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Earnings losses and the role of the welfare state during the COVID-19 pandemic: evidence from Sweden[a]

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Abstract: Many governments introduced temporary adjustments to counter the economic and health consequences of the COVID-19 pandemic. We study the importance of already existing government transfers and pandemic measures to mitigate individual income losses during the pandemic in Sweden using a difference-in-differences approach and population-wide data on monthly earnings and government transfer payments. We find that labor earnings dropped by 2.7 percent in 2020. Existing transfers and pandemic measures reduced earnings losses to 1.5 percent. These average effects mask considerable differences in income losses, which were, by and large, evened out by existing transfers and pandemic measures.

Keywords: COVID-19, income inequality, government transfers, short-time work
JEL-codes: D31, E24, H20, H12, C23

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Content

1 Introduction

Government transfers to individuals are designed to mitigate income risk from adverse events such as unemployment or illness. It is, however, most likely neither possible nor desirable to design these welfare institutions such that they fully absorb the effects of rare and extreme systemic events such as the COVID-19 pandemic. Similarly, traditional macroeconomic tools such as stimulating aggregate demand through targeted or untargeted measures cannot fully mitigate the economic consequences of recessions (Chetty et al. 2020; Cho et al. 2022). For this reason, understanding the reach of the already existing transfer system and the complementary role of temporary adjustments during the pandemic is crucial for future policy development.

In addition to being the most acute public health crises in recent decades, the COVID-19 pandemic led to rapid and substantial GDP losses in the second quarter of 2020: up to 9.1 percent for the US, 7.6 percent in Sweden, and 11.4 percent for the European Union (OECD 2020). The drop in GDP was followed by a fast recovery by the third quarter of 2021 (Milesi-Ferretti 2021). These effects were driven by changes in global supply chains (Bonadio et al. 2021), and by changes in demand due to temporal variation in contamination risk. Like many countries, Sweden already had an encompassing government transfer system in place. Yet governments saw a need to extend existing government transfers and introduce new measures to dampen the expected negative impact of the pandemic on individual incomes and businesses. In addition to increasing the generosity and reach of government transfers to individuals, Sweden followed other countries and introduced new and substantial firm support measures, such as short-time work allowance (STW), to preserve employment relationships and save jobs (Giupponi and Landais 2018). While earlier studies have highlighted the consequences of the pandemic itself for economic inequality (Angelov and Waldenström 2021a; Clark et al. 2021; Stantcheva 2022), and have studied the role of existing transfers and pandemic measures through cross-country simulation models (Almeida et al. 2021; Cantó et al. 2022), less is known about the details of how the combination of already existing transfers and the pandemic measures were able to compensate earnings losses and reduce the unequal impact of the pandemic on individual income. In particular, no previous studies have been able to study these

questions using population wide data on earnings and transfer payments at the individual level.

The purpose of this paper is to assess how the COVID-19 pandemic affected labor earnings across the income distribution and for various groups on the labor market, and to analyze the degree to which already existing government transfer systems and new pandemic measures compensated for these earnings losses. To this end, we use monthly administrative data on labor earnings, social insurance benefits, and means-tested income transfers for the universe of the Swedish working age population, which includes 5.7 million individuals. We also use monthly individual employee level data on STW transfers directed to firms. To analyze the causal impact of the pandemic during 2020 on earnings and transfers, we first define population cohorts k=2016, …, 2019 including all individuals aged 20-64 in the respective year. We then follow these individuals until the end of the year after ($k+1$). We then apply a difference-in-differences (DID) framework comparing the most recent cohort (k=2019), which was exposed to the pandemic, with earlier cohorts (k=2016, …, 2018), which were not exposed to the pandemic. This estimation framework results in comparable treatment and control groups (see, e.g., Hensvik et al. 2021) and allows for controls for seasonal (monthly) variation in outcome variables.

Our main findings can be summarized as follows: First, we find that the pandemic decreased average labor earnings by 2.7 percent. These earnings losses, however, already include the STW allowance, which essentially kept many individuals in employment with only minor earnings reductions. Our estimates of the increase in STW suggest that earnings losses net of STW allowance amounted to 4.5 percent. Because all STW-recipients are unlikely to have lost their job in the absence of the STW allowance, this represents an upper bound of earnings losses in the absence of STW. Second, the already existing transfer system and pandemic measures together replaced 43 percent of earnings losses, primarily through unemployment and sickness benefits. We further show that the pandemic measures were almost as important for replacing earnings losses as the already existing transfer system. Disaggregating the different types of transfers, we find that, amongst pandemic measures, changes to unemployment benefits and sickness benefits affected earnings the most. Third, we analyze which groups suffered the most from earnings losses. We find that labor earnings at the lower end of

the pre-pandemic income distribution were most heavily affected by the pandemic, and that losses were particularly large for young individuals, low-educated, foreign-born, and, most notably, for those working in the hospitality sector prior to the pandemic. While STW limited earnings losses in a similar fashion across the disposable income distribution, government transfers to individuals compensated those with the largest earnings losses the most and were largely able to even out differences across the income distribution.

A number of studies have analyzed the effects of the pandemic on incomes and income inequality (see Stantcheva 2022 for a recent overview). Most closely related to this paper, Angelov and Waldenström (2021a) use monthly tax data from Sweden to study how labor earnings and earnings inequality were affected by the pandemic. In addition to documenting an increase in inequality in labor earnings, they estimate a difference-in-difference model and find that the pandemic decreased pre-tax earnings on average between 2.5 and 3.8 percent. Using a substantially larger sample which includes also zero earners, a larger number of untreated cohorts, and a longer observation period per cohort, our results show a fairly similar effect of the pandemic on labor earnings: 2.7 percent.[1] Angelov and Waldenström (2021a) study two COVID-19 policies that were directed to firms, STW and reorientation support, and suggest that overall inequality would have increased two to three times more absent these policies. Similarly, using longitudinal survey for Australia, Li et al. (2021) find that additional wage subsidies offset negative effects of increasing unemployment for income inequality. For the US, Han et al. (2020) show that policy measures were effective in reducing poverty during the start of the pandemic. In part, this is driven by generous unemployment insurance benefits often exceeding lost wages (Ganong et al. 2020). In the present study, we complement monthly labor earnings with monthly receipts from a wide range of government transfer systems, including sickness benefits, unemployment transfers, parental leave benefits, and income support for the entire working age population. Our data allow us to distinguish how different types of government transfers affected income losses, but also to assess the importance of already existing government

[1] Angelov and Waldenström (2021a) define their sample based on all individuals with at least one month with positive labor income. Further, our study uses a longer pre-treatment period (8 months), longer observation periods for each cohort (18 months vs. 12 months), and more untreated cohorts (3: 2016, …, 2018). An additional difference is that Angelov and Waldenström (2021a) have information on taxable transfers on a yearly basis.

transfers relative to newly introduced pandemic measures. This provides a more comprehensive account of the economic situation of all working age individuals in Sweden during the pandemic irrespective of working or not and allows us to analyze in detail through which transfer systems the economic burden of the pandemic was alleviated.[2]

A large literature has used microsimulation methods to quantify the impact of the pandemic on individual income, and to analyze to what extent government policies manage to cushion the fall.[3] This approach has the advantage that it can be deployed very quickly, since it does not require the availability of up-to-date microdata. However, a drawback is that it relies heavily on modelling assumptions and macroeconomic forecasts. Furthermore, these models are typically static, and do not account for behavioral changes. This contrasts to our paper, which uses detailed administrative data capturing actual outcomes before and during the pandemic. Furthermore, while microsimulation studies tend to cover existing tax-and-transfer systems well (including existing short-time work schemes), there are some limitations in their coverage of new COVID-19 policies.[4] In general, these microsimulation studies have found that existing government transfers and pandemic measures could be expected to reduce income losses by half or more in the EU and UK.[5] For the EU as a whole, Almeida et al. (2021) estimate that disposable income would have fallen by over 9 percent absent discretionary fiscal policy changes, but that pandemic measures reduced this fall by half. Christl et al. (2021) estimate large drops in market incomes, hitting poorer households particularly hard. However, almost three fourths of this drop were absorbed by tax-and-transfer systems and around half of this came from discretionary policy

[2] There is a small literature studying inequalities along other work-related dimensions using Swedish microdata. Campa et al. (2021) use individual-level data from the Swedish Public Employment Service to show that the pandemic initially led to increased unemployment among young and foreign-born workers. Eliason (2021) finds similar patterns using aggregate data. Sjögren et al. (2021) use aggregate Labor Force Survey data to show that mothers with small children were harder hit than other parents.

[3] These papers typically combine models of national tax and transfer systems with representative survey data from before the pandemic, allowing researchers to simulate the effects of macroeconomic changes and policy changes on the distribution of incomes.

[4] For example, Almeida et al. (2021) account for short-time work schemes, but are not able to model COVID-related policies in detail; Cantó et al. (2021) exclude, among other policies, some changes to unemployment benefits in Belgium, parental leave reforms in Italy, and rent subsidies in Spain.

[5] In Latin America, existing government transfer systems tended to protect the poorest, while discretionary COVID-19 policies tended to cushion the income drops higher up in the income distribution. This resulted in middle-income households experiencing the largest income losses (Avellaneda et al. 2021; Lustig et al. 2021). In Africa, where many work in the informal sector, the pandemic led to increases in both poverty and income inequality. Neither existing government transfer systems nor discretionary policies did much to counteract this (Lastunen et al. 2021).

measures. Cantó et al. (2021) estimate that household incomes would have dropped as much as 15-25 percent absent policy changes in Belgium, Italy, Spain, and the UK, but that fiscal policy dampened most of this, resulting in actual drops of 4-8 percent. In Germany and Ireland, COVID-19 policies even resulted in slightly increased incomes for people at the bottom of the income distribution (Bruckmeier et al. 2021; O'Donoghue et al. 2021). In Finland, the pandemic resulted in a 4.5 percent drop in market incomes, while disposable incomes only fell by 1.8 percent (Kyyrä et al. 2021).[6] In contrast to these studies, we find that earnings losses are smaller (2.7 percent), but also that already existing government transfers and pandemic measures helped dampening these losses by 43 percent.

A third strand of the literature uses real-time surveys that were conducted during the pandemic to analyze consequences of the pandemic. Unlike our study, these papers do not estimate causal effects of the pandemic but rather provide valuable descriptive evidence on the economic consequences. Using survey data from France, Germany, Italy, Spain, and Sweden, Menta (2021) finds that poverty[7] increased sharply during the spring of 2020, and then decreased during the summer, with Italy being the most affected, and France the least. Young individuals and women were the most affected. Using the same data, Clark et al. (2021) find a similar time pattern of household disposable income inequality. Adams-Prassl et al. (2020) find that around one fifth of workers in the UK and US lost their jobs during spring 2020, compared to only around 5 percent in Germany.

In the following section, we present a detailed account of the most important transfer types and pandemic measures that affected the working age population during the pandemic. In Section 3, we provide information on the data sources, the estimation framework and descriptive statistics. Section 4 presents the estimation results and Section 5 concludes.

[6] Other microsimulation studies which reach similar conclusions include Brewer and Tasseva (2021) for the UK; O'Donoghue et al. for (2020) Ireland; Brunori et al. (2021), Figari and Fiorio (2021), and Carta and Philippis (2021) for Italy; Christl, Poli, Hufkens, et al. (2021) for Germany; and Christl, De Poli, Kucsera, et al. (2022) for Austria.
[7] Poverty is defined as having a net household income below 60 percent of median equivalized household income.

2 Background

Sweden has an extensive government transfer system with universal sickness and parental benefits with basic and income-related levels. Unemployment insurance is income-related for individuals who fulfill two conditions, a sufficiently long voluntary membership in an unemployment fund and a work requirement, and has a basic level for those who fulfill a work requirement (Landais et al. 2021). Social assistance and housing allowance are means tested basic income support programs to guarantee a minimum level of living and housing standard for households with insufficient means – earnings, benefits or assets – to support themselves.

As the COVID-19 pandemic hit Sweden in March 2020, the government introduced several *pandemic measures* – both in the form of changes to already *existing government transfer* systems and introduction of new measures. Early in the pandemic, a STW allowance was introduced to protect jobs and maintain employer-employee links. To increase insurance coverage, membership and work requirements in the unemployment insurance were eased, and to incentivize sick leave, the waiting day deduction in the sickness insurance was reimbursed by the government. Moreover, in July 2020 the housing allowance was raised to strengthen poor households and prevent evictions of families.

In the following, we first describe how COVID-19 affected both health outcomes and the Swedish economy. Thereafter, we present in detail both existing transfers and pandemic measures analyzed in this study: the introduction of the STW scheme, unemployment insurance, sickness insurance, parental benefits, and basic income support.[8]

2.1 How was Sweden affected during the first year of the pandemic?

In many dimensions, the Swedish experience of the COVID-19 pandemic represents what happened in an average European country. The first wave of the coronavirus hit Sweden in March 2020 when people returned from their winter sports breaks in the Alps. As a reaction, there was a rapid decrease in individual mobility. But in contrast to many European countries, Sweden did not enforce strict lockdowns. Instead, the

[8] See Adermon et al. (2022) for detailed references on the institutional details and changes discussed in this section. Table A-1 lists details on all pandemic measures introduced during the pandemic.

Swedish Public Health Agency gave general advice and recommendations that workers should work from home if possible[9], remote learning should be introduced in high schools and universities, and people should avoid traveling and social contacts outside the family. In addition, public gatherings and events were limited, and visitors were not allowed in hospitals and residential care facilities for older people.[10]

Even though Sweden did not introduce severe pandemic restrictions, such as strict lockdowns, the pandemic had severe effects on the economy. The employment rate decreased during 2020 for the first time since the financial crisis and did not fully return to pre-pandemic levels until the end of 2020[11]. During the first wave in the spring of 2020, job vacancies dropped by 40 percent (Hensvik et al. 2021), and consumption dropped by 25 percent (Sheridan et al. 2020).

2.2 Government transfers before and during the pandemic

2.2.1 Short-time work

As it was clear that otherwise healthy and profitable businesses would be severely affected by the pandemic, short-time work (STW) allowance was rapidly launched in response to the massive increase in advance notices of layoffs in March 2020. The aim was to protect jobs and maintain links between employers and employees. The STW scheme implied that employers could temporarily reduce employees' working hours by 20, 40, 60 or 80 percent. The government covered 75 percent of the corresponding earnings losses, while 10 percent were covered by the employer and 15 percent by the worker. This scheme implied that firms could reduce their wage costs by up to 72 percent while still maintaining employment of their workers. Workers on STW worked shorter hours, but retained much of their pay, e.g., a fulltime worker with working hours reduced by 80 percent only lost 12 percent of pre-tax earnings.

[9] During the second and third wave in the fall and winter of 2020, around 40 percent of the workforce 16-74 years old worked from home (Statistics Sweden, https://www.scb.se/pressmeddelande/ny-statistik-sa-manga-har-jobbat-hemifran-under-pandemin/, accessed 2022-08-31). But the ability to work from home varied between occupations and sectors.

[10] The limit was first set to 500 people from 12 March 2020 and then to 50 people from 29 March 2020. The visiting ban was introduced on 1 April 2022. Distance learning was also introduced in upper secondary schools and higher education while primary and lower secondary mostly remained open during 2020.

[11] Statistics Sweden (https://www.scb.se/hitta-statistik/statistik-efter-amne/arbetsmarknad/arbetskraftsundersokningar/arbetskraftsundersokningarna-aku/pong/statistiknyhet/arbetskraftsundersokningarna-aku-arsmedeltal-2020/), accessed 2022-08-31.

2.2.2 Unemployment insurance

Unemployed workers in Sweden are entitled to basic unemployment benefit while searching for a new job, conditional on fulfilling a *work condition* of having worked during six of the last 12 months and being registered as unemployed with the Swedish Public Employment Service (PES). The pre-pandemic basic UI benefit was 365 SEK per day, corresponding to 24 percent of the median full-time equivalent (FTE) daily wage in 2019.[12] This amount was reduced proportionally for former part-time workers. Unemployed job seekers who have been members of an unemployment fund (*a-kassan*) for at least a year also fulfill the *membership condition* which qualifies them for income-related benefit. Fund membership coverage varies across industries, and is generally low for young workers, but also for workers in service jobs, industries with low unemployment risk and large shares of temporary workers. Before the pandemic, the income-related benefit replaced 80 percent of the previous labor earnings up to a ceiling of 910 SEK per day during the first 100 days of unemployment, and 70 percent of previous earnings with a ceiling of 760 SEK per day from day 101 for a maximum of 300 days of unemployment.[13] Overall, about 10 percent of the total UI claims are basic UI claims.

Several reforms to the unemployment insurance system were implemented in the first half of 2020 in order to limit the adverse consequences of job-loss for incomes and consumption. In April, the basic benefit was raised from 365 to 510 SEK per day (from 24 percent to 34 percent of the median FTE daily wage), and a minimum compensation of 255 SEK per day was introduced (17 percent of the median FTE wage). For income-related unemployment insurance, the ceiling during the first 100 days was raised from 910 to 1,200 SEK per day (from 60 to 80 percent of the median wage). In late June, the ceiling after the first 100 days in the income-related benefit was increased from 760 to 1,000 SEK per day (from 50 to 66 percent of the median wage).

In addition to increased benefits levels, the requirements for fulfilling the *membership condition* and the *work condition* requirements were eased. From March 2020 onwards, unemployed individuals could receive income-related unemployment

[12] In February 2020, 10 SEK correspond to 1.04 USD and 0.94 EUR, respectively. 1 USD (1 EUR) converted to 9.66 SEK (10.54 SEK). In 2019, the median full-time equivalent monthly wage was 31,700 SEK and the average number of working days per month was 21 (www.arbetstimmarpermanad.se and https://www.statistikdatabasen.scb.se, accessed 2022-09-08). Given these numbers, the median full-time equivalent daily wage was 1,510 SEK.

[13] Parents with children under the age of 18 are eligible for 450 days of income-related benefits.

benefits already after being a member of an unemployment fund for three (instead of 12) months. Before the pandemic, qualifying for income related benefits was conditional on having worked either (1) for 80 hours per calendar month for six of the last 12 months; or (2) for 480 hours during a continuous six-month period during the last year, and for at least 50 hours during each calendar month. In late March 2020, the work requirements were relaxed to 60 hours per month in the first case, and 420 hours in total and 40 hours per month in the second case.[14]

2.2.3 Sickness insurance

Sweden has a universal, publicly administered sickness insurance. The central part of the insurance is sickness benefits compensating earnings losses, with an 80 percent replacement rate up to a ceiling, for employees whose work capacity is temporarily reduced due to sickness. A *one-day waiting period* implies that the worker is not compensated for earnings losses the first day of the sickness spell. Day 2-14 of a sickness spell, *the employer period*, the worker is compensated by the employer in the form of *sick pay*. Thereafter, the Social Insurance Agency (SIA) pays a *sickness benefit*. Moreover, a doctor's certificate is required for sick spells longer than seven days.

In March 2020, the one-day waiting period in the sickness insurance became reimbursable from the SIA as a means to encourage workers to stay home from work at the slightest symptom of illness. Initially, the maximum payment for the first sick day was set to 700 SEK, but it increased to 804 SEK in April 2020. To further limit the spread of COVID-19, and ease the burden on the health care system, the requirement to have a doctor's certificate was postponed from day 8 to day 21, and later abolished altogether (see Table A-1 in the Appendix for details). Moreover, during the pandemic, employers were compensated for their sick pay costs by the government. The full cost was covered during April-July 2020, after which compensation was paid for above-normal costs according to a fixed schedule.

Because COVID-19 was classified as a public health hazard already in February of 2020, workers were also eligible for disease carrier's benefits, with an 80 percent replacement rate for earnings losses up to 804 SEK per day if diagnosed with COVID-19 or for suspected COVID-19. In the summer of 2020, to protect vulnerable groups,

[14] In addition, the waiting period of six days for unemployed workers to become eligible for unemployment benefits was abolished.

the disease carrier's benefit was extended to individuals working closely with and to relatives of persons diagnosed with medical conditions deeming them vulnerable to severe COVID-19. Furthermore, a risk group compensation, targeting workers with these same medical conditions, who were unable to work from home, was also introduced, with the same replacement rate as the disease carrier's benefits.

2.2.4 Parental benefits

Parents are eligible to 480 days of paid parental leave per child, to be used before the child turns 12; 390 days are income related with a replacement rate of 80 percent up to a ceiling and 90 days have a low flat rate. For working parents of children below age 12, there is also a temporary parental benefit, which compensates for earnings losses up to a ceiling for a maximum of 60 days per year and child when caring for a sick child.[15] Before the pandemic, temporary parental leave when caring for a sick child required a doctor's note from day eight. This was postponed to day 22 during March-October of 2020.[16] Otherwise, there were no changes to parental benefits during the pandemic.

2.2.5 Income support

Individuals who lack the means to financially support themselves are eligible for means tested basic income support in the form of social assistance (SA) from their municipality of residence. Means testing is at the household level and requires depletion of any savings or other assets (owned housing, cars etc.) before support is granted. Young adults and families with children may also be eligible for a housing allowance from the Social Insurance Agency. To further support poor families and prevent eviction of children, an additional housing allowance was introduced in the summer of 2020. It was targeted toward the families with children already receiving regular housing allowance and increased the total allowance by 25 percent, summing to a maximum of 1,335 SEK per month.

[15] For children before 2014, parental leave days needed to be used before a child turns eight.
[16] From April 2020 on, it was also possible for parents to take temporary parental leave during preschool or school closures, even if their own child was not sick. Note, however, that childcare facilities and compulsory schools (ages 6-16) generally remained open, unless hit by severe COVID-19 outbreaks.

3 Data and empirical strategy

3.1 Data sources and outcome variables

The analysis is based on several administrative data sources collected within Stockholm University's COVID-19 program, containing information on the entire Swedish population from 2015 onwards. We analyze the impact of the COVID-19 pandemic on labor earnings during 2020 and investigate to what extent different types of government transfers cushioned the potentially adverse effects on individual incomes. Although our focus is the income replacement offered by government transfers directed to individuals, we also study the role of the STW scheme introduced during the pandemic. This is motivated by the STW's direct impact on the earnings of the individual worker, who is the final recipient of short-time work pay. In addition to demographic and socio-economic information, the data include labor earnings and all payments from the major government transfer systems directed to individuals in Sweden, as well as short-time work pay.

In the main analysis, we analyze the impact of the pandemic on the following income sources:

Labor earnings: Payments of gross labor earnings from employers to employees, also including employers' sick pay during the 14-day employer period and short-time work pay to the individual for reducing hours worked during the pandemic (see Section 2 for details).

Labor earnings excluding STW: Labor earnings, as defined above, excluding short-time work pay.

Transfers: The sum of government transfers from the major transfer systems directed to individuals: unemployment benefits, sickness benefits, parental benefits, and means-tested income support. These include benefits in place before the pandemic as well as benefits introduced or changed during the pandemic.

Total income: The sum of labor earnings and the above-mentioned government transfers.

Data on labor earnings are provided by the Swedish Tax Authority from the monthly payroll tax register during 2019-2020 and the annual personal tax-return register during

2015-2018.[17] All government transfer payments are available on a monthly basis from 2015 onwards. Table A-3 provides a detailed overview of all transfers and its data sources.

A limitation of our data is that we do not observe receipts of national student grants and loans. These are of course of particular relevance for younger individuals. New enrollment in higher education increased by 13 percent in the fall of 2020, and by 28 percent among recent upper secondary school graduates.[18] Hence student grants and loans are likely to have become a more important income source for young adults than before the pandemic. We also exclude some transfers which mainly respond to slow-moving demographic changes, and thus are unlikely to have been impacted by the pandemic during 2020.[19]

3.2 Decomposing existing transfers and pandemic measures

To identify the relative contribution of the already existing transfers at the onset of the pandemic and the pandemic measures introduced during 2020, we calculate the amount of a given transfer that an individual would have received if the pandemic measure would not have been introduced. That is, in the absence of behavioral changes due to the pandemic measures, the high level of detail of our data allows us to calculate the additional benefit an individual received due to the introduction of pandemic measures.[20]

3.3 Estimation framework

The strength of our analysis is the access to monthly data on labor earnings, government transfers and STW pay. Since the COVID-19 pandemic was a sudden and unforeseen change in the economic environment, we can exploit the onset of the pandemic to study

[17] The monthly earnings data does not include earnings for sole proprietors or business owners, but results in appendix Table A-2 show that our main result holds at an annual level when including these income sources. We also do not observe capital incomes, further limiting our ability to study sole proprietors and business owners.

[18] Swedish Higher Education Authority, https://www.uka.se/publikationer--beslut/publikationer--beslut/statistiska-meddelanden/statistiska-meddelanden/2020-11-18-16-000-fler-sokande-utan-tidigare-hogskolestudier.html, accessed 2022-09-08.

[19] These include disability benefits, pensions, additional housing allowance for pensioners, work-related injury compensation, child allowance, and pregnancy benefits.

[20] The only transfer we are not able to precisely decompose into existing transfers and pandemic measures are activity support benefits to unemployed workers participating in an active labor marker program, which are paid out to the same criteria following the basic and income-related unemployment insurance. Because of missing information on unemployment insurance membership for these recipients, we are not able to incorporate all changes introduced during the pandemic. Missing information for activity support benefits should, if anything, result in an underestimation of the effect of UI-related pandemic measures.

the effects of the pandemic on individual income. We do this by applying a difference-in-differences (DID) framework, in which we compare the change in monthly income from different sources before and after the onset of the pandemic in March 2020 with the corresponding change during previous years. This type of method has previously been employed when studying the impact of the pandemic (see, e.g., Angelov and Waldenström 2021a, 2021b; Hensvik et al. 2021).

For the estimation, we define cohorts *k*=2016, ..., 2019 consisting of all individuals aged 19-63 in December of year *k*. In order to allow for several unaffected months for the pandemic cohort sampled in 2019, we follow the cohorts already from July in the sampling year *k* to December in year *k+1*, i.e., our DID estimation consists of a total of 18 months during which we compare outcome variables. Our main model can be written as:

$$Y_{i,k,m,t} = \alpha + \beta \times Pandemic_t + \lambda_m + \lambda_k + \varepsilon_{i,k,m,t} \quad (1)$$

where *i* denotes an individual of cohort *k*, *m* the running month for each cohort (1=July_k, …, 18=December_{k+1}), and *t* the calendar month (July 2016, …, December 2020). The vectors λ_m and λ_k are month and cohort-fixed effects. The treatment dummy *Pandemic* takes the value one from March 2020 and onwards and zero otherwise, and the parameter of interest β captures the average monthly effect of the COVID-19 pandemic on individual incomes during March–December 2020. The estimated β should be interpreted as the overall effect of the pandemic on earnings. This effect is the aggregate effect of the pandemic, including underlying economic effects (such as layoffs), any behavioral effects due to the pandemic, but also any behavioral effects that are related to the changes of the government transfer system during the pandemic.[21]

We are also interested in the dynamic effects of the COVID-19 pandemic during 2020. To study this, we augment Equation (1) and estimate month-specific treatment effects β_s in an event-study framework:

[21] Ganong et al. (2020) provide evidence for the US that strong increase in UI supplements did only have minor effects on re-employment rates.

$$Y_{i,k,m,t} = \alpha + \sum_{s=july\ 2019}^{Dec\ 2020} \beta_s \times T_s + \lambda_m + \lambda_k + \varepsilon_{i,k,m,t} \quad (2)$$

where $T_s = 1[t = s]$ are monthly indicators, and β_s estimates the month-specific effects. January 2020 is used as the reference month (i.e., $T_{january\ 2020}$ is left out). Because individuals can enter the analysis in different cohorts, standard errors $\varepsilon_{i,k,m,t}$ are clustered at the individual level throughout the analysis.

Our key identifying assumption is that, absent the COVID-19 pandemic, all cohorts would have had similar trends in labor earnings and benefit levels. While there is no formal test of this assumption, we assess its plausibility by comparing pre-trends from July in year *k* to February in year *k+1*.

3.4 Descriptive evidence

Figure 1 shows the development of our main outcome variables, i.e., labor earnings (Panel a), the four transfer types (Panels b-e), and total income (Panel f) for each of the analysis cohorts during the 18-month follow-up period between July of year *k* and December of year *k+1*. Because labor earnings are available at the monthly level only from January 2019, Panels a and f show the corresponding information from January to December of year *k+1*. Because STW did not exist prior to the pandemic, we do not show it here.

Panel a shows the development of average labor earnings for the analysis cohorts 2018 and 2019. Although monthly data on labor earnings is restricted to 2018 onwards, the figure paints a clear picture. Before the pandemic, average labor earnings were higher for the 2019-cohort in comparison to the same months for the 2018-cohort. Once the pandemic hits the 2019-cohort, their average labor earnings drop relative to the average levels of the 2018-cohort one year earlier.

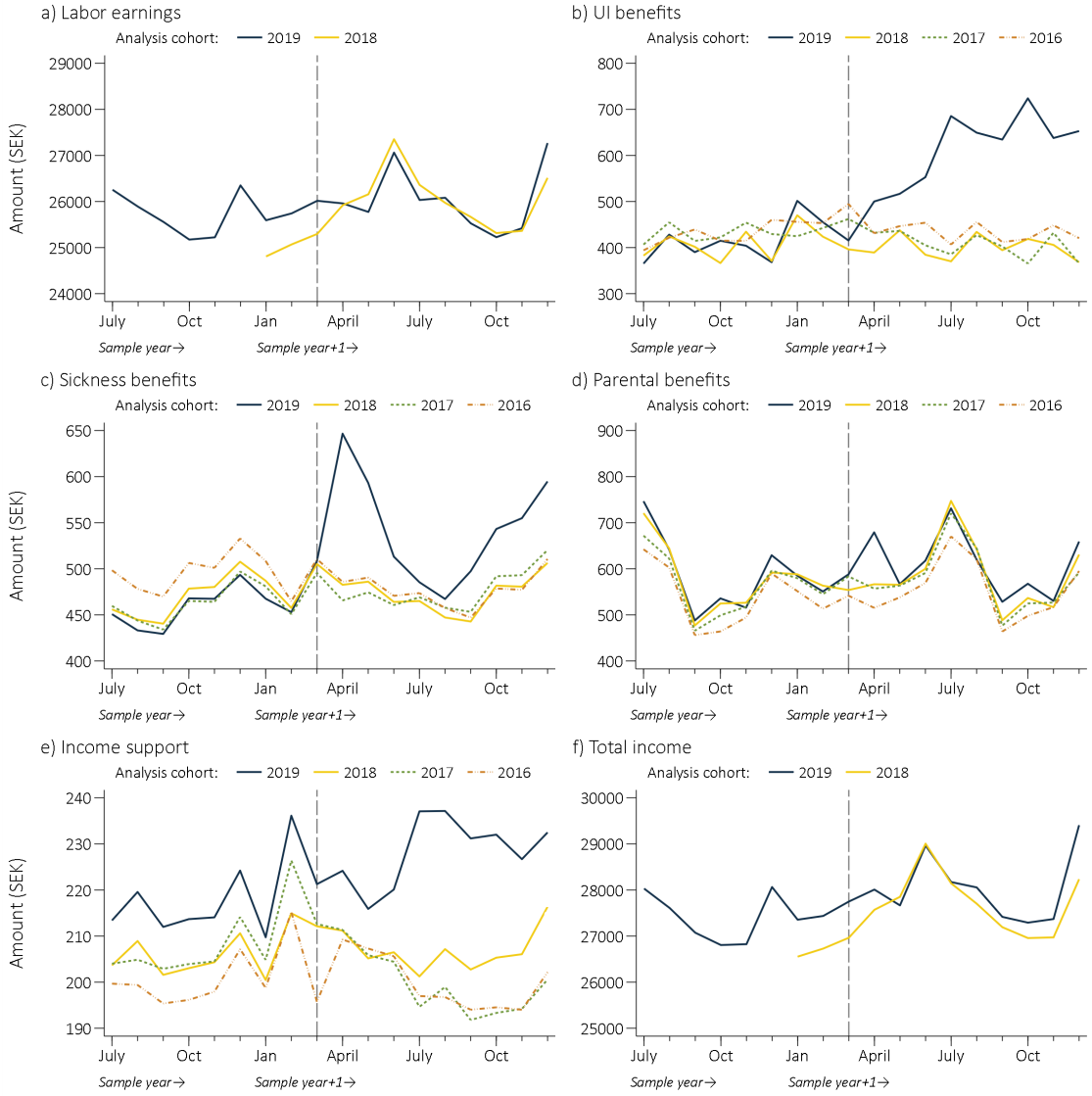
Panels b to e show the development of different transfers for the cohorts *k*=2016, …, 2019. For these outcomes an 18-month comparison period is available. For unemployment insurance, sickness insurance, and parental benefits, respectively, the average levels are fairly similar during the pre-period from July in year *k* to February in year *k+1* (i.e., data points to the left of the dashed vertical line). The same holds for the

period between March and December in year $k+1$ for cohorts unaffected by the pandemic. During the pandemic (cohort k=2019 between March and December in $k+1$), however, the average benefits are clearly higher than those of previous cohorts. From a DID perspective, these patterns in the data suggest that the parallel trends assumption is met. For income support, shown in Panel e, the figure shows that average benefits were at a higher level already before pandemic (blue line, k=2019). During the pandemic, however, income support transfers were further increased, relative to the previous cohorts. Despite higher levels before the pandemic, this suggests that income support was affected by the pandemic.

Panel f shows the corresponding figure for total income, i.e., the sum of labor earnings and the four transfer types. Expectedly, the lines are similar to those of labor earnings but levels are slightly larger.

Table A-4 in the Appendix shows some descriptive statistics for the 2019 cohort. In the sample, which comprises all the 5,746,478 individuals aged 20 to 64 registered in Sweden in January 2020, average monthly labor earnings are 25,592 SEK (2,790 USD). 75 percent of all individuals have positive labor earnings. Between four and five percent of the sample receive transfers from the unemployment insurance, sickness insurance, and income support, respectively. Almost eight percent of the sample receive parental benefits.

Figure 1: Average monthly labor earnings, government transfers and total income over time



Notes: the figure displays average monthly income over time by different cohorts. Data on monthly labor earnings available from January 2018 and onwards. Labor earnings for 2019 cohort include payments for STW. UI benefits include unemployment insurance and activity support. Sickness benefits include sickness insurance, disease carriers' benefits, etc. Parental benefits include parental leave and temporary parental leave payments and Income support includes social assistance and housing allowance. Total income is the sum of all income sources.

4 Results

We now turn to the average and dynamic effects of the pandemic during 2020 on earnings and incomes from various sources for the working-age population, based on estimations of Equations (1) and (2), respectively. We disentangle the protective role of the already existing transfer system from the additional measures introduced during the

pandemic. We further provide evidence on the effect of the pandemic on different population groups and trace its impact across the income distribution.

4.1 Labor earnings, STW, and transfers

Column 1 of Table 1 shows that the pandemic reduced monthly labor earnings by, on average, 683 SEK (approx. 70 USD). This corresponds to an earnings reduction of 2.7 percent compared to the pre-pandemic average for the 2019-cohort. However, without the STW allowance introduced in March 2020, the drop in labor earnings would most likely have been higher because more workers would have lost their jobs. On average, payments for STW amounted to 470 SEK per person and month between March and December 2020 (Column 2). An upper bound on the pandemic's impact on labor earnings is thus a reduction of 1,153 SEK per person and month (Column 3), or 4.5 percent of pre-pandemic labor earnings.[22] This suggests that without the introduction of STW, labor earnings would have been reduced by between 2.7 and 4.5 percent.

Table 1: The effect of the COVID-19 pandemic on earnings, short-time work payments, government transfers, and total income

	(1)	(2)	(3)	(4)	(5)
	Labor earnings	STW	Labor earnings (excl. STW)	Transfers	Total income
COVID-19 effect	-683.0	470.4	-1153.4	291.0	-404.3
	(11.048)	(0.812)	(11.091)	(1.722)	(10.859)
Mean dep. var.	25,667.3	–	25,667.3	1,678.2	27,396.8
Percentage change	-2.661	–	-4.494	17.34	-1.476
Number of individuals	5,899,454	5,899,454	5,899,454	6,195,625	5,899,454
Number of observations	137,320,835	137,320,835	137,320,835	408,503,830	137,320,835

Notes: Standard errors in parentheses are clustered at the individual level. The mean of the dependent variable is defined as the average of the period between July 2019 to February 2020 for the 2019-treatment cohort. This table shows results from estimating Equation (1). STW=short-time work allowance. Transfers include unemployment benefits, sickness benefits, parental benefits, and means-tested income support and Total income includes labor earnings plus transfers.

Government transfers to individuals also played an important role in mitigating the adverse income effects of the pandemic. On average, the pandemic brought an increase in transfers by 291 SEK during the period from March to December 2020 (see Column 4).[23] The estimated effect includes both existing transfers and pandemic measures, such

[22] Excluding from earnings all increases in sickness pay implies that labor earnings, for time actually worked, fell even further and the total drop in earnings amounted to some 1,400 SEK.

[23] The estimate in Column 4 is based on a larger sample as data are available for the period 2016 to 2020. When limiting the time period to the one used in the other columns, the corresponding estimate is only slightly lower (278.8). Table A-5 in the Appendix shows corresponding estimates when using annual information (equally divided

as higher replacement in the unemployment insurance. Total income, i.e., labor earnings plus government transfers, decreased on average by 404 SEK (Column 5). This implies that increased transfers compensated, on average, for 43 percent (291/683) of the drop in labor earnings.

4.2 Existing government transfers vs pandemic measures

Starting in March 2020, Sweden introduced a range of temporary changes to the existing government transfer system. Table 2 shows results disaggregated by transfer type and whether the transfer existed before the pandemic or was introduced as part of the pandemic measures. Panel a displays the overall effects of the transfer system by type, where the overall impact of 291 SEK is disentangled into the four transfer types: UI benefits, sickness benefits, parental benefits, and income support. The results show that, of the total effect of the different transfer types in 2020, UI benefits increased the most: 65 percent of the total increase in transfers is due to UI benefits (188 SEK of 291 SEK). Sickness benefits increased by 80 SEK (28 percent), followed by parental benefits and income support with 11 SEK and 12 SEK (4 percent each), respectively.

In the next step, we disentangle the share of transfer payments that comes from the existing transfer system that was in place before the pandemic and the share that comes from measures introduced during the pandemic. Even though we are not able to account for potential behavioral responses to changes in the welfare system, these estimates provide us with an indication of the relative contribution of different transfer types, as well as the relative contribution of existing government transfers and pandemic measures. In that sense, these estimates provide a benchmark to which degree the existing transfer system protected individual incomes.

Panel b shows corresponding results for the existing transfer system, i.e. how large the effects would have been if no pandemic measures would have been introduced and individuals would have received the same types of benefits. Of the existing transfers, UI benefits are by far the most important, making up 79 percent of the total increase in transfer payments (126 SEK of 159 SEK), followed by sickness benefits (12 percent), parental support (7 percent) and income support (2 percent). Under the implicit assumption that individual behavior is unaffected by the introduction of pandemic

into monthly earnings information) for labor earnings. Despite some differences, the results are fairly similar to those shown in Table 1.

measures, the existing government transfer system would have protected individuals' incomes by 158.7 SEK or 23 percent of individual earnings losses due to the pandemic, hence contributing a bit over half of the total replacement rate of 43 percent of the transfer system (see Section 4.1).

Table 2: Effects of the COVID-19 pandemic on transfer payments, overall and attributed to the existing transfers and to pandemic measures

Panel a: Overall effects					
	(1)	(2)	(3)	(4)	(5)
	UI benefits	Sickness benefits	Parental benefits	Income support	Total transfers
COVID-19 effect	188.2	79.66	10.64	12.46	291.0
	(0.955)	(0.968)	(1.140)	(0.315)	(1.722)
Mean dep. var.	416.0	457.9	586.5	217.9	1678.2
Percentage change	45.25	17.40	1.815	5.719	17.34
Panel b: Existing transfers					
COVID-19 effect	125.7	19.72	10.64	2.592	158.7
	(0.878)	(0.960)	(1.140)	(0.313)	(1.680)
Mean dep. var.	416.0	457.8	586.5	217.9	1678.1
Percentage change	30.22	4.308	1.815	1.190	9.455
Panel c: Pandemic measures					
COVID-19 effect	62.51	59.94	–	9.867	132.3
	(0.169)	(0.110)	–	(0.026)	(0.202)
Number of individuals	6,195,625	6,195,625	6,195,625	6,195,625	6,195,625
Number of observations	408,503,830	408,503,830	408,503,830	408,503,830	408,503,830

Notes: Standard errors in parentheses are clustered at the individual level. This table shows results from estimating Equation (1). Columns 1 to 4 show the estimate for the respective transfer type; Column 5 shows the sum of the four transfer types. Panel a shows the effects for the transfer type overall; Panel b shows corresponding results for the transfers that existed before March 2020; Panel c shows the effects of the newly introduced or changed transfers during the pandemic. The mean of the dependent variable is defined as the average of the period between July 2019 to February 2020 for the treatment cohort.

Panel c of Table 2 shows the estimated increases in transfer payments due to pandemic measures. Changes to unemployment and sickness insurance had the most substantial impact, with on average 63 SEK and 60 SEK per month, respectively, constituting 47 percent and 45 percent of the effect of pandemic measures, respectively. For UI, the main changes include faster eligibility for income-related UI (shortened membership and work requirements), and higher floors and ceilings in both basic insurance and income-related UI. For sickness insurance, reimbursement of the waiting day deduction resulted in increased transfers. There were no changes to parental benefits, and the increase in income support of on average 10 SEK per month (8 percent) resulted from the additional housing allowance. Overall, the pandemic

measures increased the benefits by 132 SEK per month, which corresponds to 19 percent of the total labor earnings losses of 683 SEK due to the pandemic.

The estimates in Table 2 help us understand the relative importance of existing transfers and pandemic measures within each transfer type—the pandemic measures for UI amount to roughly half of the existing system. For sickness insurance, however, the pandemic measures were three times larger than the existing transfers.

4.3 The dynamics of the effects on earnings, government transfers, and income

Extending our DID model to a dynamic event study version, as shown in Equation (2), serves two purposes. First, it enables us to trace the dynamic effects on incomes and transfers which might have been caused by dynamics in economic activity as well as by the design of the pandemic measures, such as changes in the minimum membership requirements for UI payments. Second, it allows us to assess further the parallel trends assumption underlying our DID model.

Figure 2 shows the dynamic effects on earnings and income measures (Panel a) and the different types of transfers (Panel b). Panel a shows that average labor earnings (yellow line) fell drastically at the onset of the pandemic. The policy response to introduce STW was rapid. In line with the estimates shown in Table 1, the measure of labor earnings excluding STW allowance (dashed orange) fell more than 2,000 SEK by May 2020, compared to pre-pandemic levels. As mentioned, this represents an upper bound on the impact of the pandemic on labor earnings because it is likely that unemployment would have been higher in the absence of the STW allowance, but unlikely that all workers on STW would have been dismissed. The provision of STW allowance roughly halved the fall in labor earnings. The dashed gray line displays the fall in income when the increase in transfers from the existing government transfer system are included, and the black line displays the fall in income when transfers from pandemic measures and adjustments are also accounted for. From May 2020 onwards, all income types shown in Panel a started to recover and total income even surpassed pre-pandemic levels at the end of the year. Note that the sharp recovery in December 2020 likely stems, at least in part, from payments due to agreed wage raises accumulated for the last few months as union-employer negotiated wage agreements were finally signed in late 2020 (Medlingsinstitutet 2021). Despite this positive trend towards the end of 2020, the overall pandemic effect on earnings in 2020 shown in

Table 1 was a reduction of wage earnings by 2.7 percent and a loss of total income of 1.5 percent.

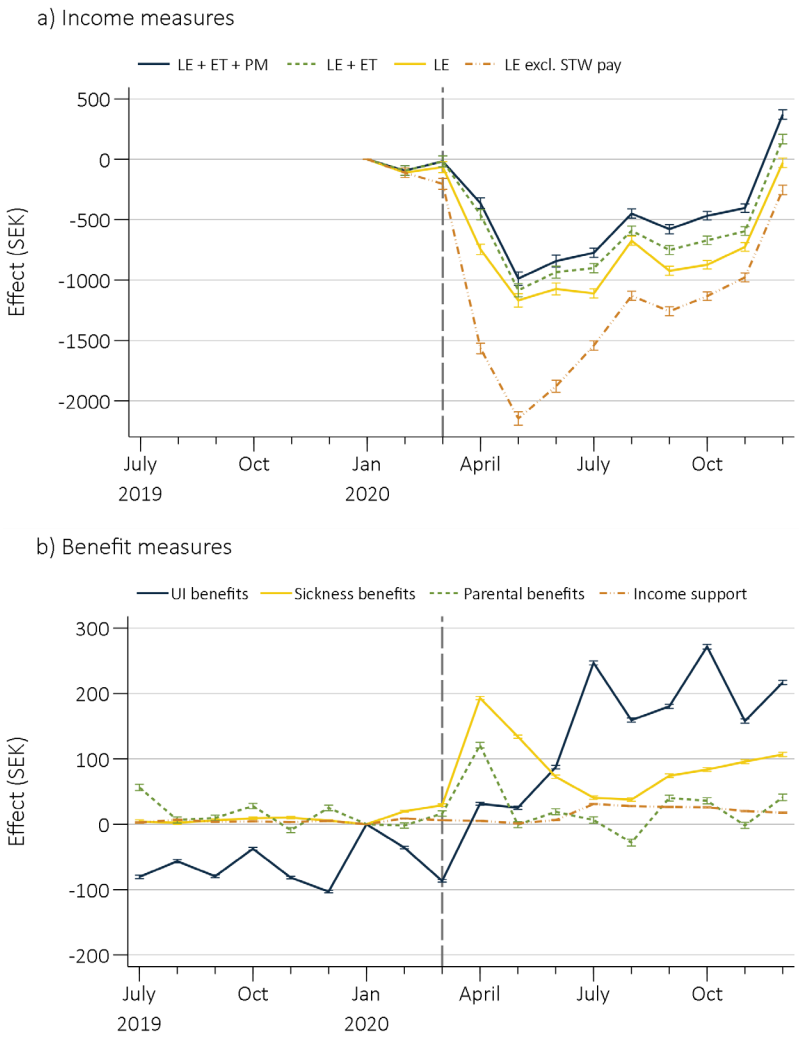
Panel b of Figure 2 shows the estimated monthly changes for the four transfer types. In line with Table 2, most transfers increased during the pandemic, although by different magnitudes. As suggested by the point estimates in Table 2, increases in UI and sickness benefits have the most significant compensatory effect on the drop in labor earnings. While sickness and parental benefits increased sharply at the beginning of the pandemic as many workers were sick or needed to care for sick children, UI reached a high level by July. This delayed response can be explained by notice periods in employment contracts, the design of UI, and the changed eligibility criteria, which allowed individuals to receive income-related UI benefits already after three months of membership in their respective UI funds (instead of, previously, 12 months), creating an additional incentive to become member in one of Sweden's UI-funds. Indeed, from May 2020 onwards, membership levels were around seven percent higher than in 2019. Before March 2020, however, membership levels were essentially the same as in the previous year.[24]

Figure 2 also allows us to look at pre-trends.[25] Albeit estimated only for a short pre-pandemic period, due to the lack of monthly labor earnings data prior to 2019, all income measures in Panel a show pre-pandemic estimates close to zero, suggesting that the parallel trends assumption holds. Panel b shows that for all transfers types except UI, the estimates are close to zero prior to March. UI levels appear lower prior to the pandemic compared to the reference month, January, but display no trend. In fact, it seems January is somewhat of an outlier with a high level of UI. Had February been chosen as the reference month, pre-pandemic estimates would have been closer to zero. The estimates for UI, nevertheless, show a clear break in the trend with the onset of the pandemic suggesting a causal effect of the pandemic also on UI transfers. We argue that the estimated pre-pandemic effects presented in Figure 2 support a causal interpretation of our estimated effects of the pandemic on earnings, transfers and income.

[24] Data taken from the Swedish Unemployment Insurance Inspectorate (IAF)'s website (https://www.iaf.se, accessed 2022-09-08).

[25] While the identifying assumption of parallel counterfactual trends is fundamentally untestable, observing parallel trends before the pandemic is at least suggestive evidence in support of it.

Figure 2: Dynamic effects on earnings, incomes, and government transfers



Notes: this figure shows event-study estimates with 95 percent confidence intervals for earnings and various income measures (Panel a), and for transfers (Panel b). LE=labor earnings, ET=existing transfers, PM=pandemic measures. Estimates are taken from estimating Equation (2).

4.4 The effect of the pandemic on different groups

So far, the focus has been on the average effects of the pandemic on labor earnings, transfers, and total income. Still, it is likely that some groups were more severely affected by the spread of the virus itself, while the rapid contraction of economic activity hit groups differentially. Figure 3 shows estimates of the effects on labor earnings and total income, i.e., the sum of earnings and transfers, for several groups defined by demographic, socio-economic, and work characteristics. Demographic groups include gender, age, migration background, and family status. Socio-economic groups are limited to education categories. Work characteristics include whether or not

an individual was employed in an occupation with possibility to work from home, whether or not an individual worked in the hospitality sector that was severely hit by the pandemic, and whether or not an individual worked in a "contact profession" with regular contact to other individuals.[26] Note that the groups are not mutually exclusive. Instead, the sample is divided into groups by each characteristic separately. Characteristics are determined in the sampling year, i.e., pre-pandemic for the 2019-treated cohort.

The results show that the labor earnings losses (in percent) were largest for young individuals, individuals with low education, foreign-born individuals, and, by far most severe, for those who worked in the hospitality industry before the pandemic.[27] Unlike evidence from other countries and earlier studies for Sweden (Angelov and Waldenström 2021a; Adams-Prassl et al. 2020; Dang and Viet Nguyen 2021), we do not find that the pandemic hit women more severely than men. On the contrary, earnings losses and total income losses are significantly larger for men than for women.[28]

Comparing the losses of labor earnings to the impact on total income, our analysis shows that the government transfer system functioned in a compensatory way, i.e., that those hit hardest were also those who were "compensated" for large losses by the transfer system. In spite of this, young individuals emerge as a group that was hit hard, and where the transfer types included in this analysis failed to fully compensate the earnings losses. This group might, however, have found other ways to mitigate labor earnings losses, e.g., by registering in education and thus increasing their take-up of student grants or student loans. Unfortunately, our data do not include student grants and loans, but CSN (2021) reports that the number of students at municipal adult education, vocational colleges, and universities increased by 17 percent, 9 percent, and 29 percent, respectively in 2020 compared to the year before.

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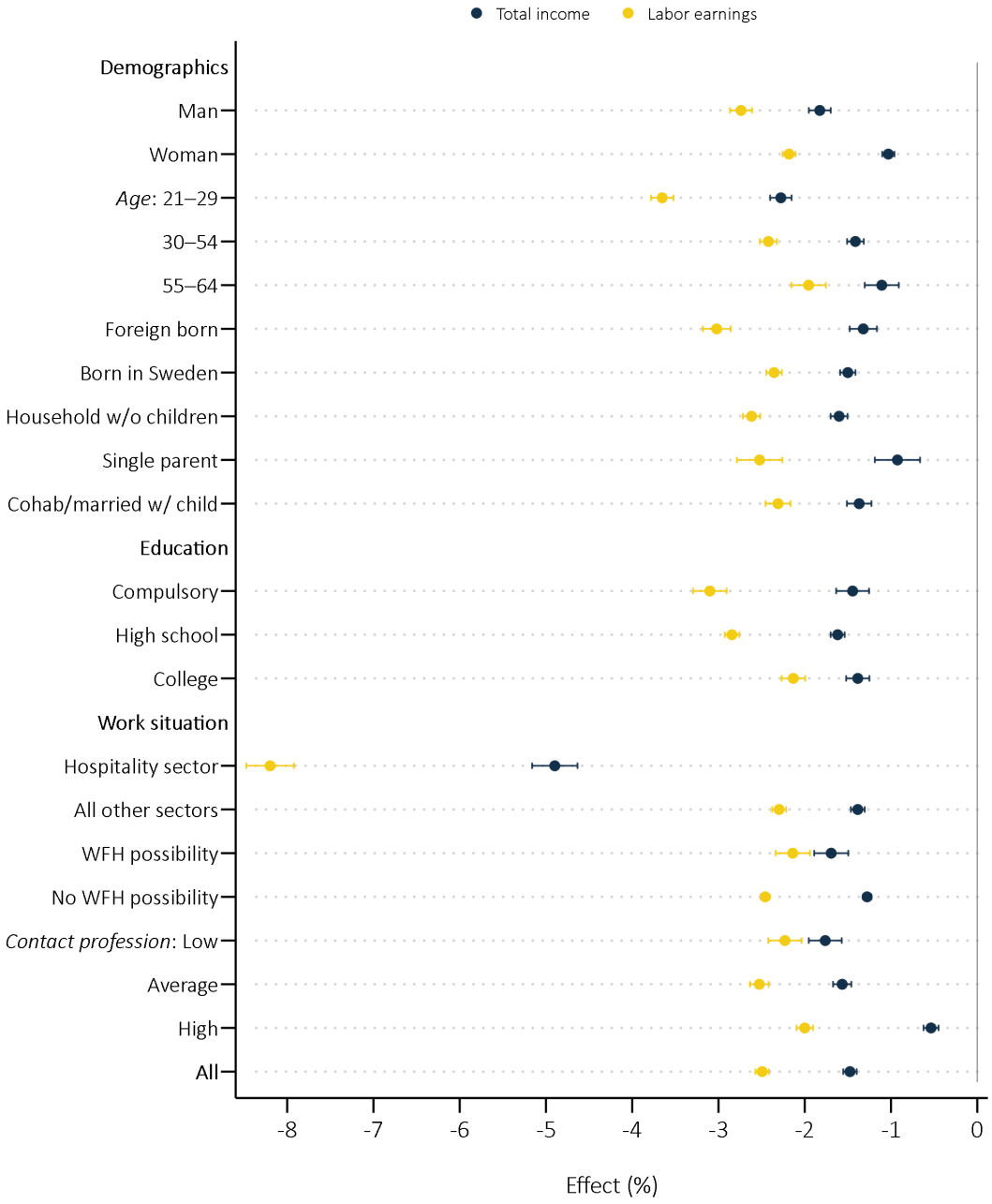
[26] The measure for the possibility of working from home uses occupational information created by Dingel and Neiman (2020) based on SOC12. Hensvik et al. (2021) harmonize it to the Swedish standard SSYK2012. The measure for contact profession comes from CES (Centre for Epidemiology and Community Medicine) and CAMM (Center for Occupational and Environmental Medicine). It approximates how much physical contact an occupation requires. The measure goes from 0 (no physical contacts) to 100 (very close physical contact). We create three groups, low (0-49), medium (50-74) and, high (75-100) contact.

[27] The percentage effect for group G is defined as the estimated effect for group G relative to the average pre-pandemic total income for group G in the 2019-cohort. Figure A-1 includes corresponding estimates for all sectors of industry.

[28] One untested hypothesis for this difference might stem from the fact that Angelov and Waldenström (2021a) also include capital income, which we do not observe. Moreover, our sample includes individuals without labor earnings. This group is larger among women.

Figure 3: Effects on labor earnings and total income by group



Notes: the figure show estimation results for labor earnings (yellow dots) and total income (blue dots) with corresponding 95 percent significance intervals. Each estimate is based on a separate regression for the respective subsample.

To analyze whether pandemic measures targeted specific groups, Figure A-2 in the Appendix shows the replacement rate for existing transfers and pandemic measures for

different groups.[29] This analysis shows that among demographic groups, single parents received the strongest income protection from transfers during the pandemic in relative terms. They benefitted from the additional housing allowance, increased UI, and sickness benefits. Workers in jobs characterized by a high level of personal contact also received a high replacement rate from the transfer system for their loss in labor earnings. This group is largely made up of health sector employees and teachers, and they benefitted from high protection from sickness benefits and the waiting day reimbursement. In Figure A-3 in the Appendix, we present estimates for the extent to which the introduction of the STW allowance protected the labor earnings of these different groups. The amount of STW allowance is put in relation to the loss in labor earnings. This analysis shows that STW was almost as large as the loss in earnings for workers with low contact jobs and workers with the ability to work from home.

4.5 Income losses across the income distribution

The previous subsection shows significant heterogeneity in the effect of the pandemic on labor earnings with less heterogeneity in the effect on total incomes, suggesting that the government transfer system had a compensatory effect on total incomes. This section presents an analysis of effects along the entire distribution of pre-pandemic disposable income. We present estimates for the impact on labor earnings, labor earnings excluding STW, incomes including labor earnings and transfers from the existing government transfer system, and total income including pandemic measures in Figure 4. The estimates are presented for each vingtile of the distribution. Because our previous analysis shows different effects of the pandemic for men and women, we conduct the analysis separately for men and women, and overall. Panel a shows that for men, labor earnings fell by eight percent for the lowest vingtile and by 6 percent for the second vingtile. For the remaining part of the income distribution, the earnings losses range from four percent to two percent for the highest vingtiles. The figure clearly shows that in the absence of STW allowance, these earnings losses would have been substantially larger, with up to two percentage points. Existing transfers reduced income losses the most at the lower end of the income distribution. But including these transfers, the income losses are still largest for low-income groups. The pandemic's

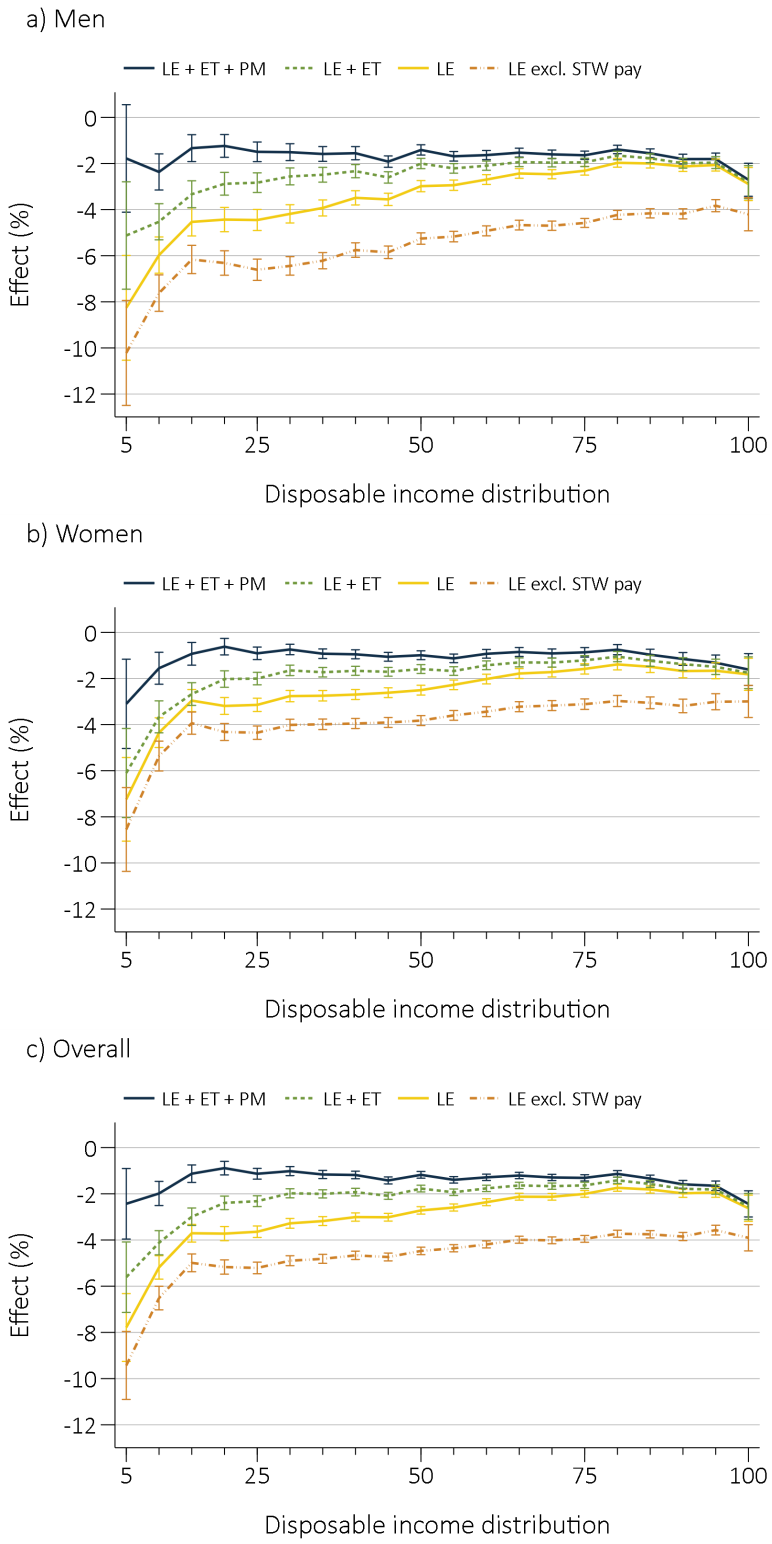
[29] The replacement rate is defined as the estimated COVID-19 effect on existing transfer or pandemic measures divided by the estimated COVID-19 effect on labor earnings using Equation (1).

effect on total income, which also includes the transfers due to pandemic measures, is similar across the pre-pandemic income distribution. Hence, the pandemic measures provided important income protection for men with low incomes.

Panel b shows corresponding results for women. The key differences to the patterns of men are the following: first, losses in labor earnings are smaller than for men in the lower half of the income distribution. In the upper part of the income distribution, losses in labor earnings are relatively similar to those of men. Second, short-time work allowance played a smaller role for women: while STW prevented about two percentage points of earnings losses for men, the corresponding protection for women is between one and 1.5 percentage points. Third, total income losses are also slightly smaller for women, overall. But the figure also shows that while ordinary transfers did not contribute much to leveling out female income losses at the very low end, and instead had a more protective effect for below median incomes above the 15th percentile, the pandemic measures, in particular the additional housing allowance, had a protective role at the very bottom of the income distribution of women. Yet, women in the bottom vingtile experienced slightly larger income losses than the lowest vingtile among men.

In Panel c, we show the corresponding results for our entire sample. For the entire population, the larger earnings losses in the lowest vingtiles, which are driven by women, can be clearly seen. From roughly the fourth vingtile, however, the earnings losses are largely equalized through both existing transfers and pandemic measures.

Figure 4: The effect of COVID-19 across the income distribution



Notes: Each figure shows estimates for the respective earnings and income definitions for men (Panel a), women (Panel b), and the overall sample (Panel c). LE=labor earnings, ET=existing transfers, PM=pandemic measures. Each point estimate and respective 95 percent significance interval is based on a separate regression of the respective vingtile of the two-year pre-pandemic disposable income distribution.

5 Conclusions

During the COVID-19 pandemic, many governments introduced temporary adjustments to the government transfer system to counter the economic and public health consequences of the COVID-19 pandemic. We study the effects of the COVID-19 pandemic on labor earnings and on government transfers using a difference-in-differences approach and population-wide Swedish administrative data on monthly earnings and monthly government transfer payments.

We find that, on average, labor earnings declined by 2.7 percent during the first ten months of the pandemic. 43 percent of this decline, however, was replaced by government transfers, primarily unemployment and sickness benefits. Moreover, we find that the generous short-time work allowance, introduced to protect jobs, constituted a large share of individual labor earnings during 2020 and is thus likely to have significantly reduced the economic impact of the pandemic on earnings by an order of magnitude similar to the government transfer system.

Our detailed data allows for disaggregation of government transfers into payments due to already existing transfers, that were in place before the pandemic, and payments due to pandemic measures that were introduced in response to the pandemic. The analysis shows that the pandemic measures were almost as important for replacing earnings losses as the existing transfers. The most important transfer systems were UI and Sickness Insurance. Important pandemic measures included the raised ceilings in income related UI, and the waiting day reimbursement in the Sickness Insurance system.

Our results further show that labor earnings at the lower end of the pre-pandemic income distribution were most heavily affected by the pandemic, and that losses were particularly large for young individuals, low-educated, foreign-born, and, most notably, for those working in the hospitality sector prior to the pandemic. Yet, both the existing transfers and the pandemic measures were compensatory and were largely able to even out differences in income losses. The short-time work scheme, on the contrary, was non-compensatory, replacing a larger share of earnings losses higher up in the distribution.

Our findings show that swift discretionary policy measures can play an important role in mitigating the economic consequences of unanticipated crises. While existing

transfer systems can mitigate some of these consequences, using them to target particularly vulnerable groups with additional measures and introducing measures adjusted to the nature and type of crisis can be equally important. The crucial challenge of designing temporary measures lies in targeting the groups most affected by upcoming crises, as well as being able to remove temporary measures when they are not needed any longer.

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Appendix

Tables

Table A-1: Changes to the government transfer system during the pandemic

Type of change	*Introduction*	*Repeal*	*Change to existing transfers*
(a) Short-time work (STW)			
Short-time work expansion	03/16/2020	30/09/2021	Short-time work allows to reduce working hours by 20, 40 or 60 percent (between 05/01/2022 and 07/31/2022 also 80 percent possible). Government covers 75 percent of wage reduction up to a ceiling of 44,000 SEK.
(b) UI benefits			
Membership condition (*medlemsvillkor*)	03/01/2020	12/31/2020	Change of minimum membership period for eligibility for income-related benefit from 12 to 3 months.
Work condition (*arbetsvillkor*)	03/30/2020	12/31/2022	Change of minimum work requirements for UI eligibility from (to) at least 80 (60) hours/month in six out of the 12 months preceding unemployment or at least 480 (420) hours in six consecutive months with at least 50 (40) hours/month during the 12 months prior to unemployment.
Basic UI benefits (*grundbelopp*)	04/13/2020	12/31/2022	Increase basic benefit from 365 to 510 SEK per day and increase of the minimum benefit from 0 to 255 SEK per day.
Minimum amount income related UI (*inkomst-relaterad ersättning*)	04/13/2020	12/31/2022	Increase of minimum income-related benefit from 365 to 510 SEK per day.
Ceiling increase (days 1-100)	04/13/2020	12/31/2022	Increase of ceiling for days 1-100 of income-related benefit from 910 to 1,200 SEK per day.
Ceiling increase (days >100)	06/29/2020	12/31/2022	Increase of ceiling for days >100 of income-related benefit from 760 to 1,000 SEK per day.
Removal mandatory waiting period (*karensvillkor*)	04/13/2020	01/03/2021	Removal of mandatory waiting periods (otherwise 6 days).
(c) Sickness benefits			
Removal of one-day qualifying period	03/11/2020	10/01/2021	Income loss at first day of sickness reimbursed. By 700 SEK from 11/03/2020, 804 SEK from 06/01/2020 and 810 SEK from 01/01/2021.
Relaxed requirement of a doctor's certificate when using sickness benefits	03/21/2020	04/01/2022	A doctor's certificate of the medical status when receiving sickness benefits postponed from the 8th day to the 15th day from 13/03/2020 and to the 21st day from 03/26/2020. From 11/01/2020 to 12/15/2020 a certificate needed at the 15th day and after that at the 21st day.

Disease carrier's benefits for COVID-19	02/01/2020	*04/01/2022*	COVID-19 classified as public health hazard. Employees with confirmed or suspected COVID-19 receive 80 percent replacement rate, up to a daily cap of 804 SEK for labor earnings losses. The amount increases to 810 SEK 01/01/2021. From 07/01/2020, disease carrier's benefit also covers persons who works closely with or are relatives to persons classified as high-risk groups of COVID-19.
Risk group compensation	08/24/2020	*04/01/2022*	Workers with medical conditions making them vulnerable to COVID-19 receives benefits if they can't work from home. Benefits amount to 804 SEK per day and could be applied retroactively from 07/01/2020.
(d) Parental benefits			
No requirement of a doctor's certificate to get temporary parental benefits	03/19/2020	*03/31/2022*	The requirement to get a doctor's certificate of the child's medical status at the 7th day is abolished.
Temporary parental benefits possible if daycare/school closed	04/25/2020	*03/31/2022*	Parents can receive temporary parental benefits if their child's daycare or school is closed due to a COVID-19 outbreak.
(e) Income support			
Additional housing allowance	07/01/2020	12/31/2020	Additional allowance to families with children who receive housing allowance. Amounts to 25 percent of ordinary allowance. Reintroduced 07/01/2021 to 12/31/2020.

Table A-2: Main results including earnings for sole proprietors and business owners using all cohorts

	(1)	(2)	(3)	(4)	(5)
	Labor earnings	STW	Labor earnings (excl. STW)	Transfers	Total income
COVID-19 effect	-639.4	391.9	-1031.3	257.0	-382.3
	(6.544)	(0.677)	(6.587)	(1.721)	(6.327)
Mean dep. var.	26,079.3	0	26,079.3	1,661.1	27,740.1
Percentage change	-2.452	.	-4.954	15.47	-1.378
Number of individuals	6,195,625	6,195,625	6,195,625	6,195,625	6,195,625
Number of observations	408,503,830	408,503,830	408,503,830	408,503,830	408,503,830

Notes: This table reproduces the results in Table 1 including earnings for sole proprietors and business owners using average monthly labor earnings allowing us to use data from 2016-2020. Average monthly labor earnings at the individual level are defined as yearly labor earnings divided by 12. Standard errors in parentheses are clustered at the individual level. The mean of the dependent variable is defined as the average of the period between July 2019 to February 2020 for the treatment cohort. This table shows estimation results from estimating Equation (1) without additional controls. STW=short-time work allowance.

Table A-3: Data sources and types of transfers

Type of transfer	*Transfers included*	*Data source*
STW	STW payments at the individual worker level	Swedish Agency for Economic and Regional Growth
UI benefits	Income-related benefits	Swedish Unemployment Insurance Inspectorate (IAF)
	Activity support to unemployed individuals who participate in active labor market programs (ALMPs)	Swedish Social Insurance Agency (SIA)
	Development allowance for individuals aged 18 to 24	SIA
	Introduction benefits for newly arrived immigrants	SIA
Sickness benefits	Sickness insurance benefits (also includes benefits aimed at preventing sickness or for participating in rehabilitation)	SIA
	Disease carrier's benefits	SIA
	Risk group compensation	SIA
	Waiting day compensation	SIA
Parental benefits	Parental leave	SIA
	Temporary parental leave	SIA
Income support	Social assistance	National Board of Health and Welfare
	Housing allowances	SIA

Table A-4: Descriptive statistics for the 2019 cohort

	(1) Mean	(2) Standard deviation
Labor earnings	25,592.3	40,126.6
Share positive (in percent)	75.2	
UI benefits	501.5	2,905.3
Share positive (in percent)	4.2	
Sickness benefits	467.6	2,768.9
Share positive (in percent)	3.6	
Parental benefits	585.2	3,856.7
Share positive (in percent)	7.8	
Income support	209.7	1,295.9
Share positive (in percent)	4.5	
Total income	27,356.3	39,769.1
Woman (in percent)	48.9	
Age	41.1	
Compulsory education (in percent)	13.9	
Upper secondary education (in percent)	44.1	
Post-secondary education (in percent)	42.0	
Foreign born (in percent)	25.2	
Single parent	5.5	
Cohabitating or married with child(ren)	32.8	
Household without children	61.8	

Notes: this table includes mean (Column (1)) and standard deviations (Column (2)) for the most recent sample cohort (k=2019), which includes all individuals aged 19-63 in 2019. Earnings and benefit measures are from January 2020. Education is defined as the highest completed education. Individuals are defined as children until they reach age 18. The total number of individuals is 5,746,478.

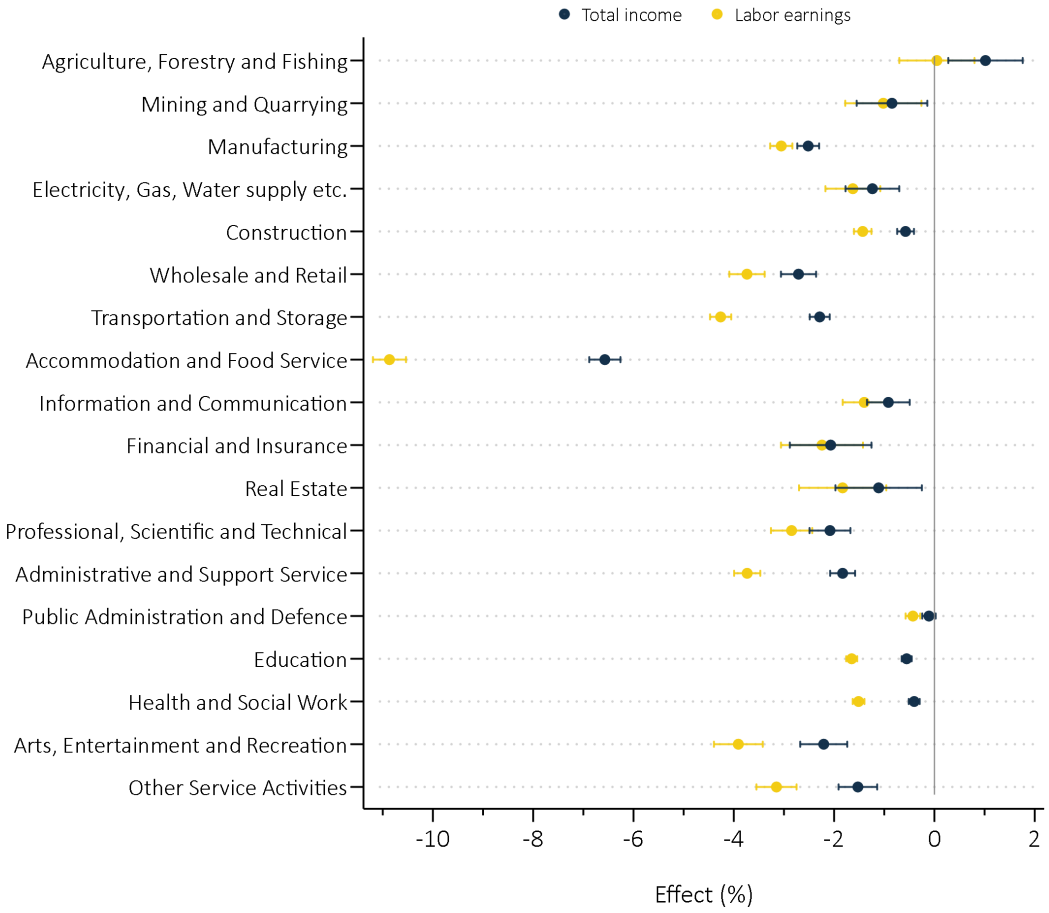
Table A-5: Main results using all cohorts

	(1)	(2)	(3)	(4)	(5)
	Labor earnings	STW	Labor earnings (excl. STW)	Transfers	Total income
COVID-19 effect	-687.4	391.9	-1079.3	257.0	-430.3
	(6.459)	(0.677)	(6.502)	(1.721)	(6.242)
Mean dep. var.	25,569.0	0	25,569.0	1,661.1	27,230.1
Percentage change	-2.688	.	-4.221	15.47	-1.580
Number of individuals	6,195,625	6,195,625	6,195,625	6,195,625	6,195,625
Number of observations	408,503,830	408,503,830	408,503,830	408,503,830	408,503,830

Notes: This table reproduces the results in Table 1 using average monthly labor earnings allowing us to use data from 2016-2020. Average monthly labor earnings at the individual level are defined as yearly labor earnings divided by 12. Standard errors in parentheses are clustered at the individual level. The mean of the dependent variable is defined as the average of the period between July 2019 to February 2020 for the treatment cohort. This table shows estimation results from estimating Equation (1) without additional controls. STW=short-time work allowance.

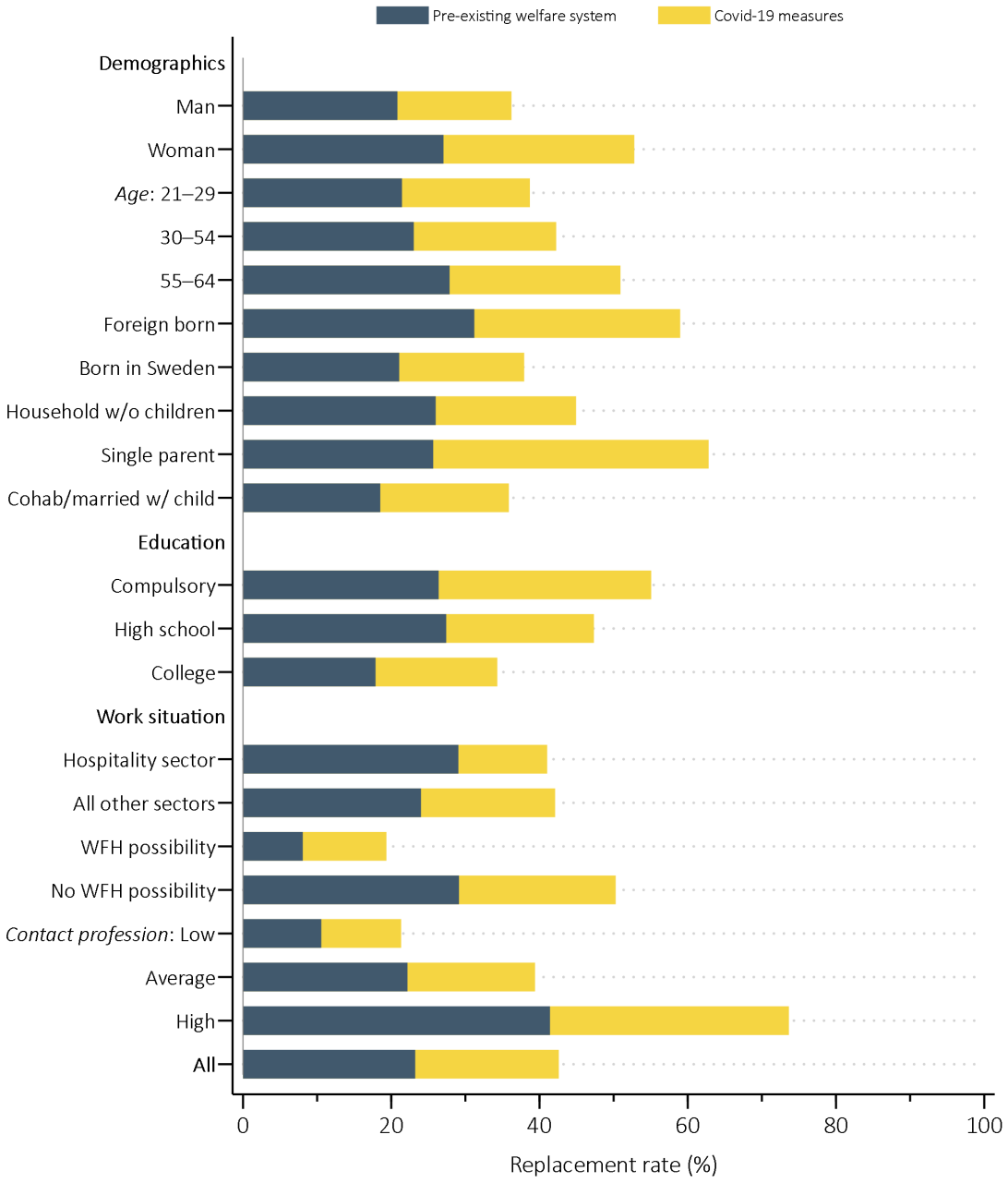
Figures

Figure A-1: Corona effects by sector of industry



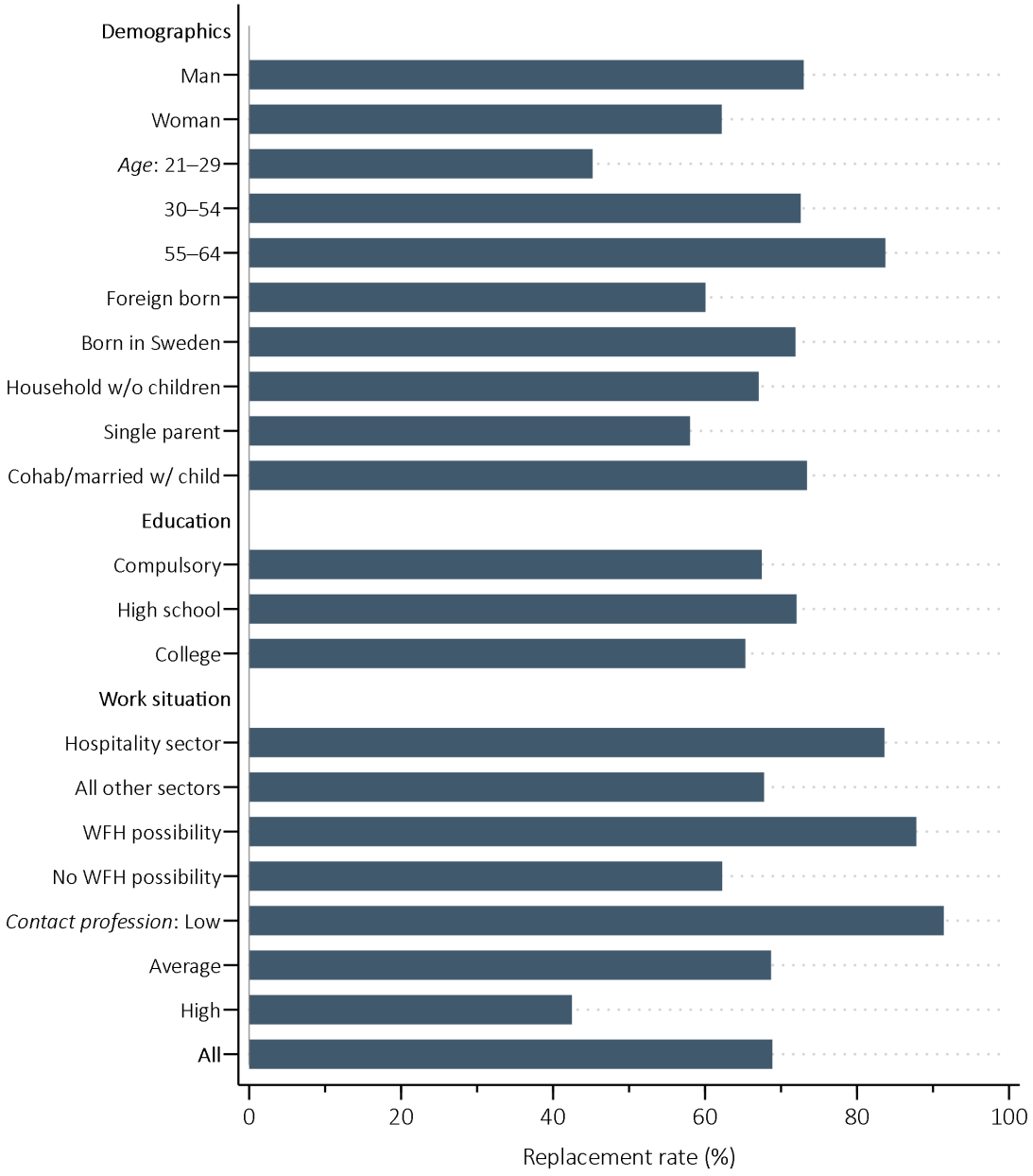
Notes: the figure shows estimated COVID-19 effects on labor earnings (yellow dots) and total income (blue dots) with corresponding 95 percent significance intervals. Each estimate is based on a separate regression for the respective subsample suing Equation 1.

Figure A-2: Replacement rates of existing transfers and pandemic measures



Notes: this figure displays the replacement rate from existing transfers and pandemic measures for different groups. The replacement rate is defined as the estimated COVID-19 effect on existing transfers or pandemic measures scaled by the estimated COVID-19 effect on labor earnings. Each estimate is based on a separate regression for the respective subsample using Equation 1.

Figure A-3: Replacement rate of short-time work allowance by group



Notes: this figure displays the replacement rate from short-time work allowance. The replacement rate is defined as the estimated COVID-19 effect on short-time work scaled by the estimated COVID-19 effect on labor earnings. Each estimate is based on a separate regression for the respective subsample using Equation 1.