxonomy proposal for investment activities, which is a regulation on the establishment of a common framework for what is green, and, at a global level, the Financial Stability Board's Task Force on Climate-related Disclosures has issued recommendations to firms on disclosure of climate-related risks, EU TEG (2019) and FSB-TCFD (2017).

In addition to addressing greenwashing, standards defining green investments – and hence also the opposite – can help inform investors' decisions with respect to pricing of the assets taking risks into account.

Green bonds are an example of a new investment product that has grown in recent years both in Denmark and globally (Box 3). However, these bonds still only account for a small part of the total bond market and thus continue to be a limited alternative source of financing. In a market with several types of financing, the cheapest source of financing is determined by the relative demand. Some studies, cf. Zerbib (2019), indicate that green bonds as a source of financing are only marginally cheaper than comparable bonds.

Network for Greening the Financial System Box 2

In the spring of 2019, Danmarks Nationalbank became a member of the Network for Greening the Financial System (NGFS), whose membership consists of central banks and supervisory authorities. Danmarks Nationalbank participates in a macrofinancial workstream analysing transmission channels from climate change on the financial system.

NGFS intends to be a forum in which members voluntarily can exchange knowledge and best practice. In addition, the network will contribute to the development of environment- and climate-related risk management in the financial sector and the mobilisation of finance to support the transition toward a sustainable economy. NGFS currently has 48 members and 10 observers.

NGFS makes recommendations, e.g. on monitoring of climate-related risks in terms of financial stability and data sharing as well as contributes to increased awareness of how climate change may lead to financial risks.

3 See e.g. European Banking Federation (2017) and European Commission (2018)

4 Financial system sustainability is often reflected by what is known as ESG factors. ESG stands for environment, social, governance and covers business transactions (e.g. lending or investment) in which those factors are considered. Furthermore, the UN Development Goals of 2015 address a large number of socio-economic conditions, including in relation to climate and the environment.

Green bonds

Box 3

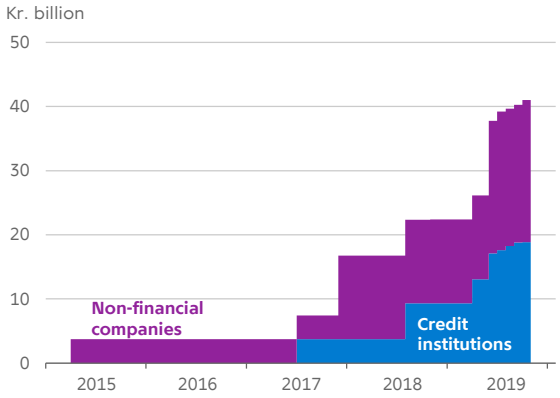
At end-Q3 2019, the outstanding value of green bonds was just under 700 billion euro globally. Despite a quadrupling over the last four years, green bonds still account for only a minor share of the total bond market at around 1 per cent (Moody's 2019).

In Denmark, issuance of and investment in green bonds have also increased, but on a lower scale, cf. the chart. In September, outstanding green bonds stood at just over kr. 40 billion, of which the financial sector accounted for almost half of the issuance. By comparison, Danish investors have purchased green bonds totalling around kr. 37 billion, of which the insurance and pension sector holds the majority.

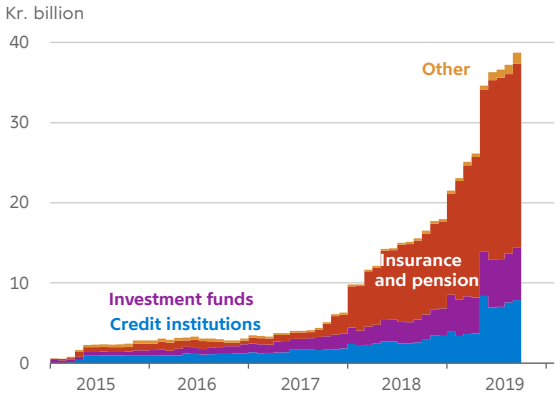
There is no universal definition of a green bond, but the International Capital Markets Association (2018) has developed the Green Bond Principles, a set of globally recognised voluntary guidelines aimed at promoting transparency and disclosure for green bonds. Bloomberg (2018) has made a definition based on those principles, which can be used to classify green bonds. According to that definition, green bonds are instruments for which the proceeds are applied towards green projects or activities that promote climate change mitigation or adaptation, or other environmental and sustainable purposes.

Issuance of and investment in green bonds have been going up

Credit institutions and corporate customers alike issue green bonds



The insurance and pension sector holds the largest portfolios of green bonds



Note: Danish issuances of and Danish firms' investment in green bonds The most recent observations are for September 2019.
Source: Bloomberg, Danmarks Nationalbank and own calculations.

Increasing risk of flooding of collateral used for mortgages

Denmark has a long coastline with many low-lying areas and, by international comparison, a high level of housing debt. This makes rising sea levels a physical risk that is relevant in Denmark and may, among other things, affect credit institutions' collateral used for mortgages.

Some mortgages are collateralised in property at increasing risk of flooding

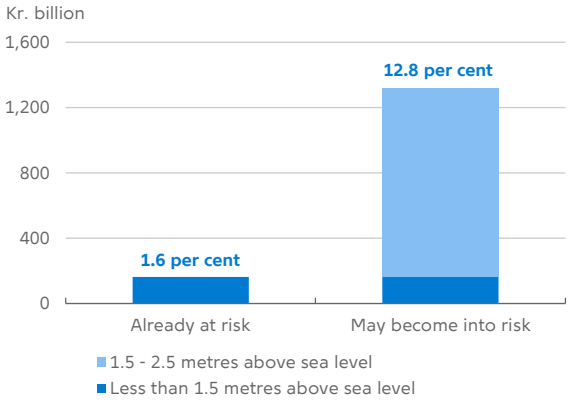
Along large parts of the Danish coastline, extreme weather conditions may currently lead to sea levels temporarily rising by approximately 1.5 metres.[5] In a scenario of continued carbon emissions, sea levels may rise by approximately 0.5 metres towards the middle of this century and approximately 1 metre by 2100. In this scenario, buildings may potentially become at risk of flooding if they are located in areas up to 2.5 metres above the current sea level.

Calculations show that if no further measures are taken before that time, the share of underlying collateral in buildings at risk of flooding could multiply, cf. Chart 3. Moreover, DMI points out that what is currently deemed a 20-year flood, could average one every year. A 20-year flood is a statistical concept defining the worst flood historically to be expected to occur in a given 20-year period.

If a borrower is unable to repay her debt, credit institutions expect to be able to recover a substantial part of the debt by taking over the mortgaged home and auctioning it through a forced sale. If the value of the home has fallen since the loan was issued, e.g. due to increased risk of flooding, the credit institution can suffer a greater loss on the loan than expected when the loan was issued.

If home buyers expect that the risk of flooding will increase in some local areas in the future, house prices could decline before any flooding has actually occurred.

The share of mortgaged assets at risk of flooding may increase by a factor of seven Chart 3



Note: Registered mortgages on buildings pledged as security for loans in Danish credit institutions. Observations are from the end of October.
Source: Danmarks Nationalbank, the Land Registry, the Danish Agency for Data Supply and Efficiency and own calculations.

On average, credit institutions require higher collateral value than the value of loans for mortgages. On aggregate, collateral worth approximately kr. 10,000 billion have been registered, while total lending, collateralised and uncollateralised, by credit institutions amounts to approximately kr. 5,000 billion.

Credit institutions are allowed to grant mortgages up to 80 per cent of the value of the home at the time of the issuance. For other types of buildings, the maximum LTV ratios required are lower. Therefore, a more accurate calculation of the risk associated with flooding would require the availability of detailed data on LTV ratios for each building.

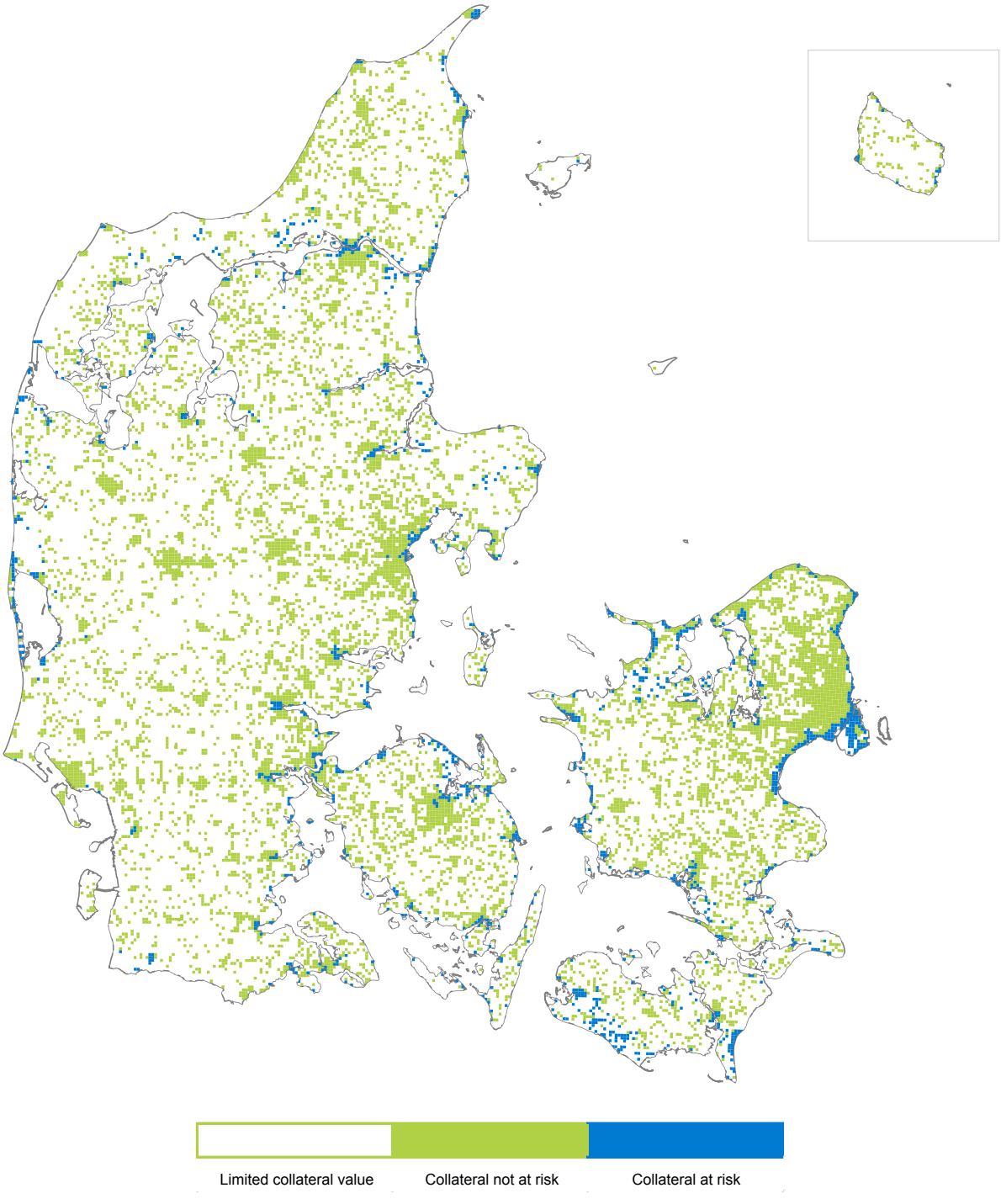
Collateral at risk of flooding will be concentrated in large coastal towns and cities

Several areas of Denmark in which the credit institutions have granted a substantial part of their mortgages are at risk of flooding, cf. Chart 4.

5 Based on Kystdirektoratets Højvandstatistikker (Danish Coastal Authority's high water statistics – in Danish only) 2017 (*link*). How high the water can go during extreme events varies considerably across the Danish coastline. For example, while the water level rises by 1.4 metres during a 20-year mean time event in the port of Copenhagen, it rises as much as 3.7 metres in the port of Esbjerg.

The credit institutions' mortgages on buildings that may become at risk of flooding in 2100 are concentrated in large coastal towns and cities

Chart 4



Note: The map is divided into 1 km² quadrants. "Limited mortgage value" refers to situations where the total mortgage value is less than kr. 50 million. "No risk of flooding" refers to situations where the total mortgage value is more than kr. 50 million, but no mortgaged buildings are flooded when sea levels rise by 2.5 metres. "Significant risk of flooding" refers to situations where the total mortgage value is more than kr. 50 million, and one or more mortgaged buildings are flooded when sea levels rise by 2.5 metres. Along large parts of the Danish coastline, extreme weather conditions may currently lead to sea levels rising by approximately 1.5 metres. In a scenario of continued carbon emissions, buildings in areas located up to 2.5 metres above sea level could be at risk of flooding in 2100. The values include only registered mortgages pledged as security to Danish credit institutions. Observations on mortgages from the Land Register are from the end of October 2019.

Source: Danmarks Nationalbank, the Land Registry, the Danish Agency for Data Supply and Efficiency and own calculations.

Many large towns and cities in Denmark are located by the sea, and in many of those, buildings are situated in low-lying areas. Several towns and cities have seen net immigration increase in recent decades, and new housing has been built, e.g. on former industrial sites in dock areas.

The calculations in the analysis take into account existing climate protection, e.g. dikes. In addition to that, many local authorities are planning to extend their climate protection efforts. Particularly in areas already housing large numbers of people, and where many of the credit institutions' mortgages are consequently located, investments to protect buildings against flooding must be expected to be implemented in future.

Considerable variation in systemic groups' exposure to rising sea levels

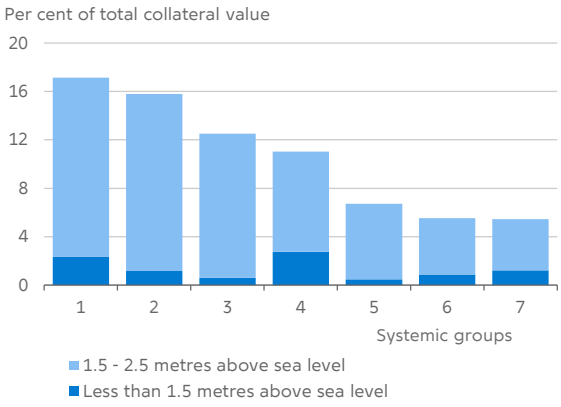
Credit institutions are exposed to rising sea levels to varying degrees. For two systemic groups, more than 15 per cent of collateral used for mortgages could become at risk of flooding, cf. Chart 5. By comparison, only 1-3 per cent of their mortgaged assets are currently at risk of flooding.

According to DMI, future climate changes may lead to more frequent cloudbursts, which may cause flooding in domestic areas. The risk of flooding due to cloudburst is not considered in the analysis.

The financial sector has limited exposure to the highest carbon-emitting industries

While rising sea levels are an example of physical risks that may be of relevance in Denmark, the financial sector's exposure to carbon-intensive production could be an example of how to calculate some of the sector's transition risks.

More than 15 per cent of mortgaged assets could become at risk of flooding Chart 5



Note: Registered mortgages on buildings pledged as security for loans in the systemic groups: Danske Bank, Nykredit, Nordea (Danish branch and mortgage credit institution), Jyske Bank, Sydbank, Spar Nord and DLR Kredit.
Source: Danmarks Nationalbank, the Land Registry, the Danish Agency for Data Supply and Efficiency and own calculations.

Substantial variations in the carbon intensity of firms' production

Firms with carbon-intensive production may be particularly exposed to green technology, changes in consumer preferences and regulation. For example, an increase in the price of greenhouse gas emissions could change the expected value of investments in industries with carbon-intensive production if they fail to adapt. This could lead to losses in the financial sector, either as non-repayment of loans or losses on investments.

On average, Danish firms within energy, agriculture and transport are the highest carbon emitters in terms of their production, cf. Chart 6.[6] On the other hand, their carbon intensity is lower for activities related to both industry and buildings.

6 Categories based on average figures for industry classifications do not reflect differences in firms' carbon intensity within a particular industry. For example, the industry entitled Production of electricity, which is part of the energy category, includes both combined heat and power plants using both (partial) coal firing and wind turbines to generate energy. Energy production from coal firing is highly carbon-intensive, while the carbon intensity of generating wind energy is very low. See Box 4 in the Appendix for further information.

The calculations in this analysis apply a carbon intensity measure that includes only emission of greenhouse gases in actual production and not intermediate inputs in the production process.

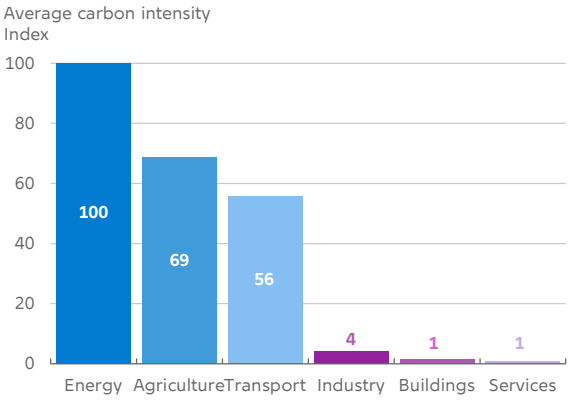
Direct emissions from production provide a first indication of the types of industry with production processes at high risk of becoming negatively affected by a green transition of the economy.[7] In further work on transition risks in the Danish economy, it could be useful to identify those parts of the economy where the goods consumed are produced with high carbon emissions, and the industries' total emissions caused by production and intermediate inputs.

Financial institutions are only to a limited extent exposed to the highest carbon-emitting industries

The credit institutions have generally provided lending to corporate customers in industries with less carbon-intensive production processes, cf. Chart 7. The institutions' mortgage lending for buildings is particularly pronounced here. On the other hand, a large share of energy production is consumed in buildings, e.g. for electricity and heating. Higher

Substantial variations in average carbon intensity in industries' production

Chart 6

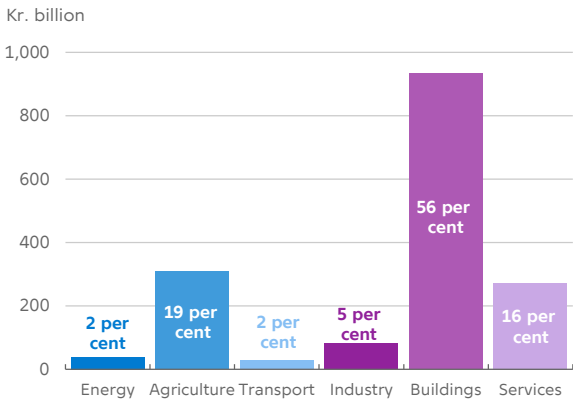


Note: Index of the average carbon intensity is calculated as each industry's total emission of greenhouse gases stated in CO_2 equivalent units relative to the value of their gross value added (GVA). An industry's carbon emission includes emission from activity in the industry only, not indirect emissions from intermediate inputs used. See Box 5 in the Appendix for further information. Observations are for 2017.
Source: Statistics Denmark and own calculations.

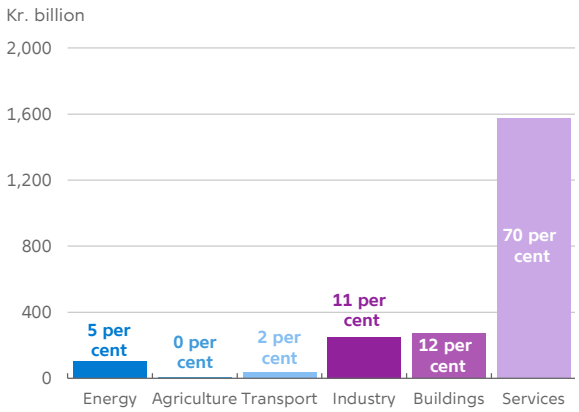
Financial institutions primarily have assets in industries with less carbon-intensive production

Chart 7

Lending by credit institutions



Investment by institutional investors



Note: Left-hand chart: Total lending to the corporate sector by credit institutions. Right-hand chart: Total investments in the corporate sector by insurance companies and pension funds. Investments include both bonds and shares. The statistics reflect investment in insurance companies and pension funds' own investment funds. See Box 5 in the Appendix for further information. The most recent observations are from end-September 2019.
Source: Danmarks Nationalbank, Statistics Denmark and own calculations.

7 The analysis is inspired by the methods used in European Central Bank (2019), Battiston et al. (2017) and Vermeulen et al. (2019).

requirements for the energy efficiency of housing could affect the value of some older homes. Furthermore, the construction sector uses a number of materials the production of which is carbon-intensive.

On aggregate, the credit institutions' lending to the three industries with the most carbon-intensive production accounts for 23 per cent of lending to the corporate sector. Due to the institutions' large share of lending to the agricultural sector, some banks are more exposed to transition risks. Loans to agricultural customers also account for a large share of total lending for a number of smaller banks.

The institutional investors in banks, insurance companies and pension funds are mostly exposed to industries with low carbon intensity and especially the service sector. However, 5 per cent of investment is in the energy sector, which may face challenges in a transition process.

Danmarks Nationalbank will develop a Danish stress test with transition risks

By mid-2020, Danmarks Nationalbank expects to be able to present an analysis of transition risks in the coming stress test of credit institutions. The purpose is to get a clearer understanding of these risks in the credit institutions.

In a stress test, the credit institutions' capital adequacy are compared with the current capital requirements in a number of scenarios in which the credit institutions are affected by a stress to a higher or lower degree. Today, stress tests constitute a significant element in the authorities' assessment of financial stability.

Internationally, stress tests with climate-related risks are a relatively new phenomenon that is still under development. As a result, there are still a number of outstanding issues in terms of how to model the impact of climate change on the financial sector.

One example of "stress" in a Danish context could be the sudden introduction of a global emission tax. In addition to impacting the affected industries, this could also lead to lower housing prices with a low energy rating due to higher costs of use.

A number of central banks and academics are already working to develop relevant models. For example, the Bank of England's latest stress test includes a climate scenario for insurance companies and pension funds where the institutions are required to consider scenarios extending to 2100 (Bank of England 2019).

Earlier this year, De Nederlandsche Bank published a short-term stress test of financial institutions with focus on transition risks, cf. Vermeulen et al. (2019). The method is also based on mapping of transition risks according to the sensitivity of individual industries to carbon emissions.

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Appendix

Mortgaged buildings at risk of flooding: Data basis and calculations

Box 4

The analysis of mortgaged buildings at risk of flooding is based on the linkage of three public registers:

- The Danish Address Registry contains information on all addresses in Denmark, including coordinates for the location of each address. The Register is freely accessible from the Basic Data Program (*link*).
- The Land Registry includes information on rights to real estate in Denmark, including property information, ownership and mortgaging. There is free access to looking up individual properties in the Land Registry (in Danish only) (*link*).
- The model entitled "Havvand på land" (Seawater on land – in Danish only) is a tool to provide information about the areas in Denmark that my be affected by rising sea levels. The flooded areas are calculated on the basis of the Danish Elevation Model. The data basis of the model is freely accessible from the Basic Data Program (*link*).

Based on the three data bases above, Danmarks Nationalbank has compiled information on geographical locations, mortgaged assets, mortgagors and water levels in case of flooding. Mortgages where the mortgagor is a Danish credit institution have then been selected.

The focus of the analysis is on mortgaged assets that will be flooded if sea levels rise by 1.5 metres and 2.5 metres, respectively. Along large parts of the Danish coastline, extreme weather conditions may currently lead to sea levels rising by approximately 1.5 metres. In a scenario with continued carbon emissions, buildings in areas that are up to 2.5 metres above sea level may become at risk of flooding in 2100.

Carbon intensity of firms' production: Data basis and calculations

Box 5

In a number of cases there is significant uncertainty about the degree to which a given firm is exposed to transition risks in the form of increased regulation, technological developments and/or changes in consumer behaviour. Firstly, it is not clear what specific transition risks a given firm is facing. Secondly, it is not clear when any transition risks may materialise. Thirdly, the available data on firms' climate footprint is currently limited.

Danmarks Nationalbank has used as its basis a mapping of firms' greenhouse gas emissions in CO_2 equivalent units relative to their gross value added (GVA). Danmarks Nationalbank does not have access to data on individual firms' greenhouse gas emissions, but Statistics Denmark publishes statistics on industries' total greenhouse gas emissions in CO_2 equivalent units (tonnes).

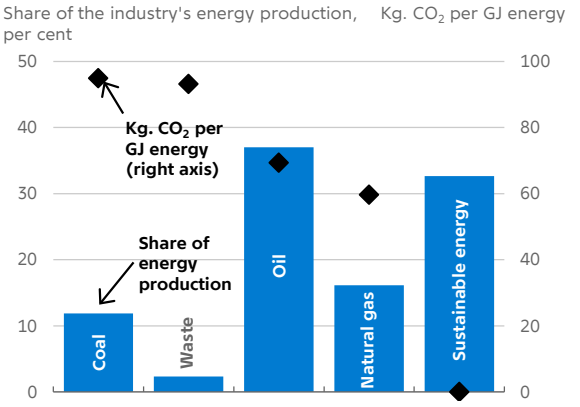
With the current classification of industries in the Danish Industrial Classification of All Economic Activities 2007, all firms are aggregated across highly different production processes in terms of greenhouse gas emission. For example, the energy supply industry covers electricity and heating production using both coal, oil and renewable energy sources such as wind turbines, cf. the chart.

The production of electricity and heating based on renewable energy sources, accounting for approximately one third of energy production in Denmark in 2017, causes hardly any greenhouse gas emission. On the other hand, the remaining production based on e.g. fossil fuels causes such high levels of greenhouse gas emission that the overall result for the energy supply industry is a very high average carbon intensity.

The industries' emissions have been aggregated as the main categories used in the analysis, which reflect both differences in average emissions and common climate and business policy groupings, cf. the table.[1]

Continues

Denmark's energy supply is diversified



Note: Observations are for 2017.
Source: Danish Energy Agency.

1. The method is also inspired by the European Central Bank (2019), Vermeulen et al. (2019) and Battiston et al. (2017). The main categories of the analysis are adapted to Danish conditions and the level of detail in Danish industry statistics.

Grouping of main category industries

Box 5

continued

Main category	Industries
Energy	Extraction of oil and gas and services for raw material extraction, oil refineries etc., energy supply, water supply and sewerage, waste management, reuse and cleaning of soil and groundwater
Landbrug	Agriculture, forestry and fisheries
Transport	Land transport, sea transport, air transport, transport-related auxiliary activities and postal and courier activities
Manufacturing	Other extraction of raw materials, e.g. gravel, stone, salt and coal, the industries of food, beverages and tobacco, textiles and clothing, leather and shoes, wood and paper, pharmaceuticals, plastics and rubber, glass and ceramics as well as concrete and tileworks, metal industry, electronics industry, manufacture of electrical equipment, engineering industry, manufacture of motor vehicles and parts for motor vehicles, building of ships and other means of transport as well as manufacture of furniture and other manufacture
Buildings	Construction, hotels and restaurants, real estate, buying, selling and letting of real estate
Services	Car sales and repair shops, wholesale trade, except motor vehicles and motorcycles, retail trade, book publishing and publishing of computer games and other software, production of motion pictures and television as well as radio and television broadcasting, telecommunications, IT and information services, legal activities, accounting, bookkeeping and auditing activities, activities of head offices, business consultancy activities, architectural activities and consulting engineering activities, research and development, advertising, market research, other business services, renting and leasing of cars and other equipment, other administrative services and auxiliary services, public administration, defence and police, teaching, healthcare, social institutions, theatres, music and art, libraries, museums, etc., gambling and betting activities, sports, amusement and recreation activities, organisations and associations, repair of household appliances, hairdressing, laundries, etc. and services for own use and activities of households as employers of domestic personnel

GVA of the industries is then aggregated to the main categories, and CO_2 intensity is finally calculated as the ratio between emissions in CO^2 equivalent units and production.

Greenhouse gas emissions by the industries include emissions from production in the industry only, not indirect emissions from intermediate inputs. Direct emissions from production provide a rough estimate of the types of industry that are using production processes at high risk of becoming negatively affected by a green transition of the economy.

ABOUT ANALYSIS

As a consequence of Danmarks Nationalbank's role in society we conduct analyses of economic and financial conditions.

Analyses are published continuously and include e.g. assessments of the current cyclical position and the financial stability.

The analysis consists of a Danish and an English version. In case of doubt regarding the correctness of the translation the Danish version is considered to be binding.

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