

Staff Memo

How a cost on emissions could affect banks' credit risk

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Staff Memo

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Summary

One of the tasks of the Riksbank is to promote a stable and efficient financial system. In addition, the Riksbank shall identify threats to sustainable development that affect the conditions for its activities. As the severity of climate change has increased, the need to analyse the exposure of the financial system to climate-related risks has become more pressing.

In this Staff Memo, we look at how a cost for emissions could affect the profitability of Swedish companies, and how this in turn could affect banks' credit risks. We do this by first estimating the production-based emissions of individual companies and then putting a cost on those emissions. We then calculate how an increased cost for emissions affects the debt-servicing capacity of the companies.

Based on the data and methods we use, we find that there is little evidence that a cost for emissions would have a significant impact on Sweden's financial system. The results suggest that an emission cost has a relatively small financial effect on most companies, and that the banks are expected to manage any potential credit losses that may arise. This can be attributed to two main factors. First, the majority of companies contribute with such small emissions that the cost for these companies will be more or less negligible. Second, banks in Sweden primarily lend large volumes to low-emission sectors and small volumes to high-emission sectors. Studies from other countries that analyses the risks of increased emission costs have shown similar results, although the explanations for these findings vary.¹

An important limitation of the method used here is that it does not capture the links between the companies' inputs, production and the consumption of their products, which is likely to lead to underestimation of the results. In order to draw more precise conclusions using this method, better access is needed to data on individual companies' emissions and how emissions are distributed across their value chains.

Our method is one of several ways to examine banks' exposures to climate-related risks. To obtain a more comprehensive picture, the results of this study need to be used in conjunction with other types of metrics of banks' exposure to climate-related risks.

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¹ See Vermeulen et al. (2018) and Grippa and Mann (2020).

² We would like to thank David Forsman, Mia Holmfeldt, Johan Molin and Annika Svensson for their valuable comments.

1 Climate risks can affect financial stability

The world is facing serious climate change challenges that are affecting, or may affect, societies and economies on a global level. Greenhouse gas emissions are a major contributor to climate change. Many countries have therefore set various targets to reduce their emissions, such as the 2015 Paris Agreement, which aims to limit global warming by reducing greenhouse gas emissions. In the EU, the objective is to significantly reduce emissions by 2030 and to reach climate neutrality, i.e. zero net emissions of greenhouse gases, by 2050, with negative net emissions thereafter.³ Sweden has the same emissions target but aims to reach zero net emissions already by 2045.⁴

One tool to achieve these objectives is via the EU Emissions Trading Scheme (EU ETS). In this system, a company that wants to emit greenhouse gas must buy the right to do so. The more a company emits, the more it has to pay. The scheme is thus designed to incentivise emission reductions. To achieve the climate targets, the system is designed to gradually reduce the supply of emission allowances. This is likely to push up the price of allowances, and those companies that fail to reduce their emissions will face an increased cost for them. In this Staff Memo, we look at how an increased cost for emissions could affect the profitability of Swedish companies and their ability to pay for their interest-bearing debt, and how this in turn could affect banks' credit risks.

To do this, we use data on emissions by different sectors from Statistics Sweden's Environmental Accounts and data on the sectors' turnover from Statistics Sweden's Structural Business Statistics. We estimate the impact on companies' profitability and debt-servicing capacity using this data, and make an assumption on how much the cost for emissions will increase. Using the Riksbank's database (KRITA), we identify the amount of loans Swedish companies have in Swedish banks.⁵ We then assess which companies are at risk of insolvency, and in this way we see whether a higher price for emissions could affect banks' credit risk.

The Riksbank and Finansinspektionen (FI) have previously published analyses of how climate risks can affect financial stability in Sweden.⁶ In this analysis, we focus on a specific type of climate-related risk and its potential impact on companies and banks. However, there are many other climate-related risks that also require further study, such as physical risks like wildfires and floods. Additionally, the availability of necessary data for a comprehensive analysis remains limited. Therefore, the results should be interpreted with some caution.

We begin this report by illustrating how loans and emissions are distributed among Swedish companies that have loans from a Swedish bank. In Section 3, we calculate how a cost on emissions would impact these companies' profitability and their ability

³ In the shorter term, the EU also has a programme called Fit for 55, which aims to reduce the EU's net emissions by 55 per cent by 2030, compared to 1990 emissions.

⁴ On 23 January 2025, the Swedish Government commissioned the Cross-Party Committee on Environmental Objectives to evaluate Sweden's national intermediate objectives.

⁵ With Swedish banks we refer to banks and branches that operate in Sweden.

⁶ See, for example: Apel (2022), Cella (2021), Danielsson (2020), Finansinspektionen and the Riksbank (2022), Finansinspektionen (2024) and Frykström (2025).

to pay interest. In Section 4, we estimate how the bank's' credit risk could be affected. We conclude with a discussion of the method's limitations in Section 5 and with final remarks in Section 6.

2 Banks' exposures to companies with high emissions

2.1 Companies' greenhouse gas emissions

Greenhouse gases are a collective term for gases that affect our climate when they are released into the atmosphere. Greenhouse gas emissions have become a common metric of society's environmental impact. In order to have a simple and standardised gauge of these emissions, they are usually reported as carbon dioxide equivalents (CO₂eq). In the rest of the report, we refer to CO₂eq when we use the word emissions.

There are different methods for measuring the volume of greenhouse gas emissions. Total emissions for a country can be calculated in three ways: territorial emissions, production-based emissions and consumption-based emissions. These emissions are usually reported in aggregate by sector. In short, territorial emissions only include emissions generated within Sweden's borders. Production-based emissions also include emissions generated abroad by Swedish operators, in the form of international transport. Consumption-based emissions are estimates that attempts to capture all emissions generated by Swedish consumption. This way of measuring would give the most accurate picture of Swedish actors' actual emissions, but according to the Swedish Environmental Protection Agency, the figures are uncertain.

At the company level, the concepts of scope 1, 2 and 3 are used to measure company-specific emissions. In short,

- scope 1: refers to direct emissions from companies
- scope 2: refers to companies' indirect emissions from electricity, heating and cooling
- scope 3: refers to indirect emissions from other parts of the value chain, such as emissions from the production of purchased materials and product use.

Today, only a few companies report their emissions at scope 1 level, and even fewer at scope 2 and 3 levels. With the implementation of the new EU Sustainability Reporting Directive (CSRD), many companies will have to report their emissions at scope 1, 2 and 3 level.

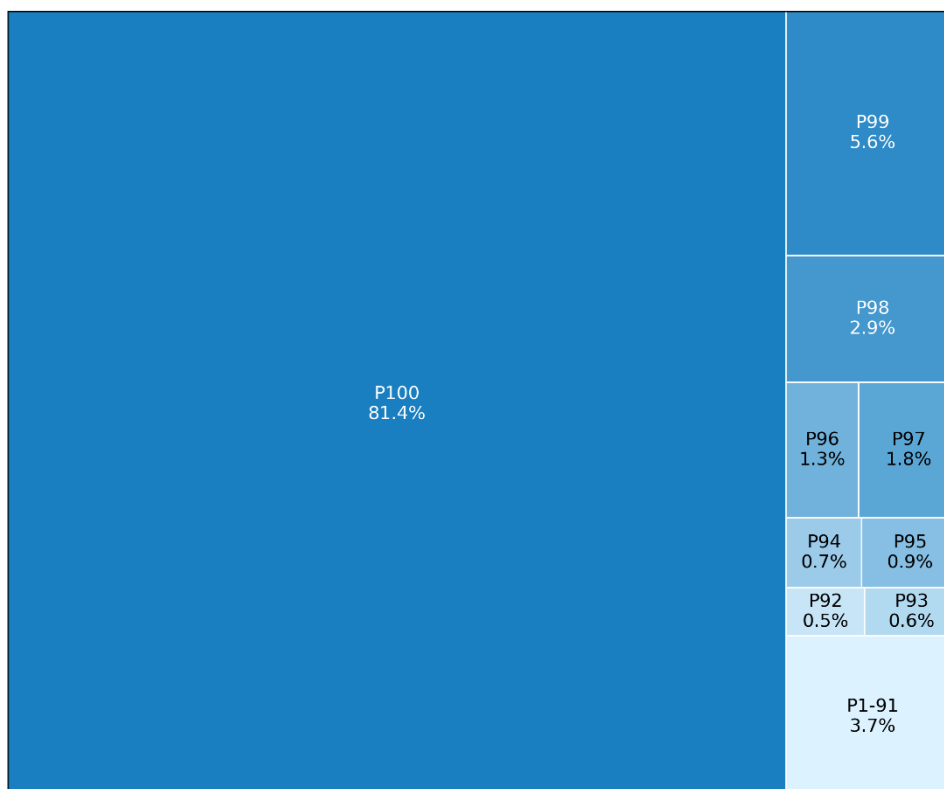
In this report we use production-based emissions, as they are more reliable than consumption-based emissions while also including some international emissions. Production-based emissions are roughly comparable to the sum of scope 1 and 2. To approximate the emissions of individual companies, we allocate production-based emissions by sector based on each company's share of the sector's total turnover. That is, if a company accounts for 1 per cent of total turnover in a sector, we assume that the

company accounts for 1 per cent of the sector's emissions. Limitations of this method are discussed in Section 5.

Of Swedish companies with loans in a Swedish bank, 1 per cent account for just over 81 per cent of the emissions, see Chart 1. This means that risks associated with production-based emissions are largely concentrated to a few actors.

Chart 1. Distribution of companies' emissions by percentile

Per cent



Note. P stands for percentile and the number represents the percentile to which the box refers. P100 shows the share of total emissions from the top 1 per cent of emitters, P99 shows the share of emissions of companies in percentile 99 and so on.

Sources: Statistics Sweden, the Riksbank.

2.2 Banks' exposures to companies in climate-impacting sectors

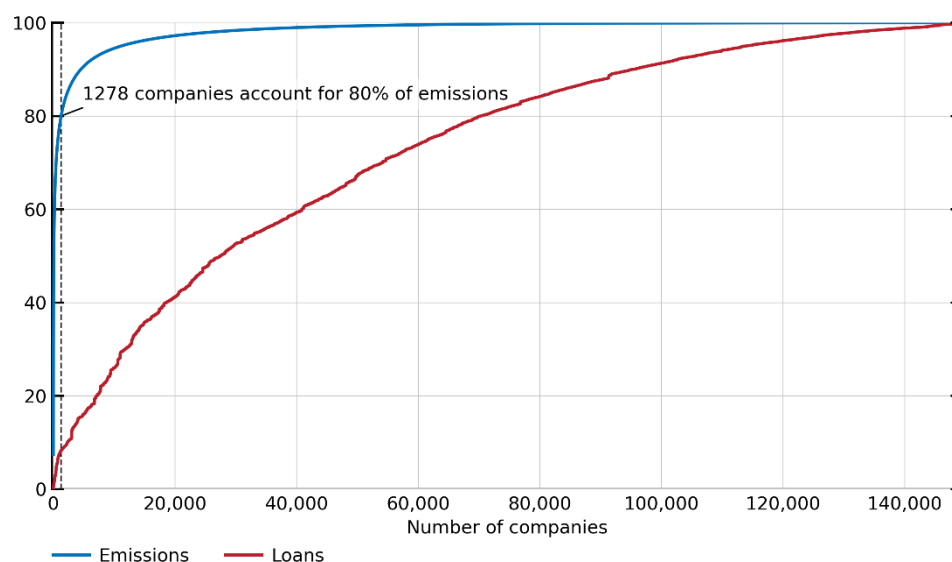
Banks are exposed to climate-related risks mainly through their assets. In Sweden, banks' assets mainly consist of loans to companies and households. The climate risk for these loans arises, for example, if companies or households with loans experience difficulties in servicing their loans due to the materialisation of climate-related risks. In this Staff Memo, we limit ourselves to examining how banks, through their loan portfolios, are exposed to climate-related risks in the form of the risk of companies having to pay for their emissions, which is a type of transition risk.

To examine banks' loan portfolios, we use the Riksbank's database KRITA. KRITA contains statistics on every single loan issued by the 24 largest lenders in Sweden, with the exception of loans to households. KRITA covers around 95 per cent of the banking sector's total lending to Swedish companies. We match data in KRITA with balance sheets and income statements for Swedish companies. In this analysis, loans to housing cooperatives are excluded, as these debts are in practice borne by the household sector. Our sample includes around 150,000 companies for the year 2022, which is our reference year. The reference year is chosen because it is the most recent year with data for production-based emissions and turnover by sector. By using KRITA data and combining it with estimates of individual companies' emissions, we can get a picture of how exposed banks are to these companies.

Although less than 1 per cent of companies account for 80 per cent of emissions, these companies account for less than 10 per cent of the volume of bank loans, see Chart 2. The blue line in the graph shows the aggregated emissions of the companies, sorted from the largest emitter to the smallest emitter. The red line shows the aggregate bank loans taken out by these companies. The majority of loans are thus taken out by small emitters. One potential explanation for why the largest emitters have small Swedish bank loans relative to their emissions could be that they often belong to large corporations with international presence, and they may have loans from international banks, intra-group loans, or issued bonds.

Chart 2. Cumulative emissions and loans

Per cent



Note. The dashed line shows the number of companies accounting for 80 per cent of emissions.

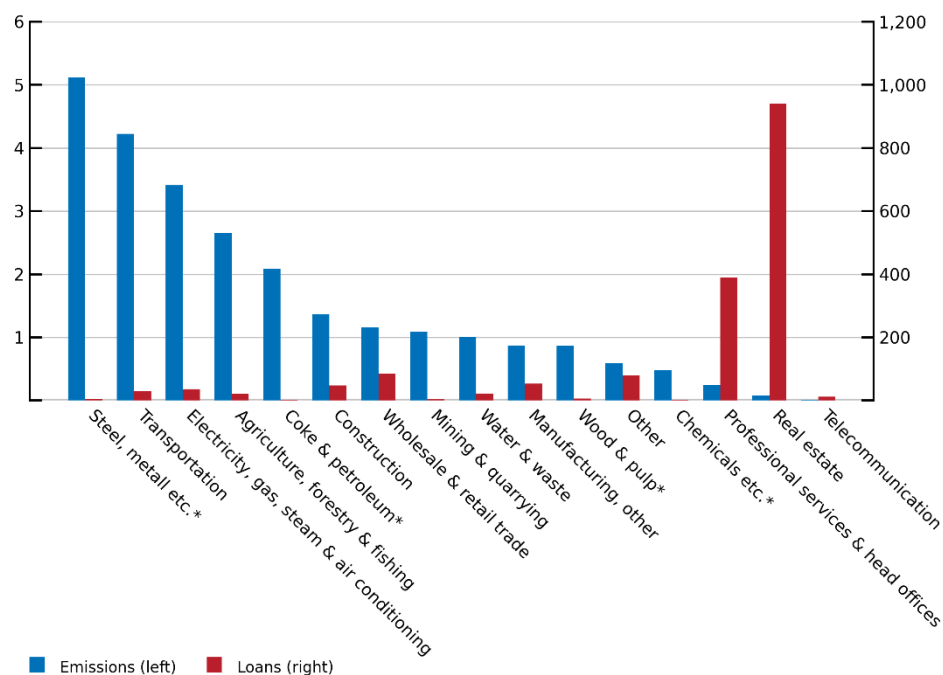
Sources: Statistics Sweden, the Riksbank.

By grouping companies by sector, we can examine whether there are any sectoral links between emissions and bank loans. Chart 3 shows that banks mainly have large volumes of loans to low-emission sectors and small volumes of loans to high-emission

sectors. A clear majority of the loans are made to *Real estate* companies, which, according to the sample's production-based emissions, is the sector with the second lowest emissions. *Professional services & head offices* also have large loans. However, their emissions may be misleading, as a head office may take out loans and then lend internally to a subsidiary in another sector.⁷

Chart 3. Swedish banks' loan exposures to companies and their emissions, aggregated by sector

Million tonnes CO₂eq, SEK billion



Note. Emissions refer to production-based emissions. * refers to manufacturing.

Sources: Statistics Sweden, the Riksbank.

Note that with this method we can only examine Swedish companies' loans from Swedish banks. Companies may have other types of financing, such as bonds, intra-group loans and equity capital, which may also have an impact on the financial system through more or less complex interconnections. Furthermore, companies can indirectly contribute with emissions from their value chain. Service companies with offices can, for example, contribute with indirect emissions from the building materials in the property, electricity and heating for the office space, materials in the computers and phones, as well as from data storage and AI chatbots that depend on energy-intensive data centres. Additionally, there are other ways to view sectors and their connection to climate-related risks, one of them being the Pillar 3 framework which, for example, classifies real estate companies as a sector that *highly contributes to climate change*.⁸

⁷ For example, there are a small number of *Real estate* companies in the sector *Professional services & head offices*

⁸ Se Frykström (2025).

3 Emission costs and their impact on companies' finances

3.1 Existing schemes to finance emissions

In economics, we sometimes talk about negative externalities. In simple terms, these are the negative socio-economic effects of a company's activities that the company does not have to pay for. The EU has a system for trading emission allowances (EU ETS) aimed at reducing emissions by requiring certain companies to pay for their emissions, thus covering the negative socio-economic effects of their emissions. In Sweden, in addition to the EU ETS, we also have a carbon tax.

The Swedish carbon tax⁹ is an excise tax on fuels, paid by the companies that supply fossil fuels. The EU ETS is an emissions trading scheme covering the most emitting sectors in the EU. The EU ETS consists of three schemes called ETS 1, ETS 2 and the Carbon Border Adjustment Mechanism (CBAM), of which ETS 2 and CBAM are currently being implemented. Together, these systems will cover emissions from manufacturing industries, electricity generating plants, aircraft operators, shipping companies, road transport and heating of buildings and premises.¹⁰

3.2 How the cost for emissions can affect companies

The EU ETS and the carbon tax primarily affect a small number of large companies in Sweden. In this section, we examine how companies would be affected if we assume that all companies would have to pay for their emissions. We start from a no-intervention scenario in which we assume that no companies pay for their emissions.¹¹ Following this, we introduce an emission cost of 65 EUR per tonne CO₂eq, which we then stress to higher levels.¹² In the calculations, we use a fixed EURSEK exchange rate of 11.5.

After introducing the cost for emissions, we find that just over 120,000 out of the approximately 150,000 companies included in our study would incur an emission cost of between SEK 0 and 20,000 per year, see Chart 4. For all companies up to the ninety-ninth percentile, the median cost would be SEK 1,900, while the maximum amount in this group would be around SEK 1.1 million. We use the median instead of the mean because the emissions are very unevenly distributed between companies and a mean is not representative of most companies. For companies in the top percentile, the median cost would be around SEK 2 million, while the highest amount for an individual company would be just over SEK 1.4 billion. The cost for the majority of companies

⁹ Energy Tax Act (1994:1776) Chapter 2

¹⁰ For further information on the EU ETS see: [EU Emissions Trading System \(EU ETS\) - European Commission](#)

¹¹ Swedish companies within EU ETS receive to a large degree free allowances and do not fully pay for their emissions, for additional information see (swedish only): [Listor över utsläpp och tilldelning.](#)

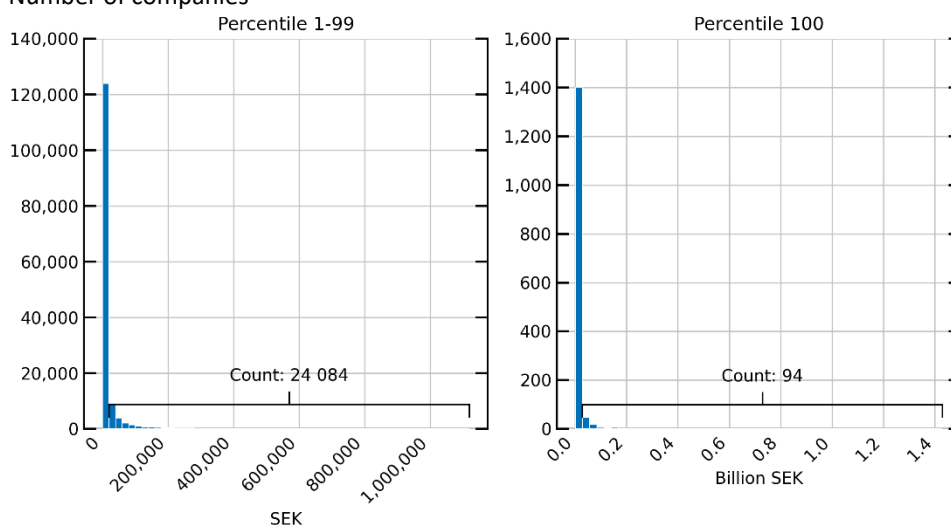
¹² The average market price in 2024 was EUR 65.77/tonne. Source: Bloomberg

becomes more or less negligible, which is an expected result given that a clear majority of the companies have low production-based emissions.

In total, the companies in this study emit 25 million tonnes of CO₂eq, which at a price of 65 EUR/tonne would cost just under SEK 19 billion. As a reference, the results can be compared to Sweden's total emissions and how much it would cost to pay for all emissions at the national level. In 2022, Sweden emitted 49 million tonnes of CO₂eq. If each tonne of emissions were to cost EUR 65, the total cost would be around SEK 37 billion, equivalent to 0.6 per cent of Sweden's GDP.

Chart 4. The companies' cost for emissions

Number of companies



Note. The left chart shows all companies in percentile 1-99 and the right chart shows all companies in percentile 100. The bars show many companies would incur a certain cost for their emissions. Each bar in the left-hand chart shows a range of SEK 20,000 and in the right-hand chart each bar shows a range of SEK 28 million. The horizontal line in each chart shows the total number of companies except the companies in the first bar.

Sources: Statistics Sweden, the Riksbank.

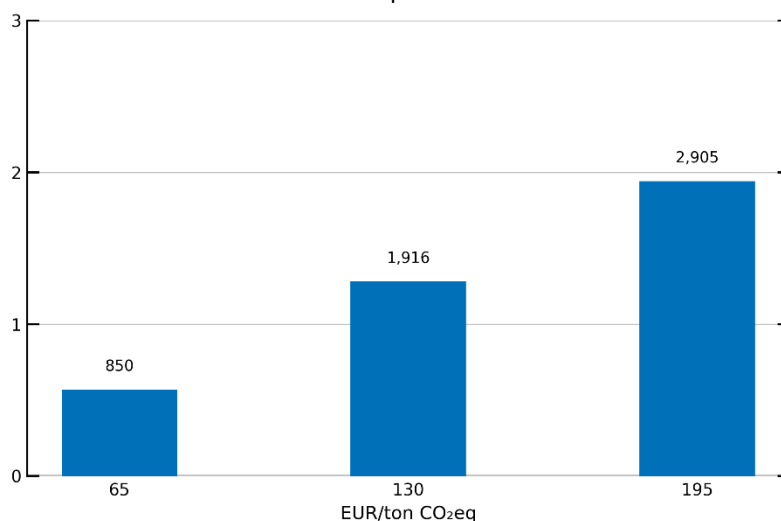
As a next step in the analysis, we examine how the cost of emissions could affect companies' profitability and debt-servicing capacity. We start with the operating margin, which is a common key performance indicator that shows how profitable a company's core business is. It is calculated by taking the company's profit before interest and taxes (operating profit) and dividing it by the turnover. Since a cost for emissions will reduce the operating profit, the operating margin will fall the more the company emits.

In Chart 5, we show how many of the companies that would get a negative operating margin after a cost for emissions has been introduced. We also examine how the operating margin would be affected if the cost per tonne of CO₂eq would increase by

100 or 200 percent, i.e., from 65 EUR/tonne to 130 EUR/tonne and 195 EUR/tonne respectively.¹³ As shown in the chart, only a small share of companies would have a negative operating margin, even with a 200 percent increase in the cost of emissions. We have also examined how the median operating margin is affected and it decreases from about 7.6 percent in the no-intervention scenario to 7 percent at a cost of 195 EUR/tonne, that is, around 0.6 percentage points. The result can be considered expected as the median cost for all companies up to the ninety-ninth percentile is SEK 1,900 at a cost of EUR 65/tonne.

Chart 5. Companies that get a negative operating margin per scenario

Per cent of the total number of companies



Note. The number above each bar shows the number of companies.

Sources: Statistics Sweden, the Riksbank.

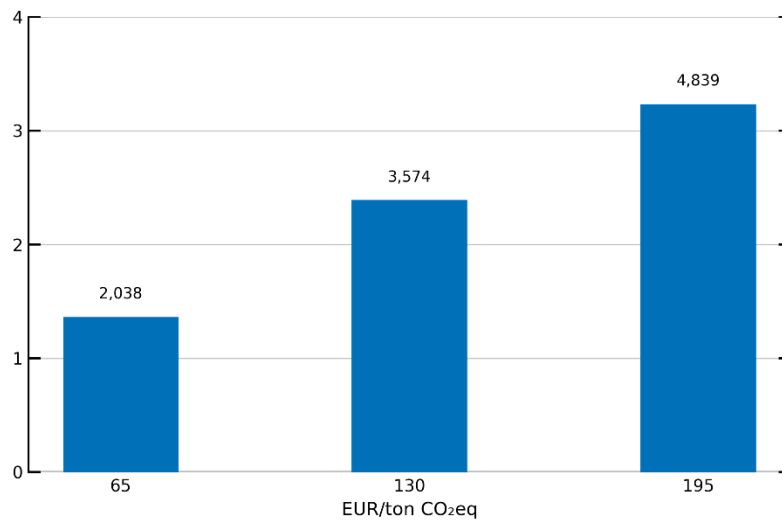
In a next step, we examine whether companies' debt-servicing capacity is affected by the increased cost. Here we use the measure of interest coverage ratio, calculated by dividing the operating profit by interest expenses. The annual interest expense per year is taken from the companies' income statements and may include interest on more types of debt than bank loans. An interest coverage ratio below 1 means that the company's revenues are not sufficient to cover its interest expenses. We assume henceforth that companies with a ratio below 1 have low debt-servicing capacity.

Chart 6 shows the share and number of companies that have an interest coverage ratio above 1 in the no-intervention scenario but would get an interest coverage ratio below 1 in different scenarios. It shows that about 1-3 percent, or 2,000-5,000 of all companies would get an interest coverage ratio below 1. Note that these may be different companies than those that get a negative operating margin.

¹³ Forecasts for the price of EU emission allowances for the years 2035-2040 fall within the range of 114-182 EUR/ton. Sources: [Bloomberg](#) and [S&P](#).

Chart 6. Companies that get an interest coverage ratio below 1 per scenario

Per cent of the total number of companies

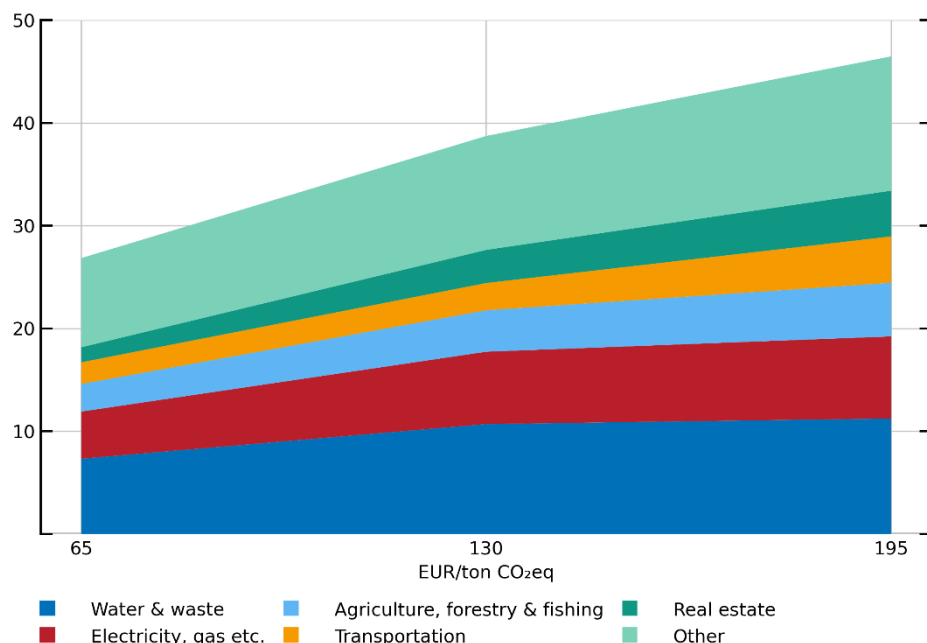


Note. The number above each bar shows the number of companies.

Sources: Statistics Sweden, the Riksbank.

We then look at how much these companies have borrowed and group the companies by sector, see Chart 7. The loans for companies that get an interest coverage ratio below 1 at different price levels sum up to SEK 27-46 billion depending on the scenario. On average across all sectors, companies with low debt-servicing capacity at 65 EUR/tonne have about SEK 13 million in loans, while companies affected at 195 EUR/tonne have on average just under SEK 10 million in loans. The two sectors with the largest loan volume from companies that get a low interest coverage ratio are *Water & waste* and *Electricity, gas, steam & air conditioning supply*.

Chart 7. Loans to companies with an interest coverage ratio below 1 per scenario
SEK billion



Sources: Statistics Sweden, the Riksbank.

We have also examined whether these companies have other debts than bank loans to see if other financiers may be affected. The companies that would get an interest coverage ratio below 1 at 195 EUR/tonne have total long-term debts of just over SEK 124 billion, which in addition to the SEK 46 billion in bank loans may include, for example, intra-group loans, long lease contracts, and bond loans. This means that repayment problems risk affecting a broader group of investors than just banks. Banks often have better collateral, and the risk would in this case be higher for the other investors who have lent to the companies. However, we find that none of the companies that would get an interest coverage ratio below 1 at 195 EUR/tonne have issued any bonds.

4 An increased cost of emissions affects the banks

From Chart 7, it is evident that at a price of 65 EUR per tonne CO₂eq, the loans held by companies with low debt-servicing capacity amount to approximately SEK 27 billion. If the price triples to 195 EUR per tonne CO₂eq, this amount increases to about SEK 46 billion. To estimate how much banks may need to set aside as loan loss provisions for these loans, we perform a simple calculation by assuming different provisioning rates for loans in different risk categories.¹⁴ We assume that a loan to a company initially

¹⁴ Under IFRS 9, loans are classified into three risk classes: stage 1 (performing) is for loans that have not shown any signs of increased credit risk, stage 2 (under-performing) is for loans with increased credit risk and stage 3 (non-performing) is the highest risk class for loans. IFRS 9 (International Financial Reporting

falls under Stage 1, but if the increased emission costs prevent the company from covering its interest expenses, the loan moves to Stage 2. However, this assumption may not be realistic for all companies, as banks consider more factors than just interest coverage when deciding whether to reclassify a loan into a different risk category. For instance, a company may have a very strong owner, such as municipally owned enterprises, which reduces the likelihood that a bank would move the loan to a different risk category. At the same time, there may be loans to companies that the bank moves to the highest risk category (Stage 3), which would increase the need for provisions. However, it is relatively unlikely that banks would move a loan to the highest risk category solely because the interest coverage ratio is below 1, so we disregard this scenario.

The amount banks set aside for loan loss provisions (provisioning rate) varies between the different stages. For simplicity, we assume a provisioning rate of 0.1 per cent in Stage 1 and 2.5 per cent in Stage 2. In reality, the actual rate can depend on several factors, such as the type of loan, the collateral the bank holds, the type of company borrowing the funds, and which bank has lent the money.

Based on these assumptions, with a price of 65 EUR per tonne CO₂eq, banks might need to allocate around SEK 644 million for loan loss provisions. If the price rises to 195 EUR per tonne CO₂eq, the corresponding figure would be just over SEK 1 billion. The size of these provisions can be compared to the combined operating profit of Sweden's three largest banks, which exceeded SEK 110 billion in 2024.¹⁵ However, it is unlikely that these provisions would materialize within a single year. Projections for the cost of emission allowances in 2035–2040 range from 114 to 182 EUR per tonne CO₂eq.¹⁶ Unless unexpected events occur, these provisions could therefore be spread out over several years. Over a longer period, both businesses and banks may also adapt. Companies could succeed in transitioning and thereby reduce their emissions, while banks may become more restrictive in lending to high-emission companies.

5 Better data can improve the analysis

We have estimated the credit risk that may arise from a cost for emissions in banks' loans to Swedish companies. The method is based on available data. According to this method, banks have only small exposures to high emitters, suggesting that from this perspective these exposures do not pose a clear risk to financial stability. However, there are a number of limitations to this method which are important to take into account before drawing any definitive conclusions. The limitations can be grouped into three areas: variations within sectors, no consideration of value chains, and geographical scope. These limitations have in common that they can largely be addressed through better access to data. The availability of such data is expected to improve as

Standard 9), which is the accounting standard that Swedish banks have been required to use to value loans and financial instruments since January 2018.

¹⁵ During 2024, the three major Swedish banks made provisions for credit losses of approximately SEK 17 million. That the reservations were so low is partly due to the banks making reversals from previous reservations. During 2023, the same banks made provisions for credit losses of approximately SEK 2.8 billion.

¹⁶ See: [Bloomberg](#) and [S&P](#)

the CSRD is implemented, with a large number of companies having to disclose their emissions at scope 1, 2 and 3 levels, among other things.

The limitation of variations within sectors is that a sector contains different types of activities. For example, the sub-sectors within the *Electricity, gas, steam & air conditioning supply* category consist of both hydropower, which has low emissions, and coal-fired power plants, which have high emissions. According to this method, a bank lending to a hydropower company has the same exposure to climate risk as a bank lending to a coal-fired power plant. It is also not certain that turnover and emissions are linearly correlated or homogeneous within a sector. Two companies within a sector are likely to have different emission levels, even if they have similar turnover levels.

While our method only results in exposure per sector, several sectors may be interdependent and part of cross-sectoral value chains. This means that even if a sector has low emissions, it may depend on sectors with high emissions. For example, many sectors depend on the large emitting sectors of steel and metal, transport, electricity and heat. Should the prices of products from these sectors increase, it could affect sectors further down the value chain such as wholesale and retail trade, services and real estate.

This study has a geographical limitation and only covers Swedish banks and their exposures to Swedish companies.

6 Concluding comments

In this study, we find that overall there is little to suggest that a cost for emissions would have a significant impact on banks' credit losses and thereby Sweden's financial system. One explanation for our results is that Swedish banks have relatively small loan exposures to Swedish sectors that emit large amounts of greenhouse gases from their own operations.

However, the results should be interpreted with some caution. The risks could increase if, for example, the sectors to which banks have large loans are in turn dependent on sectors that emit large amounts of greenhouse gases. To be able to analyse how much the risks would increase, it is important to have better data on emissions for both companies and value chains.

To get a more comprehensive picture, the results from this study need to be used together with other measures of banks' exposures to climate-related risks. A cost for emissions is, as mentioned, one of many potential climate-related risks that can put pressure on the financial system. Other risks that need to be analysed include risks associated with climate events and physical risks such as floods, landslides, and fires, which are likely to increase due to climate change. Other transition risks such as changes in regulations, technological development, or changes in consumer and investor behaviours also need to be taken into account when assessing banks' exposures to climate-related risks.

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