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The Economic Effects of COVID-19 in Sweden: A Report on Income, Taxes, Distribution, and Government Support Policies

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ABSTRACT

The Economic Effects of COVID-19 in Sweden: A Report on Income, Taxes, Distribution, and Government Support Policies

This report analyses the economic consequences of the coronavirus pandemic and support policies using underutilized data sources from the Swedish Tax Agency's tax register, which provides real-time information on firm sales and employees' wage income. Firms' sales, particularly in areas heavily impacted by COVID-19, declined by 6.1% on average, inducing a drastic economic recession. Excise tax revenue analysis reveals a decline in industrial electricity and air travel tax revenues, but a rise in alcohol tax revenue. The hospitality industry experienced significant negative effects, with drops in sales, employment, and wage income. Payroll tax revenues decreased due to government intervention, whereas sick pay drastically increased. Average pre-tax labor income decreased by 5%, largely due to increased unemployment among part-time workers, escalating income inequality. Policy simulations indicate government support measures mitigated wage income reduction and unemployment rise, yet they contributed to income inequality under certain conditions. These results provide insight into the diverse, yet significant, economic impacts of the pandemic. A number of policy recommendations are presented based on the empirical findings.

JEL Classification: D31, H12, H24, J22, J24

Keywords: COVID-19, taxes, inequality, policy effects

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Summary

The coronavirus pandemic was a global crisis between 2020 and 2022 that had serious consequences for the world economy. Like other countries, Sweden was hit hard, and a number of policy measures were introduced to mitigate the negative impact of the pandemic on firms and households.

Effective policymaking in times of crisis such as the outbreak of the pandemic requires up-to-date information about the state of the economy. Unfortunately, official economic statistics contain significant time lags when it comes to real economic data. In Sweden, data on economic outcomes such as firm sales and individual income levels and distribution are typically reported on a quarterly or annual basis. The household income distribution income is presented only on an annual basis and with a delay of more than one year. It cannot be excluded that these time lags have impaired the design and effectiveness of the government's support measures during the coronavirus pandemic.

This report analyses the economic consequences of the coronavirus pandemic and support policies using underutilized data sources from the Swedish Tax Agency's tax register, which provides real-time information on firm sales and employees' wage income. The register is based on a continuous collection of information from companies on taxes paid and monthly income from employers for all companies and employees in the country. The periodicity is normally every month, which is considerably more frequent than that of most short-term statistics.

The two main outcomes that the report focuses on are firm sales and employee income. In both cases, we measure the impact of the pandemic at the level (how large was the impact on average?) and the distribution (how was income inequality affected?). The empirical approach for measuring the impact of the pandemic utilises information provided by inter-year trends, intra-year variations and regional differences in the spread of COVID-19.

The pandemic caused a drop in firm sales and tax revenues.

Our empirical analysis shows that the average pandemic effect on firms' sales was 6.1 per cent. This decline in activity is one of the most severe economic recessions that Sweden has experienced in modern times. The effect was greatest among firms registered in municipalities where the spread of COVID-19 was greatest.

Tax revenues decreased as a result of the pandemic. We analyse the impact on a number of excise taxes. Industrial electricity, measured as special deduction fields from the declaration form for energy tax on

electricity, is of particular interest as electricity is needed in the manufacturing process and therefore it provides an alternative picture of the level of activity in the manufacturing industry. The results show that the pandemic caused a decrease in industrial electricity by five per cent in March-May 2020 and by over eight per cent in June-August. Revenues from the tax on air travel decreased by almost 95 per cent in 2020, reflecting the fact that international air traffic almost completely stopped during a significant part of the first year of the pandemic. By contrast, revenue from the alcohol tax increased by 7 per cent, which can probably be explained by the fact that travel restrictions encouraged Swedes to consume alcohol in Sweden rather than abroad during holidays.

Our analyses show that the impact of the pandemic varied across industry branches. The largest negative effects are found in the hotel and restaurant industry: firms sales fell by 25 per cent, employment fell by just over 10 per cent and among employees who had income from employers throughout 2019 and 2020, wage income fell by around 11 per cent.

Payroll tax revenues decreased very strongly, by more than 8%, largely due to the government's reduction of payroll tax rates in 2020. Furthermore, the amount of sick pay increased very strongly as a result of the pandemic (by 67.7% on average in March-December 2020). According to our assessment, this effect is partly due to the pandemic itself, and partly due to changes in the incentives in the health insurance system in connection with the pandemic in the form of the government's reimbursement of companies' sick pay costs and the removal of the qualifying period deduction for individuals.

Wage earners' incomes fell and income inequality increased slightly

We estimate that the effect of the pandemic on employees' pre-tax labor income was almost 5% on average in the first year of the pandemic in 2020, which is large but not extreme compared to previous economic crises. Most of this effect seems to be explained by increased unemployment, especially among part-time workers under 30 and over 65.

Income dispersion in monthly wage income among employees increased slightly during the pandemic. The Gini coefficient rose by a couple of per cent in 2020, likely due to the increase in unemployment among low-paid part-time workers, mainly in the private sector. The labor income of middle and high earners did not change much. The analysis of annual income from both labor and capital cannot, for methodological reasons, capture the effects of the coronavirus pandemic as clearly, but here too a similar increase in pre-tax income inequality is seen. The change in 2020 was relatively modest, while 2021 shows a more significant increase in income inequality.

However, the latter can mainly be explained by increased capital gains from the sale of housing and securities.

Government support measures curbed the fall in labor income and the rise in income inequality

The report carries out policy simulations to study the impact of the government support measures in the form of short-term wage allowance (*korttidsstöd*) and reorientation support (*omställningsstöd*). The results show that the support measures helped contain the reduction in income for wage earners: the fall in wage income would have been almost twice as large during the initial phase of the pandemic without the short-term wage allowance and reorientation support. We also note that without the government support measures, unemployment would have increased more than it did.

The policy simulations are also used to give an indication of what the income distribution would have been in the absence of the support measures. We find that a situation where employees in failing firms had been guaranteed full-time work and unchanged wages, but where some workers had been laid off, would have increased income inequality more than in an alternative scenario where everyone had kept their jobs but worked slightly fewer hours and thus had slightly lower income.

The lessons learnt from the report's analysis relate to various aspects of labor market organisation, economic policy design and future data collection arrangements.

More flexible working hours can reduce the impact of crises on the income distribution

Our observations of the development of wage income during the pandemic, combined with simulations of different choice scenarios for crisis management in the labor market, suggest that the degree of flexibility in working hours and income can affect the trajectory of income inequality during recessions. The traditional 'Swedish model', which prioritises employees' right to full-time employment, is associated with a higher risk of increased unemployment and income dispersion in times of economic downturn compared to a more modern 'German model', which promotes flexible working time while maintaining employment.

Short-term wage allowance can be a useful crisis measure, but should not be expanded to deal with normal downturns

Short-term wage allowance is a government subsidy intended to counteract firms being forced to lay off employees during crises. In a labor market where companies can easily reduce the number of hours worked as a response to an economic downturn, a government provided short-term work subsidy would not add anything. In a labor market where full-time employment has instead been the norm, even in times of crisis, a severe economic downturn can lead to increased unemployment and then a government short-term wage allowance could be a model for bridging the effects of the crisis. Our analysis shows that the short-term wage allowance had a large impact on employees' wage incomes, especially among employees who can be assumed to have permanent employment and with incomes in the upper three quarters of the distribution (with the exception of those with top incomes). We lack data on disposable income, but it is reasonable to assume that the short-term wage allowance had a similar, though much smaller, impact in terms of disposable income. It is important to point out that our analyses are short-term and we cannot comment on the possible impact of short-term wage allowance after the more acute crisis of the pandemic. In the longer run, there is a risk that a system with short-term wage allowance can discourage a necessary structural transformation and for this reason, the support should not be used during normal economic downturns.

Implicit support to the public sector should be analysed

The downturn in the private sector during the pandemic led to increased unemployment and reduced income. In the public sector, employment or wage income were not significantly affected during the pandemic, despite some of its activities being affected by the fall in demand. Some areas of activity, such as parts of the health sector, experienced a sharp increase in demand, but this is unlikely to be the case across the whole public sector. Maintained employment and wage income in those parts of the public sector that faced reduced demand during the pandemic can be considered as an indirect short-term wage allowance. Such indirect support has not been discussed in the context of the pandemic. We therefore raise the question of how these differences in direct and indirect support policies during crisis periods to the private and public sectors affect the economy in the short and longer term. In a country like Sweden, where the public sector is relatively large and some activities are carried out in both the public and private sectors, this question should be of particular importance. In the private sector, output is measured by how much is sold in competitive markets. Since public sector output is largely based on the size of wage income, reductions in output in the public sector are not captured in an economic downturn as much as in the private sector. We therefore also wonder whether the analysis of government support measures would be affected by also considering and the implicit support to the public sector. It is not clear how such an analysis would be carried out, but we believe that the question is important and should be investigated in future studies.

Increase the use of real-time economic data, in particular the Swedish Tax Agency's records

Measurements of outcomes in the private sector can already be made with high frequency by using the Swedish Tax Agency's register data on firm sales, tax payments, and wage payments. By actively including these data in official statistics, the time lag in economic analysis and income distribution analysis could be drastically reduced. In addition, the quality of the analyses would be improved.

Introduce reporting of working time and type of employment in the monthly employer declarations.

There are no comprehensive data on employees' working hours in Swedish registers. This makes it difficult to analyse how economic fluctuations and labor market reforms affect labor income and its distribution between different groups of employees. The monthly data should therefore be supplemented with information on the percentage of full-time work, after an impact assessment of the administrative burden this may cause for employers.

Introduce accounting for sick pay at the individual level

Short-term sick pay for employees is currently reported as a lump sum at firm level in the monthly data from employer declarations, not specified per employee. This makes it difficult to analyse how cyclical fluctuations and policy reforms affect sickness absence. It is therefore important to change the registers such that short-term sick pay is also registered at the individual level, as is already the case with paid wage income from the employer.

1 Introduction*

The coronavirus pandemic of 2020-22 caused a major downturn in the global economy, and Sweden's economy was also hit hard. Immediately after the outbreak of the pandemic in the spring of 2020, many governments launched extensive packages of measures to mitigate the effects of the crisis on firms and households. The Swedish government's support measures were in some respects less extensive than those of other countries, but they still cost the state around SEK 200 billion. This report examines how companies and employees were affected by the pandemic and the role played by some of the support measures. How large was the real economic impact of the pandemic measured in terms of firm sales or employees' income? Where in the economy was economic activity most affected? Some sectors and groups of firms and individuals were hit very hard, while others were affected less or not at all.

One of the challenges during the pandemic was the slow reporting of economic data. The need to be able to study economic developments in real time, or at least without major time lags, is always important, but it is especially important in times of crisis. Policy makers need up-to-date information on the size of economic fluctuations to be able to design the right economic policies, both in terms of the accuracy and size of measures. Of course, up-to-date data on the economic situation is also important for firms and households to make their economic decisions.

Unfortunately, Swedish official statistics have some problems with managing the flow of information in a rapidly changing economic situation such as during the coronavirus pandemic. The most important economic statistics have long been quarterly based, which is a relatively long time interval in times of crisis when companies have to act quickly. By comparison, the spread of infection was measured and reported daily throughout the pandemic.

When it comes to observing how crises affect groups and individuals differently, continuous data on income distribution is also required. However, Swedish income distribution statistics are normally only reported on an annual basis and with a very long time lag. Policy makers may have to wait almost two years to find out about economic inequality. In practice, this means that no one has good knowledge of the current state of the Swedish income distribution.

In this report, we present an in-depth analysis of the impact of the coronavirus pandemic on economic activity among firms and individuals in

* This report is an English version of Angelov and Waldenström (2023c).

Sweden using a new type of economic data that is observed at the monthly level and thus with a very short time lag. These are data from the Swedish Tax Agency's register of tax payments and earned income. In this way, we are popularizing the use of *monthly tax receipts* and *monthly income from employers* as indicators of the state of the economy. One could say that these data sources offer the closest thing to real-time reporting that Swedish register-based population statistics can currently produce.

In the absence of real-time data from population registers, many international studies of the consequences of the corona pandemic have tried to measure the effects of the pandemic in other ways. Some studies have constructed data using advanced simulation models[1] while most have used data from conventional economic statistics sources such as surveys or data from other sample-based data sources, which are often presented with a significant time lag. In other words, our contribution to knowledge in this area is to instead use the continuously collected tax revenues from the entire economy's taxpayers that the Swedish Tax Agency collects and which gives us the opportunity to describe the outcomes with high precision and a short time lag.

The analyses in the report are based on four main data sources. Monthly firm data consist of VAT and excise tax returns and individual data are based on monthly employer declarations and annual income tax returns. Business payments of VAT and excise duties provide a picture of firm sales and the tax capacity of the economy as a whole, as well as of different sectors and geographical regions. For example, VAT declarations contain information on firm sales, while excise taxes on travel or electricity use in manufacturing provide a complementary picture of specific activities in transport and production.

Wage earners' labor income and its distribution during the pandemic are studied based on monthly control data on income, tax payments and sick pay that began to be reported in January 2019. The time perspective is relatively short, but it is still possible to create a picture of the impact of the pandemic on the level and development of earned income in different groups of the population by comparing the outcomes in the same months in 2019, 2020, 2021 and 2022. This method is used both to describe the development of total earned income and to show how the distribution of income has developed during the pandemic.

The Government's support measures in 2020 and 2021 have included direct income support to companies, employees and municipalities. In addition, a number of indirect measures have also been implemented, such as reduced payroll taxes and state responsibility for companies' sick pay costs. This study analyzes in particular the effects of the Government's two

[1] See for example Clemens and Veuger (2020) and Green and Loualiche (2021).

largest support packages: short-term wage allowance and reorientation support. By simulating employees' labor income, with and without support, we are able to estimate the impact of the support packages on average income and on the income distribution.

An important conclusion of the report is that the ability to analyze the development of the economy with the help of comprehensive and more high-frequency statistics than before means a better basis for decision-making for companies, politicians and households. These data also make it easier for authorities such as the National Institute of Economic Research (*Konjunkturinstitutet*) and Statistics Sweden to provide updated information on the economic situation and the economic distribution among households. In this way, our report provides examples of how Swedish economic statistics can be further strengthened with the help of the continuous register data that the Swedish Tax Agency collects and can provide to other actors in the economy.

1.1 Previous studies of the economic impact of the pandemic

Since the outbreak of the coronavirus pandemic in the spring-winter 2020, academic researchers, public authorities and various organizations have studied the economic impact of the pandemic in different countries and from a variety of perspectives. In this section, we present a brief overview of the academic research on the social economic impact of the coronavirus pandemic, in particular with regard to analyses of economic activity, for example in terms of firm sales, and of income distribution among households or different groups of income earners. The volume of academic studies on the corona pandemic has grown very large and we therefore focus on the analyses that are most relevant for understanding developments in Sweden.

The very first academic studies were based on insufficient data. The availability of new and better data has since enabled more reliable studies and credible results. Methodological developments have also been rapid, and increasingly sophisticated analytical approaches have been presented to identify the impact of the pandemic on different parts of the economy. In addition to the academic research literature, there are numerous reports from government ministries, statistical agencies and international organizations examining the economic impact of the coronavirus pandemic.

For an early analysis of the impact of the pandemic on economic activity, Andersen et al. (2020) use detailed data on private banking transactions in Denmark and Sweden. They measure the impact of the various lockdowns during the first months of the pandemic. The study finds that the pandemic shutdown led to a clear reduction in private card purchases by around 25%

in Sweden and 30% in Denmark. What is particularly interesting about the result is that the two countries chose different lockdown measures, Denmark a higher degree of forced social distancing while Sweden chose more voluntary restrictions. Despite this, the difference in the effect of the pandemic on economic activity was relatively small. Another study of the impact of the pandemic on economic activity is Chetty et al. (2021), who collect high-frequency data from a large number of private sector sources in the US and map details of consumer behavior and firm revenues during the pandemic. Using a similar approach, Chen, Qian and Wen (2021) track Chinese consumption responses using data on bank card purchases and cell phone use.

The combined effects of lockdown policies on the spread of infection and economic decline at the national level are not easy to measure convincingly. The reason is that many changes occurred simultaneously during the coronavirus pandemic, and the relative contribution of the lockdown policy in particular is difficult to identify among other simultaneous effects. Despite this, there are studies that discuss the issue, not least with a focus on the outcome of the Swedish policy, which was characterized by a higher degree of voluntariness and a lower degree of mandatory restrictions. Herby, Jonung and Hanke (2022) conduct a so-called meta-study in which they bring together and synthesize the results of several other studies of the effects of lockdowns in different countries. Their conclusion is that closures had a marginal impact on excess mortality while their macroeconomic effects were significant. Andersson (2022) and Andersson and Jonung (2023) argue that Sweden's corona policy of voluntary adaptation and greater openness has proved more successful than other countries' more coercive and lockdown-oriented corona measures.

Some studies have analyzed the impact on tax revenues by combining simulation methods and results based on empirical observations: Clemens and Veuger (2020) find evidence of significant tax revenue losses for US states. However, Green and Loualiche (2021) find that the loss in US local taxes, such as the sales tax, effectively made fiscal policy more expansionary and helped to mitigate the decline in employment during the early stages of the pandemic.

The distributional effects of the pandemic are studied in a research literature that has grown in scope as income data have become increasingly available. The earliest analyses used simulated individual income data in the absence of actual income outcomes of income earners. Almeida et al. (2021) study the evolution of income dispersion across EU Member States. Their results show a rather mixed picture, with a pandemic effect on lower income dispersion in nine countries, higher income dispersion in seven countries and no clear pandemic effect in ten countries. Policies are mostly found to mitigate income dispersion effects, but the sign of this mitigation effect varies across countries. O'Donoghue (2020) also applies microsimulation methods to European data, but finds more homogeneous results that show that the pandemic increased income inequality, but that government policies reversed this result and reduced inequality.

An early study of observed income is Clark, D'Ambrosio and Lepinteur (2021) who use household surveys in several different countries at different times in 2020. Their results indicate relatively small effects on income dispersion in disposable income for equivalent households.[2] Crossley, Fisher and Low (2021) use UK income data and Carta and DePhillips (2021) use Italian income data. Both these studies find that low-income earners experienced larger income reductions than other groups as a result of the pandemic and that young people and immigrants were hardest hit in the labor market.

Some studies focusing specifically on the labor market report that the pandemic caused both layoffs and reduced employment in several Western countries, as shown by, among others, Adams-Prassl et al. (2020) and Casarico and Lattanazio (2020). Gender differences are studied by Farre et al. (2022) for Spain and Hupkau and Petrongolo (2020) for Canada. They generally find rather small differences between men and women in their labor market performance during the pandemic. In a comprehensive analysis of the effects of the pandemic on income distribution in several Western economies, Stantcheva (2022) shows that most countries seem to have experienced increased income inequality in income before taxes and transfers but decreased income inequality when taxes and transfers are taken into account.

Developments in Sweden during the coronavirus pandemic have been the subject of several studies. Angelov and Waldenström (2023a) examined the effects on firm sales and tax payments and found that these were generally negative. Angelov and Waldenström (2023b) examined the impact of the pandemic on income distribution, in particular the evolution of monthly income. The analyses and results of both these studies form part of the basis for this report. The Corona Commission (SOU 2022:10) carried out a very ambitious analysis of how Sweden has been affected by the corona pandemic in terms of public health, the economy and policy, and how policy has in turn affected these outcomes. Their specific analyses of how the coronavirus support affected firms and households were presented in a number of background reports. Ekholm et al. (2022) examined the extent and impact of firm support, while Adermon et al. (2022a) examined individuals' labor income and their receipt of various forms of social security income and

[2] Disposable income is equal to the sum of wage income and capital income minus taxes plus transfers. Equivalent households means taking into account household size in terms of the number of adult and minor members.

transfers.[3] The use and impact of short-term wage allowance is currently being investigated and an interim report (SOU 2022:30) has been published so far. It describes the extent and use of short-term benefits in different parts of the private sector.

In two studies of how the number of employees in Sweden developed during the corona pandemic, Andersson and Wadensjö (2022a,b) use the Swedish Tax Agency's monthly data as we do. Their results are in line with ours regarding the impact of the pandemic on the change in unemployment in different groups. However, they highlight a number of additional interesting aspects. For example, they present a comparison with Denmark and Norway, which have similar monthly data and show that the fall in the number of employees in 2020 was significantly larger in Norway than in both Sweden and Denmark. Thanks to access to data on the country of birth of Swedish income earners, these studies also show that some groups of foreign-born people have experienced a slightly more positive development during the later periods of the pandemic.

Overall, these studies show that the coronavirus pandemic caused a severe economic downturn in all Western countries studied. The decline in economic activity has been measured in industrial production, service production and in the real wages of employees. Some sectors have been affected more than others, with services being particularly affected during the most severe periods of lockdown, while digital services firms have performed well during the pandemic. In terms of the impact on households, the crisis does not seem to have affected different groups of the population differently, and the effects of the crisis appear to have been similar for most people. Regarding the differences between women's and men's income and labor market outcomes during the crisis, these are generally small in the countries where these outcomes have been studied. In fact, the overall income gap has narrowed in several countries during the pandemic. This is mainly explained by the extensive support programs that were launched, which included broad-based targeted grants and cash benefits. Some groups of low-income earners experienced a significant increase in income during the pandemic.

1.2 Structure of the report

The basic structure of this report relies on empirical analysis of the economic impact of the coronavirus pandemic in two areas: firm sales and employee income.

[3] Adermon et al (2022b) present a further in-depth analysis of household income during the pandemic.

Chapter 2 describes the overall course of the coronavirus pandemic in both epidemiological and economic terms. It also presents the main policy supports introduced by the government during the pandemic.

Chapter 3 presents the data and methods used in the study. The registers of the Swedish Tax Agency form the basis of the analysis and we describe the different data sets and variables used. The statistical analysis methodology is an important starting point for drawing conclusions about the effects of the pandemic in addition to other macroeconomic trends.

Chapters 4 and 5 contain the analysis of firm sales and tax payments during the pandemic. We report how firm sales and a number of taxes paid have developed and we measure the size of the effects of the pandemic in these outcomes. We also analyse how different sectors have been affected and measure the extent to which the pandemic has had different effects on the economy. Chapter 4 also contains an analysis of how tax revenues from a number of excise taxes have developed. Finally, we introduce an analysis of the size distribution among companies in terms of firm sales and calculate the extent to which it has changed during the pandemic.

Chapters 6 and 7 contain analyses of how the economic situation and income distribution of Swedish adults have been affected by the pandemic. First, we analyze the monthly income of wage earners and monthly preliminary tax payments, and then we study the annual income of all taxpayers, including capital income and all taxes.

Chapter 8 analyses the Government's corona support policy in the form of short-term wage allowance and reorientation support for employees and companies. The research involves describing the size of the support in relation to other income and calculating its simulated effects on the income distribution.

Chapter 9, finally, summarizes the main findings of the report and presents conclusions and recommendations for policy and data collection.

2 The Covid-19 pandemic in Sweden: a summary

The coronavirus pandemic was a major crisis worldwide and differed in many ways from previous crises. The speed of the spread of the virus and the rapid reactions of many governments to it gave rise to unique crisis trajectories. Our analysis of the impact of the pandemic on the Swedish economy is based on these events and actions.

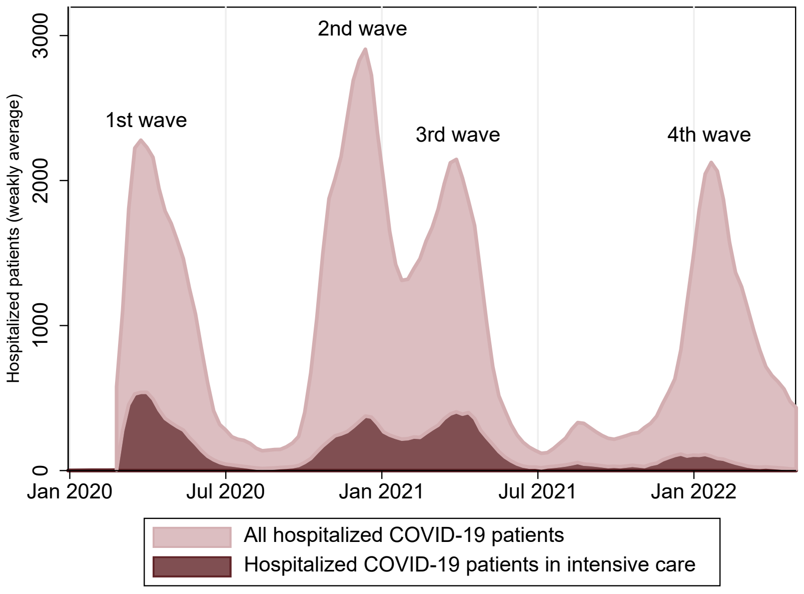
In this chapter, we describe the course of the coronavirus pandemic in Sweden. The aim is to provide a framework for our analysis and interpretation of the results we find. We therefore review the timeline of the epidemiological course of the pandemic in Sweden in terms of the spread of the disease in the population. We also describe a number of key economic outcomes that indicate how the macroeconomic picture was affected during the different periods of the pandemic, and how the development relates to the situation in recent years.

In the early stages of the pandemic, there was great uncertainty about the public health and economic impact of the pandemic. This uncertainty influenced the behavior of politicians and other societal actors, not to mention the population at large. Overall, ex-post figures show that the economic impact of the coronavirus pandemic was most evident in 2020. The impact was particularly strong in the first half of the year following the outbreak of the pandemic in March 2020, when many measures of economic activity had already returned to their previous levels by the end of that year. The economic support policy, which mainly took the form of a number of cash subsidies to the labor market and municipalities, was launched relatively soon after the outbreak of the pandemic and was also at its most extensive in 2020. After the last major wave of infection in spring 2022, the pandemic was declared over and this is also clearly reflected in the country's economic situation.

2.1 The course of the infection

The coronavirus pandemic broke out in the world in early 2020. According to the WHO, the new virus infection, Covid-19, was classified as a worldwide pandemic on 11 March 2020. In Sweden, the Public Health Agency of Sweden reported the first cases of the virus in February and the first deaths in March. Throughout the rest of 2020, 2021 and early 2022, the number of infected and deceased people grew, but not at a constant pace but in waves. The fourth, and last, major wave of infection (the so-called omicron variant) took place in January-February 2022 and when this had subsided, the Public Health Agency of Sweden declared on April 1, 2022 that Covid-19 was no longer to be considered a generally dangerous and socially dangerous disease. The corona pandemic in Sweden can thus be said to have lasted between March 11, 2020 and April 1, 2022. During this period, approximately 2.5 million people in Sweden were infected with Covid-19 and almost 20 thousand people died.[4]

Figure 2.1 **Number of new COVID-19 patients, total and in intensive care units, February 2020-April 2022**



Source: National Board of Health and Welfare, Statistics on Covid-19, https://www.socialstyrelsen.se/statistik-och-data/statistik/statistik-om-covid-19/ (2023-01-26).

The time course of the corona pandemic in Sweden can be represented in several ways, but the most common is to consider certain epidemiological outcomes such as the number of people infected by the virus, the number of COVID-19 patients in intensive care in hospitals or the number of COVID-19 deaths.[5] In this section, we use data from the National Board of Health and Welfare showing the development of the number of patients in Swedish

[4] At the end of 2022, the Public Health Agency of Sweden reported a total of almost 2.7 million infections and 22 thousand deaths. Of these, about half (46%) of all deaths occurred during the first year of the pandemic in 2020, while only a small proportion (17%) of all reported infections occurred in that year.
[5] For other comprehensive accounts of the coronavirus pandemic in Sweden, see for example SOU 2022:10 and 2022:30.

hospitals and health centers.[6] The presentation focuses on the number of patients treated for COVID-19, either in intensive care units or in other departments. [7]

Figure 2.1 shows the number of people in Swedish healthcare facilities who were treated for COVID-19 per week during the period March 2020-April 2022, i.e. during the entire course of the pandemic in Sweden. Two categories of COVID-19 patients are presented: all hospitalized and intensive care patients. The time series suggest the presence of four wave peaks (or three, if the second and third peaks are combined as belonging to the same wave). The first wave during March-April 2020, the second wave during November-December 2020, the third wave March-April 2021 and the fourth wave December 2021-February 2022.

According to these figures, the pandemic had a rapid onset in the first two months. Both the total number of hospitalizations and the number of intensive care patients rose sharply. In the latter case, a peak was reached and then never exceeded. The number of deaths of people infected with COVID-19 followed the same dramatic trend, with 5 000 deaths by early June 2020.

The number of people infected with COVID-19 is different from the number of hospitalized patients or the number of deaths. Figure 2.2 shows the number of reported cases of COVID-19 and a slightly different picture emerges. The increase in late 2020 and early 2021 as the first major wave in Sweden. During these months, approximately one million Swedes were infected. However, by far the largest spread of infection occurred at the beginning of 2022, when the famous omicron variant of Covid-19 spread in Sweden. In just a few weeks around January, one million Swedes reported being infected. At the beginning of the period, the difference between the patterns in Figures 2.1 and 2.2 is due to the low testing capacity, which means that the number of infected people, in relative terms, was underestimated at the beginning of 2020 in Figure 2.1. At the end of the period, the relationship between Figures 2.1 and 2.2 is the opposite: a record number of infected people, fewer people in intensive care and slightly fewer people hospitalized. This difference is probably due to the fact that the omicron variant that dominated in early 2022 was more infectious but less virulent than previous variants. In other words, more people became infected, but relatively few of them developed severe symptoms.

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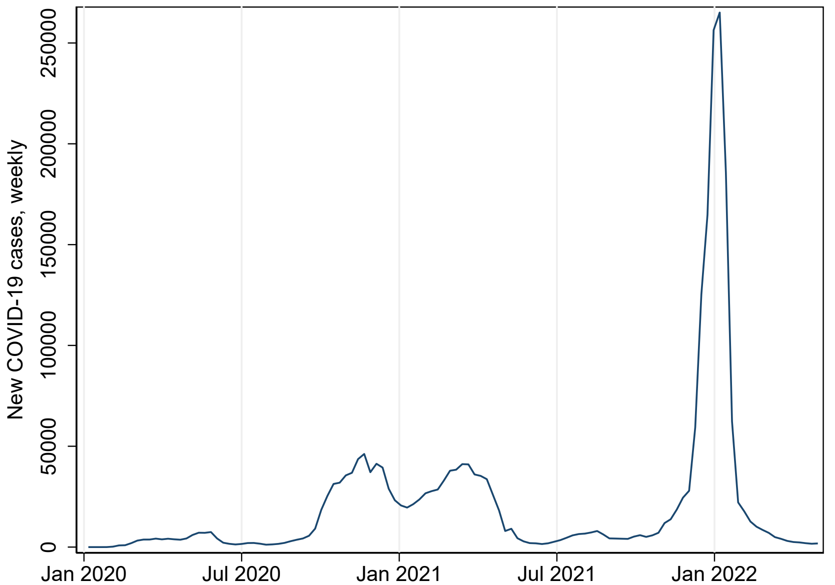
[6] Socialstyrelsen, “Static on Covid-19“. https://www.socialstyrelsen.se/statistik-och-data/statistik/statistik-om-covid-19/ (2023-02-02).

[7] As mentioned above, there are also other indicators of the pandemic’s spread. The Public Health Agency of Sweden reports data on the number of people infected. However, it should be noted that data on infection rates do not necessarily reflect the true number of infected people in the economy. The reporting of hospitalised COVID-19 patients may vary between hospitals and regions, which is also a possible source of error.

Figure 2.2 Number of people infected in Covid-19, February 2020-April 2022



Source: Public Health Agency of Sweden, Confirmed cases of COVID-19, https://www.folkhalsomyndigheten.se/fall-covid-19/ (2023-01-26).

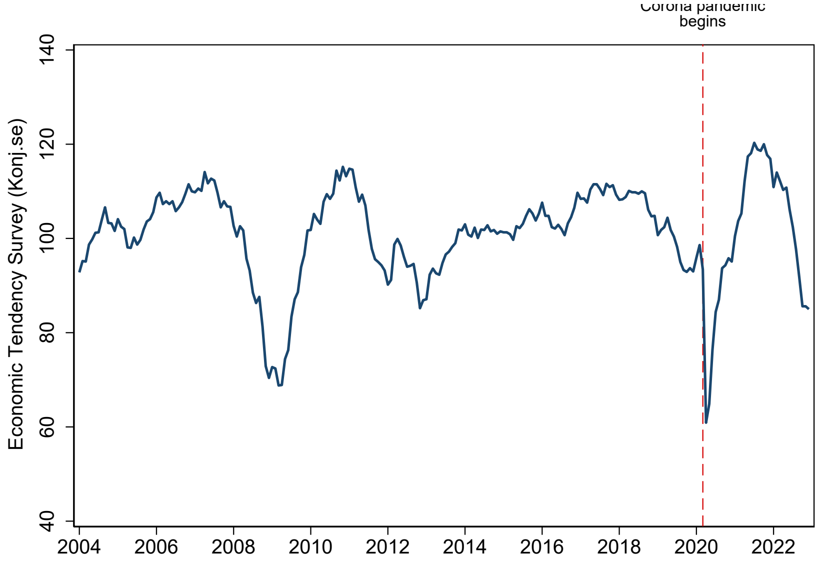
The different pandemic-related outcomes may have different socio-economic implications. For example, if many elderly people die without working-age adults being affected to any great extent, as was the case during the first wave of the pandemic, the decline in economic activity may not be very large. If, on the other hand, a large number of adult workers are infected without many deaths, as happened during the fourth and final wave of the pandemic, both sick leave and the decline in firm output will increase.

2.2 Some socio-economic trends during the pandemic

The purpose of this report is to examine the economic impact of the coronavirus pandemic on the private sector: firm sales and employee income. This means that the description of the development of the national economy during the pandemic will be presented in the various chapters of the report, and we therefore do not devote too much space to this in this chapter. However, we would like to report some particularly important outcomes at the outset. These are developments in the labor market and in the contemporaneous business cycle assessment, which are valuable inputs to the subsequent analysis. In this sub-section we will review three of these:

the Business Tendency Survey published monthly by the NIER, the redundancy notice statistics and the unemployment outcome.

Figure 2.3 Business tendency survey of the Swedish economy

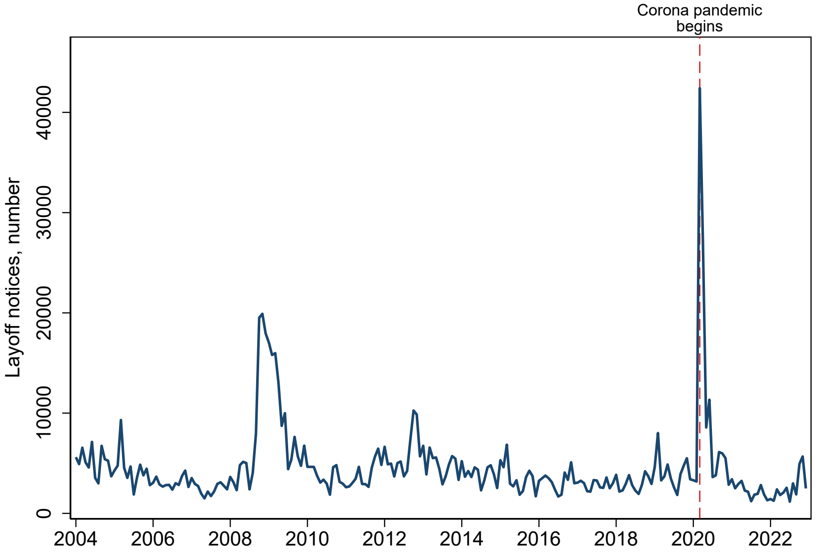


Source: National Institute of Economic Research, Barometer indicator, http://statistik.konj.se/PXWeb/pxweb/sv/KonjBar/KonjBar__indikatorer/Indikatorm.px/ (2023-01-26).

The mood in the economy and the view of current economic activity are measured in the Economic Tendency Survey on the basis of questions to companies and households. The barometer indicator is the measure that weighs together all the participants' responses from all sectors of the economy, from manufacturing to services. Figure 2.3 shows that the outbreak of the coronavirus pandemic had a very strong negative effect on people's assessment of the economic situation in Sweden. The value in March 2020 was 60.9, which was the lowest value measured since measurements began in the mid-1990s. The fall from the previous month was also the largest month-on-month drop on record. At the same time, business surveys recovered almost as quickly. Already in October 2020, the level was at pre-pandemic levels, and by mid-2021 the assessment of the economic situation was more positive than in many years. Thus, this subjective indicator shows that while the situation was considered extremely serious at the time of the outbreak, the long-term impact of the pandemic was still considered limited.

Redundancy statistics are another indicator that tells us something about the state of the economy. Redundancy notices are an instrument that employers must use to indicate to employees that there is a risk that their employment will be terminated. Research shows that many notices are not implemented (Fredriksson et al., 2023), and this was also very much the case during the coronavirus pandemic. The statistics show that the outbreak of the coronavirus pandemic had a very large impact on the number of redundancies, which soared from around 4 000 per month in the 2010s to over 40 000 in March 2020 and 26 000 in April 2020 (see Figure 2.4). This was twice as many redundancies as during the 2008 financial crisis, thus confirming the very strong negative impact on the outlook shown by the economic projections in Figure 2.3.

Figure 2.4 Layoff notices in the Swedish economy, 2004-2022



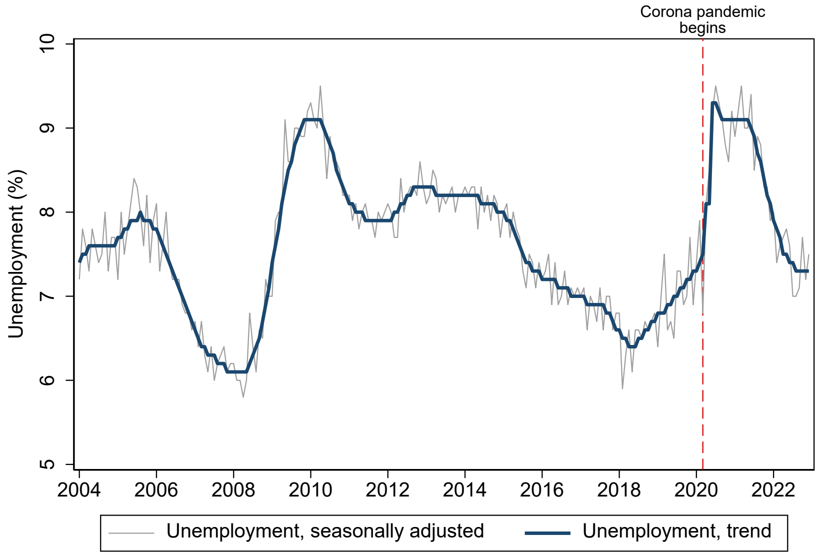
Source: Ekonomifakta, "Varsel per månad", https://www.ekonomifakta.se/fakta/arbetsmarknad/arbetsloshet/varsel/ (2023-01-26).

The unemployment rate according to Statistics Sweden's large-scale labor force survey (LFS) shows that the outbreak of the coronavirus pandemic affected not only the projections but also the labor market (see Figure 2.5). From an unemployment rate of 6.8% in March 2020, Sweden went to an unemployment rate of 9.2% in June of the same year, both seasonally adjusted.[8] The actual unemployment rate in June 2020 was 10%. This is the highest figure since June 2009 and before that the mid-1990s. The high level of unemployment persisted well into 2021, but from the second half of 2021 onwards the unemployment rate declined relatively quickly. At the end of

[8] Seasonal adjustment means taking into account natural fluctuations in the unemployment rate during the months of the year due to recurrent seasonal factors, mainly linked to holiday patterns.

the pandemic, the unemployment rate was around 8%, a sharp decline from the peak in 2020 but still higher than the pre-pandemic level.

Figure 2.5 Unemployment rate in Sweden



Source: Ekonomifakta, Unemployment per month, 15-74 years, https://www.ekonomifakta.se/fakta/arbetsmarknad/arbetsloshet/arbetsloshet/ (2023-01-26).

2.3 Policy support measures

With the outbreak of the coronavirus pandemic in early 2020, a number of specific economic and policy measures were introduced to mitigate the socio-economic impact of the pandemic. Corona policies immediately attracted a lot of attention. An interesting aspect is that the pandemic hit all countries almost simultaneously, which meant that the implementation of support packages and specific measures could be followed and compared in real time. In wealthy countries, governments almost invariably chose to introduce extensive support packages for firms and households, as well as far-reaching restrictions on citizens' travel and social interaction.

Sweden also introduced a number of specific measures as part of its coronavirus policy. As described above, there was considerable uncertainty about the impact of the pandemic on public health and the economy as a whole. The measures introduced by Sweden quickly proved to be somewhat less extensive than those implemented by other countries. The Swedish support packages were smaller in size and the government did not place as much emphasis on mandatory social restrictions. Instead, Swedish policy came to be based more on various types of cash support, some tax relief, and a mainly voluntary social distancing instead of forced closures and restrictions.

Sweden's economic support measures contained several elements. Some of these were regulatory changes in the form of deferring companies' social security or tax payments and taking over part of the companies' sick pay costs. Other measures were direct cash grants to municipalities, companies and employees. Some of these measures were general and provided without the need for a means test. Examples of these are grants for payment of employer's contributions and contributions to companies' sick pay costs. However, other measures were means-tested, such as deferrals for tax payments or short-term wage allowance. The companies' applications for deferment or support were examined by the relevant authorities before decisions were made.

The deferrals on the payment of social security contributions, preliminary income tax and VAT were introduced early in the pandemic and lasted until the beginning of 2022. These deferrals were not designed as transfers, but as loans. Companies' immediate costs for taxes and social security contributions were deferred in time, but not canceled. The government also took over the cost of sick pay to mitigate the negative effects of the surge in sickness absence caused by the pandemic. During the period April-July 2020, the government took over the full cost of sick pay, and thereafter it took over part of the cost. The value of the deferrals and sick pay support was significant, SEK 61 billion. They were used by more than 55 000 companies.

The government established a special business emergency fund to support bank lending to companies affected by the pandemic. This was managed by the Swedish National Debt Office, which was tasked by the government with issuing credit guarantees to the banks that lent money to small and medium-sized enterprises. The government guaranteed 70% of the credit amount in order to encourage banks to lend to companies. However, the size of the program was relatively small, SEK 2.6 billion, and it ended in autumn 2021.

Another measure introduced by the government was a special support to landlords who experienced reduced rental income as a result of the pandemic. The support was aimed at landlords of commercial properties when their tenants could no longer pay all or part of the rent. The situation was considered particularly threatening for shopping centers and similar commercial properties where companies in the hotel and restaurant sector and trading companies were active. The aid was set at a maximum of 50% of the rent reduction. When the rent subsidy was abolished in September 2021, an amount of SEK 2.4 billion had been paid out.

Cash grants to companies and their private sector employees were perhaps the most high-profile of the government's pandemic-related support measures.[9] They were of two types: short-term wage allowance and reorientation support.

Short-term wage allowance was a person-based wage support paid to companies but also registered to their final individual beneficiaries. The short-term employee benefit was the largest single cash benefit to the private sector and in 2020 and 2021 it cost the state around SEK 40 billion. The support was paid to 76 888 companies during this period. This means that the short-term wage allowance reached significantly more companies than any other support measure. Companies could apply for support from the competent authority Tillväxtverket. The aid was aimed at all employees and allowed them to reduce their working hours by up to 80% without losing more than 12% of their salary. Employers paid for the actual working time and a small additional fee, while the state supplemented the wage cost up to almost the full agreed amount.

Conversion aid was another aid aimed at smaller companies and was not on the same scale as the short-term aid. This aid was mainly aimed at SMEs and was paid in proportion to their reported loss of turnover during the pandemic. The application procedures were more cumbersome than was the case with the short-term wage allowance and the conditions for qualification were changed several times, but despite this, just over 33 000 companies were reached by the reorientation support during 2020-2021-. The budgetary cost of the reorientation support during this period was SEK 16.4 billion-.

Table 2.1 provides an overview of the various economic support measures that the Government decided on in connection with its corona policy in 2020 and 2021. The total cost of these measures was just over SEK 123 billion, which is more than half of the total budgetary costs of the corona crisis reported by the Government. The remaining part was mainly the Government's increased grants to municipalities to compensate them for the sharply increased costs, primarily in elderly care.

[9] Less attention was paid to the fact that businesses and employees in the public sector received largely unchanged funding during the pandemic. We discuss in the concluding chapter whether these unchanged employment conditions for public sector employees can be regarded as a form of borderless cash support, compared to the conditional cash support to the private sector studied in this report.

Table 2.1 Summary of selected coronavirus support measures

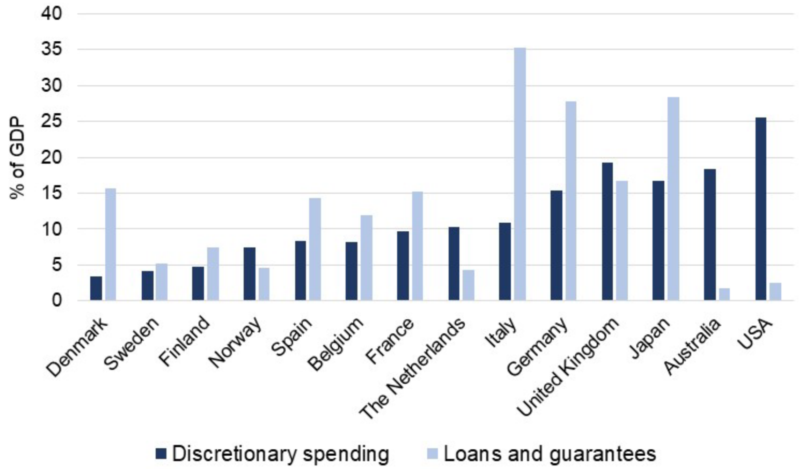
	Responsible authority	Total amount	Number of enterprises
Short-term work allowance	Swedish Agency for Economic and Regional Growth	40.4 mSEK	76 888
Deferment of payment of employers' contributions, deducted taxes and VAT	The tax authorities	61.5 mSEK	55 381
Reorientation support	The tax authorities	16.4 mSEK	33 403
Temporary discount for rental costs in vulnerable industries	The county councils	2.4 mSEK	36 874
Business emergency services	National Debt Office	2.7 mSEK	762
Total		**123.4 mSEK**	

Source: "mSEK" denotes million SEK (one SEK roughly 0.1 EUR). Figures for the entire period 2020 and 2021, data taken from SOU 2022:30, Table 3.1.

How much did the coronavirus support cost Swedish taxpayers in relation to GDP and how large was this cost in comparison with other rich countries? Figure 2.6 shows the ex-post calculated size of the fiscal commitments related to the coronavirus pandemic in a number of Western countries. The comparison clearly shows how Sweden's spending was among the lowest among the world's rich countries in relation to the size of its economy.[10] According to these figures, the Swedish government's spending levels on these supports were lower than most other countries in terms of both direct cash support and loans to municipalities, firms and households. However, it is worth adding that there are differences between these countries in the size of existing social safety nets and automatic stabilizers, which means that the comparison is not entirely accurate.

[10] T he comparison between the Nordic countries' expenditure on corona policy varies somewhat depending on the definitions of expenditure items, as shown in the Corona Commission's discussions (SOU 2022:10, section 3.2).

Figure 2.6 Fiscal stimulus with direct budgetary impact 2020-2021



Source: IMF Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic, October 2021.

3 Data and methodology

This chapter describes the data sources on which the report's analyses are based and the methodology used to measure the impact of the pandemic. Readers who are only interested in the results can skip this chapter and go directly to Chapter 4, where the first results are presented. The results sections contain both the presentation and the interpretation of the results and we hope that this will be sufficient to get a good understanding of the main content of the report. This chapter is useful for anyone interested in gaining a deeper insight about both the advantages and disadvantages of the data sources and the chosen method.

3.1 The Swedish Tax Agency's register data

We analyze how the coronavirus pandemic has affected economic activity among Swedish firms and individuals using detailed information from the Swedish Tax Agency's register of tax payments and labor income.[11] Using tax revenues and tax bases as an indicator of the state of the economy is a relatively new approach. The idea is that most of the country's economic transactions are taxed, and data on current tax revenues combined with knowledge of tax rates provide a picture of the value of all household and firm purchases and sales made.

An advantage of the Swedish Tax Agency's monthly register is that the analysis can be done with a very short time lag, only a few months. This can be compared with official statistics on the national accounts or household income, which are presented with a time lag of more than a year. Some previous studies of the coronavirus crisis have used simulations, i.e. constructed datasets, to get a more up-to-date picture of the outcomes during the pandemic, but in this report we use collected tax revenues that describe the actual outcomes almost in real time.[12]

In this report, we study three broad categories of taxpayers: firms, individuals, and taxpayers (firms) filing excise tax returns. Although we use the Swedish Tax Agency's records in all these cases, there are some important differences in the type of data analyzed. In some cases, the

[11] The micro data used for the analysis have been obtained by combining several administrative registers collected and held by the Swedish Tax Agency . Data have been provided by the Swedish Tax Agency for use in this ESO report. Access to these data is restricted by national and international regulations, but any researcher wishing to replicate them can apply to the Tax Agency for access. The practical arrangements for accessing the final dataset will depend to some extent on the location of the researcher and will need to be managed on a case-by-case basis.

[12] See for example Clemens and Veuger (2020) and Green and Loualiche (2021).

distinction between firms and individuals is not easy to make. To see this, consider payroll taxes or local and national income taxes. Formally, companies pay these taxes and contributions, but it is the income of employees that is taxed. In this report, we have placed these payroll taxes in the chapter on employee income and behavioral effects of the pandemic.[13]

Finally, it may be worth mentioning that the data used in this report are used in other contexts, such as official statistics. Nevertheless, there may be some discrepancies between our data and other statistical sources. These discrepancies are usually due to differences in grouping or periodization. Unfortunately, we lack data on full-time equivalent monthly wages and working hours. Below we describe which data sources we have used and which economic outcomes our analyses focus on.

3.1.1 Data on firm sales and tax payments

At the heart of the analysis of firm sales are firms' current payments of VAT and excise duties, which provide a picture of firm sales and the tax capacity of the economy as a whole as well as of different sectors and geographical regions. For example, VAT provides a picture of firm sales while excise duties on travel or energy use provide a complementary picture of specific activities in transport and production.

Data on corporate tax payments come from the Swedish Tax Agency's tax register, which includes all companies registered in Sweden. The registers contain data reported on a monthly basis and for this report we have access to data from January 2017 to April 2022.[14] Our main analysis uses observations from 2018-2022 -and we use 2017 and 2018 data in separate placebo regressions aimed at testing the reliability of the chosen effect estimation method. Due to late reporting by some companies, it may take up to a few months before full population coverage for a month is achieved.

The analysis of firms' tax payments focuses on three tax categories: value added tax (VAT), excise duties and personal taxes on work and sick pay.

Value added tax (VAT) is a major consumption tax in Sweden, accounting for over a fifth of total tax revenue. VAT targets most sectors and transactions with a 25% VAT rate and a few sectors with a lower VAT rate. VAT rates have not changed during the coronavirus pandemic. Value added tax is 12.5% on food and 6% on book sales. This analysis uses company-level data on VAT payments registered in the Swedish Tax Agency's VAT register.

[13] A further complexity relates to who ultimately pays the tax in the form of reduced business profits or employee income. The distribution of this tax burden depends on several factors, but it is generally considered that businesses and employees share the taxes paid.
[14] There are previous tax data at the company level, but these have not been made available for this project.

These data are based on VAT declarations and cover all VAT payments from Swedish companies. The frequency of VAT reporting is either monthly, quarterly or annual. There is a significant concentration of large firms among those reporting monthly: about 23% of firms report VAT monthly but these firms account for 90% of total VAT payments. In the analysis, we only use data on firms that report monthly because we want to measure the intra-year variation in VAT and sales as accurately as possible on a monthly basis. Thus, the population of interest in the VAT and sales analyses is firms that report monthly. As we use monthly dynamics throughout the report, it is not reasonable to include firms that report less frequently, although interpolation of data points is possible (see further section 4.1).

Excise taxes are an umbrella term for fees and taxes on more than 40 different types of transactions and activities, and excise tax revenues account for about 7 percent of total taxes in Sweden. We limit the analysis to four large and economically interesting excise taxes. Two of them concern production activities: tax on energy use for energy-intensive manufacturing companies (a proportional tax on the consumption of electrical energy) and on advertising (tax on printed flyers, advertisements, posters and billboards, etc.). Two are taxes on transport activities: the petrol tax (a tax on energy and carbon dioxide) and the tax on air travel (a fixed charge per passenger). The data on excise tax estimates differ slightly from VAT and sales. In the case of excise duties, the way in which the data are collected does not provide a clear reason to suspect outliers a priori. This is because for a specific excise tax (e.g. on air travel) the data points (observations during a month) reflect consumption or sales made by a large number of economic agents (consumers or firms). In other words, compared to monthly sales and VAT data from firms, there are far fewer situations where a single order or other economic transaction can constitute an extreme deviation. This hypothesis is supported by the placebo analyses we perform for excise duties, as will be shown after the presentation of the results.

Taxes on labor and sick pay refer to all employer-reported payroll taxes, i.e. payroll taxes and payments of preliminary municipal and state income taxes. There are also data on employers' expenditure on short-term sick leave, known as sick pay. It should be noted that the employer's contribution includes several different contributions and taxes, some of which give the right to withdraw from the social security system, such as old age pensions, while others are purely statutory taxes. In this case, municipal and state income taxes are the preliminary tax payments made by employers in connection with wage payments. The final income tax is later settled in the annual income tax return (described in the next sub-section) where workers receive tax refunds in the form of earned income tax credits and other possible deductions for the purchase of services. The earned income tax credit is the largest of these credits and is granted to all wage earners, but it has its greatest proportional impact on low wages. Sick pay is the compensation to employees for short-term sickness absence that employers are obliged to pay (up to the first 14 days of absence). Due to the coronavirus pandemic, the government took over the payment of all sick pay during March-June 2020 and partly for later months in 2020. In terms of reporting, employers were still obliged to pay sick pay as before, but were subsequently reimbursed by the authorities. Our data consists of payments of sick pay to employees. Another corona-related measure was the temporary reduction in payroll taxes introduced in 2020. The reduction meant that employers could request a reduction in employer contributions for a maximum of 30 of their employees for payments made between March 1 and June 30, 2020. The reduction meant that only the old-age pension contribution (10.21%) on remuneration up to SEK 25,000 per salary recipient and month would be paid.

The analysis uses monthly firm-level data covering 2019-April 2022, consisting of payroll tax, preliminary income tax paid, and employer paid sick pay to employees. For example, each observation of employer's contributions for each company month is the total sum of the employer's contributions paid by the company for all its employees in that month. Two of the three outcome variables (payroll taxes and sick pay) are only available at the enterprise level. The third variable, preliminary income tax, is also available at the individual level, but to keep the units of measurement intact, we use enterprise-level data for all three outcomes. As these monthly data were not collected in the administrative registers before 2019, we cannot perform placebo tests as is done in the analysis of data based on VAT returns. We perform the estimation using so-called firm fixed effects and standard errors that have been clustered at the industry level. In practice, firm fixed effects mean that in the results we hold constant differences between firms that do not change over time. The purpose of this is to allow for circumstances that are not of real interest for our main analyses. When making industry classifications, we use the Swedish Standard Industrial Classification (SNI) from Statistics Sweden. If a company operates in several industries in the Swedish Tax Agency's data, each company is assigned the SNI code corresponding to the largest share. We use the two-digit level provided by Statistics Sweden as a breakdown, resulting in 88 industries. [15]

[15] See https://www.scb.se/en/documentation/classifications-and-standards/swedish-standard-industrial-classification-sni/ (2023-01-07) for details.

3.1.2 Data on employees' earnings and tax payments

We measure individuals' income using data from two of the Swedish Tax Agency's population-wide registers: earned income in monthly employer declarations and all employment, pension (etc.) and capital income, as well as income from self-employment in annual tax declarations.

The register of monthly employer declarations is our main data source. The data include monthly compensation and preliminary income tax from all employers. An observation point in the data material consists of a wage income amount that refers to a specific individual who has received wage compensation from a specific employer. In the report we refer to this as monthly income or wage income. Note that we do not include information on working hours and on wages such as hourly or full-time equivalent monthly wages. This information on wages is often used in data analyses with Swedish register data but is not available in the Swedish Tax Agency's register.

The monthly employer declarations at individual level were launched in January 2019 and consist of monthly wage income before and after tax for all employed persons in the country, regardless of the size of the income or the length of the employment contract. Prior to 2019, this register was annual, but otherwise similar in nature. Since we have direct access to data from the tax authorities, we can analyze the reported income with only a short delay. This immediate access to data appears to be a unique contribution to the literature.

The population covered by these monthly income data is all individuals with a non-zero income for at least one month during our observation period (January 2019 to April 2022). There is a significant number of individuals with zero income, i.e. who have no income from any employer. We have no further information about these individuals in the Swedish Tax Agency's register except for the fact that they had zero income in a given month. For lack of a better measure, we use zero income in a given period as a measure of unemployment, fully aware that this definition is poorly aligned with the standard definition of unemployment, especially in a welfare state like Sweden.[16] In section 6.3, we analyze the evolution of unemployment during the pandemic based on this definition.

The annual register of income tax returns includes not only wage income but also pension and occupational and health insurance income, income from business activities, capital income and all income taxes paid. There are thus several differences from the monthly employer declarations discussed above. It should be noted that the concept of earned income is considerably

[16] In their analysis of the development of the number of employees in Sweden during the coronavirus pandemic, Andersson and Wadensjö (2022a) use the same monthly data as we do and thus make a similar assessment that zero income indicates lack of employment or unemployment.

broader in annual declarations in so far as these include not only wage income but also other work-related income such as pension income and social security income from long-term illness or unemployment, as well as earned income for self-employed persons within the framework of a sole proprietorship.

In the case of taxes, the monthly data report only preliminary taxes paid, while the annual returns include final income taxes, including earned income tax credits, and of course other taxes such as property taxes and capital income taxes. Untaxed transfers such as housing benefits or child benefits are not included in any of these data sources.

One difficulty with using annual income to analyze the pandemic is that the full-year income statement partially blurs the impact of the pandemic because 2020 includes both pre-pandemic and pandemic months. Officially, the last day for filing the personal tax returns was May 2, 2022, but under special circumstances, some taxpayers are entitled to file their tax returns later. The latest filing date in the income tax return data used in the report is 22 June 2022. According to our estimate based on previous tax years, around 160 000 more people can be expected to have filed their tax returns for the income year 2021 after 22 June 2022. In order to make the data for 2021 comparable with previous years, we have applied the same data limitation for 2018, 2019 and 2020.

In other words, we have removed observations for individuals who filed their taxes after 22 June. Since the sample of late filers may have changed as a result of the pandemic, we have conducted a sensitivity analysis. The analysis consisted of comparing descriptive results based on two different data sets: the data set described above, where returns filed after 22 June each year are removed, and data consisting of a balanced panel where only observations for individuals who had filed their income tax return each year are included. The results from this balanced panel are qualitatively very similar to the results presented in the article, which means that the most important changes we observe for the income year 2021 are not due to selection. The results for the balanced panel are available upon request from the authors.

A general problem associated with these tax register databases is that they contain limited information on household composition, socio-economic characteristics and limited information on various payments from the welfare systems low-income households.[17] The analyses are therefore conducted mainly on adult taxpayers, which means employed individuals aged 18-64 in the monthly payroll register and adult individuals aged 18 and over in the annual tax return register. This means that our analyses of

[17] For data protection reasons, the Tax Agency is not free to combine its tax records with the civil registration register or with records from other public authorities covering, for example, household characteristics, transfers received or level of education.

income distribution effects cannot take into account the broadest income measures such as disposable income, nor the income equalizing impact that households often have on individuals' consumption possibilities. Since Statistics Sweden and the Ministry of Finance mainly use household disposable income as the basis for distributional analyses, some discrepancies may arise in both the level and trends in the income distribution studied. It should also be noted that the very term "income distribution" is often associated with the income statistics generated by Statistics Sweden and the Ministry of Finance.

Finally, in this report, we also have access to register data on some government corona support payments to companies and individuals, which we describe above in section 2. The largest support is the *short-term wage allowance,* an individualized wage support paid to companies but also registered for their final individual recipients. Data on short-term work are collected by the responsible body, the Swedish Agency for Economic and Regional Growth, and are also available from the Swedish Tax Agency. However, data on short-term wage allowance is not available in the work of this report and therefore the policy simulations in section 8 are based on previous results from Angelov and Waldenström (2023b).[18] The second largest support package, the *reorientation support, is* mainly targeted at SMEs and is paid out roughly in proportion to their reported turnover loss during the pandemic. We only observe payments to firms, but since we also know the individuals working in these firms, we can allocate the support to them after making certain assumptions about the shares of capital and labor in income (see further section 8).

3.2 Methodology

A recurring feature of the analyses in the report is that each chapter begins with a graphic description of the data to which the chapter relates. In most cases, we have access to monthly data and the descriptive analyses are made at the monthly level. This concerns sections 4 to 6 and 8 and covers firm sales and VAT, excise duties, employees' monthly income from employers, employers' contributions, preliminary taxes and sick pay. For the analysis of yearly personal income tax returns in section 7, annual data are used for obvious reasons. In the descriptive parts where monthly data are used, we can study both variation across years (for example by comparing levels during the pandemic with levels before the pandemic), and within years where we can compare different months with each other. The descriptive

[18] The reason why we did not request data on short-term wage allowance from the Swedish Tax Agency was that it is unclear whether the Tax Agency could have legally provided this data, which originally comes from the Swedish Agency for Economic and Regional Growth.

analyses with annual data obviously lack the monthly aspect, and in order to extract as much information as possible from the data, the types of figures in section 7 differ from the rest of the text.

What is also recurrent in the report is that sections where monthly data are used contain regression results in addition to descriptive analyses. The basic principle behind all regressions is described below, but in short we use the fact that the first two months of 2020 were pandemic-free (see our discussion below on the exact timing of the Covid-19 outbreak in Sweden). This makes it possible to compare the change in a particular outcome variable between the last ten months and the first two months of 2020 with the corresponding change in 2019 to assess the impact of the pandemic.

The purpose of the regressions is to quantify the pandemic effect that can be discerned in the figures and to measure whether the effect differs between different groups (industries in terms of firms and gender and public and private sectors in terms of employees). In the rest of this section, we describe the methodology chosen for the effect estimates. Measuring the impact of the coronavirus pandemic on economic activity in a country is difficult because we lack natural counterfactuals. There is simply no "parallel" Sweden that is identical to the actual Sweden except that the fictional country was never exposed to a pandemic. It is always possible to compare developments over time for selected industries or other groups, but an examination of the results in the following sections shows that such an estimate would not be credible. The reason is that there is sufficient variation within and between years to prevent any valid conclusions from a comparison of raw averages over calendar time. In addition, no sector of the economy can be assumed to be unaffected by the pandemic, which makes it difficult to carry out an estimate based on differences in group changes over calendar time.

Our chosen method of analysis has an important advantage over simpler before-after estimation, which measures changes over time, such as comparing post-pandemic outcomes with pre-pandemic outcomes. The main reason is that our method can control for nominal changes across calendar years and also variations within calendar years. We can thus to some extent take into account effects from the variation in factors that would have occurred during the pandemic period even in the absence of a pandemic. As will be shown in our descriptive analyses of various economic outcomes, such within-year variation seems to occur in a systematic way in Sweden during the examined years. While we argue that our chosen estimation method has advantages over a before-and-after estimation method, we want to emphasize that we cannot estimate the impact of the pandemic without any statistical bias. The main reason for this caution is that we have no way of controlling for possible cyclical effects that would have occurred in the absence of the pandemic.

In the following, we present a more formal discussion of the chosen estimation method and of the identification challenges. Readers who do not want to go through these technical aspects of the econometric analysis can skip the rest of section 3.2 as it is not essential reading for understanding the report's results.

In order to clarify the structure of the econometric analysis, we let Y_{ipt} denote the outcome variable that we study (e.g. a firm's sales or an employee's income) reported by the company or individual in the period January-February ($p = 1$) or March-December ($p = 2$) in the year $t = 2019$ or 2020. In addition, let $D_t = 1[t = 2020]$ where $\mathbf{1}[.]$ is the indicator function that has the value one if the expression in brackets is true and zero otherwise, and $S_p = \mathbf{1}[p = 2]$. In the empirical analysis that follows, we will use monthly data. However, in order to convey the main ideas, it is useful to disregard the monthly dimension for the moment and take $p = 1, 2$ as our observation frequency within one year. With this in mind, we can consider the following empirical specification:

$$Y_{ipt} = \delta + \theta_1 D_t + \theta_2 S_p + \theta_3 D_t S_p + u_{ipt}, \quad (3.1)$$

where u_{ipt} is an error term. Let $\bar{Y}_{pt} = \frac{1}{N_{pt}} \sum_i Y_{ipt}$ where N_{pt} is the number of observations in period p and calendar year t and finally $\Delta Y_t = \bar{Y}_{2t} - \bar{Y}_{1t}$. The parameter of interest is θ_3. Given a random sample from the population (remember that we have the whole population) θ_3 captures the following expression:

$$E(\Delta Y_{2020} - \Delta Y_{2019}). \quad (3.2)$$

Technically, this can be considered a difference-in-differences estimator (DD), but the group assignment is somewhat unorthodox. While D from equation (3.1) in a standard DD application would denote treated units, in our case it denotes (largely) the same units measured in two separate calendar years. Moreover, in a standard application, S would denote the post-treatment period in terms of calendar time, but in our case it is a measure of a period within a particular year.

The empirical specification described above can be made more flexible. For example, it is possible to estimate monthly effects by letting S be a set of categorical variables for month (March, April,... , December), or a set of categorical variables across periods (March to May, June to August, etc.). This is done in some sub-analyses in the empirical part of the report.

Using within-year variation in the way we do is not new in the literature. Using Swedish data, Johansson and Palme (2005) studied the effect of a reform of the national health insurance system on the take-up of sickness benefit. The reform reduced the replacement rate and came into force on March 1, 1991. To measure the effect of the reform on sickness absence, Johansson and Palme (2005) used a DD estimate where the change between January/February and March/April 1991 was compared with the corresponding change in 1990. Similar estimation methods are used in Angelov and Waldenström (2023a, 2023b) and Campa et al. (2021) and Eliason (2021), who both estimate the effect of the pandemic on the Swedish labor market.

Whether or not θ_3 identifies the impact of the pandemic depends on two critical assumptions. The first concerns the choice of periods within one year, defined by p. If the pandemic had an impact on the economy before March 2020, the chosen definition of p means that we underestimate the impact. On the other hand, if there was in fact no impact before April or even May, we may lose some precision in the estimates. When weighing the different options, even if the choice of p is somewhat *ad hoc*, we feel reasonably confident in choosing March as the first potential month of impact. In Sweden, the coronavirus was not a big deal before the end of March. In the first months of the pandemic, the measures were very lax in an international context, meaning that government-imposed measures may almost by definition have had no effect on the economy in January or February.

Of course, it cannot be excluded that the economy was affected by a change in the behavior of the general population or other economic agents, but even this seems unlikely to have occurred in Sweden in the first two months of 2020. In fact, as late as 25 February, the Public Health Agency of Sweden assessed the risk of general spread of the virus in Sweden as low.[19] In conclusion, we consider that there are no good reasons to expect a significant corona effect in January or February 2020. As individuals and other economic actors became increasingly aware of the pandemic in March 2020, especially after the WHO assessment of COVID-19 as a pandemic on 11 March, it seems reasonable to choose March as the starting month. [20]

Secondly, in order to θ_3 be able to measure the impact of the pandemic, that

$$E(\Delta Y^0_{2020} - \Delta Y^0_{2019}) = 0 \tag{3.3}$$

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[19] Source: https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2020/februari/forandrad-riskbedomning-for-fall-av-Covid-19-i-sverige/ (2023-01-07). See also SOU 2022:10.

[20] https://www.who.int/news/item/29-06-2020-Covidtimeline (2023-01-07).

where we define ΔY_t^0 as the difference within years t under the assumption that there was no pandemic in years t. This is analogous to the assumption of parallel trends in standard DD estimates and cannot be tested directly. One circumstance under which the assumption in 3.3 would fail is if there are cyclical variations in the average within-year variation of the outcome variable. A concrete example is that 2020 and 2019 would have been in significantly different parts of the business cycle in the absence of the pandemic, and that 2020 would have performed poorly in comparison. In this case, the usually good sales figures in June might have been lower than in January, even without Covid-19 affecting the economy in 2020.

While we have no direct way to assess the counterfactual (pandemic-free) state of the economy in 2020, there were already clear signs in 2018 that the economy had entered a slowdown phase. If the slowdown had been even more severe in 2020, in the absence of a pandemic, than in 2019, our impact estimates are overstated in magnitude. While it is difficult to assess the magnitude of the potential statistical bias, we consider the size of the bias relative to the pandemic estimates we present to be relatively small, as justified below.

According to NIER's latest quarterly assessment of the Swedish economy in 2018, published in December 2018, the Swedish economy had peaked in the first half of 2018 and was entering a slowdown phase (NIER 2018). In March 2019, NIER made the same assessment (NIER 2019a). In the last assessment before the pandemic, in December 2019, NIER wrote that the Swedish economy had entered a clear slowdown phase in 2019 (NIER 2019b).

Importantly, the December 2019 NIER forecasts for annual GDP growth for 2019, 2020 and 2021 were 1.1%, 1.0% and 1.5% respectively. Thus, according to the best available pre-pandemic forecasts for the Swedish economy, GDP growth in 2020 was expected to be positive and only marginally lower than growth in 2019. According to the same source, an economic recovery was expected in 2021.

In summary, given the identification challenges mentioned above, it is reasonable to expect some statistical bias in the impact estimates presented in this document. While we have argued that the size of the bias is expected to be small relative to the estimates to be presented in the later sections of the report, it is important to keep in mind throughout the text that it is difficult to estimate the impact of the pandemic on a country's economy.

Although the DD approach we have chosen is far from perfect, we consider it a more reasonable alternative to a before-after comparison. The DD approach also allows for an informal assessment of the assumption of parallel trends in equation 3.3 for outcome variables for which we have available data for 2018. In an appendix, we therefore present placebo estimates under the assumption that 2019 is the treatment year and 2018 is the control year.

It should be emphasized that the placebo analysis (like all checks for observed parallel trends before treatment) is not a proper test of the validity of the identification assumptions. However, we believe that the placebo test is still useful. The placebo analysis has led us to remove so-called outliers, i.e. values that can be considered statistically extreme, in the estimates of the effect of the pandemic on firm sales. Unusually high sales in a particular month would otherwise risk having too great an influence on the results.

We conclude this chapter with a brief discussion of what the impact estimates in the report can be expected to measure. In other words, it may be interesting to discuss what may be included in the broad concept of the *impact of the pandemic*. The guiding principle of the analysis is that we aim to estimate an effect, i.e. the average difference between a certain outcome and what the outcome would have been in the absence of a pandemic. As already mentioned, there are methodological reasons to expect some statistical bias in the estimates, although we have argued that the bias is probably small in relation to the estimated effects.

What exactly are the estimated impacts? To begin with, we can roughly divide the effects into those that are due to the pandemic itself (A) and those that are due to the way the government and authorities have handled the pandemic (B). The impact of the pandemic A can be further divided into direct effects (e.g. acting through reduced productivity due to increased morbidity) and indirect effects (e.g. reduced international demand). Similarly, B can be divided into direct coercive measures (i.e. changes in legislation) and recommendations (advice against travel, keeping distance, etc.).

It is of course possible to make an even more fine-grained breakdown of the estimated effect, but our aim is not to provide a complete account of all potential effect mechanisms. Instead, we want to emphasize that the impact of the pandemic should be considered broadly and an observed effect can be driven by many different mechanisms.

An interesting question in this context is to what extent we can distinguish different mechanisms from each other. Unfortunately, we will only in some cases be able to provide answers to what drives a particular estimated effect. We will be able to comment on one mechanism in particular, namely the effect variation with respect to local transmission. Otherwise, it will be difficult to draw any conclusions about what drives a particular estimated effect, but we will still discuss potential mechanisms where possible in the text.

4 Firm sales and taxes

The impact of the pandemic on private sector production of goods and services is a key outcome in the analysis of the impact of the coronavirus pandemic. The size of the fall in economic activity affects firms and households and also the type of economic policy that should be pursued in response to the pandemic.

Data and methodology

The chapter uses data from the Swedish Tax Agency's register on firms' sales and their payment of VAT and excise duties. These outcomes directly reflect how the private sector developed as a whole during the coronavirus pandemic. The firm sales data are based on the reporting of VAT, which is done monthly by most firms.

The two sub-sections of the chapter begin with a descriptive graphical analysis of monthly figures on firm sales and VAT (section 4.1) and excise duties (4.2). If Sweden had uniform VAT rates, it would not have been meaningful to report results for both VAT and sales as they would have been identical except for scale. However, as VAT rates vary between sectors, it is of interest to report results for both VAT and sales. Firm sales can be said to be a direct measure of the impact of the pandemic on firms, while VAT payments show the fiscal impact on government tax revenues.

We use data from January 2018 to April 2022. Using monthly data spanning several years makes it possible to illustrate both annual changes and more short-term fluctuations between individual months. The latter is important because the pandemic did not start at the end of a year. Therefore, if we had only used annual data, important within-year variation linked to the pandemic would have been partly invisible. As will be shown in the figures, the start of the pandemic from March 2020 onwards is clearly visible in most cases.

After the descriptive graphical analysis, we then go on to measure the effects of the pandemic using econometric methods in order to distinguish the effect of the pandemic from general macro trends and normal within-year variation. The impact estimation method was described in Chapter 3.2. The main impact estimates are presented and interpreted in the main text and Appendix B contains tables of results, placebo analysis, etc.

Summary of the chapter's findings

The main finding of this chapter is that the pandemic had a significant negative effect on the production of goods and services, as measured by firm sales, VAT payments, and excise duties. The average effect of the pandemic over the period between March and December 2020 on sales and VAT payments was around 6 and 5 percent respectively. We see a clear effect variation with regard to local infection, where the effect is generally more significant among companies registered in municipalities where the spread of COVID-19 has been high compared to companies in municipalities with less infection.

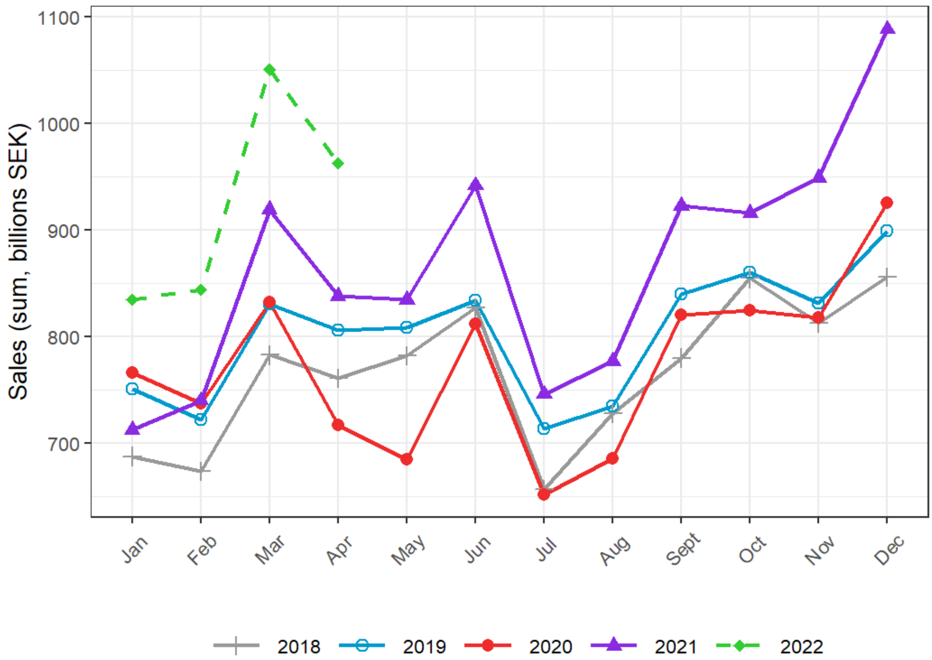
Looking at revenues from a number of excise taxes, we find significant negative effects of the pandemic on industrial electricity in spring and summer 2020, and a huge negative effect on air travel throughout the first year of the pandemic. Even in 2021 and 2022, the airline industry had not recovered and revenues from the airline tax in the first three months of 2022 were barely half of the corresponding months in 2019.

4.1 VAT and firm sales

We begin by studying how the pandemic has affected firm sales and VAT payments on a monthly basis. In the initial descriptive analysis, we use monthly totals, i.e. the sum of all firms' sales and VAT payments on a monthly basis. The reason is that in this initial part we want to study the impact of the pandemic on the entire economy. The econometric analysis presented later in the text uses monthly data at company level, which means that in practice we study the average pandemic effect per firm.

Figure 4.1 shows the development of the monthly sales of firms in 2018-2022 -and the corresponding development for VAT is shown in Figure 4.2. As seen in the first figure, the sales of VAT-registered firms have varied over time, both within and between years. The levels in 2020 and January 2021 are clearly lower than in the same months in 2019, with the exception of December 2020. We see a clear decline in sales at the beginning of the pandemic (April and May 2020), with the intra-year variation in 2020 differing significantly from the corresponding months in 2018 and 2019. Starting from February 2021, firm sales have increased above the previous years' level.

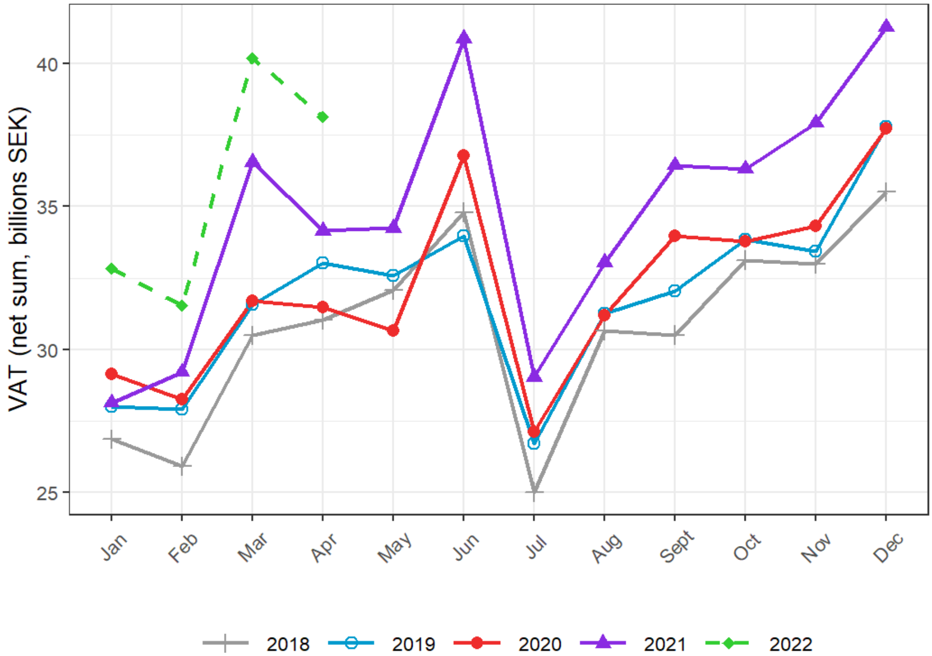
Figure 4.1 Turnover of Swedish enterprises per month



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Figure 4.2 shows VAT receipts from VAT-paying firms over the same period, 2018-2022. VAT receipts tend to increase within each year, with a notable break during the holiday month of July. The pandemic does not seem to have changed this pattern. VAT-payments decreased after the outbreak of the coronavirus in April-May 2020 compared to developments in 2019 and 2018. Later in 2020, they then returned to almost the same levels as before the pandemic. The larger decrease in sales compared to VAT in April-May 2020 is mainly explained by the fact that the sectors where sales decreased the most, transport and cultural events, are sectors with the lowest statutory VAT rate.

Figure 4.2 **VAT payments by Swedish firms per month (net)**



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

The analysis of VAT and sales is based on those firms that report VAT monthly, as described in the data presentation in section 3.1. This means that we exclude all firms that report less frequently than monthly, such as quarterly or annually. As large companies usually report monthly, we only lose around 10% of the amounts in the data in this way. The reason for using only real monthly data is that we want to measure the within-year variation in VAT and sales as accurately as possible for each month. [21]

The next step in the analysis is to estimate the magnitude of the effect of the pandemic on firms' average VAT payments and sales. Here we go beyond the simple description of time series and the rough calculations of differences in mean values. In order to increase the accessibility of the text, we have chosen to only summarize the main results in the main text. The

[21] In principle, it is possible to interpolate monthly data from lower frequency data under the (unrealistic) assumption that VAT and turnover for a given enterprise are equally distributed over the months. To illustrate what this would mean in practice, we have included Figure A.1 in Appendix A showing turnover data for businesses reporting monthly (bottom right, same as in Figure 3.1), and interpolated data using: all businesses; VAT reporting period 1, 3 or 12 months; and VAT reporting period 1 or 3 months. As Figure A.1 shows, the overall appearance does not change when moving from all businesses to businesses reporting monthly. Since interpolating data for non-monthly reporting firms would by definition introduce measurement errors of unknown magnitude at the firm level, we consider it better to use only data for monthly reporting firms. With the exception of the bottom right panel, which is the selected panel in the report, the rest of the panels in Figure A.1 are virtually indistinguishable from each other.

interested reader is referred to Appendix B, which contains a description of the method, regression estimates in tabular form, a detailed description of the results, so-called placebo estimates, etc.

Table B.2 in Appendix B presents the results of the estimation of the impact of the pandemic on sales and VAT. For firm sales, the effect is about SEK -15,100, or about -6.15 percent, and the corresponding figure for VAT is SEK -2,410 (-5.46 percent). This effect is both economically and statistically significant: the estimate thus implies that the average sales of firms in the period March-December 2020 were about 6 percent lower than it would have been if the pandemic had not occurred. Both estimates (for sales and VAT) are statistically significant.

How much of these negative effects are due to direct effects of the spread of the virus and how much are more general effects of COVID on the economy? It is not possible to fully answer this question as the whole of Sweden was affected by both factors. However, we can use the geographical variation in the spread of infection in Sweden to shed light on the issue.[22] This analysis is done following two lines of reasoning about the mechanism behind the observed effect: i) an overall reduction in economic activity in the entire Swedish economy or ii) an overall reduction with an additional effect due to the covid infection rate in the municipality where the company is registered. As there were no restrictions at municipal (or other regional) level in Sweden in 2020, this additional effect can be interpreted as an expression of behavioral changes among consumers or firms due to caution or fear of contracting or spreading the virus. In the following, we try to see if there is support in the data for (ii) over (i) by measuring whether the impact of the pandemic varies with the local infection rate. Appendix B explains how the infection rate has been calculated and how firms have been divided into groups according to the infection rate. Below, the analysis is explained only in general terms.

To simplify the analysis, the companies are first divided into four groups according to the incidence of infection in the company's municipality of registration between March and December 2020. The companies are ranked according to their municipality of registration's incidence of infection, where QG_1 companies are registered in municipalities with the lowest infection incidence (i.e. infection incidence below the first quartile), QG_2 are registered in municipalities with infection incidence between the first and second quartile, QG_3 with infection incidence between the second and third quartile and finally, enterprises in the group are QG_4 are registered in municipalities with the highest incidence of infection (above the third quartile). For simplicity, in the text below we will use transmission and

[22] An alternative would be to use covid-related mortality data. Unfortunately, we do not have access to such data at the municipal level. It could also be argued that in the media, infection rate data were more widely available than mortality data, although we do not have objective data to support this claim.

infection rate/incidence synonymously. Once firms are divided into these four groups, we then measure whether the impact of the pandemic varies across groups. For example, if (ii) from the discussion above is correct, the effect in group QG_4 should be more pronounced (larger in absolute terms) than in the QG_3.

Before turning to the results of this heterogeneity analysis, it is important to emphasize that the results should be seen as an indication of the possible importance or lack thereof of contagion, rather than as a formal hypothesis test. There are two main reasons to interpret the results with caution. First, there may be confounding factors at the municipal level that cause effect heterogeneity and are positively correlated with infection rates. The reported infection rates are far from error-free. As the testing capacity increased in 2020, the reporting rate also increased. Since we estimate effect heterogeneity with respect to geographical variation (and not variation over time), this is not necessarily problematic. However, if misreporting is due to municipality characteristics, our estimates of effect heterogeneity may capture effect heterogeneity with respect to these characteristics rather than variation in infection rates. Another shortcoming of our data is that the municipality of registration of the firms is not necessarily strongly related to the firms' activities. Turnover data are reported at the firm level, but many firms have multiple establishments operating in different locations. We have no information on the place of work in the data material, and we also have no information on whether a particular company has only one or several places of work. This means that we may underestimate the significance of the spread of infection, i.e. any real difference in effect between companies operating in municipalities with high and low levels of infection may appear smaller with our data than if we had access to data without these measurement errors. With these data shortcomings in mind, we now move on to the estimates.

The results are presented in the last two columns of Table B.2 in Appendix B. Overall, the results are in line with what we expected and suggest that the local covid infection rate can explain some of the firms' lost revenue. For sales, the effect estimate among firms registered in municipalities with the highest cumulative infection rate (QG_4) is -7.82% and is statistically significant. The corresponding estimate for QG_3 is -4.95% and the difference between QG_3 and QG_4 is statistically significant. In the next group, QG_2, the effect is roughly the same size (-5.06%) and again statistically different from QG_4. Finally, the effect in QG_1 smaller in size (-4.15 percent) but no longer statistically different from the QG_4.

The estimates discussed above refer to the average impact of the pandemic from March to December 2020. However, it is reasonable to assume that the size of the impact varied throughout the year. The first two columns of Table B.3 in Appendix B show the effects for sales and VAT estimated separately for three periods in 2020: March-May, June-August and September-December. Below we summarize the results for sales only, as the estimates for VAT as a percentage are similar.

If we start with the average seasonal effects, we find the strongest effect during the initial phase of the pandemic (SEK -25,180 or -10.25 percent for sales) and the weakest effect during September-December (SEK -8,130 or -3.31 percent for sales, not statistically significant at the 5 percent significance level). Figure A.2 in Appendix A shows monthly effects, confirming the picture that the greatest impact of the pandemic on sales and VAT occurred at the beginning of the pandemic. The strongest negative effect on sales was in May 2020 (just below SEK -40 thousand). [23]

Overall, the results of the regression analysis show that the pandemic had a significant negative impact on firm sales and VAT, and that this impact was particularly strong during the initial stages of the pandemic. We have also seen that the local COVID-19 infection rate may be an important factor behind the loss of business revenue. Since most firms (i.e. even those registered in municipalities with low infection rates) have been affected by the local infection rate, it is difficult to determine the relative size of the impact of the general decline in the economy due to COVID-19 and the additional impact due to the local spread of infection.

4.2 Excise duties

Excise taxes are fees and taxes on different types of transactions and activities. Figure 4.3 shows the evolution of monthly revenues from six major excise taxes. Industrial electricity, i.e. tax deductions for electricity use by industrial companies, is a proxy for production activity in the private sector.[24] Electricity use in the manufacturing industry has declined during the pandemic and there is no apparent recovery in 2021.

Revenue from the tax on advertising costs (printed advertisements, posters, billboards, etc.) fell by almost half in the first year of the pandemic in 2020 and has remained low ever since. However, it is worth noting that tax revenues from the advertising tax also decreased between 2018 and 2019, even before the pandemic.

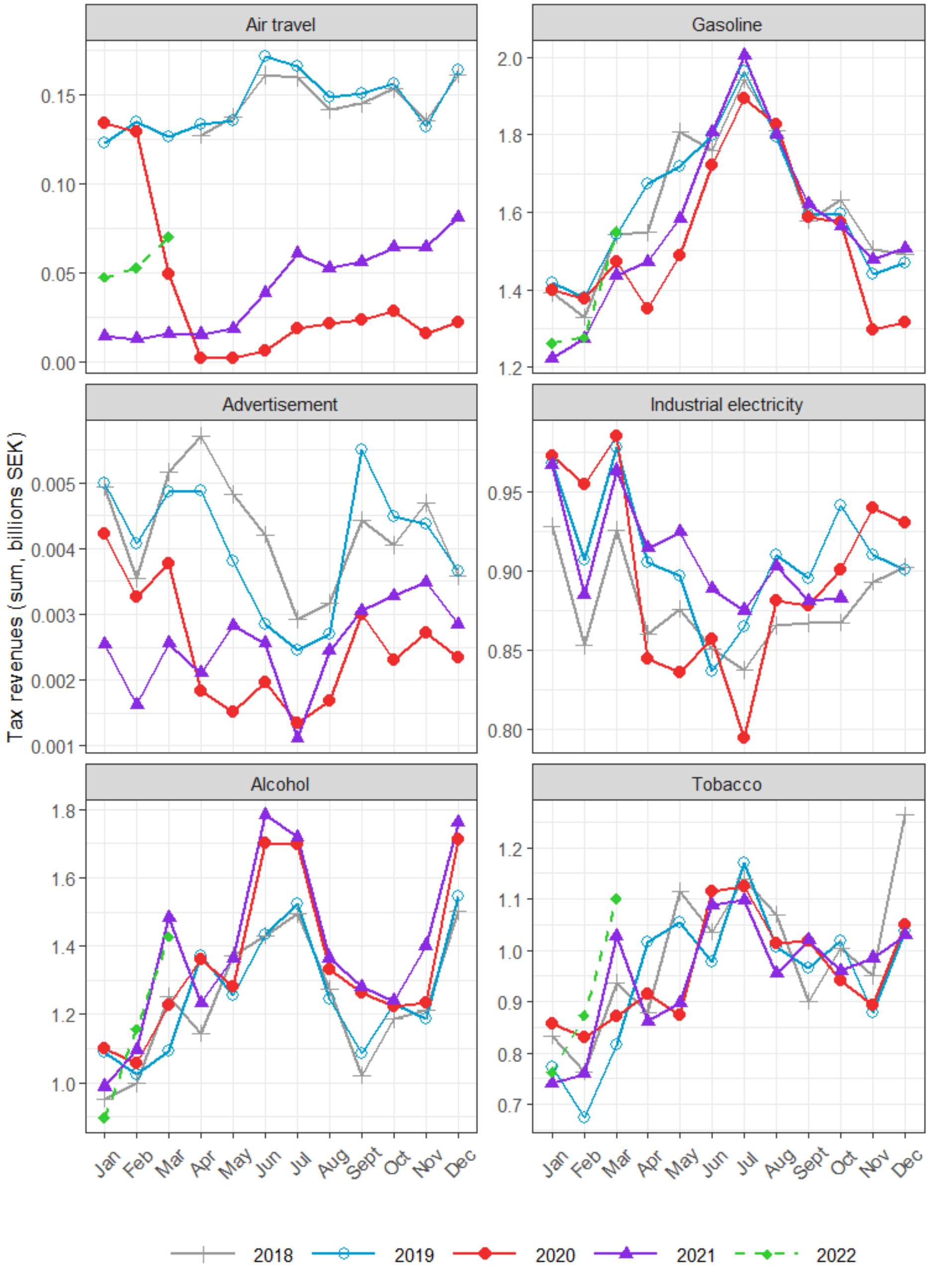
[23] Appendix B also presents an analysis of the link between the variation of the pandemic effect in 2020 and the intra-year variation of the infection rate. As this analysis is complex and it is difficult to draw clear conclusions from it, it is only discussed in the appendix.

[24] We measure the electricity consumption of the industry as the sum of two deduction fields from the declaration form for energy tax on electric power: i) deduction of tax on electricity consumed by the taxable enterprise for chemical reduction, electrolytic or metallurgical processes or for certain manufacturing of mineral products and ii) deduction of tax on electricity consumed for chemical reduction, electrolytic or metallurgical processes or for certain manufacturing of mineral products.

Revenues from taxes on automotive fuels, mainly gasoline, dropped significantly in the first months of the pandemic, but have since remained almost at pre-pandemic levels.

By contrast, revenues from the air travel tax fell sharply after the outbreak of the pandemic, were almost zero in the first months and then increased only slowly.

Figure 4.3 **Monthly tax revenue from excise duties**



Note: The flight tax was introduced in April 2018 and therefore values for January-March 2018 are missing. Industrial electricity refers to the deduction fields from the declaration form for energy tax on electric power. These deductions apply to electricity consumed by the taxable company for chemical reduction, electrolytic or metallurgical processes or for certain manufacturing of mineral products. The source of the data is the Swedish Tax Agency's excise tax register (Kuling).

We now turn to the regression results for excise taxes. When estimating the impact of the pandemic on excise taxes, we use the same analytical framework as we did earlier when analyzing the impact of the pandemic on VAT and firm sales.[25] A summary of the results is presented below and Appendix B contains tables of results and placebo tests.

We start with estimates of the average impact throughout 2020 (that is, the impact of the pandemic from March to December) for the same excise taxes analyzed earlier in this section. All point estimates in Table B.5 in Appendix B have the expected negative signs and the approximate percentage impacts are all economically significant. The only statistically significant average impacts are for air travel and industrial electricity. For air travel, the estimated effect is SEK -1,067,000 and the percentage effect approximation is -94.56%. The approximation is imprecisely measured for such a high impact, but it is still clear that air travel was hit very hard by the pandemic. The point estimate for industrial electricity is -190,000 SEK or about -5.77%.

It is more informative to estimate the impact separately for different periods in 2020: March-May, June-August and September-December (Table B.6 in Appendix B).[26] As before, all point estimates have the expected negative signs and are economically significant. The largest negative effects are for the tax on air travel, where the effects are large and negative in all three sub-periods. The largest impact is in the summer period (-1 202 000), likely reflecting the relatively more profound policy responses to pandemics on international rather than domestic travel, and the fact that this most affected the holiday period when long-distance travel is most common. For industrial electricity use, the largest impact was in the summer months of June-August (-272 000 or -8.27%), but the impact was also significant in the March-May period (-5.17%). The monthly impact estimates presented graphically in Figure A.3 in Appendix A show in which individual months the impact was greatest for different excise taxes. For the tax on air travel, the impact was greatest in June 2020 and for industrial electricity the impact was greatest in July.

In summary, we find significant negative effects of the pandemic on excise duties on industrial electricity in spring and summer 2020, and a huge

[25] A difference in the empirical specification compared to the one in section 4.1 is that it is not possible to group standard errors at the industry level. Although there is some variation in the industry affiliation of the firms completing and reporting tax returns for a given excise tax, there is likely to be a weak relationship between the industry of the firm and the industry of the actual consumption on which the excise tax is based. Instead of clustering standard errors at the industry level, we cluster at the firm level to take into account the intra-firm correlation between observations measured in different months.

[26] Due to the way data on excise taxes are collected, and also the characteristics of several of the taxes, it is not meaningful to interact the effect with local covid infection rates as was done in section 4.1 in the analysis of turnover and VAT.

negative effect on air travel throughout the first year of the pandemic. Also in 2021 and 2022, the airline industry has not recovered and the revenue from the airline tax in the first three months of 2022 was barely half of the corresponding months in 2019. Advertising seems to have had a strong negative trend even before the pandemic, which is a sign that the effect estimates may contain statistical bias and are therefore not as reliable as other estimates.

5 The impact in different industries and the distribution of firm sales

A major economic shock such as the coronavirus pandemic changes conditions for most firms. However, the impact of the pandemic is likely to affect industries and firms to varying degrees. In the previous chapter, we estimated the impact of the pandemic at the aggregate national level. This chapter presents separate analyses of the pandemic impact for different sectors, such as trade, manufacturing, transport and services. We also analyze, perhaps for the first time, the impact of the pandemic on market structure, as measured by the size distribution of firms' sales. This analysis shows how the relative market shares of large and small firms evolved during the pandemic.

Data and methodology

The first subsection of the chapter first shows graphically how firm sales have developed in different industries and then presents regression results estimated separately for the same industries. The structure of the subsection is therefore similar to section 4.1, except that we have chosen to exclude VAT as the results for VAT do not differ significantly. Similar to the structure of section 4, the text contains a discussion of the main impact estimates and Appendix C contains the result tables. Section 5.2 contains only descriptive analyses of differences in how the pandemic has affected firms of different sizes, and whether there are differences in this respect across industries.

Summary of the chapter's findings

The results in this chapter show that the three sectors most affected in the first year of the pandemic were manufacturing, hotels and restaurants, and the cultural sector. The descriptive analysis shows that total sales in each of these industries fell between 23 and 48% in April-May 2020 compared with April-May 2019. The regression results further show that the impact of the pandemic, measured over the whole of 2020, was on average -4% in manufacturing, -25% in hotels and restaurants and -19% in the cultural sector.

When we measure how the pandemic effect varies with the spread of infection in the municipalities where the firms are registered, we see a clear but far from perfect negative correlation in the decline in sales and the spread of infection in different industries. This confirms that the tax register's sales data capture the pandemic effect on business activity, but also that how hard a sector was hit by the pandemic also depends on factors other than disease rates in the population.

The concentration of firm sales differs relatively strongly between different industries, with the cultural sector having the highest concentration of sales together with the manufacturing industry. It is difficult to see any clear pandemic effect on the sales structure in any industry except in the culture industry, where the concentration increased significantly at the outbreak of the pandemic in 2020.

5.1 Turnover in different sectors

Although the coronavirus pandemic affected the entire Swedish economy, it is reasonable to assume that some sectors were affected more than others. For example, the media reported on how companies in the travel industry and the hotel and restaurant sector in particular were affected by the lockdowns, especially in relation to inter- and intra-country travel restrictions. The cultural sector was also negatively affected when performances were canceled due to restrictions on the number of people who could stay in the same venue. At the same time, there was media coverage of industries that appear to have coped well with the pandemic crisis, and even been positively affected, such as consumer electronics, online shopping and parts of the construction industry, especially those related to home carpentry.

In this section, we analyze how firm sales developed during the period 2018-2022 in different Swedish business sectors. We have chosen to focus on six economically interesting industries that we believe, based on the media reports, may have been affected differently by the pandemic: manufacturing, construction, trade, transportation, hotels and restaurants, and culture.

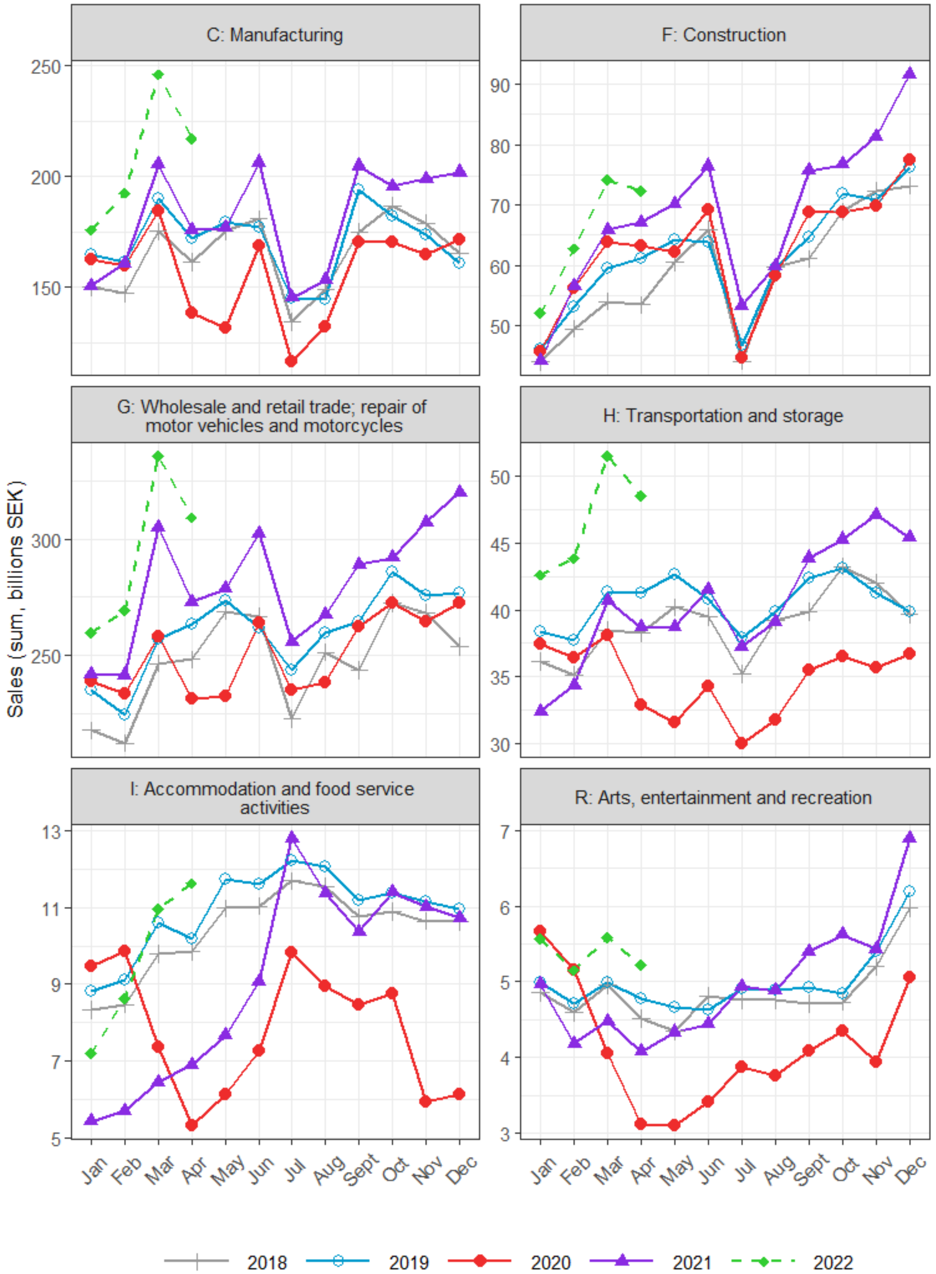
According to Figure 5.1, the sales figures show that the two of these industries most affected in the initial phase of the pandemic were hotels and restaurants (-48% in the period April-May 2020 compared with April-May 2019) and the cultural sector (-33%). Compared with the fall in sales in the economy as a whole (Figure 4.1, -13% in the period April-May 2020 compared with April-May 2019), the decline in sales in these two sectors was much more pronounced.

The three sectors in Figure 5.1 that were slightly less affected in the first months of the pandemic were trade (-13% compared to 2019), transport

(-23%) and manufacturing (-23%). Based on this sales calculation, the sales of the construction sector did not fall significantly between 2019 and 2020.

In the figure, we can also study the recovery period in the final phase of the pandemic in autumn 2021 up to and including spring 2022. Interestingly, the degree of recovery also differs across industries. The slowest growth in sales has been in trade (a 3 percent increase between January-April 2022 compared to 2021) and construction (12 percent). A much faster recovery is seen in manufacturing (20 percent), culture (19 percent) and transport (28 percent). The greatest recovery during the final phase of the pandemic is seen in the hotel and restaurant industry, whose sales increased by 57 per cent between January-April 2021 and the corresponding period in 2022. The fact that some industries recovered at a slightly slower pace could be due to the fact that the pandemic also affected them to a greater extent in the final phase, but it could also be due to the fact that these industries were facing a structural transformation that would have partly taken place even without the pandemic. We cannot distinguish between these two mechanisms here.

Figure 5.1 Turnover per month in different industries



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Appendix C shows regression results measuring the impact of the pandemic on sales in 2020 in each of the industries shown in Figure 5.1 (see Table C.1). These estimates can be compared with the previously reported average effect across all industries of -6.15% (see Section 4.1). In all industries except construction, there are significant negative effects of the pandemic. The lowest impact in absolute terms is in trade (-2.37%) and even in manufacturing the impact is less than the average across all industries (-4.21%). The largest effect is in hotels and restaurants (-25.57 percent) and culture and recreation (-18.75 percent).

We also examine the extent to which the industry-level effects vary with the geographical spread of infection (Table C.2 in Appendix C). As before, the QG_4 the group of firms registered in municipalities with the highest cumulative infection rate in the period March-December 2020. The estimates show that the pandemic effect varies, as expected, with the level of infection in three of the sectors studied: manufacturing, transportation and hotels and restaurants, with the effect being more negative among firms registered in municipalities with high levels of infection. In a way, it is interesting that the spread of infection does not seem to play a role in the size of the effect in the cultural sector, as cultural and entertainment events were identified early in the pandemic as common ways to become infected. A reasonable explanation is that the restrictions on the number of people at public gatherings and public events, which were added early in the pandemic, applied to the entire country and were thus not conditional on the proportion of infected people in a particular municipality. These restrictions (such as the limit of 500 and later 50 participants for public gatherings) probably had a major impact on the activities of the cultural, entertainment and leisure sector throughout the country.[27] It cannot be excluded that companies operating in the sector and/or their customers adapted their behavior to the prevailing local spread of infection, but this potential adaptation was probably insignificant given the already existing restrictions at the national level.

5.2 The distribution of firm sales

Were large and small firms equally affected by the negative effects of the pandemic? An extensive research literature has studied how economic crises, especially financial crises, affect firms according to their ability to cope with a downturn. Financial buffers are important in times of crisis, and relatively large firms are more likely to have such resources available. Crises

[27] The SNI code R: Culture, entertainment and recreation includes the subsectors 90: Artistic, cultural and entertainment activities; 91: Libraries, archives and museums, etc.; 92: Gambling and betting activities; 93: Sports activities and amusement and recreation activities.

often lead to bankruptcies and exclusion, so if these problems are not evenly distributed in terms of firm size, one effect of the coronavirus pandemic may be that the structure of firms has changed as a result of the economic impact of the pandemic.

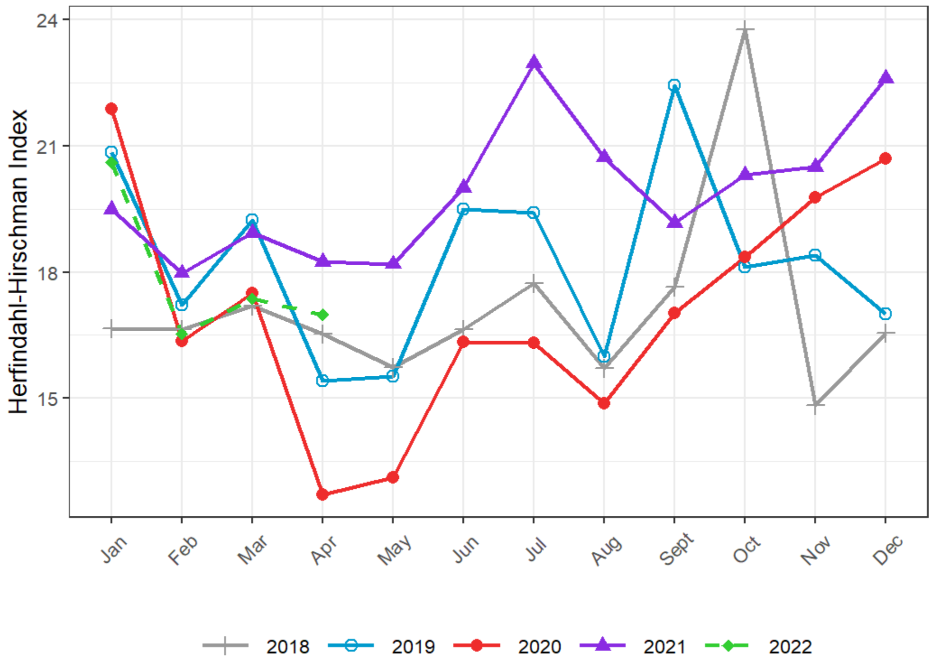
In this section, we present an analysis of the impact of the coronavirus pandemic on the size distribution of firms as measured by their sales size. To our knowledge, the analysis is the first of its kind for with respect to the coronavirus pandemic. The question is about the effects of an economic crisis on firm structure. Were mainly large firms affected by a macroeconomic downturn or were small and medium-sized enterprises (SMEs) primarily affected? Does the impact of the pandemic on business structure differ across industries? The analysis uses one of the most common measures of concentration in a distribution, the Herfindahl-Hirschman Index (HHI), and we also report the average sales by different percentile groups. The HHI ranges from 0 ('perfect competition') to 10 000 ('monopoly').

Figure 5.2 shows the HHI sales concentration by month for the period 2018-2022. We can see that the concentration index varies quite significantly between months within a year as well as between years. In 2020, concentration fell significantly (i.e. competition increased) in connection with the outbreak of the pandemic in the spring and then remained below the levels of 2018 and 2019. In 2021, concentration then increased.

Figure 5.3 shows the HHI sales concentration by industry. As expected, the degree of concentration differs greatly between industries. The cultural sector has the highest concentration of sales (i.e. the lowest competition), which could reflect so-called superstar effects. Turnover in the manufacturing industry also appears to be concentrated in comparison with construction, trade, transport, and hotels and restaurants.

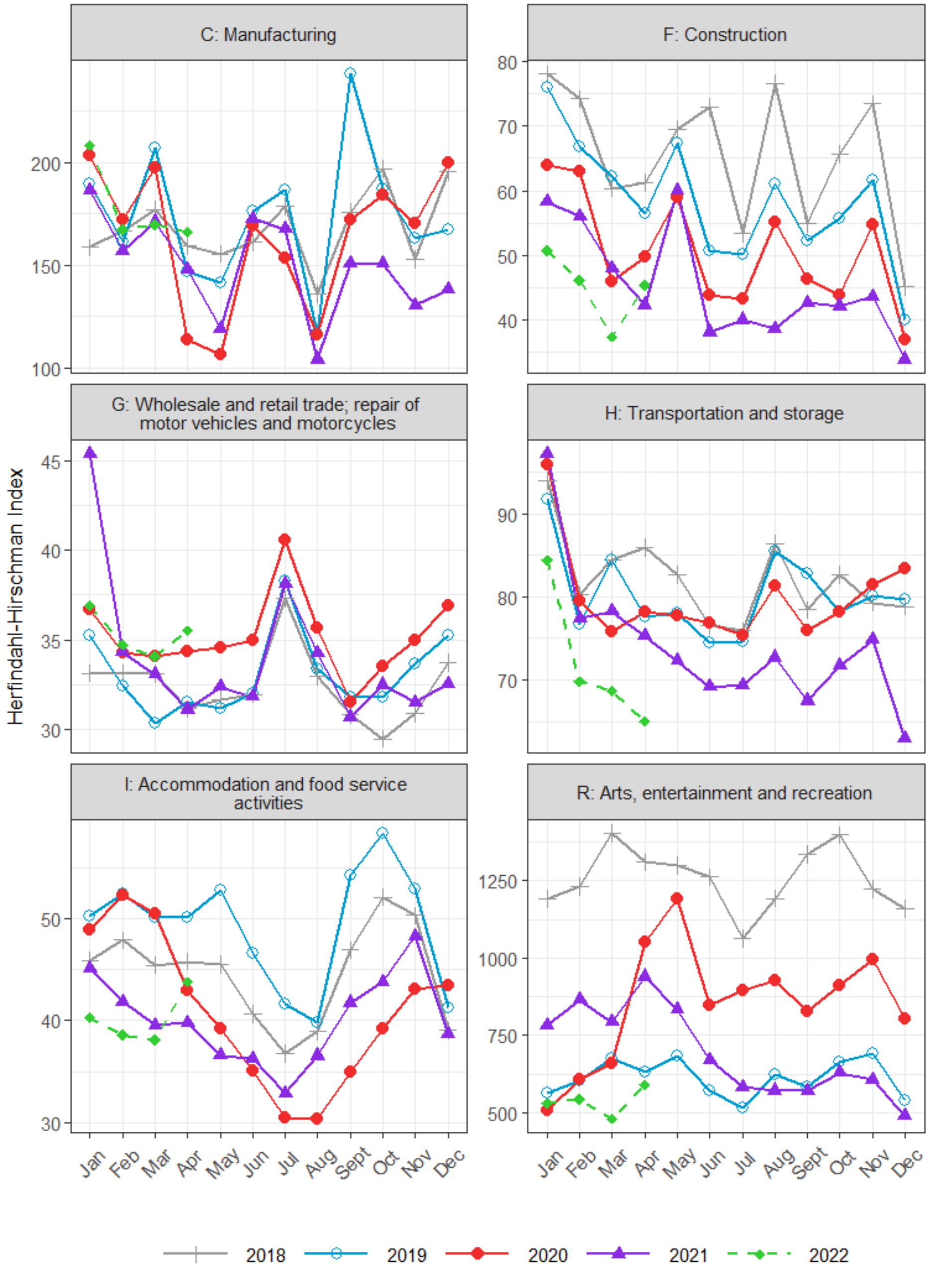
It is difficult to see any clear pandemic effect on the HHI except in the culture sector, which is the least competitive from the outset. The HHI increased dramatically in April and May 2020 in the culture sector and the value for May was almost double that of the last pandemic-free month (February 2020). Thus, one result of the pandemic in the cultural sector was that sales were concentrated in a number of large firms and many smaller firms had lower sales. The HHI then remained high throughout the rest of 2020, before slowly declining to roughly the same levels as before the pandemic.

Figure 5.2 Concentration of firm sales in the whole economy according to HHI



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Figure 5.3 HHI firm sales concentration by industry



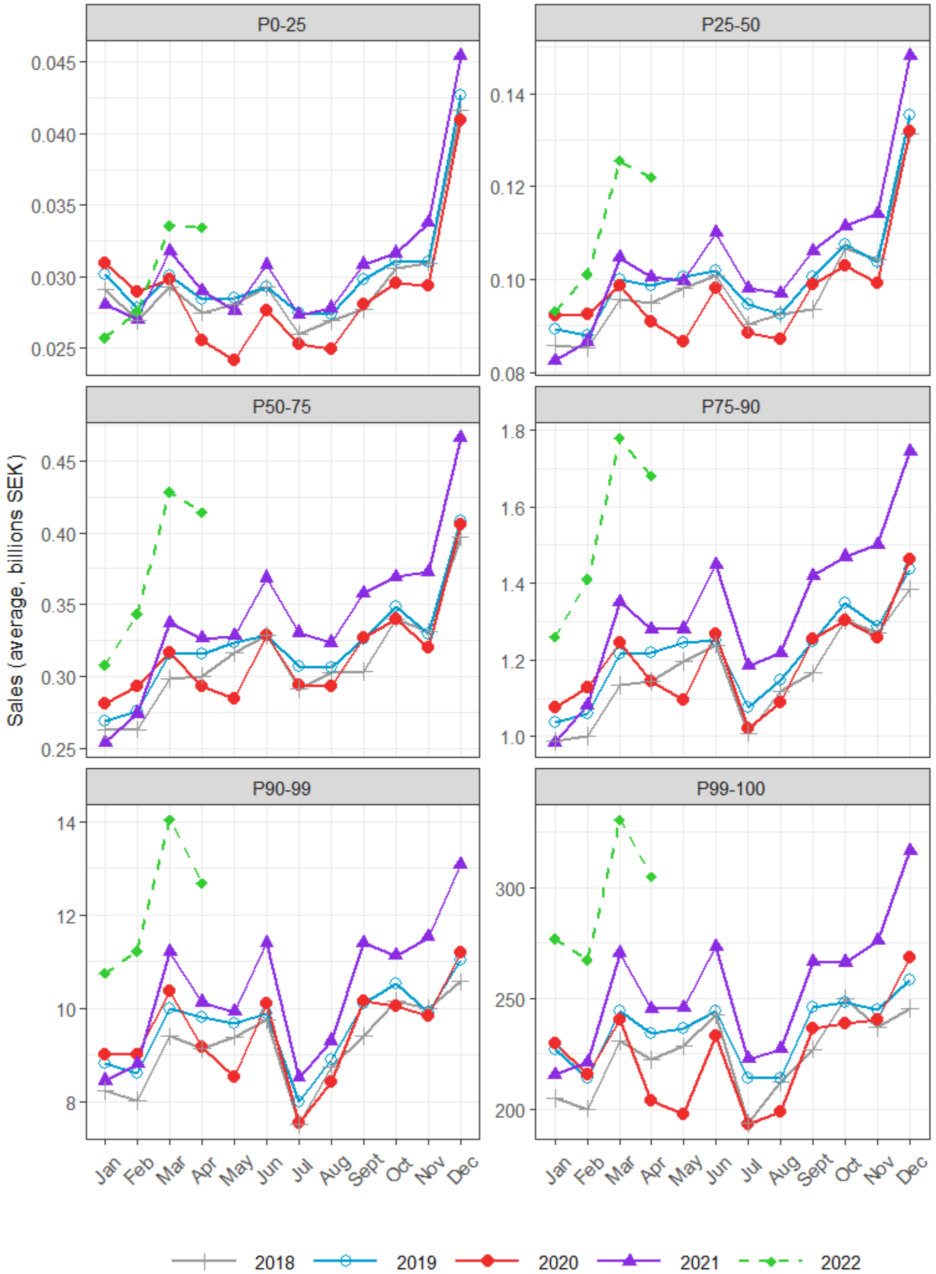
Source: The Swedish Tax Agency's register of VAT returns, own calculations.

In Figure 5.4, we study the average monthly firm sales by different percentile groups. Each percentile demarcates one hundredth of the business population ranked by sales, from the lowest sales percentile (P1) to the highest (P100). We group the companies into quarters (quartile groups) in the three lowest quartile groups (P0-25, P25-50, P50-75) and by dividing the top quartile group into three smaller groups consisting of the group up to the highest decile group (P75-90), the nine lowest percentiles of the highest decile group (P90-99) and the top hundredth (P99-100). We see a clear decline in sales in all percentile groups during the initial phase of the pandemic (April-May 2020). Interestingly, the pattern is roughly the same for companies with monthly sales below the first quartile (P0-25) with an average sales of only between about 25 and 45 thousand SEK per month, and companies in the highest percentile (P99-100) with an average sales of between about 200 and 350 million SEK per month.

However, in the last period examined (January to April 2022), we see a difference between the groups: the recovery in the higher percentile groups is much stronger than in the lower ones, and especially in the lowest percentile group, where the average monthly sales at the beginning of 2022 seems to remain at about the same level as in the corresponding period in previous years. Thus, we see some signs that large firms have fared better in the slightly longer term.

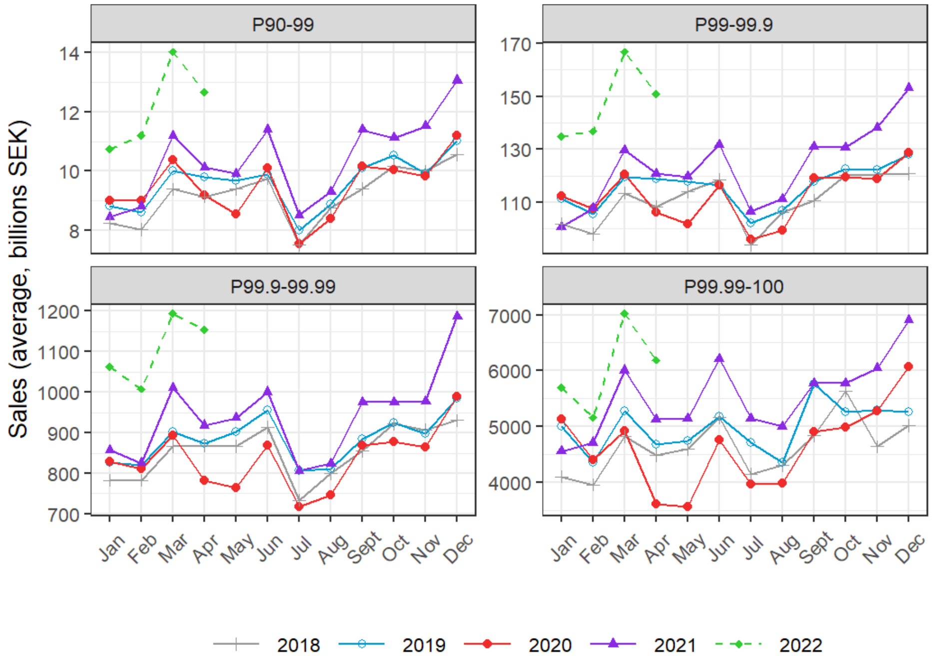
Finally, Figure 5.5 shows the monthly average sales of the 10% largest firms, divided into four percentile groups. Despite the large differences in firm size, we see similar patterns in all percentile groups. The recovery in the absolute largest firms (those with the 0.01% highest monthly sales) may have been somewhat weaker at the beginning of 2022 than in the other percentile groups.

Figure 5.4 Average monthly firm sales in 2018- 2022 in different percentile groups



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Figure 5.5 Average monthly firm sales in 2018-2022 -in different top percentile groups.



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

6 Monthly wage income of employees

One of the big questions during the coronavirus pandemic was how the economic downturn would affect different groups in the labor market. Would everyone lose out, with some groups perhaps being affected more than others, or would there also be groups that experienced a positive economic development during the pandemic? Many questions have also focused on whether the effects of the pandemic affected specific categories of workers, such as young people, the elderly, women or public sector employees.

Data and methodology

In this section, we use monthly data from employers on pre-tax wage income among Swedish working adults aged 18-64 to study how the level and distribution of monthly income developed during the coronavirus pandemic. The data used concerns the monthly wage income paid by the employer and reported monthly to the Swedish Tax Agency, which corresponds to income from employment. The analysis focuses on comparisons of income and its distribution before and during the pandemic. An initial analysis compares outcomes during the same months in 2019, 2020, 2021 and early 2022. We then conduct a series of statistical analyses, including estimating regressions to study specific patterns in how the pandemic has affected different groups in the population.

Summary of the chapter's findings

The results in this chapter show that the pandemic led to a general reduction in monthly income of four to five percent in 2020 across all workers in the country. The fall was most pronounced among low-income earners, who were more affected by unemployment than other wage earners. Income dispersion generally increased among workers during the pandemic. Women's and men's incomes were affected by the pandemic in roughly the same way, while wage income in the private sector fell more than in the public sector. Paid sick leave increased very strongly during the pandemic, which appears to be partly due to extra generous government subsidies that encouraged sick leave.

6.1 The level of wage income

In order to put the effects of the pandemic on wage earners' incomes in the right context, we begin the chapter with a table overview of how Swedish wage earners' monthly incomes are distributed. Table 6.1 describes the wage income distribution by dividing the population into income limits, income percentiles (P), where each percentile delimits one hundredth of the population from the lowest income percentile (P1) to the highest (P100). We group the population into quarters, quartile groups, partly in the three lowest quartile groups (P0-25, P25-50, P50-75), and partly by dividing the top quartile group into five smaller groups consisting of the group up to the highest decile group (P75-90) as well as the nine lowest percentiles of the highest decile group (P90-99) and the top hundredth, which in turn is divided into three smaller groups (P99-99.9, P99.9-99.99 and P99.99-100).

The table shows that the average monthly income (mean income) from employment was SEK 28 200, while the median income (P50), i.e. the income earned by the employee in the middle of the entire distribution, was SEK 27 800. The higher average income shows that the distribution is skewed to the right, which normally characterizes income distributions. Expressed differently, this means that the monthly income distribution has a long tail to the right due to the fact that there are fewer people with top incomes than with really low incomes. To belong to the highest tenth of the income distribution, a monthly income of SEK 49 300 was required in 2020. Since the Swedish Tax Agency's register data includes all wage earners in the economy, we have statistical data that also covers the income earners with the very highest incomes throughout the country. The top ten thousandth of the distribution contained 540 people and required a monthly income from employment of SEK 592 000 to qualify. But even in this group, income was unevenly distributed, as shown by the fact that the average monthly income for these employees was SEK 1 022 300.

Table 6.1 Description of the distribution of monthly income

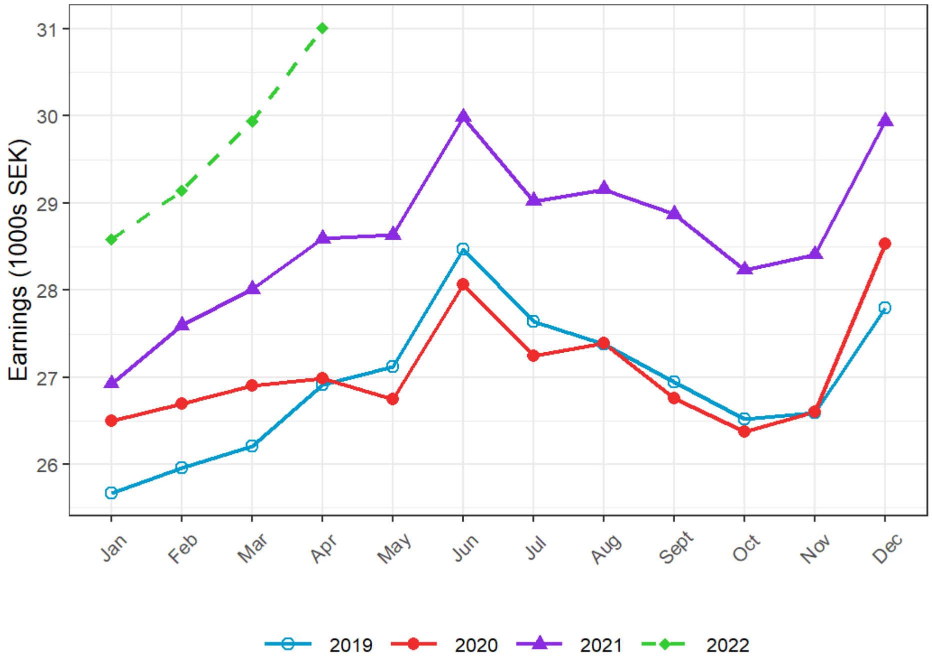
Percentile	Monthly income	Percentile group	Number of taxpayers	Average monthly income
		P0-100	5 396 585	28.2
		P0-25	1 349 142	4.8
P25	13.8	P25-50	1 349 147	21.9
P50	27.8	P50-75	1 349 141	32.4
P75	37.6	P75-90	809 495	42.5
P90	49.3	P90-99	485 694	61.6
P99	95.9	P99-99.9	48 569	126.0
P99.9	220.0	P99.9-99.99	4 857	311.1
P99.99	592.0	P99.99-100	540	1 022.3
		P90-100	539 660	70.6
		P99-100	53 966	151.6

Note: The table shows monthly income from employers according to employer declarations for adults in Sweden aged 18-64 in 2020. The data for the table consists of one observation per individual. The monthly income for a particular individual corresponds to the sum of the individual's monthly income during the year divided by 12. All incomes are in SEK 1,000s. The left panel of the table shows the monthly income corresponding to the cut-off point for a particular percentile. For example, 25 percent of monthly incomes are below SEK 13.8 thousand, 50 percent are below SEK 27.8 thousand, etc. The right panel of the table shows the number of taxpayers and average monthly income in different percentile groups.

A graphic presentation of the monthly pre-tax income of Swedish employees between January 2019 and April 2022 is shown in Figure 6.1. When comparing the development between the first three months of 2019 and 2020, i.e. the pre-pandemic months of both years, it can be seen that the level of income increased by about four percent in one year. When instead studying the same year for months later in the year, which means looking at the months of 2020 after the outbreak of the pandemic, a clearly lower level is seen in 2020 until July and then approximately the same level for the rest of the year. Under the assumption that the rate of income growth from the beginning of the year would have continued for the rest of 2020 had there been no pandemic, we can tentatively conclude from these figures that the pandemic led to a general reduction in income of four to five percent across all workers in the country. It should be noted that the figures do not say anything about whether the changes are due to changes in working hours, changes in hourly wages or changes in other benefits. We return to these issues, and to a more formal measurement of the impact of the pandemic, later in the report.

The figure also contains interesting results on monthly variation patterns in aggregate monthly income from employers that are relatively new to the research literature as this type of monthly administrative income data has not been widely used before. Two clear income peaks stand out, one in June and one in December. To explain them, we need to look more closely at the patterns in different parts of the income distribution.

Figure 6.1 Employees' average monthly income from employers



Source: The Swedish Tax Agency's register of employer declarations, own calculations.

Figure 6.2 thus shows the average evolution of monthly income in six different percentile groups of the income distribution. These groups have been subdivided according to the following income thresholds: the three lowest quartile groups (P0-25, P25-50, P50-75) and the top quartile group divided into three smaller groups consisting of the group up to the highest decile group (P75-90) as well as the nine lowest percentiles of the highest decile group (P90-99) and the top hundredth (P99-100).

According to Figure 6.2, the overall negative impact of the pandemic on monthly income was not evenly distributed among employees. In percentage terms, the decline in income was greatest in the groups with the lowest annual earnings. The lowest quartile group has a very low average monthly income of SEK 2,000-7,000, which is due to the fact that a large proportion of these wage earners do not work during all months of the year and many are also likely to work part-time. The group has an income peak in August, which is due to the fact that a large fraction consists of seasonal workers who work a lot during this high season month. When we compare the pandemic period with the previous years, we see that the income of this group falls by about 10-15% in the pandemic year 2020. In the first months of 2021, the group's income fell even more and then recovered, but fell again in early 2022 and even below the income levels of 2019.

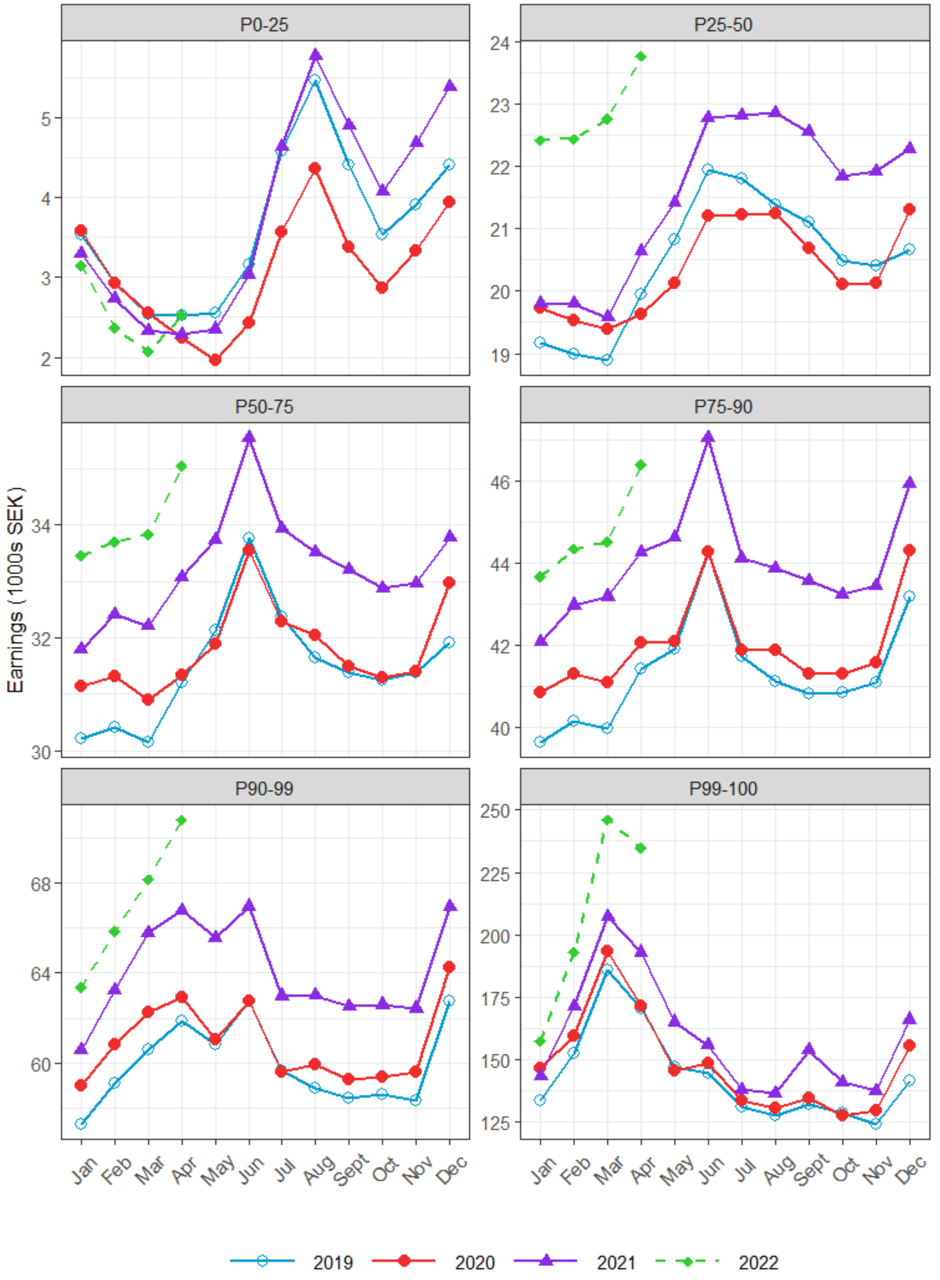
The income earners higher up the distribution are mostly full-time workers. In the second, third and lower part of the fourth quartile groups, which have an income between the 25th and 90th income percentile, the monthly variation over the calendar year follows relatively similar patterns. Income peaks are seen in June and December, and these also had an impact on the total aggregate monthly income variation as shown in Figure 6.1. The December 2020 income peak in the second and third quartiles reflects one-off payments to broad groups of workers in 2020 as part of a new collective agreement on wages between employers and unions.[28] In the fourth quartile group, the December income peak also reflects supplementary wage payments to owners of closely-held corporations made to maximize lower-tax dividend income.[29] A comparison of pre-pandemic and post-pandemic incomes in these groups shows relatively similar patterns to the lower quartile groups: the pre-pandemic increase is not observed for the rest of 2020, but a clear increase appears in 2021 and early 2022.

The monthly incomes of the top tenth, or decile group, are presented at the bottom of Figure 6.2. The group with the lower nine tenths (P90-99) has incomes that peak in June (smaller increase) and December (larger increase). The top percentile group of the entire distribution (P99-100), on the other hand, exhibits quite different income patterns, not only in a markedly higher income level, but also in that its largest income peak comes in the March-April period. This income peak reflects predominantly variable compensation to managers (bonuses and other gratuities). The timing is explained by the fact that most companies have their annual meetings in March, and therefore the board of directors finalizes the annual report and decides on variable remuneration for executives in February. We study these top incomes in more detail later in this chapter.

[28] A lump sum payment to employees of the trade union Kommunal, the lump sum payment in 2020 was SEK 5 500 (https://www.kommunal.se/fragor-och-svar-om-kollektivavtalet-dig-som-arbetar-inom-kommuner-eller-regioner 2023-01-07).

[29] https://blogg.pwc.se/taxmatters/loneuttag-2020-famansforetag (2023-01-07).

Figure 6.2 Average monthly income of workers in different percentile groups.



Source: The Swedish Tax Agency's register of employer declarations, own calculations.

6.2 Distribution of wage income

How has income inequality evolved in Sweden during the coronavirus pandemic? In this section, we present a number of measures of how the distribution of monthly wages has evolved. The Gini coefficient, or simply Gini, is the most common measure of income inequality. Gini is between 0 and 1, where 0 corresponds to a completely equal distribution where everyone has the same income and 1 is a situation where one person receives all the income. We also use income shares for different groups in the distribution to analyze income differences and developments in different parts of the distribution.

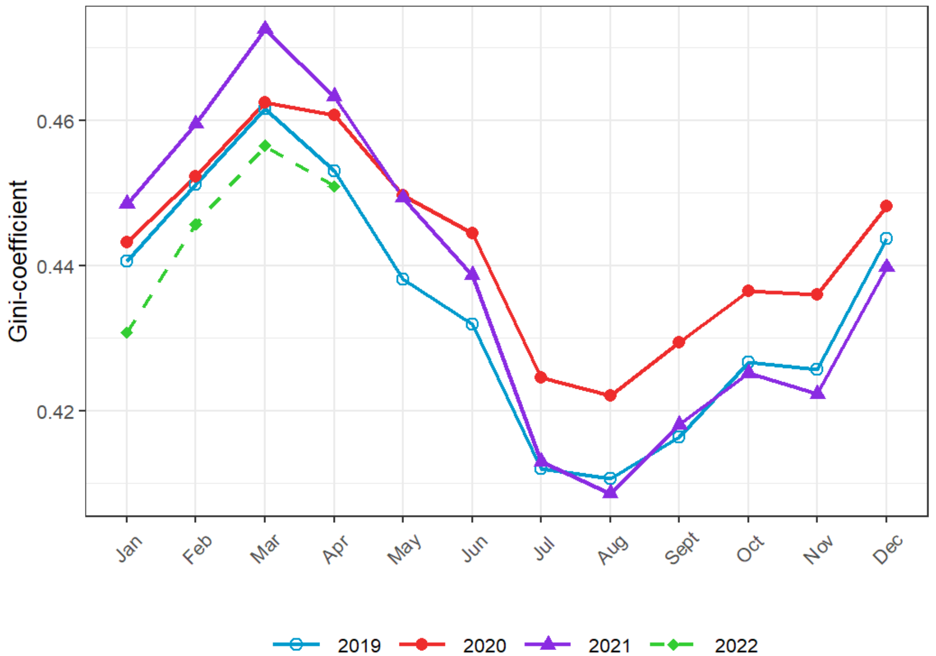
Figure 6.3 shows the Gini coefficient for monthly pre-tax income among working adults. First, we would like to briefly discuss the monthly variation in the Gini which, to our knowledge, has not been studied before in the scientific literature based on administrative full population data.

A first interesting observation is that the monthly variation in the Gini for monthly wage income is significantly larger than Gini changes from one year to another. We observe a range in the Gini over the calendar year of about five Gini points, which corresponds to a variation of over ten percent. Changes between years rarely exceed two percent, and during the economic crisis in the early 1990s in Sweden, the Gini coefficient in the labor income of full-time employees increased by five percent.

A second observation in Figure 6.3 is that the Gini shows two distinct monthly peaks: March and December. With reference to the sections above, both of these peaks reflect wage income increases observed among top earners (see Figure 6.2). This is not the first documentation of such a large impact of variations in the top layer on the Gini coefficient (see e.g. Alvaredo et al. 2011), but it has not been done in this way at the monthly level and linked to specific income patterns in the population.

So how has the coronavirus pandemic affected the distribution of Swedish employees' monthly income? Figure 6.3 shows a clear increase in Gini from the period before the pandemic to the pandemic period. In 2019, Gini varied between 0.39 and 0.44, and during the pandemic period it has varied between 0.40 and 0.45. The increase is thus about one Gini point, which corresponds to between one and three percent higher Gini coefficient. That this increase is associated with the outbreak of the pandemic in April 2020 is obvious from the figure. We also note that the increase remained almost unchanged until mid-2021 when a clear downward trend emerged. Since mid-2021, the Gini coefficient is actually below the corresponding values for the pre-pandemic period.

Figure 6.3 Gini coefficient based on employees' monthly income from employers



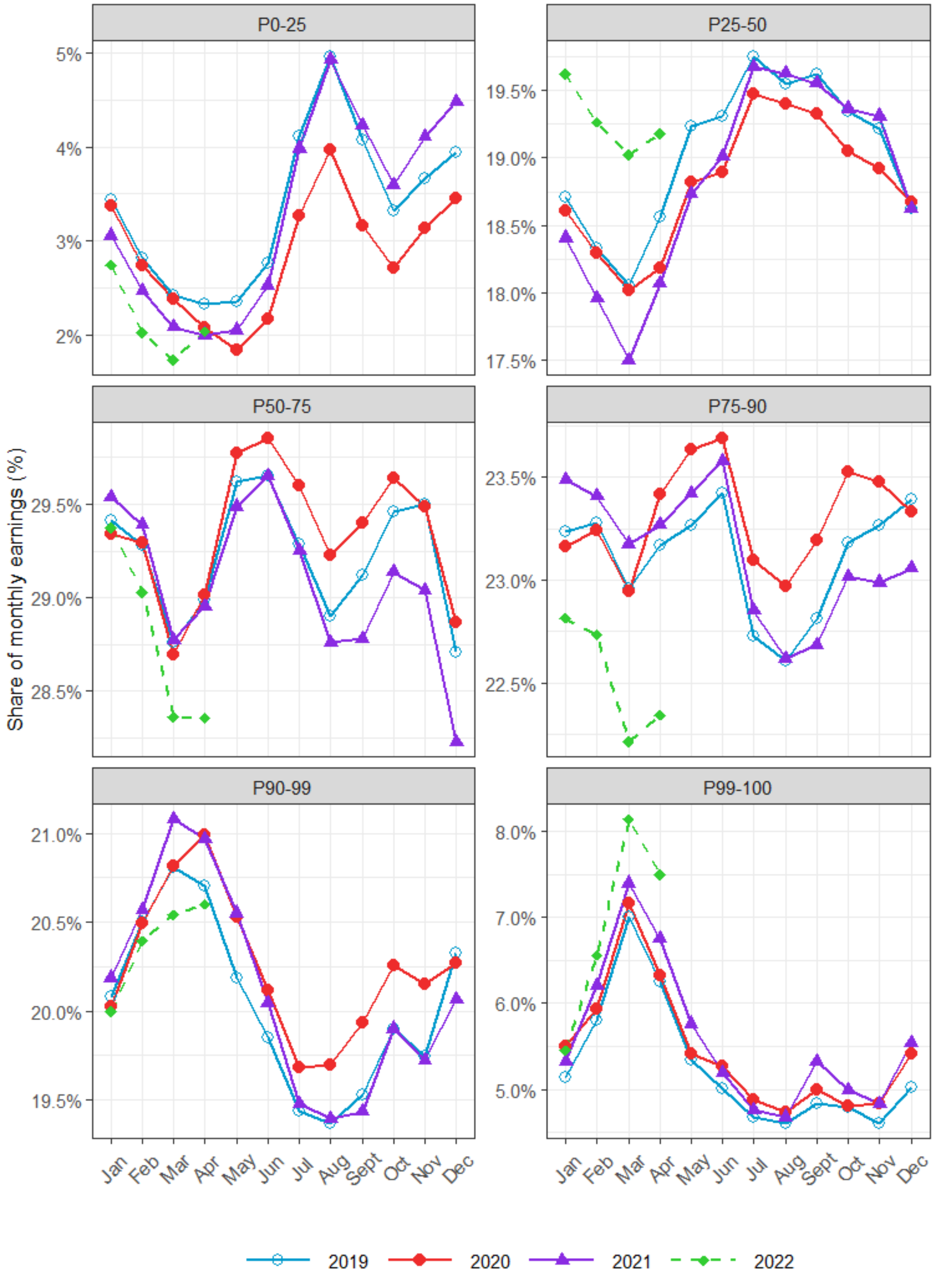
Source: The Swedish Tax Agency's register of employer declarations, own calculations.

We also analyze the development before and during the pandemic of different percentile groups' income shares of the total monthly income sum. The analysis of these groups' income shares is shown in Figure 6.4 and complements the income distribution analysis of the Gini coefficient by providing a finer picture of where in the distribution the overall income dispersion patterns emerge. The groups consist of the same six different percentile groups as in the income level analysis above: the three lowest quartile groups (P0-25, P25-50, P50-75) and the top quartile group divided into three smaller groups consisting of the group up to the highest decile group (P75-90) as well as the nine lowest percentiles of the highest decile group (P90-99) and the top hundredth (P99-100).

If we start by looking at workers in the lower half of the distribution, we can see that the income shares of this group decreased at the time of the outbreak of the pandemic in March-April 2020. The decrease was relatively the largest in the lower quartile group, where the wage income share decreased by one tenth in 2020 compared to 2019. In the upper half of the distribution, income shares instead increased during the pandemic. The relative changes were quite similar across these percentile groups, with an increase of around one to two percent.

One conclusion from this distributional analysis of individuals' monthly labor income is that the pandemic caused a regressive shock to labor income. Low-income earners saw their income fall, while earners in the upper half of the distribution were not much affected. However, starting from the middle of 2021, the Gini-coefficient began decreasing and subsequently fell to below pre-pandemic levels.

Figure 6.4 Share of different percentile groups in the total monthly income sum.



Source: The Swedish Tax Agency's register of employer declarations, own calculations.

We can compare these results with other countries' measured pandemic effects on income distribution as discussed in the introductory chapter. The comparison reveals some interesting differences, in particular in the sense that income inequality seems to have decreased in several countries during the initial part of the pandemic, while our results point to an increase in inequality.

There are several explanations for these differences in results. Some of the earliest studies use simulated incomes based on historical data and model calculations, while we use empirical income data in our Swedish tax assessment registers. The size of the study populations also differs. Some studies use relatively small study populations, such as surveys covering a sample of the population, while we use incomes from the entire total population of between five and eight million individuals.

Another reason for the differences in results is that we use data on individuals' pre-tax labor income, while most of the above-mentioned studies use household disposable income, i.e. the sum of labor and capital income after taxes and transfers. In Chapter 7, we analyze Swedes' declared annual income, where we approach a measure of disposable income by adding capital income, income from self-employment (sole proprietorship) and taxed transfers such as pensions and income from employment and health insurance.

6.3 What are the factors behind the distributional effects?

An important part of understanding the distributional outcomes documented above is to discuss the factors that may be behind these outcomes. In this section, we explore some such aspects of the possible impact of the pandemic on income inequality.

Our analysis focuses on four channels through which the distribution has been affected and which our data allow us to study: unemployment, top incomes, relative effect differences between the public and private sectors, and gender differences. These channels of influence are of course not exhaustive, but they nevertheless frame some of the most important and frequently studied factors behind changes in income distribution.

6.3.1 Zero income as a measure of unemployment

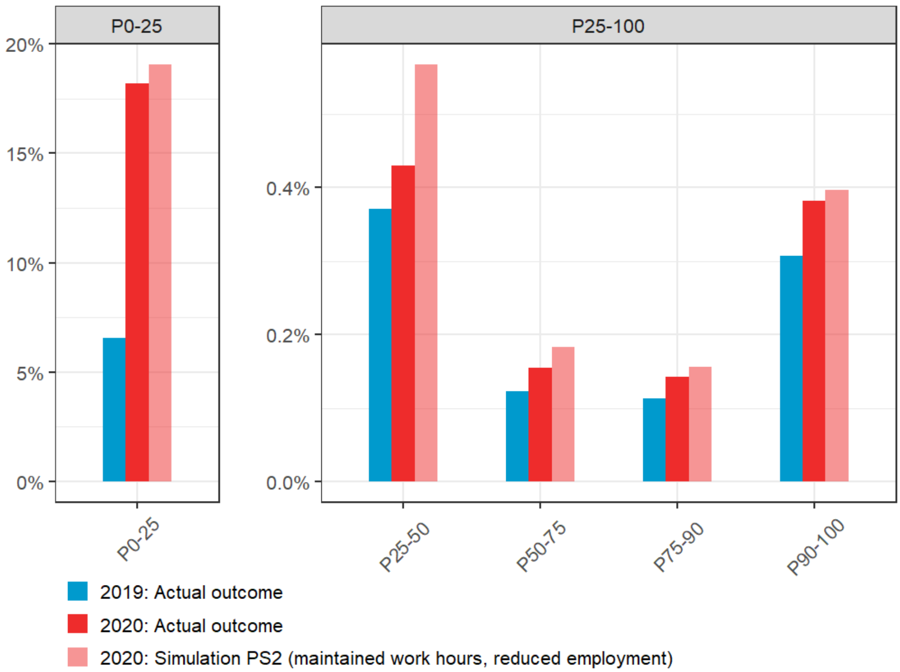
Unemployment is one of the most common ways that an economic downturn can affect income distribution. While the coronavirus pandemic affected society as a whole, our analysis of firm sales showed that some sectors were more affected than others. It is therefore reasonable to assume that even among employees there are groups that were more affected by the pandemic than others. As we describe in section 2.1, we cannot measure unemployment directly in the Swedish Tax Agency's register, but we use individuals' zero income from employers during a certain period as a measure of unemployment. A worker who in a given year had income in January-February but had no income during any month between March and December is defined here as unemployed. This measure obviously deviates from standard definitions of unemployment but, despite its shortcomings, is useful for our purposes.

Figure 6.5 shows the share of workers in different percentile groups who had an income in January-February 2019 and 2020, and who had no income in March-December 2019 and 2020. The percentile groups are calculated separately for each year (2019 and 2020) and are based on the distribution of income in January and February of that year. About 6.5% of workers in the lower quartile group in January-February 2019 were later unemployed in March-December. Workers in the higher quartile groups were almost never unemployed later in the year; their rates vary between 0.1% and 0.35% in 2019.

In 2020, the share of workers in the pre-pandemic lower quartile group (January-February) who became unemployed in March-December increased to 18%, a threefold increase. In contrast, the unemployment rate among higher income groups changed only marginally, from 0.1-0.35% in 2019 to 0.15-0.40% in 2020.

These results are in line with those of Andersson and Wadensjö (2022a), who also use employers' reported monthly wage income data to study the development of the number of employees in Sweden during the pandemic. Campa et al. (2021) use data from Arbetsförmedlingen and Statistics Sweden and compare the risk of unemployment in different wage decile groups between the pandemic year 2020 and 2019. Like us, they find that the effect is greater among employees with lower wages. Eliason (2021) compares the differences in the inflow, outflow and stock of jobseekers before and after the outbreak of the pandemic in 2020 with the corresponding differences in 2019 by using weekly statistics from the Swedish Public Employment Service. The results show that younger and foreign-born people became unemployed at a higher rate than older and native-born people.

Figure 6.5 Zero income from employers as a measure of unemployment



Note: We measure unemployment from the Swedish Tax Agency's monthly data from employers by using individuals' zero income in a given period. A worker who in a given year had income in January-February but had no income in all months between March and December is here defined as unemployed. The PS2 simulation is briefly described in the text of this section, and in detail in section 8.

In Figures A.6 and A.7 in Appendix A, we conduct this analysis separately for private and public sector employees. The results show significant differences in unemployment patterns in 2019 and 2020 across sectors. In the private sector, the share of unemployed in the bottom quartile was below 5% in 2019 and increased to 20% in the first year of the pandemic in 2020 (Figure A.6). The corresponding figures for the public sector were 9% and 16% respectively (Figure A.7). The difference between 2019 and 2020 was thus much more pronounced in the private sector among low-income workers. For the top three quartile groups (P25-100), the contrast between 2019 and 2020 is comparable between the two sectors, but a clear difference is the levels, with a generally higher share of private sector employees becoming unemployed each year compared to public sector employees. We return to the employment effects of the pandemic by sector in section 6.3.3.

We extend the analysis of the effects of unemployment on the income distribution by making a simulation of what unemployment would have looked like without short-term wage allowance and reorientation support. The aim is to try to make a rough estimate of the importance of the subsidies for the impact of the pandemic on unemployment. The analysis is carried out by calculating counterfactual simulated shares with zero income, where we simulate employees' income in the absence of the government support measures. The scenario we study is referred to as PS2 and is based on the assumption that some workers would have had to leave their employers if they had not received short-term or reorientation support. The similation is explained in detail in section 8. In short, the simulation amounts to assuming that workers at the bottom of the income distribution, who are likely to be less educated and younger, would have had to leave their jobs if government assistance had not been paid to the firm.[30] The policy simulation is described in detail in Chapter 8. The simulation shows that an additional 1.2% of workers would have become unemployed without support, with about 1% extra from the lowest quartile group and the remaining 0.2% extra mainly from workers in the second quartile group.

Overall, the results show that the pandemic crisis led to an increase in unemployment in the Swedish labor market, and that this increase mainly affected low-income earners, especially part-time workers, with incomes in the lowest income quartile group. We also note that without the government support, unemployment would have increased even more, again mainly in the lowest income quartile group, but this effect is still relatively small compared to the observed unemployment effect of the pandemic.

It should be noted that these results refer to developments in 2020, which is the period for which the impact of the pandemic on unemployment can best be measured. When considering developments in 2021, we see clear signs of a gradual recovery across the economy, including in the unemployment rate. [31]

6.3.2 Top incomes

Top earners are a special group in the income distribution and there are several reasons for studying their income in particular. Top earners have a particularly strong impact on the income distribution and can thus provide clues to what determines the overall development of the distribution. The previous top income research has shown that a closer examination of the top is important for understanding differences between different categories among the best-paid employees in the economy. One example of an interesting question is whether wage income around the 90th percentile,

[30] In this ESO report, we do not have data on short-term wage allowance available as micro-data after as they originally come from the Swedish Agency for Economic and Regional Growth. For this reason, the reported policy simulations are based on results previously reported in Angelov and Waldenström (2023b).

[31] See Andersson and Wadensjö (2022b) for an analysis of the number of employees in 2021.

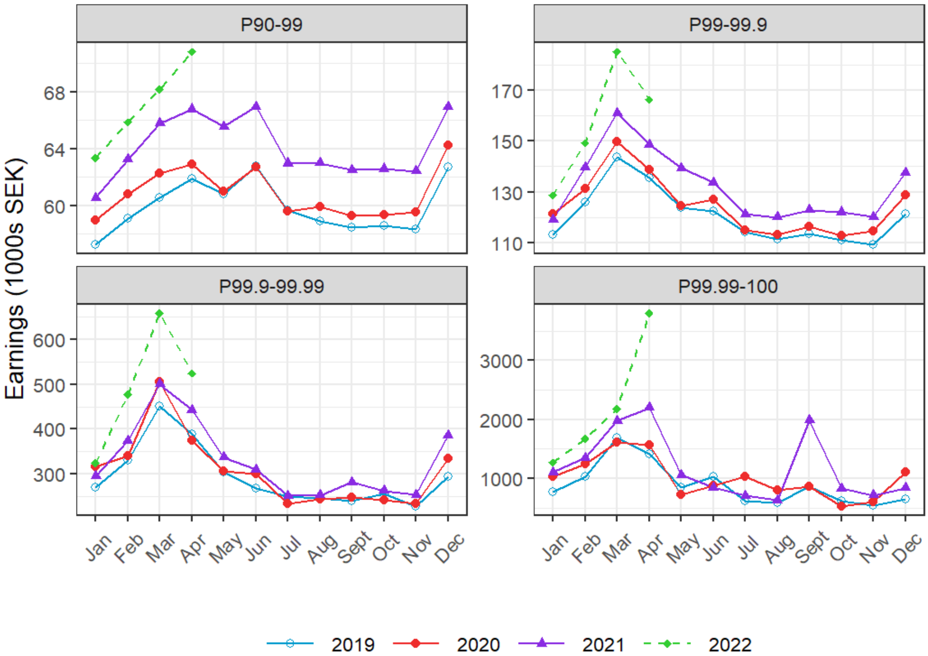
which corresponds to a monthly income of around SEK 50 000, develops in the same way as income around the 99th percentile, just under SEK 100 000, or the 99.99th percentile where the monthly income is just over SEK 500 000.

To better understand how the income of these high-paid individuals has evolved during the pandemic, we define different top groups in the income distribution. We do this by splitting the highest paid tenth of the distribution into three groups based on their rank position in the monthly income distribution: P90-99 (the lowest nine tenths of the top tenth), P99-99.9 (the lowest nine tenths of the top percent), P99.9-99.99 (the lowest nine tenths of the top thousandth) and P99.99-100 (the top ten thousandth).

Figure 6.6 presents the development of monthly income in the different top income groups. Earners at the bottom of the top decile have incomes that follow a similar pattern to the average, but the decline in monthly incomes in connection with the outbreak of the pandemic in March 2020 is less pronounced (cf. Figure 6.1). In the second half of 2020, there is a gradual return to pre-pandemic levels.

However, when we look higher up the distribution, some new patterns emerge. Although incomes have fallen among the highest earners, the decline appears to be relatively small there. The pattern of particularly high incomes around March, which probably reflects the payment of variable remuneration to business executives, is present throughout the top percentile group and visible in three of the four sub-figures in Figure 6.6.

Figure 6.6 **Top income: workers in the top decile in terms of monthly income from employers**



Source: The Swedish Tax Agency's register of employer declarations, own calculations.

6.3.3 Industries, sectors, and gender

In this section, we try to answer the following questions: How were employees in different sectors affected by the pandemic? Were employees in the private sector or in the public sector most affected? Was the impact on earnings different for women and men?

These questions are answered using regressions of the same type as in Chapters 4 and 5. We measure the effects of the pandemic on average monthly income from employment in different groups, with the constant influence of average annual effects and within-year trends. We then measure the impact of the pandemic in different parts of the monthly income distribution. This is done in order to study more formally than in previous descriptive analyses among which groups in the monthly income distribution the pandemic effect has been most noticeable.[32]

[32] For this purpose, so-called unconditional quantile regressions are estimated (see Firpo, Fortin, Lemieux 2008 and Firpo, Fortin, Lemieux 2018), where a quantile corresponds to a certain percentile of the income distribution.

As described earlier, our strategy for identifying pandemic effects is based on the variation within one year and in two different calendar years. In Appendices B and C linked to the previous chapters 4 and 5, we discuss and perform several estimates of the placebo effect to informally test the identification model in an indirect way. Unfortunately, the monthly wage income data used in this chapter starts in 2019, which means that it is not possible to estimate placebo effects. Since it is impossible to empirically assess the assumption of parallel trends using monthly income data, we proceed to provide the empirical specification below and move on to discuss the results, noting that we cannot exclude the possibility that a negative intra-year trend in monthly income or employment before the pandemic could potentially bias the presented effect estimates.

As in Chapters 4 and 5, we estimate a regression model based on monthly data, but in this chapter on monthly income from employers.[33] Since the effect is mainly identified at the group level and pre-covid observations of treated taxpayers largely act as their own controls, no individual fixed effects are needed for identification. We get very similar results when adding individual fixed effects. The estimates are made on a random sample corresponding to 20% at the individual level.

We start with effect estimates with three different outcome variables: the logarithm of each individual's monthly income (log(w)), a categorical variable that takes the value one if the income is positive and zero otherwise (1[w>0]), and the income level (w). We use these three outcome measures for the following reasons. In the estimates of log(w), we aim to estimate the percentage effect of the pandemic for individuals who have had positive income in all months during the period under study (2019 and 2020). The restriction is made partly for technical reasons (we cannot take the log if there is zero income) and partly to be able to make statements about the effect of the pandemic for a population that does not change over time. The estimates with log(w) as the outcome variable are thus the closest we can get to an estimate along the so-called intensive margin of the labor supply. We lack information on hours worked, so this estimate of the effect includes, in addition to adjustments to the number of hours worked, also any wage adjustments, for example due to switching to more low-paid jobs.

One advantage of taking logarithms is that the effect estimates can be interpreted approximately as percentage effects. Moreover, later in the report we will compare the effect estimates between different groups, which is facilitated if the effect estimates are expressed in relative (percentage) terms rather than in absolute terms. A disadvantage is that we lose many

[33] To draw conclusions with statistical confidence, we use standard errors that are clustered at the individual level.

observations.[34] Since it is not random which individuals have had zero income at some point during the period, it is important to point out that the sub-population used in these estimates will not be representative of the entire population: in this part of the analysis, we can only comment on the effect of the pandemic among people with a good foothold in the labor market.

In the estimates with 1[w>0] as the outcome variable, the entire population is included and we are instead looking to measure the effect along the so-called extensive margin. In other words, we ask the following question: To what extent has the pandemic increased unemployment, measured as a reduced incidence of above-zero income? Finally, the level estimates (i.e. with w as the outcome variable) can be said to be a combination of the effect of the pandemic on the extensive and intensive margin. These estimates may be difficult to interpret when considered separately, but together with the other two estimates they provide a more complete picture of the impact of the pandemic on different margins. [35]

Results for all sectors

Appendix D contains results from regression estimates of the impact of the pandemic on three outcome variables: logarithmic income conditional on positive income, employment defined as having positive income, and level of income (see Table D.1). A first result is that the pandemic reduced the average pre-tax income of individuals with positive income each month by an average of 4.2% during March-December 2020. Turning to the employment effects, we see that the pandemic resulted in a reduction in total employment of around 1.4 percentage points. Finally, the total effect on monthly income in SEK is SEK 779 per month. To see how sensitive the results are to the choice of empirical model, we have added two employee characteristics and one employer characteristic: a categorical variable for gender and age in years and a categorical variable for sector (private and public). Unfortunately, the tax registers do not contain any workplace characteristics, length of employment, working hours, type of contract, educational level of the income earner, etc. Adding the three variables does not affect the estimates significantly, but especially for monthly income in

[34] Simultaneously showing effect estimates in level and on logarithmic data in the DD context is not entirely standard in the research literature, but it works as long as this is taken into account in the interpretation of results.

[35] To simultaneously show effect estimates in level and on logarithmic data in the DD context is somewhat inconsistent because the identification assumption (see equation 3.3) cannot really apply both in level and logarithmic. Moreover, equation 3.3 also needs to apply to the third outcome variable, 1[w>0]. When we weigh the advantages and disadvantages of presenting the estimates with a logarithmic outcome variable, we still think that the pedagogical advantages outweigh the disadvantages.

level (w), the estimates are lower. In additional analyses, we have found that the difference is driven by the sector variable while gender and age are only marginally important.

Figure A.4 in Appendix A shows monthly impact estimates graphically. The figure shows a U-shaped effect trend over the year for all three outcome variables: low effect size in the first month of the pandemic (March); significant effect size in May, June and July; lower effect size in December. The estimates of log income for people who had income in all months differ slightly in that the December effect is still relatively large and the most negative effect was in November.

Industry-specific impact estimates for a selection of industries

We have also estimated the effect of the pandemic on log income (log(w)) separately for wage earners in different industries for the same industries used in section 5.1 where the effect on firm sales was studied. The estimates shown in Table D.2 in Appendix D refer to a subpopulation that has had positive income every month and should be compared with the average estimate for all industries reported above (about -4.2 percent, see Table D.1). We see great variation in how hard the pandemic has hit incomes in different industries. All effect estimates are negative and statistically significant. The smallest effect, in absolute terms, was on income in the construction industry, where the effect is about -1.8 percent. It may be interesting to relate the effect of the pandemic on log income to the effect on firm sales in the construction sector: as shown in previous sections, the effect of the pandemic on firm sales in the construction sector is about half as large (about -0.88%, see Table C.1) but not statistically significant. In manufacturing, trade and transport, the effect of the pandemic on income is between -2.2% and -2.7%, i.e. below the average for all industries (-4.2%). However, culture, entertainment and recreation was affected somewhat more than the average (about -5.9%) and the effect on monthly income in hotels and restaurants was even stronger: -11.2%.

As mentioned earlier, the results for log income are based on a sample of individuals who had monthly income each month during the period under study. We now proceed to study the effect on the so-called extensive margin, or employment (1[w>0]) separately for employees in different industries. These estimates are presented in Table D.3 in Appendix D and are based on all individuals who have had monthly income from employers for at least one month in the observation window. The estimates should be compared with the average estimate for all industries reported earlier in this section (see Table D.1, about -1.4 percentage points, which corresponds to about -

1.7 percent compared to the outcome variable's mean value for March-December 2019, which was 81.3 percent).

Like the estimates of log(w), all estimates of employment are significantly negative and we see the smallest effect size in construction (around -0.9 percent). The effect on employment in manufacturing is close (around -0.95 percent) while trade and transport have seen a larger decrease in employment (around -2.1 percent and -2.9 percent respectively, both of which are stronger than the average effect of around -1.7 percent). We see the same pattern as before when it comes to culture, entertainment and leisure (around -5.9 per cent) and hotels and restaurants (around -10.6 per cent). Based on all the sectoral effect estimates we have presented so far in the report, it is therefore clear that these two sectors have been hit very hard by the pandemic. The hotel and restaurant industry in particular has been affected extremely strongly: a decrease in firm sales of about 25 percent (Table C.1), a decrease in employment of just over 10 percent (Table D.3) and a decrease in income for people who have had income throughout the period of about 11 percent (Table D.2).

Impact differences with respect to gender and private versus public sector

We further explore how the impact of the pandemic varies by gender and sector (Table D.4 in Appendix D). Looking at the impact on log earnings across sectors, the results show that public sector workers who had positive earnings throughout the period experienced a larger negative income shock compared to private sector workers (around -3.9% compared to -2.6%). The impact among women in the private sector is -3.6%, indicating that women were hit harder by the pandemic than men (a statistically significant difference of around one percentage point). We find no evidence of any additional effect of being a woman employed in the public sector. Turning to employment effects, we see that public sector employment actually increased during the pandemic: for men in the public sector, the increase in employment was around 1.1 percentage points (Table D.4). The relative impact on employment of women in the private sector compared to men in the private sector is negative and statistically significant (-1.1 percentage points), meaning that women were more negatively affected than men also in terms of employment.

How should we interpret the result that, on the one hand, the public sector experienced a larger negative income shock compared to the private sector and, on the other hand, an increase in employment during the pandemic? In the light of the findings in section 6.3.1, we consider these figures to be reasonable. As shown in Figure 6.5, the unemployment shock mainly affected low-income workers, and we know from column 2 of Table

D.4 that these workers were mostly employed in the private sector. This means that one effect of the pandemic was that the public sector instead saw an increase in employment, as documented in column 2 of Table D.4.

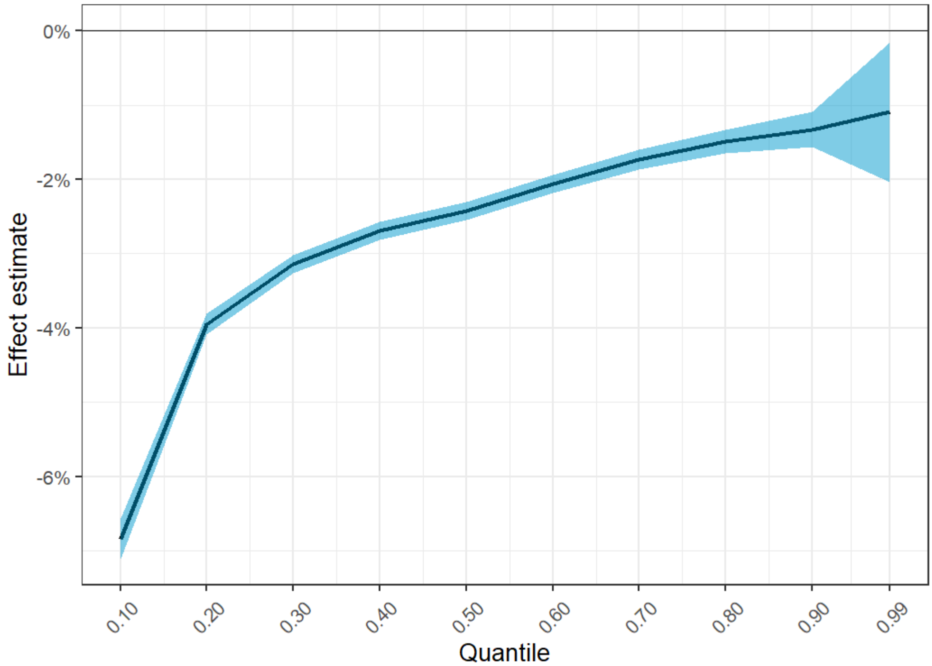
It is not unreasonable to assume that the increase in public sector employment was made up of people with low incomes, either because of part-time work or low pay, who were hired to cope with the pandemic. Conditional on having positive income, one would then expect a larger negative effect on the income of public sector employees. This shows that to get a more complete picture of the effects of the pandemic, one needs to look at the effects both on wage income, which depends on employment, and on employment.

Summarizing the results so far in this sub-section, we can conclude that the entire decline in employment during the pandemic took place in the private sector. The combination of lower earnings but higher employment among female employees in the public sector suggests an expansion of low-income jobs, either in the form of temporary jobs with full pay or long-term jobs with low pay. We cannot distinguish between these two in our data because we do not observe hours or hourly wages.

The impact in different parts of the monthly income distribution

The unconditional quantile regression results in Figure 6.7 show graphically how the pandemic affected monthly wage income in different parts of the income distribution. The results confirm what we observed earlier in the report. The strongest pandemic effects are in the lower part of the distribution and the upper part of the distribution is only marginally affected. The effects range from about -6.8 per cent at the 10th percentile to about -1.2 per cent at the 99th percentile. The statistical precision is good with the exception of the 99th percentile, probably due to the smaller number of observations and the higher variance of income. That said, there is a striking monotonicity in the difference between the crisis effects in the different quantiles, confirming the regressive nature of the COVID-19 pandemic as seen in previous sections.

Figure 6.7 **The impact of the pandemic in different parts of the monthly income distribution**



Source: The Swedish Tax Agency's register of employer declarations, own calculations. The estimates are based on unconditional quantile regressions (see Firpo, Fortin, Lemieux 2008 and Firpo, Fortin, Lemieux 2018). The outcome variable is log monthly income from employers.

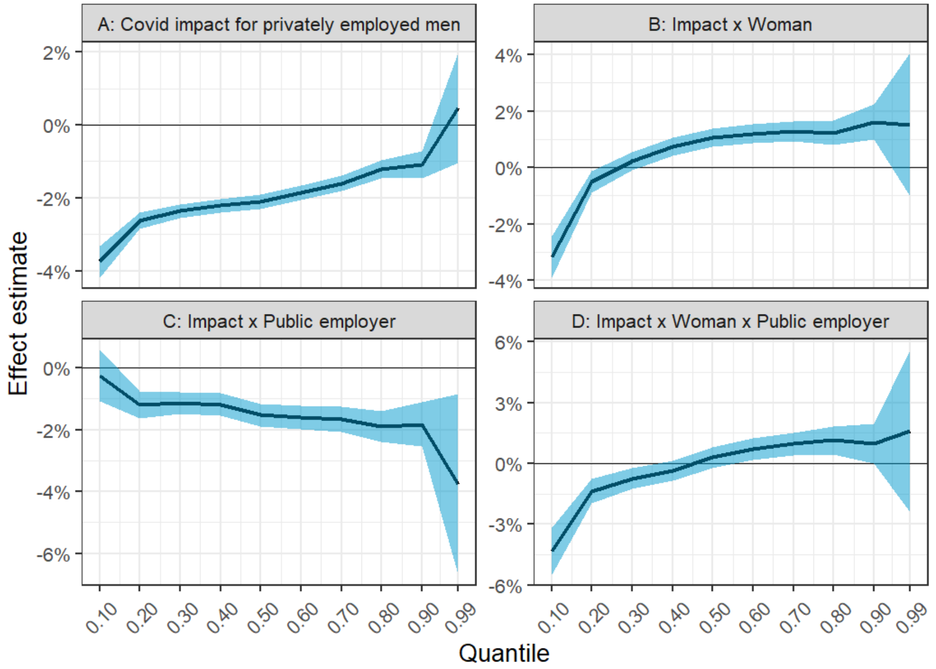
Figure 6.8 shows how the effect estimate in the unconditional quantile regressions varies across public/private sector and male/female employees (but with the quantiles still defined over the whole population). In the reference category (Panel A), men in the private sector, we find the monotonically decreasing (in absolute terms) negative effect of the pandemic across the income distribution. Panel B shows the relative impact of women in the private sector compared to men in the private sector. A negative value in panel B for a given quantile means that the impact among women is more negative than among men in this part of the income distribution.

The relative effect for women is negative at the lower end of the distribution (percentiles 10-20), but the effect varies with income and actually turns out to be positive for women in the 40th to 90th percentiles. Among men employed in the public sector (Panel C), the relative crisis effect is negative compared to the effect among men in the private sector for all but the 10th percentile, where it is not statistically different from zero.

Finally, among women in the public sector (Panel D), the relative impact shows significant heterogeneity across the income distribution: it is strongly negative in the 10th to 30th percentile, positive between the 60th and 80th percentile and virtually zero in the rest of the distribution.

Taken together, these results show significant non-linearities in the impact of the pandemic on income and significant heterogeneity across sectors and gender.

Figure 6.8 Impact of the pandemic in different parts of the monthly income distribution: heterogeneous effects



Source: The Swedish Tax Agency's register of employer declarations, own calculations. The estimates are based on unconditional quantile regressions (see Firpo, Fortin, Lemieux 2008 and Firpo, Fortin, Lemieux 2018). The outcome variable is log monthly income from employers.

6.4 Payroll taxes and sick pay

What was the impact of the pandemic on payroll taxes, i.e. payroll taxes and preliminary income tax paid? This question is important given the importance of these taxes in the financing of public administration. In this section, we examine how income tax revenues developed during the pandemic and the presentation focuses on the employer's contribution and income taxes on earned income to municipalities and the state.

The payment of sick pay during the pandemic is also studied. In the Swedish social insurance system, sick pay is paid by firms to their employees for the first 14 days of sick leave. What makes the issue of sick pay during the pandemic particularly interesting is that during the initial months of the pandemic, the government took over responsibility for sick pay expenditures, which implies a change in the incentive structure for firms to monitor short-term sick leave in particular. The outcomes are described and, in a separate analysis, we relate them to the local spread of the coronavirus and the proportion of infected people per municipality according to the Public Health Agency of Sweden's statistics.

Figure 6.8 shows the evolution of income taxes on labor and the cost of sick pay to firms. Tax revenues declined after the pandemic outbreak but then increased to 2019 levels. Payroll taxes declined much more than preliminary income tax payments in March-June 2020 and recovered thereafter. This dramatic decrease is not only due to the economic downturn, but also to the temporary reduction in payroll taxes introduced in 2020. The reduction meant that employers could request a reduction in payroll taxes for a maximum of 30 of their employees for payments made between March 1 and June 30, 2020. The reduction means that only the old-age pension contribution (10.21%) on remuneration up to SEK 25,000 per salary recipient and month must be paid.

Sick pay is paid by employers for absences of less than 14 days. The total amount of sick pay paid doubled in the first months of the pandemic, before falling towards the end of 2020. The sum of sick pay throughout 2021 was significantly higher than the pre-pandemic values (2019). In the first months of 2022, and especially in February, the amount of sick pay paid was very high and significantly higher than in spring 2020.

The increase in sickness absence is clearly linked to periods when the spread of the coronavirus was significant. An additional possible explanation could also be behavioral reactions to the increased government support for employers' sick pay costs and the removal of the waiting period deduction. Below, we examine the relative importance of these two channels by analyzing the temporal and geographical correlation between the reported incidence of coronavirus and sick pay costs.

Figure 6.9 **Monthly payments of preliminary income tax, employer's contributions and sick pay by enterprises**

Source: The Swedish Tax Agency's register of employer declarations, own calculations.

Table D.5 in Appendix D presents the results from regressions estimating the effect of the pandemic on payroll taxes, preliminary tax and sick pay. As in previous regression results, we start with estimates of the average effect and then measure the difference in effect with respect to municipal infection levels captured by quartile group categorical variables, $QG_1 - QG_4$.[36] The quartile group classification is described in detail in Appendix B.

The average effect of the pandemic on the employer's contribution is -8.22 percent, and on preliminary income tax -2.9 percent. As expected, both effects are negative and statistically significant. The relatively larger effect on employers' contributions is likely to be largely explained by the reduction in employers' contributions in March-June 2020. A further contribution to the larger reduction in employers' contributions is the lower progressivity of employers' contributions combined with the fact that mainly low-income earners have lost their jobs during the pandemic. Figure A.5 in Appendix A shows monthly impact estimates on payroll taxes, preliminary tax and sick pay. It shows that the impact of the pandemic was strongest in the initial

[36] Monthly data were not collected in the administrative registers before 2019, so we cannot perform placebo tests similar to those in Chapter 4.

phase, in particular in April and May 2020. The impact estimates in Figure A.5 thus provide roughly the same picture of the dynamics as Figure 6.8.

Our results further show that the effect is by far the largest among firms registered in municipalities with the highest infection rate (QG_4), -9.2 percent. The effects for the groups QG_3, QG_3 and QG_1 are smaller in absolute terms than for QG_4 and the differences are statistically significant. This means that the impact of the pandemic was smaller in municipalities with lower infection rates. The estimates for preliminary income tax also show that the effect is strongest in municipalities with the highest infection rate, but the difference compared to less affected municipalities is not as large as for payroll taxes and none of the effect estimates for the groups QG , QG_{32} and QG_1 are statistically different from the group with the highest infection rate QG_4 .

In terms of paid sick pay, we find a large average effect of the pandemic, SEK 3,110 or 71.2 percent. The effect is undoubtedly partly related to covid morbidity, either actual or suspected, in which case people were advised not to go to work. However, the government's increased compensation of companies' costs for sick leave and the abolition of the two qualifying days (the waiting period deduction) in the sickness insurance scheme could potentially also have contributed to the effect through incentive effects on sick leave. There is an extensive research literature on the effect of incentives in the health insurance system.[37] In addition, Swedish media have reported hundreds of cases where companies that had no payroll payments before the pandemic suddenly reported full payroll sick leave in the first months of the pandemic. There are also reports of companies requiring employees to call in sick but continue working, at work or from home. [38]

To investigate these two potential mechanisms behind the large effect on sick pay, we examine whether the covid effect on sick pay varies with the municipal infection incidence captured by the four quartile groups defined earlier. If the effect on sick pay is mainly driven by covid morbidity, we should expect a lower effect of the pandemic on the amount of sick pay paid among firms registered in municipalities with low infection rates, and vice versa. The results show that only two of the three groups with relatively lower infection intensity have a lower effect on sick pay than QG_4 , and one of the groups even has a larger effect. However, none of the effects in QG , QG_{32} and QG_1 are statistically different from the highest infection intensity group QG_4 .

[37] See, for example, Johansson and Palme (2005) who estimate the effect of the replacement level of the Swedish national health insurance system on absenteeism behavior or Boheim and Leoni (2020) who study the effect of abolishing the reimbursement of firms' sick leave costs using Austrian data.
[38] See for example news from public service media, https://www.svt.se/nyheter/inrikes/foretag-fuskar-med-sjuklon-under-coronakrisen-300-arenden-har-stoppats-for-kontroll (2023-01-07) and https://sverigesradio.se/artikel/7616510 (2023-01-07).

We find it interesting that we cannot detect any clear effect heterogeneity with respect to local covid infection rates in the outcome where such heterogeneity would seem most natural among those we analyze, namely sick pay. While the reliability of the covid infection rate data is questionable, it should be noted that it yielded expected and statistically significant results for VAT and firm sales (Table B.3 in Appendix B). Moreover, for the same data and sample as for sick pay, the covid infection rate interaction yields reasonable and statistically significant results for payroll taxes, as shown in column 4 of Table D.5 in Appendix D.

Some of the effect of the pandemic on sick pay may also be due to precautionary measures rather than being infected with COVID-19. It is reasonable to assume that sick leave as a precautionary measure could well be related to the temporarily changed incentives in the health insurance system, as the changed incentives made it easier to take such precautions. However, if one believes that the main driver of the effect on sickness absence is precautionary behavior, precautionary measures should after all be more widespread where infection rates are higher. This in turn should lead to a stronger pandemic effect on sick pay in municipalities with higher infection rates, which we do not find any support for in the data.

As already mentioned in section 4.1, it is important to emphasize that the results should be considered as a hint of the possible importance or absence of contagion, rather than as a formal hypothesis test. A cautious interpretation of the results is that we cannot rule out that part of the estimated effect of COVID on sick pay costs may be due to monetary incentives created by the temporary government compensation scheme for companies' costs for sick workers. Our hypothesis to explain the measured results is therefore that changing monetary incentives (whether due to own morbidity or caution due to high local infection rates) have probably contributed to the large average effect of the pandemic on sick pay of 71.2 percent. Unfortunately, we cannot test this claim using data from tax registers. One important reason is that information on sick pay does not exist at the individual level in the tax registers. To get a more complete understanding of what is happening, such individual data would be required.

7 Income distribution in annual income from labor and capital

The impact of the coronavirus pandemic on household income is one of the key issues in both the economic debate and economic policy. In this report, we have analyzed how the monthly income of wage earners has been affected in both level and distribution. The results show that pre-tax wage income differences increased during the pandemic. An important explanation is that unemployment increased among part-time low-income workers, while full-time middle- and high-income workers were not significantly affected by the pandemic.

Data and methodology

In this section, the focus shifts from monthly labor income in the working population to annual income from both labor and capital in the income tax declarations of the entire adult population. This sum of labor and capital income is usually called market income and it differs in several ways from the income studied in the previous chapter.

Previously only pre-tax earnings were analyzed, but now earnings are studied both before and after all taxes. A further difference in the analysis is that the earned income included in the declared annual income is more extensive than the monthly wage income studied above. Employment income in this chapter also includes pensions, which constitute a large part of the income of people aged 65 and over. Taxable transfer payments are also included in the income declared as earned income, especially insurance income from unemployment benefits and sickness benefits. Income from self-employment in the form of business income is included in the declared annual income. Capital income in the form of interest from bank savings and bond holdings, dividends from both listed and unlisted companies, capital income from holdings in investment savings accounts (ISK), and realized capital gains are also included. The analyses use the difference between capital income and capital expenditure (in the form of interest expenditure and various types of capital losses) and we refer to the difference as capital income (net). All these incomes are observed both before and after deducting all taxes paid. Standard terminology refers to this aggregate income concept as market income (and sometimes total income) and we study here the level and distributional characteristics of market income in the adult population for the period 2019-2022. Detailed variable definitions are presented in Appendix E.

When comparing the distribution of these annual market incomes, one should note a number of important differences with the income distribution statistics that, for example, Statistics Sweden and the Swedish Ministry of Finance analyze in their regular statistical publications. One important difference is that market income does not include untaxed transfers, such as housing allowance, child allowance or income support. In this way, it is less good at capturing the scope for consumption and the level of welfare, particularly in the lower part of the income distribution. Another difference is that the market incomes we analyze in this chapter make deductions for capital expenditures in the form of interest expenses, while this is not done in Statistics Sweden's household income concept of disposable income.

The Swedish Tax Agency's data is individual-based and this is another important difference from Statistics Sweden's income distribution survey, which is household-based. This means that the economies of scale enjoyed by multi-person households in their consumption and welfare levels are not taken into account in our analyses.

Using annual income to study the distributional effects of the corona pandemic is not without its problems, as the pandemic broke out in Sweden a few months into 2020. This means that the year 2020 both is and is not a pandemic year, which we also used in our previous analyses to calculate the pandemic effect on both firm sales and employees' monthly income. In this chapter, we analyze the annual income of Swedes, which adds a number of new perspectives thanks to a broader income measure, but we also lose precision in determining the effects of the pandemic. This trade-off is unavoidable but should be kept in mind when interpreting the results.

Summary of the chapter's findings

The results in this chapter show that the level and distribution of annual incomes remained relatively static during the first year of the pandemic in 2020, while income dispersion increased markedly in 2021. This increase is driven both by income reductions at the bottom of the distribution, mainly caused by falling wage income among the young and elderly, and by strong income increases at the top of the distribution, mainly increased capital income from asset sales. The analyses show that the results are similar both before and after tax.

7.1 Annual income trends before and during the pandemic

Table 7.1 shows the adult population's annual market income from wages and capital in 2020 and how this income was distributed in different size classes. The two left-hand columns show that the median income, i.e. the income received by the person in the middle of the income distribution, was SEK 276 100. The income threshold for belonging to the tenth with the highest income, P90, was SEK 576 400. The three right-hand columns present average annual incomes for different income groups. For example, the average annual income of the entire adult population (P0-100) was SEK 316 600, while the average income of the richest ten thousandth was just over SEK 40 million.

Table 7.1 Description of the distribution of annual market revenues

Percentile	Annual market income	Percentile group	Number of taxpayers	Average annual market income
		P0-100	8 280 140	316,6
		P0-25	2 070 033	30,1
P25	137,9	P25-50	2 070 037	207,8
P50	276,1	P50-75	2 070 031	343,5
P75	415,2	P75-90	1 242 023	481,9
P90	576,4	P90-99	745 214	774,9
P99	1 410,1	P99-99,9	74 521	2 103,5
P99,9	4 369,4	P99,9-99,99	7 452	6 959,5
P99,99	16 233,2	P99,99-100	829	40 427,5
		P90-100	828 016	989,8
		P99-100	82 802	2 924,3

Note: The table shows annual market income, i.e. the sum of labor, business and capital income according to the income tax return for adults in Sweden aged 18 or older. All incomes are in SEK 1 000s. The left panel of the table shows the market income corresponding to the cut-off point for a certain percentile. For example, 25 percent of market income is below SEK 137.9 thousand, 50 percent is below SEK 276.1 thousand, etc. The right panel of the table shows the number of taxpayers and average market income in different percentile groups.

Figure 7.1 shows a graphical overview of tax revenues and incomes for the income years 2018-2021 based on individuals' income tax returns. For details on the individual data and variable definitions used, we refer to Appendix E.

The results suggest that aggregate tax revenues paid by individuals have not been significantly affected by the coronavirus pandemic. The tax base that shows the largest change in 2020 is the declared net income from business activities of sole proprietors. This income has a negative net in all years, and the negative net increased relatively much in 2020. Also in 2021, business income was more negative than in 2018 and 2019, but slightly less negative than in 2020.

In 2021, capital income increased significantly, from a level of around SEK 220 billion in 2018-2020 -to SEK 349 billion in 2021. Capital income taxes also increased in 2021, from around SEK 80 billion in 2018-2020 -to SEK 116 billion in 2021. The main reason for this is the increase in capital gains from the sale of housing and financial assets. These data do not allow us to comment on the exact reasons for this increase in sales and the associated increase in capital gains and capital income taxes.

Figure 7.1 Tax revenue and income from different sources

Source: The Swedish Tax Agency's register of annual income declarations, own calculations. The capital income reported is in net terms, i.e. capital income minus capital expenditure. For details on the individual data and variable definitions used, we refer to Appendix E.

7.2 Distribution of annual income

We now move on to analyze how the distribution of annual market income has evolved during the coronavirus pandemic. Figure 7.2 shows Gini coefficients for adult individuals' annual incomes before and after tax during the period 2018-2021-.[39] The pre-tax values have been calculated on market income and the after-tax values on market income minus the individual's final tax amount for the income year.

The results for annual market income are somewhat different from the outcomes in the distribution of monthly wage income presented in section 6.2. The Gini coefficient for annual income did increase somewhat between 2019 and 2020, just under two percent (Gini before tax from just over 0.44 to just under 0.45 and Gini after tax from just over 0.41 to 0.42), but this increase is clearly less than the increase in the Gini of monthly income presented earlier in the report.

In 2021, however, the Gini coefficient has increased significantly, by 7.9%. The Gini before tax increased from 0.45 to 0.48, while the Gini after tax increased from 0.42 to just over 0.45.

Figure 7.2 Gini coefficient based on pre- and post-tax market income

Source: The Swedish Tax Agency's register of annual income declarations, own calculations.

It should be mentioned that the most commonly used Gini measure, which is calculated by Statistics Sweden, is based on a slightly different concept of

[39] See Appendix E for variable definitions of market income before and after tax. It should be noted that these data are based on the Swedish Tax Agency's data on compilations of income declarations before all declarations have been finally confirmed and therefore contain some preliminary data. For this reason, some totals may differ marginally from the final tax assessment outcome.

income: disposable income. This income is similar to the market income after tax that we use, but disposable income also includes income from untaxed transfers (e.g. housing benefits and social assistance), which are particularly important for income earners at the bottom of the distribution. Statistics Sweden also takes into account household size, which tends to have a smoothing effect on the distribution. Statistics Sweden's Gini coefficient based on disposable income is therefore at a clearly lower level than what we see in Figure 7.2. For the years 2018-2020, it is at 0.309, 0.311 and 0.310, i.e. almost completely stationary, but in 2021 it rises to 0.333. Although the Gini levels differ from ours, the Gini percentage increase in 2021 is 7.4%, which is virtually identical to the figures in Figure 7.2 for market income both before and after tax.

We thus conclude that the development of the income distribution, measured as a percentage Gini increase, during the coronavirus pandemic was not primarily affected by redistributive effects caused by untaxed transfers but by changes in market income. Notably, the first year of the pandemic, 2020, saw no significant change in income inequality on a full-year basis. In contrast, 2021 saw a significant increase in income inequality, both before and after taxes and transfers.

To see whether the increase in the Gini coefficient in 2021 is mainly driven by changes in income at the top or at the bottom of the distribution, Figure 7.3 shows what the average market income has been each year in the same six percentile groups analyzed earlier in the report.[40] The figure also shows a breakdown of market income into labor and pension income, income from business activities and capital income (interest and dividends and realized capital gains). From this picture it is clear that the increase in the Gini coefficient is driven both by decreases in market income at the bottom of the distribution and by increases in market income at the top.

For individuals with income in the bottom quartile group, market income was stable at around SEK 47,000 in 2018 and SEK 49,000 in 2019, before falling to around SEK 43,000 in 2020 and SEK 37,000 in 2021. Expressed as a percentage, the decrease compared to 2019 was around 11 and 24 per cent in 2020 and 2021 respectively. As this group makes up a quarter of the population, this decrease is an important mechanism behind the increase in the Gini coefficient in 2020 and 2021. The decrease in income in 2020 was mainly due to an increase in the business deficit, while the decrease in 2021 was due to lower labor and pension income. Looking at the top of the income distribution, we see an increase in income in 2020 of around 10% and a significant increase in 2021. In this last year, the average income of the top 1% increased by around 31%, from around SEK 3.5 million to SEK 4.6

[40] See Appendix E for variable definitions.

million. The figure shows that the increase was mainly due to increased capital gains.

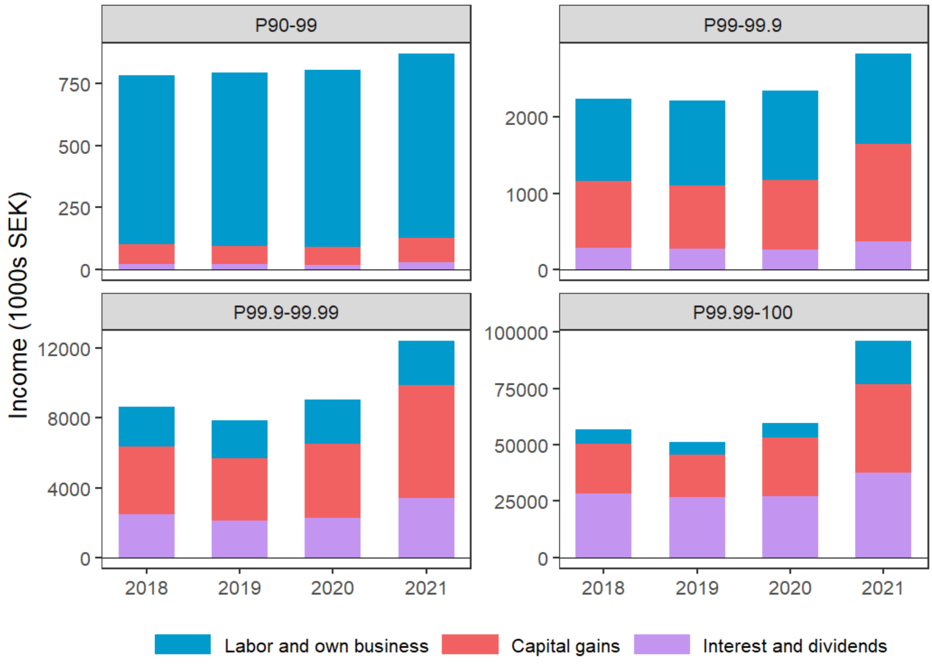
Figure 7.3 Average income from different sources in different percentile groups.

Source: The Swedish Tax Agency's register of annual income declarations, own calculations. For details on which individual data and variable definitions have been used, we refer to Appendix E.

An even more detailed picture of the development of top incomes is given in Figure 7.4, where we focus on incomes in the top decile group.[41] The figure confirms the picture that there were no large increases in income in this group between 2018 and 2020, while there have been quite a few in 2021. Above all, it is capital income that has increased in 2021, including realized capital gains and interest and dividends. However, in the very top income group, the top ten thousand P99.99-100, all types of income have increased. As Table 7.1 shows, an annual income of just over SEK 16 million is required to qualify for this group of just over 800 individuals. Most of the income in this group is capital income. What is new for 2021 is that wage income increased significantly faster than other income, and the average amount increased almost fourfold. Dividend income and realized capital gains also increased, less in relative terms but similarly as wage income.

[41] See Appendix E for variable definitions.

Figure 7.4 Average income from different sources in the top decile



Source: The Swedish Tax Agency's register of annual income declarations, own calculations. For details on which individual data and variable definitions have been used, we refer to Appendix E.

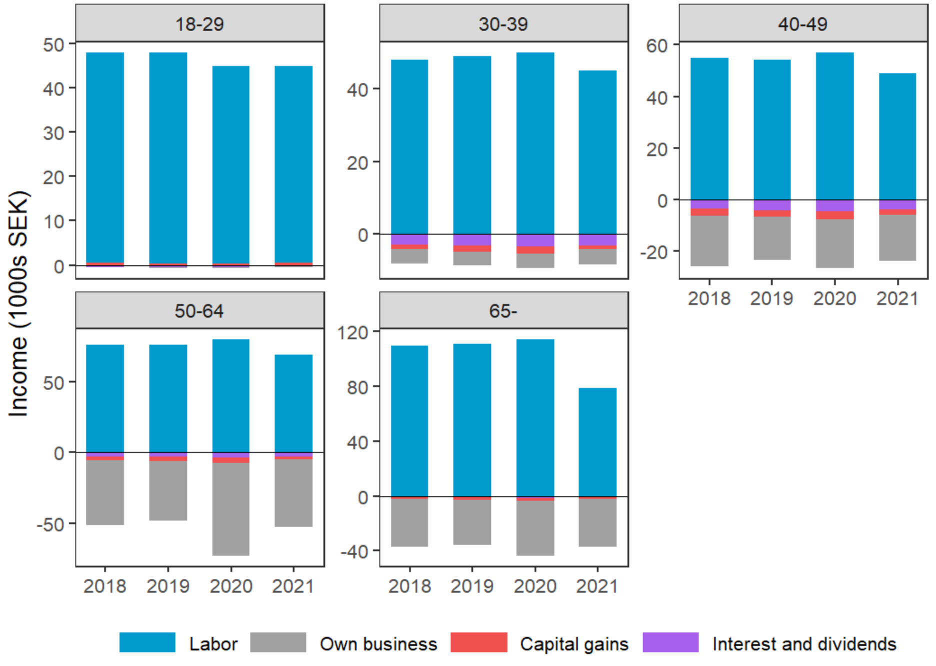
7.3 What happens at the lower end of the distribution?

We have found evidence several times in the study that individuals at the lower end of the income distribution were hit hardest by the pandemic crisis. Looking back at the previous figures, this is true for average monthly income (upper left panel of Figure 6.2), the unemployment shock (left panel of Figure 6.5) and annual market income (upper left panel of Figure 7.3). While these separate analyses have been broadly consistent, it is difficult to draw conclusions about potential mechanisms from each analysis separately.

In this subsection, we bring these results together and try to distinguish between different potential mechanisms with the help of some additional results. For this purpose, we examine individuals with annual incomes below the bottom quartile along two dimensions: age (for all outcomes) and source of income (for market income). Broadly speaking, we try to answer the following question: Which age groups were most affected and in what way - through increased unemployment or loss of income conditional on having a job?

We start with the annual market income. Figure 7.5 shows the different sources of income for total income for individuals below the bottom quartile (P0-25) by age group.[42] The figure shows no significant changes within the groups between 2018 and 2019. In 2020, two things seem to happen: labor and pension income falls among the youngest, and the negative net income from self-employment increases sharply in the 50-64 age group. This large increase in self-employment losses is not unexpected in a crisis year, but we find it interesting that it is so clearly concentrated in this particular age group. Although there is an under-representation of people in the 50-64 age group relative to the young and the old (in terms of the number of individuals, the relative sizes of the groups starting with the youngest and ending with the oldest are 36%, 15%, 10%, 13% and 26% respectively), they still represent 13% of the total number of individuals in P0-25. Thus, the large decrease in self-employment income is an important partial explanation for the decrease in total income in P0-25 during the pandemic.

Figure 7.5 Average income from different sources in different age groups

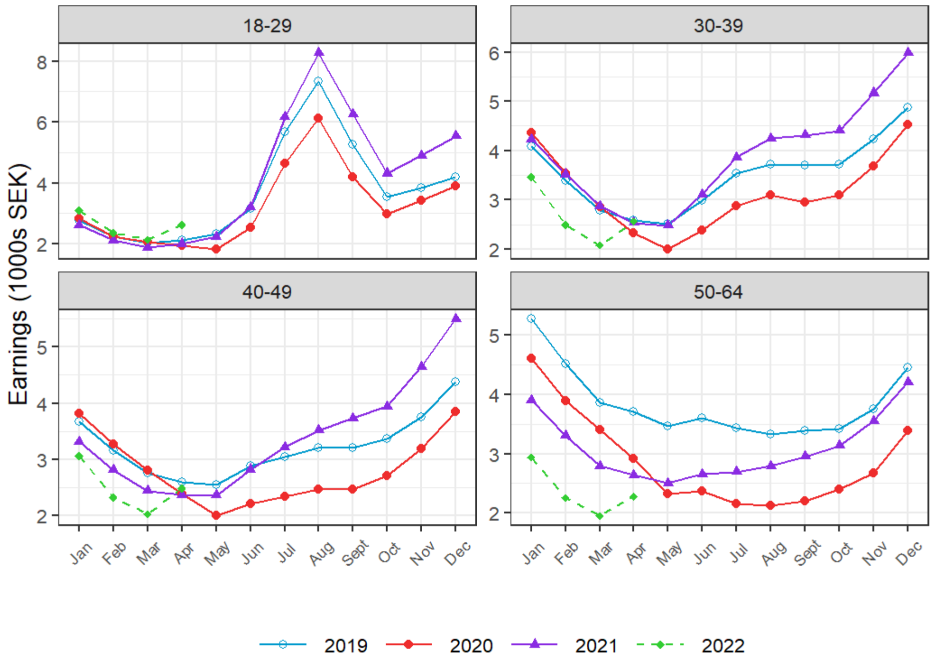


Source: The Swedish Tax Agency's register of annual income declarations, own calculations. For details on which individual data and variable definitions have been used, we refer to Appendix E.

[42] See Appendix E for variable definitions.

The decrease in annual earned income in the tax return may be due to unemployment, fewer hours worked or a reduction in salary, e.g. due to a new, lower paid job. Unfortunately, we cannot observe these factors directly in the tax return data. Instead, we once again use the monthly income data and divide the lowest income quartile group into the same age groups as in Figure 7.5. Figure 7.6 shows that incomes decreased in all age groups in 2020. The largest decrease is found among 50–64-year-olds, which is also the age group most affected in terms of income from self-employment in Figure 7.5.[43] Moreover, for this group we see a downward shift in income even before COVID-19, i.e. already in January and February 2020.

Figure 7.6 Average monthly income from employers in different age groups



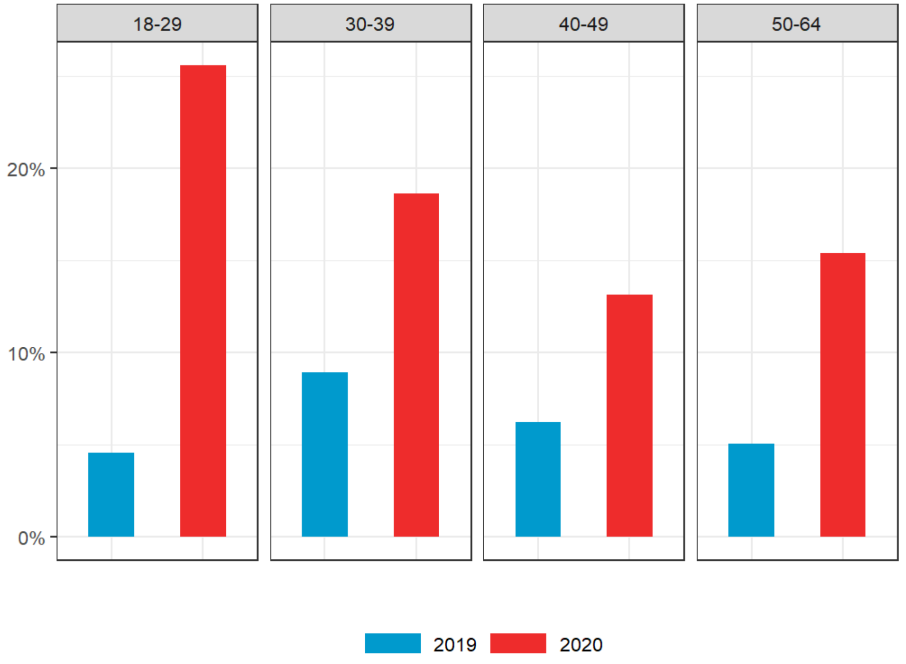
Source: The Swedish Tax Agency's register of employer declarations, own calculations.

In a final analysis, Figure 7.7 examines unemployment shocks among workers in the lowest income quartile group by age group. Among individuals with positive wage income in January-February 2019 but who were unemployed (i.e. had zero wage income) in March-December of the same year, we see some variation across age groups. The shares are around 5% among the youngest and oldest, 6% among those aged 40-49 and 9% in

[43] It should be kept in mind that the percentile thresholds in both figures are from different distributions.

the 30-39 age group. Looking at the corresponding figures for 2020, it is clear that the youngest group has been hit the hardest by the pandemic: the share of people with no income in March-December 2020 but with income in January-February is over 25%, which is more than five times higher than in the pre-covid year. The second highest share of unemployed is in the 30-39 age group (around 19%).

Figure 7.7 Zero income from employers as a measure of unemployment across age groups



Source: We measure unemployment based on monthly employer data from the Swedish Tax Agency by using individuals' zero income in a given period. A worker who in a given year had income in January-February but had no income in all months between March and December is here defined as unemployed.

If one summarizes the analysis of the lowest incomes in terms of age patterns, a relatively clear picture emerges. A recurring finding in the report is that the increase in income inequality during the pandemic is mainly due to a significant drop in income at the lower end of the distribution. Within this part of the distribution, we find that labor income fell in all age groups (but possibly most among those aged over 50), that unemployment increased in all age groups (but clearly most among the youngest) and that losses from self-employment have contributed to the drop in income (but the losses are limited to the 50-64 age group).

8 The government corona policy and its distributional effects

A highly visible and controversial aspect of the coronavirus pandemic was the political response. Questions about how to deal with the infection and the role of national governments were discussed in every country in the world, and Sweden was no exception. Uncertainty was high during the initial phase of the pandemic and this shaped the coronavirus policy in all countries, including Sweden.

The Swedish policy measures soon came to occupy a special position in the global policy discussion. What came to be known by some as "the Swedish experiment" involved a policy that included relatively mild restrictions and rules on social contact and mouthguards, and relatively restrained testing activity. The Swedish government consistently relied on its responsible authority, the Public Health Agency of Sweden, for the epidemiological part of the coronavirus policy, particularly the design of the restrictions. However, the Swedish government also stressed the importance of maintaining economic activity so as not to undermine the resources needed to fight the pandemic and support vulnerable groups.[44]

Data

This chapter contains an analysis of certain aspects of the Government's corona policy based on two of the largest measures in budgetary terms: short-term wage allowance and reorientation support. Using register data on which companies and wage earners have received support, it is possible to assess the impact of the support on income and income distribution through policy simulations.

Our analysis is based on official register data from the relevant authorities and is therefore very precise and comprehensive. However, the data does not cover the entire period of the payment of the aid, as we have not had access to data for the entire period. This means that the analysis ends in 2020 and is thus not complete in terms of the full scope of the aid.

[44] See the Corona Commission's report (SOU 2022:10) and Ekholm et al. (2022) for more in-depth discussions on the design of the corona policy and the discussions surrounding it.

Summary of the chapter's findings

The results in this chapter show that the support measures clearly mitigated the negative income effects of the crisis on household wage income during the early part of the pandemic. This dampening effect was mainly driven by short-term wage allowance. However, the dampening impact of the policy gradually diminished and was relatively marginal in the latter part of 2020.

8.1 The short-term wage allowance and the reorientation support

In 2020 and 2021, the Swedish government launched a series of corona measures to support employees and firms that were negatively affected by the pandemic. The two single largest policy packages were short-term wage allowance and reorientation support. The short-term wage allowance package amounted to SEK 40 billion and the reorientation support to SEK 17 billion during the financial year 2020-2021 -and constituted about a quarter of the Government's total budget for corona support.[45] The total budgeted government corona support amounted to SEK 389 billion (SOU 2022:10).

The government also took a number of other policy measures, the most important of which was the increase in central government contributions to municipalities whose social protection expenditure was particularly high during the pandemic. Other measures included reductions in payroll taxes, state support for firms' short-term sick-leave costs in the form of sick pay, and more generous reimbursements for health insurance and parental leave.

In comparison with other countries, Swedish fiscal support in response to the COVID-19 pandemic appears to have been relatively limited in relation to national income. According to a comparison by the International Monetary Fund (IMF 2021), Sweden's spending was about half of the average support in rich countries.

Our analyses of the distributional effects of the Government's short-term wage allowance and reorientation support are based on simulations of counterfactual income outcomes as they would have been if no allowance had been paid. Table 8.1 first shows how the short-term wage allowance was distributed. The subsidy was targeted at employees and allowed them to reduce their working hours by up to 80% without losing more than 12% of their wages. While employers pay for the actual working time (plus a small additional fee), the state supplements the salary to almost the full amount.

[45] For a detailed presentation and analysis of short-term wage allowance, see SOU 2022:30. It should be noted that the Government's original commitments were significantly higher: SEK 50 billion for short-term wage allowance and SEK 39 billion for reorientation support.

Table 8.1 **Table 8.1 Support rules for short-term wage allowance in 2020**

Level	Reduction of working time	Costs		
		Employee (reduced salary)	Companies (higher wage costs)	State (short-term wage allowance)
1	20%	4%	1%	15%
2	40%	6%	4%	30%
3	60%	7,5%	7,5%	45%
4	80%	12%	8%	60%

Note: The table shows the eligibility rules for short-term benefits in 2020 and how the costs are divided between workers, employers and the state. The highest level of support (80%) was only available between May and June 2020.

The reorientation support was paid directly to firms that had experienced a drop in sales during the pandemic. Although it was distributed to firms and not directly to employees, our analysis assumes that the support will ultimately be used in part to pay wages to employees. Thus, the subsidy is shared between owners and employees and we assume that this is done with a distribution of the factor shares so that 70% goes to the labor force and 30% to the owners of capital.[46] In the data, monthly incomes are observed where both short-term wage allowance and reorientation support are included and the policy simulations consist of calculating counterfactual monthly incomes where the support has been excluded under different assumptions. The methodology of the policy simulations is described in the next sub-section.

8.2 The policy simulations

In the case of short-term wage allowance, as mentioned above, we have the exact amounts per employee per month, while we only have information on which companies have received the reorientation support and when they received it. In practice, our 70/30 assumption about the reorientation support means that we assume that observed monthly income among employees in companies that have received reorientation support contains a total of 70 percent of the reorientation support the company has received in a given month. We further assume that the reorientation support has been distributed to each worker in proportion to their reported individual wage income. The reason is that high earners may have higher bargaining power vis-à-vis the employer. At the end of the section, we perform a robustness

[46] A capital-labor split of 30-70 is a common assumption in the macro literature (Rognlie 2015), but at the firm level this split can vary considerably.

check where we instead assume that the reorientation support in the observed data has been distributed equally among all employees in the firm.

Register data on the amount of support at the individual and company level is obtained from registers kept by the responsible authorities, which are the Swedish Agency for Economic and Regional Growth for short-term wage allowance and the Swedish Tax Agency for conversion support. Information on short-term wage allowance is also available from the Swedish Tax Agency. In this ESO report, we do not have this information available as microdata because it originally comes from the Swedish Agency for Economic and Regional Growth. For this reason, the policy simulations reported below are based on results previously reported in Angelov and Waldenström (2023b). Observing the exact amounts distributed gives the analysis a unique degree of accuracy in estimating the distributional effects of the more significant short-term wage allowance. The results are based on data on short-term benefits paid during April-November 2020 and the reorientation support April-June 2020.

The income data in the registers include both short-term wage allowance and, according to our assumption, 70 percent of the reorientation support. We estimate the distributional effects of the two support measures in two *counterfactual simulations* where we subtract the observed support money from the observed income.

In policy simulation 1 (PS1), "reduced working hours, maintained employment", we allow each employee to keep his/her job but deduct the individually observed short-term subsidy or the estimated transition subsidy from the employee's wage and then recalculate the income distribution excluding the subsidy. This is based on the implicit (and reasonable) assumption that only working hours, and not the nominal wage, can change in the short run.

Instead, in Policy Simulation 2 (PS2), "maintain full-time employment, reduce employment", we allow employees to keep their wages but reduce the number of employees so that the total wage costs of firms are equal to their wage costs excluding government subsidies. We do this by simulating the dismissal of workers from the bottom of the income distribution within the firm until the wage bill of the dismissed workers is equal to the aid money. [47]

As shown in the rest of the analysis, the largest unemployment shock associated with the pandemic was among workers in the lowest income quantile. It therefore seems reasonable to assume in PS2 that low-income

[47] We typically obtain integer effects for the last worker, meaning that if the worker is retained, the firm would make a loss, while firing the worker would result in a net surplus. In these cases, we choose to let the worker keep the job and the firm make a loss. Although this is not an equilibrium for the firm, it may actually be optimal for the firm to retain the worker if one also considers redundancy costs and expectations of a recovery in the not too distant future.

earners in firms receiving reorientation support would have been hit hardest in the absence of the assistance. This reasoning is also in line with the established "last in-first out" rule in the Swedish labor market, which is regulated by the Employment Protection Act (LAS; SFS 1982:80). On average, we can expect those who are hired last to be younger and earn less. In addition, note that there is likely to be a high concentration of part-time workers among low-income workers. Part-time workers would be easier to fire in a crisis. However, our register data lacks information on both working hours and employment contracts, so we cannot comment in more detail on these issues.

An interesting dimension of our policy analysis is its relevance for our understanding of how the labor market in general can cope with a crisis such as the coronavirus pandemic. The difference between our two simulated outcomes, PS1 and PS2, can be interpreted as reflecting an institutional difference in European labor markets.

The PS1 variant with "reduced working hours, maintained employment" is close to a German labor market model, Hartz IV, where a crisis is managed by allowing a reduction in working hours and wages while keeping employment intact.

The PS2 variant with "maintained full-time, reduced employment", on the other hand, is closer to a traditional Swedish labor market model, where central wage agreements prescribe full-time jobs and full-time wages as the baseline and where the unemployed are covered by the state-supported unemployment insurance. The introduction of short-term wage allowance in Sweden thus represents a departure from this traditional approach. [48]

8.3 Results from the simulations

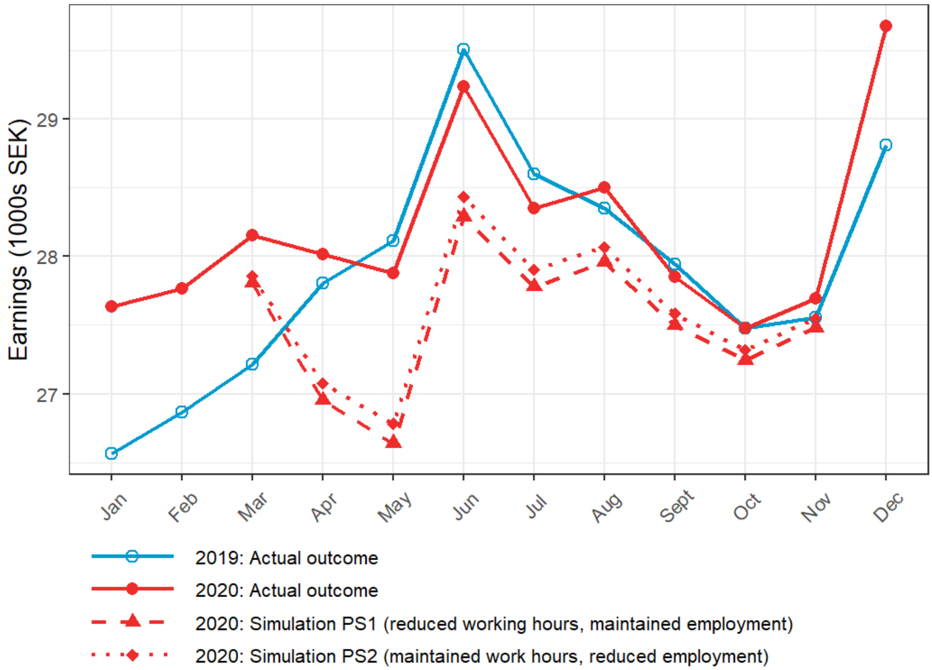
Monthly income levels

Figure 8.1 shows the average monthly pre-tax income of all employees aged 18-64 for real data (including subsidies) and for our counterfactual simulations (without subsidies). The series show that in 2020 the average wage income without support would have been around 4% lower in the period April-June, 2% lower in July-August and 1% lower in September-November. In other words, the support measures had a clear dampening effect on the negative income effects of the crisis on household wage income.

[48] During the 2008 crisis- 2009, a partial experiment with short-term wage support was carried out in the Swedish metal industry following a bilateral agreement between employers and the metalworkers' union.

However, the dampening effect of the policy gradually diminished and was relatively marginal in the latter part of 2020. [49]

Figure 8.1 Actual and simulated monthly income from employers



Source: The Swedish Tax Agency's register of annual income declarations and data on transition and short-term benefits. Own calculations carried out earlier in Angelov and Waldenström (2023b).

In an attempt to assess the relative importance of short-term and reorientation support on the level of wage earnings, Figure A.8 in Appendix A presents the policy simulation with reorientation support only. The results show that the importance of reorientation support was limited: in both PS1 and PS2, the differences between actual and counterfactual average monthly earnings are small relative to the corresponding difference in Figure 8.1.

Distributional effects

We now turn to the analysis of the distributional effects of the short-term wage allowance and the reorientation support. First, we present simulation results for average wage income in different parts of the income distribution.

[49] Please note that our support money is not the final sum for all support due to significant delays in the support programs. In May 2021, it was still possible for companies to apply for SWTA support covering December 2020 and RS support covering July-December 2020.

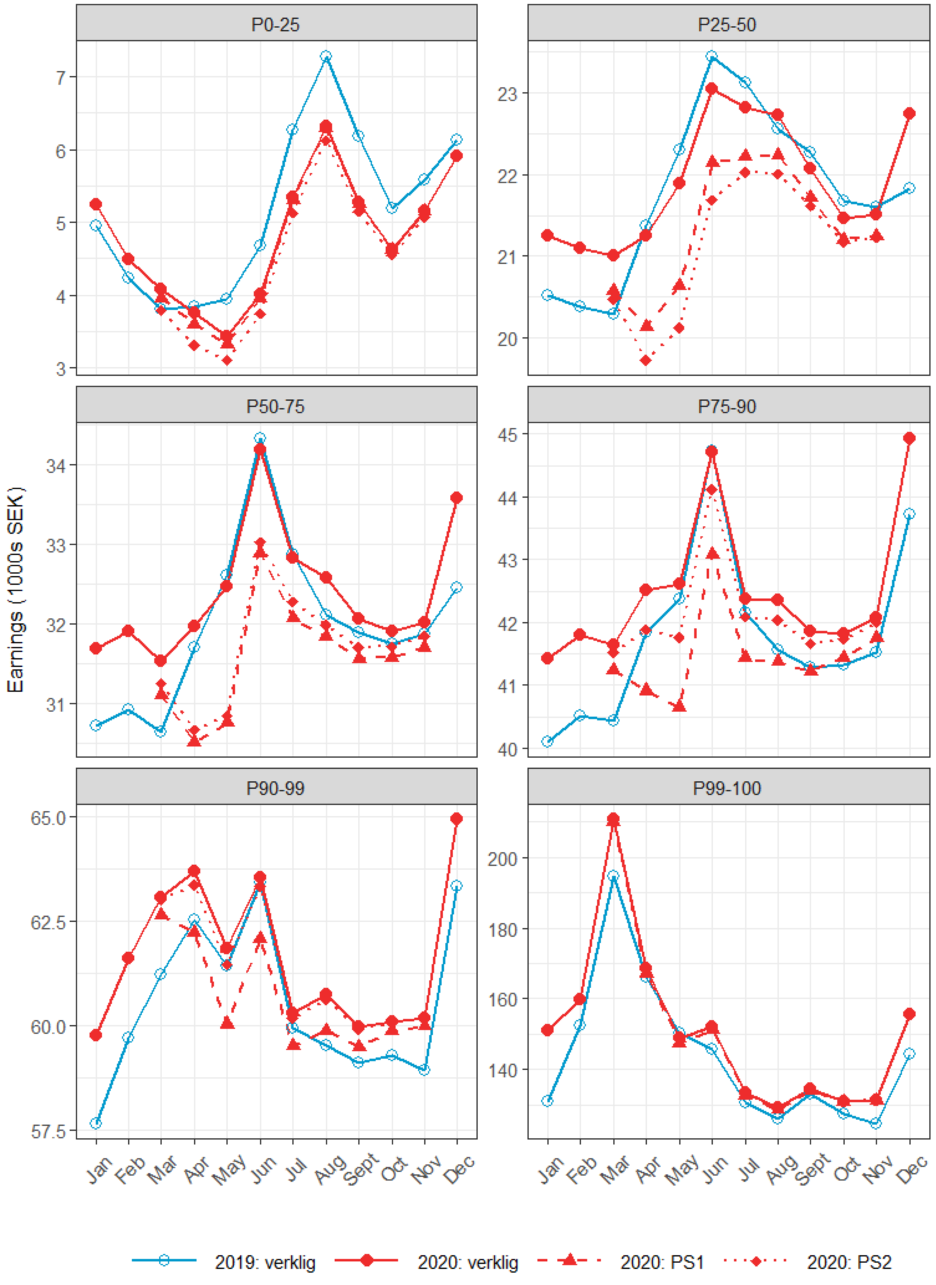
We then show how the Gini coefficient and the income shares of different income groups develop in the different scenarios.

Figure 8.2 shows how wage incomes in different percentile groups develop in the two counterfactual scenarios when the support money is withdrawn. In the PS1 scenario, “reduced working hours, maintained employment”, low-income earners are relatively little affected, while middle-income earners in the second, third and fourth quartile income groups see their incomes fall by 2-6 percent. For high-income earners, the effect of removing the support money is very small.

In the PS2 scenario, “maintained working hours, reduced employment”, the simulated effects of the subsidies are differently distributed compared to PS1 in all groups except P50-75. The lowest quartile group would have suffered a monthly income reduction of 2-12% if the short-term and conversion subsidies disappeared, which is a much larger drop in income than in PS1, but still relatively limited in nominal terms. In the second quartile group, wage income would have fallen by 1-8% without the subsidy, and in the third quartile group by 0-2%. In the top quartile group, incomes were not significantly affected.

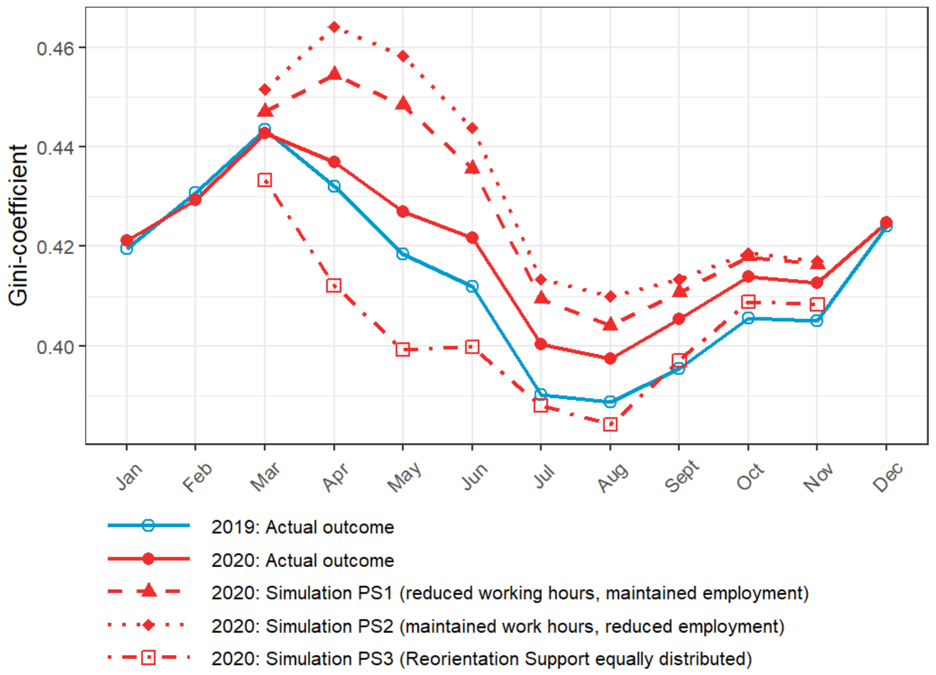
If we compare the two scenarios, an interesting picture emerges. While PS1 distributes most of the effects of the crisis in terms of lower income to the upper half of the distribution, PS2 distributes most of the effects of the crisis to the lower half of the distribution. This pattern is explained by the fact that PS1 reduces the income of all supported workers, while PS2 instead directs the shock mainly to low-paid, less experienced workers who become unemployed. The simulated income distribution effect of the government support is defined as the difference between the estimated actual and counterfactual outcomes. In the PS1 scenario, government support is directed more towards groups in the middle and upper part of the income distribution and in the PS2 scenario, funds are directed more towards the lower parts of the distribution.

Figure 8.2 Actual and simulated monthly income from employers: different percentile groups of workers



Source: The Swedish Tax Agency's register of annual income declarations and data on transition and short-term benefits. Own calculations carried out earlier in Angelov and Waldenström (2023b).

Figure 8.3 **Gini coefficient based on monthly income from employers: actual and simulated values**



Source: The Swedish Tax Agency's register of annual income declarations and data on transition and short-term benefits. Own calculations carried out earlier in Angelov and Waldenström (2023b).

The next step in the distributional analysis of the Government's corona support is to study how the usual income distribution measures, the Gini coefficient and income shares in different groups, are affected when the support is withdrawn. Figure 8.3 presents the Gini coefficient for monthly pre-tax income for adult wage earners. Both of the counterfactual scenarios previously discussed (PS1 and PS2) result in higher Gini coefficients than in the actual baseline for 2020.

Compared to the actual values for 2020, the Gini coefficient in PS1 is 3-5% higher in April-June and 1-2% higher in July-November. The Gini coefficient for PS2 is 5-6% higher than the baseline in April-June and 1-3% higher in July-November. This means that without the State aid, Sweden would have experienced an increase in income inequality in the first three months of the pandemic that would have been two to four times higher than what actually occurred if the country had applied a German labor market model where all workers keep their jobs, but with fewer hours and lower wages (PS1).

Had Sweden instead chosen a “traditional” Swedish model, where some workers keep their pre-pandemic job and salary while some would have lost their job (PS2), income inequality would have increased even more without support. In the second half of 2020, the increase in income dispersion without government support is smaller in both scenarios, but the PS2 scenario still results in higher income dispersion than the PS1 scenario.

Sensitivity analysis

We conclude this section with a sensitivity analysis of the assumed mechanism for the allocation of reorientation support under PS1. As explained at the beginning of the section, reorientation support go to the firm and not directly to the employees, as is the case with short-term benefits. In PS1, we assumed that 70% of the reorientation support is allocated to each worker in proportion to his/her individual wage. In order to check the importance of this assumption, we have simulated the monthly values of the Gini coefficient in Figure 8.3 in PS3 under the assumption that the reorientation support had instead been distributed equally among employees. Thus, unlike PS1 and PS2, PS3 does not remove any support but redistributes it.

This sensitivity analysis is also interesting in that it provides some clues as to how the Swedish income distribution would have developed if the Swedish corona support policy had been as extensive as some other countries’. The IMF (2021) provides a summary of the size of the support that suggests that the Swedish fiscal support was about half the size of the average support in other Western economies. This raises the question whether the actual amounts of support in Sweden could hypothetically have reduced income dispersion if the money had been distributed equally among all employees. Therefore, in PS3 in Figure 8.3 we have simulated the monthly values of the Gini coefficient under this particular scenario. First, we have removed the actual aid amounts received at individual level. Then we have distributed the aid money equally among all employees of the company in question. This means that the total amount of aid is the same under PS3 as was actually given in March-November 2020. This is of course an unrealistic scenario given the actual purpose of the aid money analyzed, namely to help companies and not individuals during the crisis.

It is reasonable to expect that many companies would have had to lay off staff in such a scenario, which could lead to different actual results than what we simulate. The purpose of the exercise is simply to see whether the amount of aid could hypothetically reduce the Gini coefficient if it were distributed differently. As shown by the PS3 curve in Figure 8.3, such an unrealistic policy would have reduced the Gini coefficient below 2019 values in March-August and increased it to just above in September-November. The gap between PS3 and the actual 2020 values is about the same size as the gap between PS1 and the actual 2020 values, except in March, April and May where the gap for PS3 is slightly larger.

Our conclusion from the sensitivity analysis is that the assumption that the reorientation support is distributed equally gives similar results to the basic assumption of a distribution that is proportional to each employee's relative monthly income. This conclusion is based on the observation that there is an insignificant difference in the distance between PS1 and PS3 and the actual values for 2020 in Figure 8.3.

8.4 Corona support and top incomes

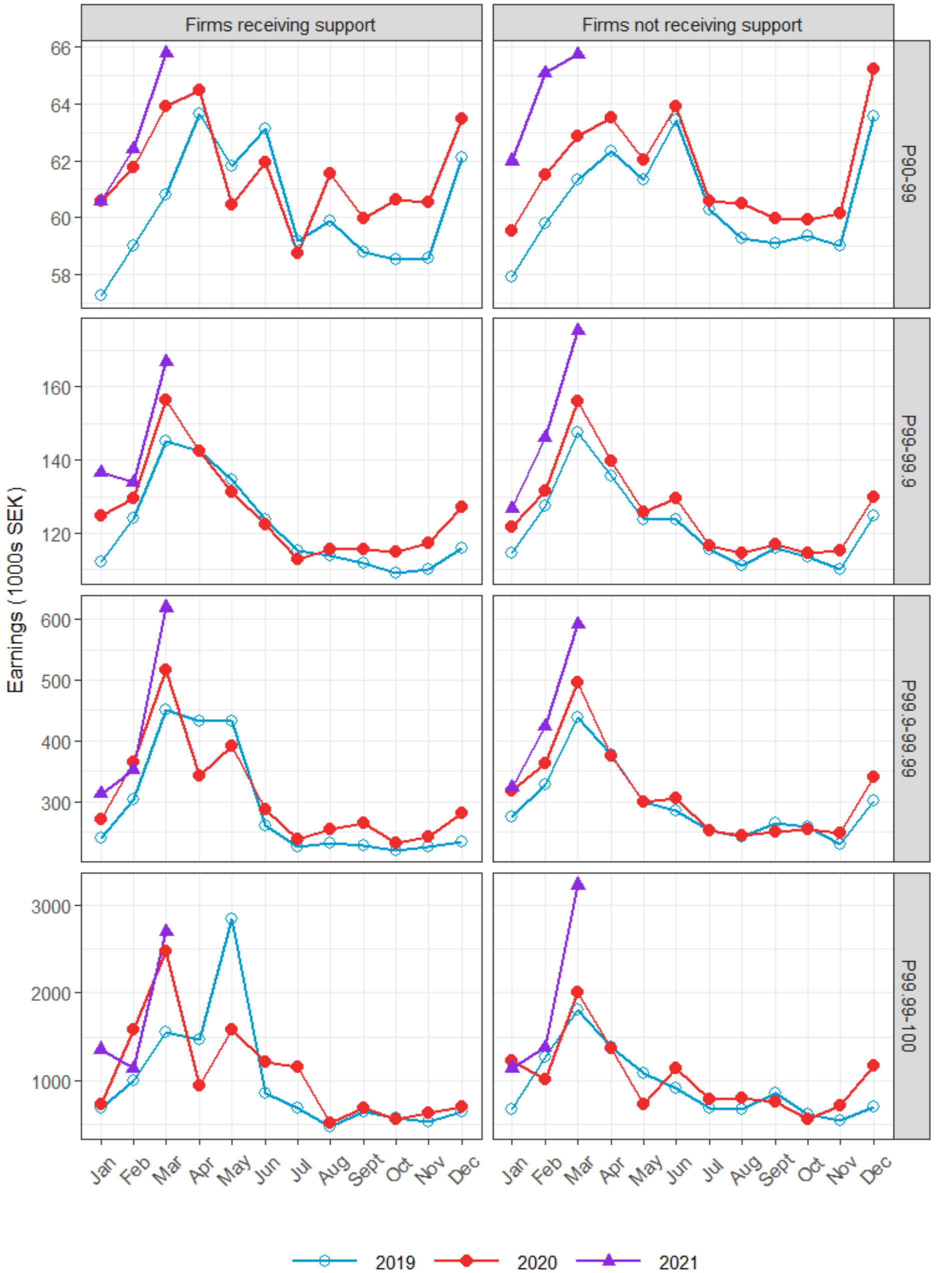
In the report, we have previously studied how the top earners in the wage income distribution were affected by the coronavirus pandemic (section 6.3). However, there is an additional dimension that that analysis did not address, namely how this group was affected by the government's support package. The link between firms and their management is often strong, and the distribution of aid money within the firms that received pandemic support could therefore be interesting to map. Of particular interest is the variable remuneration paid by firms to senior executives, which is included in the wage income we analyze.

This section examines how the monthly income of the highest paid employees evolved during the coronavirus pandemic based on a breakdown of these individuals according to whether they worked in firms that received government coronavirus support or in firms that did not. The analysis thus provides a picture of the relationship between receiving public crisis support and paying extra compensation to top executives. In this part of the report, we use results from Angelov and Waldenström (2023b) as we lack data on short-term wage allowance in the data base of this report. Since we observe earnings in March 2021, we capture variable compensation among the highest paid that is related to the pandemic year 2020.

Figure 8.4 presents the monthly incomes of the top groups in the firms that did and did not receive state aid. The results show that the pandemic hit top wage incomes harder in firms that received aid, with April-July wages at or below 2020 compared to 2019. However, it is noticeable that top salary income increased significantly in early 2021 and that compensation in March 2021 (which includes variable compensation for performance in 2020) has increased in each percentile group in both the supported and unsupported group.

The average monthly income in the group with support in March 2019, 2020 and 2021 was approximately SEK 1.6 million, SEK 2.5 million and SEK 2.7 million respectively. The corresponding figures among companies that had not received support were approximately SEK 1.8 million, SEK 2 million and SEK 3.2 million. The increase in income among top earners employed in companies without aid was thus significantly greater than in companies that had received aid. As we cannot distinguish between fixed and variable pay, we cannot explain this result in more detail.

Figure 8.4 **Monthly incomes (from employers) in the top decile by employees in companies that have and have not received short-term or conversion assistance.**



Source: The Swedish Tax Agency's register of annual income declarations and data on transition and short-term benefits. Own calculations carried out earlier in Angelov and Waldenström (2023b).

9 Summary and lessons learned

9.1 Summary

The coronavirus pandemic in 2020-22 had major consequences for the Swedish economy. Economic activity fell sharply in many sectors. This was due to people staying at home due to concerns about being infected, combined with politically decided lockdowns and restrictions on social interaction. The whole world was affected by the pandemic and the global economic downturn amplified the negative effects on the Swedish economy.

The aim of this report is to study the economic impact of the pandemic on the Swedish economy and the role of policy interventions on the effects of the pandemic. The results can be used to draw lessons on how to respond to future economic crises.

The report's empirical analyses are based on the Swedish Tax Agency's registers, which are an underutilized data source in this context. There are several advantages to using the Swedish Tax Agency's registers to measure economic activity in the private sector. These registers are collected continuously, often with a high time frequency, for all individuals and firms in the economy. This means that outcomes are measured in almost real time. In other statistics on real economic outcomes, the time lags can be significant. GDP statistics are presented at quarterly level, while income distribution statistics are annual with a time lag of up to two years. In addition, the the Swedish Tax Agency's data have a fairly high measurement precision as they are based solely on actual market outcomes in the private sector. Many of the official statistics on economic output combine market-based observation data from the private sector with data from the public sector, where output cannot be measured directly because it is not sold in a market but is instead estimated from model calculations or observed costs.

We measure the impact of the pandemic on firms' economic activity in terms of their sales and various forms of tax payments. We study employees' income on a monthly and annual basis. In both cases, we measure pandemic effects on both the level and distribution of these outcomes. The methodology for measuring the effects of the pandemic is based on the exploitation of both inter- and intra-year variation and regional differences.

The main results are as follows. We measure a large negative effect of the pandemic on firm sales, -6.1 percent, and on output VAT, -5.5 percent. This decline in activity is one of the most severe economic recessions Sweden has experienced in modern times. The pandemic effect is greatest among firms registered in the municipalities where the spread of COVID-19 was greatest.

Tax revenues from several excise taxes were negatively affected by the pandemic. Manufacturing firms' deductions for energy tax on electricity decreased during much of 2020. The effect was most pronounced in the summer months (-5.1% March-May and -8.3% June-August), indicating a sharp decline in the manufacturing sector. The pandemic caused a large increase (11.4%) in alcohol tax revenues in the summer months of 2020. Based on the data provided in this report, we cannot say whether this effect reflects a general increase in alcohol consumption by the population or is due to the imposed (and in some cases self-imposed) travel restrictions. However, as data on alcohol consumption in 2020 indicate that consumption had decreased by 6% compared to 2019 (CAN, 2021), the increase in alcohol tax revenue is most likely an effect of the travel restrictions. The extra alcohol consumed in Sweden during the summer of 2020 would most likely have been consumed abroad in the absence of a pandemic.

The pandemic affected different sectors differently. We find great variation in the effects and the hotel and restaurant industry was particularly hard hit: a decrease in firm sales of around 25%, a decrease in employment of just over 10% and a decrease in wage income for people who have had income throughout the period of around 11%.

The payment of payroll taxes fell sharply, -8.2%, which is more than the decline in firm sales due to the pandemic. Part of this decrease is due to the fact that less work was done during the pandemic crisis. However, some of it is due to the government's decision to reduce social security contributions, which are a part of the payroll tax, in 2020 in order to reduce the tax burden on firms. We also document a sharp increase in sick pay paid (67.7 percent). Although this effect is partly due to increased sickness rates during the pandemic, our assessment is that it was also affected by changes in the incentives in the health insurance system when the government decided that the state took over parts of the companies' sick pay costs and the removal of the qualifying period deduction for individuals.

In the first year of the pandemic, employees' labor income fell by 4-5% overall. The impact is significant, but not extreme compared to previous economic crises or other countries' downturns. The government support measures (short-term wage allowance and reorientation support) helped to contain the reduction in income for employees. Our policy simulations show that the fall in income would have been almost twice as large during the initial phase of the pandemic (March-May 2020) without the short-term wage allowance and the reorientation support. This result is mainly driven by the short-term wage allowance.

Individuals at the lower end of the income distribution were hit harder by the pandemic. Probably the most important explanation for the increase in income inequality is increased unemployment among low-paid part-time workers in the private sector. The labor income of middle and high earners did not change much. Nevertheless, the overall distributional effects are relatively small. The differences in pre-tax labor income among employees increased slightly during the pandemic: the Gini coefficient rose by a moderate one to two percent.

Unemployment increased during the pandemic. The report uses individuals' zero income during a certain period as a measure of unemployment, which is a flawed measure but still useful for our purposes. The results show that the pandemic crisis led to an increase in unemployment in the Swedish labor market, and that this increase mainly affected low-income earners, especially part-time workers, with incomes in the bottom income quartile.

The government's support measures can be studied in register data, and our analyses focus on the effect of the short-term wage allowance and the reorientation support to companies and employees. In counterfactual simulation calculations, we show that the increase in income dispersion during the pandemic would have been two to four times larger than what actually occurred without these two support measures. We also find that without the government support, unemployment would have increased even more, especially in the lowest income quartile group. However, this effect is still relatively small compared to the observed unemployment effect of the pandemic. The government's corona policy thus seems to have mitigated the distributional effects of the pandemic on the labor market. Our analyses of annual incomes cannot identify the effects of the coronavirus pandemic as clearly, but they still show a similar increase in pre-tax income inequality. [50]

9.2 Lessons for policy and statistics collection

The report's analysis and findings point to a number of lessons regarding economic policy and the collection of economic data. These lessons may be important for Sweden's ability to respond to future crises.

[50] Our results on increased income inequality during the pandemic differ somewhat from other studies in other countries. One explanation is that these other studies study household disposable income while we study pre-tax income. Another explanation is that the governments of the other countries studied have considerably more extensive economic support measures and that these have been targeted at low-income earners to a greater extent than in Sweden. According to the IMF (2021), the fiscal stimulus with direct budgetary impact in 2020- 2021 was just over four per cent in Sweden and around ten per cent on average in advanced economies. For previous analyses of the distributional effects of the pandemic, see, for example, Blundell et al. (2020), O'Donoghue et al. (2020), Almeida et al. (2021), Clark et al. (2021) and Stantcheva (2022).

Labor market:

1. *The Swedish model's traditional focus on the right to full-time employment, and thus the lack of flexibility in working hours, leads to a greater increase in income inequality during economic crises than a model with the possibility of reducing working hours*. Our observations of wage income developments during the coronavirus pandemic, combined with simulations of different policy scenarios, suggest that a more flexible labor market model with reduced working hours and labor income in times of economic downturn mitigates the effect of the downturn on income dispersion. According to our results, a traditional "Swedish model", where employees' right to full-time employment is given priority with the risk of increased unemployment in times of economic downturn, leads to greater income dispersion than a more modern "German model", where working time flexibility with maintained employment is rewarded.

Government crisis support policy:

2. *Short-term wage allowance can be a useful crisis measure, but should not be extended to deal with normal economic downturns*. The short-term wage allowance is an aid to prevent companies from letting workers off during crises. In a labor market where companies can easily reduce the number of hours worked as a response to an economic downturn, a government short-term wage allowance would not add anything. However, in a labor market where the norm is been full-time employment, even in times of crisis, and where a severe economic downturn instead means increased unemployment, a short-term wage allowance could be a model for bridging the effects of the crisis. Our analysis shows that the support had a large impact on employees' wage income, especially among employees who can be assumed to have full-time employment and with incomes in the top three quarters of the distribution (with the exception of those with top incomes). While we lack data on disposable income, it is reasonable to assume that the short-term wage allowance had a similar, yet much smaller impact in terms of disposable income. It is important to point out that our analyses are short-term and we cannot comment on the possible impact of short-term wage allowance after the more acute crisis of the pandemic.

3. *The reorientation support is less successful in that* it had little impact on the income of firms and employees and also on the evolution of income distribution during the pandemic. The purpose of the reorientation support was twofold: to mitigate the economic consequences of the spread of COVID-19 and to enable firms to overcome the acute crisis and to facilitate their adjustment and adaptation (Prop. 2019/20:181, p. 26).

It should be noted that the policy simulations in the report should not be regarded as a proper evaluation of the reorientation support and only relate to the first sub-purpose of the support. It is therefore not possible to comment on possible effects on the ability of companies to cope with the acute crisis or to adapt.

4. *Implicit short-term wage allowance in the public sector should be analyzed*. During the pandemic, not only the private sector was affected, but also public sector activities. The downturn in the private sector led to an increase in unemployment. In the public sector, employment or wage income was not significantly affected during the pandemic, although the decline in demand affected some of its activities (while some activities in the public sector, such as parts of health care, experienced a sharp increase in demand). Maintained employment and wage income in those parts of the public sector that faced reduced demand during the pandemic can be considered as an indirect short-term wage allowance, which has not been discussed in the context of the coronavirus pandemic. We therefore raise the question of how these differences in direct and indirect support policies during crisis periods to the private and public sectors affect the economy in the short and longer term. In a country like Sweden, where the public sector is relatively large and some activities are carried out in both the public and private sectors, this question should be of particular importance. Since public sector output is also largely based on the size of wage income (in the private sector, output is measured by how much is sold in a market), reductions in public sector output are not captured in an economic downturn. We therefore also wonder whether the analysis of state aid measures would be affected by taking into account payments to both the private and public sectors.

Lessons learned on economic data collection:

5. *Increase the use of real-time economic data, particularly with regard to the Swedish Tax Agency's registers, which should be integrated into ongoing analyses of the economic situation, income distribution and the effects of stabilization policies*. Real-time outcomes in the private sector can be observed in the Swedish Tax Agency's register data on companies' tax payments and wage payments. By actively including these data in official statistics, the time lag in both business cycle analysis and income distribution analysis could be drastically reduced. Monthly data from employer declarations are already used in Statistics Sweden's register of the population's labor market status (BAS), which is currently updated quarterly and is planned to become part of Sweden's official statistics. In

principle, all the monthly registers used in this report can be used in a similar way, and on a monthly rather than quarterly basis.

6. *Introduce reporting of working time and type of employment in monthly employer declarations*. There are no comprehensive data on individuals' working hours in Swedish registers. This makes it difficult to analyze how economic fluctuations and labor market reforms affect labor income and its distribution between different groups of employees. Monthly data should therefore be supplemented with information on the percentage of full-time work, following an impact assessment of the administrative burden this may cause for employers.
7. *Introduce reporting of sick pay at the individual level*. Sick pay for employees is currently reported in a lump sum at company level in the monthly data from employer declarations, not specified per employee. This makes it difficult to analyze how economic fluctuations and political reforms affect short-term sickness absence.

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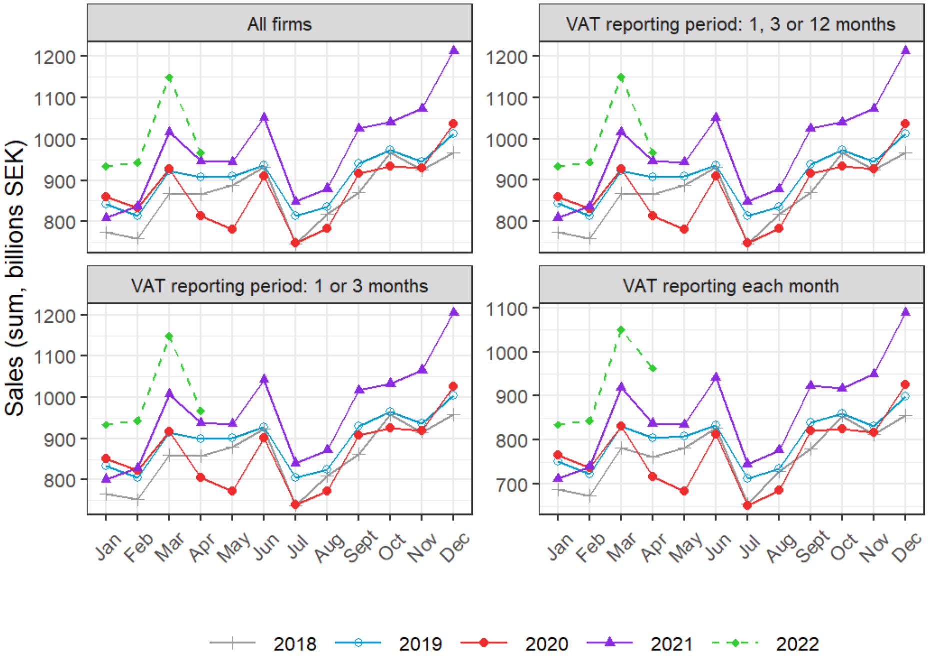
Appendix A Figures

Figure A.1 Turnover of Swedish enterprises per month for different VAT accounting periods

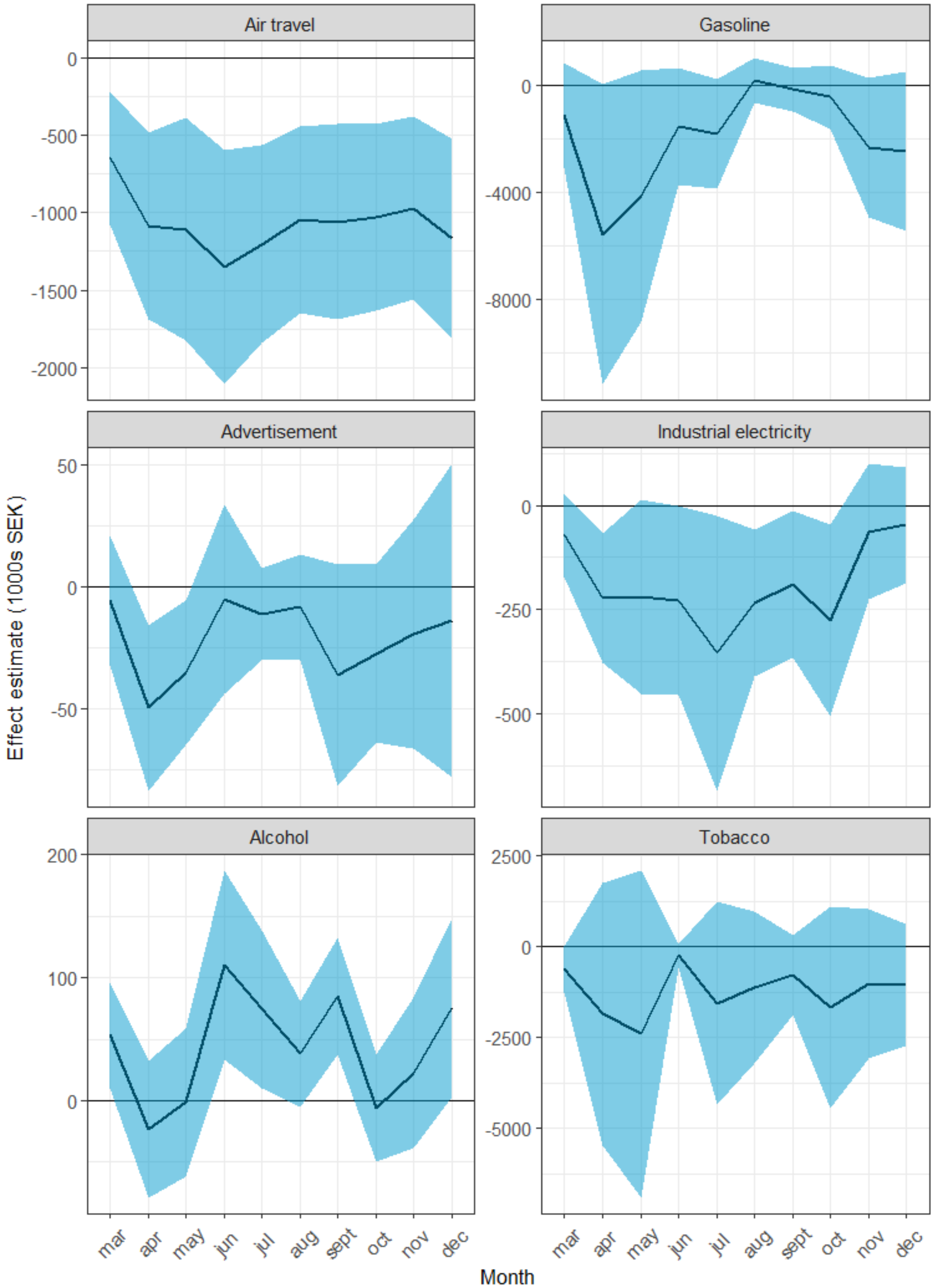


Source: The Swedish Tax Agency’s register of VAT returns, own calculations.

Figure A.2 Monthly impact of the pandemic on firm sales and VAT

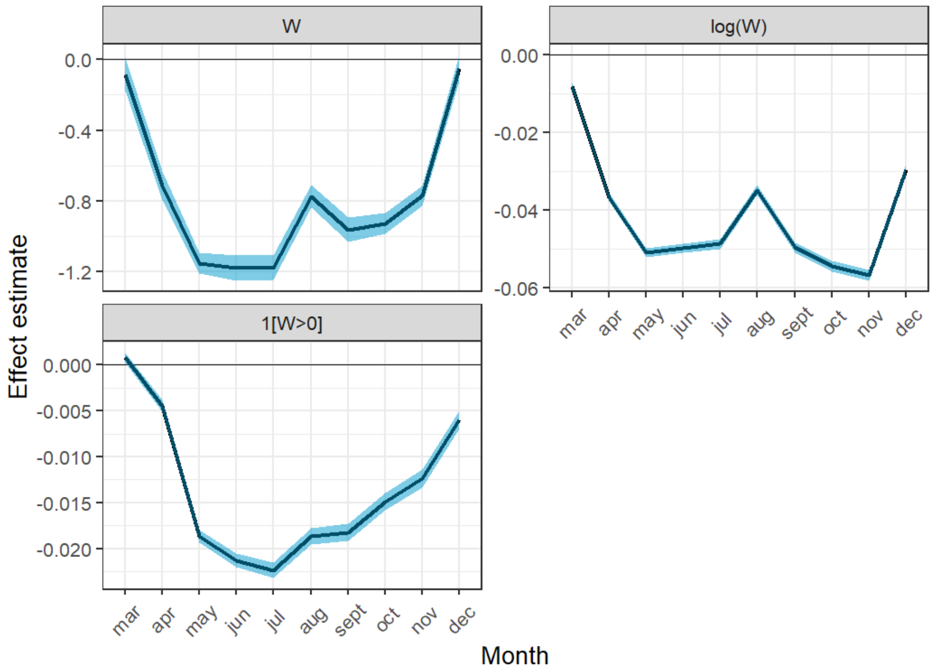
Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Figure A.3 Monthly impact of the pandemic on receipts from various excise taxes



Source: The Swedish Tax Agency's register of VAT returns, own calculations.

Figure A.4 Monthly impact of the pandemic on monthly income, the logarithm of monthly income and the incidence of non-zero monthly income.

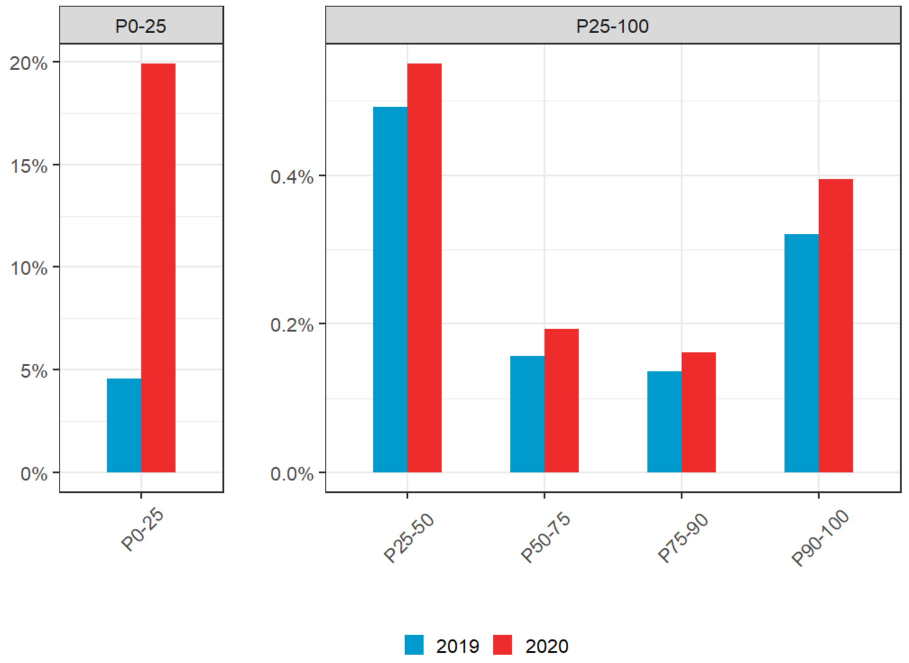


Source: The Swedish Tax Agency's register of employer declarations, own calculations.

Figure A. 5Monthly impact of the pandemic on employers' contributions paid, preliminary taxes and sick pay paid out

Source: The Swedish Tax Agency's register of employer declarations, own calculations.

Figure A.6 Zero income from employers as a measure of unemployment: private sector

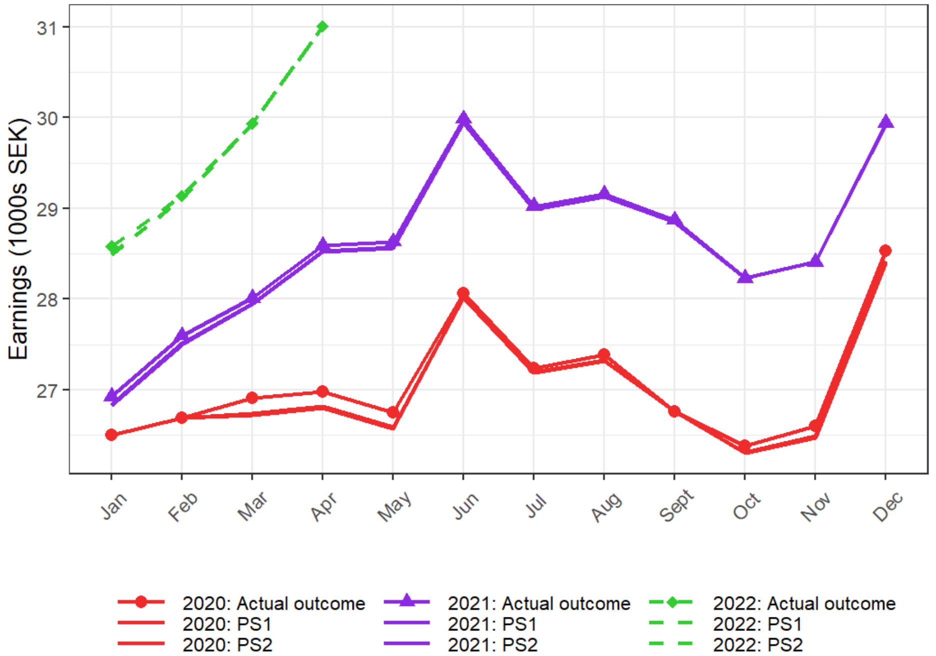


Note: We measure unemployment from the Swedish Tax Agency's monthly data from employers by using individuals' zero income in a given period. A worker who in a given year had income from a private employer in January-February but had no income in all months between March and December is defined here as unemployed.

Figure 9A.7 Zero income from employers as a measure of unemployment: public sector

Note: We measure unemployment based on monthly data from employers by using individuals' zero income during a given period. A worker who in a given year had income from a public employer in January-February but had no income in all months between March and December is defined here as unemployed.

Figure A.8 Actual and simulated monthly incomes from employers: simulation based on transition benefits only



Source: The Swedish Tax Agency's register of employer declarations and data on reorientation support, own calculations. "Actual" shows outcomes based on observed income. "PS1" stands for simulation analysis where we assumed reduced working hours but maintained employment. "PS2" stands for simulation analysis where we assumed reduced employment but maintained working hours. See chapter 8 for details.

Appendix B Regression results: VAT, firm sales, and excise duties

This appendix presents regression results related to section 4.1. The analysis starts with an estimation of a version of equation 3.1 on monthly data and with firm fixed effects. The firm fixed effects are used to hold constant the effects of unobserved firm-specific factors that could affect sales or VAT payments but are not of interest to us in this context. The empirical specification is as follows:

(B.1) $$Y_{imt} = \delta_0 + \theta_1 D_t + \theta_2 S_m + \theta_3 D_t S_m + \delta_i + u_{imt}$$

where $m = 1,2, \ldots, 12$ stands for month, $S_m = \mathbf{1}[m \geq 3]$, δ_i is a corporate fix effect and $D_t = 1[t = 2020]$. As shown in equation 3.2 in section 3.2, the effect is identified at the group level and the treatment (the pandemic) is also at the group level. To a large extent, treated firms (in 2020) act as their own controls (in 2019) as there is a large overlap of the population in the two years. The firm-specific fixed effects are therefore not needed to obtain a consistent estimate, but we include them to increase precision. It is reasonable to assume that the pandemic affected different industries to varying degrees, which means that the error terms may correlate within industries. In the statistical analysis, we therefore use standard errors that we have clustered at the industry level. Data for VAT and sales are expressed in thousands of SEK per month.

We start with a first look at the impact of the pandemic on firms' sales and VAT in the first column of Table B.1. θ_3 from equation B.1 and shows an effect of SEK -214,410 that is statistically significant at the one percent level. Since it is quite common for firms to declare zero sales in a given month, it is not possible to log transform the data to facilitate interpretation and comparison. Instead, we provide an approximate interpretation of the percentage effect by relating the effect to the mean value of the outcome variable during the period March-December 2019 (the row showing the mean value, SEK 3,356,710).[51] This suggests a covid effect on the company's sales of about - 6.4 percent. The effect on VAT is negative, significant at the five percent level, but smaller in size, around -3.4 percent.

Table B.1 A first look at the effect estimates, placebo, and choice of specification

				Outcome variable				
	Turnover	**Moms**	**Turnover**	**Moms**	**Turnover**	**Moms**	**Turnover**	**Moms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Covid effect	-214.41**	-16.16*	-94.49	-9.10	34.58	-1.60	0.47	-0.09
	(73.64)	(6.59)	(56.02)	(6.57)	(36.74)	(3.77)	(1.64)	(0.23)
2020	24.71	3.32	225.73**	23.09**	176.51***	25.67***	2.21	0.60**
	(54.04)	(6.37)	(73.05)	(7.88)	(44.88)	(7.47)	(1.45)	(0.20)
Mar-Dec	316.01**	50.59**	421.19***	60.92***	394.08***	63.49***	50.36***	9.27***
	(96.31)	(15.86)	(99.45)	(15.10)	(92.35)	(16.79)	(5.81)	(0.88)
Mar-Dec-19	3356.71	478.1	3231.21	463.79	3019.8	439.47	236.97	44.38
Effect (%)	-6.39	-3.38	-2.92	-1.96	1.14	-0.36	0.2	-0.2
N obs.	5 834 028	5 834 028	5 832 090	5 832 090	5 822 484	5 822 484	5 196 036	5 196 036

[51] An alternative would be to relate the effect to the mean value in January and February 2019. This would have been equivalent to relating the effect to the intercept in a model without firm fixed effects. In an earlier version of the paper, we used Jan-Feb as the reference point, which resulted in larger (in order of magnitude) effects for VAT and business sales, some differences with mixed signs for excise taxes, and a lower effect size for sick leave. Following a thoughtful comment from a referee, we changed the reference point to March-December because the within-year variation in the outcome variables is generally larger than the between-year variation. Therefore, it is more reasonable to relate the effect measured in March-December 2020 to the level in March-December 2019 than to compare with January-December 2019.

					Outcome variable			
	Turnover	**Moms**	**Turnover**	**Moms**	**Turnover**	**Moms**	**Turnover**	**Moms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Adj. R^2	0.91	0.94	0.91	0.94	0.92	0.94	0.96	0.79

Not:*p<0.05; **p<0.01; ***p<0.001

One possible source of bias in our estimated results, which we highlighted in the methodological discussion in Section 3.2, is that an economic slowdown could have occurred in 2020 even if the pandemic had not occurred. In that case, both our observed inter- and intra-year variations would not be fully representative as a basis for the econometric estimation.

One way to examine whether this is the case, and whether it creates such problems for our conclusions, is to conduct a so-called placebo analysis. A placebo analysis in this context means that we estimate equation B.1 under the (incorrect) assumption that the pandemic occurred already in 2019. We know a priori that we should not expect a pandemic effect in 2019 because 2019 had not been affected by a pandemic. This placebo analysis can be seen as an informal way to test the assumption of parallel trends. For this purpose, we use VAT and sales data for 2018 and 2019. The third column of Table B.1 shows the placebo effect estimated using the specification equation 4.1 but on data covering 2018 and 2019 and with the treatment group variable redefined as follows $D_t = 1[t = 2019]$. The point estimate for the placebo effect is about -94 490 SEK, i.e. of the same sign and about half as large as the effect estimate. The effect estimate is not statistically significant at the usual 5 percent level, but we are still not convinced that this placebo analysis provides a green light for our main analysis because the point estimate is quite significant after all.

To examine the viability of our model based on an additional placebo analysis, we move the analysis back one more year and estimate a placebo effect using data covering 2017 and 2018 by $D_t = 1[t = 2018]$. Now, the point estimate of the placebo effect is positive and lower in magnitude (around SEK 34,580) and far from significant at any reasonable level of significance. This result could be interpreted to mean that the effect should be estimated on data from 2020 and 2018 (or even 2017), but this is not a satisfactory strategy for at least two reasons. First, it is more difficult to argue that the equivalent of the assumption in equation 3.3 in section 3.2 is met, i.e. that the within-year variation is the same even if we go back another year. In addition to the pandemic, more changes in the economy have undoubtedly occurred between 2018 and 2020 than between 2019 and 2020. Second, the use of another year as a reference does not give any indication of the reason for the relatively large placebo effect with 2019 as the treatment year.

The results of the placebo analysis can be interpreted as indicating that 2019 stands out in some way compared to 2018 and 2017. When studying firm sales, it is not unreasonable to think that there are cases of monthly outliers, for example when a single firm reports sales as a result of an unusually large order, which may distort the results. To test this conjecture, in specification 7 of Table B.1 we have again estimated a placebo effect on data covering 2018 and 2019 with 2019 as the treatment year, but this time on a sample where outliers have been removed on a monthly basis. In a given month, an outlier is defined as a value above $Q_3 + 3(Q_3 - Q_1)$, where Q_1 and Q_3 are the first and third quartiles respectively.[52] It is more common to see a factor of 1.5 rather than 3, but we have chosen the latter to keep a larger proportion of the population in the sample. About 11% of the observations disappear when we remove outliers.

Removing outliers in this way appears to make the estimates of the placebo effect insignificant, both in economic and statistical terms. The point estimate for sales converted to a percentage effect dramatically decreases in size and changes sign (from -3.05% for the full sample to 0.2% when the outliers are removed). We consider this result to be more convincing than the full-sample placebo analysis, assuming that 2018 is the treatment year (specification 5). Thus, on data where the outliers have been removed, the placebo test provides informal support for the assumption of parallel trends. Although we have not mentioned VAT as an outcome variable, it is clear from the results in Table B.1 that outlier removal is also needed for VAT. Consequently, we remove outliers for both VAT and sales in the subsequent regression analysis.

Table B.2 presents the results of the estimation of equation B.1 on monthly sales and VAT data in 2019 and 2020 where we have removed so-called outliers, i.e. observations with strongly deviating values, using the interquartile range procedure described above. In order for the sample to be the same regardless of the outcome variable, we have removed outliers for both sales and VAT regardless of the outcome variable. This is also reasonable because sales is the tax base for VAT and if it were not for the different VAT rate levels for different goods (6 percent, 12 percent and 25 percent), the results for sales and VAT would be virtually indistinguishable. For company sales, the effect is about SEK -15 100, or about -6.15 percent, and the corresponding figure for VAT is SEK -2 410 (-5.46 percent). Both estimates are significant at the one percent level. In Table B.4 at the end of the appendix, we have made a rough calculation of the effect of the pandemic on commonly used monthly macro data on industrial and service production in Sweden. In the figures for the industrial and services production indices,

[52] We get similar results when we remove outliers which are defined as any value above the 95th percentile of the company's sales distribution in a given month.

the effects on sales and VAT have the same negative sign and are very close to the estimates in columns (1) and (2) of Table B.2 (5-6%).

The last two columns of Table B.2 show how the effect varies with the local infection rate. This is done by interacting all categorical variables in the right-hand side of equation B.1 with the covid infection rate in each firm's municipality of registration. The infection rate is calculated as follows. First, we retrieved weekly COVID-19 infection rates at municipality level for the period March-December 2020 from the Public Health Agency.[53] Some weeks run over two separate months. The month affiliation for these weeks is determined on the Thursday of each week, i.e. the month falling on Thursday defines the month to which the entire week's infection data belongs. This is only relevant for the first week of March and the last week of December 2020, as we sum the total number of cases for each municipality from March to December. This is in line with the definition of S_m in Equation B.1. To obtain data per individual, we then divide the total number of cases by the population of each municipality on December 31, 2020 using data from Statistics Sweden.[54] Finally, we divide the companies into four quartile groups, $QG_1 - QG_4$, with respect to the variable

C_k = *the total number of COVID-19 cases from March to December 2020 in municipality k per inhabitant*.

Enterprises are ranked according to the infection incidence of their municipality of registration, where QG_1 are municipalities with C_k below the first quartile, QG_2 with C_k between the first and second quartile, and so on.

The results from the interaction with dummy variables corresponding to the $QG_1 - QG_4$ are presented in the last two columns of Table B.2. The group of firms registered in municipalities with the highest cumulative infection rate (i.e. those in QG_4) is chosen as the reference. If guess (ii) above is correct, we expect that a negative effect i QG_4 is higher in magnitude than in the other groups, which have lower infection rates. For sales, the effect estimate is for QG_4 SEK -19,210 (-7.82 percent) and statistically significant at the one percent level.

[53] https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/Covid-19/statistik-och-analyser/bekraftade-fall-i-sverige/ (2023-01-07).
[54] https://scb.se/hitta-statistik/statistik-efter-amne/befolkning/befolkningens-sammansattning/befolkningsstatistik (2023-01-07).

Table B.2 Effect of the pandemic on sales and VAT

	Outcome variable			
	Turnover	**Moms**	**Turnover**	**Moms**
	(1)	**(2)**	**(3)**	**(4)**
Covid effect	-15.10**	-2.49**	-19.21**	-3.25**
	(4.67)	(0.80)	(6.05)	(0.99)
Effect × QG_3			7.05*	1.26*
			(3.30)	(0.54)
Effect × QG_2			6.79*	1.37**
			(3.11)	(0.49)
Effect × QG_1			9.00	1.51
			(5.02)	(0.92)
Year 2020	0.18	0.14	-0.86	-0.02
	(1.23)	(0.22)	(1.70)	(0.29)
March-Dec	49.50***	9.03***	45.75***	8.25***
	(6.23)	(0.89)	(5.62)	(0.79)
HQ_3			-16.47***	-3.26***
			(4.33)	(0.85)
HQ_2			-11.22***	-2.44***
			(3.17)	(0.50)
HQ_1			-38.51***	-7.88***
			(8.55)	(1.52)
Year 2020 × QG_3			3.05*	0.46
			(1.32)	(0.24)
Year 2020 × QG_2			1.96	0.28
			(1.48)	(0.24)
Year 2020 × QG_1			7.19**	1.52**
			(2.67)	(0.54)
Mar-Dec × HQ_3			7.13**	1.40**
			(2.39)	(0.47)
Mar-Dec × HQ_2			10.40***	2.10***
			(2.37)	(0.43)
Mar-Dec × HQ_1			3.10	0.91
			(3.72)	(0.70)
Average March-Dec 2019	245.59	45.62	245.59	45.62
Covid effect (%)	-6.15	-5.46	-7.82	-7.13
Effect × QG_3 (%)			2.87	2.77
Effect × QG_2 (%)			2.76	3
Effect × QG_1 (%)			3.67	3.32
Number of obs.	5 194 987	5 194 987	5 194 987	5 194 987
Adjusted R^2	0.60	0.63	0.60	0.63

*p<0.05; **p<0.01; ***p<0.001.

The positive estimate of Effect × QG_3 of SEK 7,050 (2.87%) shows that the pandemic had a lower effect on firms in municipalities with an infection rate between the median and the third quartile, compared to those in the third quartile. QG_4. The effect in QG_3 was thus -7.82 percent + 2.87 percent = -4.95 percent. *For* QG_2 the relative effect is about the same (2.76%) and in QG_1 the effect is not statistically significant but the point estimate is larger in size (3.67%). The interaction results for VAT in the last column of Table B.2 are very similar: the covid effect in QG_4 is around -7.13% and the relative effects in $QG_3 - QG_1$ are 2.77%, 3% and 3.32% respectively. As for sales, the relative effect in group QG_1 (the group with the least contagion) is not statistically significant at the 5% level.

We now turn to the link between the variation of the pandemic effect in 2020 and the intra-year variation of infection rates. It is not entirely clear what to expect: a stronger or weaker link in the latter part of 2020 compared to the initial phase of the pandemic. On the one hand, in the latter part of 2020, the general population was more informed about COVID-19 in terms of the severity of the disease (which turned out to be less severe than some of the more pessimistic assessments from spring 2020), which groups are most affected (i.e. the elderly and people with co-morbidities) and so on. All else being equal, more, and arguably more positive, information should lead to less fear of the infection and less precautionary behavior, making local infection rates less important. On the other hand, testing capacity in Sweden as well as in many other countries increased significantly in the fall of 2020, meaning that there was simply more signal for the economic actors to act on. This should imply a stronger link between the covid effect and the local infection rate. We explore this question below.

Column 3 of Table B.3 contains seasonal effect interactions with quarterly infection rate groups. The quartile groups $QG_1 - QG_4$ are calculated as previously described but now separately for the three periods (i.e. March-May, June-August and September-December). All point estimates for the interaction effects in column 3 are positive, although not all are statistically significant at the 5% level. As before, the reference quartile group QG_4 (i.e. municipalities with the highest infection rates in each period). The positive estimates of the interaction effect are thus in line with our basic hypothesis, namely that the negative pandemic effect during a given period is smaller in magnitude the lower the infection rate in the municipality during the same period.

Table B.3 Effect of the pandemic on sales and VAT: seasonality of the effect

	Outcome variable			
	Turnover	**Moms**	**Turnover**	**Moms**
	(1)	**(2)**	**(3)**	**(4)**
Covid effect March-May	-25.18***	-4.54***	-26.13***	-4.94***
	(6.09)	(1.01)	(7.82)	(1.24)
effect March-May × HQ_3			5.94*	1.30**
			(2.93)	(0.42)
effect March-May × HQ_2			2.24	0.66
			(3.39)	(0.43)
effect March-May × HQ_1			1.56	0.65
			(4.63)	(0.70)
Covid effect June-August	-13.65***	-2.23***	-16.25***	-2.84***
	(3.38)	(0.58)	(3.93)	(0.65)
effect Jun-Aug × QG_3			0.39	0.29
			(1.65)	(0.26)
effect Jun-Aug × QG_2			8.32***	1.79***
			(1.90)	(0.31)
effect Jun-Aug × QG_1			12.48***	2.68***
			(3.51)	(0.58)
Covid effect Sept-Dec	-8.13	-1.05	-13.53*	-1.85
	(4.90)	(0.88)	(5.46)	(0.97)
effect Sept-Dec × HQ_3			7.88**	1.19**
			(2.97)	(0.45)
effect Sept-Dec × HQ_2			10.50**	1.56**
			(3.71)	(0.50)
effect Sept-Dec × HQ_1			10.72*	1.56*
			(5.08)	(0.78)
Year 2020	0.45	0.18	0.53	0.21
	(1.19)	(0.22)	(1.17)	(0.21)
March-May	46.97***	9.01***	46.88***	8.99***
	(4.94)	(0.79)	(4.93)	(0.79)
Jun-Aug	31.59***	5.61***	31.50***	5.60***
	(5.65)	(0.97)	(5.67)	(0.97)

	Outcome variable			
	Turnover	**Moms**	**Turnover**	**Moms**
	(1)	**(2)**	**(3)**	**(4)**
Sept-Dec	65.07***	11.64***	65.01***	11.64***
	(9.25)	(1.20)	(9.23)	(1.20)
Average March-Dec 2019	245.59	45.62	245.59	45.62
Covid effect March-May (%)	-10.25	-9.95	-10.64	-10.82
impact March-May × HQ_3 (%)			2.42	2.85
effect March-May × HQ_2 (%)			0.91	1.45
effect March-May × HQ_1 (%)			0.64	1.42
Covid effect Jun-Aug (%)	-5.56	-4.88	-6.62	-6.23
Impact Jun-Aug × QG_3 (%)			0.16	0.64
Impact Jun-Aug × QG_2 (%)			3.39	3.92
Impact Jun-Aug × QG_1 (%)			5.08	5.88
Covid effect Sept-Dec (%)	-3.31	-2.31	-5.51	-4.05
effect Sept-Dec × HQ_3 (%)			3.21	2.61
effect Sept-Dec × HQ_2 (%)			4.27	3.43
effect Sept-Dec × HQ_1 (%)			4.36	3.42
Number of observations	5 194 987	5 194 987	5 060 347	5 060 347
Adjusted R^2	0.60	0.63	0.61	0.64

Not:*p<0.05; **p<0.01; ***p<0.001.

Table 9B.4Estimating the impact of the pandemic using monthly macro data on industrial and services output in Sweden

	Industrial production index	**Services production index**
Covid effect	-5.6	-7.7
% (Base: March-Dec 2019)	-5.0%	-6.9%
Placebo (2019 vs. 2018)	-0.8	-1.5
% (Bottom: March-Dec 2018)	-0.7%	-1.3%
Triple DD over calendar time	-4.8	-6.2
Triple-DD % (Base: March-Dec 2019)	-4.3%	-5.6%

Source: Own calculations based on monthly data from Statistics Sweden. Industrial production index refers to SNI division B-D which consists of mining and quarrying; manufacturing; electricity, gas and heat supply. The service production index refers to SNI divisions 45-63 and 68-96 which consist of service industries excluding credit institutions and insurance companies etc.

Looking separately at the results in each season, we see that the point estimates for the interaction effect during the initial stage of the pandemic are not statistically significant except for QG_3. This is perhaps expected as testing capacity was low in the spring of 2020, meaning that infection rates are likely to be underestimated. During the summer, fall and winter, the estimates are significant both economically and statistically, with the exception of the relative effect for the QG_3 during the summer months. The relative impact of the local infection rate is strongest in the latter part of the year. During September-December, we observe an impact on the company's sales in QG_4 of around -5.51%. I QG_3 the relative impact compared to QG_4 is about 3.21 percent, which means that the estimated effect of the pandemic in QG_4 during September-December is around -5.51%+3.21% ≈ -2.3%. The relative effects for QG_2 and QG_1 are slightly larger and monotonically increasing: the impact of the pandemic in the fall and winter months of 2020 was -5.51%+4.27% ≈ -1.24% for QG_2 and -5.6%+4.4% ≈-1.2% for QG_1.

We now turn to the regression results for excise taxes, also discussed in section 4.2. Table B.5 presents the estimated average pandemic effect separately for different excise taxes. The only statistically significant average effects are for air travel and industrial electricity. For air travel, the estimated effect is SEK -1 067 140 and is statistically significant at the 0.1 percent level. The point estimate for industrial electricity is SEK -190,150 or about -5.77%.

Table B.6 presents the impact of the pandemic, estimated separately for three periods in 2020: March-May, June-August and September-December.

Table B.5 Effect of the pandemic on tax revenues from excise duties

	Outcome variable					
	Flights	**Petrol**	**Advertising**	**Industrial electricity**	**alcohol**	**Tobacco**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-1 067.14***	-1 889.34	-21.55	-190.15*	42.99	-1 239.66
	(312.42)	(1 113.49)	(14.00)	(78.25)	(24.90)	(1 080.38)
Year 2020	-14.15	-11.05	-16.53*	122.37*	20.25	1 145.54
	(89.75)	(385.61)	(7.61)	(54.24)	(16.19)	(1 054.72)
March-Dec	140.22	4 682.97*	-12.23	-103.90*	127.49***	2 163.55
	(87.70)	(2 226.01)	(9.52)	(42.73)	(32.75)	(2 076.82)
Mar-Dec 2019	1 128.54	29 410.31	78.25	3 293.92	655.47	7 114.86
Covid eff. (%)	-94.56	-6.42	-27.54	-5.77	6.56	-17.42
Obs.	3 038	1 399	1 151	6 600	48 311	3 475
Adj. R^2	0.67	0.98	0.64	0.99	0.95	0.53

Not:*p<0.05; **p<0.01; ***p<0.001.

Table B.6 Pandemic impact on tax revenues from excise duties: seasonality

	Outcome variable					
	Flights	**Petrol**	**Advertising**	**Industrial electricity**	**alcohol**	**Tobacco**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect March-May	-946.15**	-3 604.61	-30.33*	-170.36*	9.83	-1 637.30
	(293.81)	(1 995.66)	(12.85)	(72.93)	(24.82)	(1 466.63)
Covid effect June-August	-1 202.02***	-1 043.88	-8.57	-272.27*	74.77**	-977.14
	(337.03)	(707.51)	(11.71)	(110.02)	(28.55)	(868.28)
Covid effect September-Dec.	-1 056.31***	-1 321.43	-24.40	-143.87	44.09	-1 134.73
	(311.12)	(865.17)	(20.39)	(73.23)	(26.77)	(954.10)
Year 2020	-13.71	-41.66	-16.65*	122.29*	20.62	1 145.31
	(89.93)	(379.85)	(7.63)	(54.23)	(16.26)	(1 054.92)
March-May	19.13	4 420.87*	-0.38	-42.22	96.60***	1 927.97
	(88.84)	(2 145.16)	(10.36)	(43.60)	(26.69)	(1 845.47)
June-August	248.63*	8 243.41*	-38.30***	-189.56***	181.12***	2 581.32
	(104.09)	(3 832.45)	(10.59)	(55.88)	(46.62)	(2 504.25)
September-December	149.96	2 285.76	-1.92	-86.42*	111.34***	2 028.46
	(83.88)	(1 159.06)	(15.34)	(43.71)	(30.41)	(1 935.45)
Average March-Dec 2019	1 128.54	29 410.31	78.25	3 293.92	655.47	7 114.86
Covid effect March-May (%)	-83.84	-12.26	-38.76	-5.17	1.5	-23.01
Covid effect June-August (%)	-106.51	-3.55	-10.95	-8.27	11.41	-13.73
Covid effect sep tember-dec. (%)	-93.6	-4.49	-31.18	-4.37	6.73	-15.95
Number of observations	3 038	1 399	1 151	6 600	48 311	3 475
Adjusted R^2	0.67	0.99	0.64	0.99	0.95	0.52

Not:*p<0.05; **p<0.01; ***p<0.001.

In Table B.7, we present placebo effect estimates estimated on data from 2018 and 2019 (as opposed to 2019 and 2020 in Table B.6), assuming that 2019 was the treatment year. It is not possible to perform the placebo test on the airline tax because it was introduced in April 2018. Out of 15 placebo effects, one turns out to be statistically significant at the five percent level (-18,410 SEK or -23.68 percent for advertising in March-May). While not an unreasonable result given the usual 5% significance level (which on average implies a false rejection of a true null out of 20 tests), the point estimate for advertising in Table B.7 has the same size and roughly the same magnitude as that in Table B.6. Therefore, our results on advertising cannot be said to have passed the placebo test. We also saw in Figure 4.3 that revenues from the advertising tax seem to have been on a downward trend even before the pandemic.

Table B.7 Placebo estimates of the impact of the pandemic on excise duties

	Outcome variable				
	Petrol	**Advertising**	**Industrial electricity**	**alcohol**	**Tobacco**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Covid effect March-May	-935.11	-18.41*	4.29	-38.15	149.71
	(710.83)	(8.53)	(62.21)	(20.39)	(219.59)
Covid effect June-August	-962.65	-23.47	13.46	-35.47	2 348.06
	(867.22)	(12.38)	(68.55)	(24.30)	(2 332.41)
Covid effect Sept-Dec	-1 613.52	-0.82	19.99	-16.14	3 478.01
	(838.55)	(10.12)	(63.39)	(20.61)	(3 392.09)
Year 2019	1 171.79	7.56	88.74*	35.99	-3 942.36
	(1 066.89)	(8.81)	(38.95)	(22.65)	(3 844.82)
March-May	5 205.87*	18.06	-46.13	133.17***	1 777.78
	(2 372.54)	(12.21)	(39.58)	(33.99)	(1 682.83)
Jun-Aug	9 040.51*	-14.66	-203.73***	215.95***	247.18
	(4 166.87)	(12.64)	(53.42)	(56.97)	(220.43)
Sept-Dec	3 741.63*	-0.93	-97.50*	127.07***	-1 431.68
	(1 756.57)	(13.34)	(43.14)	(35.65)	(1 461.62)
Average March-Dec 2018	30 486.89	77.75	3 389.01	667.34	9 463.15
Covid effect March-May (%)	-3.07	-23.68	0.13	-5.72	1.58
Covid effect Jun-Aug (%)	-3.16	-30.18	0.4	-5.32	24.81
Covid effect Sept-Dec (%)	-5.29	-1.06	0.59	-2.42	36.75
Number of observations	1 330	1 272	6 342	46 797	2 934
Adjusted R^2	0.99	0.73	0.99	0.96	0.56

Not:*p<0.05; **p<0.01; ***p<0.001.

Appendix C Regression results: industries

This appendix presents estimates of the impact of the pandemic in different industries. The estimates are discussed in section 5.1.

Table C.1 The impact of the pandemic on sales in different industries

	Industry					
	C: Manufacturing	**F: Construction**	**G: Trade; repair**	**H: Transportation**	**I: Hotels and restaurants**	**R: Culture**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-35.22***	-2.85	-13.44**	-27.11***	-74.01***	-17.96***
	(5.50)	(2.16)	(4.27)	(1.66)	(5.33)	(2.23)
Year 2020	-11.20	2.70*	-0.26	-9.98***	3.55	-2.02
	(7.84)	(1.22)	(2.80)	(0.55)	(1.84)	(1.22)
March-Dec	95.46***	91.34***	93.56***	38.93***	57.71***	12.70***
	(11.58)	(3.32)	(3.78)	(2.56)	(6.96)	(2.50)
Average March-Dec 2019	836.88	325.06	566.45	281.85	292.87	95.83
Covid effect (%)	-4.21	-0.88	-2.37	-9.62	-25.27	-18.75
Number of observations	339 762	847 178	864 039	345 480	357 910	125 926
Adjusted R^2	0.84	0.60	0.81	0.58	0.72	0.54

Not:*p<0.05; **p<0.01; ***p<0.001.

Table C.2 Effect of the pandemic on sales in different industries

	Industry					
	C: Manufacturing	**F: Construction**	**G: Trade; repair**	**H: Transportation**	**I: Hotels and restaurants**	**R: Culture**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-53.20***	-4.78	-11.63***	-34.88***	-85.08***	-19.52***
	(5.97)	(2.98)	(3.23)	(0.83)	(7.00)	(1.04)
effect × QG_3	47.35***	2.79	5.59	16.45**	26.64***	6.13
	(10.78)	(2.23)	(5.59)	(5.02)	(3.33)	(3.32)
effect × QG_2	29.88**	4.40	-3.41	14.82***	24.22***	1.80
	(10.21)	(2.48)	(5.56)	(2.92)	(4.10)	(4.28)
effect × QG_1	10.01	2.48	-15.00	13.87**	16.19	-0.49
	(12.60)	(2.51)	(10.09)	(4.45)	(8.42)	(8.40)

	Industry					
	C: Manufac-turing	**F: Construction**	**G: Trade; repair**	**H: Transpor-tation**	**I: Hotels and restaurants**	**R: Culture**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Year 2020	3.58	2.55	-5.25	-11.06**	4.31*	-2.85
	(6.74)	(1.61)	(4.28)	(3.66)	(1.68)	(2.24)
March-Dec	109.04***	91.62***	84.49***	32.43***	52.22***	12.84***
	(13.81)	(4.55)	(1.82)	(2.52)	(5.65)	(2.05)
HQ_3	16.53	-7.96	-34.43*	-20.95***	-60.14***	9.86**
	(27.49)	(10.08)	(17.26)	(0.40)	(1.56)	(3.44)
HQ_2	23.23	2.46	-31.36	-24.79**	-32.96**	-9.50
	(29.70)	(1.49)	(20.31)	(9.15)	(12.71)	(15.01)
HQ_1	25.13	-8.75***	-17.39	-35.28***	-57.31***	-18.08***
	(18.36)	(0.44)	(12.06)	(1.55)	(5.90)	(5.39)
Year 2020 × QG_3	-30.38***	1.62	6.31*	2.67	-1.13	0.24
	(8.91)	(0.86)	(2.53)	(7.48)	(1.44)	(1.91)
Year 2020 × QG_2	-21.62	1.23	11.59	0.82	-1.36	1.45
	(11.41)	(1.77)	(7.07)	(4.41)	(2.09)	(0.77)
Year 2020 × QG_1	-22.63	-1.49**	10.29	6.85	1.81	7.76
	(12.26)	(0.54)	(9.35)	(7.82)	(2.04)	(7.14)
Mar-Dec × HQ_3	-31.48*	-4.86*	17.08***	12.46***	13.09*	-1.44
	(12.26)	(2.25)	(3.24)	(1.29)	(5.41)	(3.02)
Mar-Dec × HQ_2	-8.73	5.29*	22.15***	12.64***	11.77***	2.08
	(11.11)	(2.40)	(5.06)	(2.31)	(1.43)	(1.89)
Mar-Dec × HQ_1	-31.00*	-0.16	9.91	15.81***	10.04	-2.49
	(12.86)	(1.58)	(11.36)	(1.59)	(7.27)	(7.18)
Average March-Dec 2019	836.88	325.06	566.45	281.85	292.87	95.83
Covid effect (%)	-6.36	-1.47	-2.05	-12.38	-29.05	-20.37
Effect × QG_3 (%)	5.66	0.86	0.99	5.83	9.1	6.4
Effect × QG_2 (%)	3.57	1.35	-0.6	5.26	8.27	1.88
Effect × QG_1 (%)	1.2	0.76	-2.65	4.92	5.53	-0.51
Number of observations	339 762	847 178	864 039	345 480	357 910	125 926
Adjusted R^2	0.84	0.60	0.81	0.58	0.72	0.54

Not:*p<0.05; **p<0.01; ***p<0.001.

Appendix D Regression results: employees' monthly income, payroll taxes and sick pay

The estimates in the tables in this appendix are discussed in sections 6.3.3 and 6.3.4. Table D.1 presents our results from the DD estimation for three outcome variables: log monthly income conditional on positive income (columns 1-2), employment (columns 3-4, where employment is defined as having positive income), and monthly income level (columns 5-6). In columns 2, 4 and 6 of Table D.1 we have added two employee characteristics and one employer characteristic: a categorical variable for gender and age in years and a categorical variable for sector (private and public). Tables D.2 and D.3 show effect estimates on log income and employment for different industries, respectively, and finally Table D.4 contains estimates of how the effect varies with gender and public and private sectors.

Finally, Table D.5 presents the results from regressions based on equation B.1 of the effect of the pandemic on paid payroll taxes, preliminary tax and paid sick pay. The table shows both estimates of the average effect in columns 1-3 and interacted effects using municipal infection levels captured by quartile group categorical variables, $QG_1 - QG_3$, where the municipalities with the highest infection rates per capita QG_4 are the reference group.

Table D.1 The impact of the pandemic on wage income and employment

	Outcome variable					
	log(w)	**log(w)**	**1[w>0]**	**1[w>0]**	**w**	**w**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-0.042***	-0.038***	-0.014***	-0.013***	-0.779***	-0.642***
	(0.0005)	(0.0005)	(0.0003)	(0.0003)	(0.024)	(0.024)
Year 2020	0.060***	0.060***	-0.001***	0.004***	0.781***	1.182***
	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.022)	(0.022)
March-Dec	0.049***	0.047***	0.022***	0.022***	1.342***	1.304***
	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.023)	(0.023)
Female		-0.162***		0.008***		-4.714***
		(0.001)		(0.001)		(0.040)
Age		0.010***		0.007***		0.577***
		(0.00005)		(0.00002)		(0.002)
Public employers		-0.116***		-0.013***		-4.432***
		(0.001)		(0.001)		(0.036)

	Outcome variable					
	log(w)	**log(w)**	**1[w>0]**	**1[w>0]**	**w**	**w**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Intercept	3.444***	3.142***	0.791***	0.509***	25.818***	6.145***
	(0.001)	(0.002)	(0.0004)	(0.001)	(0.030)	(0.057)
Number of observations	15 350 616	15 350 616	26 931 606	26 931 606	26 931 606	26 931 606
Adjusted R^2	0.001	0.085	0.0005	0.051	0.0001	0.055

Not:*p<0.05; **p<0.01; ***p<0.001.

Table D.2 Pandemic impact on log wage income in different industries

	Industry					
	C: Manufacturing	**F: Construction work cohesiveness**	**G: Trade; repair of motor vehicles and motorcycles**	**H: Transportation and storage**	**I: Hotels and restaurants**	**R: Culture, entertainment and leisure**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-0.022***	-0.018***	-0.026***	-0.027***	-0.112***	-0.059***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.005)	(0.006)
Year 2020	0.034***	0.051***	0.064***	0.043***	0.166***	0.104***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.006)
March-Dec	0.048***	0.061***	0.054***	0.040***	0.132***	0.075***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)
Intercept	3.580***	3.536***	3.406***	3.438***	3.000***	3.286***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.006)	(0.007)
Number of observations	1 656 357	900 146	1 509 297	593 677	262 097	165 350
Adjusted R^2	0.002	0.005	0.002	0.001	0.008	0.003

Not: *p<0.05; **p<0.01; ***p<0.001

In Table D.2, we estimate the effect of the pandemic on log monthly income (log(w)) separately for employees in different industries.

Table D.3 Pandemic impact on employment in different sectors

	Industry					
	C: Manufacturing	**F: Construction work cohesiveness**	**G: Trade; repair of motor vehicles and motorcycles**	**H: Transportation and storage**	**I: Hotels and restaurants**	**R: Culture, entertainment and leisure**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Covid effect	-0.009***	-0.007***	-0.018***	-0.024***	-0.077***	-0.044***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Year 2020	-0.007***	0.004***	-0.006***	0.0001	0.004	-0.012***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
March-Dec	0.017***	0.027***	0.027***	0.023***	0.043***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Intercept	0.889***	0.791***	0.836***	0.824***	0.686***	0.718***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Average March-Dec 2019	0.906	0.818	0.863	0.847	0.729	0.756
Covid effect (%)	-0.947	-0.901	-2.091	-2.862	-10.57	-5.873
Number of observations	2 232 811	1 540 706	2 523 046	1 006 363	909 682	402 273
Adjusted R^2	0.001	0.001	0.001	0.001	0.005	0.004

Note: *p<0.05; **p<0.01; ***p<0.001.

Table D.4 Effect of the pandemic on log monthly income, incidence of monthly income greater than zero (employment) and level of monthly income

	log(w)	**1[w>0]**	**w**
	(1)	**(2)**	**(3)**
Covid effect	-0.026***	-0.021***	-0.966***
	(0.001)	(0.001)	(0.054)
Effect × Female	-0.010***	-0.011***	0.113
	(0.001)	(0.001)	(0.067)
Effect × Public employers	-0.013***	0.032***	0.747***
	(0.002)	(0.001)	(0.080)
Effect × Female × Public employers	-0.005	-0.002	-0.234*
	(0.002)	(0.002)	(0.095)
Year 2020	0.056***	-0.001	0.930***
	(0.001)	(0.001)	(0.049)
March-Dec	0.051***	0.027***	1.800***
	(0.0005)	(0.0004)	(0.055)
Female	-0.191***	-0.002	-5.702***
	(0.002)	(0.001)	(0.082)

	log(w) (1)	1[w>0] (2)	w (3)
Public employers	-0.108***	-0.014***	-3.903***
	(0.002)	(0.001)	(0.087)
Female × Public employers	0.063***	0.030***	2.685***
	(0.003)	(0.002)	(0.104)
Year 2020 × Female	0.024***	0.001	-0.198**
	(0.001)	(0.001)	(0.062)
Year 2020 × Public employers	-0.014***	-0.006***	-0.423***
	(0.002)	(0.001)	(0.074)
Year 2020 × Female × Public employers	-0.006*	0.005**	0.409***
	(0.002)	(0.002)	(0.090)
March-Dec × Female	0.007***	-0.001	-0.427***
	(0.001)	(0.001)	(0.062)
Mar-Dec × Public employers	-0.021***	-0.013***	-1.104***
	(0.001)	(0.001)	(0.068)
Mar-Dec × Female × Public employers	0.008***	0.004***	0.579***
	(0.002)	(0.001)	(0.078)
Intercept	3.561***	0.790***	29.393***
	(0.001)	(0.001)	(0.068)
Average value March-Dec 2019		0.81	27.16
Covid effect (%)		-2.54	-3.56
Effect × Female (%)		-1.37	0.42
Effect × Public employers (%)		3.97	2.75
Effect × Female × Public employers (%)		-0.19	-0.86
Number of observations	15 350 616	26 931 606	26 931 606
Adjusted R^2	0.041	0.001	0.009

Note: *p<0.05; **p<0.01; ***p<0.001.

Table D.5 Pandemic impact on AG, preliminary tax and sick pay

	Outcome variable					
	AG (1)	Preliminary tax (2)	Sick pay (3)	AG (4)	Preliminary tax (5)	Sick pay (6)
Covid effect	-9.61***	-4.18**	3.11**	-10.72***	-5.23	3.27**
	(0.80)	(1.61)	(0.95)	(0.97)	(2.74)	(1.00)
Effect × QG_3				2.27***	1.96	-0.31
				(0.58)	(2.75)	(0.47)
Effect × QG_2				2.41***	2.69	0.34
				(0.59)	(2.72)	(1.01)

	Outcome variable					
	AG	**Preliminary tax**	**Sick pay**	**AG**	**Preliminary tax**	**Sick pay**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Effect × QG_1				3.59**	3.70	-1.31
				(1.10)	(2.80)	(0.81)
Year 2020	2.73***	4.92**	-0.34*	3.77***	7.06*	-0.26
	(0.67)	(1.69)	(0.14)	(0.89)	(2.82)	(0.16)
March-Dec	5.03***	8.22***	-0.83**	5.51***	9.95***	-0.76**
	(0.61)	(1.69)	(0.27)	(0.77)	(2.58)	(0.24)
HQ_3				-1.53	1.47	0.39
				(1.63)	(2.85)	(0.27)
HQ_2				1.38	3.67	0.28
				(2.08)	(3.01)	(0.34)
HQ_1				-3.02	1.29	-0.03
				(2.63)	(2.81)	(0.38)
Year 2020 × QG_3				-1.74*	-4.17	-0.14
				(0.70)	(2.71)	(0.21)
Year 2020 × QG_2				-1.81**	-4.17	-0.17
				(0.66)	(2.57)	(0.20)
Year 2020 × QG_1				-2.97**	-6.62*	-0.13
				(0.97)	(2.94)	(0.17)
Mar-Dec × HQ_3				-0.63	-3.62	-0.17
				(0.65)	(2.48)	(0.23)
Mar-Dec × HQ_2				-0.51	-3.60	-0.35
				(0.73)	(2.55)	(0.38)
Mar-Dec × HQ_1				-3.08**	-5.71**	0.15
				(1.01)	(1.98)	(0.34)
Average March-Dec 2019	116.85	144.14	4.59	116.85	144.14	4.59
Covid effect (%)	-8.22	-2.9	67.72	-9.17	-3.63	71.13
Effect × QG_3 (%)				1.94	1.36	-6.83
Effect × QG_2 (%)				2.06	1.86	7.47
Effect × QG_1 (%)				3.07	2.57	-28.51
Number of obs.	10 248 289	10 248 289	10 248 289	10 248 289	10 248 289	10 248 289
R^2	0.99	1.00	0.76	0.99	1.00	0.76
Adjusted R^2	0.99	1.00	0.75	0.99	1.00	0.75

Note: *p<0.05; **p<0.01; ***p<0.001.

Appendix E Variable definitions

The following variable definitions are used in Figures 7.1-7.5. The numbering of some variables corresponds to boxes in the personal income tax return (INK1).

- *Final tax*: total final tax for the income year.
- *Municipal tax*: municipal tax for the year (tax to municipality and tax to region)
- *State income tax*: state income tax on earned income.
- *Capital tax*: state income tax on capital income.
- *A. Employment and pension income*: the sum of boxes 1.1-1.7 of the income tax return, i.e. [1.1 Salary, benefits, sickness allowance, etc.] + [1.2 Reimbursement of expenses] + [1.3 General and occupational pensions, etc.] + [1.4 Private pension and annuity] + [1.5 Other income not qualifying for a pension] + [1.6 Income, e.g. hobbies, for which you have to pay your own contributions] + [1.7 Income from tax declaration form K10, K10A and K13].
- *B. Capital income [net]*: [7.1Standard income] + [7.2 Interest income, dividends, profit from tax declaration form K4, section C, etc.] + [7.3 Surplus from the letting of private dwellings] + [7.4 Profit from mutual funds, etc. Gains from tax declaration form K4 Sections A and B, K9 Section B, K10, K10A, K11, K12 Section B and K13.] + [7.5 Gains from unquoted fund shares etc. Gains from tax declaration form K4 Section D, K9 Section B, K12 Section C and K15A/B etc.] + [7.6 Gain from tax declaration form K5 and K6. Reversed deferral from tax declaration form K2.] + [7.7 Gain from tax declaration form K7 and K8] - [8.1 Interest payable etc. Loss from tax declaration form K4 section C etc.] - [8.3 Loss fund shares etc. Loss from tax declaration form K4 section A, K9 section B, K10, K12 section B and K13.] - [8.4 Loss unquoted fund shares. Losses from tax declaration form K4 section D, K9 section B, K10A, K12 section C and K15A/B.] - [8.5 Losses from tax declaration form K5 and K6] - [8.6 Losses from tax declaration form K7 and K8].
- *C: Income from business activity*: [10.1 Surplus from active business activity (amount from NE + amount from N3A)] - [10.2 Deficit from active business activity (amount from NE + amount from N3A)] + [10.3 Surplus from passive business activity (amount from NE + amount from N3A)] -

[10.4 Deficit from passive business activity (amount from NE + amount from N3A)]

- *Market income (before tax)*: A + B + C
- *Market income after taxes*: A + B + C - Total taxes
- *Capital gain*: [7.4 Gain on fund units etc. Gain from tax declaration form K4 sections A and B, K9 section B, K10, K10A, K11, K12 section B and K13.] + [7.5 Gain on unquoted fund units etc. Gain from tax declaration form K4 section D, K9 section B, K12 section C and K15A/B etc.] + [7.6 Gains from tax declaration form K5 and K6. Reversed deferral from tax declaration form K2.] + [7.7 Gains from tax declaration form K7 and K8] - [8.3 Losses on fund shares etc. Losses from tax declaration form K4 section A, K9 section B, K10, K12 section B and K13.] - [8.4 Losses on unquoted fund shares. Losses from tax declaration form K4 section D, K9 section B, K10A, K12 section C and K15A/B.] - [8.5 Losses from tax declaration form K5 and K6] - [8.6 Losses from tax declaration form K7 and K8].
- *Interest and dividends*: [7.1Standard income] + [7.2 Interest receivable, dividends, profit from tax declaration form K4 Section C, etc.] + [7.3 Surplus from letting of private dwellings] - [8.1 Interest payable, etc. Loss from tax declaration form K4 Section C, etc.].