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Keywords: Labor demand shock; COVID-19; Employment; Social Gradient
JEL: E24; J2; J4; J6; J11
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The Social Gradient in Employment Loss during COVID-19*

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February 15, 2022

We provide new evidence on the heterogeneous employment responses to the economic crisis induced by COVID-19. Utilizing monthly administrative pay records for all Norwegian employees, we document increases as well as reductions in employment and hours worked. With pre-crisis cohorts as controls, we use a difference-in-differences strategy to identify the effects of the crisis. Total pay (hours worked) dropped by 8% the first two months after the initial lockdown, followed by a quick recovery. By October 2021, we estimate a reduction in total hours worked of about 2%. The crisis affected prime-aged employees, senior workers, youth, and those initially unemployed differently. For prime-aged employees, we find monthly pay reductions in line with those for the whole economy. For senior wage earners and unemployed, the negative long-term employment effects were even larger. We identify significant social gradients, as persons with low past earnings, immigrants, and youth with a disadvantaged family background experienced more adverse consequences of the crisis.

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1 Introduction

The economic crisis triggered by the COVID-19 pandemic gave rise to major labor market disruptions and caused unemployment and underemployment to rise at unprecedented scales, especially for lower socio-economic groups.[1] In the present paper, we examine how the pandemic affected labor input of contemporaneous and potential workers, both during the crisis and after the dust had settled.

While nearly 12% of the Norwegian labor force claimed unemployment benefits within a few weeks of the initial lockdown (Alstadsæter et al. 2020), the official labor force unemployment rates rose by only 0.9 percent from Q1 to Q2 in 2020 (Statistics Norway, 2022). To accurately measure changes in hours worked, we exploit administrative micro data with monthly pay records for the full population of Norwegian employees. Since most contracts are regulated by collective agreements, the hourly wage did not change in the short run. Therefore, records of actual wages paid provide accurate measures of month-by-month fluctuations in hours worked. In contrast to standard unemployment statistics, monthly pay records also capture increases in hours worked during the crisis.[2] By comparing with data constructed exactly the same way for pre-crisis cohorts, we estimate that the crisis reduced total labor input in Norway by approximately 8% from February to April 2020. Thereafter, the labor market recovered gradually with some fluctuations, and by October 2021 (the last observation month in our data), we estimate that total labor input was still approximately 2% below the pre-COVID level. Increases in hours worked and transitions into employment were almost as prevalent as reductions in hours worked and exits from employment, even during the darkest hours of the COVID-19 crisis.

The pandemic hit the whole economy, but effects were far from uniformly distributed across the labor market. First, individual effects of a crisis critically depend on initial labor market status. Employees are exposed to a higher risk of temporary or permanent layoff. While the unemployed people and labor market entrants are less likely to find a job, older workers with

[1] See, for instance, Chetty et al. (2020) for the US, Alstadsæter et al. (2020) for Norway, Adams-Prassl et al. (2021) for the UK, US, and Germany, Crossley et al. (2021) for the UK, Zimpelmann et al. (2021) for the Netherlands, and Stantcheva (2022) for a recent overview.

[2] A distinguishing feature of the COVID-19 crisis is that it not only destroyed (at least temporarily) jobs in industries exposed to social distancing measures, but also triggered expansionary fiscal and monetary policy interventions, as well as consumer substitution, that fueled employment in some industries not directly affected by social distancing measures. Hence, in order to comprehensively measure the overall effects of the crisis, and to assess their distributional consequences, we need to identify both winners and losers.

pension entitlements may decide to retire. In the main part of our analysis, we therefore examine the consequences of the pandemic separately by labor market situation just before the onset of the crisis, i.e., in February 2020. In particular, we examine effects of the crisis for prime-aged wage earners (30-60), older employees with pension entitlements (62-72), unemployed, and youth of school leaving age (18-19). Second, there is heterogeneity within groups. Encrypted identification numbers enable us to link the earnings data to other administrative registers that include demographic characteristics, family background, educational attainment, occupation, labor market status, and employer characteristics. To study how the employment loss was distributed, we estimate, by gender, “social gradients" by earnings rank and immigrant status. While employees and unemployed are ranked by their own previous earnings, we study the social gradient for youth using the earnings history of their parents. The existing literature has revealed that job-loss during a crisis may have scarring effects and make individuals more exposed to future unemployment (Mousteri et al. 2018; Pieh et al. 2020), hence, from a policy perspective, it is important to identify those that are hardest hit by the crisis.

We examine how each group was affected by the crisis month by month, both in terms of pay and employment. When we follow these groups month by month, pay and employment will change even in the absence of a labor market shock. Employees may adjust their labor supply up or down, but extensive margin employment rates are bound to decline as we move into the outcome period. For the unemployed, employment is bound to increase. To isolate the effects of the COVID-19 crisis, we use a simple difference-in-differences strategy, where we compare pay and employment changes during the pandemic for cohorts observed in February 2020 with cohorts constructed in the exact same fashion two years earlier, i.e., in February 2018.

For prime-aged employees, we find that the crisis caused an immediate 6-7 % drop in average hours worked, followed by a quick recovery towards pre-crisis levels during the fall of 2020. A new decline followed from another wave of pandemic-related restrictions during the winter months of 2020/2021, yet by October 2021, average hours worked was again almost back to normal. For senior workers, with potential access to early retirement, negative employment and earnings effects have had a more lasting impact. Some of these workers did not return to the labor market during our observation window, and by October 2021, overall hours worked remained 2-3 % below pre-crisis levels. We find social gradients of the COVID shock for both prime-aged and senior wage earners. The drop in pay over all 20 months was significantly higher for employees in the lower end of the earnings rank distribution as well as for

immigrants. In contrast to the typical downturn, we find strikingly similar patterns for men and women.

The pandemic slowed down the employment transitions for individuals unemployed at the onset of the crisis. By the end of October 2021, the employment rate for men in this group is estimated to be almost 5 percentage points below predictions based on pre-crisis data, suggesting a more persistent impact on persons without stable employment than for employees. Unlike for employees, we find no evidence of any reinforced earnings rank effect during the pandemic. To the contrary, among those initially unemployed, the COVID crisis reduced the earnings gradient for both men and women. For unemployed immigrants, we find no consistent pattern of deepened employment gaps relative to natives, but labor migrants from Eastern European EU countries were disproportionally hit by the pandemic.

Finally, for young people at the entrance of the labor market, we show that the crisis reduced employment in the short run, but youth employment recovered quickly in line with the pattern for prime-aged employees. Since the youth employment rate is strongly affected school enrollment, we focus on the NEET status. On average, COVID led to a drop in the NEET rate, but with a reinforced social gradient in NEET status.

Our paper makes three main contributions. First, we show the potential of administrative pay records to provide accurate evidence of labor input adjustments to demand shocks, both at the extensive and intensive margin. Second, we study employment responses to the COVID-19 shock until the end of crisis, and document how it affected wage earners, the unemployed and youth in different ways. Third, we identify significant social gradients in the effects, as employees with low previous earnings, immigrants and youth with a disadvantaged family background were particularly exposed to the adverse consequences of the crisis.

2 Background and data

In Norway, the COVID-19 crisis hit the labor market with full force on March 12, 2020. Strict, and largely unexpected, regulations on social distancing led to an immediate and massive reduction in economic activity, and during the following few weeks 360,000 people (approximately 12% of the labor force) signed up for unemployment benefits. Approximately 90 percent of the layoffs during the initial stages of the crisis were temporary, however, and many of them were “partial”, in the sense that employment continued with reduced work hours. This means that most of the directly affected workers retained their employment relationship,

also because bankruptcies dropped. A few days into the crisis (on March 16), the Norwegian parliament agreed to temporarily change the unemployment insurance program with increased replacement rates, longer maximum duration and lighter eligibility requirements. As in most other countries, the lockdown was later followed up by a wide range of stimulus packages, including generous cash support to firms with sufficiently large, documented reductions in sales (compared to previous year).

The analysis in this paper is based on encrypted administrative registers providing records on actual wage payments from all employers (including public sector) to all employees on a monthly basis, currently up to and including October 2021. As the payment records are directly reported by the firms and used for administrative tax purposes, they are highly reliable. Given that hourly wages are typically adjusted once a year only, and then only moderately, the monthly fluctuations in individual earnings almost exclusively reflect fluctuations in labor input. Hence, for the period covered in this paper, they offer a unique insight into the individual labor market effects of the COVID-19 pandemic, capturing negative as well as positive changes in hours worked, and entries into employment as well as exits out of employment. The generous unemployment insurance implies that the earnings losses examined in this paper do not automatically translate into losses of individual income. The purpose of this study, however, is to describe the reduction in total labor input over time and across groups – and not to examine the individual consequences for economic welfare.

To enable comparison with unaffected pre-crisis data, we use monthly pay covering the period from 2017 through October 2021 for the whole population of residents in Norway. Based on encrypted identification numbers, we merge the earnings data with administrative registers containing information about demographic characteristics (sex, birth-year, and, for immigrants, country of origin), family background (with parental annual earnings dating back to 1967), own earnings history (annual earnings during the past 10 years), educational attainment, occupation, industry, firm identity, and labor market status.

3 The course of the COVID-19 induced crisis in Norway

To examine the overall labor market impacts of the crisis, Figure 1 first shows how the total wage bill (to all resident employees in Norway) developed month-by-month after the onset of the crisis in March 2020. For comparison, we include the corresponding developments two years earlier; i.e., from March 2018. Each scatter point indicates the percentage change in the total wage bill since the respective base month (February 2018/2020). For example, the number

-10 reported for men in month 6 in the 2020 sample, means that the total wage bill in August 2020 (6 months after February) had declined by 10 percent compared to the base month (February 2020). Figure 1 shows that there are considerable monthly (seasonal) variations in overall wage payments also under "normal" cyclical conditions, here represented by the 2018-data. In particular, we note that total pay in August were considerably lower than in February also in 2018. We use March 2018 to the end of 2019 as "control period" since this was a period of relative labor market stability in Norway. The LFS unemployment rate changed from 4 % in Q1-2018 to 3.8 % in Q4-2019. According to Figure 1, total pay (adjusted for average nominal wage inflation) increased by 2 % from February 2018 to February 2019, largely in line with the trend in GDP.

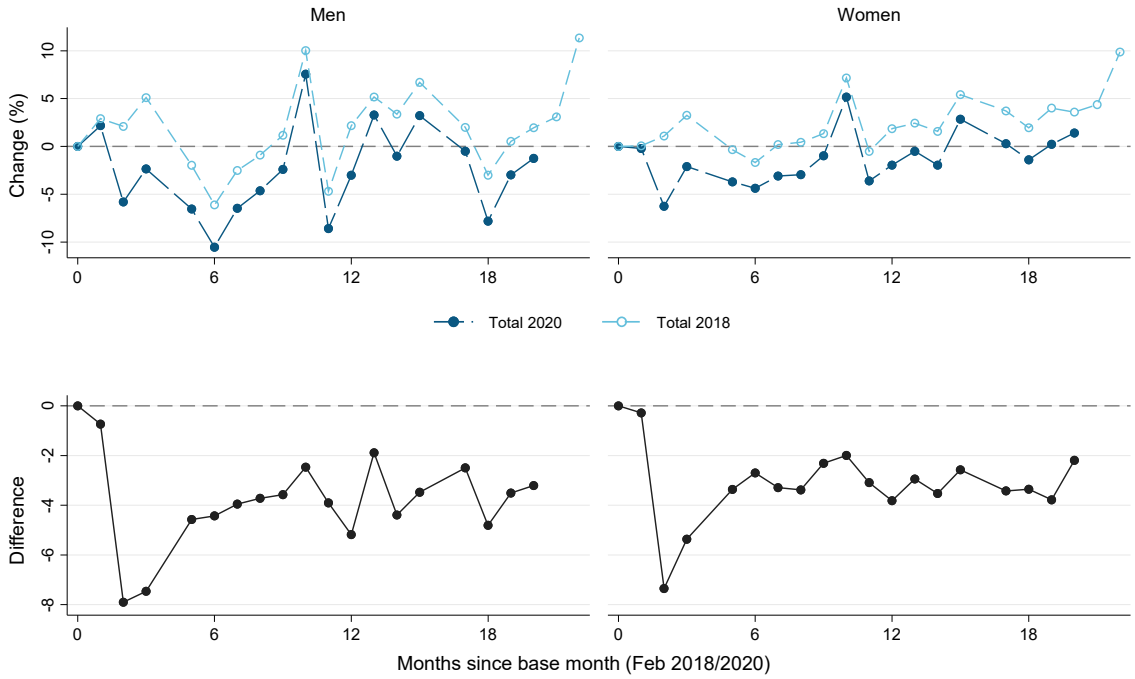


Figure 1. Change in total wage bill since February 2018 and 2020 (excluding June)

Note: The numbers of the horizontal axis denote months since February 2018/2020. Population consists of all residents age 16-72 as of 1 Jan in base year (2018/2020). Wages are inflated to October 2021 NOK using the consumer price index. The June pay observations are dropped since they typically include "holiday" payments stemming from earnings the previous year.

To zoom in on the consequences of the COVID crisis, we focus on the differences between 2020 and 2018, reported in the bottom panels of Figure 1. They indicate that the peak of the labor demand shock was reached already in April-May 2020, with total wage payments for both men and women close to 8 % below the trend predicted from 2018-data. Thereafter, there has been a gradual economic recovery, with some fluctuations largely reflecting the variation

in social distancing policies. Yet, 20 months on – in October 2021 – overall wage payments were still 2-3 % below trend. Hence, even though virtually all restrictions were lifted at that time, the labor market had not fully recovered.

To provide further insight into the dynamics of the crisis, Figure 2 decomposes each monthly change in overall pay into sums of its positive and negative contributions, where the former consists of individual pay increases and employment entries, and the latter of individual earnings decreases and exits from employment. The figure illustrates that the crisis-generated changes in individual earnings are small relative to the changes (in both directions) that takes place also under stable conditions. By comparing the 2018 and 2020 series, it is clear that the crisis caused a decline in positive pay changes as well as an increase in negative changes. During the first weeks of the crisis, the drop in aggregate pay was dominated by individual earnings reductions among stayers and job exit (primarily driven by temporary layoffs and hours-reductions). However, already five months into the crisis (from July 2020), the negative contributions from a decline in positive pay changes became equally important, and from the spring 2021, lower pay growth among stayers and labor market entrants have taken over as the major source of depressed aggregate pay to wage earners.

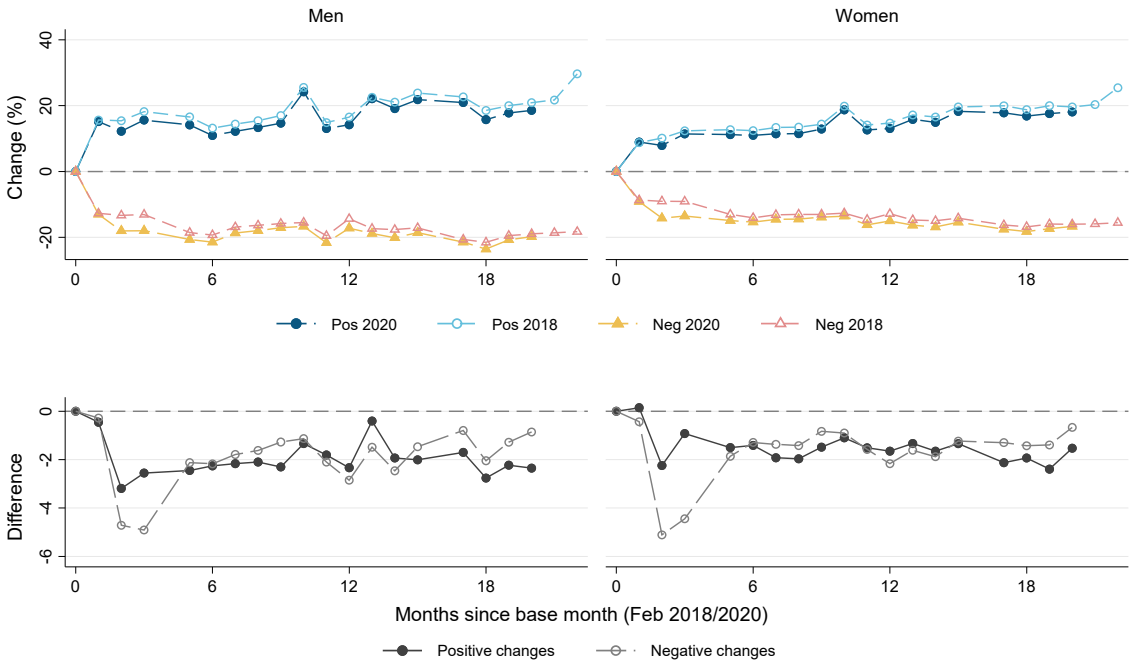


Figure 2. Positive and negative contributions to changes in aggregate pay

Note: In the upper panel, the scatter points labeled "Positive changes" show the sum of all individual pay increases (including increases from a starting point of zero) compared with the base-month as percent of total pay in the base-month (February 2018/2020). The points labeled "Negative changes" show the sum of all negative changes (including changes to zero) as minus percent of total pay in the base-month. The bottom panels show the differences between the 2020 and 2018 scatter points.

Positive and negative contributions to pay growth can again be decomposed into positive and negative changes among stayers and changes due to entry and exit. In the Appendix Figure A1, we present such a decomposition. In the beginning of the crisis, the drop in aggregate pay was largely driven by a combination of more pay decreases, less pay increases, and more exits, whereas the reduction in hiring played a less central role. The contribution from exits tended to be short-lived, however, and by October 2021, there were no longer any crisis-generated pay reductions caused by loss of employment among workers who were employed at the onset of the crisis.

3.1 Group-specific Responses and Social Gradients

The pandemic led to a significant drop in aggregate demand, with differential impacts across industries. Since workforce composition varies by industry, heterogeneous effects are likely to show up in the labor force as well. While employees of all age groups initially were (temporarily) laid off, labor supply responses are expected to differ by age as older workers are more responsive at the extensive margin (e.g., retirement). With negative labor demand shocks, those unemployed at the outset and labor market entrants are less likely to find a job. For youth in particular, college entry (or delayed graduation) is a relevant margin. Educational investments are less costly when job opportunities are bleak, and we expect higher participation rates in higher education during COVID. Since individuals are differentially affected by COVID, we split the analyses by age and employment status at the onset of the crisis in March 2020. We study labor market outcomes separately for four distinct groups: prime-aged employees (30-60), older workers with pension entitlements (62-72), those unemployed in February 2020, and youth of school leaving age (19-20).

We examine how these groups were affected by the crisis, month by month, from March 2020 through October 2021, both in terms of pay and employment. When we condition on labor market status at the onset of the crisis, pay and employment will change considerably over time even if labor demand remained constant. For example, as those observed with a job in February by construction are employed at the beginning of the crisis, their employment rates are bound to decline as we move into the outcome period. For those unemployed, employment rates must increase. To isolate the effects of the pandemic, we use a simple difference-in-differences strategy, where we compare the changes in outcomes for the cohorts observed in February 2020 with similar cohorts constructed in exactly the same fashion two years earlier, i.e., in February 2018.

Our main focus is how the effects of COVID on pay and employment were distributed across groups. Did COVID disproportionally affect the low skilled, as typically observed during economic crises (e.g., Hoynes et al. 2012; Chetty et al. 2020). And were immigrants hit harder than natives as expected from previous studies of economic fluctuations and immigrant labor market outcomes (Dustmann et al. 2010; Bratsberg et al. 2010; 2018)?

Social/economic status: For employees we study social gradients by own earnings rank defined as the position of the individual in the distribution of past earnings across employees of the same gender and born in the same year. More specifically, we use the highest three out of the past 10 years of annual earnings as the foundation for ranking. We construct earnings rank in a similar fashion for those unemployed at the onset of the crisis. Since past earnings histories generally are not observed for young individuals, we instead rank them based on the earnings rank of their parents. For this purpose, we choose the three highest of the available earnings observations for each parent pair when they were 52 to 58 years.

Immigrants are defined as foreign-born residents with two foreign-born parents, all others are included with natives. We split immigrants into three groups by origin; pre-2004 EU countries plus USA, Canada, Australia, and New Zealand (labeled "OldEU"), new member states of the European Union following the 2004 and 2007 extension ("NewEU"), and immigrants from all other countries ("LDC").

We use the total monthly pay as the basis for assessing labor supply of the individual worker. This accurate information is sent from all employers to the tax authority each month as third-party reporting used for income taxes and social insurance entitlements. Since collective agreement coverage is high, individual wages are inflexible in the short run and a drop in total pay primarily reflects fewer hours worked. During the pandemic, many workers were temporarily laid off (furloughed) and had their employer pay replaced by unemployment benefits.

For employees we define the outcome of primary interest as the percentage change in monthly pay from a base period of six months (ending February 2020 for the COVID period and February 2018 for the counterfactual).[3] As a summary measure for the whole period, we use the average change in monthly pay over the next 20 months (ending October 2021/2019). Table

[3] Monthly pay change is winsorized at +/- 100%.

1, Panel A, reports summary statistics for the two wage earners samples. Prime-aged employees lost 3.7% of their base pay during the pandemic, compared to a 1.1% loss for the pre-COVID cohort. Senior worker pay dropped significantly more by 23.9% compared to 20.2% for the 2018 sample. Table 1 also shows that the female share is close to one half among prime-aged workers and somewhat lower for seniors. The share of foreign-born workers has more than doubled in Norway over the last 15 years and the immigrant share in 2020 is close to twenty percent among prime-aged wage earners. Among senior workers, immigrant shares are just one to three percent.

For those unemployed at the time of the initial lockdown, we use monthly employment status as the post-period outcome. Employment is based on monthly pay and, in accordance with previous studies, we use the basic amount (G) in the national social insurance system and define employment as monthly pay exceeding G/12. For those initially unemployed, the average employment rate during the 20-month post-period drops from 35.7% during pre-COVID to 29.5% during the pandemic. Table 1 also shows that immigrants are overrepresented among the unemployed. While close to 20% of prime-aged wage earners in 2020 are immigrants, it is about 45% among the unemployed.

Table 1. Descriptive statistics, analysis samples.

	2018	2020	2018	2020
	(1)	(2)	(3)	(4)
A. Wage earner samples	**Prime age (30-60)**		**Senior (62-72)**	
Change in monthly pay (%)	-1.1	-3.7	-20.2	-23.9
Female (%)	48.0	47.9	44.8	44.3
Age	44.7	44.6	64.6	64.6
OldEU (%)	4.1	4.2	3.0	3.1
NewEU (%)	5.1	5.6	0.9	1.2
LDC (%)	7.7	9.0	2.3	2.8
Observations	1574928	1640282	142565	156759
B. Unemployed and youth samples	**Unemployed (20-60)**		**Youth (19-20)**	
Employment post period (%)	35.7	29.5	44.1	44.0
Enrolled post period (%)			57.3	59.2
Change in NEET status (pp)			-4.2	-5.3
Female (%)	40.4	41.9	48.2	48.0
Age	37.7	37.3	18.5	18.5
OldEU (%)	4.3	4.2	1.4	1.4
NewEU (%)	15.3	14.8	1.8	2.0
LDC (%)	23.4	26.1	7.5	7.8
Observations	53749	49280	131682	132944

Note: Wage earner samples are drawn from February 2018/2020 payroll files and are restricted to those with earnings exceeding G/12 that month. Samples of unemployed consist of persons registered as unemployed in February 2018/2020, while youth samples consist of all resident youth aged 19 and 20 as of January 1, 2018/2020, regardless of employment status. Change in monthly pay is the mean pay change between the base period and

each month in the post period. Base period covers 6-month period ending February 2018/2020; post period the next 20 months (ending October 2019/2021). Pay changes exclude the month of June. Immigrants are defined as foreign-born with two foreign-born parents, all others are included with natives. The OldEU category adds immigrants from the US, Canada, Australia, and New Zealand; NewEU consists of new member countries following the 2004 and 2007 extension; LDC covers immigrants from all other countries. Main countries of birth in the prime-age wage earner sample are Sweden (28%), Germany (17%), and Denmark (11%) in the OldEU group, Poland (53%), Lithuania (21%), and Romania (8%) in the NewEU group, and the Philippines (7%), Thailand (6%), Russia (5%), Iran (5%), Bosnia (5%), and Iraq (5%) in the LDC group.

The youth employment rate during the post period is similar for the two cohorts, but we see from Table 1 that enrollment in education increased during the pandemic (compared to the earlier cohort). We focus on NEET status as the main outcome for youth, defined as not being employed nor enrolled in education. As for pay of wage earners, we define outcomes as the change from a base period ending in February. When we follow youth as they age, the NEET fraction will typically fall. Table 1 shows that fewer youths were NEET during the pandemic, reflecting higher enrollment in education.

3.2 Prime aged employees

For employees, we focus on the percent change in monthly pay relative to base pay given by the average monthly pay over the last six months before sampling (September-February). In Figure 3, we display how the crisis evolved among prime-aged employees when measured by the monthly pay change from base pay. The top panels reveal a clear seasonal pattern, both before and after the pandemic, which motives our focus on the differential change in pay displayed in the lower panels. It is reassuring for the DiD-approach that the monthly pay change (relative to the base period, September through February), is very close to zero for all months leading up to the pandemic. Just after the initial lockdown, the average pay dropped by about seven percent for both genders in April and May. Already in July 2020, the pay loss was reduced to two-three percent and fluctuated around that level thereafter. In October 2021, the average individual pay change from the base period is very close to what we observe for the pre-COVID cohort.

Unlikely in other countries, Figure 3 shows no indications of a “she-cession” (Adams-Prassl et al. 2020; Albanesi and Kim 2021; Alon et al. 2021). The pattern is strikingly similar for men and women. If we focus on private sector workers, the reduction in pay (i.e. hours) during April-May 2020 was largest among women (see Appendix). Since a higher fraction of women was protected by a public sector job, the overall gender difference is close to zero.

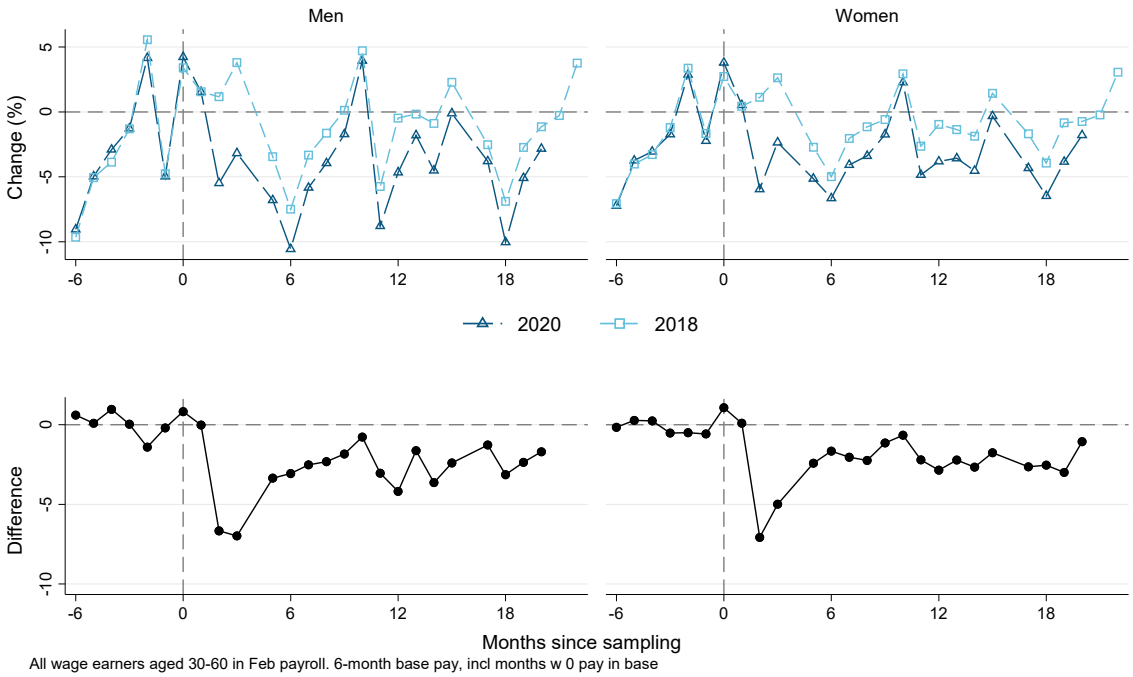


Figure 3. Change in monthly pay from 6-month base period ending February 2018 and 2020. Prime-aged workers (30-60).

Note: Population consists of all resident wage earners aged 30 to 60 in February payroll file, earning at least G/12 in February. Observation count is 819 361 (2018) and 854 183 (2020) for men and 755 567 (2018) and 786 899 (2020) for women. Scatter points in top panels show the mean change in monthly pay from the base period for each sample. The base period is the 6-month period ending in February 2018/2020; individual monthly pay changes are capped at -100 and 100 percent.

To study social gradients, we aggregate all monthly pay changes for each employee into a single scalar (dW), defined as the average change in monthly pay from the base period to each post-period month (i.e., March 2020 through October 2021 for the cohort exposed to COVID). Individual employee outcomes are defined in the same way for the pre-COVID cohort of employees in February 2018. The estimated model is

$$(1)\ dW_i = \alpha + \beta Rank_i + \gamma Covid_i + \delta(Rank_i \cdot Covid_i) + f(Age) + \sum \theta_j ImmGroup_{ij} + \sum \eta_j (ImmGroup_{ij} \cdot Covid_i) + Controls + u_i,$$

where COVID equals 1 for those sampled in February 2020 and 0 for those sampled two years earlier. We estimate the model separately by gender and control for age in a flexible way with age fixed effects. Equation (1) imposes a constant marginal rank effect, which turns out to be a fair approximation of the data. The controls include, in various specifications, 5-digit industry, firm, 4-digit occupation, and 1-digit educational attainment. All controls are included as fixed effects. Whether social gradients have been reinforced under COVID is operationalized in a simple way: Do we see excess gradients during the pandemic? In terms

the empirical model, what does the set of interaction terms $(\delta,,\eta_j)$ look like? These coefficients inform us whether the COVID crisis had disproportional impacts on employees with different levels of human capital, and whether immigrants were hit harder than natives.

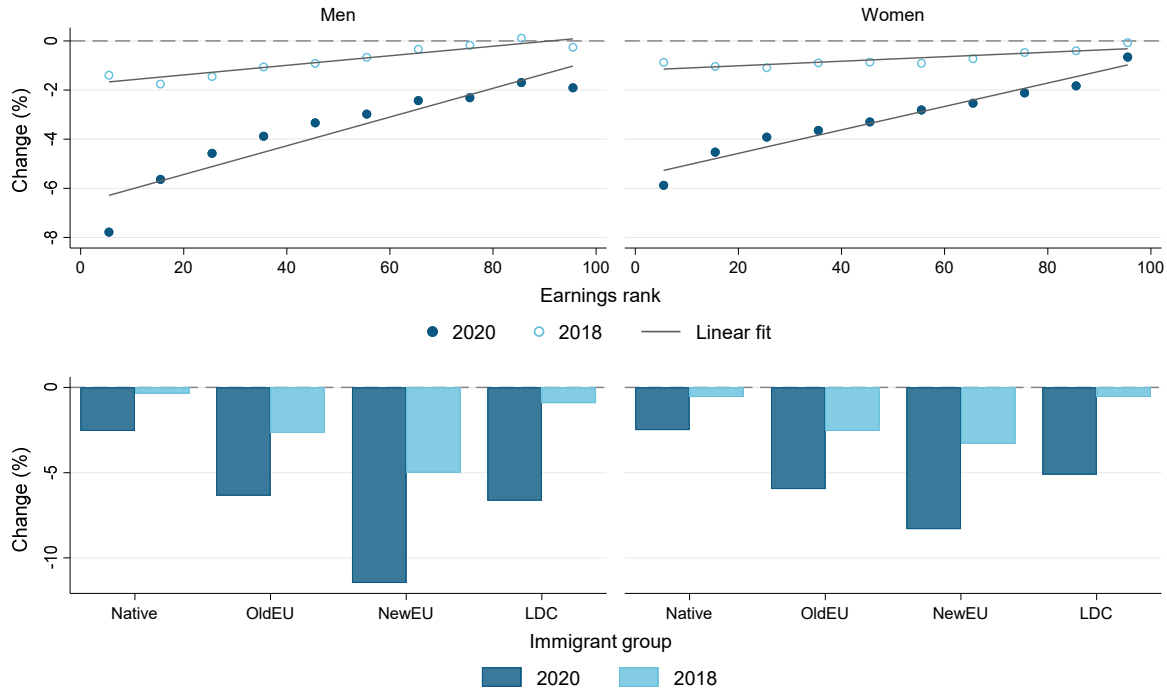


Figure 4. Change in monthly pay between base and post periods, 2018 and 2020. Prime-aged workers (30-60)

Note: Population consists of wage earners in the February 2018/2020 payroll files; see notes to Table 1 and Figure 3. Base period covers 6-month period ending February 2018/2020; post period covers next 20 months (ending October 2019/2021), excluding June. Earnings rank based best three of past 10 years of earnings and gives rank within cells formed by gender*birth year*observation year.

An instructive preview is given in Figure 4 which, for each cohort, plots the pay change by earnings decile (upper panel) and immigrant background (lower panel). The modest earnings rank gradient for both men and women changed during the pandemic. Male employees in the lowest decile of the earnings distribution experienced an 8% pay loss, four times the loss of the highest deciles (-2%). The gradient is similar for women (-6% vs -1%). Figure 4 also illustrates that pay volatility is much higher for immigrants. Actually, for the pre-COVID cohort, the average individual pay change is very close to zero for both native men and women. We also see that the pandemic had a larger impact, measured by percentage point drop in monthly pay, for immigrants than natives.

In Table 2, we report the coefficients from Equation (1) estimated for prime-aged, employed men. They confirm the patterns of Figure 4, even when the model includes a large number of controls.

Table 2. Pay change by earnings rank and immigrant group. Prime-aged men (30-60).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
COVID	-2.825***	-2.131***	-2.254***	-2.251***	-2.674***	-2.674***	-2.687***
	(0.036)	(0.040)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
Earnings rank	0.036***		0.027***	0.005***	-0.008***	-0.020***	-0.023***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
COVID*rank	0.039***		0.026***	0.025***	0.027***	0.027***	0.027***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Immigrant group:							
OldEU		-1.963***	-1.722***	-1.193***	-1.061***	-0.995***	-1.165***
		(0.125)	(0.125)	(0.124)	(0.123)	(0.123)	(0.125)
NewEU		-4.580***	-3.681***	-2.516***	-1.266***	-0.867***	-1.355***
		(0.106)	(0.110)	(0.113)	(0.121)	(0.123)	(0.129)
LDC		-1.162***	-0.539***	0.653***	1.248***	1.370***	1.285***
		(0.101)	(0.103)	(0.105)	(0.106)	(0.107)	(0.108)
COVID*OldEU		-1.314***	-1.107***	-1.111***	-1.108***	-1.094***	-1.053***
		(0.173)	(0.174)	(0.172)	(0.165)	(0.165)	(0.165)
COVID*NewEU		-4.372***	-3.682***	-3.604***	-4.235***	-4.200***	-4.078***
		(0.146)	(0.151)	(0.150)	(0.148)	(0.148)	(0.149)
COVID*LDC		-3.507***	-2.869***	-2.972***	-2.877***	-2.913***	-2.867***
		(0.137)	(0.140)	(0.138)	(0.135)	(0.135)	(0.135)
Constant	-1.266***	-0.796***	-0.910***	-1.105***	-0.850***	-0.875***	-0.828***
	(0.026)	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)	(0.029)
Observations	1673544	1673544	1673544	1673381	1643885	1641689	1641689
Controls	Age	Age	Age	Add industry	Add firm	Add occupation	Add education
#fixed effects:							
Age	31	31	31	31	31	31	31
Industry				758			
Firm					87001	87001	87001
Occupation						348	348
Education							8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. Dependent variable is the mean change in monthly pay between base and post periods. See also note to Figure 4.

However, a significantly stronger earnings rank coefficient under COVID (about 0.04) drops by one third (to 0.026) when we include industry, firm, occupation, and education fixed effects. The coefficient of 0.026 means that if we compare employees at each end of the earnings rank distribution, the pay loss increases by 2.6 pp then we go from the top to the bottom. In column (2) we see that, at baseline, all three immigrant groups experience more severe pay losses than natives.[4] These immigrant-native differentials were reinforced during the pandemic. When we

[4] Some of this immigrant pay decline reflects emigration. When we re-estimate the model restricting the sample to those not emigrated from Norway by the end of the post period, the baseline immigrant differentials are lower than those reported in Table 2. Importantly, the coefficients of covid interactions with immigrant groups are not attenuated in this exercise.

include both earnings rank and immigrant dummies, the baseline effects of both decline as we would expect since NewEU and LDC immigrants on average place lower in the earnings ranking. The robustness of the interaction terms is striking. When we control for industry, firm, occupation, and even educational attainment fixed effects, the earnings rank gradient is stronger during COVID. All three immigrant groups experienced more severe pay losses under the pandemic than in normal times. The immigrant-native differentials change as we introduce more controls for type of work. Interestingly, when the model accounts for industry affiliation, employed men from low-income countries experienced a smaller pay loss than natives of the same age during pre-COVID years.

Table 3. Pay change by earnings rank and immigrant group. Prime-aged women (30-60).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
COVID	-2.385***	-1.976***	-2.086***	-2.063***	-2.317***	-2.330***	-2.363***
	(0.038)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)	(0.042)
Earnings rank	0.020***		0.018***	0.001	-0.009***	-0.021***	-0.027***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
COVID*rank	0.038***		0.033***	0.030***	0.032***	0.032***	0.031***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Immigrant group:							
OldEU		-1.561***	-1.508***	-1.006***	-0.717***	-0.772***	-1.049***
		(0.143)	(0.143)	(0.142)	(0.142)	(0.142)	(0.143)
NewEU		-2.272***	-1.816***	-0.216	0.485***	0.508***	-0.176
		(0.144)	(0.146)	(0.147)	(0.151)	(0.152)	(0.156)
LDC		-0.240**	0.130	0.640***	1.138***	1.159***	0.990***
		(0.098)	(0.099)	(0.099)	(0.100)	(0.102)	(0.103)
COVID*OldEU		-1.159***	-1.071***	-0.968***	-0.947***	-0.926***	-0.882***
		(0.199)	(0.199)	(0.197)	(0.193)	(0.193)	(0.193)
COVID*NewEU		-2.840***	-2.096***	-1.964***	-2.036***	-2.015***	-1.894***
		(0.195)	(0.197)	(0.195)	(0.194)	(0.194)	(0.195)
COVID*LDC		-2.357***	-1.664***	-1.573***	-1.637***	-1.635***	-1.581***
		(0.132)	(0.135)	(0.134)	(0.131)	(0.131)	(0.131)
Constant	-0.945***	-0.785***	-0.834***	-0.980***	-0.797***	-0.785***	-0.721***
	(0.027)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Observations	1541666	1541666	1541666	1541332	1519360	1517641	1517641
Controls	Age	Age	Age	Add industry	Add firm	Add occupation	Add education
#fixed effects:							
Age	31	31	31	31	31	31	31
Industry				745			
Firm					59884	59884	59884
Occupation						342	342
Education							8

*/**/***Statistically significant at 10/5/1 percent levels. Note: See note to Table 2.

The COVID-19 shock also reinforced the earnings rank gradient and the immigrant-native differentials for women. In Table 3, the coefficients of Equation (1) for prime aged women are strikingly similar to those for men. Independent of the set of controls, the interaction terms of earnings rank and immigrant background are statistically significant. It is evident from this section that for employees of both genders, COVID led to greater pay inequality.

3.3 Senior workers

The pay dynamics of elderly employees are very different from those of prime-aged and dominated by changes at the extensive margin (Goda et al. 2021). In Norway, all employees aged 62 or older are entitled to pensions provided by the government, occupational pension schemes, or firm-specific entitlements, all based on individual work history. During pre-COVID years, monthly pay of senior employees dropped by more than 30 percent over the next 20 months. Figure 5 reveals a parallel development during the pandemic, with a sizable excess reduction in total pay appearing in April-May 2020 of 8-9% for men and 6-7% for women. From the summer months of 2020 onwards, the pay loss from the pandemic appears to have stabilized around 3-4%.

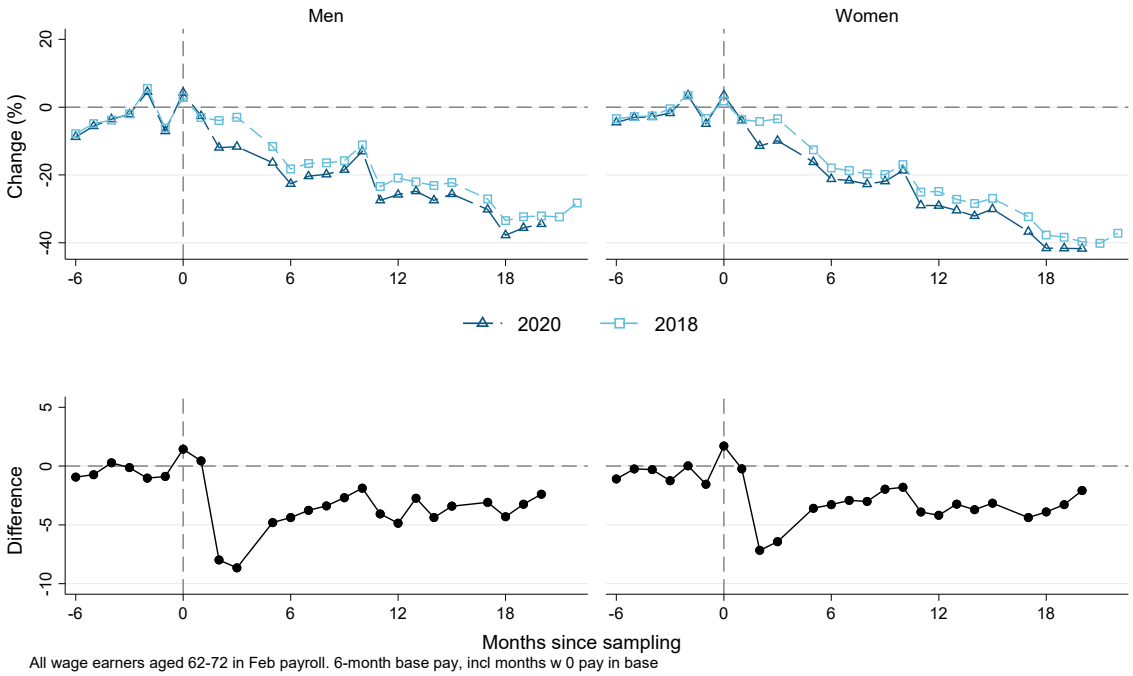


Figure 5. Change in monthly pay from 6-month base period ending February 2018 and 2020. Senior workers (62-72).

Note: Population consists of all resident wage earners aged 62 to 72 in February payroll file, earning at least G/12 in February. Observation count is 78 759 (2018) and 87 331 (2020) for men and 63 806 (2018) and 69 428 (2020) for women. See also note to Table 1.

In Figure 6, we plot the average monthly pay reduction by earnings rank. Just like for prime-aged employees, we see a gradient and the span from bottom to top before COVID is about a five percentage points. Even for senior employees, the COVID reinforced the differences between workers with high or low earning ranks.[5]

Tables 4 and 5 report the earnings rank coefficients of Equation (1) for senior men and women. From the first columns, we find a significant earnings rank COVID interaction effect for both men and women. The male estimates suggest that the COVID reduces average pay by two percent at the top of the earnings distribution compared to five percent at the bottom. For women, the earnings rank effect is even stronger with the pay declines of 5.5% for those with the lowest earnings rank and 1% for the top ranked. When we introduce different sets of controls, the earnings rank coefficient increases for both men and women. The extra-gradient under COVID, however, is unaffected of adding more sets of controls.

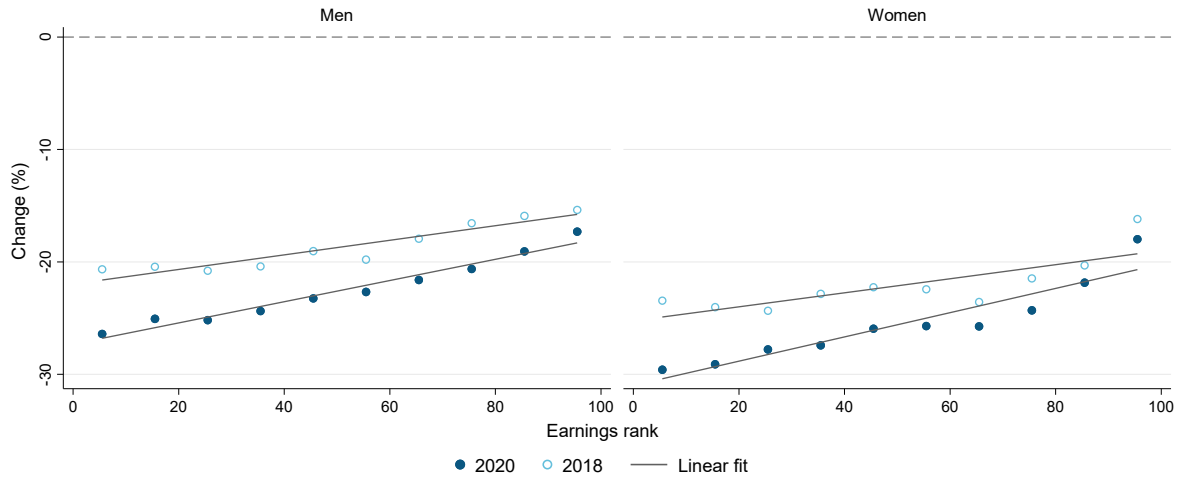


Figure 6. Change in monthly pay between base and post periods, 2018 and 2020. Senior workers (62-72)

Note: Population consists of wage earners in the February 2018/2020 payroll files. Base period covers 6-month period ending February 2018/2020; post period covers next 20 months (ending October 2019/2021), excluding June. See also note to Figures 4 and 5.

[5] In the analyses of senior workers, we do not report immigrant-native differentials because of small immigrant shares in this age bracket, each group representing 1-3% of the sample.

Table 4. Pay change by earnings rank. Senior men (62-72).

	(1)	(2)	(3)	(4)	(5)	(6)
COVID	-3.713***	-3.548***	-3.546***	-5.092***	-5.093***	-5.114***
	(0.156)	(0.161)	(0.160)	(0.171)	(0.171)	(0.171)
Earnings rank	0.065***	0.069***	0.085***	0.097***	0.088***	0.082***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)
COVID*rank	0.030***	0.027***	0.028***	0.038***	0.038***	0.038***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Constant	-18.773***	-18.999***	-19.047***	-17.836***	-17.784***	-17.755***
	(0.113)	(0.117)	(0.116)	(0.121)	(0.120)	(0.121)
Observations	166090	166090	166035	150190	149833	149833
Controls	Age	Add immigrant group	Add industry	Add firm	Add occupation	Add education
#fixed effects:						
Age	11	11	11	11	11	11
Immgrp##COVID		8	8	8	8	8
Industry			698			
Firm				21010	21010	21010
Occupation					337	337
Education						8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. Population consists of wage earners in the February 2018/2020 payroll files. Dependent variable is the percent change in monthly pay between base and post periods. See also notes to Figures 5 and 6.

Table 5. Pay change by earnings rank. Senior women (62-72).

	(1)	(2)	(3)	(4)	(5)	(6)
COVID	-3.214***	-3.282***	-3.279***	-4.488***	-4.500***	-4.540***
	(0.174)	(0.179)	(0.179)	(0.194)	(0.194)	(0.194)
Earnings rank	0.063***	0.064***	0.067***	0.074***	0.110***	0.104***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)
COVID*rank	0.045***	0.046***	0.045***	0.053***	0.050***	0.049***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Constant	-22.216***	-22.504***	-22.508***	-21.603***	-21.584***	-21.531***
	(0.125)	(0.129)	(0.129)	(0.136)	(0.135)	(0.136)
Observations	133234	133234	133186	124142	123856	123856
Controls	Age	Add immigrant group	Add industry	Add firm	Add occupation	Add education
#fixed effects:						
Age	11	11	11	11	11	11
Immgrp##COVID		8	8	8	8	8
Industry			641			
Firm				11031	11031	11031
Occupation					289	289
Education						8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. See note to Table 4.

3.4 Unemployed

Vacancies dropped in response to the pandemic (Barth et al. 2021) and did not match the qualifications offered by the unemployed very well. We therefore expect that the pandemic also hit the unemployed and slowed down transitions from unemployment to employment. Figure 7 confirms this prediction, as the employment rates of the stock of fulltime unemployed in February are systematically lower for the COVID-cohort (unemployed in February 2020) compared to those unemployed two years earlier. Despite the gradual convergence over time, the employment rate as of October 2021 remains five (men) and two (women) percentage points lower than for those unemployed two years earlier.

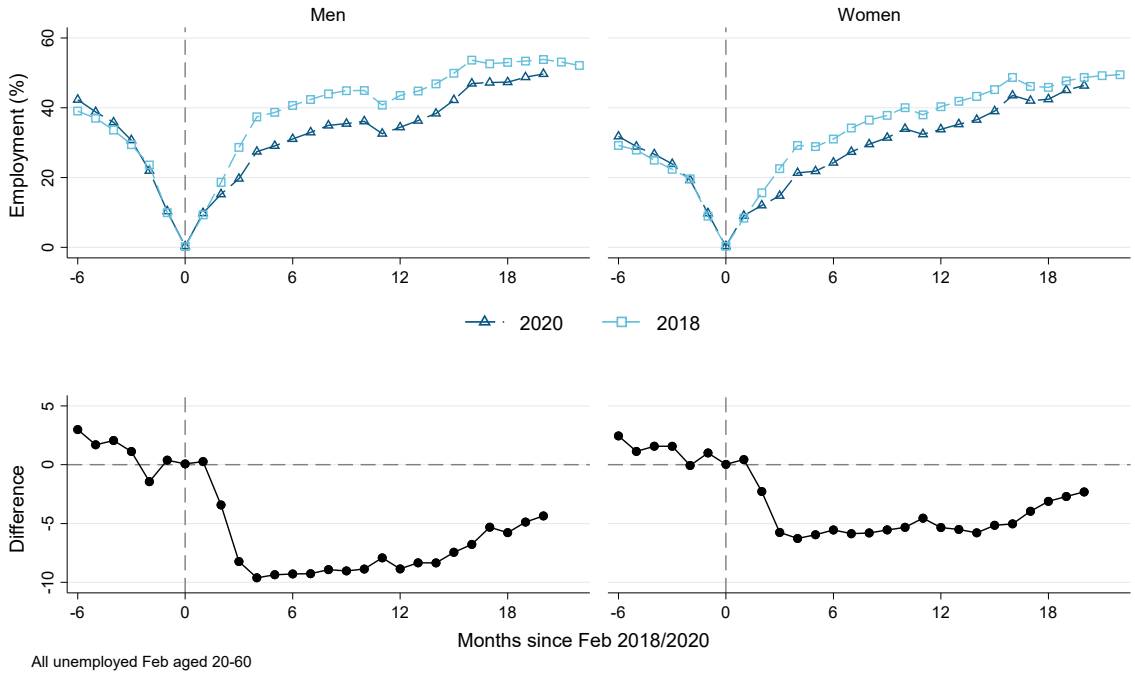


Figure 7. Trends in employment among those unemployed in February 2018 and 2020.

Note: Population consists of those registered unemployed and aged 20-60 in February 2018 and 2020. Observation count is 32 041 (2018) and 28 652 (2020) for men and 21 708 (2018) and 20 628 (2020) for women. Scatter points in top panels show the monthly employment rate for each sample. Employment is measured as having monthly earnings from work exceeding G/12.

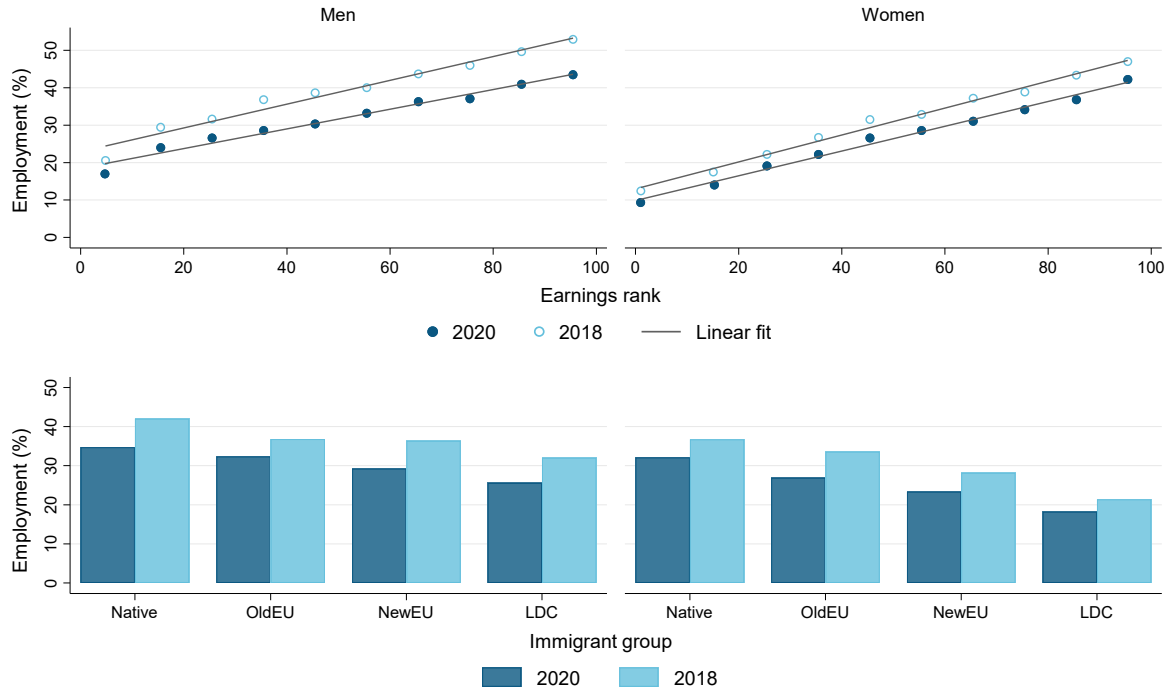


Figure 8. Employment during 20-month post period among unemployed persons in February 2018 and 2020.

Note: Population consists of persons aged 20-60 who were registered unemployed in February 2018/2020; see also notes to Figures 6 and 7. For each individual, the employment rate is computed as the average of 20 monthly employment rates covering the upcoming 20 months.

There is a strong earnings gradient in the return to employment among the unemployed (Figure 8). The higher the rank based on past earnings, the faster is the return to employment. In contrast to the employed, there is no clear evidence that COVID affected this gradient. The lower panel of Figure 8 shows that natives are more likely to return to employment than immigrants. There is no indication, however, that the pandemic altered the immigrant-native difference in future employment rates among the unemployed. When we estimate Equation (1) with the average employment rates of subsequent months as outcome, we actually find a slightly weaker COVID earnings gradient for men, but no significant interaction for women (Tables 6 and 7).

For immigrants, there is not a consistent pattern of deepened employment gaps relative to natives. We do find, however, some indication that the employment return of unemployed labor migrants from Eastern European EU countries (NewEU) were disproportionally hit by the pandemic, among men (Table 6) as well as women (Table 7).

Table 6. Employment during post-period by earnings rank and immigrant group. Unemployed men (20-60).

	(1)	(2)	(3)	(4)
COVID	-7.276***	-7.366***	-6.774***	-6.696***
	(0.267)	(0.359)	(0.356)	(0.355)
Earnings rank	0.319***		0.309***	0.294***
	(0.006)		(0.007)	(0.007)
COVID*rank	-0.055***		-0.061***	-0.058***
	(0.009)		(0.010)	(0.010)
Immigrant group:				
OldEU		-4.374***	-1.952**	-1.872**
		(0.907)	(0.884)	(0.908)
NewEU		-5.726***	0.001	-0.689
		(0.531)	(0.531)	(0.606)
LDC		-10.202***	-3.104***	-2.572***
		(0.497)	(0.507)	(0.513)
COVID*OldEU		2.890**	2.031	1.930
		(1.345)	(1.310)	(1.318)
COVID*NewEU		0.433	-2.305***	-2.360***
		(0.773)	(0.765)	(0.802)
COVID*LDC		0.836	-0.589	-0.407
		(0.698)	(0.712)	(0.713)
Constant	38.992***	42.057***	39.680***	39.623***
	(0.184)	(0.246)	(0.244)	(0.248)
Observations	60693	60693	60693	60693
Controls	Age	Age	Age	Add education
#fixed effects:				
Age	41	41	41	41
Education				8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. Population consists of unemployed persons in February 2018/2020. Dependent variable is the mean monthly employment rate during the 20-month post period. See also notes to Table 1 and Figure 8.

Table 7. Employment during post-period by earnings rank and immigrant group. Unemployed women (20-60).

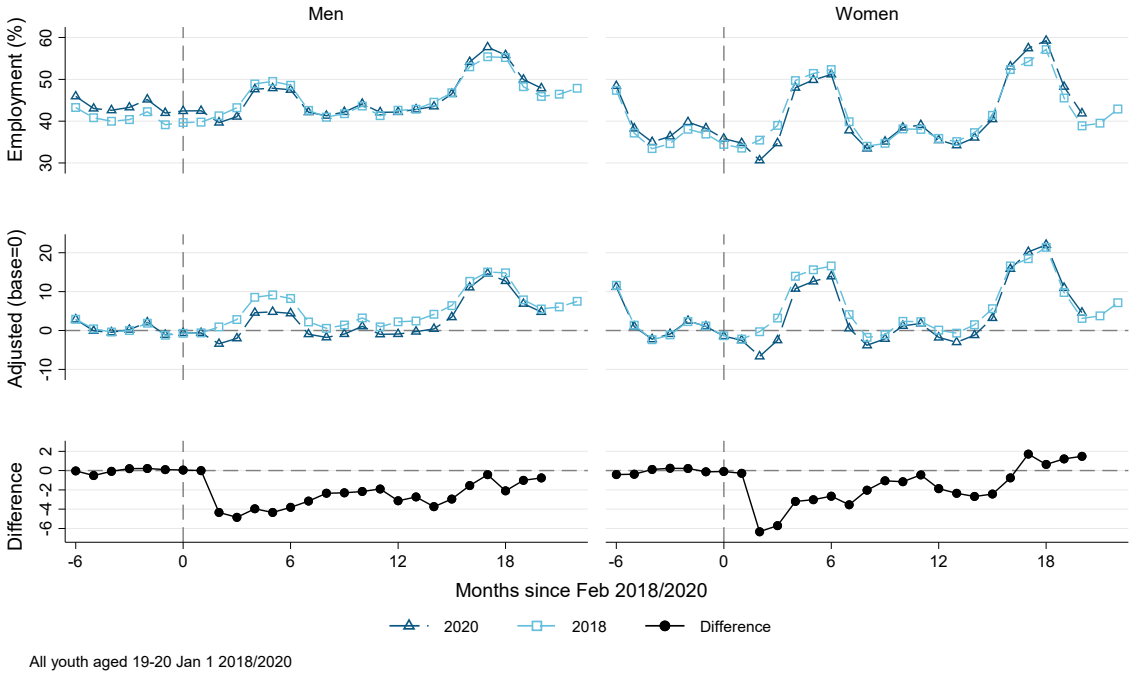
	(1)	(2)	(3)	(4)
COVID	-4.554***	-4.560***	-4.324***	-4.500***
	(0.300)	(0.428)	(0.428)	(0.425)
Earnings rank	0.361***		0.316***	0.287***
	(0.007)		(0.008)	(0.008)
COVID*rank	-0.029***		-0.023**	-0.019*
	(0.010)		(0.011)	(0.011)
Immigrant group:				
OldEU		-3.893***	-0.520	-1.849*
		(1.141)	(1.105)	(1.118)
NewEU		-9.820***	-4.099***	-5.530***
		(0.662)	(0.654)	(0.699)
LDC		-16.479***	-7.139***	-7.186***
		(0.503)	(0.535)	(0.542)
COVID*OldEU		-1.757	-2.311	-2.729*
		(1.620)	(1.568)	(1.566)
COVID*NewEU		-0.229	-2.195**	-2.402**
		(0.941)	(0.922)	(0.944)
COVID*LDC		1.427**	0.962	1.055
		(0.705)	(0.749)	(0.747)
Constant	31.131***	37.247***	33.779***	34.117***
	(0.209)	(0.298)	(0.300)	(0.301)
Observations	42336	42336	42336	42336
Controls	Age	Age	Age	Add education
#fixed effects:				
Age	41	41	41	41
Education				8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. See note to Table 6.

3.5 Youth

There is a widespread concern that the pandemic had a particularly adverse effect on labor market outcomes among youth (Barth et al. 2021; Chatterji and Li (2021): Crossley et al. 2021). Youth employment rates are strongly procyclical, partly because of seniority-based firing and experience-based hiring. In Figure 9 we display monthly employment rates of the cohorts with expected graduation from high school in 2019 and 2017. Youth employment rates are particularly high during the summer months (June-Aug), simply because many have left university/college campuses for summer jobs. The seasonal variation is more pronounced for women since they enter higher education more frequently than men. Another striking feature is that youth employment rates during the pandemic are very similar to those of the two-year older cohorts. However, when we account for their somewhat higher employment rates during

the base period, the lower panels suggest that a DiD approach will give a modest negative overall COVID impact on youth employment rates.



All youth aged 19-20 Jan 1 2018/2020

Figure 9. Youth employment before and after February 2018 and 2020.

Note: Population consists of all resident youth aged 19 and 20 Jan 1, 2018/2020. Observation count is 68 168 (2018) and 69 074 (2020) for men and 63 514 (2018) and 63 870 (2020) for women. Scatter points in top panels show the monthly employment rate for each sample. Employment is measured as having monthly earnings from work exceeding G/12. Adjusted series in middle panels subtract the employment rate in the 6-month base period ending in February 2018/2020. Difference in bottom panel is the difference between the two adjusted series.

This negative effect of COVID on youth employment suggested by Figure 9 is open to alternative interpretations. Lower employment rates can reflect both increased college enrollment and higher youth unemployment rates. Youth may enter higher education – or extend their schooling - in response to the weaker labor market because the opportunity cost of educational investment has dropped. We therefore look at the fraction not in employment nor education (NEET). To compute NEET rates, we combine months of non-employment during the base and post periods with an indicator for not being enrolled in education. When we follow youth aged 19-20 and track their average NEET rates over the next 20 months, the NEET rate drops because some enter employment and other go back to school or enter higher education. On average, the drop in the NEET rate was actually larger for the COVID cohort as indicated by natives in the lower panel of Figure 10. The average COVID effect on NEET is likely driven by the higher enrollment rates (see Table 1).

Turning to the social gradient, we replace own earnings rank with a similar concept based on the earnings history of parents. The upper panel of Figure 10 shows that the change in the NEET rate is strongly correlated with family background as we expect from studies of family background on educational investments. Youth with an advantaged background are more likely to exit NEET (or less likely to enter) compared to less privileged peers of the same birth cohorts. The patterns in Figure 10 also suggest that this gradient was reinforced during COVID.

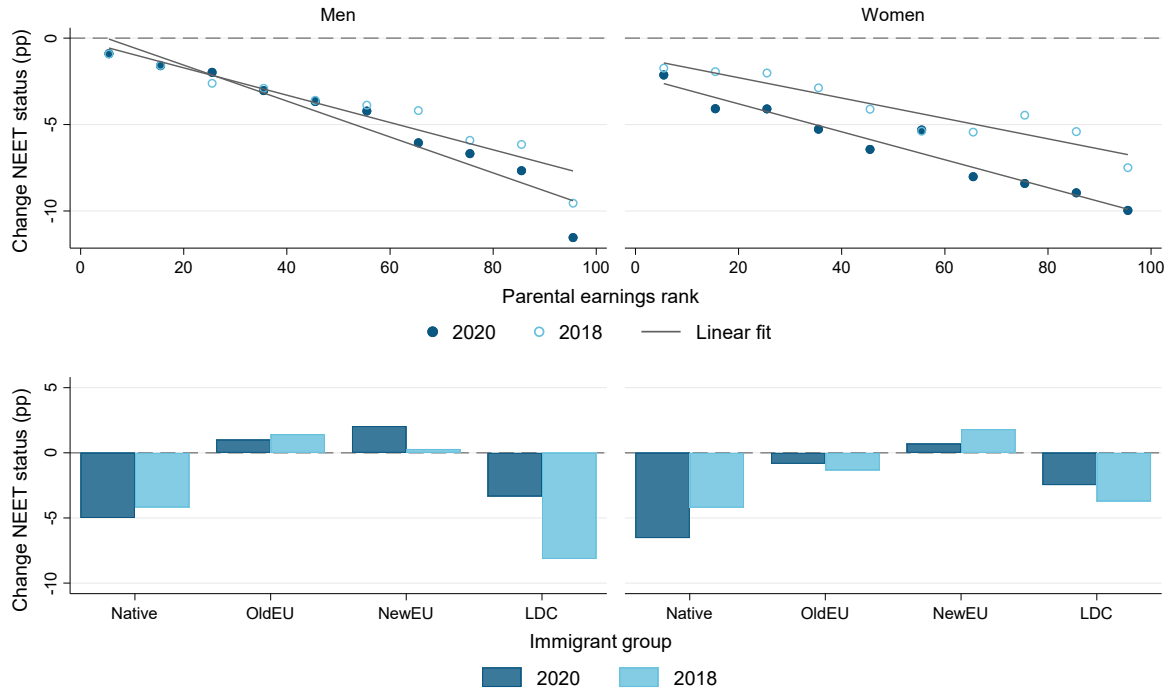


Figure 10. Change in NEET status between base and post periods, 2018 and 2020. Youth (19-20)

Note: Population consists of all resident youth 1 Jan 2018/2020 aged 19 and 20. Base period covers 6-month period ending February 2018/2020; post period covers next 20 months (ending October 2019/2021), excluding June. NEET status in a given month is computed as not employed combined with not enrolled in education in the month of September; change in NEET is the difference between mean NEET status in post and base periods.

In Table 8 and 9, we report coefficients of a model similar to Equation (1) with individual change in NEET status outcome. The reinforced social gradient under COVID is confirmed by the significantly negative interaction terms for both male and female youth. Compared to the COVID-effect on earnings rank among employees, the increase in social gradient is modest.

Table 8. Change in NEET status by parental earnings rank and immigrant group. Male youth (19-20).

	(1)	(2)	(3)	(4)
COVID	-0.612***	-0.826***	-0.743***	-0.574**
	(0.226)	(0.232)	(0.233)	(0.232)
Parental earnings rank	-0.080***		-0.080***	-0.062***
	(0.006)		(0.006)	(0.006)
COVID*rank	-0.024***		-0.021***	-0.021***
	(0.008)		(0.008)	(0.008)
Immigrant group:				
OldEU		5.597***	1.633	0.942
		(1.361)	(2.234)	(2.225)
NewEU		4.452***	0.886	-0.312
		(1.170)	(1.580)	(1.574)
LDC		-3.975***	-0.165	-1.399
		(0.562)	(0.855)	(0.853)
COVID*OldEU		0.422	-0.271	-0.304
		(1.928)	(3.145)	(3.132)
COVID*NewEU		2.591	4.032*	4.197**
		(1.595)	(2.094)	(2.085)
COVID*LDC		5.641***	2.050*	2.151*
		(0.779)	(1.221)	(1.216)
Constant	-4.124***	-4.175***	-4.135***	-4.159***
	(0.160)	(0.164)	(0.165)	(0.164)
Observations	126409	137242	126409	126409
Controls	Age	Age	Age	Add education
#fixed effects:				
Age	2	2	2	2
Education				8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. Population consists of resident youth aged 19 and 20 Jan 1, 2018/2020. Dependent variable is the change in mean monthly NEET status between base and post periods. Base period covers 6-month period ending February 2018/2020; post period the next 20 months (ending October 2019/2021). Parental earnings rank based on lifetime earnings and gives rank within cells formed by gender*birth year*observation year. Immigrants defined as foreign-born with two foreign-born parents, all others included with natives. The OldEU category adds immigrants from the US, Canada, Australia, and New Zealand; NewEU consists of new member countries following the 2004 and 2007 expansion; LDC covers immigrants from all other countries. See also note to Figure 9.

For immigrants, there is no consistent pattern of differences with regard to natives. For LCD immigrant youth, our estimates suggest that COVID had a particularly strong effect on NEET status. Compared to the pre-COVID cohort, LCD immigrant youth of age 19-20 during COVID experienced a more persistent NEET status between the base and post periods.

Table 9. Change in NEET status by parental earnings rank and immigrant group. Female youth (19-20).

	(1)	(2)	(3)	(4)
COVID	-2.172***	-2.328***	-2.272***	-2.070***
	(0.208)	(0.214)	(0.214)	(0.213)
Parental earnings rank	-0.058***		-0.056***	-0.040***
	(0.005)		(0.005)	(0.005)
COVID*rank	-0.023***		-0.020***	-0.021***
	(0.007)		(0.007)	(0.007)
Immigrant group:				
OldEU		2.811**	1.199	0.683
		(1.224)	(2.098)	(2.088)
NewEU		6.061***	5.455***	4.759***
		(1.101)	(1.436)	(1.430)
LDC		0.476	0.803	-0.188
		(0.574)	(0.781)	(0.778)
COVID*OldEU		2.858*	1.528	1.640
		(1.694)	(2.876)	(2.862)
COVID*NewEU		1.158	-0.867	-0.556
		(1.498)	(1.940)	(1.931)
COVID*LDC		3.590***	2.483**	2.571**
		(0.814)	(1.116)	(1.111)
Constant	-4.090***	-4.212***	-4.184***	-4.241***
	(0.147)	(0.151)	(0.151)	(0.151)
Observations	119642	127384	119642	119642
Controls	Age	Age	Age	Add education
#fixed effects:				
Age	2	2	2	2
Education				8

*/**/***Statistically significant at 10/5/1 percent levels. Note: Standard errors reported in parentheses. See note to Table 7.

4 Concluding remarks

Based on administrative register data containing monthly pay for all employees in Norway, we have evaluated the overall labor market impacts of the COVID-19 pandemic, from its start in March 2020 through October 2021. The impacts are identified with a difference-in-differences approach, using patterns observed for cohorts observed just before the COVID lockdown to establish counterfactual outcomes. We emphasize three takeaways from our analysis.

The first is that even though the crisis did cause massive temporary (and to some extent partial) job losses, particularly in the beginning of the crisis, there were also sectors of the economy demanding more labor. By focusing on the changes in monthly pay for all workers in Norway, rather than on reported unemployment, we provide a more complete picture of the labor market

impacts of the crisis. We show that increased work-hours and transitions into employment were almost as prevalent as reduced work-hours and exit from employment, creating winners as well as losers. Despite the heterogeneous impacts, we estimate that the crisis reduced total labor input in Norway by approximately 8% from February to April 2020. The recovery was remarkably quick however, and already in June, half of the initial employment loss had been recouped. Yet, by October 2021, we estimate that total labor input was still approximately 2% below prediction based on pre-COVID data. Hence, even though most restrictions had been lifted at that time, the crisis was not over.

The second takeaway is that the crisis effects varied considerably across groups defined by labor market status held at the moment of the first closedown in March 2020. People who were employed at that time were immediately hit in the form of temporary layoffs and forced hours-reductions. However, most of the affected workers were called back just after a few months, and by October 2021, total work hours were close to pre-COVID counterfactuals, particularly for prime-aged workers. For senior workers, there appears to have been a more lasting impact, most likely related to early retirement. People who were already unemployed when the crisis hit came in a particularly difficult situation. For them, the likelihood of returning to employment in the near future dropped considerably, and by October 2021 their employment propensity remained well below its pre-COVID counterfactual level (by 5 percentage points for men and 2 percentage points for women). Youth at high-school-leaving age were clearly exposed to a labor market with exceptionally difficult entry conditions. Yet, for them we see no long-term negative employment effect, and the propensity to drop out of both education and employment (NEET) actually showed a small decline.

Finally, we explore the social gradient of the crisis by examining how the resultant changes in pay and employment relates to social/economic background. For employees and unemployed, we establish social/economic background from their own (age -and gender-specific) earnings rank over the past 10 years (picking out the best three years), whereas for youth, we establish social rank based on their parents' (prime-age) earnings. In addition, we study effect gradients by immigrant background. We identify strong social gradients in the effects of the crisis for employees. For example, for prime aged male employees, we find that the workers belonging to the bottom past-earnings-decile experienced an 8% pay loss, whereas workers at the top lost only 2%. A similar gradient applied for female workers (with 6% versus 1% pay loss). In addition, we find that the losses were much larger for immigrants than for natives. For unemployed, we also identify a strong social gradient in the probability of returning to

employment, but this gradient does not appear to have been strengthened as a result of the crisis. Finally, for youth, our results indicate that the crisis led to a somewhat stronger social gradient in the probability of being outside both employment and education.

Viewed as a whole, our findings suggest that the COVID-19 crisis has unequivocally contributed to increased inequality in labor market outcomes. People who were unemployed when the crisis hit stand out as a particularly exposed group in terms of adverse longer-term employment effects.

The type of pay-roll based administrative data we use for constructing our employment measure are available in several other countries with third-party reporting of income to tax administrations. In our paper, we demonstrate how these can form a stable employment measure that authorities, and researchers, can use for real-time monitoring of labor market developments for different groups.

5 References

Adams-Prassl, A., T. Boneva, M. Golin, and C. Rauh (2020): Inequality in the impact of the coronavirus shock: Evidence from real time surveys. Journal of Public Economics 189, 104245.

Albanesi, S. and J. Kim (2021): "Effects of the COVID-19 recession on the US labor market: Occupation, family, and gender." Journal of Economic Perspectives 35(3): 3-24

Alon, T., S. Coskun, M. Doepke, D. Koll, and M. Tertilt (2021): From Mancession to Shecession: Women's Employment in Regular and Pandemic Recessions. NBER Macroeconomics Annual, forthcoming.

Alstadsæter, A., B. Bratsberg, G. Eielsen, W. Kopczuk, S. Markussen, O. Raaum, and K. Røed (2020): The First Weeks of the Coronavirus Crisis: Who Got Hit, When and Why? Evidence from Norway. NBER Working Paper No. 27131.

Barth, E., H. Dale-Olsen, P. Schøne, and K.M. Østbakken (2021): Chutes and Ladders? Job Opportunities for Generation COVID. IZA Discussion Paper No. 14530.

Bratsberg, B., O. Raaum, and K. Røed (2010): When Minority Labor Migrants Meet the Welfare State. Journal of Labor Economics 28(3), 633-676.

Bratsberg, B., O. Raaum, and K. Røed (2018): Job Loss and Immigrant Labor Market Performance. Economica 85, 124–151.

Chatterji, P. and Y. Li (2021): Recovery from the COVID-19 Recession: Uneven Effects among Young Workers? NBER Working Paper No. 29307.

Chetty, R., J.N. Friedman, N. Hendren, and M. Stepner (2020): the Economic Impacts of COVID-19: Evidence from a New Public Database Built Using Private Sector Data. NBER Working Paper No. 27431.

Crossley, T.F., P. Fisher, and H. Low (2021): The heterogeneous and regressive consequences of COVID-19: Evidence from high quality panel data. Journal of Public Economics 193, 104334.

Dustmann, C., A. Glitz, and T. Vogel (2010): Employment, Wages, and the Economic Cycle: Differences between Immigrants and Natives. European Economic Review 54(1), 1-17.

Goda, G.S., E. Jackson, L.N, Hersch, and S. Stith (2021): The Impact of Covid-19 on Older Workers' Employment and Social Security Spillovers. NBER Working Paper No. 29083.

Hoynes, H., D.L. Miller, and J. Schaller (2012): Who Suffers During Recessions? Journal of Economic Perspectives 26(3), 27–48.

Markussen, S. and K. Røed (2020): Economic Mobility Under Pressure. Journal of the European Economic Association 18(4), 1844–1885.

Mousteri, V., M. Daly, L. Delaney (2018): The scarring effect of unemployment on psychological well-being across Europe, Social Science Research 72, 146-169.

Pieh, C., S. Budimir, and T. Probst (2020): The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria. Journal of Psychosomatic Research 136, 110186.

Stantcheva, S. (2022): Inequalities in the Times of a Pandemic. NBER Working Paper No. 29657.

OECD Employment Outlook 2021: Navigating the COVID-19 Crisis and Recovery, OECD Publishing, Paris, https://doi.org/10.1787/5a700c4b-en.

Zimpelmann, C., H.-M. v. Gaudecker, R. Holler, L. Janys, and B. Siflinger (2021): Hours and income dynamics during the Covid-19 pandemic: The case of the Netherlands. Labour Economics 73, 102055.

Appendix

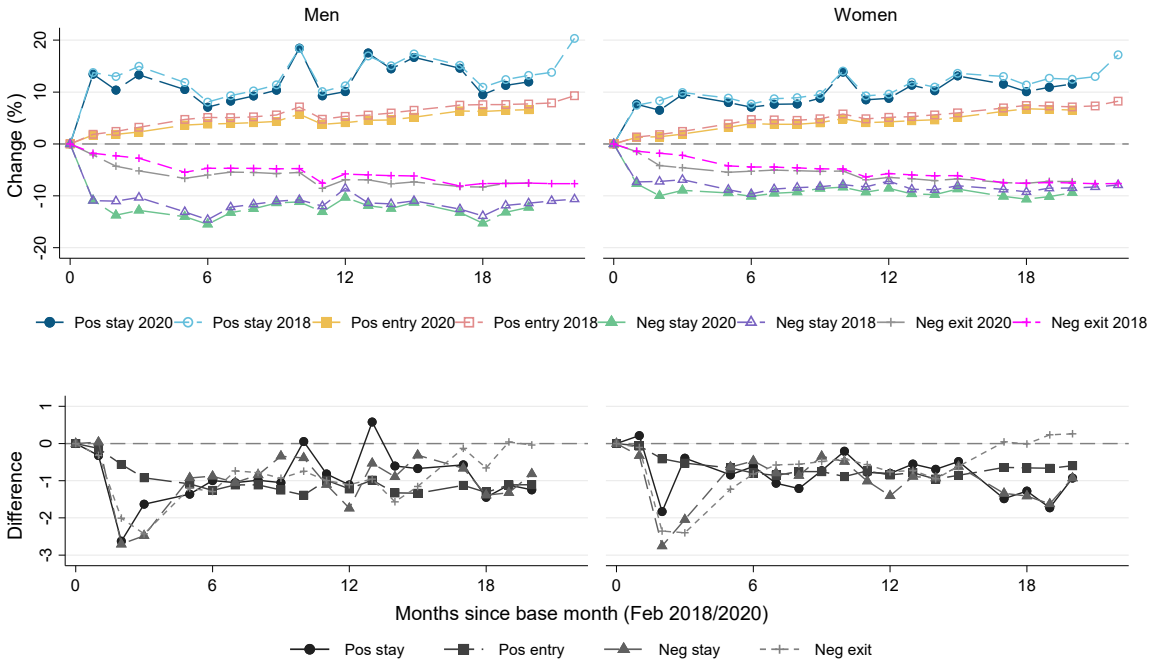
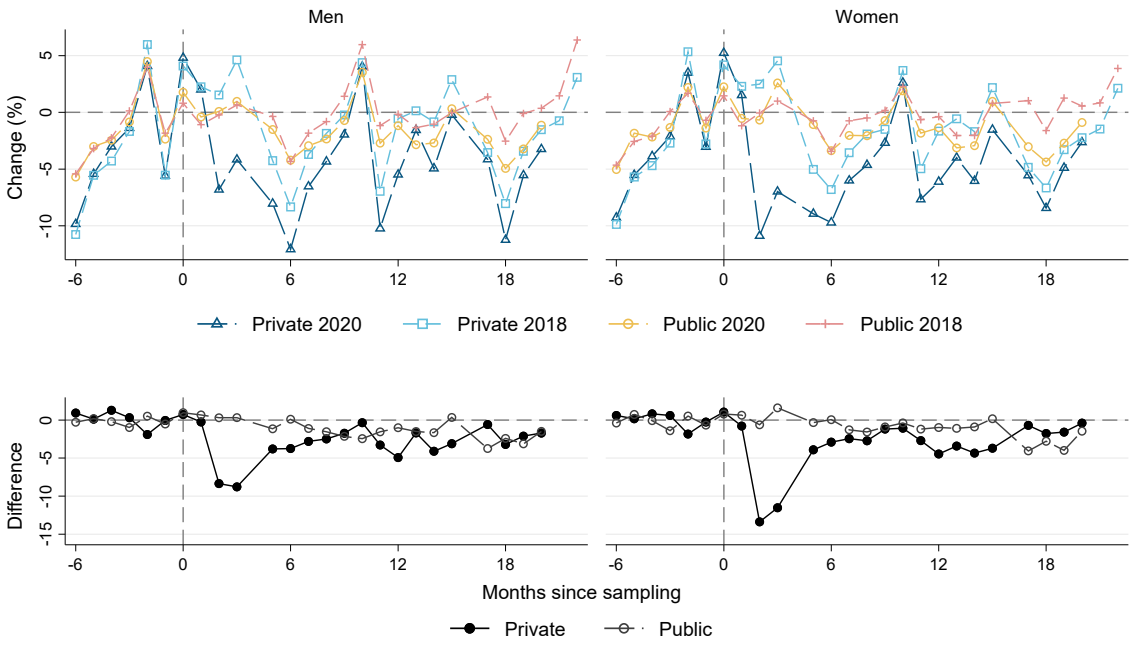


Figure A-1. Decomposition of positive and negative earnings changes of stayers, entrants, and exits. Full resident workforce.

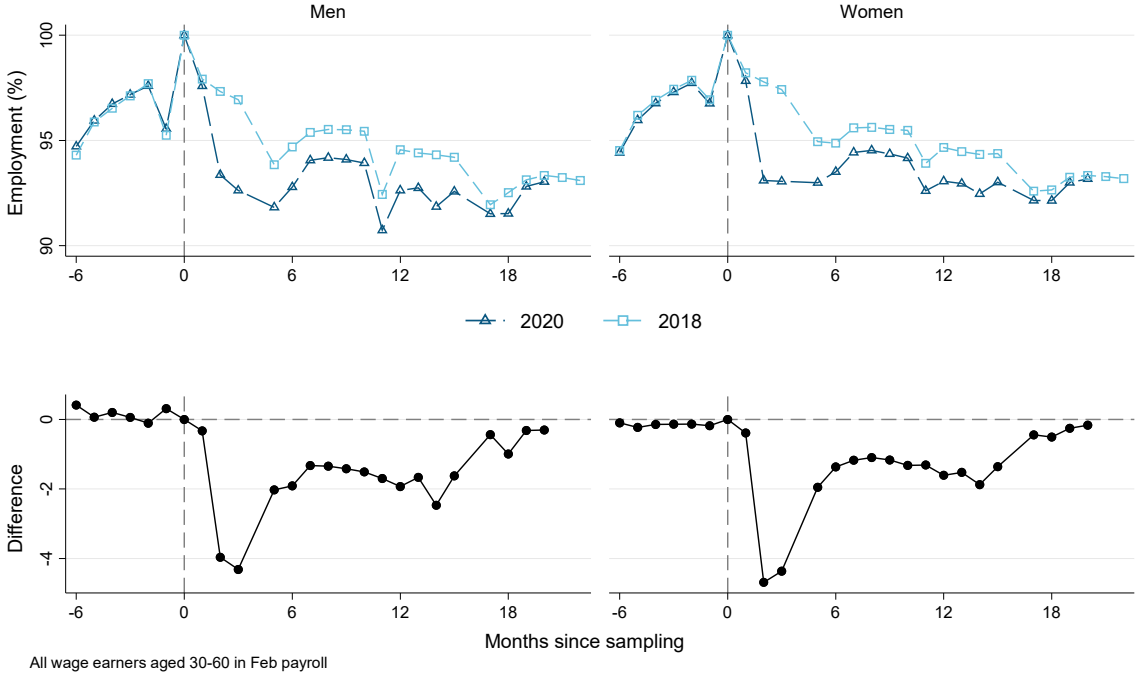
Note: In the upper panel, the scatter points labeled "Pos stay" show the sum of all individual earnings increases as percent of total earnings in the base month (February 2018/2020) for those employed both in February and the month displayed. The scatter points labeled "Pos entry" shows total earnings of those employed in the month displayed but not employed in February (i.e., zero earnings in February). Similarly, "Neg stay" and "Neg exit" show earnings changes of those employed both months and those employed in February but not the month displayed. The bottom panels show the differences between the 2020 and 2018 scatter points. See also notes to Figures 1 and 2.



All wage earners aged 30-60 in Feb payroll. 6-month base pay, incl months w 0 pay in base

Figure A-2. Change in monthly pay from 6-month base period ending February 2018 and 2020. Prime-aged workers (30-60). Private vs. public sectors.

Note: Population consists of all resident wage earners aged 30 to 60 in February payroll file, earning at least G/12 in February. See also note to Figure 3.



All wage earners aged 30-60 in Feb payroll

Figure A-3. Change in employment from February 2018 and 2020. Prime-aged workers (30-60).

Note: Population consists of all resident wage earners aged 30 to 60 in February payroll file, earning at least G/12 in February. See also note to Figure 3.

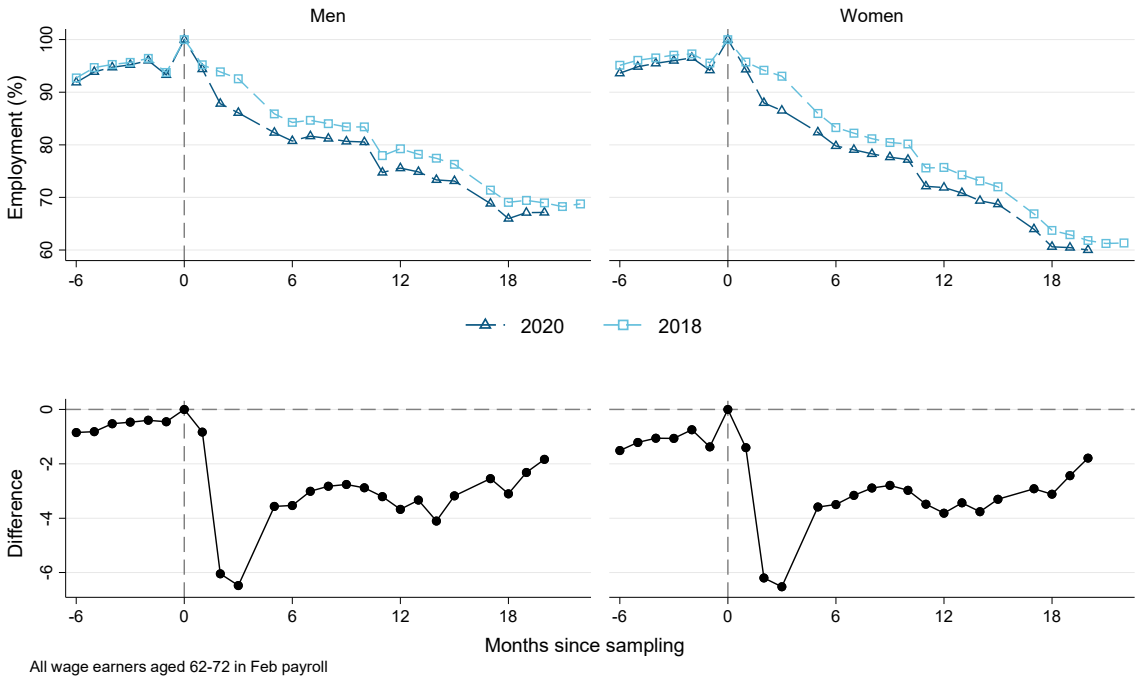


Figure A-4. Change in employment from February 2018 and 2020. Senior workers (62-72).

Note: Population consists of all resident wage earners aged 62 to 72 in February payroll file, earning at least G/12 in February. See also note to Figure 5.

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