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Who lost the most? Distributive effects of the Covid-19 pandemic

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ABSTRACT

Who lost the most? Distributive effects of the Covid-19 pandemic

This paper investigates what happened to the wage distribution in Italy during the first wave of the Covid-19 pandemic. It shows which categories of workers and economic sectors suffered more than others and to what extent both the actual level of smart-working and the ability to work from home can influence the wage distribution. We use a unique dataset relying on the merging of two sample surveys: the Italian Labor Force Survey set up by the National Institute of Statistics and the Italian Survey of Professions conducted by the National Institute for Public Policy Analysis. We estimate quantile regression models accounting for selection. The findings reveal that the pandemic has affected the wages of all workers but that the effect is greater at the bottom of the wage distribution. In addition, the actual working from home mitigates the negative distributional consequences of Covid-19 observed for those at the bottom of the wage distribution. However, the advantage of workers at the bottom tail of the wage distribution appears to lessen in the long term once the health emergency has passed. Third, looking at sectoral heterogeneity, the retail and restaurant sectors are the hardest-hit in terms of wage loss. Fourth, separating by gender, men have been more strongly impacted by the pandemic, and particularly at the lowest deciles, though they benefited more from working at home at higher deciles. Finally, it appears that in the long run, women would benefit more from increasing the possibility of working from home.

KEYWORDS: wage inequality, health emergency, smart working, quantile regression

JEL CODES: J01, J21, J31

1. Introduction

The coronavirus emergency has now hit all countries of the world (Karabulut *et al.* 2021; Milani 2021; Papageorge *et al.* 2021; Zimmermann *et al.* 2020), with a serious impact on the labor market both in the short (Alon *et al.* 2020a; Botha *et al.* 2021) and long term (Baert *et al.* 2020). Governments have had to adopt drastic measures to combat the pandemic, on the one hand by shutting down the activities of non-essential services (Ascani *et al.* 2021; Brodeur *et al.* 2020a; Brodeur *et al.* 2020b; Caselli *et al.* 2020; Depalo 2021; Qiu *et al.* 2020) and on the other hand by increasing the share of jobs that can be carried out remotely (Dingel and Neiman 2020; Montenovo *et al.* 2020; Palomino *et al.* 2020). Thus, the possibility of working from home (WFH hereafter) is considered a key job characteristic in the age of Covid-19, as it allows people to continue their work activities while limiting both the risks to public health and the pandemic's recessive impacts (Bonacini *et al.* 2021a).

Among the different labor market outcomes affected by the Covid-19 crisis, the wage distribution has been relatively less investigated, mainly due to the lack of timely and reliable data (Adams-Prassl *et al.* 2020; Gallo and Raitano 2020). In this article, we investigate the effect of the Covid-19 pandemic on the wage distribution in Italy. Three questions are relevant: What actually happened along the wage distribution during the (first wave of the) pandemic? To what extent can both the actual level of remote working and the capacity to WFH as a possible long-lasting solution influence the wage distribution? What categories of workers (e.g., women) and economic sectors are suffering more than others?

We choose Italy as an interesting case study because it is one of the countries most affected by the pandemic, as the early epicenter of the pandemic in Europe. As of March 2021, it is the seventh country in the world in terms of cumulative cases, with about 3.2 million cases, the sixth in terms of the number of deaths, with about 103 thousand[1], and it was the first Western country to adopt severe lockdown measures, on March 11 2020 (Barbieri *et al.* 2020). Moreover, the consequences for the labor market in Italy have been severe. The employment growth in the first quarter of 2020 was followed by a consistent decline in the second quarter, which continued – albeit at a slower pace – in the third and fourth quarters. An unprecedented fall in the annual average employment was observed (-456 thousand; -2.0%), associated with a drop in unemployment and strong growth in the number of inactive. Furthermore, the decrease in employee positions (-1.7%) and in the number of hours worked (-13.6%), as well as the increase in the use of the furlough scheme (*Cassa Integrazione Guadagni,* CIG) (+139.4 hours per thousand worked), are more marked in the service sector compared to that of industry[2]. Finally, the Covid-19 pandemic has had significant effects on low wages and on poverty in Italy. The preliminary estimates of absolute poverty for the year 2020, released in March 2021 by the Italian National Institute of Statistics (*Istituto Nazionale di Statistica*, Istat hereafter), have provided a clear picture of the consequences that the serious economic crisis caused by the pandemic and the health emergency have had on the living conditions of Italian families. These preliminary estimates

[1] See https://coronavirus.jhu.edu/map.html.
[2] See https://www.istat.it/it/files//2021/03/Mercato_lavoro_IV_trim_2020.pdf.

indicate a growth in the incidence of absolute poverty both in terms of households (from 6.4% in 2019 to 7.7%, +335 thousand), amounting to over 2 million families, and in terms of individuals (from 7.7% to 9.4%, over 1 million more), which amounted to 5.6 million. In the year of the pandemic, the improvements recorded in 2019 disappeared. After four consecutive years of increase, the number and share of families (and individuals) in absolute poverty had in fact decreased significantly, although these remained at values much higher than those preceding the crisis that started in 2008, when the incidence of absolute family poverty was less than 4% and that of individuals was around 3%. Therefore, during pandemic, absolute poverty in Italy reached its highest values since 2005 (i.e., since the time series for this indicator has been available)[3].

To contain the spread of Covid-19, it has recently been estimated that at least 3 million employees (i.e., about 13% of the total) started working remotely, along with an additional number of workers that did so even earlier due to the closure of schools and universities on March 5 (Bonacini *et al.* 2021b). Before the pandemic, Italy was the European country with the lowest share of teleworkers (Eurofound and ILO 2017), but because of the Covid-19 crisis it has greatly increased the possibility to work remotely in a very short period of time – without either clear legislation or satisfactory policies, however (Bonacini *et al.* 2021a). Since the country is now gradually improving the share of remote working, it is important to estimate – with the help of real-time data – the distributive impact of the actual WFH. Thus, we build an indicator of remote working to add as a covariate in our estimates, to evaluate its effect along the wage distribution (see section 3 for details). Despite some recent empirical papers examining the social and economic consequences of the current pandemic in Italy (Barbieri *et al.* 2020; Bonacini *et al.* 2021c; Brunetti *et al.* 2021; Carbonero and Scicchitano 2021; Casarico and Lattanzio 2020), the impacts in terms of inequality and wage distribution have been left largely unexplored. Likewise, all of the existing evidence (Bonacini *et al.* 2021a; Gallo and Raitano 2020) uses data referring to the pre-pandemic period to simulate the distributional consequences; to our knowledge, this is the first paper to estimate the real effects of the Covid-19 pandemic on the wage distribution in Italy.

We use quarterly data from the time span of the first quarter of 2019 to the second quarter of 2020 – at the turn of the crisis period and during which the lockdown in Italy occurred – to investigate distributive effects, controlling for individual and job characteristics. We use a unique dataset relying on the merging of two sample surveys. The first is the Italian Labor Force Survey set up by Istat, which is the official and largest survey conducted in Italy to monitor the dynamics of the labor market. It provides a large amount of information on the socio-economic conditions of Italian men and women of working age, including the actual work performed remotely. The second sample survey is the Italian Survey of Professions (*Indagine Campionaria delle Professioni*, ICP) provided by the National Institute for Public Policy Analysis (Inapp), which contains detailed information on the task contents of occupations at the 5-digit ISCO classification level. The ICP is the Italian equivalent of the US O*NET repertoire and allows us to build the Remote Working attitude. We use this proxy to test whether the potential ability to WFH can be used in the long term as a "new normal" way of working (Bonacini *et al.* 2021a) once the health emergency situation has passed and the lockdown is over. Indeed, it has been predicted that once companies and workers incur significant fixed costs for WFH due to

[3] More details are available at https://bit.ly/3ftfwRL.

technologies, changes in production processes, and the updating of human capital, it is likely that they will no longer want to go back and that, therefore, remote work should be considered as a long-lasting solution (Brynjolfsson *et al.* 2020).

Our results show that the pandemic has affected the wages of the entire workforce, but the effect is higher at the bottom. Moreover, the retail and restaurant sectors are the most affected. Notably, the actual WFH variable mitigates the negative distributional consequences of Covid-19 observed (in general) for those at the bottom of the wage distribution. However, when we consider the WFH capacity index to test the potential long-lasting effects of the opportunity to work remotely, we note that the index underestimates the positive advantage of WFH for workers at the lowest quintiles. The advantage for workers in the bottom tail of the wage distribution, therefore, seems to lessen over the long term. When we separate by gender, we note that women may benefit more from WFH prospects in the long run.

The rest of the article is structured as follows. The next section presents a literature review of the topic and a brief chronicle of the Covid-19 outbreak in Italy. In section 3 we describe the datasets, define our variables of interest, and provide some descriptive evidence. Section 4 reports the econometric methodology, and section 5 presents results and robustness checks. Section 6 concludes with some policy implications.

2. Covid-19, labor markets, and incomes: the current literature

The economic literature that empirically investigates the effects of the Covid-19 pandemic on the labor market is exploding (see Brodeur *et al.* (2020a) for a recent comprehensive survey). Our paper is related to certain strands of this literature. First, some recent studies evaluate the potential and the real distributional effects of the pandemic. Using data from a large Fintech company in the United Kingdom, Hacıoğlu-Hoke *et al.* (2021) show that the smallest spending cuts and the largest earning drops were observed at the lowest quantiles, but total incomes in these were reduced by much less because of the rise in government benefits. Deaton (2021) shows that per capita incomes decrease more in high-income countries. Wildman (2021) demonstrates a significant positive correlation between income inequality and Covid-19 incidence. Clark *et al.* (2020) use longitudinal data from France, Germany, Italy, Spain, and Sweden and find a reduction in relative inequality between January and September 2020. They argue that a possible explanation is that the policy responses to Covid-19 have been focused on the bottom of the income distribution, where the individuals most affected by the pandemic are expected to be found. Kosteas and Renna (2020) use the concentration index to calculate income-related inequality in unemployment in the US and to examine the change in inequality between February and April of 2020. They find that an absolute measure of inequality increased during the early months of the pandemic, while a relative measure shows reduced inequality. The authors also find that the potential for remote working helps explain the increased inequality. Lemieux *et al.* (2020) investigate the impact of the current pandemic on the Canadian labor market and show that half of job losses are related to workers in the bottom earnings quartile. The impact was higher in the industries most affected by shutdowns (accommodation and food services) and for younger workers, those paid hourly, and non-union workers. What this line of research makes clear is that the possibility of investigating this issue is highly dependent on the availability of timely

and reliable data, since representative datasets on population incomes and living conditions are normally released long after the interviews (Gallo and Raitano 2020). The UK (Benzeval *et al.* 2020; Witteveen 2020) and the US (Berman 2020; Cortes and Forsythe 2020) are two exceptions with ad hoc real-time surveys. To solve the issue, scholars have generally used real-time surveys (e.g., Adams-Prassl *et al.* 2020; Galasso 2020) or big data from bank records (Aspachs *et al.* 2020). However, these kinds of data cannot be taken as representative of the whole population and do not allow reliably estimating changes occurring along the income distribution (Gallo and Raitano 2020). We aim to help fill the gap in this literature by analyzing what happened to the labor income distribution in Italy during the crisis, using real-time data from the official Labor Force Survey (LFS).

It is clear that the impact of the pandemic and the subsequent containment measures on the economy crucially depend on the WFH ability of workers. Thus, an exploding strand of economic literature aims to classify the jobs that can be performed at home, so as to determine which workers might have been less impacted by social distancing measures, mobility restrictions, and the risk of contagion (Baker 2020; Boeri *et al.* 2020; Dingel and Neiman 2020; Gottlieb *et al.* 2020; Hensvik *et al.* 2020; Holgersen *et al.* 2021; Mongey *et al.* 2021; Yasenov 2020). Further empirical papers explore potential consequences on the labor income distribution related to a long-lasting increase in WFH feasibility. Palomino *et al.* (2020), for instance, simulate the capacity of individuals to work under a lockdown based on a Lockdown Working Ability index, which considers their teleworking capacity and whether their occupation is essential or was shut down in 29 European countries. Under four different scenarios, they estimate an average increase in the headcount poverty index that goes from 4.9 to 9.4 percentage points and a mean loss rate for poor workers between 10% and 16.2%. The average increase in the Gini coefficient ranges from 3.5% to 7.3%. Similarly, Delaporte and Pena (2020) aim to evaluate the distributional outcomes of social distancing due to the pandemic by considering poverty and labor income inequality in Latin America and the Caribbean. They show that both poverty and labor income inequality have gone up, and the majority of the income losses can be attributed to the sectoral and occupational structure of the economies. Duman (2020) builds an index of the possibility to work remotely in Turkey: he argues that wage inequality is expected to increase as a result of the supply shocks from confinement policies. Adams-Prassl *et al.* (2020) investigate the inequality in job and income losses based on occupation and individual characteristics for the US and the UK. They show that workers unable to work from home have a higher probability of losing their job and that younger and lower-educated workers are more likely decrease their income. In the current paper, we build the actual level of remote working and a WFH capacity index for Italy and then evaluate their effects at different quantiles of the wage distribution.

Finally, some studies have also investigated the consequences of the Covid-19 pandemic on the labor market in terms of gender inequality, showing that its impact on women may be greater (Alon *et al.* 2020a, 2020b; Cuesta and Pico 2020; Del Boca *et al.* 2020). The potential effects of the pandemic in terms of the gender wage gap (GWG), instead, have largely been left unexplored. Bonacini *et al.* (2021b) use simulations with pre-pandemic data, finding that the current pandemic may increase the gender pay gap since it is greater among females working in an occupation with a high level of WFH attitude. In our study, we estimate the GWG along the whole labor wage distribution during the pandemic and show the role of actual and potential WFH in shaping it.

Regarding Italy, it appears to be suffering more than other countries from the effects of the pandemic, due to its structural problems (Capano 2020). Using ICP data for Italy, Barbieri *et al.* (2020) show that

the sectors with the greatest share of workers that could work from home are 'energy', 'finance', 'public administration', and 'professional services' – not the sectors affected by the lockdown decrees. Given the share of those who can work from home, there could be up to 3 million persons who worked from home (rather than in workplaces) in essential (i.e., open) sectors during the first wave of the pandemic. Following the methodology proposed by Dingel and Neiman (2020) and applying it to Italy, Cetrulo *et al.* (2020) catalogue which occupations can be performed from home and conclude that only 30% of the Italian workforce is employed in WFH activities. Casarico and Lattanzio (2020) find that starting from the beginning of March 2020, there was a clear cut in hiring and an increase in the ending of temporary contracts. They also demonstrate that young, temporary, and low-skill workers are more at risk of unemployment because of Covid-19, while gender is not significant. Regarding the possible impact on incomes in Italy, it has been demonstrated that a positive shift in WFH capacity as a long-lasting result of the pandemic would be associated with an increase in the average labor income, but this potential benefit would be not equally distributed among employees. Specifically, an increase in WFH would favor older, highly educated, and highly paid workers (Bonacini *et al.* 2021a). Thus, the pandemic and the potentially long-lasting increase in WFH risk exacerbating pre-existing inequalities in the labor market, especially if not adequately regulated. Consequently, the authors suggest that policies aimed at alleviating inequality, such as income support measures (in the short run) and human capital interventions (in the long run), should play a more important compensating role in the future. Gallo and Raitano (2020) simulate the effects of the pandemic for the whole of 2020 in Italy under three different scenarios. They show that the pandemic has led to a relatively greater decrease in labor incomes for those at the bottom of the income distribution but that this section of the income distribution received higher benefits from the government. As a result, market incomes decreased, but social transfers have been found to be effective in reducing the most serious economic consequences of the pandemic. Carta and De Philippis (2021) use micro data referring to the fourth quarter of 2019 to simulate the impact of the pandemic on the distribution of labor income in Italy and find a potential clear increase in income inequality.

To sum up, all of the existing evidence on the impact of the pandemic on income in Italy relies on simulations, using data from before the advent of the pandemic. We investigate what happened to the wage distribution in Italy during (the first wave of) Covid-19 using data up to the second quarter of 2020, showing the effect of actual WFH as well as of the ability to WFH. The effects in terms of GWG and sectoral heterogeneity along the whole wage distribution are also further explored.

3. Data and sample

Our empirical study draws from a unique dataset relying on the merging of two major Italian labor market surveys: the LFS from Istat and the Italian Survey of Professions conducted by Inapp. The data from these two surveys are combined to obtain a dataset on employment dynamics, individual characteristics, and labor market variables, including both the actual and the capacity to WFH.

The empirical analyses exploit cross-sectional quarterly data (2019Q1-2020Q2) derived from the LFS. This is the largest survey in Italy monitoring the quarterly dynamics of the labor market: each year, it collects information on almost 280,000 households in 1,246 Italian municipalities, for a total of 700,000 individuals. Because we are interested in estimating the effect of the Covid-19 pandemic on

labor market outcomes, we analyze six quarters: from the first quarter of 2019 to the second quarter of 2020. To isolate the effects of the pandemic, as will be seen below, we include in our set of covariates a dummy variable that equals one in the second quarter of 2020 and 0 otherwise.

The sampling design of the survey involves two stages, with a stratification of the unit at the first stage; the first-stage units are municipalities, whereas the second stage comprises households. Each household member is interviewed. The main difference between the two stages is that although for families a 2-2-2 rotation scheme is applied, the municipalities surveyed do not change over time. More specifically, a household was interviewed for two consecutive surveys and, after being excluded from the sample for two quarters, was interviewed for another two consecutive quarters. This is defined as a (2-2-2) rotation scheme (for details on the sampling design see, for instance, Mussida and Lucarelli 2014). This rotation system makes it possible to maintain half of the sample unchanged in two consecutive quarters and in quarters 1 year apart. In other words, the scheme implies a 50 percent overlapping of the theoretical sample to a quarter of the distance, a 25 percent overlapping to three quarters, 50 percent to four quarters, and 25 percent to five quarters.

Our analyses are based on quarterly cross-sectional data for the sample of individuals from the age of 15 to the age of 64. The sample is representative of the overall population as we use the provided population weights. In the first stage – selection – we use the overall sample of individuals, while in the second stage – wage equation – our sample includes only employees. Considering both the non-employed and the employed, 311,654 individual observations are available over the period of 2019Q1-2020Q2, and the total number of wage observations is 214,429.

As explained in section 4, we estimate a quantile regression model with parametric sample selection. The dependent variable for the second and most important stage is the monthly net wage in the respondent's main job, corrected for part-time work. The variables used in the two stages of our econometric framework are summarized in table 1. Explanatory variables may be grouped into supply determinants reflecting individual characteristics (Mincer 1974), which are related to: (1) gender, (2) age, (3) education, (4) geographical area of residence, (5) citizenship, (6) family features/household structure (marital status, household type), (7) characteristics of the job (contract type, occupation, sector of economic activity), (8) actual WFH, and (9) the WFH capacity index. As explained above, we include a dummy variable to account for the Covid-19 pandemic. We also consider quarterly dummy variables in our set of covariates. The relevance of gender is emphasized both in past literature, which analyses aggregate data on the overall labor market (e.g., Baussola 1988) and in studies using individual labor force data from the Italian labor market for the 1993-2003 decade, such as Schindler (2009) and Trivellato *et al.* (2005). The heterogeneity through the overall age range of 15-64 is considered by introducing specific dummy variables for the age brackets [15, 24], [25, 34], [35, 44], [45, 54], and [55, 64]. We consider four educational attainment levels[4]: no education, lower secondary school, upper secondary school, and graduate. Around half of our sample attained upper secondary

[4] Educational dummy indicators refer to the highest successfully completed educational attainment of the individual. The educational classification used to build these indicators is the ISCED 97. We have four categories: no education (none or elementary educational level), primary education (lower secondary educational level), secondary education (upper secondary level), and tertiary education (post-secondary, tertiary, or higher educational level).

education (47.9%), a lower percentage had no education or attained lower secondary education (around 29%), and approximately one-fifth achieved a degree (or above).

Table 1. Descriptive statistics

Variable	Mean	Std. Dev.
Female	0.452	0.498
Age		
15-24	0.053	0.225
25-34	0.187	0.390
45-54	0.309	0.462
55-64	0.191	0.393
Education		
None	0.024	0.152
Lower secondary school	0.271	0.445
Upper secondary school	0.479	0.500
Graduate	0.226	0.418
Geographical area of residence		
North-West	0.305	0.461
North-East	0.227	0.419
Center	0.212	0.409
South	0.255	0.436
Italian citizenship	0.881	0.323
Married	0.554	0.497
Household type		
Single	0.161	0.368
Couple with child	0.599	0.490
Couple without child	0.145	0.352
Single father	0.016	0.124
Single mother	0.080	0.271
Characteristics of the job		
Fixed-term contract	0.164	0.370
Managerial occupation	0.087	0.282
White-collar	0.435	0.496
Blue-collar	0.477	0.499
Sector of economic activity		
Agriculture	0.026	0.160
Industry	0.238	0.426
Construction	0.047	0.211
Retail	0.117	0.322
Restaurant	0.057	0.232
Transportation	0.056	0.230
Communication	0.028	0.165
Finance and Insurance	0.030	0.169
Real estate	0.087	0.282
Public administration	0.068	0.252
Education	0.172	0.378
Other services	0.073	0.261
Actual WFH	0.044	0.205
Observations	311,654	

Source: Authors' elaborations on 2019Q1-2020Q2 Istat data

We also control for citizenship, and around 88% of the sample is Italian. As for family features/household structure, we control for family status (single or married) and the household type: single (around 16% of the sample), couple with kids (the strong majority, around 60%), couple without kids (14.5%), mono-parental mother (8%), and mono-parental father (only 1.6%). As explained in section 4, the variables for household type are included only in the selection equation for identification purposes.

The geographical differential, which is a structural characteristic of the Italian labor market (Bertola and Garibaldi 2003), is considered by including specific covariates. Four dummy variables for geographical area of residence classified according to the NUTS system were introduced[5], i.e., North-West, North-East, Center, and South/Islands. More than half of our sample lives in the North (approximately 53%), more than one-fifth in the Center, and the remainder live in the South of Italy.

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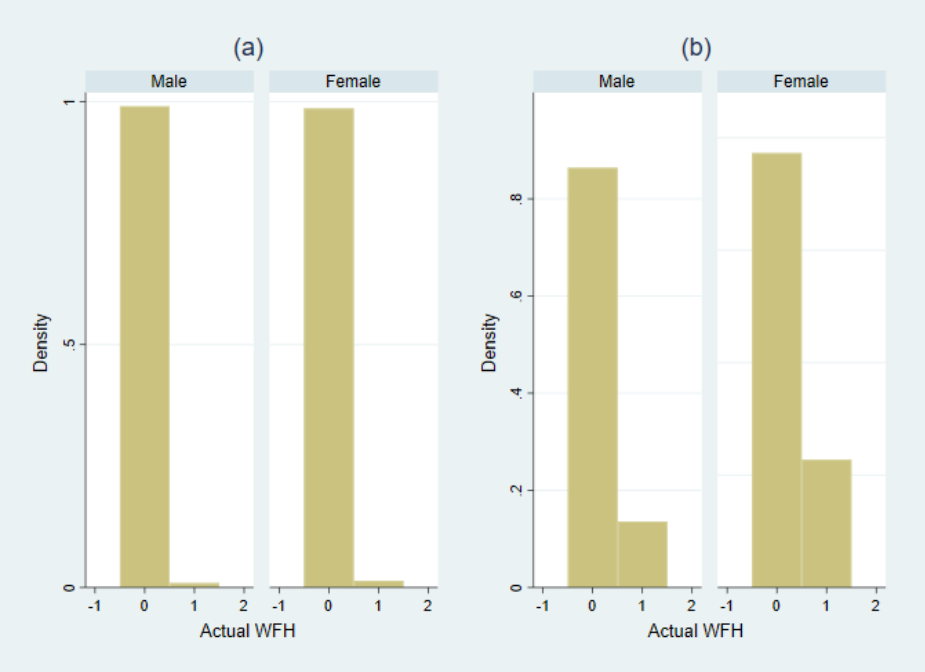
The Italian LFS allows controlling for a rich set of job characteristics, which is especially relevant for our second stage, that is, the estimation of the wage equation for employees. We control for temporary work, the type of occupation, and the sector of economic activity. The occupation classification used to build these indicators is the CP2011, and we use three dummies for managerial, white-collar, and blue-collar occupations. For the sector of economic activity, the classification is the 2-digit ATECO, and we have twelve sectors.

Since the ability to WFH has been shown to be a key variable for limiting the negative consequences of the current pandemic, we first want to determine the short-term effects that the actual WFH has had in the lockdown situation, using a covariate that captures the hours performed remotely during the last month; thus, we build a dummy variable, actual WFH, equal to 1 if the employees have done their work remotely more than twice a week and 0 otherwise. Clearly, as a result of the containment measures implemented on March 9th 2020, the hours carried out remotely are expected to be much greater than in the pre-pandemic situation. From our data, we note that only 1.8% of employees had done their work from home in the second half of 2019, while a year later – as the pandemic raged – this percentage increased up to almost 18%. The actual WFH indeed varies between genders and across sectors of economic activity before and during the Covid-19 pandemic. Figures 1 and 2 offer a visual inspection of the changes in the actual WFH of men and women due to the pandemic, and across different sectors of economic activity, respectively. We note that while before the pandemic WFH was basically null for both genders (panel (a) of figure 1), with the pandemic attitudes increase especially for females (panel (b) of figure 1). Interestingly, from figure 2 we see that the pandemic

[5] NUTS is the acronym for "*Nomenclatura delle unità territoriali statistiche*". Specifically, we refer to the first level of disaggregation, NUTS1, corresponding to the macro-region. According to this classification, there are four NUTS1 for Italy: North-West, North-East, Center, and South (and Islands).

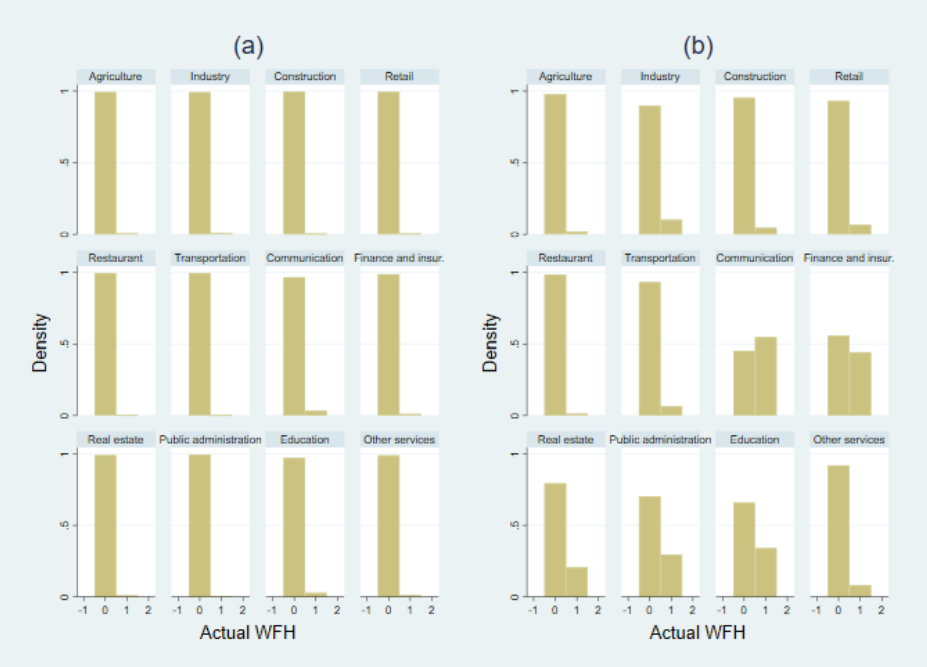
caused a non-negligible increase in WFH for the sectors of communication, finance and insurance, education, public administration, and real estate.

Figure 1. Actual WFH of men and women before (panel a) and during the pandemic (panel b)



Source: Authors' elaborations from 2019Q1-2020Q2 Istat data

Figure 2. Actual WFH by sector of economic activity before (panel a) and during the pandemic (panel b)



Source: Authors' elaborations from 2019Q1-2020Q2 Istat data

Finally, we build the WFH capacity as an index useful for measuring the potential ability to work from home in the long term: this proxy can be used to test a possible 'new normal' way of working once the emergency has passed and the lockdowns are over. To do this, we use data from the *Indagine Campionaria sulle Professioni* (Inapp-ICP). The ICP is a rather unique source of information on skills, tasks, and work contents. In fact, the ICP is the only European survey extensively replicating the American O*Net[6]. Both the American O*Net and the Italian ICP focus on occupations (i.e., occupation-level variables are built relying on both survey-based worker-level information as well as on post-survey validation by expert focus groups). The ICP survey has been realized twice (in 2007 and 2012), based on the whole spectrum of the Italian 5-digit occupations (i.e., 811 occupational codes). The interviews cover 16,000 Italian workers, ensuring representativeness with respect to sector, occupation, firm size, and geographical domain (macro-region)[7].

WFH capacity is a composite index (ranging from 0 to 100, from less to more intense) that is a continuous variable measuring the degree to which jobs can be performed remotely. We average the responses to the questions regarding i) the frequency with which respondents use electronic mail, ii) whether the job requires written letters and memos, and iii) how often they have telephone conversations. The indicator follows that employed by Montenovo *et al.* (2020) and Kosteas and Renna (2020), who use the O*NET dataset for the US; however, we use the Inapp-ICP dataset, allowing us to build a specific indicator for Italian occupations. The score is calculated for each 5-digit occupation and then aggregated at the 3rd digit to realize the ICP-LFS matching. Table A1 in appendix A presents the specific ICP questions used to build the index, while in table A2 the occupations with the highest and the lowest ratings for the index are shown. To test the reliability of this proxy, we use WFH capacity instead of the actual WFH as a robustness test of our findings for the long term (see table 6).

[6] The US O*Net database is based on the Dictionary of Occupational Titles, which since 1939 has provided information on occupations, with a specific focus on the skills required in the public employment service. The O*Net is based on the Standard Occupational Classification (SOC), providing for each elementary occupation variables on knowledge, skills, abilities, and tasks. The key dimensions included in the O*Net are the following: *worker characteristics* – permanent characteristics affecting workers' performance as well as their propensity to acquire knowledge and skills; *worker requirements* – worker characteristics matured by means of experience and education; *experience* – characteristics mostly related to past work experience; *occupation* – a large set of variables referring to requirements and specific features of the various occupations.

[7] On average, 20 workers per each Italian occupation are interviewed, providing representative information at the 5th digit. The survey includes more than 400 variables regarding skill, work contents, attitudes, and tasks, as well as other subjective and objective information on occupations. More specifically, the ICP offers a massive amount of information concerning work contents and attitudes, skills and tasks, technological and organizational characteristics of productive processes, degree of standardization and control of worker operations, and the importance and nature of social interactions. A fundamental aspect of our data is that our task and skill variables are specific to the Italian economy. Thus, the ICP may be used to define the structure of the labor market, the level of technology, and the industrial relations that characterize the Italian economy. More specifically, the use of ICP variables avoids potential methodological problems that may arise when information related to the US occupational structure (i.e., contained in the US O*Net repertoire) is matched with labor market data referring to other economies such as the European ones. As the ICP is based on Italian occupations and not those of the US, it is more reliable in defining characteristics of the Italian production structure, technology, and industrial relations.

4. Econometric strategy

The effects of exogenous variables on wages are likely to differ across individuals. For example, fixed-term contracts can have a more negative effects for low-wage workers than for high-wage workers (Brunetti *et al.* 2018). The standard OLS techniques ignore this heterogeneity and only provide an estimate of the mean effect of a given variable. The quantile regression (QR) approach, introduced by Koenker and Basset (1978), allows estimating the conditional quantiles of a response variable Y (wages, in our case) as a function of a set X of covariates on different sections of the wage distribution. In our paper, following Martins and Pereira (2004), we model the quantile regression as follows:

$$lnw_i = x_i\beta_o + u_{\theta i} \quad \text{with} \quad Q_\theta(lnw_i|x_i) = x_i\beta_o,$$

where x_i is the vector of exogenous variables and $Q_\theta(lnw_i|x_i)$ represents the θth conditional quantile of (ln) wages given the vector x_i. The θth regression quantile, 0 < θ < 1, is defined as a solution of a minimization problem (Martins and Pereira 2004). The coefficients estimated in quantile regression for the quantile point quantify the expected change in the wage distribution for each quantile as x increases by 1 unit net of other covariates. Therefore, the quantile regression provides snapshots of different points of a conditional distribution. It constitutes a parsimonious way of describing the whole distribution and should bring much value added if the relationship between the regressors and the independent variable evolves across its conditional distribution. However, the technique relies on a strong assumption: the conditional quantile of an individual remains the same when his/her characteristics change. Since this assumption may not hold in practice, the results must be interpreted with caution (Koenker 2005).

The empirical specification of our model is the following. The dependent variable is the natural logarithm of the net monthly wage, and the set of exogenous variables in vector X includes individual characteristics such as age, gender, level of education, geographic location, and job characteristics (Mincer 1974). As discussed in the previous section, we include dummy variables to account for the Covid-19 pandemic and for the actual and potential WFH. We provide different specifications of the model: with and without the interaction between the Covid-19 indicator and the sectors of activity, to understand whether the effect of the pandemic is more pronounced in particular sectors, and with and without the interaction between the actual and potential WFH measures and a female dummy.

Unfortunately, the estimates could be biased by a sample selection problem. Indeed, differences due to the Covid-19 pandemic and the use of remote working between workers occur when it comes to labor market participation (Heckman 1979). Biases due to differences between individuals in the propensity to work may be important in determining whether and how wage inequality changes along the distribution, and failing to account for this bias may result in inaccurate and biased estimations of the wage equations. Hence, due to the potential issues of self-selection, we decide to implement the two-stage estimation strategy, like Heckman (1979) and further inspired by Buchinsky (1998). This procedure applies the parametric sample selection model to quantile regression. In the first stage, we estimate the probability of participating in the labor market:

$$Pr(Y_w|X) = X\beta_w(\theta) + h_\theta(z_w\gamma) \;\; \forall\, \theta \,\epsilon\, (0,1).$$

The vector Z regression is a set of observable characteristics that influence the probability that an individual participates in the labor market. These variables are uncorrelated with the (ln of) wage, and they are variables for household type (see section 3 for details). The term $h_\theta(z_w\gamma)$ corrects the selection at the θth quantile. It represents the inverse Mill's ratio in the Heckman method. In the second stage, we estimate the selectivity-corrected model.

5. Results

In this section, we present the results of the empirical strategy described in section 4. The average marginal effects (AMEs hereafter) of the probability of being employed (i.e., the first step of our estimates) are shown in table B1 in appendix B. With reference to the selection equation and in line with the literature (see, for example, Del Boca *et al.* 2020), the AME of females highlights that they are less likely to be employed. Accordingly, single people with children have lower chances of working with respect to singles or couples without children (i.e., reference category); more specifically, the penalty is of about 2 percentage points (hereafter p.p.) for fathers and 4 p.p. for mothers. The employment probability positively increases with age as for each age group above 25 the AMEs are higher. For example, in the 25-34 age bracket the advantage is of about 7 p.p., which goes up to 17 p.p. for the 55-64 age interval. Being Italian enhances the probability of working by 3.4 p.p. compared to foreigners. In addition, and as expected, individuals with a higher level of education are more likely to join the labor market, ceteris paribus. Finally, those who live in the most productive areas of the country, namely the north-west and north-east of Italy, have greater job opportunities.

Table 2 shows the second-step estimates for the sample of employees, examining the short-term consequences of Covid-19 on wages in Italy. Our dependent variable looks at the wage distribution of employees by analyzing the 10th quantile, the median, and the 90th quantile. The post-Covid dummy that captures the first quarter entirely exposed to Covid-19 (2020Q2) suggests that the pandemic has affected the wages of the entire workforce, but the effect is higher at the bottom of the wage distribution, with a penalty of about 7.5 p.p. versus only 1.1 p.p. for the 90th quantile. The actual WFH coefficient, which is a dummy for whether an individual is WFH more than twice a week, confirms that workers who benefit from teleworking receive a wage premium, and especially those belong to the 10th quantile. Regarding gender, it emerges that females experience a wage penalty that decreases across quantiles. Specifically, this gap goes from 8 p.p. for the 10th quantile to 3.7 p.p. for the 90th quantile[8]. Regarding age groups, the wage premium increases with age up to the 45-54 age interval. Holding Italian citizenship positively affects wages (Piazzalunga and Di Tommaso 2019; Strøm *et al.* 2018) and this advantage is greater for top earners (4.2 p.p.). The returns to education are especially large for graduates (Mussida and Picchio 2014b). Working in a more productive economic area entails a larger wage premium as well. Likewise, fixed-term employment contracts provide a lower return, but the penalty is notably relevant for the 10th-quantile earners (22 p.p.). In terms of occupation, the wage premium is greater for managers and white-collar workers compared to blue-collar workers but

[8] Such a result confirms that the GWG phenomenon is traditionally an important issue in Italy (Biagetti and Scicchitano 2011, 2014; Mussida and Picchio 2014a, 2014b; Picchio and Mussida 2011).

the reward is more consistent for the former, and especially those in the tail of the distribution (60.9 p.p.)[9]. Finally, considering industry as the reference category, all other sector dummies except finance and insurance have lower wage returns, irrespective of the wage distribution. In specification II (columns 4-6) of table 2, we add the interaction terms between sector of economic activity and the Covid-19 dummy to the baseline estimates in specification I (columns 1-3). Results show that the pandemic, in reference to the conditions of workers employed only in the industry sector, has a more pronounced effect; in particular, the wage penalty is of 11.4 p.p., 3.1 p.p., and 2.9 p.p. for the 10th quantile, the median, and the 90th quantile, respectively. Regarding the interaction terms of sectors with the pandemic dummy, we observe that some have been more exposed to Covid-19; for example, in the 2nd quarter of 2020 workers in the restaurant and retail sectors faced a higher wage penalty. In particular, the wage cut has been more pronounced for the 10th quantile and median earners. Considering the lockdown implemented during the pandemic, which mainly affected industry (the reference category) and the retail and restaurant sectors, these interaction terms show that workers in sectors that benefited from remote working, substantial employment protection, or a rise in demand received positive compensation, regardless of their position along the wage distribution. A visible increase in wages occurred mainly for employees in education, real estate, and other services. However, only workers employed in public administration, transportation, and agriculture at the bottom and the median of the distribution obtained a wage premium, whereas no effects are observed for workers in the higher tail of the wage distribution. Similarly, only workers in the bottom tail of the wage distribution in communication and finance and insurance received an increase. Furthermore, when including this interaction term, the magnitude of the actual WFH dummy during the pandemic decreases, especially for the bottom tail of the wage distribution.

Table 2. Estimates of the effects of Covid-19 on the wage distribution of Italian workers

	(I)			(II)		
	Quantile					
	10th	**Median**	**90th**	**10th**	**Median**	**90th**
Covid-19	-0.075***	-0.021***	-0.011**	-0.114***	-0.031***	-0.029***
	(0.004)	(0.002)	(0.005)	(0.010)	(0.003)	(0.005)
WFH	0.077***	0.040***	0.045***	0.052***	0.034***	0.044***
	(0.005)	(0.003)	(0.007)	(0.007)	(0.004)	(0.010)
Female	-0.080***	-0.072***	-0.037***	-0.079***	-0.072***	-0.035***
	(0.005)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
Age 25-34	0.038***	0.037***	0.027**	0.032***	0.037***	0.025***
	(0.012)	(0.004)	(0.011)	(0.010)	(0.005)	(0.009)
Age 35-44	0.067***	0.072***	0.066***	0.063***	0.072***	0.062***
	(0.017)	(0.006)	(0.016)	(0.013)	(0.007)	(0.016)
Age 45-54	0.075***	0.086***	0.069***	0.070***	0.086***	0.064***
	(0.019)	(0.006)	(0.019)	(0.014)	(0.007)	(0.018)
Age 55-64	0.066***	0.068***	0.043**	0.060***	0.068***	0.038*
	(0.022)	(0.008)	(0.022)	(0.016)	(0.008)	(0.021)
Italian citizenship	0.014*	0.037***	0.042***	0.013***	0.037***	0.042***
	(0.008)	(0.002)	(0.005)	(0.005)	(0.003)	(0.007)

[9] This is consistent with what Biagetti *et al.* (2020) found with respect to Italy.

Lower secondary school	0.017**	0.018***	-0.001	0.017	0.019***	-0.002
	(0.008)	(0.003)	(0.010)	(0.012)	(0.005)	(0.012)
Upper secondary school	0.013	0.020***	-0.011	0.012	0.021***	-0.013
	(0.011)	(0.005)	(0.011)	(0.014)	(0.005)	(0.016)
Graduate	0.043***	0.058***	0.023*	0.041**	0.058***	0.019
	(0.015)	(0.006)	(0.013)	(0.018)	(0.006)	(0.020)
North-West	0.041***	0.032***	0.015*	0.039***	0.032***	0.013
	(0.011)	(0.004)	(0.008)	(0.008)	(0.003)	(0.010)
North-East	0.045***	0.041***	0.028**	0.040***	0.041***	0.025**
	(0.014)	(0.005)	(0.012)	(0.008)	(0.004)	(0.013)
Center	0.020**	0.005	-0.019***	0.017***	0.005	-0.020***
	(0.008)	(0.004)	(0.007)	(0.006)	(0.003)	(0.006)
Managerial Occupations	0.310***	0.367***	0.609***	0.314***	0.369***	0.610***
	(0.004)	(0.003)	(0.008)	(0.004)	(0.003)	(0.007)
White-collar	0.128***	0.125***	0.132***	0.129***	0.125***	0.132***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)
Fixed-term contract	-0.220***	-0.091***	-0.019***	-0.223***	-0.090***	-0.020***
	(0.005)	(0.002)	(0.004)	(0.008)	(0.002)	(0.005)
Agriculture	-0.222***	-0.147***	-0.136***	-0.230***	-0.150***	-0.139***
	(0.009)	(0.005)	(0.006)	(0.009)	(0.005)	(0.006)
Construction	-0.029***	-0.015***	0.006	-0.024***	-0.012***	0.007
	(0.003)	(0.004)	(0.005)	(0.004)	(0.003)	(0.005)
Retail	-0.098***	-0.061***	-0.035***	-0.097***	-0.063***	-0.038***
	(0.005)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)
Restaurant	-0.200***	-0.069***	0.005	-0.174***	-0.063***	0.004
	(0.011)	(0.004)	(0.006)	(0.008)	(0.003)	(0.008)
Transportation	-0.031***	0.003	0.070***	-0.039***	-0.000	0.068***
	(0.003)	(0.004)	(0.005)	(0.004)	(0.003)	(0.004)
Communication	-0.034***	-0.008*	-0.002	-0.037***	-0.009***	-0.001
	(0.008)	(0.004)	(0.006)	(0.007)	(0.003)	(0.007)
Finance and Insurance	0.055***	0.092***	0.081***	0.044***	0.090***	0.081***
	(0.007)	(0.004)	(0.004)	(0.006)	(0.003)	(0.006)
Real estate	-0.158***	-0.092***	-0.045***	-0.166***	-0.097***	-0.052***
	(0.005)	(0.002)	(0.005)	(0.006)	(0.003)	(0.005)
Public administration	-0.034***	-0.042***	-0.055***	-0.047***	-0.046***	-0.057***
	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)	(0.003)
Education	-0.075***	-0.068***	-0.065***	-0.087***	-0.072***	-0.069***
	(0.002)	(0.002)	(0.005)	(0.003)	(0.002)	(0.004)
Other services	-0.311***	-0.166***	-0.047***	-0.321***	-0.169***	-0.055***
	(0.007)	(0.002)	(0.005)	(0.005)	(0.003)	(0.005)
Covid-19*Agriculture				0.104***	0.023**	0.022
				(0.035)	(0.011)	(0.014)
Covid-19*Construction				-0.012	0.010*	0.020**
				(0.012)	(0.006)	(0.010)
Covid-19*Retail				-0.229***	-0.066***	0.011
				(0.033)	(0.010)	(0.019)
Covid-19*Restaurant				-0.085***	-0.016**	-0.004
				(0.022)	(0.008)	(0.014)
Covid-19*Transportation				0.071***	0.023***	0.017
				(0.012)	(0.005)	(0.012)

Covid-19*Communication				0.060***	0.006	0.001
				(0.023)	(0.006)	(0.020)
Covid-19*Finance and Insurance				0.091***	0.014	0.004
				(0.017)	(0.011)	(0.014)
Covid-19*Real estate				0.081***	0.030***	0.053***
				(0.020)	(0.006)	(0.015)
Covid-19*Public administration				0.111***	0.021***	0.019
				(0.011)	(0.007)	(0.011)
Covid-19*Education				0.102***	0.029***	0.033***
				(0.010)	(0.005)	(0.010)
Covid-19*Other services				0.103***	0.026***	0.047**
				(0.016)	(0.007)	(0.023)
Constant	6.507***	6.982***	7.329***	6.509***	6.982***	7.333***
	(0.019)	(0.007)	(0.015)	(0.015)	(0.007)	(0.019)
N. observations			214.148			

Note: reference category: 15-24 years old; no education; South and Islands; Industry; Blue-collar. Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. (I) is the specification without interaction terms; (II) is the specification with the interaction terms between sectors dummies and Covid-19 dummy.
Source: Authors' elaborations on 2019Q1-2020Q2 Istat ICP data

To the baseline estimates of table 2 and the specification reported in column 2 we add the interaction term of actual WFH with Covid-19 (see table 3).

Table 3. Estimates of the effects of Covid-19 on the wage distribution of Italian workers with the interaction WFH and Covid-19

	(I)			**(II)**		
	Quantile					
	10th	**Median**	**90th**	**10th**	**Median**	**90th**
Covid-19	-0.084***	-0.021***	-0.009*	-0.116***	-0.031***	-0.026***
	(0.004)	(0.002)	(0.005)	(0.008)	(0.004)	(0.008)
WFH	0.038***	0.044***	0.069***	0.038***	0.045***	0.070***
	(0.009)	(0.004)	(0.012)	(0.007)	(0.005)	(0.010)
Covid-19*WFH	0.071***	-0.006	-0.039**	0.023**	-0.019***	-0.044***
	(0.011)	(0.006)	(0.016)	(0.009)	(0.006)	(0.014)
Female	-0.080***	-0.072***	-0.036***	-0.080***	-0.072***	-0.035***
	(0.005)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)
Age 25-34	0.038***	0.037***	0.027***	0.033***	0.037***	0.025***
	(0.015)	(0.006)	(0.009)	(0.012)	(0.005)	(0.007)
Age 35-44	0.068***	0.072***	0.065***	0.065***	0.072***	0.062***
	(0.019)	(0.008)	(0.014)	(0.018)	(0.006)	(0.011)
Age 45-54	0.075***	0.086***	0.067***	0.073***	0.086***	0.064***
	(0.021)	(0.009)	(0.017)	(0.021)	(0.007)	(0.012)
Age 55-64	0.066***	0.068***	0.042**	0.064***	0.068***	0.037**
	(0.023)	(0.011)	(0.019)	(0.022)	(0.008)	(0.015)
Italian citizenship	0.014**	0.037***	0.043***	0.014**	0.037***	0.042***
	(0.006)	(0.003)	(0.005)	(0.006)	(0.003)	(0.005)
Lower secondary school	0.018	0.018***	-0.001	0.018*	0.019***	-0.002
	(0.013)	(0.005)	(0.009)	(0.011)	(0.005)	(0.008)

Upper secondary school	0.014	0.020***	-0.011	0.013	0.021***	-0.013
	(0.016)	(0.006)	(0.013)	(0.012)	(0.005)	(0.012)
Graduate	0.044**	0.057***	0.022	0.043***	0.057***	0.020
	(0.020)	(0.008)	(0.017)	(0.014)	(0.006)	(0.015)
North-West	0.041***	0.032***	0.014*	0.040***	0.032***	0.013
	(0.011)	(0.006)	(0.008)	(0.008)	(0.003)	(0.009)
North-East	0.045***	0.041***	0.027***	0.043***	0.040***	0.026**
	(0.013)	(0.007)	(0.009)	(0.010)	(0.004)	(0.010)
Center	0.020***	0.005	-0.019***	0.018***	0.004	-0.020***
	(0.008)	(0.004)	(0.006)	(0.007)	(0.003)	(0.006)
Managerial Occupations	0.311***	0.367***	0.609***	0.314***	0.369***	0.609***
	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)	(0.007)
White-collar	0.128***	0.125***	0.132***	0.129***	0.125***	0.132***
	(0.002)	(0.001)	(0.003)	(0.003)	(0.002)	(0.004)
Fixed-term contract	-0.220***	-0.090***	-0.020***	-0.223***	-0.090***	-0.021***
	(0.005)	(0.002)	(0.004)	(0.005)	(0.002)	(0.005)
Agriculture	-0.221***	-0.147***	-0.136***	-0.230***	-0.150***	-0.139***
	(0.010)	(0.005)	(0.005)	(0.013)	(0.006)	(0.009)
Construction	-0.029***	-0.015***	0.006	-0.024***	-0.012***	0.007
	(0.005)	(0.003)	(0.005)	(0.004)	(0.004)	(0.005)
Retail	-0.099***	-0.061***	-0.036***	-0.097***	-0.063***	-0.038***
	(0.005)	(0.002)	(0.003)	(0.005)	(0.002)	(0.004)
Restaurant	-0.200***	-0.069***	0.005	-0.173***	-0.064***	0.004
	(0.008)	(0.004)	(0.007)	(0.008)	(0.004)	(0.005)
Transportation	-0.032***	0.003	0.070***	-0.039***	-0.000	0.068***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)
Communication	-0.033***	-0.009**	-0.001	-0.036***	-0.010***	-0.002
	(0.006)	(0.004)	(0.008)	(0.006)	(0.004)	(0.008)
Finance and Insurance	0.054***	0.093***	0.081***	0.044***	0.090***	0.081***
	(0.005)	(0.004)	(0.006)	(0.006)	(0.003)	(0.007)
Real estate	-0.159***	-0.092***	-0.045***	-0.167***	-0.097***	-0.053***
	(0.005)	(0.002)	(0.006)	(0.005)	(0.002)	(0.005)
Public administration	-0.036***	-0.042***	-0.055***	-0.048***	-0.047***	-0.057***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
Education	-0.076***	-0.068***	-0.066***	-0.087***	-0.072***	-0.069***
	(0.003)	(0.001)	(0.003)	(0.003)	(0.002)	(0.005)
Other services	-0.312***	-0.165***	-0.048***	-0.321***	-0.169***	-0.054***
	(0.009)	(0.003)	(0.008)	(0.008)	(0.003)	(0.008)
Covid-19*Agriculture				0.105***	0.023*	0.021
				(0.029)	(0.012)	(0.020)
Covid-19*Construction				-0.011	0.009	0.020*
				(0.014)	(0.006)	(0.011)
Covid-19*Retail				-0.228***	-0.066***	0.009
				(0.043)	(0.017)	(0.030)
Covid-19*Restaurant				-0.084***	-0.017*	-0.006
				(0.020)	(0.009)	(0.016)
Covid-19*Transportation				0.072***	0.022***	0.015
				(0.014)	(0.008)	(0.012)

Covid-19*Communication				0.059***	0.011	0.003
				(0.021)	(0.010)	(0.024)
Covid-19*Finance and Insurance				0.088***	0.017*	0.010
				(0.021)	(0.010)	(0.015)
Covid-19*Real estate				0.083***	0.032***	0.052***
				(0.019)	(0.006)	(0.011)
Covid-19*Public administration				0.109***	0.024***	0.019**
				(0.009)	(0.006)	(0.009)
Covid-19*Education				0.097***	0.031***	0.034***
				(0.007)	(0.005)	(0.009)
Covid-19*Other services				0.100***	0.026***	0.045**
				(0.013)	(0.010)	(0.019)
Constant	6.510***	6.982***	7.327***	6.508***	6.982***	7.332***
	(0.013)	(0.006)	(0.013)	(0.017)	(0.006)	(0.014)
N. observations	214.148					

Note: reference category: 15-24 years old; no education; South and Islands; Industry; Blue-collar. Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. (I) is the specification without interaction terms; (II) is the specification with the interaction terms between sectors dummies and Covid-19 dummy.
Source: Authors' elaborations on 2019Q1-2020Q2 Istat data

Overall, the magnitude and statistical significance of the estimates remain the same, but by disentangling the effect of actual WFH before and during the pandemic, we find that workers in the bottom tail of the wage distribution compose the sub-group that benefited most from the introduction of the national pandemic measures, which extended remote working facilities as well as parental leave, given that their wage premium is still statistically significant during Covid-19.

In tables 4 and 5, we investigate heterogeneous effects of Covid-19 by gender using the same specification as in table 3 (columns 1 and 2). Regarding women (table 4), the Covid-19 wage reduction for those at the 10th quantile and median of the distribution is significant but smaller in magnitude compared to men; indeed, the wage penalties are of about 5.2 p.p., 1.3 p.p. and 8.7 p.p., 2.6 p.p., respectively, for females and males. In addition, for men (table 5) the wage cut is statistically significant also for workers in the top tail of the distribution but is null for their counterparts. Regardless of gender, the actual WFH reward is significant along the entire wage distribution, although the wage increase is particularly large for the lowest quantile. Nevertheless, the male sub-group has benefited the most from WFH, and especially those with wages above the median. Results suggest that for both sexes, the wage premium increases with age and education irrespective of position along the wage distribution, but the magnitude is always greater for men. Similarly, working in a well-off geographical area, especially in the North, provides a wage increase across the whole wage distribution. Regarding sectors, the worst performance is registered for males and females working in agriculture, real estate, public administration, education, and other service sectors, compared to employees in industry. In contrast, they both receive a wage premium in the finance and insurance sector. Gender differences are instead observed in the restaurant sector, as women are not only penalized when their wage is in the 90th quantile, and in the communication sector for wages above the median – whereas men are always penalized. In contrast, men in transportation get rewarded when their wage is above the median; conversely, women are always penalized. Once we add the interaction term between sector and pandemic (tables 4 and 5, column 2), employees in the industry

sector have been equally affected during Covid-19, regardless of gender. Again, regardless of gender, workers in the public administration and education sectors obtained a wage premium that is similar in magnitude within the same quantile. For those working in the restaurant sector, the wage decreases during the pandemic affected only men in the lowest tail of the distribution, while women were unaffected. The wage inequalities have been particularly biting for those in the retail sector up to the median wage, and especially for men, though women in the 90th quantile received a premium of 6.6 p.p. Males in the agriculture sector benefited from the pandemic across the entire wage distribution; conversely, women received the larger wage premium only in the 10th quantile (18.1 p.p.). Regarding transportation, both males and females received a wage increase during Covid-19, up to the median, but the advantage is always larger in magnitude for the latter. In addition, real estate workers registered a wage increase – mainly males in the 10th quantile – but at the top of the distribution the benefit is solely for women (11.1 p.p.). A positive wage was obtained by workers in the bottom tail of the distribution for finance and insurance, with men additionally benefitting when at the median of the distribution. Women received a wage reward during the pandemic over the whole distribution in the other services sector, whereas for men this occurred strictly in the bottom tail. Finally, the communication sector provided a wage premium only for men in the 10th quantile of the wage distribution (7.2 p.p.).

Table 4. Estimates of the effects of Covid-19 on the wage distribution of Italian workers: Female sub-sample

	(I)			(II)		
	Quantile					
	10th	**Median**	**90th**	**10th**	**Median**	**90th**
Covid-19	-0.052***	-0.013***	0.002	-0.111***	-0.031***	-0.023**
	(0.006)	(0.003)	(0.007)	(0.015)	(0.006)	(0.011)
WFH	0.073***	0.029***	0.030***	0.055***	0.024***	0.035***
	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)	(0.012)
Age 25-34	0.103***	0.063***	0.096***	0.096***	0.063***	0.096***
	(0.022)	(0.008)	(0.014)	(0.015)	(0.011)	(0.012)
Age 35-44	0.168***	0.117***	0.158***	0.161***	0.116***	0.156***
	(0.026)	(0.010)	(0.019)	(0.019)	(0.014)	(0.016)
Age 45-54	0.196***	0.141***	0.166***	0.188***	0.140***	0.165***
	(0.028)	(0.011)	(0.023)	(0.020)	(0.014)	(0.016)
Age 55-64	0.209***	0.141***	0.141***	0.198***	0.139***	0.139***
	(0.030)	(0.013)	(0.026)	(0.023)	(0.016)	(0.021)
Italian citizenship	0.023***	0.065***	0.085***	0.021*	0.066***	0.087***
	(0.008)	(0.005)	(0.009)	(0.011)	(0.005)	(0.009)
Lower secondary school	0.056***	0.036***	-0.007	0.047**	0.033***	-0.013
	(0.014)	(0.007)	(0.025)	(0.019)	(0.009)	(0.027)
Upper secondary school	0.087***	0.066***	0.012	0.075***	0.064***	0.006
	(0.020)	(0.008)	(0.026)	(0.019)	(0.010)	(0.027)
Graduate	0.145***	0.125***	0.066**	0.134***	0.122***	0.060*
	(0.027)	(0.010)	(0.029)	(0.021)	(0.012)	(0.032)
North-West	0.095***	0.072***	0.066***	0.090***	0.071***	0.062***
	(0.017)	(0.006)	(0.011)	(0.011)	(0.007)	(0.011)
North-East	0.109***	0.091***	0.097***	0.104***	0.090***	0.094***
	(0.020)	(0.007)	(0.015)	(0.015)	(0.007)	(0.014)

Center	0.064***	0.038***	0.023***	0.060***	0.037***	0.021**
	(0.013)	(0.006)	(0.008)	(0.011)	(0.005)	(0.008)
Managerial Occupations	0.305***	0.309***	0.535***	0.308***	0.309***	0.535***
	(0.008)	(0.003)	(0.010)	(0.006)	(0.005)	(0.011)
White-collar	0.153***	0.125***	0.105***	0.154***	0.124***	0.106***
	(0.005)	(0.003)	(0.004)	(0.005)	(0.003)	(0.006)
Fixed-term contract	-0.208***	-0.075***	0.025***	-0.211***	-0.075***	0.026***
	(0.010)	(0.003)	(0.009)	(0.009)	(0.003)	(0.007)
Agriculture	-0.265***	-0.148***	-0.122***	-0.284***	-0.145***	-0.116***
	(0.020)	(0.012)	(0.014)	(0.030)	(0.009)	(0.012)
Construction	-0.084***	-0.021**	0.068***	-0.087***	-0.018	0.065***
	(0.015)	(0.010)	(0.023)	(0.014)	(0.016)	(0.023)
Retail	-0.077***	-0.030***	0.011	-0.079***	-0.033***	0.011**
	(0.008)	(0.004)	(0.007)	(0.007)	(0.003)	(0.006)
Restaurant	-0.174***	-0.040***	0.032***	-0.151***	-0.037***	0.027***
	(0.013)	(0.005)	(0.008)	(0.015)	(0.004)	(0.009)
Transportation	-0.042***	-0.042***	-0.001	-0.056***	-0.047***	-0.003
	(0.008)	(0.005)	(0.007)	(0.008)	(0.005)	(0.010)
Communication	-0.003	0.030***	0.075***	-0.013	0.029***	0.070***
	(0.012)	(0.007)	(0.016)	(0.012)	(0.009)	(0.018)
Finance and Insurance	0.061***	0.136***	0.158***	0.050***	0.133***	0.166***
	(0.010)	(0.007)	(0.009)	(0.009)	(0.007)	(0.011)
Real estate	-0.138***	-0.069***	-0.002	-0.147***	-0.074***	-0.014
	(0.009)	(0.004)	(0.010)	(0.008)	(0.004)	(0.009)
Public administration	-0.019***	-0.024***	-0.019**	-0.034***	-0.028***	-0.023**
	(0.005)	(0.004)	(0.009)	(0.008)	(0.004)	(0.010)
Education	-0.046***	-0.038***	-0.022***	-0.058***	-0.042***	-0.027***
	(0.006)	(0.003)	(0.006)	(0.006)	(0.003)	(0.006)
Other services	-0.286***	-0.150***	-0.012	-0.300***	-0.155***	-0.018*
	(0.011)	(0.005)	(0.011)	(0.010)	(0.005)	(0.010)
Covid-19*Agriculture				0.181**	-0.011	-0.063
				(0.075)	(0.028)	(0.042)
Covid-19*Construction				-0.008	0.012	0.007
				(0.031)	(0.011)	(0.021)
Covid-19*Retail				-0.221***	-0.057***	0.066**
				(0.041)	(0.018)	(0.029)
Covid-19*Restaurant				-0.130	0.002	0.034
				(0.098)	(0.033)	(0.059)
Covid-19*Transportation				0.104***	0.026**	0.021
				(0.023)	(0.011)	(0.029)
Covid-19*Communication				0.046	0.004	0.030
				(0.049)	(0.018)	(0.046)
Covid-19*Finance and Insurance				0.080***	0.011	-0.027
				(0.027)	(0.011)	(0.021)
Covid-19*Real estate				0.065**	0.034***	0.111***
				(0.026)	(0.010)	(0.027)
Covid-19*Public administration				0.105***	0.026***	0.018
				(0.015)	(0.010)	(0.020)
Covid-19*Education				0.094***	0.029***	0.031*
				(0.018)	(0.009)	(0.018)

Covid-19*Other services				0.091***	0.029***	0.050**
				(0.033)	(0.009)	(0.023)
Constant	6.297***	6.831***	7.216***	6.314***	6.833***	7.224***
	(0.027)	(0.014)	(0.032)	(0.035)	(0.015)	(0.049)
N. observations			99.117			

Note: reference category: 15-24 years old; no education; South and Islands; Industry; Blue-collar. Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. (I) is the specification without interaction terms; (II) is the specification with the interaction terms between sectors dummies and Covid-19 dummy.
Source: Authors' elaborations on 2019Q1-2020Q2 Istat data

Table 5. Estimates of the effects of Covid-19 on the wage distribution of Italian workers: Male sub-sample

	(I)			**(II)**		
	Quantile					
	10th	**Median**	**90th**	**10th**	**Median**	**90th**
Covid-19	-0.087***	-0.026***	-0.019***	-0.120***	-0.034***	-0.027***
	(0.006)	(0.003)	(0.004)	(0.009)	(0.003)	(0.010)
WFH	0.071***	0.041***	0.055***	0.042***	0.037***	0.058***
	(0.008)	(0.006)	(0.010)	(0.005)	(0.006)	(0.010)
Age 25-34	0.142***	0.081***	0.050***	0.142***	0.081***	0.050***
	(0.011)	(0.005)	(0.008)	(0.009)	(0.004)	(0.007)
Age 35-44	0.225***	0.156***	0.130***	0.227***	0.155***	0.131***
	(0.011)	(0.005)	(0.008)	(0.009)	(0.003)	(0.008)
Age 45-54	0.254***	0.191***	0.162***	0.257***	0.190***	0.163***
	(0.010)	(0.005)	(0.008)	(0.008)	(0.003)	(0.008)
Age 55-64	0.261***	0.191***	0.178***	0.262***	0.190***	0.180***
	(0.011)	(0.005)	(0.008)	(0.009)	(0.003)	(0.007)
Italian citizenship	0.062***	0.051***	0.053***	0.063***	0.051***	0.052***
	(0.005)	(0.003)	(0.005)	(0.006)	(0.002)	(0.005)
Lower secondary school	0.074***	0.050***	0.034***	0.077***	0.052***	0.034***
	(0.010)	(0.004)	(0.009)	(0.011)	(0.006)	(0.009)
Upper secondary school	0.109***	0.080***	0.061***	0.113***	0.082***	0.061***
	(0.009)	(0.004)	(0.009)	(0.012)	(0.006)	(0.008)
Graduate	0.160***	0.146***	0.143***	0.164***	0.147***	0.143***
	(0.010)	(0.005)	(0.011)	(0.012)	(0.006)	(0.010)
North-West	0.128***	0.091***	0.087***	0.127***	0.090***	0.087***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.005)
North-East	0.141***	0.109***	0.107***	0.138***	0.108***	0.107***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)
Center	0.084***	0.040***	0.026***	0.081***	0.040***	0.027***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)
Managerial Occupations	0.331***	0.420***	0.666***	0.333***	0.420***	0.666***
	(0.007)	(0.004)	(0.008)	(0.005)	(0.004)	(0.006)
White-collar	0.118***	0.123***	0.157***	0.119***	0.123***	0.157***
	(0.005)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
Fixed-term contract	-0.226***	-0.105***	-0.053***	-0.226***	-0.106***	-0.053***
	(0.010)	(0.003)	(0.005)	(0.006)	(0.002)	(0.005)
Agriculture	-0.217***	-0.146***	-0.132***	-0.224***	-0.150***	-0.140***
	(0.017)	(0.005)	(0.008)	(0.016)	(0.005)	(0.007)
Construction	-0.032***	-0.019***	0.004	-0.029***	-0.017***	0.004
	(0.005)	(0.003)	(0.006)	(0.005)	(0.003)	(0.005)

Retail	-0.110***	-0.078***	-0.063***	-0.109***	-0.080***	-0.065***
	(0.006)	(0.003)	(0.004)	(0.006)	(0.003)	(0.004)
Restaurant	-0.221***	-0.094***	-0.013	-0.194***	-0.082***	-0.009
	(0.010)	(0.005)	(0.008)	(0.010)	(0.005)	(0.010)
Transportation	-0.033***	0.014***	0.080***	-0.037***	0.011***	0.078***
	(0.006)	(0.003)	(0.004)	(0.005)	(0.003)	(0.005)
Communication	-0.038***	-0.026***	-0.036***	-0.048***	-0.027***	-0.033***
	(0.007)	(0.005)	(0.006)	(0.008)	(0.005)	(0.008)
Finance and Insurance	0.048***	0.059***	0.022***	0.041***	0.056***	0.021***
	(0.011)	(0.005)	(0.005)	(0.010)	(0.004)	(0.005)
Real estate	-0.163***	-0.108***	-0.066***	-0.173***	-0.112***	-0.065***
	(0.008)	(0.004)	(0.006)	(0.007)	(0.003)	(0.006)
Public administration	-0.046***	-0.050***	-0.076***	-0.058***	-0.054***	-0.078***
	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.006)
Education	-0.113***	-0.105***	-0.099***	-0.123***	-0.110***	-0.104***
	(0.006)	(0.002)	(0.008)	(0.007)	(0.003)	(0.007)
Other services	-0.319***	-0.152***	-0.074***	-0.331***	-0.156***	-0.076***
	(0.012)	(0.005)	(0.008)	(0.009)	(0.006)	(0.009)
Covid-19*Agriculture				0.086*	0.033**	0.052*
				(0.049)	(0.014)	(0.027)
Covid-19*Construction				-0.014	0.013*	0.018*
				(0.029)	(0.007)	(0.010)
Covid-19*Retail				-0.249***	-0.075***	-0.042
				(0.066)	(0.013)	(0.032)
Covid-19*Restaurant				-0.089**	-0.018	-0.008
				(0.037)	(0.012)	(0.018)
Covid-19*Transportation				0.055***	0.019**	0.019
				(0.015)	(0.008)	(0.016)
Covid-19*Communication				0.072***	0.009	-0.011
				(0.015)	(0.013)	(0.017)
Covid-19*Finance and Insurance				0.099***	0.023*	0.007
				(0.034)	(0.012)	(0.017)
Covid-19*Real estate				0.092***	0.031***	0.001
				(0.024)	(0.012)	(0.017)
Covid-19*Public administration				0.115***	0.028***	0.016
				(0.010)	(0.011)	(0.013)
Covid-19*Education				0.102***	0.024***	0.031*
				(0.018)	(0.006)	(0.019)
Covid-19*Other services				0.090***	0.022	0.011
				(0.030)	(0.019)	(0.029)
Constant	6.593***	6.944***	7.224***	6.594***	6.946***	7.226***
	(0.012)	(0.006)	(0.014)	(0.011)	(0.007)	(0.010)
N. observations	115.031					

Note: reference category: 15-24 years old; no education; South and Islands; Industry; Blue-collar. Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. (I) is the specification without interaction terms; (II) is the specification with the interaction terms between sectors dummies and Covid-19 dummy.

Source: Authors' elaborations on 2019Q1-2020Q2 Istat data

Finally, as robustness checks, we run the same specifications reported in tables 2, 4, and 5 (table 6 panel A, B, and C, respectively) but replacing actual WFH with the WFH capacity index to test potential

long-lasting effects of the possibility of remote working. As shown in table 6, the findings underscore that, irrespective of the working sample, on average this index underestimates the positive advantage of WFH for the 10th quantile of the distribution because during the emergency this category of workers was the one that most took advantage of teleworking. On the other hand, with reference to the female sub-sample (panel B), it is notable that in the long run women may benefit more from the opportunity to work from home, as the wage premium for those belonging to the median and 90th quantile is almost double with respect to that observed for the actual WFH (see table 4). This result seems to confirm that in Italy, most of the additional housework and childcare associated with the health emergency situation has fallen on women (Del Boca *et al.* 2020). All in all, the evidence suggests that when the Covid-19 emergency has passed, the WFH attitude can provide – especially for women – a solution to reconcile family and working life without being penalized.

Table 6. Robustness check of the effects of Covid-19 on the wage distribution of Italian workers using WFH capacity index

	(I)			**(II)**		
	Quantile					
	10th	**Median**	**90th**	**10th**	**Median**	**90th**
			Panel A - All			
WFH capacity index	0.042***	0.044***	0.048***	0.041***	0.044***	0.048***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
			Panel B - Females			
WFH capacity index	0.048***	0.055***	0.062***	0.045***	0.055***	0.062***
	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
			Panel C – Males			
WFH capacity index	0.042***	0.039***	0.043***	0.041***	0.039***	0.043***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.004)

Note: bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' elaborations on 2019Q1-2020Q2 Istat ICP data

6. Conclusions

The actual distributive effects of the pandemic have as-of-yet been poorly examined, mainly because of the lack of timely and reliable data. In this paper, we investigated the effects of the Covid-19 pandemic on the whole labor income distribution in Italy by using a unique dataset obtained by merging real data from the official LFS and from the Italian Survey of Professions. WFH has become the key variable for dealing with the coronavirus without interrupting economic activities: recent estimates for the US show that the share of people working from home has quadrupled to 50% of that country's workforce (Brynjolfsson *et al.* 2020). In addition, due to uncertainty about the duration of the pandemic and the progression of production and distribution of vaccines, it has been shown that WFH might become an ordinary rather than unconventional way of working (Bonacini *et al.* 2021a). We thus estimated the effects of both the actual level of WFH in the emergency and the potential capacity to work remotely once the health emergency is over across the labor income distribution.

Our results show that the negative distributional consequences of the Covid-19 pandemic are more pronounced at the lowest quantiles of the labor income distribution. Looking at the sectoral composition, workers in the retail and restaurant sectors face the highest wage penalty. However, the possibility of WFH mitigates the negative effect observed (in general) for those at the bottom of the wage distribution. Indeed, on average workers that benefit from WFH receive a wage premium, and this is especially true for those at the bottom of the distribution. Notably, this relative advantage is confirmed by disentangling the effect of actual WFH before and during the pandemic. Our findings suggest that while the benefit associated with WFH disappears for median and top earners, it persists after the pandemic for workers in the bottom tail of the distribution. When we estimate our models separately by gender, we see that the consequences of Covid-19 were negative over the whole wage distribution for workers employed in the industry sector, regardless of sex, while those in retail were only penalized at the 10th and median quantiles. Conversely, penalization is observed only for male workers in the lowest tail of the distribution in the restaurant sector. Notably, when we consider the WFH capacity index to test the potential long-lasting effects of the possibility of working remotely, we note that the index underestimates the positive advantage of WFH for workers at the bottom of the wage distribution. The advantage for workers at the lowest quantiles, therefore, seems to reduce in the long term, likely because they were in the group that immediately and most benefited from WFH during the emergency. Interestingly, we see that women may benefit more from WFH opportunities in the long run, as this might be a way to reconcile family and working duties.

In conclusion, our findings suggest that the current crisis risks exacerbating some of the pre-existing inequalities in the labor market, especially if effective regulation is not put in place. In this respect, during a health emergency ex-post policy aimed at reducing inequality in the short run, such as short-time work schemes, appear crucial (Giupponi and Landais 2018, 2020).

The current crisis has pushed many companies towards the extensive use of WFH and to think about a 'new normal' way of working. For instance, facebook and some other companies in the information technology sector have already established that they will allow many employees to WFH permanently[10]. Thus, long-term policies able to solve potential knowledge gaps are necessary. First, childcare facilities and financial support to households with children are crucial to reconcile family and work for mothers (Del Boca and Vuri 2007) and to enable the adoption of remote working, especially for women with young children (Pouliakas 2020). Second, education policies aimed at increasing school enrolment rates are decisive in reducing the unequal distribution of benefits related to an increase in remote working opportunities, by increasing human capital and facilitating its complementarities with technological change (Acemoglu 1997; Scicchitano 2010).

A massive contribution to finance policies in support of the groups most affected by the crisis and to improve the labor market may come from the Next Generation European Union funds. Italy, which pushed hard for more EU support at the height of the crisis, is set to receive the largest share: 209 billion euros, or 28 percent of the entire rescue fund. The Italian Recovery and Resilience Plan (RRP) that is currently under construction translates this opportunity into action. It mobilizes over 300 billion

[10] More specifically, Mr. Zuckerberg declared "*It's clear that Covid has changed a lot about our lives, and that certainly includes the way that most of us work. Coming out of this period, I expect that remote work is going to be a growing trend as well.*" (see: https://nyti.ms/3u1F9hE).

euros by adding the funds allocated in the 2021-2026 budget planning to the financial resources coming from the Next Generation EU program. The RRP defines “actions and interventions to overcome the economic and social impact of the pandemic, acting on the country’s structural nodes”, and our paper provides fresh evidence from real-time data to help inform policymakers build relevant evidence-based policies.

Appendix

Appendix A

Table A1. ICP index related questions

Code	Title	Sub-title
		Remote Work
H.3	Using Telephone	How often do you have telephone conversations in this job?
H.4	Using mail	How often do you use electronic mail in this job?
H.5	Using letters and memos	How often does the job require written letters and memos?

Table A2. Occupations with the highest and the lowest ratings of WFH index

Code	Description	WFH score
	Top Five	
11210	Ambassadors, plenipotentiary ministers and other leaders of the diplomatic career	99
11231	Directors of territorial and equivalent school offices	99
11242	Rectors of universities, directors of higher education institutions and research institutes	99
12390	Other directors and department managers	99
22151	Chemical and petroleum engineers	99
	Bottom five	
72320	Drivers of machinery for the manufacture of other rubber articles	13
81410	Unqualified cleaning staff in accommodation services and ships	12
54870	Lifeguards and similar professions	9
74240	Drivers of animal-drawn vehicles	6
81420	Unqualified personnel in catering services	5

Appendix B

Table B1. First stage estimates

	Prob. Employment
Couple with child	0.003***
	(0.001)
Single father with child	-0.020***
	(0.003)
Single mother with child	-0.039***
	(0.002)
Female	-0.030***
	(0.001)
Age 25-34	0.069***
	(0.002)
Age 35-44	0.118***
	(0.002)
Age 45-54	0.144***
	(0.002)
Age 55-64	0.169***
	(0.002)
Italian citizenship	0.033***
	(0.002)
Lower secondary school	0.041***
	(0.003)
Upper secondary school	0.084***
	(0.003)
Graduate	0.119***
	(0.003)
North-West	0.083***
	(0.001)
North-East	0.098***
	(0.001)
Center	0.059***
	(0.001)
N. observations	311.654

Note: reference category: 15-24 years old; no education; South and Islands. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' elaborations on 2019Q1-2020Q2 Istat data

References

Acemoglu D. (1997), Training and innovation in an imperfect labor market, *Review of Economic Studies*, 64, n.3, pp.445-464

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

Alon T., Doepke M., Olmstead-Rumsey J., Tertilt M. (2020a), *This Time It's Different. The Role of Women's Employment in a Pandemic Recession*, CEPR Discussion Paper n.15149, London, CEPR

Alon T., Doepke M., Olmstead-Rumsey J., Tertilt M. (2020b), *The impact of COVID-19 on gender equality*, NBER Working Paper n.26947, Cambridge MA, NBER <https://bit.ly/33Ne1Zn>

Baert S., Lippens L., Moens E., Sterkens P., Weytjens J. (2020), *The COVID-19 crisis and telework. A research survey on experiences, expectations and hopes*, GLO Discussion Paper n.532, Essen, Global Labor Organization

Ascani A., Faggian A., Montresor S. (2021), The geography of COVID-19 and the structure of local economies. The case of Italy, *Journal of Regional Science*, 61, n.2, pp.407-441

Aspachs O., Durante R., García Montalvo J., Graziano A., Mestres J., Reynal-Querol M. (2020), *Real-Time Inequality and the Welfare State in Motion. Evidence from COVID-19 in Spain*, CEPR Discussion Paper n.15118, London, CEPR

Baker M.G. (2020), Nonrelocatable Occupations at Increased Risk During Pandemics. United States 2018, *American Journal of Public Health*, 110, n.8, pp.1126-1132

Barbieri T., Basso G., Scicchitano S. (2020), *Italian workers at risk during the Covid-19 epidemic*, Questioni di economia e finanza n.569, Roma, Banca d'Italia <https://bit.ly/3oq40uk>

Baussola M. (1988), Labour Mobility in Italy. An Empirical Investigation, *Labour*, 2, n.3, pp.113-142

Benzeval M., Burton J., Crossley T., Fisher P., Jäckle A., Low H., Read B. (2020), *The Idiosyncratic Impact of an Aggregate Shock. The Distributional Consequences of COVID-19*, IFS Working Paper n.15, London, Institute for Fiscal Studies

Berman J. (2020), *The Distributional Short-Term Impact of the COVID-19 Crisis on Wages in the United States*, MPRA Paper n.100466, Munich, University Library LMU

Bertola G., Garibaldi P. (2003), *The Structure and History of Italian Unemployment*, CESifo Working Paper n.907, Munich, CESifo <https://bit.ly/2T2I7Gd>

Biagetti M., Giangreco A., Leonida L., Scicchitano S. (2020), *BrExit or BritaIn. Is the UK more Attractive to Supervisors? An Analysis of Wage Premium to Supervision across the EU*, GLO Discussion Paper n.510, Essen, Global Labor Organization

Biagetti M., Scicchitano S. (2014), Estimating the Gender Pay Gap in the Managerial and non Managerial Italian Labor Market, *Economics Bulletin,* 34, n.3, pp.1846-1856

Biagetti M., Scicchitano S. (2011), A note on the gender wage gap among managerial positions using a counterfactual decomposition approach. Sticky floor or glass ceiling?, *Applied Economics Letters*, 18, n.10, pp.939-943

Boeri T., Caiumi A., Paccagnella M. (2020), Mitigating the work-safety trade-off, *Covid Economics. Vetted and real-time papers*, n.2, 8 April, pp.60-66 <https://bit.ly/2Qqua3E>

Bonacini L., Gallo G., Scicchitano S. (2021a), Working from home and income inequality. Risks of a 'new normal' with COVID-19, *Journal of Population Economics*, 34, n.1, pp.303-360

Bonacini L., Gallo G., Scicchitano S. (2021b), Will it be a shecession? *The unintended influence of working from home on the gender wage gap related to the COVID-19 pandemic*, GLO Discussion Paper n.771, Essen, Global Labor Organization

Bonacini L., Gallo G., Patriarca F. (2021c), Identifying policy challenges of COVID-19 in hardly reliable data and judging the success of lockdown measures, *Journal of Population Economics,* 34, n.1, pp.275-301

Botha F., de New J.P., de New S.C. (2021), Implications of COVID-19 labour market shocks for inequality in financial wellbeing, *Journal of Population Economics,* 34, n.1, pp.655-689

Brodeur A., Gray D., Islam A., Bhuiyan S.J. (2020a), *A Literature Review of the Economics of COVID-19*, GLO Discussion Paper n.601, Essen, Global Labor Organization

Brodeur A., Grigoryeva I., Kattan L. (2020b), *Stay-at-Home Orders, Social Distancing and Trust*, GLO Discussion Paper n.553, Essen, Global Labor Organization

Brunetti I., Cirillo V., Ferri V. (2018), Differenziali salariali fra occupati laureate con contratto a tempo determinato e indeterminato. Una misura dell'effetto contratto, *Sinappsi*, VIII, n.3, pp.35-49

Brunetti I., Corsini L., Martelli I. (2021), *Covid-19 and women's attitude to work. Commitment, effectivity and participation*, Inapp Working Paper n.57, Roma, Inapp

Brynjolfsson E., Horton J., Ozimek A., Rock D., Sharma G., Yi Tu Ye H. (2020), *Covid-19 and remote work. An early look at U.S. data*, NBER Working Paper n.27344, Cambridge MA, NBER <https://bit.ly/3bx8U3O>

Buchinsky M. (1998), The dynamics of changes in the female wage distribution in the USA. A quantile regression approach, *Journal of Applied Econometrics*, 13, n.1, pp.1-30

Capano G. (2020), Policy design and state capacity in the COVID-19 emergency in Italy. If you are not prepared for the (un)expected, you can be only what you already are, *Policy and Society*, 39, n.3, pp.326-344

Carbonero F., Scicchitano S. (2021), *Labour and technology at the time of Covid-19. Can artificial intelligence mitigate the need for proximity?*, GLO Discussion Paper n.765, Essen, Global Labor Organization

Carta F., De Philippis M. (2021), *The impact of the COVID-19 shock on labour income inequality. Evidence from Italy*, Questioni di economia e finanza n.606, Roma, Banca d'Italia <https://bit.ly/3uZDgTY>

Casarico A., Lattanzio S. (2020), The heterogeneous effects of COVID-19 on labor market flows. Evidence from administrative data, *Covid Economics. Vetted and real-time papers*, n.52, 15 October, pp.152-174 <https://bit.ly/33QrHm7>

Caselli M., Fracasso A., Scicchitano S. (2020), *From the lockdown to the new normal. An analysis of the limitations to individual mobility in Italy following the Covid-19 crisis*, GLO Discussion Paper n.683, Essen, Global Labor Organization

Cetrulo A., Guarascio D., Virgillito M.E. (2020), The privilege of working from home at the time of social distancing, *Intereconomics*, 55, n.3, pp.142-147

Clark A., D'Ambrosio C., Lepinteur A. (2020), *The Fall in Income Inequality during COVID-19 in Five European Countries*, ECINEQ Working Paper n.565, Roma, ECINEQ - Society for the Study of Economic Inequality <https://bit.ly/2RqF9ux>

Cortes G.M., Forsythe E. (2020), *Impacts of the COVID-19 Pandemic and the CARES Act on Earnings and Inequality*, IZA Discussion Paper n.13643, Bonn, IZA <https://bit.ly/3fv3reX>

Cuesta J., Pico J. (2020), The Gendered Poverty Effects of the COVID-19 Pandemic in Colombia, *The European Journal of Development Research*, 32, n.5, pp.1558-1591

Deaton A. (2021), *COVID-19 and Global Income Inequality*, NBER Working Paper n.28392, Cambridge MA, NBER <https://bit.ly/3osDzEk>

Delaporte I., Pena W. (2020), *Working From Home Under COVID-19. Who Is Affected? Evidence From Latin American and Caribbean Countries*, GLO Discussion Paper n.528, Essen, Global Labor Organization

Del Boca D., Oggero N., Profeta P., Rossi M. (2020), Women's and men's work, housework and childcare, before and during COVID-19, *Review of Economics of the Household*, 18, pp.1001-1017 <https://bit.ly/3hvRQ1T>

Del Boca D., Vuri D. (2007), The Mismatch between Employment and Child Care in Italy. The Impact of Rationing, *Journal of Population Economics*, 20, n.4, pp.805-832

Depalo D. (2021), True COVID-19 mortality rates from administrative data, *Journal of Population Economics*, 34, n.1, pp.253-274

Dingel J.I., Neiman B. (2020), How many jobs can be done at home?, *Journal of Public Economics*, 189, special issue, article 104235

Duman A. (2020), *Wage Losses and Inequality in Developing Countries. Labor market and distributional consequences of Covid-19 lockdowns in Turkey*, GLO Discussion Paper n.602, Essen, Global Labor Organization

Eurofound, ILO (2017), *Working anytime, anywhere. The effects on the world of work*, Luxembourg, Publications Office of the European Union, and Geneva, International Labour Office <https://bit.ly/2QqFRr4>

Galasso V. (2020), Covid. Not a great equalizer, *CESifo Economic Studies*, 66, n.4, pp.376-393

Gallo G., Raitano M. (2020), *SOS incomes. Simulated effects of COVID-19 and emergency benefits on individual and household income distribution in Italy*, ECINEQ Working Paper n.566, Roma, ECINEQ - Society for the Study of Economic Inequality <https://bit.ly/3hMYIbp>

Giupponi G., Landais C. (2020), Building effective short-time work schemes for the COVID-19 crisis, *VoxEu.org*, 1 April <https://bit.ly/3ouAa8m>

Giupponi G., Landais C. (2018), *Subsidizing labor hoarding in recessions. The employment and welfare effects of short-time work*, CEPR Discussion Paper n.13310, London, CEPR

Gottlieb C., Grobovsek J., Poschke M. (2020), *Working from home across countries*, CIREQ Cahiers de recherche n.7, Montréal, CIREQ

Hacıoğlu-Hoke S., Känzig D.R., Surico P. (2021), The distributional impact of the pandemic, *European Economic Review*, 134, article 103680

Heckman J. (1979), Sample selection bias as specification error, *Econometrica*, 47, n.1, pp.153-162

Hensvik L., Le Barbanchon T., Rathelot R. (2020), *Which Jobs Are Done from Home? Evidence from the American Time Use Survey*, IZA Discussion Paper n.13138, Bonn, IZA <https://bit.ly/3ymZJfO>

Holgersen H., Jia Z., Svenkerud S. (2021), Who and how many can work from home in Norway? Evidence from task descriptions, *Journal for Labour Market Research,* 55, n.4, pp.1-13 <https://bit.ly/3weB4bt>

Karabulut G., Zimmermann K.F., Bilgin M.H., Doker A.C. (2021), Democracy and COVID-19 Outcomes, *Economics Letters*, 203, article 109840

Koenker R. (2005), *Quantile Regression*, Cambridge, Cambridge University Press

Koenker R., Bassett G. (1978), Regression quantiles, *Econometrica,* 46, n.1, pp.33-50

Kosteas V.D., Renna F. (2020), *COVID-19, Job Characteristics, and Inequality in Employment Outcomes*, Mimeo online printing

Lemieux T., Milligan K., Schirle T., Skuterud M. (2020), Initial Impacts of the COVID-19 Pandemic on the Canadian Labour Market, *Canadian Public Policy*, 46, n.S1, pp.S55-S65

Martins P.S., Pereira P.T. (2004), Does education reduce wage inequality? Quantile regression evidence from 16 countries, *Labour Economics,* 11, n.3, pp.355-371

Milani F. (2021), COVID-19 outbreak, social response, and early economic effects. A global VAR analysis of cross-country interdependencies, *Journal of Population Economics*, 34, n.1, pp.223-252

Mincer J.A. (1974), *Schooling, Experience, and Earnings*, Cambridge MA, National Bureau of Economic Research

Mongey S., Pilossoph L., Weinberg A. (2021), *Which Workers Bear the Burden of Social Distancing Policies?*, NBER Working Paper n.27085, Cambridge MA, NBER <https://bit.ly/2SVCHfT>

Montenovo L., Jiang X., Rojas F.L., Schmutte I.M., Simon K.I., Weinberg B.A., Wing C. (2020), *Determinants of Disparities in Covid-19 Job Losses*, NBER Working Paper n.27132, Cambridge MA, NBER <https://bit.ly/3hC4bl4>

Mussida C., Lucarelli C. (2014), Dynamics and Performance of the Italian Labour Market, *Economia Politica*, 31, n.1, pp.33-54

Mussida C., Picchio M. (2014a), The trend over time of the gender wage gap in Italy, *Empirical Economics*, 46, n.3, pp.1081-1110

Mussida C., Picchio M. (2014b), The gender wage gap by education in Italy, *Journal of Economic Inequality*, 12, n.1, pp.117-147

Palomino J.C., Rodriguez J.G., Sebastian R. (2020), Wage inequality and poverty effects of lockdown and social distancing in Europe, *European Economic Review*, 129, article 103564

Papageorge N.W., Zahn M.V., Belot M. (2021), Socio-demographic factors associated with self-protecting behavior during the Covid-19 pandemic, *Journal of Population Economics*, 34, n.2, pp.691-738

Piazzalunga D., Di Tommaso M.L. (2019), The increase of the gender wage gap in Italy during the 2008-2012 economic crisis, *Journal of Economic Inequality*, 17, n.2, pp.171-193

Picchio M., Mussida C. (2011), Gender wage gap. A semi-parametric approach with sample selection correction, *Labour Economics*, 18, n.5, pp.564-578

Pouliakas K. (2020), *Working at Home in Greece. Unexplored Potential at Times of Social Distancing?*, IZA Working Paper n.13408, Bonn, IZA <https://bit.ly/3fqWUC2>

Qiu Y., Chen X., Shi W. (2020), Impacts of social and economic factors on the transmission of coronavirus disease 2019 (COVID-19) in China, *Journal of Population Economics*, 33, pp.1127-1172 <https://bit.ly/3wdc44s>

Schindler M. (2009), *The Italian Labor Market. Recent Trends, Institutions and Reform Options*, IMF Working Paper n.47, Washington, International Monetary Fund

Scicchitano S. (2010), Complementarity between heterogeneous human capital and R&D. Can job-training avoid low development traps?, *Empirica*, 37, n.4, pp.361-380

Strøm S., Piazzalunga D., Venturini A., Villosio C. (2018), Wage assimilation of immigrants and internal migrants. The role of linguistic distance, *Regional Studies*, 52, n.10, pp.1423-1434

Trivellato U., Bassi F., Discenza A.R., Giraldo A. (2005), Transizioni e mobilità nel mercato del lavoro italiano. 1979-2003, in Contini B., Trivellato U. (a cura di), *Eppur si Muove. Dinamiche e persistenze nel mercato del lavoro italiano*, Bologna, il Mulino, pp.143-203

Yasenov V. (2020), *Who can work from home?*, IZA Discussion Paper n.13197, Bonn, IZA <https://bit.ly/3v0RK67>

Wildman J. (2021), COVID-19 and income inequality in OECD countries, *European Journal of Health Economics*, 22, n.3, pp.455-462

Witteveen D. (2020), Sociodemographic inequality in exposure to covid-19-induced economic hardship in the United Kingdom, *Research in Social Stratification and Mobility*, 69, special issue, article 100551

Zimmermann K.F., Karabulut G., Bilgin M.H., Doker A.C. (2020), Inter-country distancing, globalization and the coronavirus pandemic, *The World Economy*, 43, n.6, pp.1484-1498

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