The heterogeneous effects of COVID-19 on labor market flows: evidence from administrative data

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Abstract

We investigate the short-term effects of COVID-19 on labor market flows and how they are mediated by labor market policy. Using Italian administrative data on a sample of active contracts between 2009 and the second quarter of 2020, we show that, before the pandemic, a higher share of female compared to male, young compared to old and low educated compared to high educated workers is employed in non-essential activities. When we look at the change in hirings and separations, from the 9th week of 2020 - the time when first cases and deaths due to COVID-19 were recorded -, we find a pronounced drop in hirings and endings of fixed-term contracts. Layoffs and quits increase after the 9th week, and then decline significantly, reflecting the effects of government intervention. The lifting of the lockdown triggers a slow recovery of labor market flows. Young workers, those on temporary contracts, low-educated workers, those employed in the South and those with no opportunities of working from home experience a greater decline in separation probability, indicating that government policy partly protected them from the labor market impact of the recession. The decline in the separation probability for women is lower than that for men.

Keywords COVID-19 · Hirings · Separations · Flows · Gender

1 Introduction

The COVID-19 pandemic is having dramatic consequences on society. In order to contain the spread of the virus, many governments around the world adopted unprecedented interventions that in most cases resulted in lockdowns of entire regions or countries. The

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suspension of economic activities had severe repercussions on employment and earnings of individuals and on profits of firms. As a consequence, global GDP growth in 2020 was −3.2 percent (IMF 2021), with considerable heterogeneity between advanced (−4.6 percent) and emerging economies (−2.1 percent). Governments responded to the economic downturn with encompassing packages of fiscal measures, ranging from transfers, loans, postponements of tax dues, to facilitating liquidity and access to credit for firms. Preventing or reducing the disruption of the labor market was among the main goals of government intervention, and the specific instruments adopted varied across countries, also in light of pre-existing labor market institutions. The implemented policy measures and pre-existing labor market conditions and institutions mediate the impact of the pandemic on jobs. For example, Adams-Prassl et al. (2020) compare the United Kingdom, the United States and Germany and show that the job losses were higher in the first two countries, which are characterized by more flexible labor markets.

Using administrative data on a large sample of contracts active in the first and second quarters of 2020, this paper investigates the short term effects of COVID-19 on labor market flows and studies how they were mediated by policy put in place by the government to shield workers from the disruption of economic activity. Italy was the first country in Europe to be hit by COVID-19 and the first to implement a national lockdown, which involved the definition of essential and non-essential economic activities, the former to be continued, the latter to be shut down. The lockdown was shortly after followed by two further policy measures relevant for labor market dynamics: a ban on layoffs and an ease of requirements to access short-time work (STW) compensation schemes. While the former is unique to Italy for its breadth, the latter is common to most European countries (see OECD 2020, for details on government policy responses across OECD countries).

First, we provide descriptive evidence on the individual and job characteristics of workers employed as of January 2020, distinguishing across essential and non-essential activities. The latter were mainly concentrated in services, such as restaurants, bars, hotels, and some categories of wholesale and retail shops, in line with government decisions in other countries. We show that a higher share of female compared to male, young compared to old and low educated compared to high educated workers is employed in non-essential activities.

Second, we analyze the change in net hirings, computed as hirings net of separations, and in hirings, layoffs, endings of fixed-term contracts and quits – all as separate flows –, in each week of the first two quarters of 2020 relative to the average in the same weeks of 2017-19. For each labor market flow, we provide graphical evidence of the cumulative weekly change for all workers and for different subgroups based on age, gender, macro area of work, type of contract (open-ended, apprenticeship or fixed-term/temporary), education level, and sector (essential vs non-essential activities). The descriptive evidence shows that, before the pandemic, the trend in cumulative labor market flows was in line with the average in the previous three years. When COVID-19 spread quickly around the country, starting from the 9th week of the year (i.e., from 26 February), there was a pronounced drop in net hirings, which halted only after the lockdown was lifted. We observe a similar pattern for hirings until week 13, after which they continued to decline at a faster rate, until their fall slowed down after the end of the lockdown. As to separations, we find that endings of fixed-term contracts declined except for a sudden increase at the end of the 13th week of the year, which corresponds to the end of March, when many contracts were not renewed given the weaker labor market conditions. Layoffs and quits increased right after the 9th week, and then dropped significantly. The evolution of layoffs reflects the policy introduced on 17 March, that explicitly forbids firms from laying off workers and, at the same time, eases the requirements to have access to STW compensation schemes. Before the policy was enacted,

layoffs were rising with respect to the past. Note that the decline in separations may also be linked to the recession-induced decrease in job creation. Also the ban on layoffs may have contributed to the decline in job creation, as the higher employment protection for workers may have decreased turnover.

Third, we further explore separations by examining which factors are associated with the change in the probability of being separated from a job between 2018-2019 and 2019-2020. We do so both comparing the pre- and post-pandemic period and examining dynamic effects in each month. Workers on fixed-term relative to open-ended contracts, workers in the South relative to the North, low relative to high educated workers and those employed in occupations that cannot be performed at home compared to those that can, experience a higher drop in the separation probability after the pandemic compared to the period before it, showing that the policies implemented were able to protect these groups of vulnerable workers. We also find that female workers benefited less from the reduction in the separation probability compared to men. The result that women experienced a lower reduction in the separation probability is in line with Adams-Prassl et al. (2020), who show that women have a higher likelihood to separate from their jobs than men. Given the higher concentration of women in temporary contracts and part-time positions, coupled with the nation-wide school closures, one could expect a harsher impact of the crisis on women, as highlighted by Alon et al. (2020). However, Hupkau and Petrongolo (2020), using data from the COVID-19 supplement of Understanding Society, report that job losses of women and men were of comparable size in the UK.

Note that the effect of gender in the aggregate may even be stronger than the one we find, since we can only discuss the extensive margin of adjustment – whether a worker separates from her job or not. Clearly, the adjustment may happen also on the intensive margin, if women had to adjust their work hours in response to the pandemic. This is an important element we cannot directly address with the data at hand.

Our analysis contributes to the recent and growing literature on the effects of the pandemic recession on economic activity (e.g. Carvalho et al. 2020; Chetty et al. 2020; Baker et al. 2020) and, specifically, on the labor market and policy responses put in place by governments. Evidence using real-time survey data (Bick and Blandin 2020; Adams-Prassl et al. 2020; von Gaudecker et al. 2020; Galasso and Foucault 2020), administrative data (Cajner et al. 2020) and a combination of both (Forsythe et al. 2020) highlights the severe and unequal consequences of the pandemic recession on the labor market. A strand of this literature specifically focuses on how different categories of workers were affected by the pandemic (Blundell et al. 2020; Crossley et al. 2021; Bonacini et al. 2021; Cortes and Forsythe 2020), with particular focus on age (Belot et al. 2021) and gender (Alon et al. 2020; Hupkau and Petrongolo 2020; Farré et al. 2020).[1] We provide new evidence based on detailed administrative data on a sample of active, new and terminated contracts, coming from the *Comunicazioni Obbligatorie*, i.e. the compulsory information firms need to provide on their workforce. These data are highly reliable and less subject to measurement errors with respect to survey data. In addition, we can exploit a large sample size and a long time period to compare changes in labor market flows before and after the pandemic. Moreover, we can explore many dimensions of heterogeneity and provide an exhaustive picture of the unequal impact of COVID-19, distinguishing workers according to age, gender, education level, area of work, type of contract, sector and opportunity of remote work. We also assess the short run impact of a government policy that explicitly forbids layoffs and

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[1]See Stantcheva (2021) for a review of the literature on the impact of COVID-19 on different dimensions of inequality.

extends the generosity of STW compensation schemes. We show it was successful in taming layoffs – as expected –, but may also have reduced hirings. This lays the groundwork for a long term assessment of the impact of these policies on labor market dynamics. Finally, by showing how workers on different types of contracts and different degrees of employment protection are affected by the pandemic recession, we contribute to the literature that analyzes the margins of adjustment in the labor market in the presence of negative shocks (Izquierdo et al. 2017; Garin and Silvério 2019; Adamopoulou et al. 2020).

The remainder of the paper is organized as follows. Section 2 describes the data and gives details about the evolution of the pandemic in Italy and the policy response by the government. Section 3 shows the distribution of workers in essential and non-essential activities before the pandemic. Section 4 analyzes the changes in hirings and separations between 2020 and previous years, whereas Section 5 focuses on the analysis of the determinants of the separation probability. Section 6 concludes.

2 Data and Institutional Context

2.1 Data and Descriptive Statistics

We use data from a random sample of mandatory notifications (*Campione Integrato delle Comunicazioni Obbligatorie*, CICO) that firms submit to relevant public agencies in Italy and to the Ministry of Labor and Social Policy. The data collects information on a sample of contracts activated and terminated between 2009 and the second quarter of 2020 for public- and private-sector workers, farming and domestic workers.[2] For each contract, we have information on the exact start date and, if the contract ends, on the end date and the reason for its ending (mainly, layoffs, expiry of temporary contracts, voluntary quits).[3] Furthermore, we have information on the type of contract (open-ended, apprenticeship or temporary/fixed-term, full-time or part-time), detailed occupational and sectoral codes (4-digit CP 2011 and 6-digit Ateco 2007,[4] respectively) and individual characteristics of workers, such as gender, the year of birth, the region of domicile and work, and the education level. We keep only workers in the private sector in our analysis and we further exclude workers in agriculture and domestic workers, as information on these workers is less reliable. Table 1 reports descriptive statistics on the contracts – and on the individual characteristics of the workers holding them – and compares them with the population of workers from aggregate data provided by the Italian Social Security Administration (INPS) as of 2019, the last information available on the labor market before the pandemic started. Our data over-samples contracts held by workers in the age group 15-34 and under-samples contracts of workers on open-ended and full-time positions and contracts of workers in

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[2]The sampling strategy is based on the day of birth: workers born on the 1st, 9th, 10th and 11th day of each month and year in the full administrative records are included in the sample. CICO contains information on contracts that have been activated, transformed or ended starting from 2009. Hence, the data contains information on new contracts from 2009 and on contracts that have been established before 2009 but that were either terminated or transformed in subsequent years. Therefore, the data do not contain information on contracts that have been stipulated before 2009 and that have not been modified since then.

[3]We exclude from the sample contracts ending due to retirement (0.74% of all contracts) and death (0.17%), and contracts whose end date is modified (3.74%). We exclude the latter because there is no further information on whether the end date is anticipated or postponed and this does not allow us to assign them to any of the flows.

[4]CP 2011 and Ateco 2007 are the Italian counterparts of ISCO-08 and Nace Rev. 2.

Table 1 Descriptive statistics

	(1) CICO	(2) Inps
Female	0.39	0.38
Age 15-34	0.34	0.29
Age 35-54	0.53	0.55
Age 55+	0.14	0.17
North	0.56	0.58
Centre	0.22	0.21
South	0.22	0.21
Open-ended contract	0.65	0.83
Full-time contract	0.64	0.72
Manufacturing	0.22	0.29
Total contracts	1,561,611	–
Total workers	1,363,010	12,192,608

The table reports the share of contracts in each group from the sample of *Comunicazioni Obbligatorie* (CICO) as of January 2020 and the share of workers from official statistics provided by the Social Security Administration (INPS) at the end of 2019 in the non-agricultural, non-domestic, private sector. The last two rows of the table report the total number of contracts and workers (as a worker may hold multiple contracts) present in CICO and the total number of workers in INPS

manufacturing. The bottom part of the table, column (1), reports the sample size of CICO, distinguishing total contracts and total workers (as workers can hold multiple contracts) by the end of the sample period.[5] Column (2) reports the number of private sector workers from INPS (excluding agriculture and domestic workers). Overall, our sample represents approximately 11.2% of the population of workers in Italy.

The fact that contracts held by younger workers are over-represented, whereas more stable contractual arrangements – such as open-ended and full-time contracts – are under-represented comes as no surprise given the sample selection described above. The data over-samples contracts stipulated in the last decade, which capture the first contract of new workers, who are therefore more likely to be young and on temporary positions. However, although not fully representative of the population of workers at a given point in time, the data allows us to compare flows between different years (e.g., the change in hirings or separations over time) and to contrast the distribution of workers in the subgroups of essential and non-essential activities, as one can believe the sampling bias would be orthogonal with respect to the allocation of workers across essential and non-essential activities.[6]

2.2 COVID-19 in Italy and Public Policy

The first cases of COVID-19 in Italy date back to 31 January 2020, but the disease began to spread exponentially in the second half of February. At the beginning, the virus spread

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[5]The sample statistics reported in column (1) are computed using the contract as unit of observation, as this is the unit we consider for our analysis in Sections 3 and 4. If we use the worker as unit of analysis and keep only the primary contract per each worker, we get almost identical sample shares.

[6]In our sample, 50.7% of contracts are in non-essential activities as of January 2020. This figure is very close to the one reported in INPS (2020) on the universe of contracts in the private sector, which equals 50.1%.

predominantly in Northern regions and the first COVID-related death was registered in Veneto on 21 February. Following the diffusion of the virus in the North, two "red zones" were implemented, involving 11 municipalities in Lombardy and Veneto, that were effectively in lockdown. At the same time, many Northern regions opted to close schools, a measure that extended to the whole nation on 4 March. On 10 March the whole country went into lockdown. The decree establishing the nationwide lockdown also specified the activities that were deemed as essential and could continue to operate and those that were classified as non-essential and were forced to shut down. These activities were further specified with the decree of 22 March, which identified the sectoral codes that fell in either of the two groups (see Table A.1 in the Supplementary Material). Essential activities mainly include agriculture, some manufacturing, energy and water supply, transports and logistics, ICT, banking and insurance, professional and scientific activities, public administration, education, healthcare and some service activities. Non-essential activities, which coincide with shutdown sectors, include most of manufacturing activities, wholesale and retail trade, hotels, restaurants and bars, entertainment and sport activities. In light of these closures, the government adopted on 17 March a Decree Law that considerably increased worker's employment protection. Two main labor market policies were adopted:

(1)   A special COVID-related STW compensation scheme of the duration of 9 weeks that applied retroactively starting from 23 February. The STW compensation scheme is a subsidy, granted by the government, for partial or full-time hours reduction, which preserves employment relationships and replaces 80 percent of the earnings forgone due to hours reduction, up to a threshold.[7] The COVID-related STW scheme extended the coverage of the regular STW to firms with less than 15 employees, which are not covered normally, and to those already using the extra-ordinary STW, one of the sub-species of STW granted by the Italian employment protection legislation, which in normal times cannot be cumulated with the regular one. Moreover, firms using the COVID-related STW could renew temporary contracts, waiving to the norms of standard regulation. Thus, the COVID-related STW scheme allowed firms to cut labor costs during the lockdown period.

(2)   A ban on layoffs that forbade them for 60 days, starting from 17 March and that could be applied retroactively to pending layoffs (i.e. those that were yet to be validated) from 23 February.

Two later decrees extended the validity of these measures until the end of 2020. Thus, the COVID-related STW compensation scheme and the ban on layoffs were valid throughout the whole period we consider for our analysis.

3 Before the pandemic: the distribution of workers in essential and non-essential activities

Using data from CICO up to January 2020, we show the distribution of workers in essential and non-essential activities (i.e. in open and shutdown sectors, as defined by the Prime Minister's decree of 22 March based on sectoral codes) at the onset of the pandemic.

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[7]The threshold for the subsidy is equal to 971.71 Euro for workers earning monthly less than 2,102.24 Euro and 1,167.91 Euro workers earning monthly more than 2,102.24 Euro.
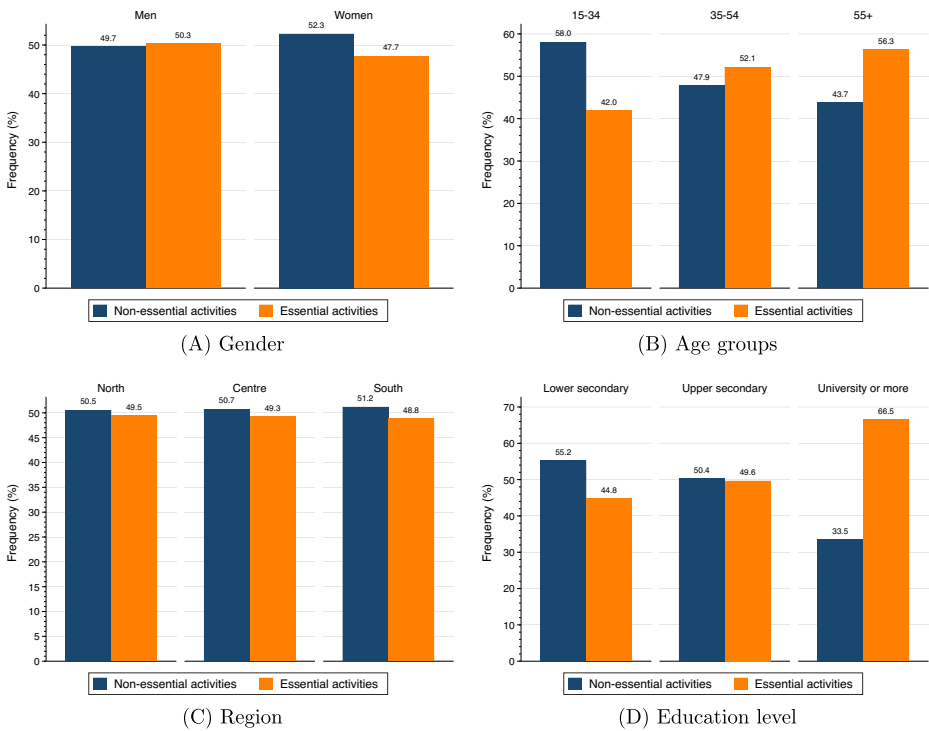
Fig. 1 Distribution of workers in essential and non-essential activities as of January 2020

Figure 1, panels A-D, shows the distribution of workers by gender, age, macro area of work and education level. Panel A shows that women are over-represented in non-essential activities (52.3%) relative to men (49.7%): this result is in line with the evidence provided, for example, by Blundell et al. (2020) for the UK.

Panel B shows the distribution by age, distinguishing workers in age groups 15-34, 35-54 and 55 or older. The figure shows that, while young workers are over-represented in non-essential activities, middle-aged and older workers are more present in essential activities. Hence, the closure of non-essential sectors has a stronger impact on young workers, 58% of whom are employed in shutdown sectors.

Panel C reports the distribution by macro area of work. Differences between the North, the Centre and the South are small and, if anything, a slightly higher share of workers in the South are employed in shutdown sectors, relative to the rest of the country. This may be surprising, given that tourism and connected services are some of the strengths of Southern Italy, where one could expect a stronger concentration of non-essential activities. This distribution may be correlated with the presence of the informal economy, which is higher in the South, as documented, for example, in Boeri et al. (2021), and particularly relevant for workers in accommodation, tourism and restaurants—sectors belonging to non-essential activities.

Panel D shows the distribution by education level. While 55.2% and 50.4% of workers with lower and upper secondary education are in shutdown sectors, only 33.5% of individuals with university degree work in non-essential activities, suggesting a disproportionate impact of the pandemic on workers with lower levels of education.[8]

This analysis takes a snapshot of the Italian labor market at the onset of the pandemic. We now turn to the inspection of the impact of the crisis on hirings and separations in the first two quarters of 2020.

4 After the pandemic: the impact of the recession on labor market flows

4.1 Measurement

In this section, we analyze the dynamics of net hirings (N), hirings[9] (H) and separations (S) in the first two quarters of 2020. Net hirings are computed as the difference between hirings and separations. We distinguish separations in layoffs (F), endings of fixed-term contracts (E) and quits (Q). We compute the cumulative weekly change in each flow between 2020 and the average of 2017-19, with respect to the total stock of workers (L_{pre}) in our sample, as of January 2020 – before the pandemic started. In other words, for each week t, we compute the per-capita cumulative change in total flows $Y_t = \{N_t, H_t, S_t, F_t, E_t, Q_t\}$ as:

$$\triangle Y_t = 100 \times \frac{Y_{t,2020} - \overline{Y}_{t,2017-19}}{L_{pre}}, \tag{1}$$

where $\triangle Y_t$ is the cumulative change in net hirings, hirings and separations up to week t, with $t = \{1, ..., 26\}$. $Y_{t,2020}$ are the cumulative flows in 2020 until week t. $\overline{Y}_{t,2017-19}$ are the average cumulative flows in 2017-2019 until week t. L_{pre} is the stock of workers in the sample at the onset of the pandemic, i.e. January 2020. Hence, we compute a change in each flow per 100 workers. We normalize the change to be 0 in week 8 of the year, that is, the week between 19 and 25 February – before the onset of the pandemic – and compare changes relative to that week.[10]

We also compute changes in flows for subgroup $g \in G$, with G including age, gender, macro area of work, type of contract (open-ended, fixed-term or apprenticeship), education level and group of activity (essential or non-essential). Specifically, for each week t, we compute the per-capita cumulative change in $Y_t^g = \{N_t^g, H_t^g, F_t^g, E_t^g, Q_t^g\}$ as:

$$\triangle Y_t^g = 100 \times \frac{Y_{t,2020}^g - \overline{Y}_{t,2017-19}^g}{L_{pre}^g},$$

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[8]To reassure about the representativeness of our sample, we compare it with data on the universe of workers in the private sector. In Table A.2 in the Supplementary Material, we report the share of workers in essential and non-essential activities according to relevant observable characteristics in our dataset (CICO) and in social security data (INPS), which covers the entire private sector workforce. The statistics from social security data are taken from INPS (2020), which explicitly distinguishes essential from non-essential activities. Overall, the shares are very similar, with the exception of the age group 15-30 and fixed-term contracts in non-essential activities, where differences in shares are more than 4 percentage points.

[9]Our definition of hirings is broad, since we use this term to indicate the activation of new contracts, which can be new hirings or transformations of fixed-term contracts into open-ended contracts.

[10]This choice is innocuous and results would almost be unchanged if we do not use this normalization.

where $\triangle Y_t^g$ is the cumulative change in flows for subgroup g. $Y_{t,2020}^g$ and $\overline{Y}_{t,2017-19}^g$ are, respectively, the cumulative flows in 2020 and 2017-19 for each g, and L_{pre}^g is the stock of workers in subgroup g in January 2020.

4.2 Total change

Figure 2 reports the cumulative change in net hirings, hirings, layoffs, endings of fixed-term contracts, quits and total separations for each week in the first two quarters of 2020 relative to the average of 2017-19 and for all workers, as from Eq. 1. Total separations are computed as an aggregate of layoffs, endings of fixed-term contracts and quits, while net hirings are the difference between the curves of hirings and total separations. The figure shows that net hirings were on a parallel trend before the onset of the pandemic, but after the 9th week (i.e. after the first cases and deaths were recorded),[11] there is a marked contraction, which is determined by a sharp decline in hirings and an increase in separations. Starting from week 12-13, separations begin to decline, too, as a consequence of the layoff ban, the COVID-related STW compensation scheme and the contraction in economic activity, which lowers job turnover. We observe that the decline is particularly marked for endings of fixed-term contracts. Until week 18 (i.e. the end of the strict lockdown) the slope of the decline in hirings is steeper than the decline in separations, therefore producing a continuing drop in net hirings. After week 18, when businesses began to return to a new normal, there is a change in the slope of net hirings as activations of new contracts started to recover, and separations continued to be below their levels in the past (as the ban on layoff and COVID-related STW were still in place). Overall, by the end of our observation period, we find a net change of -6 per 100 workers, determined by a change in hirings of -12.8 and in separations of -6.8, with respect to the average of 2017-19 and relative to week 8 of the year.[12] The large decline in job creation is a consequence of the pandemic recession and the subsequent lockdown of economic activities. It is possible that also the ban on layoffs had a negative effect on job creation, since it increased the firing cost virtually to infinity.[13] However, the graph shows that, when restrictions on mobility were lifted from week 18, net hirings started to return to their levels in the past, even in the presence of the layoff ban, mainly through a slowdown in the fall of cumulative hirings. Although this is only suggestive evidence, as it is impossible to clearly and separately identify the effect of the lockdown from that of the policy, it seems that the reduction in hirings associated with the layoff ban is smaller than that induced by the pandemic-related recession. Otherwise, we would not observe the change in the slope of hirings, once the non-pharmaceutical interventions are lifted.

4.3 Changes by subgroups

Net Hirings Figure 3, panels A-F, shows the cumulative change in net hirings per 100 workers with the same characteristics between 2020 and the average 2017-19. Panel A reports the changes for different age groups and shows that the impact of the pandemic recession was harsher for young workers (age group 15-34) relative to middle-aged (35-54) and old workers (over 55). At the end of the second quarter, we find 10 fewer net hires per 100

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[11]Note that week 9 is also the week since when the layoff ban has applied retroactively.

[12]Without the normalization in the 8th week, we have a net change of -5.6, determined by a change in hirings of -11.5 and a change in separations of -5.9 per 100 workers.

[13]Kugler and Pica (2008) study the impact of increasing firing costs on worker flows and show indeed that it has a negative effect on hirings and separations, with a zero net employment effect overall.
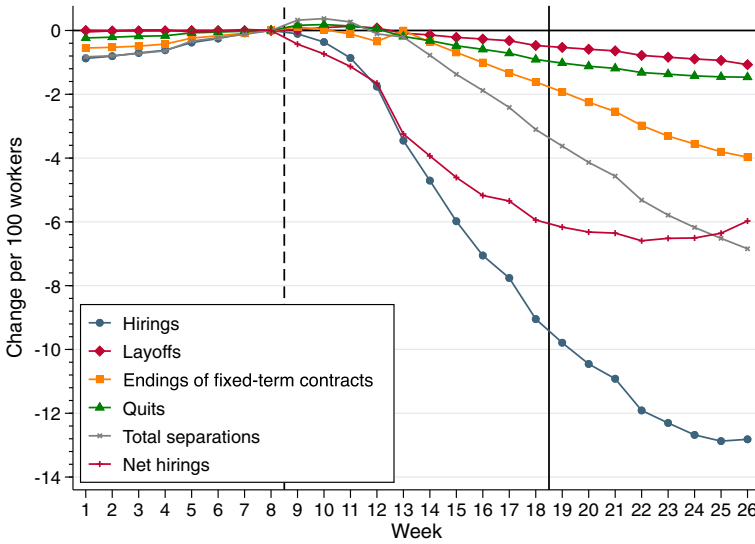
Fig. 2 Cumulative change in net hirings, hirings and separations

Notes. The figure shows the cumulative change in net hirings (activations of new contracts minus separations), hirings and separations up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed per 100 workers. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown
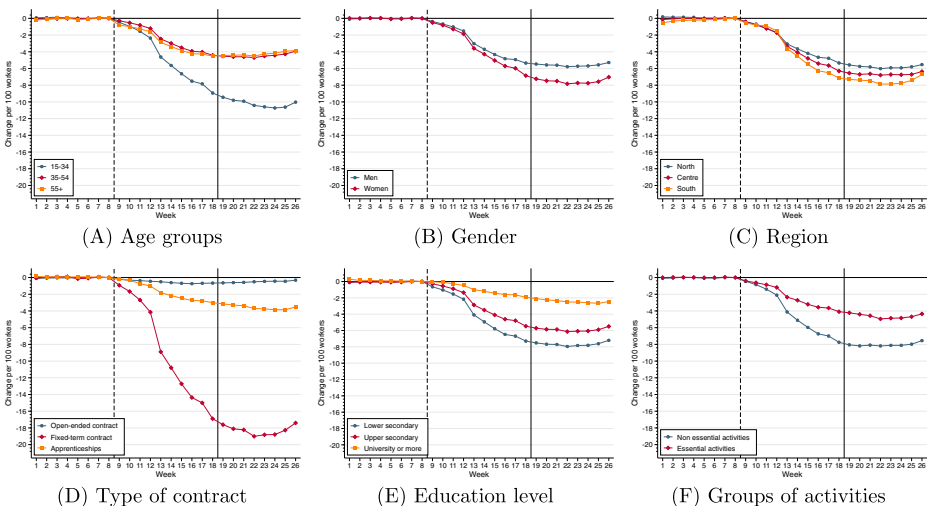

Fig. 3 Cumulative change in net hirings (hirings minus separations) between 2020 and average 2017-2019

Notes. The figure shows the cumulative change in net hirings (activations of new contracts minus separations) up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed for 100 workers in the same subgroup. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown

workers in the age group 15-34, relative to week 8, compared to 3.9 for both middle aged and old workers. Panel B reports results by gender and shows that the pandemic had a stronger impact on females. There were 7 fewer net hires for women compared to 5.3 for men per 100 workers. Panel C reports the cumulative changes by macro area, and shows that the impact was slightly larger for workers in the South and Centre (-6.7 and -6.4, respectively) than for workers in the North (-5.5): hence, although the health effects of the pandemic were more severe in the North during the first wave, the negative economic consequences were distributed across the whole country. Panel D shows the disproportionate impact of the pandemic on fixed-term contracts, with 17 fewer cumulative net hires per 100 workers, as opposed to an almost unchanged trend for open-ended contracts (-0.3) and a lower decline for apprenticeships (-3.5). Panel E reports the impact across different education groups, and shows that low educated workers are suffering more the negative consequences of the recession: workers with lower secondary and upper secondary education experience a change in net hirings of -7.2 and -5.5, respectively, relative to -2.5 for university graduates. Finally, panel F reports the change for essential and non-essential activities, i.e. for open and shutdown sectors, showing that the latter had a larger decrease in net hirings (-7.6) than the former (-4.3). The impact on non-essential activities is a consequence of business closures, as those sectors were not operating. The impact on essential activities reflects the general contraction in economic activity and demand.

Hirings Figure 4, panels A-F, shows the cumulative change in hirings in 2020 relative to 2017-19. The patterns are similar to those reported for net hirings in Fig. 3. Hirings had a sharp decline for young workers (19.5 fewer hires per 100 workers in the same age group) relative to middle-age (-9.9) and old workers (-7.6), as shown in panel A. In panel B we

(A) Age groups   (B) Gender   (C) Region

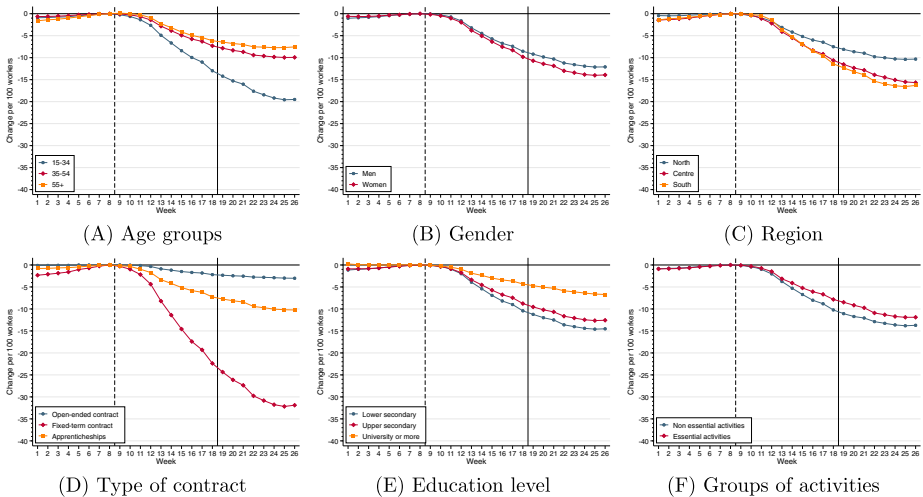(D) Type of contract   (E) Education level   (F) Groups of activities

Fig. 4 Cumulative change in hirings between 2020 and average 2017-2019

Notes. The figure shows the cumulative change in hirings up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed for 100 workers in the same subgroup. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown

see that they were slightly lower for women compared to men (-13.9 and -12.1, respectively). Panel C shows that the pandemic hampered hirings especially in Southern and Centre regions (-16.3 and -15.7, respectively) with respect to Northern regions (-10.3). Again, we see how the pandemic had a disproportionate impact on fixed-term contracts: there were 31.9 fewer hires of workers with fixed-term contracts, compared to 10.2 for apprenticeships and 3 for open-ended contracts, per 100 workers. Low educated individuals experienced larger declines in hirings than high-educated workers (panel E), as well as workers in non-essential activities compared to those in essential activities (panel F).

Layoffs Figure 5 reports the cumulative weekly change in layoffs for different subgroups (note that the scale on the vertical axis differs from the previous figures). Until the beginning of the pandemic recession, layoffs were on the same trend as those registered in the past. After the onset of the pandemic, we observe an increase in layoffs, which was particularly evident between weeks 9 and 12, and especially for workers on fixed-term contracts (panel D) and with low level of education (panel E). In week 12, the ban on layoffs together with the COVID-related STW compensation scheme came into force and we observe a steady decline in cumulative layoffs, until the end of our period of analysis, when the ban and the STW compensation scheme were still in place. Overall, this evidence suggests that, absent the policy, firms would have resorted to layoffs to cut labor costs, although it is difficult to separate the impact of the layoff ban from that of COVID-related STW compensation scheme.

Which categories benefited the most from the policy? Panel A suggests that, if anything, younger workers experience a slightly lower reduction in layoffs with respect to middle-age and old workers, but differences are small. Panel B displays differences by gender. The rise in layoffs hit both genders equally, but at the end of the observation period the
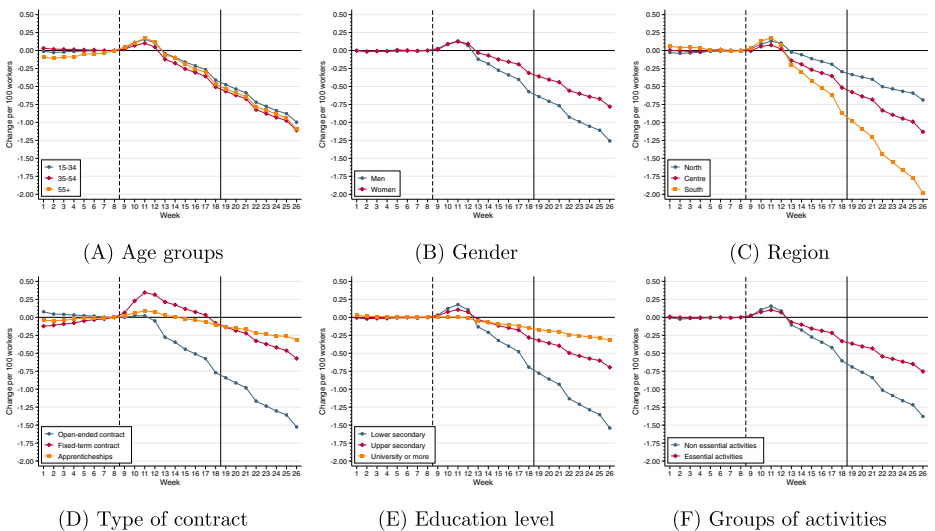

(A) Age groups   (B) Gender   (C) Region

(D) Type of contract   (E) Education level   (F) Groups of activities

Fig. 5 Cumulative change in layoffs between 2020 and average 2017-2019

Notes. The figure shows the cumulative change in layoffs up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed for 100 workers in the same subgroup. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown

cumulative decline in layoffs is higher for men (−1.3, as opposed to −0.8 for women). Geographic differences are more evident (panel C), with workers in the South benefiting from the increased employment protection legislation: we observe 2 fewer layoffs per 100 workers in the South, compared to −1.1 in the Centre and −0.7 in the North. We also report a different cumulative change for workers with open-ended contracts (−1.5) relative to fixed-term contracts (−0.6) and apprenticeships (−0.3) in panel D. A more pronounced decline is also observed for low-educated workers (panel E) and workers employed in non-essential activities (panel F), indicating that the policies aimed at preserving employment relationship helped these more vulnerable workers and more exposed sectors in coping with the consequences of the recession.

Endings of fixed-term contracts Figure 6 reports the evolution of endings of fixed-term contracts. For all subgroups, we observe similar patterns: the trend in the cumulative change in endings is similar in the first 8 weeks of the year to that observed right before the pandemic, but for few exceptions. After the start of the pandemic, there is a constant decline in the number of endings with respect to the past three years, with the exception of week 13, which corresponds to the last week of March. The positive slope in week 13 is probably due to employers choosing not to renew temporary contracts, which were expiring in that week: the end of quarters is a frequent date for the ending of fixed-term contracts and, in fact, if we plotted the weekly instead of the cumulative change in endings of fixed-term contracts, we would observe similar increases at the end of each month, but less pronounced than the one at the end of the first quarter.

The decrease in endings of fixed-term contracts is very likely to reflect the general decline in economic activity: the drop in aggregate demand generates a decrease in the
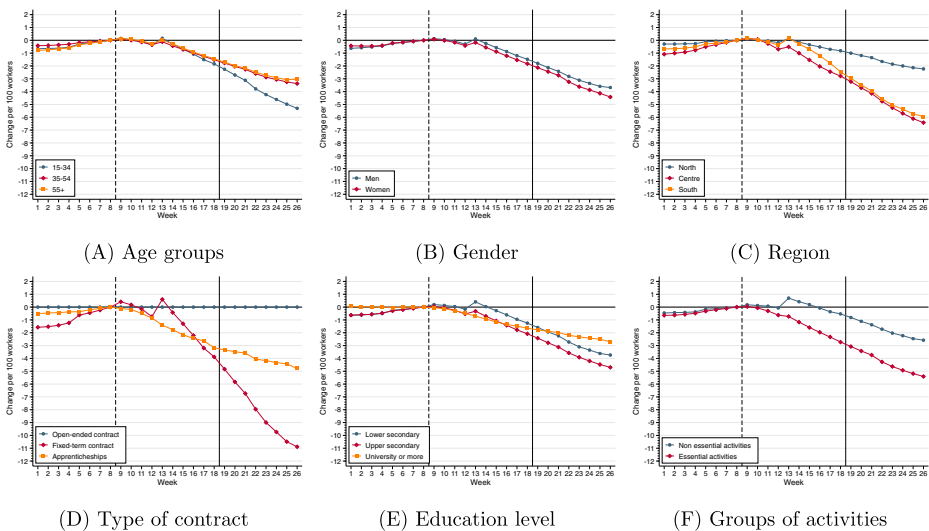

(A) Age groups   (B) Gender   (C) Region

(D) Type of contract   (E) Education level   (F) Groups of activities

Fig. 6 Cumulative change in endings of fixed-term contracts between 2020 and average 2017-2019

Notes. The figure shows the cumulative change in endings of fixed-term contracts up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed for 100 workers in the same subgroup. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown
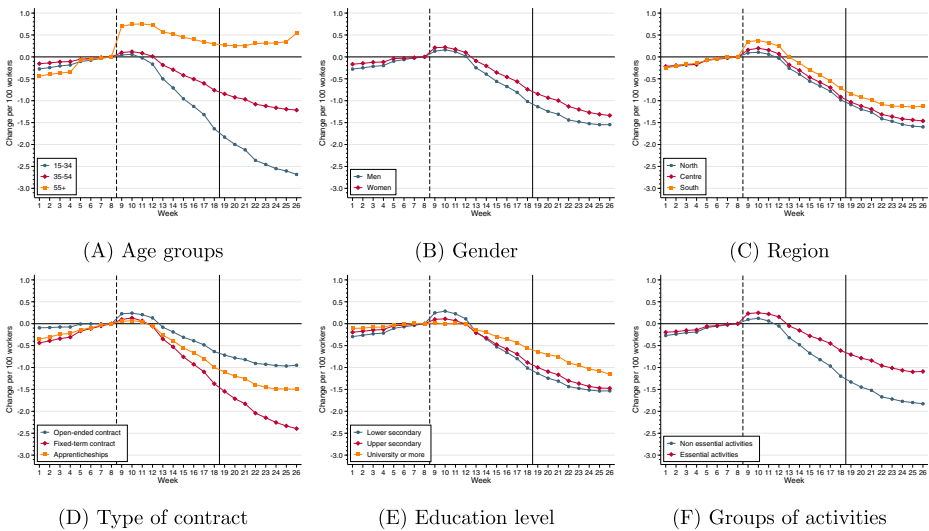
Fig. 7 Cumulative change in quits between 2020 and average 2017-2019

Notes. The figure shows the cumulative change in quits up until each week in the first two quarters of 2020 with respect to the average of 2017-19 over the same period of the year and relative to the week before the pandemic (week 8). Values are expressed for 100 workers in the same subgroup. The dashed vertical line indicates the onset of the pandemic. The solid vertical line indicates the end of the lockdown

demand for labor, and therefore in the activation of new fixed-term contracts (as highlighted in both Figs. 3 and 4), which then is accompanied by a lower number of expirations. Overall, at the end of the second quarter of 2020, endings of fixed-term contracts are lower relative to the past in particular for young workers (panel A), women (panel B), workers in the Centre and South of the country (panel C), low educated workers (panel E) and workers in essential activities (panel F).

Quits Figure 7 reports the evolution of quits. Voluntary quits display an increasing trend between weeks 9 and 12, right after the pandemic started, similarly to layoffs. Panel A shows striking differences by age groups: for older workers, the difference between quits in 2020 and in the past is always positive. Overall, by the end of the observation window, we find 0.5 more quits per 100 workers older than 55. This group of workers may have quitted their jobs at a higher rate to help their families cope with school closures and child care activities. At the same time, firms may have used quits as a way to anticipate retirement for some workers and cut labor costs.[14] We observe, instead, a decline in quits for other age groups. The exception is a slight increase in weeks 9-12 for workers aged 35-54, which can be again related to the impossibility of balancing work and family duties after school closures. Panel B shows that quits increased more for women right after the beginning of the pandemic and this may contribute to the less pronounced cumulative drop by the end of the second quarter. Quits increased in weeks 9-12 more in the South than in the rest of the

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[14]In particular, workers may have quit exploiting the so called "Quota 100" reform, which allows early retirement of workers that are at least 62 years old with 38 years of pension contributions (or older age and fewer years of contribution, as long as the sum of the two equals 100).

country (panel C) and their drop compared to the past was smaller in the South by the end of the second quarter. Panel D shows that the decline in quits is less pronounced for open-ended contracts and apprenticeships compared to fixed-term contracts: this comes as no surprise as most open-ended contracts are held by workers older than 35. The decline in quits is similar for workers with lower secondary or upper secondary education, but higher in magnitude than that of university graduates (panel E), although, in weeks 9-12, low educated workers significantly increased their quitting rate relative to the past. Finally, panel F shows that the increase in quits right after the onset of the pandemic was higher in essential activities than in non-essential ones. Since business was continuing in essential activities, some workers may have been forced to quit their jobs because of school closures or for fear of contagion or firms may have used quits as an alternative to layoffs.

5 Changes in separation probability

5.1 Empirical strategy

We focus on the separation probability and analyze what categories of workers are more likely to separate from a job during the recession, conditional on individual, sector and occupation characteristics. To this end, exploiting the start and end date of each contract, we transform our cross-sectional data at the contract (or spell) level into a panel at the monthly level, using the worker as unit of observation. We keep workers between July 2018 and June 2020. Then, for different subgroups of workers, we estimate the following difference-in-differences model:

$$y_{imt} = \alpha + \beta \cdot D_{it} + \gamma \cdot Post_m + \delta \cdot Post_m \cdot D_{it} + \eta \cdot X_{imt} + \psi_{s(i,m,t)} + \phi_{o(i,m,t)} + \epsilon_{imt}, \quad (2)$$

where y_{imt} is a dummy equal to one if worker i separates from her job in month m, with $m = \{July, ..., June\}$ and period t, with $t = \{2018\text{-}2019, 2019\text{-}2020\}$. α is a constant. $Post_m$ is a dummy variable equal to zero for months from July to January and equal to one for months from February to June. D_{it} is a dummy variable equal to zero for individuals working in the period July 2018-June 2019 and equal to one for those working in the period July 2019-June 2020. X_{imt} is a matrix of control variables: age, dummies for women, foreign workers, contract type (fixed-term or apprenticeship, open-ended excluded), full-time workers, education level (upper secondary or university, lower secondary excluded) and macro-area of work (Centre and South, North excluded). $\psi_{s(i,m,t)}$ and $\phi_{o(i,m,t)}$ are, respectively, 3-digit sector and occupation fixed effects.[15] We estimate Eq. 2 separately for different groups of workers, based on gender, age, contract type, education, macro-area of work and opportunity of remote work.[16] The variables included in X_{imt} are modified accordingly:

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[15] Although we have more granular information on both occupations and sectors (respectively, at 4- and 6-digit level), we include fixed effects at 3-digit level in order not to have clusters with too few observations (which, in the extreme case of singletons, would be dropped from the sample).

[16] We determine whether an occupation offers the opportunity of remote work based on the classification developed in Basso et al. (2021) for Italy, which in turn draws on Dingel and Neiman (2020). Occupations are classified as "work from home" according to responses to a number of different questions from the "Work context" and "Work Activities" sections of O*NET database. The occupation codes from O*NET are then matched with ISCO-08 codes, which are the closest occupation definition to the one available in our data (CP2011, provided by the Italian Statistical Institute). Of the 118 3-digit occupation codes, 40 are classified as "work from home" and 78 are classified as "no work from home". For more details on the methodology, see Basso et al. (2021).

hence, for example, when estimating regressions for different age groups, we do not include age among controls. The coefficient of interest is δ, which measures the change in the separation probability for workers in the period 2019-2020 relative to workers in the period 2018-2019, in the months after the pandemic, relative to the months before.

We also estimate a dynamic version of Eq. 2, where we replace $Post_m$ with calendar month dummies from July to June:

$$y_{imt} = \alpha + \beta \cdot D_{it} + \sum_{k \neq Jan} [\gamma_k \cdot \mathbf{1}(m = k) + \delta_k \cdot \mathbf{1}(m = k) \cdot D_{it}]$$
$$+ \eta \cdot X_{imt} + \psi_{s(i,m,t)} + \phi_{o(i,m,t)} + \varepsilon_{imt}, \tag{3}$$

where $\sum_{k \neq Jan} \mathbf{1}(m = k)$ are calendar month dummies from July to June, excluding January, which is used as a reference category. The other variables are defined as before. The coefficients of interest are δ_k's, which measure the dynamic change in separation probability for each month relative to January, for individuals employed in the period 2019-2020 relative to those employed in the period 2018-2019.

5.2 Results

Table 2 reports estimates of Eq. 2 adding controls in each column from (1) to (5). Column (1) reports unconditional estimates. Column (2) includes observable characteristics X_{imt}. Column (3) controls for occupation fixed effects, whereas column (4) controls for sector fixed effects. Column (5) adds both occupation and sector fixed effects. Panels A to F report estimates for different subgroups of workers. Panel A reports separate regressions for women and men. Both female and male workers display comparable reductions in the separation probability following the pandemic. Adding controls for observables and sector and occupation time-invariant characteristics reduces the magnitude of coefficients, indicating some selection of workers on observables and in sectors and occupations with larger employment protection during the pandemic. Overall, the most conservative estimate reported in column (5) suggests that the separation probability decreases by 0.8 percentage points for women and 0.9 percentage points for men. Panel B reports estimates for different age groups. Again, the addition of controls reduces the magnitude of coefficients, which indicate in column (5) that younger workers had larger reductions in the separation probability (1.1 percentage points compared to 0.7 percentage points for middle aged and older workers). Panel C shows results for workers with different contract types: open-ended, fixed-term and apprenticeships. For workers on open-ended contracts, adding controls makes little difference on the estimates, which equal -0.5 percentage points across different specifications. The inclusion of control variables has a larger impact on the estimates for apprentices and the more so for workers on fixed-term contracts. For the latter group, the point estimate reduces from -2.1 to -0.9 percentage points when moving from column (1) to column (5), indicating selection of workers on fixed-term contracts in sectors or occupations that are more likely to benefit from the layoff ban. Panel D distinguishes workers based on their education level and signals a higher reduction in separation probability for workers with lower secondary or upper secondary education, relative to workers with university degree. Panel E reports results for different areas of the country, confirming that workers in the Centre and South had larger reductions in the separation probability than workers employed in the North. Finally, Panel F reports results for occupations with the opportunity (or not) of remote work. Unconditional estimates or estimates conditional on observable worker characteristics in columns (1) and (2) display negative coefficients for both groups of occupations, with statistical significance

Table 2 Change in separation probability for different subgroups of workers

	Obs.	(1)	(2)	(3)	(4)	(5)
Panel A: Gender						
Women	16,229,943	−0.013***	−0.011***	−0.009***	−0.008***	−0.008***
		(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Men	25,008,062	−0.014***	−0.012***	−0.010***	−0.009***	−0.009***
		(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
Panel B: Age						
Age 15-34	13,770,343	−0.017***	−0.014***	−0.012***	−0.011***	−0.011***
		(0.005)	(0.004)	(0.003)	(0.002)	(0.002)
Age 35-54	21,432,322	−0.011***	−0.010***	−0.008***	−0.007***	−0.007***
		(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
Age 55+	6,035,340	−0.012***	−0.010***	−0.008***	−0.007***	−0.007***
		(0.004)	(0.003)	(0.002)	(0.002)	(0.001)
Panel C: Contract type						
Open-ended	21,895,908	−0.005***	−0.005***	−0.005***	−0.005***	−0.005***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fixed-term	14,239,186	−0.021**	−0.020**	−0.013**	−0.010***	−0.009**
		(0.008)	(0.008)	(0.005)	(0.004)	(0.003)
Apprenticeship	5,102,911	−0.014*	−0.013*	−0.008***	−0.009***	−0.008***
		(0.008)	(0.007)	(0.002)	(0.003)	(0.002)
Panel D: Education						
Lower secondary	21,072,019	−0.014***	−0.012***	−0.010***	−0.009***	−0.009***
		(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
Upper secondary	15,371,689	−0.015***	−0.013***	−0.010***	−0.009***	−0.009***
		(0.005)	(0.004)	(0.003)	(0.003)	(0.002)
University	4,794,297	−0.006**	−0.006**	−0.005***	−0.005***	−0.004***

Table 2 (continued)

	Obs.	(1)	(2)	(3)	(4)	(5)
Panel E: Macro-area of work						
North	22,785,255	−0.010***	−0.009***	−0.008***	−0.007***	−0.007***
		(0.003)	(0.003)	(0.002)	(0.002)	(0.001)
Centre	9,098,446	−0.018**	−0.016**	−0.011***	−0.010***	−0.009***
		(0.007)	(0.006)	(0.003)	(0.003)	(0.003)
South	9,339,051	−0.017**	−0.013***	−0.011***	−0.010***	−0.010***
		(0.006)	(0.004)	(0.003)	(0.003)	(0.003)
Panel F: Work from home						
Work from home	10,273,764	−0.014	−0.013	−0.009*	−0.008**	−0.007**
		(0.009)	(0.008)	(0.004)	(0.004)	(0.003)
No work from home	29,525,630	−0.013***	−0.011***	−0.010***	−0.009***	−0.009***
		(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Controls		No	Yes	Yes	Yes	Yes
Occupation fixed effects		No	No	Yes	No	Yes
Sector fixed effects		No	No	No	Yes	Yes

The table reports estimates of Eq. 2 for different subgroups of workers in panels A–F. Column (1) reports unconditional estimates. Column (2) controls for workers' observable characteristics: age, dummies for women, foreign workers, contract type (fixed-term or apprenticeship, open-ended excluded), full-time workers, education level (upper secondary or university, lower secondary excluded) and macro-area of work (Centre and South, North excluded). Depending on the subgroup, control variables change: in panel A, we do not control for gender; in panel B, for age; in panel C, for contract type; in panel D, for education; in panel E, for macro-area of work; in panel F, we include all controls. Column (3) includes 3-digit occupation fixed effects. Column (4) includes 3-digit sector fixed effects. Column (5) includes both occupation and sector fixed effects. Standard errors, clustered at the occupation-sector level, are reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

only for occupations that cannot be performed from home. When adding occupation and/or sector fixed effects, both estimates become statistically significant. Overall, the decline in the likelihood to separate is marginally larger in magnitude for occupations that cannot be performed from home. This result suggests that the layoff ban and the COVID-related STW compensation scheme proved effective in protecting workers that could not work remotely from losing their job.

Figure 8 reports dynamic effects from Eq. 3. The figure shows that, before the pandemic started in February, workers in 2019-2020 were on a parallel trend relative to those in 2018-2019, as estimates are generally not statistically significant for months between July and December. After the pandemic started, we observe increases in the likelihood to separate, which are particularly evident for some categories of workers in February: age group 55+ in panel A, women in panel B, workers in the South in panel C, fixed-term contracts in panel D, low educated workers in panel E and workers in occupations that cannot be performed from home in panel F. From March on, when the layoff ban and the COVID-related STW compensation scheme were in place, these trends reverse and all categories of workers experience lower separation probabilities with respect to January, compared to the past. In particular, younger workers experience larger reductions in separation probability relative to older ones, as well as men relative to women, employees in the South relative to those in the North, workers on fixed-term relative to open-ended contracts, workers with lower and upper secondary education relative to workers with a university degree and workers in occupations that cannot be performed from home compared to those that can.

These results from the static and dynamic analyses relate to those from the descriptive analysis presented in Section 4: also after controlling for a rich set of covariates and fixed effects, we find that policies reduced the separation probability for more vulnerable workers, such as those with lower levels of education, working in the South and with fixed-term contract. Women instead benefited slightly less than men from the reduction in separation probability.

6 Conclusion

This paper explores the short-run heterogeneous effects of COVID-19 on labor market flows in Italy and how policy enacted to reduce the spread of the virus and the disruption of economic activity mediated them.

We show that, before the pandemic, a higher share of female compared to male, young compared to old and low educated compared to high educated workers is employed in non-essential activities. When looking at the change in hirings and separations and decomposing it by age, gender, macro area, type of contract (open-ended or fixed-term), education level, and group of activity (essential vs non-essential), we find that from the 9th week of the year – when the virus started to spread exponentially across the country – there was a pronounced drop in hirings. Endings of fixed-term contracts slightly declined after the 9th week, and more so after the 13th week of the year. On the contrary, layoffs and quits increased right after the 9th week, and then dropped, reflecting the effects of the ban on layoffs and the ease of access to STW compensation schemes. The decline in separations may also be linked to the recession-induced decrease in job creation. The ban on layoffs may have contributed to the decline in job creation as well, since the higher employment protection for workers may have decreased turnover. However, the fact that the drop in hirings slowed down by the end of the second quarter of 2020 suggests a more prominent role of the lockdown in determining the decrease in hirings. We further explore separations by examining how separation
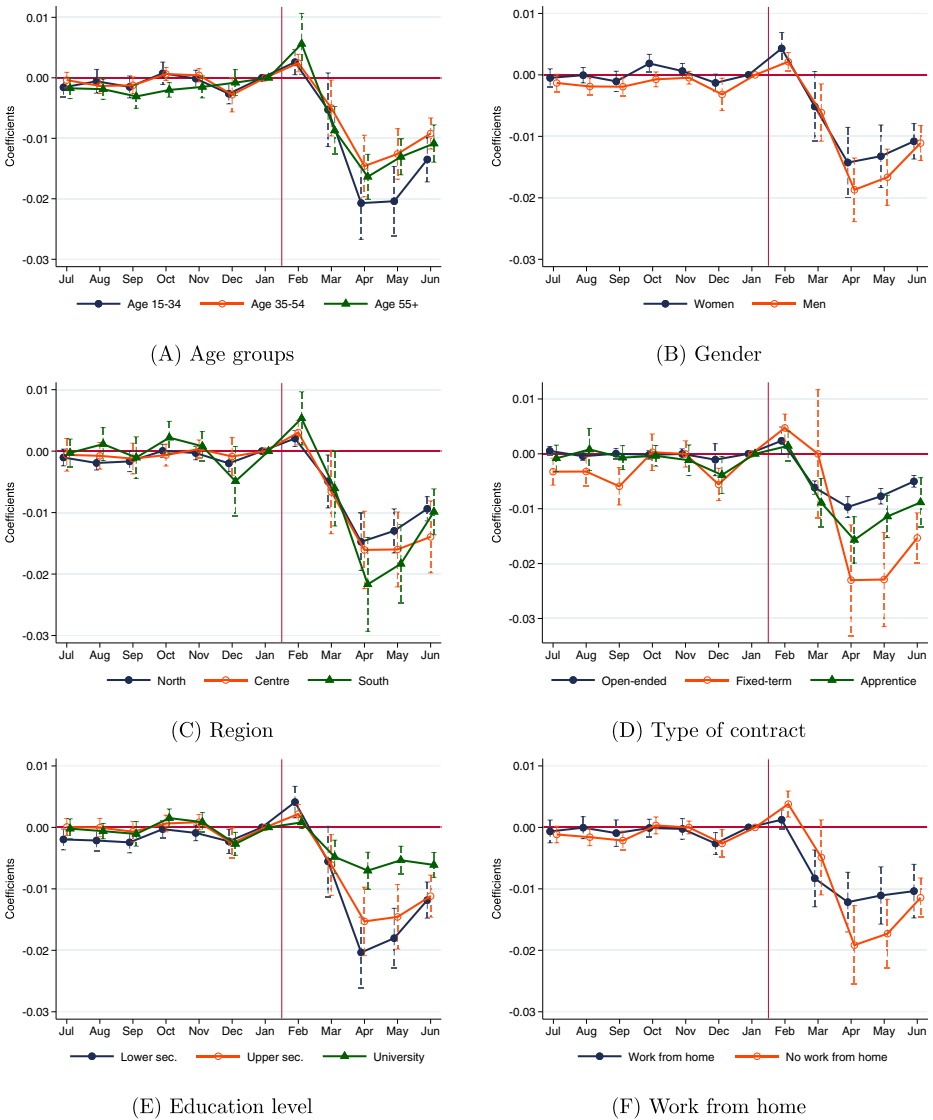
Fig. 8 Dynamic difference-in-differences estimates of separation probability for subgroups of workers

Notes. The figure reports estimates of Eq. 3 for different subgroups of workers in panels A-E. Regressions control for workers' observable characteristics: age, dummies for women, foreign workers, contract type (fixed-term or apprenticeship, open-ended excluded), full-time workers, education level (upper secondary or university, lower secondary excluded) and macro-area of work (Centre and South, North excluded). Depending on the subgroup, control variables change: in panel A, we do not control for gender; in panel B, for age; in panel C, for contract type; in panel D, for education; in panel E, for macro-area of work; in panel F, for occupations that can (cannot) be performed from home. Furthermore, both occupation and sector fixed effects are included in all regressions. Vertical lines are 95 percent confidence interval obtained from standard errors, clustered at the occupation-sector level

probabilities change after the onset of the pandemic for different subgroups of workers. We find that young workers, those on temporary contracts, low-educated workers, those employed in the South and those with no opportunity of working from home experienced a bigger reduction in the separation probability, indicating that the layoff ban and the COVID-related STW compensation scheme offered them protection. Women instead experience a slightly lower reduction in the separation probability compared to men, and are more likely to separate with respect to the past immediately after the pandemic kicks in. While we focus on short-term outcomes and cannot account for changes in hours worked, our evidence contributes to the understanding of labor market and policy responses in the wake of the pandemic. The use of detailed administrative data allows us to separately analyze how hirings and separations – distinguishing between layoffs, endings of fixed-term contracts and quits – have evolved relative to normal times and how different categories of workers have been affected. Given the critical role of the ban on layoffs and the COVID-related STW compensation scheme in affecting labor market flows, it is important to monitor the labor market transitions now that these policies have been partially lifted, since they have protected some vulnerable workers the most.

Declarations

Conflict of Interest The authors declare no conflict of interest.

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