Unemployment Inequality in the Pandemic: Evidence from Sweden

Pamela Campa[*], Jesper Roine [†] Svante Stromberg [‡]

June 2021

Abstract

Using the full population of registered unemployed individuals in Sweden, we study the unequal labor market impact of Covid-19 depending on gender, wage, age, and country of birth. Also, having very detailed data on the occupation of the unemployed, we can study inequalities both across and within occupations. We find that two demographic factors are associated with higher unemployment in the pandemic: being young and being foreign-born. Gender, however, does not seem to play a big role in the Swedish context, likely due to both institutional factors and labor market structure, as well as policy measures such as not closing schools and daycares. We also find a clear wage gradient with lower-paying jobs having higher unemployment risk. Our results confirm previous findings on the most vulnerable being hit the hardest, but at the same time emphasize the importance of country specific studies to understand the economic impacts of the pandemic.

Keywords: Covid-19, inequality, gender inequality

[*]Stockholm Institute of Transition Economics; email: pamela.campa@hhs.se
[†]Stockholm Institute of Transition Economics & Stockholm School of Economics; email: jesper.roine@hhs.se
[‡]Stockholm Institute of Transition Economics; email: svante.stromberg@hhs.se

1 Introduction

The ongoing Covid-19 pandemic has affected the health of millions of people worldwide. It has also had an enormous impact on economic and living conditions through government policies aimed at containing the spread of the infection. While, at the onset of the pandemic, government officials, mainstream media, and even celebrities labeled COVID-19 "the great equalizer" (Mein, 2020), the reality has proven quite different, with the most vulnerable groups of the population appearing to be the most harmed by both the health and the economic crises.[1]

Understanding which segments of society have born the brunt of the economic crisis fuelled by the COVID-19 pandemic is crucial as governments worldwide discuss and implement eased restrictions and post-pandemic recovery plans. A broad policy discussion also exists around how national government and international organizations can best prepare for potential future pandemics; while the focus of such discussion is on the health crisis, a thorough understanding of the economic effects of the containment policies can help to solve more effectively the trade-offs implied by the goals of protecting health while preserving living standards. For instance, it is crucial to understand the role of school closures in, on one hand, the containment of the spread of the infection and kids' learning outcomes, and on the other hand, the labor-market struggle of women throughout the pandemic, lamented by several sources.

In this paper we contribute to this discussion by leveraging new population-based monthly data on unemployment registrations, made available by the Swedish Public Employment Service, to study the impact of the pandemic on unemployment status in Sweden over the first wave of the health crisis (March 2020 to July 2020). The data distinguishes between 400 different occupations, allowing us to study the impact at a more detailed level than the sectorial one. We provide evidence on the extent to which the unemployment impact of the pandemic has been unequal across segments of the Swedish society, based on some characteristics that previous works have identified as indicators of vulnerability, namely gender, wage, age, and foreign-born status.

We construct a measure of unemployment impact of the pandemic, which compares the change in occupation-level unemployment risk during the first wave (March to July 2020) with respect

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[1]See, for instance, these articles edited by The World Economic Forum (`https://www.weforum.org/agenda/2020/10/covid-19-is-increasing-multiple-kinds-of-inequality-here-s-what-we-can-do-about-it/`), the IMF (`https://www.imf.org/external/pubs/ft/fandd/2020/09/COVID19-and-global-inequality-joseph-stiglitz.htm`).

to one month before the onset of the health crisis (February 2020) to the same change one year before, when the pandemic was neither occurring nor being anticipated. The occupation-level unemployment risk can be further disaggregated by gender, age, and foreign born status. We also complement these data with information on the average occupation-level wage in 2019, which is also disaggregated by gender. We then use the assembled dataset to answer the following questions: does the unemployment impact of the pandemic in Sweden differ systematically by gender, wage level, age-cohort, and foreign-born status? To what extent does sorting by demographics in different occupations explain differences in being affected by the pandemic impact? Our results contribute to the growing evidence that (a) the pandemic has not only exposed, but also broadened existing socio-economic inequalities in several countries worldwide, and (b) there is heterogeneity across countries in terms of which groups have been more severely affected, largely dependent on pre-existing vulnerabilities.

Our findings can be summarized as follows. First, there is large heterogeneity across occupations in the level of exposure to the pandemic. This heterogeneity mirrors the effects of the health crisis as well as the type of policy interventions that the Swedish government has adopted. Second, in a context characterized by high levels of pre-pandemic gender equality in the labor market, and by the policy choice not to close schools, we fail to find evidence of women paying a higher labor-market cost than men; if anything, the unemployment impact of the pandemic in Sweden appears to have been particularly large for some categories of male workers. Third, the wage gradient of unemployment risk, with lower-paying occupations typically suffering higher unemployment rates, has become steeper as a result of the economic crisis. Fourth, two demographics appear to be strong predictors of the unemployment impact of the pandemic in Sweden: age and foreign-born status; the increase in unemployment risk caused by the pandemic has been especially pronounced for young workers and workers born in non-EU countries, who were already more vulnerable before the pandemic.

Within the burgeoning literature on the pandemic's impact on different types and measures of inequality, a number of studies are especially related to ours, as they are focused on the labor market and study real-time data. Based on these studies, a number of patterns emerge.

First, the effect of the pandemic on increased probability of job loss appears stronger for low-skilled workers as proxied by education level (see e.g., Adams-Prassl et al. (2020), Gaudecker et al.

(2020), Casarico and Lattanzio (2020)). Gaudecker et al. (2020) also observe that in the Netherlands the negative education gradient has been mitigated by the government identifying some sectors of the economy as essential, since some of these sectors are characterized by a high concentration of low-educated workers. Our results on the wage-gradient are especially related to Cajner et al. (2020), who consider administrative data from the largest payroll processing company in the US, covering about 20% of total U.S. private employment, and find that employment losses in the first months of the pandemic have been disproportionally concentrated among low-wage workers.

Second, there is mixed evidence on the impact of the crisis on gender inequalities in the labor market. An early study by Alon et al. (2020), not based on real-time data, pointed to a number of reasons why the Covid-19 pandemic could be expected to have larger impacts on working women. They note that women are overrepresented in sectors of the economy most affected by social distancing measures and also point to the importance of factors such as opportunities for telecommuting and child care (closure of schools and daycares leading to women taking more childcare responsibilities). Subsequent papers have painted a more mixed picture. While survey information from the UK and the US (Adams-Prassl et al., 2020) and administrative data from the U.S (Cajner et al., 2020) confirm that labor market outcomes for women have more severely deteriorated during the crisis, there is no evidence of unequal impacts by gender in Germany (Adams-Prassl et al., 2020) and Italy (Casarico and Lattanzio, 2020). Other papers find that the effect on labor-market outcomes by gender varies across contexts (see, e.g., Hupkau and Petrongolo, 2020 and Alon et al., 2021).

We contribute to these findings in a number of ways. We provide unique evidence from Sweden. As noted in previous studies (see e.g. Adams-Prassl et al., 2020), while the pandemic and the measures to contain its spread have reached virtually every country worldwide, the socio-economic impacts of the crisis, including its implications for inequality, are heterogeneous across countries. Studying inequalities during the pandemic in Sweden can provide unique insights, since the country is characterized by a relatively low level of income inequality (e.g. OECD, 2019), despite an upward trend over the past decades, as well as by high participation of women in the labor market, and high level of social inclusiveness (e.g. Gottfries, 2018 and OECD, 2016). Moreover, the Swedish government response to the Covid-19 crisis has been more "laissez-faire" than in many other countries (see e.g. Ellingsen and Roine, 2020 for an account of how Sweden responded to Covid-19

in comparison to the other Nordic countries). Sweden has not adopted stay-at-home orders that would have separated sectors of the economy between "essential" and "non-essential"; as a result, sectors that were typically shut down in other countries, for instance in the hospitality industry, have remained open during the first wave of the pandemic and have faced only partial limitations during the second wave. Our paper is therefore informative of whether the pandemic's adverse socio-economic implications would have been avoided in the absence of lockdowns and similar policies, or are rather unavoidable in the presence of a massive health crisis. Finally, and crucially for the analysis of gender inequality, daycares and schools below secondary level were never closed in Sweden. Recent studies, such as Alon et al. (2021), have shown that school closures might have been the main driver of the unequal impact of the pandemic by gender: the growing gender gap in labor market outcomes observed in some countries is indeed mostly driven by parents. Our paper complements this evidence by focusing on a context where the "childcare channel" is fixed, and we can thus separately study the importance of gender segregation across sectors of the economy, as well as of other factors that intersect with gender and determine gender-gaps in labor-market dynamics.

Our study is also unique in that we leverage a rich administrative dataset of weekly unemployment insurance (UI) claims grouped by a few demographics (gender, age, foreign-born status) and by occupational sector, defined in a very granular manner. This dataset is attractive because, as opposed to survey-based information relied upon in other papers (Adams-Prassl et al., 2020), it covers the universe of individuals who have lost their job during the pandemic. Casarico and Lattanzio (2020) also draw on population-level information, by accessing data on contracts, hiring and separations in Italy; since Italy has adopted a firing-freeze after the first two months of the pandemic, our study complements theirs by specifically analyzing a context where jobs were not protected by a similarly broad intervention. Forsyth et al. (2020) also study UI claims in the US labor market. As they note, UI claims are one of the few real-time indicators of the state of the labor market and as such have received increasing attention at the onset of the pandemic; however, information on UI claims from the US is highly aggregated, with only a few states reporting claims across industries. Instead, we observe UI claims at the occupational level, centrally aggregated for the whole national labor market. For instance, while the existing studies consider the hospitality

industry as a whole, we exploit detailed occupational information within this industry.[2]

Our study of the age and foreign-born status differences is also particularly interesting given the focus on the Swedish society, which is on the one hand characterized by high levels of inclusiveness, but on the other hand appears to face important challenges integrating young and foreign-born workers in the labor market; the difference in unemployment rates between native born and others, especially non-EU-born, is among the largest in the EU [3] and youth unemployment is also relatively high in Sweden compared to the EU average[4].

Overall, our contribution emphasizes how the inequality implications of the pandemic are largely dependent on both the pre-pandemic socio-economic conditions as well as the type of government response adopted. As a result, although the pandemic has reached virtually every corner of the world with similar sweeping power, academics and policy-makers should rely on context-specific studies to formulate policy proposals and actions that address the short and long-term societal consequences of the Covid-19 crisis.

The rest of the paper is organized as follows. Section 2 presents the data and our measure of unemployment impact of the pandemic. Section 3 shows the empirical evidence of impact inequalities based on a number of group classifications. Section 4 concludes.

2 Data

We use data from the registry of unemployed individuals kept by the Swedish Public Employment Service (Arbetsformedlingen), the government agency responsible for the functioning of the Swedish labor market, for the periods February to July 2019 and 2020. The incentives for laid-off individuals to register with the Employment Service are high, since the registration is directly connected to the right to claim various (relatively generous) unemployment benefits. As such, the data arguably includes a large share of employees who lost their job over the period studied. Based on the high incentives to register as unemployed, we also assume that the probability of registering does not differ substantially across the segments of the population that we compare. Nevertheless, the

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[2]In concrete terms, we can, for instance, distinguish between chefs and waiters. Such a distinction might matter if there was a massive decline in the number of people who visited restaurants, but an increase in take-away orders.

[3]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migrant_integration_statistics_%E2%80%93_labour_market_indicators

[4]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Participation_of_young_people_in_education_and_the_labour_market#Country_differences

probability of registering is expected to be lower for self-employed individuals.

The population-wide coverage is the main advantage of our data vis-à-vis the survey information used in many recent studies of the labor market throughout the pandemic (other studies using administrative data are Casarico and Lattanzio (2020) examining the Italian labor market, and Forsyth et al. (2020), who analyze the US case). Importantly, however, our data currently do not include furloughed workers, a significant group especially in the very early stages of the pandemic. Moreover, we do not observe information on number of hours worked, implying that we are unable to capture any labor-market adjustment on the intensive margin.

During the period from February to July 2019 the average number of individuals who registered monthly with the Swedish Public Employment Service was approximately 350,000, against an active population of roughly 5.5 million.[5,6] We consider these monthly data, also for 2020 (when the corresponding number amounted to 447,00 individuals), grouped by 4-digit occupational classification (observing 400 occupations at this level). Each occupational group is further broken down by sex, age, and foreign-born status (specifically, *EU-born*, *EU no Sweden - born*, and *Outside EU - born*). We then divide the number of registered unemployed for the relevant group by the respective average number of individuals employed in 2017 and 2018.[7] Throughout the analysis we refer to the ratio of registered unemployed in 2019 or 2020 over the group-level employment in the previous two years as the "unemployment risk".

We also exploit information on the average wage by occupational group and gender in 2019, as reported by *Medlingsinstitutet* and publicly available at Statistics Sweden. This measure, although not being at the individual level, allows us to develop a relatively precise proxy of wages by occupation.

Measuring the unemployment impact of the pandemic   With the data described above, we build the following occupation-level measure of change in unemployment risk between one month

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[5]Source: Statistics Sweden, Population Statistics.

[6]Notice that, based on the 2019 Statistics Sweden Labor Force Survey, which is typically used to compute official statistics on unemployment rate, the number of unemployed persons in Sweden throughout 2019 was 373,000, which is largely comparable to the information from the Public Employment Agency that we rely on.

[7]Data on employed individuals by occupation and demographic groups are made available by Statistics Sweden.

before the pandemic onset (February 2020) and the five months after.

$$\Delta(u_{feb}^{mar-jul})_{i,2020} = \overline{u}_{i,mar-jul,2020} - u_{i,feb,2020} \tag{1}$$

where $u_{i,m,y}$ is the occupation-level monthly unemployment risk, i.e. the number of workers in 4-digit occupational sector i who registered as unemployed in month m of year y over the average number of employed in the same occupation in 2017 and 2018 (data available from Statistics Sweden). $\overline{u}_{i,mar-jul,2020}$ is the average unemployment risk during the months from March to July of 2020. Put it simply, $\Delta(u_{feb}^{march-jul})_{i,2020}$ is an occupation-level indicator of the change in unemployment risk during the first five months of the pandemic as compared to one month before its onset.

Then, we consider the same measure for 2019, namely

$$\Delta(u_{feb}^{march-jul})_{i,2019} = \overline{u}_{i,mar-jul,2019} - u_{i,feb,2019} \tag{2}$$

and we use it to seasonally adjust the 2020 unemployment change. The resulting measure of *unemployment impact* of the pandemic is thus based on the change in unemployment at the occupational level between the months March to July *versus* February 2020, i.e. between five months after the start of the pandemic and the month before its onset, as compared to the equivalent change the year before:

$$Unemployment\ impact = \Delta(u_{feb}^{march-jul})_{i,2020} - \Delta(u_{feb}^{march-jul})_{i,2019}. \tag{3}$$

We thus account for seasonal factors by differencing out the unemployment change during the same months of 2019, when the pandemic was neither occurring nor being anticipated.[8]

The average unemployment impact was of 2.5 p.p. over the period studied. Figure A1 in the

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[8]By accounting for seasonality, we aim to capture the change in unemployment risk *caused* by the pandemic. A concern is that the labor market conditions in some sectors would have evolved differently over March to July 2020 as compared to the same period of 2019, even in the absence of the pandemic, or that there were sectoral-specific shocks in February 2020, due to other determinants of unemployment incidence. We note, however, that the unprecedented shock caused by the pandemic is likely larger than many other labor-market shocks that could have happened during this period.

Appendix also shows the distribution of the unemployment impact across occupations, which is relatively skewed. The change in unemployment risk was minor for many occupations, but few occupations were severely negatively impacted by the pandemic, with increases in unemployment risk of up to 35 p.p. Table 1 below lists the ten most-affected occupations. We also report the number of employed in each occupation, as well as the share of female employment.

Table 1: Occupations by unemployment impact, ten most impacted

Occupation	Number of employed	Share female	Unemployment impact
Aircraft pilots and related associate professionals	1651	.076	.308
Choreographers and dancers	372	.570	.246
Masseurs and massage therapists	849	.812	.222
Cabin crew	2497	.785	.192
Travel guides	932	.580	.176
Bartenders	5531	.481	.168
Visual artists and related artists	595	.476	.160
Beauticians and related workers	1084	.967	.152
Chefs and sous-chefs	2570	.202	.151
Pizza makers and fast food preparers	3828	.179	.140
Average	**10781**	**.49**	**.019**

Note: This table shows the ten occupations with the highest unemployment impact of the pandemic. The unemployment impact is the change in unemployment risk during the first months of the pandemic (March to July 2020) versus one month before its onset (February 2020), as compared to the same change one year before (see definition in equation 3). We also report employment in 2017-18 in each occupation, and the respective share of women among the employed. The last row shows the mean of each variable in the sample. Many of the impacted occupations are relatively small.

The list of most-affected occupations reflects the unravelling of the pandemic in Sweden. While the country did not adopt a regulated lockdown of the types observed in many other European countries, some activities were significantly reduced. Tourism from and to other countries was basically halted, due to a combination of both the Swedish government's recommendation to avoid unnecessary travel and border closures between European countries; this is reflected in workers in the aviation and tourism sector experiencing a dramatic increase in unemployment risk. Although in the first phase of the pandemic restaurants and bars were allowed to remain open, with only limited restrictions, [9] data from mobile-phone users reveal that nonetheless mobility declined significantly (see Dahlberg et al., 2020), likely resulting in lower number of visits to bars and restaurants. In comparison, however, the cultural sector might have been even more affected, since several cultural

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[9]Initially, the only restriction applied to restaurants and bars was the obligation to offer only table service. Starting from the Fall of 2020, however, more severe limitations regarding the maximum number of customers admitted and earlier closing times were adopted.

activities were virtually impeded due to the public order against even relatively small indoor events. The recommendation that individuals practice social distance has also likely reduced exposure to activities that involve physical proximity.

3 Empirical analysis: The unequal impact of the pandemic

In this Section we study whether the unemployment impact of the first months of the pandemic differs systematically by workers' gender, wage level, foreign-born status and age group, focusing on the Swedish labor market.

The unemployment impact of the pandemic by gender We estimate some variations of the following equation:

$$unemployment\ impact = \alpha + \beta Female_g + \eta_{ig} \tag{4}$$

where *unemployment impact* is as described in (3), disaggregated by gender.[10] Since the occupational groups differ substantially in size, we weight observations by the number of employed in the respective group (i.e. occupation-by-gender), using the average employment between 2017 and 2018. We allow for arbitrary correlation of the error term η within 3-digit occupations. Practically speaking, the coefficient β describes the difference in the unemployment impact of the pandemic between women and men in the Swedish labor market, based on the occupation they work in.

We fail to find evidence for Sweden that women became relatively more at risk of being unemployed than men due to the pandemic (see Table 2, column (1), where we report the estimate of β from equation (4)). If anything, they were less impacted, although the difference is only possibly statistically significant (10%). Interestingly, once we account for occupation fixed effects, the estimated gender differ increases slightly and it is significant at conventional level (5%): in the months of March to July 2020 the risk of unemployment increased by roughly 2.5 p.p. more than over the same period of 2019 for men; the increase was 0.5 p.p., or 20% smaller, for women in the same occupation.

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[10]We consider occupations-by-gender where in 2017-2018 there were at least 100 employees. Results are robust to increasing this threshold to 500.

Early analysis at the onset of the pandemic has warned that the economic downturn following the Covid-19 outbreak would have a large impact on sectors with high female employment shares (Alon et al., 2020), although the evidence from empirical studies that emerged later on is more mixed. Media and civil-society advocates have also repeatedly warned that the Covid-19-induced economic crisis might spiral into a gender inequality crisis.

How can the evidence that we present here be reconciled with these concerns? First, we observe that conducting the analysis at the individual level (how many women and men have become unemployed?) rather than at the sectoral-level obviously captures different dynamics.[11] Some highly-feminized occupations (e.g. "masseurs and massage therapist" in the Swedish case) have been heavily impacted, but their relative size is small. Consistent with this observation, we also note that, based on our data, occupations with a larger share of female employees were indeed more impacted by the pandemic, although the difference is not significant at conventional level. We see this by regressing the overall sector-level unemployment impact against the respective share of female employment (see column (3) of Table 2). Since our data are more granular than those used in related work, for comparison we also estimate this regression using 2-digit occupation information (column 4), and the gender difference increases in size but remains statistically insignificant.

Second, the Swedish response to the pandemic was peculiar, namely (a) there was never a regulated lockdown that forced people to stay at home and businesses to close (with the exception of a few activities, most notably in the cultural sector), and, (b) crucially, daycares and schools for kids aged less than 15 were never closed. The peculiarity of the Swedish response implies that the relative impact across sectors of the Swedish economy might have been different from elsewhere, and especially that Swedish families did not have to make significant adjustments to the time devoted to childcare. Since women taking on more childcare responsibilities has been one of the main reasons why researchers, policy-makers, media and civil-society advocates have described the pandemic as a gender-inequality crisis, it is perhaps not surprising that such crisis did not unfold in Sweden. Alon et al. (2021) find that the gender-unequal labor market impact in the US is substantial especially among parents, suggesting that school closures might indeed have been a key factor behind women's struggles during the pandemic in other countries.

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[11]Notice that, since we weigh occupation-by-gender groups by the number of employed pre-pandemic, we seemingly analyse the unemployment impact at the individual level.

Third, we additionally note that the extent of occupational segregation differs among countries, and women in Sweden working predominantly in some occupations that were, if anything, more positively impacted by the pandemic, might have played a role. While a high female concentration in the health sector, one of the least impacted in terms of unemployment, is not unique to Sweden, the extent of the concentration is especially large in the Swedish labor market. Consider for instance the European Institute for Gender Equality (EIGE) Index, which ranks EU-28 countries based on a number of indicators of gender equality, including the extent of sectoral segregation by gender in the labor market.[12] In 2020, Sweden was the top-performer based on the overall EIGE index. Nonetheless, its score in terms of sectoral segregation was below the EU-28 average, denoting more gender inequality, due to the large concentration of women in sectors such as education, human health and social activities.[13] According to our data, of the handful of occupations where unemployment risk decreased in relative terms, some of the largest are "Clinical and operations managers in health care", "Department managers in elderly care", "Pediatric nurses", and "Anaesthesia nurses", whose shares of female employment vary between 74% (anaesthesia nurses) and 97% (pediatric nurses). Job creation in these occupations presumably benefited more women than men. In terms of within-occupation differences, another important factor is the intersection between gender and other characteristics that affect unemployment risk, such as, for instance, tenure; in the following sections we will consider some of these characteristics. These last observations also highlight the importance of considering not only sectoral shocks, but also within sector dynamics of unemployment risk; the granularity of our data in defining occupations is particularly suitable to capture these dynamics.

The unemployment impact of the pandemic by labor income   Some attention has also been devoted to the unequal economic impact of the pandemic based on skill-level, proxied by education, and the prevailing evidence is that less skilled workers have been more negatively affected (see, e.g., Adams-Prassl et al. (2020), Gaudecker et al. (2020), Casarico and Lattanzio (2020)). We enrich this strand of literature by considering wage inequality, similarly to Cajner et al. (2020) who study

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[12]See https://eige.europa.eu/gender-equality-index/2020/compare-countries.

[13]The EIGE index ranks the labor market as more segregated the larger is the difference between the shares of women and men working in "education, human health and social work activities". According to the data reported by EIGE, in Sweden 42% of all the women employed work in such sectors, compared to 12% of men, whereas these respective average shares among EU-28 countries are 31 and 8%.

Table 2: Gender and unemployment impact

Dep.variable:	Four-digit			Two-digit
Unemployment impact	(1)	(2)	(3)	(4)
Female	-0.004	-0.005*		
	(0.0022)	(0.0024)		
Share female			0.003	0.005
			(0.0098)	(0.0070)
Occupation FE	No	Yes	No	No
N	742	742	379	45
Mean y	0.025	0.025	0.024	0.060

Note: Unit of observation is occupation-by-gender group in columns (1) and (2), and occupation group in columns (3) and (4). Occupation groups are at 4-digit level in columns (1) to (3), and at 2-digit level in column (4). Observations are weighed by number of employed in 2017-2018 in columns (1) and (2). Standard errors are clustered by 3-digit occupational sector in columns 1-3, robust in column 4. Mean y is the mean of the dep. var. for the category *Male* in columns (1) and (2), and the mean of the dep. variable in the estimation sample in columns (3) and (4). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the US labor market; our study complements theirs by focusing on a country, Sweden, where the initial level of wage-inequality is substantially lower than in the US. Nevertheless, we reach similar conclusions to theirs, namely that the most-negatively impacted workers are those at the bottom of the wage distribution.

We first document this fact in Figure 1 . We group occupations into wage deciles, using the occupation-level wage.[14] Then, for each wage-decile, we consider the weighted (by the number of people employed in 2017 and 2018) average change in *unemployment impact*, as defined in (3), across occupations belonging to the decile. In Figure 1 we plot the unemployment impact against wage-decile and show that, while the risk of unemployment has increased due to the pandemic across all wage levels, the size of the increase is substantially larger for lower-wage occupations. In other words, the unemployment impact of the first months of the pandemic has been higher for the workers with the lowest wages in the Swedish labor market.

Since the bottom deciles were at higher risk of unemployment already before the pandemic (data not shown and available upon request), considering the unemployment impact *relative* to the pre-pandemic unemployment risk shows a reversed pattern: the unemployment cost of the pandemic

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[14]Specifically, we consider the weighted (by number of people employed in 2017 and 2018) average of the occupation-by-gender wage for women and men.
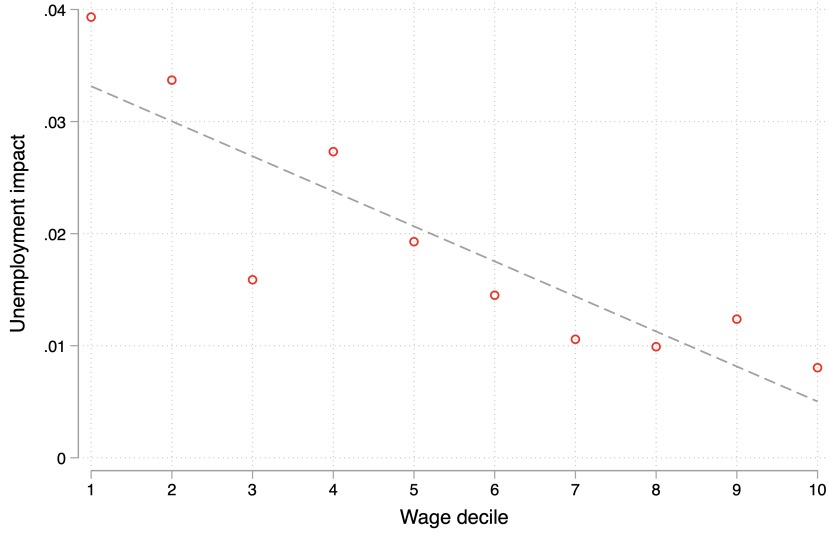
Figure 1: Unemployment impact by wage decile

Notes: This Figure shows the relationship between unemployment impact and wage decile. The unemployment impact is the change in unemployment risk during the first months of the pandemic (March to July 2020) versus one month before its onset (February 2020), as compared to the same change one year before (see definition in equation 3). The unemployment impact of the pandemic is higher for lower wage deciles.

is higher for the least vulnerable workers (see Appendix Figure A2), whose initial position has deteriorated to a larger extent.[15]

We further study the relationship between unemployment impact and wages estimating the following equation:

$$unemployment\ impact_{ig} = \alpha + \beta log(wage)_{ig} + \eta_{ig} \tag{5}$$

where *unemployment impact* is as defined in (3), and $log(wage)_{ig}$ is based on the respective average wage for occupation i and gender g. As before, we weight observations by group-size. We report the results in Table 3. Column (1), where we show estimates from the baseline specification in (5), implies that a 20% wage increase, which corresponds to moving from the 1st to the 4th decile of the wage distribution, is associated with a decrease in unemployment impact of nearly 0.006, or 17%

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[15]This fact highlights that the researcher-chosen definition and metric of "impact" is consequential. We choose to focus on the absolute rather than the relative change in unemployment impact because we are interested in how unemployment inequality has evolved during the pandemic. As we document in Figure A3 in the Appendix, unemployment inequality in Sweden has increased in 2020 as compared to one year earlier. On the other hand, if we wanted to highlight which wage-group has experienced a more significant deterioration of their initial position, then we would use a different metric and reach opposite conclusions.

of one s.d. In column (2) we also account for gender, thus comparing workers of the same gender whose wages differ based on their respective occupation, and reach the same conclusion. Moreover, as compared to the estimates reported in Table 2, where we did not consider differences in wages, the estimated female advantage is larger. This is not surprising, since women, even in a relatively gender-equal country like Sweden, tend to be highly concentrated in lower-paying occupations (see Appendix Figure A4).[16]

Table 3: Wages and unemployment impact

Dep.variable: Unemployment impact	(1)	(2)
log(wage)	-0.031***	-0.034***
	(0.0068)	(0.0069)
Female		-0.008***
		(0.0023)
N	668	668

Note: Unit of observation is occupation-by-gender. Occupation groups are at 4-digit level. Observations are weighed by number of employed in 2017-2018. Standard errors are clustered by 3-digit occupational sector. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The unemployment impact of the pandemic by age-group   The administrative data on unemployment registrations also report information disaggregated by six age-categories. In Table 4 we first show the pre-pandemic unemployment risk for these categories. Specifically, in column (1) we report estimates from a regression of the average unemployment risk during the months of March to July of 2019 for occupation i, gender g, and age group a, against age-group fixed-effects, omitting the age-group 40-49 (that is represented in the largest number of occupations) and weighting groups by the respective employment level in 2017-2018:

$$unemployment\ risk_{i,g,a}^{2019} = \alpha + \phi_a + \varepsilon \tag{6}$$

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[16]Notice that the unequal impact by wage-level contributes to explain why the gender difference that we estimate in Table ? is larger once we account for occupation fixed-effects: since women work predominantly in lower-paying occupations, which also are exposed to a larger unemployment impact, the estimate of women's relative advantage during the first months of the pandemic increases once we condition on the occupation where they work.

where ϕ_a are the age-group fixed-effects. The coefficients on the age-group fixed-effects reveal an age-gradient for unemployment risk. Before the pandemic, younger cohorts were at higher risk of being unemployed than workers in the age-group 40-49, whereas there is no statistically significant difference for the older cohorts. The age-pattern is less clear once we account for occupation fixed-effects (column 2), suggesting that the main reason why younger cohorts are at higher risk of unemployment prior to the pandemic lies in the type of occupations where they work.[17],[18]

Occupational sorting does not seem to entirely explain the higher unemployment impact of the pandemic for younger cohorts. We show this in columns (3) to (5) of Table 4, where we report estimates from a few variations of the following equation:

$$unemployment\ impact_{i,g,a} = \alpha + \phi_a + \epsilon_{iga} \tag{7}$$

The results show that the unemployment impact of the pandemic is higher the younger is the age-cohort (column 3) and accounting for differences in occupation explains only partially this age-gradient (column 5). These findings confirm the evidence from Italy in Casarico and Lattanzio (2020), who also observe that younger workers were already suffering the consequences of the previous recession. The implications of the increased vulnerability of the relatively young cohorts can be far-reaching, given the high returns to experience in the labor market. Future work should study the long-term implications of Covid-19 for this segment of the population that was less affected by the health crisis, but seems to have paid the highest cost of the economic crisis, at least in terms of unemployment risk.

We also note that the gender difference is attenuated when the age-effects are included (column 4), suggesting that a different distribution of female and male workers across occupation-by-age groups explains in part the differential unemployment impact of the pandemic by gender.

The unemployment impact of the pandemic by foreign-born status In Table 5 we repeat the same analysis shown in Table 4 replacing the age-groups with foreign- status categories, namely

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[17]Accounting for gender leaves the estimates virtually unchanged.

[18]However, for the age-group 30 to 39 the disadvantage persists even once differences in occupation are taken into account; this is not surprising, since the youngest cohorts likely include a large number of college students who work in part-time low-paying occupations; for the group aged 30 to 39 instead, the disadvantage with respect to the older cohorts is more likely determined by the type of contracts they are offered, as well as practices such as "last-in-first-out", which companies tend to adopt when they downsize.

Table 4: Age group and unemployment impact

Dep.variable	(1)	(2)	(3)	(4)	(5)
	Unemployment risk 2019		Unemployment impact		
16-24	0.032***	-0.020	0.027***	0.027***	0.019***
	(0.0067)	(0.0135)	(0.0034)	(0.0034)	(0.0035)
25-29	0.018***	-0.003	0.011***	0.011***	0.007***
	(0.0037)	(0.0048)	(0.0015)	(0.0015)	(0.0015)
30-39	0.016***	0.010***	0.006***	0.006***	0.004***
	(0.0022)	(0.0023)	(0.0008)	(0.0008)	(0.0007)
50-59	-0.000	-0.001	-0.001	-0.001	-0.001
	(0.0023)	(0.0025)	(0.0007)	(0.0007)	(0.0007)
60-64	0.004	0.003	-0.003**	-0.003**	-0.001
	(0.0046)	(0.0047)	(0.0010)	(0.0010)	(0.0011)
Female				-0.004*	-0.003
				(0.0016)	(0.0016)
Sector FE	No	Yes	No	No	Yes
Observations	4013	4013	3978	3978	3978
Reference mean	0.085	0.085	0.017	0.018	0.018

Note: Unit of observation is occupation-by-gender-by-age category. Occupation groups are at 4-digit level. Observation are weighted by number of employed in 2017-2018. Standard errors are clustered by 3-digit occupational sector. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EU-born, EU no Sweden - born, and *Outside EU - born*.

Table 5: Foreign-born status and unemployment impact

Dep.variable	(1)	(2)	(3)	(4)	(5)
	Unemployment risk 2019		Unemployment impact		
Europe outside of Sweden	0.064*** (0.0072)	0.056*** (0.0068)	0.006*** (0.0013)	0.006*** (0.0013)	0.004*** (0.0012)
Outside of Europe	0.242*** (0.0337)	0.230*** (0.0301)	0.029*** (0.0062)	0.029*** (0.0062)	0.026*** (0.0051)
Female				-0.004* (0.0016)	-0.002 (0.0015)
Sector FE	No	Yes	No	No	Yes
Observations	2055	2055	2043	2043	2043
Reference mean	0.051	0.051	0.022	0.022	0.022

Note: Unit of observation is occupation-by-gender-by-foreign born status. Occupation groups are at 4-digit level. Observation are weighted by number of employed in 2017-2018. Standard errors are clustered by 3-digit occupational sector. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

There is a large heterogeneity in the pre-pandemic risk of unemployment by foreign-born status. As compared to Sweden-born workers, the unemployment risk for workers born in other EU countries before the pandemic was 6 p.p. higher; this difference increases to a striking 25 p.p. for workers born outside of the EU (see column 1). These findings are consistent with reports documenting that Sweden has one of the largest gaps in unemployment rate between natives and foreign-born among OECD countries.[19] Importantly, the foreign-born gap is not explained by occupational sorting (column 2) and is exacerbated by the pandemic (columns 3 to 5): based on our estimates, while the pandemic implied a 2.2 p.p. increase in the risk of unemployment for Sweden-born workers, the increase was 0.5 p.p. larger (8% of a s.d.) for other EU-born workers, and more than twice as large for workers born outside of the EU. The differences are statistically significant and virtually unchanged once gender and occupation are accounted for. Lastly, the gender difference is substantially attenuated in regressions that control for foreign-born status, confirming that female workers tend to differ from male workers on some characteristics that are important determinants of the unemployment impact of the pandemic, especially within occupations.[20]

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[19]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migrant_integration_statistics_%E2%80%93_labour_market_indicators.

[20]Notice that we cannot study the relative importance of age-cohort and foreign-born status because the data are non disaggregated at occupation-by-gender, -age, and -foreign born status.

4 Conclusion

In this paper, we have studied differences in unemployment due to the Covid-19 pandemic across different groups of Swedish society. Using the full population of registered unemployed – around 400,000 individuals, grouped across some 400 occupations – we find important differences in unemployment risk across groups. Most adversely affected are the young and the foreign-born while gender does not seem to play any major role in the case of Sweden. Along the income dimension, the lower the wage the higher the unemployment.

These results both confirm what previous work has shown, namely that already vulnerable groups have been more affected by the economic impacts of Covid-19, but also remind us that country-specific institutions and other pre-pandemic factors, as well as policy responses, are likely to play an important role. In the case of Sweden, this is most obvious when it comes to the gender dimension, where we do not find that women fair worse in terms of unemployment due to the pandemic. If anything, it is the other way around. There are several plausible contributing factors for this. First, women in Sweden have high labor force participation and the welfare system has long focused on supporting possibilities to combine family and work-life. The one dimension where Sweden stands out as more gender segregated than many other countries is across sectors. But in the pandemic, this has, if anything, been to the advantage of women. Even though some of the most adversely affected jobs are dominated by women (such as cabin crew personnel) the size of these occupations is relatively small. At the same time, some of the sectors that instead have seen an increased demand for workers, such as many occupations in the health care sector, are also dominated by women and are much larger in size. Second, some aspects of the policy response to the pandemic have minimized the impact on women's labor market conditions compared to the situation in other countries. In particular, the fact that daycares and schools basically remained open has largely taken away the channel identified as most important in explaining gender inequality in other countries, namely women taking a larger responsibility for childcare. The dimensions where we find the largest impact, age and being foreign-born (especially if born outside of Europe) are in line with what has been found in other studies but can also be related to weaknesses in the Swedish labor market prior to Covid-19. Prior to the pandemic, the inclusion of both these groups in the labor market stands out as an area where Sweden is doing poorly compared to most other

OCED countries. Importantly, our detailed occupational data allows us to study differences also within occupational groups so as to separate the effects of young as well as foreign-born potentially sorting into sectors which in turn have been most affected. We find that with respect to age and foreign-born status, the sorting is not the only factor explaining higher exposure to the economic downturn.

Finally, the wage gradient in unemployment suggests that there is indeed a possibility that the pandemic leads to larger inequality also in terms of disposable incomes. However, the steps from individual wages to living standards at the household level are numerous. Preliminary simulations made by the Swedish finance ministry in April 2020 indicate that overall inequality in terms of disposable incomes has not increased much in the pandemic. But this may be a consequence of transfers and other policy measures taken, again pointing to the importance of studying country-specific consequences for economic welfare.

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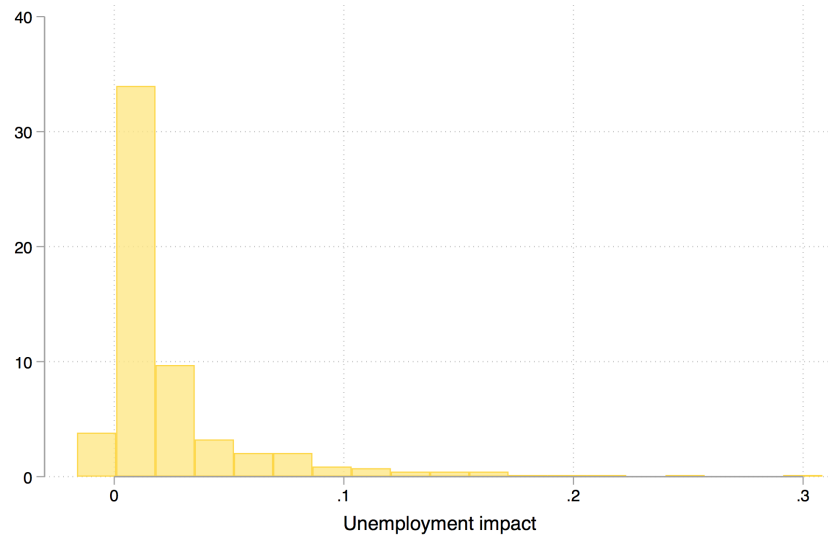
Appendix

Figure A1: Distribution of the unemployment impact of the pandemic

Notes: This Figure shows the distribution of the unemployment impact of the pandemic at occupation-level. The unemployment impact is the change in unemployment risk during the first months of the pandemic (March to July 2020) versus one month before its onset (February 2020), as compared to the same change one year before (see definition in equation 3). The unemployment impact of the pandemic varies substantially across occupations.
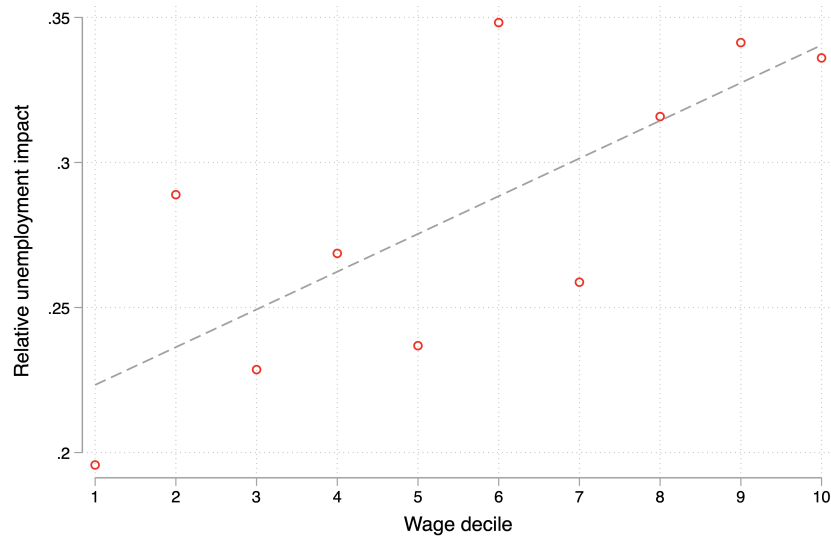
Figure A2: Relative unemployment impact by wage decile

Notes: This Figure shows the relationship between wage-decile and the occupation-level unemployment impact of the pandemic as a percentage of the pre-pandemic unemployment. The unemployment impact is the change in unemployment risk during the first months of the pandemic (March to July 2020) versus one month before its onset (February 2020), as compared to the same change one year before (see definition in equation 3). Relative to the pre-pandemic unemployment level, workers in the higher wage deciles experienced a larger increase in unemployment risk.
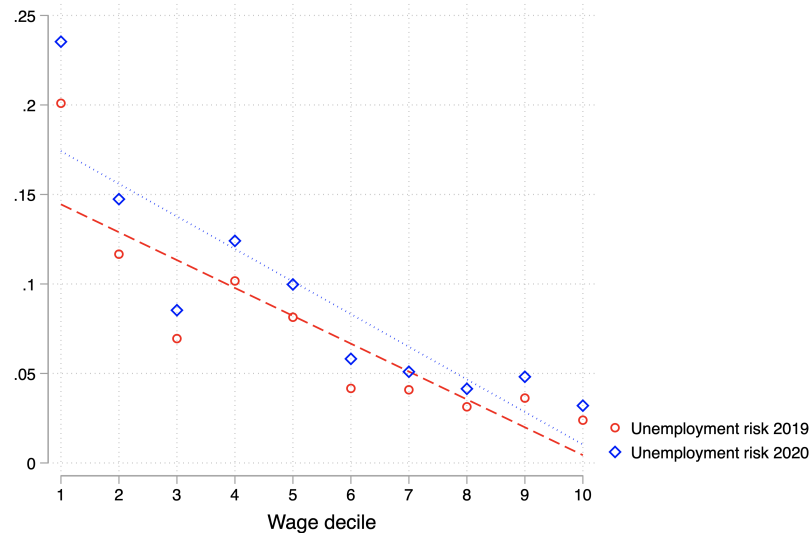

Figure A3: Unemployment inequality before and during the pandemic

Notes: This Figure shows the relationship between wage decile and unemployment risk in 2019 and 2020. Unemployment risk is unequal across wage-deciles: the lower the wage level, the higher the unemployment risk. The inequality increases during the first wave of the pandemic.

Figure A4: Share of female workers by wage decile
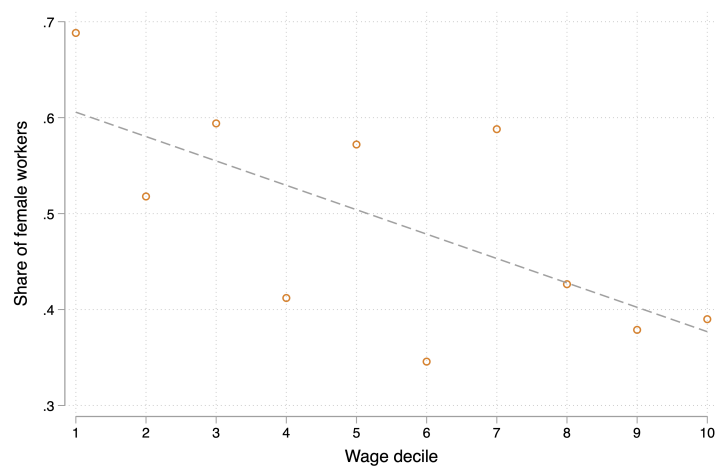
Notes: This Figure shows the relationship between wage decile and women as a share of total employment, based on occupation-level data. Women are more concentrated in lower paying occupations.