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Being on the Frontline? Immigrant Workers in Europe and the COVID-19 Pandemic

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JEL Classification: F22, J61, J20

Keywords: Employment risk, COVID-19, key occupations

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Being on the Frontline? Immigrant Workers in Europe and the COVID-19 Pandemic

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March 18, 2022

Abstract

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1 Introduction

The costs of recessions are rarely, if ever, distributed evenly across the population (Hoynes, Miller and Schaller, 2012). A growing body of evidence is showing that job losses induced by the COVID-19 pandemic are concentrated among low-wage industries and occupations, young workers, the low educated, women and ethnic minorities.[1] Inequalities in the pandemic effects are not limited to unemployment risk. Minorities and other vulnerable groups of workers are over-represented in occupations exposed to higher risk of contagion (Basso, Boeri, Caiumi and Paccagnella, 2022), they are suffering from severe deterioration in mental health (Proto and Quintana-Domeque, 2021) and their excess mortality is disproportionately high (Platt and Warwick, 2020). Policy interventions can counteract the inequality-enhancing effects of the pandemic, as shown in Cortes and Forsythe (2020) for the U.S.. In order to be effective, however, these actions need to be targeted at those in need: identifying affected categories of workers is thus key to the design of optimal response policies.

The pandemic impact on migrant workers has received relatively little attention so far. A notable exception is early work by Borjas and Cassidy (2020) showing that immigrants in the US - and undocumented immigrants in particular - experienced a severe decline in employment relative to natives: they quantify that about a third of this gap is explained by migrant workers having jobs that are less "remotable" than comparable natives. In the context of low and middle-income countries (LMICs) such as Nepal and Bangladesh, Barker *et al.* (2020) observe that migrant households suffered a double fallout: their income dropped due to reduced migration of household members and fewer remittances, while their health hazard increased due to the return of members from national and international destination areas which were more affected by the pandemic. In Europe, our previous work documents the presence of migrants in key occupations (Fasani and Mazza, 2020b) and the vulnerability of migrants' workers at the onset of the pandemic (Fasani and Mazza, 2020a). In an earlier version of this paper, we use pre-pandemic data from the EU Labour Force Survey (EU-LFS) to construct an individual measure of exposure to employment risk, and show that migrant workers - and Extra EU migrants in particular - faced a higher job loss hazard than comparable natives. A similar approach has then been followed by Bossavie *et al.* (2021), who additionally point at migrants being exposed to higher health risk than natives. Finally, Auer (2022) shows that migrant workers in Germany faced a disproportionately higher risk of layoff in 2020 relative to natives with similar observable characteristics. A systematic evaluation of the consequences of the pandemic on migrant workers in the European Union is still missing.

This paper fills this gap by providing a comprehensive empirical assessment of the effects of the 2020 pandemic recession on migrants' employment in Europe. We explore for

[1] See, among others: Cortes and Forsythe (forthcoming); Couch, Fairlie and Xu (2020); Alon, Coskun, Doepke, Koll and Tertilt (2021); Albanesi and Kim (2021); Hupkau and Petrongolo (2020); Adams-Prassl, Boneva, Golin and Rauh (2020); Farre, Fawaz, Gonzalez and Graves (2020). Stantcheva (2022) provides a first review of the evidence of the pandemic effects on inequalities.

the first time the most recent release of harmonized micro-data on the employment status of native and migrant workers across European Union countries. We study the EU14 area, which hosts the vast majority of non-native residents in the European Union, and estimate migrant-native gaps in the probability of employment separation during the first year of the pandemic. While the literature has already documented that migrants' employment status is more sensitive to business cycle fluctuations than the natives' (Dustmann, Glitz and Vogel, 2010; Orrenius and Zavodny, 2010), our paper focuses on which particular characteristics of migrants' jobs may explain their higher exposure to employment losses in the context of the ongoing COVID-19 pandemic. In particular, we consider three job characteristics that we identify as pivotal in predicting workers' employment risk in the current COVID-19 crisis: i) *essentiality*; ii) *temporariness* and iii) *teleworkability*. We first account for the distinction between *key* and *non-key* occupations that many governments introduced when imposing shutdown measures and assess whether being employed in an essential occupation shielded workers from the risk of leaving employment. We then look at the duration of employment contracts, since fixed-term workers are typically the first ones to experience job separations when negative shocks hit firms or sectors (Blanchard and Landier, 2002; Boeri and Garibaldi, 2007). Thirdly, we assess the degree of teleworkability of occupations, which has been rapidly identified as one the most important predictors of job loss in the COVID-19 crisis (Dingel and Neiman, 2020; Mongey, Pilossoph and Weinberg, 2021; Adams-Prassl, Boneva, Golin and Rauh, 2020). Studying occupational sorting is particularly interesting in the context of the ongoing pandemic because only part of its implications could be *ex-ante* predicted by workers. Individuals selecting into temporary occupations are always more exposed to employment termination, and they typically belong to the weakest categories of workers in the labor market (i.e. young, low educated, minorities, immigrants). The consequences of sorting into occupations according to the other two dimensions - i.e. essentiality and teleworkability - were instead completely unpredictable ex-ante. The concept of essential and non-essential occupations was simply non-existent before the COVID-19 outbreak. Similarly, the degree of teleworkability of a given occupation – albeit potentially observable – bore little relevance for the vast majority of workers, given the very limited diffusion of remote working arrangements before the pandemic. Hence, while we can certainly expect to see migrants being overrepresented among workers with temporary contracts, it is fundamentally an empirical question whether migrants were more or less represented in essential occupations and in teleworkable ones.

In our empirical analysis, we find that migrant workers, especially those born outside of the European Union, have suffered larger employment losses than natives. After accounting for differences in observable socio-demographic characteristics, we estimate that the probability of job separation in 2020 for Extra EU migrants was almost twice as large as that of natives. In the case of Latin American, North African and Middle Eastern workers, the difference approached 2.5 times. We estimate a smaller gap for EU migrants, whose probability of leaving employment was 1.6 times larger than that of comparable natives. To understand the origin of these gaps, we delve into the role of workers' occupations in the

response to the pandemic, the contractual protection that they enjoy and the possibility of performing their job from home. We first document differential sorting for migrants and natives into these characteristics, with the former being relatively over-represented among key occupations, temporary contracts and low-teleworkable occupations. We then show that these job characteristics significantly affect the probability of job separations. We estimate that pre-pandemic occupational sorting along these dimensions account for around 50% of the explained native-migrants gaps in the risk of employment termination. Sorting into industries accounts for the other half. We also find that, whereas being a key worker or employed with a temporary contract had similar effects on the job security of natives and migrants, the latter group faced a larger penalty from being employed in low-teleworkable occupations. Even within narrow occupation/industry cells, however, more than half of the difference in job separation probabilities remains unexplained.

The paper unfolds as follows. Section 2 describes labor market outcomes of migrant workers in Europe before and during the COVID-19 pandemic. Section 3 presents our empirical strategy, describes the data used and discusses our occupation characteristic of interest. Section 4 reports our empirical findings. Finally, Section 5 discusses some policy implications of our analysis.

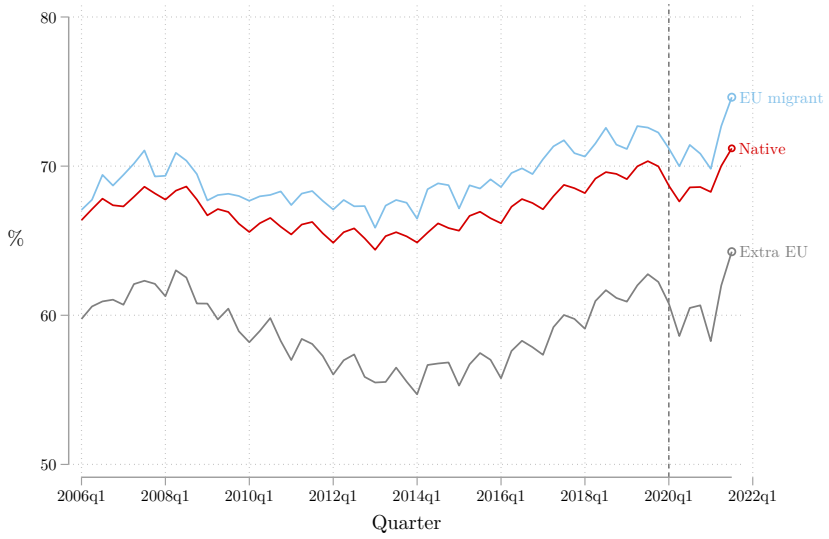
2 The COVID-19 Pandemic and Migrant Workers in Europe

At the onset of the COVID-19 pandemic, the European Union (EU-27) hosted a migrant population of approximately 36.5 million people, accounting for 8.1% of the EU resident population. Among them, 13.5 million were citizens of another EU Member State and the remaining 23 million were citizens of an Extra EU country.[2] In this paper, we focus on EU14 countries, which hosted over 90% of the foreign residents in the European Union.

Figure 1 reports the employment rates of natives, EU and Extra EU migrants in EU14 countries over the period 2006-2021. Before the first outbreak of COVID-19, employment was on a marked upward trend for all three groups of workers, recovering from the minimum level reached in 2014 when the negative effects of the Great Recession on European economies finally faded away. In the last quarter of 2019, native workers' employment rate was at 69.9%, slightly outperformed by EU migrants (72.2%) and well above the level recorded for Extra EU migrants (62.2%). Figure 1 conceals substantial gender heterogeneity, both across and within origin groups. Appendix Figure A.1 demonstrates that women (panel a) had lower employment rates than men (panel b) in all groups: the gap is particularly large for Extra EU women both relative to women of other origin groups and to their male counterpart.

[2]These figures exclude the UK which officially withdrew from the EU on the 31st of January 2020. With a resident population of 67.2 million in January 2020, the UK hosted 6.2 million foreign nationals (9% of the total population), of which 3.4 million were EU citizens.

Figure 1: Employment Rates in EU14 countries (q1 2006-q3 2021), by Origin



Note: The figure reports the 15 to 64 employment rates for native, EU mobile and Extra EU workers in EU14 from the first quarter of 2006 to the third of 2021. The vertical dotted line marks the beginning of the pandemic. *Source*: Eurostat ergacob series.

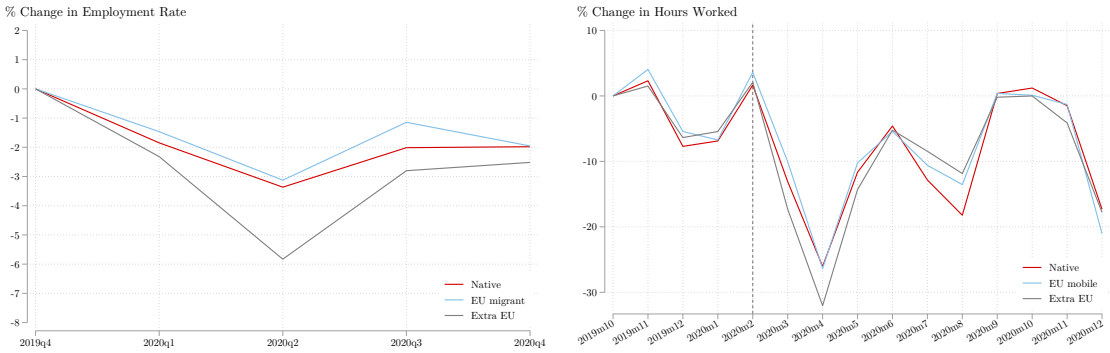
The outbreak of COVID-19 in the early months of 2020 - together with the contagion containment measures that were put in place by all governments - led to a sudden contraction of European economies. In the EU27 area, real GDP fell on average by 5.9% in 2020: this was the first drop recorded since 2009, when EU GDP had declined by 4.3% relative to the previous year.[3] Using the latest figures provided by Eurostat (2021), Figure 2 allows to take a closer look at the effects of the pandemic on employment rates (panel a) and on hours worked (panel b) in the EU14 area. Between the last quarter of 2019 and the second quarter of 2020, the employment rate of native workers experienced a 3.3% drop (from 69.9% to 67.6%), implying that almost 4 million people left employment over six months.[4] The pandemic shock affected worked hours far more dramatically, driving them down by 25 % (Figure 2, panel b). If we contrast the European and the U.S. experience, we observe similar responses to the pandemic shock in terms of reduction of GDP and of hours worked, while the employment rate has been far more volatile in the U.S., plummeting by approximately 10 percentage points between January and May 2020. Hence, while in the U.S. hours lost

[3]The pandemic shock to EU economies was highly heterogeneous. Spain suffered the biggest drop (-10.8%), followed by Greece (-9.0%), Italy (-8.9%), Portugal (-8.4%), Malta (-8.2%), Croatia (-8.1%) and France (-7.9%). The only EU country that registered an increase in GDP in 2020 was Ireland (+5.9%).

[4]The impact on unemployment rate was equally contained. Over the same period, however, Eurostat estimates an approximate 14% increase in the the labor market slack - a measure that includes unemployed, underemployed part-time workers, workers seeking job but not available to work and workers available to work but not actively seeking job - from 12.5 to 14.3%.

were almost exclusively determined by layoffs, in Europe the extensive use of subsidized short-time work schemes allowed for a large reduction in working hours while mitigating the detrimental impact on employment (Gros and Ounnas, 2021).

Figure 2: Percentage Change in Employment Rate and Hours Worked between Q4-2019 and Q4-2020 in EU14 countries, by Origin



(a) Employment rate

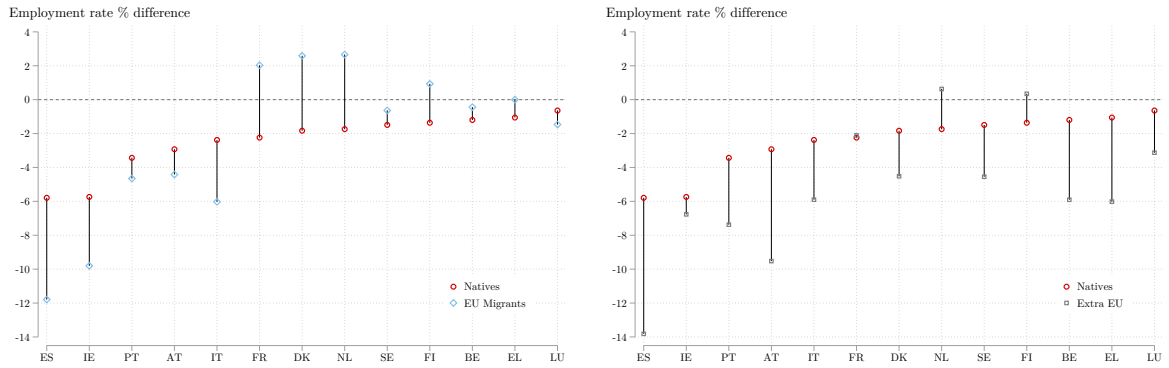
(b) Hours Worked

Note: Data for Panel 2a come from the Eurostat ergacob series. Data for Panel 2b come from our own elaboration of the EU-LFS microdata.

The impact of COVID-19 on migrant workers in the EU14 area has been far more pronounced than for native workers. As panel (a) of Figure 2 shows, between the last quarter of 2019 and the first quarter of 2021, the employment rate of migrant workers born outside of the European Union dropped by almost 6% (from 62.2 to 58.6%), while for EU migrant workers the employment loss was closer to the one experienced by natives, at about 3.1% (from 73 to 70%). For comparison, the subprime and sovereign debt crisis that shook Europe between 2008 and 2012 saw a 6 and 4 percentage point contraction for Extra EU and EU migrant workers, respectively. Figure 3 allows to take a closer look at the disproportionate impact of the COVID-19 pandemic on migrant workers in each host country in our sample. The left panel contrasts the changes in employment rates between the last quarter of 2019 and the second of 2020 for natives and EU migrant workers in each country of the EU14 area. The right panel performs the same comparison for natives and Extra EU workers. The figure displays substantial heterogeneity both in the overall impact of the pandemic and in the relative impact on native versus foreign workers. While native workers in countries such as Spain, Ireland, Portugal, Austria, Italy and France suffered employment losses between 2% and 6% over the first six months of the pandemic, the change in their employment rate was closer to zero for the other countries in the sample. Panel (a) of figure 3 suggests that EU mobile workers faced larger employment losses than natives in the five most affected countries, while their performance was similar to that of natives (if not better) in all other

countries.[5] The pattern is more clear-cut and negative for Extra EU workers (panel b), who experienced more severe drops in their employment rate in all but two EU14 countries, with employment losses in excess of 4% in nine countries.[6]

Figure 3: Change in Employment Rates 2019Q4 vs. 2020Q2 in the EU-14 area, by Origin and Country of Residence



(a) Natives Vs EU Migrants

(b) Natives Vs Extra EU Migrants

Note: The figure reports changes in employment rate between the last quarter of 2019 and the second quarter of 2020 in each of the EU14 countries for: natives and EU-mobile workers in panel (a); natives and Extra EU mobile workers in panel (b). Countries are sorted by the size of employment rate change for natives. *Source*: Eurostat ergacob series.

3 Empirical Strategy, Data and Definitions

3.1 Estimating Equation

In the previous section, we document that migrants - and Extra EU migrants, in particular - have experienced disproportionately larger reductions in employment relative to natives in the EU14 area during the first outbreak of the pandemic. In our empirical analysis, we estimate this differential impact on migrants and we assess how much of the observed migrant-native gap is explained by individual controls and by sorting into specific occupational characteristics (i.e. *essentiality*, *temporariness* and *teleworkability*) and industries. We do so by focusing on workers who were employed at the start of 2020 and by studying their probability of leaving employment over the next 12 months. We estimate the following regression equation:

[5] Actually, the employment rate of EU migrants slightly increased in a few countries (France, Denmark, Netherlands and Finland), probably driven by selective return to home countries by non employed workers.

[6] It is important to note that, differently from what happened in the US (Peri and Zaiour, 2022), the number of migrants in Europe has not changed much during the first year of the pandemic (see Eurostat *pgacws* series; last accessed 14/03/2022.) so that these employment rates refer to an almost constant population.

$$JobSep_i = \alpha_i + \beta X_i + \gamma EU_i + \theta ExtraEU_i + \delta JobChar_i \psi_c + \epsilon_i \quad (1)$$

where: $JobSep_i$ is an indicator variable for having experienced a job separation since the start of 2020; X_i is a vector of individual controls (sex, age and education); the dummies EU_i and $ExtraEU_i$ identify EU and Extra EU migrant workers, respectively; $JobChar_i$ are alternative indicators of job characteristics; ψ_c are country of residence fixed effects; ϵ_i is an idiosyncratic shock.

We focus our analysis on three job characteristics that we identify as pivotal in predicting workers' employment risk in the current COVID-19 crisis: i) *essentiality*; ii) *temporariness* and iii) *teleworkability*. We first account for the distinction between *key* and *non-key* occupations that many governments introduced when imposing shutdown measures. Despite variation in definitions and enforcement across countries, workers employed in key sectors and occupations could generally continue their activities, although with enhanced safety and health measures. Outside these key occupations, instead, workers and firms were subject to severe restrictions that often implied that workers had to stay at home while their workplaces were kept entirely or partially closed. The second dimension that we consider is the duration of employment contracts: having lower firing costs than workers on permanent contracts, fixed-term workers are the first ones to be laid off when negative shocks hit firms or sectors (Blanchard and Landier, 2002; Boeri and Garibaldi, 2007). Thirdly, we assess the degree of teleworkability of occupations, which has been identified as one the most important predictors of job loss in the COVID-19 crisis (Dingel and Neiman, 2020; Mongey, Pilossoph and Weinberg, 2021; Adams-Prassl, Boneva, Golin and Rauh, 2020).

We estimate equation (1) with a Linear Probability Model and use robust standard errors in all regressions. We first obtain baseline migrant-native gaps in employment loss hazard by including individual controls and migrant status dummies alone. We then condition on job characteristics in the specification and assess whether they significantly affect the probability of employment separation and with the expected sign. We then study to which extent the gaps vary once we control for differential sorting into occupations before the outbreak of the COVID-19 pandemic. We do so both by individually including regressors for essential occupations, temporary jobs and occupational degree of teleworkability and by then summarizing these three dimensions into a single employment risk index (that we describe below; see section 3.3). Finally, we account for pre-pandemic sorting into both industries and occupations by including a full set of fixed effects. The comparison of estimated migrant-native gaps in the baseline specification with those obtained when we gradually control for sorting allows us to quantify the contribution of each set of regressors to the observed gaps. We formally make this comparison by implementing a Gelbach decomposition (Gelbach, 2016).

3.2 Data and Estimation Sample

Our analysis is based on individual level data from the 2021 wave of the EU-LFS, a large household survey that combines and harmonizes micro-data from the Labour Force Surveys collected by the national statistical institutes of each EU Member State. These data refer to interviews conducted in 2020, and were released in November 2021, finally allowing researchers to assess the impact of COVID-19 on workers across European countries. In our empirical application, we assess how the characteristics of the occupation held at the beginning of the pandemic influenced the probability of leaving employment over the course of 2020. The EU-LFS is particularly well suited for our objective as it reports, in case of job separation, both the occupation held and the sector of employment for the previous job. It also records when the employment contract was terminated and the reason for this event (e.g. dismissal, resignation, expiration of contract). This information allows us to reconstruct the job history for both currently employed and currently non-employed workers and to determine whether the termination happened in 2020, whether the previous contract was temporary, whether the occupation held at the start of the pandemic was an essential one, and its degree of teleworkability.

We focus our analysis on EU14 countries and restrict the sample to workers aged 15-64. We restrict our sample to those who were gainfully employed at the beginning of 2020, before the first outbreak of the COVID-19 pandemic, and we drop respondents for whom retrospective information on either one of our job characteristics of interest is missing.[7] We distinguish workers into the three origin groups based on their country of birth and current residence: natives are born in the current country of residence, EU migrants are born in a EU Member State other than the one where they currently work and reside and Extra EU migrants are born outside of the EU. After having applied these selection rules, our main sample includes 480,219 individuals, of which 417,672 (87%) are natives, 21,961 (4.6%) EU migrants and the remaining 40,586 (8.4%) are Extra EU migrants.

While we discuss in the next section the job characteristics that we study, we report in Appendix Table A.1 some descriptive statistics for our estimating sample. In our sample of workers, the probability of becoming unemployed for those who were employed at the start of 2020 is 2.6%. At 5% Spain has the highest share of workers who lost their job in 2020 while only 1% of Dutch and German workers became unemployed in the same year. Appendix Table A.2 shows that the most common reason for having ones' job terminated is the end of a temporary contract (30%), followed by layoffs (20%), other reasons (13%) and normal retirement (12%). These four reasons make up for three quarters of job terminations. In our empirical analysis we focus exclusively on those who lost their job, but are still active, we therefore exclude people who left the labor market to retire, study or take on family responsibilities.[8]

[7] We drop Ireland from our sample as the information on the previous job held is missing for Irish workers.

[8] In a robustness check, we consider also these people as having lost their job. Our main results are unaffected by the inclusion of these groups. Results available on request.

3.3 Key Workers, Temporary Contracts and Teleworkability

We use the following definitions for the three job characteristics that we study in this paper:

1. *Key workers.* For the definition of key workers, we follow the Communication from the European Commission on Guidelines concerning the exercise of the free movement of workers during COVID-19 outbreak supplemented with the Dutch definition of key workers. We identify key workers based on ISCO-08 occupations at three digits, which is the most detailed classification available in the EU-LFS.[9]

2. *Temporary Workers.* The EU-LFS survey includes information on the type of employment contract that allows us to distinguish employees who are on a fixed-term contract from those with a permanent one.

3. *Teleworkability.* Our measure of *teleworkability* is taken from Dingel and Neiman (2020). This measure is based on responses to two Occupational Information Network (O*NET) surveys covering "work context" and "generalized work activities". The index runs from 0 to 100 and we use a threshold value of 60 to classify jobs above the cutoff as teleworkable and jobs below the cutoff as non-teleworkable. We then apply the cross-walk provided in the replication package by Dingel and Neiman (2020) to merge the SOC classification of occupations provided by the Bureau of Labor Statistics (BLS) with the ISCO-08 classification available in the EU-LFS.

We can combine information on key occupations, temporariness of employment contracts and teleworkability of tasks into a single index in order to characterize the employment risk that workers faced during the pandemic crisis in the EU14 area. As summarised in Table 1, we assign workers to four categories of employment risk:

1. *Very high*: this group includes workers who are vulnerable along all the three dimensions that we identify, i.e. workers employed in non-key occupations, with a temporary contract, and whose work is not teleworkable.

2. *High*: we assign workers to this group if two out of the three conditions (non-key workers, temporary contract, non-teleworkable job) are satisfied.

3. *Moderate*: this group comprises workers who meet only one of the vulnerability conditions (i.e. are either non-key workers, temporary, or their job is not teleworkable)

[9] A full list of our definition of key professions is provided in the appendix Table A.3 and can be accessed at the repository https://github.com/jacopoto/fm-migrant-key-workers. Note that both the Commission's and the National's definitions often refer to a finer ESCO four digits classification. ESCO is the European implementation of ISCO and therefore the two classifications can be easily mapped into each other. Our definition is thus necessarily broader than the original one. See Fasani and Mazza (2020b) for more information.

4. *Low*: this latter group includes key workers who have a permanent contract and a teleworkable occupation.

Table 1: Classification of Workers by Employment Risk Group

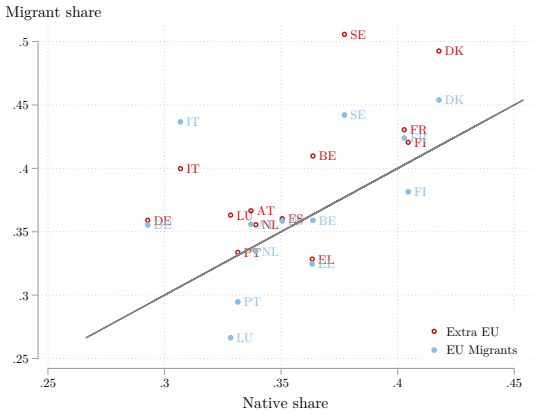
Job Characteristic:								
Key worker	✓	✓	✓	-	✓	-	-	-
Permanent Contract	✓	✓	-	✓	-	✓	-	-
Teleworkable Occupation	✓	-	✓	✓	-	-	✓	-
Risk category:	Low	Moderate			High			Very High

Note: The table reports our criteria to assign workers to different employment risk categories.

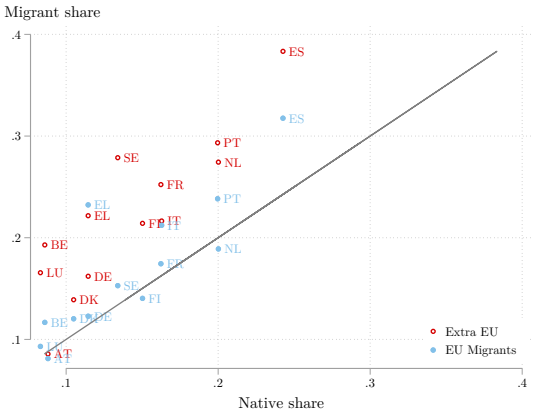
3.4 Pre-Pandemic Sorting into Job Characteristics

In this section, we describe the differential sorting at the onset of the pandemic of migrants and natives into the three job characteristics that we discussed in the previous section. Studying occupational sorting is particularly interesting in this context because only part of its consequences could be predicted in the pre-pandemic world by the workers involved. While the selection into temporary occupations leads to higher risk of employment termination under any circumstances, sorting along the other two dimensions (i.e. essentiality and teleworkability) had implications that became evident and relevant only after the pandemic started. Indeed, the distinction between essential and non-essential occupations was simply non-existent before the COVID-19 outbreak. Similarly, the degree of teleworkability of a given occupation was potentially observable but bore little relevance for the vast majority of workers, in light of the very limited diffusion of remote working arrangements before the pandemic. This *ex-ante* unpredictability makes any forecast on differential sorting of natives and migrants highly uncertain. We can reasonably expect migrants to be over-represented relative to natives in temporary occupations - since this type of jobs generally attract the most vulnerable categories of workers in the labor market - but we are unable to produce any unambiguous prediction on whether migrants were more or less represented in essential occupations and in teleworkable ones.

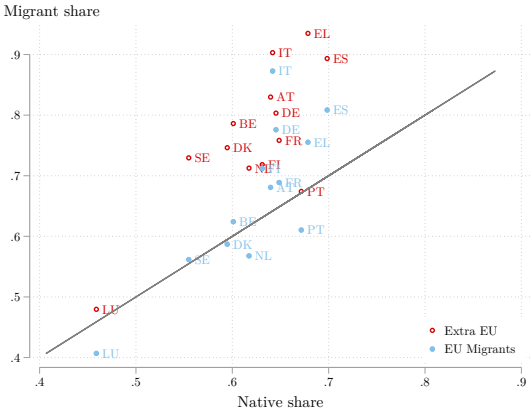
Figure 4: Share of Workers by Job Characteristic in 2019, by Host Country and Origin



(a) Key Workers



(b) Temporary Contracts



(c) Low Teleworkability

Note: The graphs report scatter plots of the share of EU or Extra EU migrants (blue and red dots, respectively; vertical axes) relative to the share of native workers (horizontal axes) which were employed: in key occupations (Panel 4a), on temporary contracts (Panel 4b) and in occupations with a teleworkability index below the .6 threshold (Panel 4c). 45 degree line in gray. Source: EU-LFS 2020.

To shed light on pre-pandemic sorting into occupational characteristics, we resort to the EU-LFS 2020 (survey year 2019), in order to observe the full population of workers before the first outbreak of COVID-19. In Figure 4 we report scatter plots of the shares of employment in key occupations (panel 4a), temporary contracts (panel 4b) and low-teleworkable jobs (panel 4c) for the two groups of migrants in comparison with native workers. Each dot represents a country in our sample: the shares for EU migrants are in light blue, while those for Extra EU migrants are in red. Panel 4a shows that, before the first outbreak of the COVID-19 pandemic, Extra EU migrants tended to be more concentrated in essential occupations than natives in all countries but Greece. The pattern is less neat for EU migrant workers, whose shares in essential occupations relative to native workers are scattered around the 45 degree line. On average, approximately 35% of native workers were in essential

occupations, increasing to 37% and 39% among EU and Extra EU migrants, respectively.[10] Panel 4b of Figure 4 focuses on the share of migrants employed with temporary contracts and contrasts it with the corresponding share among natives. The over-representation of migrant workers in temporary jobs is well illustrated by the fact that almost all points lie above the 45 degree line, and this migrant-native gap gets clearly larger for Extra EU than for EU migrants. Finally, Panel 4c of Figure 4 assesses the relative sorting of migrant and native workers in occupations characterized by low teleworkability. Somehow similarly to the previous panel on temporary contracts, we observe a large over-representation of Extra EU workers in this type of occupations relative to natives, while the relative gap for EU migrant workers appear more limited.

Overall, the pattern discussed in these graphs leads to ambiguous predictions regarding the relative exposure of migrants and natives to the risk of employment loss during the pandemic. On the one hand, the over-representation of migrants in key occupations would suggest that foreign workers may be more shielded from the negative consequences of the economic downturn. On the other hand, migrants' higher concentration in temporary and low-teleworkability jobs should make them more vulnerable to the risk of dismissal. Which of the two effects prevails in each EU-14 country will ultimately depend on the relative role played by each of these three job characteristics in determining employment risk and on the within-country correlation in the distribution of migrants along these three dimensions. In Appendix Table A.4, we report the distribution of natives, EU migrants and Extra EU migrants across employment risk groups, as defined in the Table 1 above. Consistent with the pattern observed in Figure 4, the distribution is similar for native and EU migrant workers, although the latter ones are slightly underrepresented in the lowest two risk groups (i.e. *low* and *moderate*) relative to natives. The distribution for Extra EU workers is instead more markedly shifted towards higher risk categories, although the difference is not large. In the next section, we will systematically assess the role of these job characteristics in predicting individual probabilities of experiencing an employment separation in 2020.

[10] On average, in 2019, one key worker out of five (20%) was a foreign born worker. Since immigrants account for 15.8% of employed workers in the area (EU mobile migrants account for 5.9% and Extra EU for 9.9%), they were clearly over-represented among key occupations. These figures are remarkably similar to estimates available for the U.S. which suggest that foreign born workers account for 19% of the U.S. workers in frontline key industries while making up approximately 17% of the employed workforce (Gelatt, 2020). We observe wide variation across countries in the share of immigrant key workers, being at about 5% in Finland and Greece, fluctuating around 20% in countries such as Italy, Belgium, Germany, Sweden, the U.K. and Austria and reaching 26% and 53% in Ireland and Luxembourg, respectively. See Fasani and Mazza (2020b) for a detailed description of key workers in EU countries.

4 Results

4.1 Main Results: Probability of Employment Separation

In Table 2, we report results from estimating regression equation (1) for the probability of employment separation in 2020. Estimates from our baseline specification, with individual controls and dummies for migrant status, are displayed in column 1. The positive coefficients on both migrant group indicators point at a substantially higher exposure of foreign born workers to employment risk: EU migrants face a 65% (1.7 p.p.) higher probability of employment termination relative to natives and the gap further increases for Extra EU migrants whose probability is twice as large (2.5 p.p.) than comparable natives. Women in our sample are 0.3 p.p. more likely to leave employment relative to men, which corresponds to an 11% higher probability relative to a baseline of 2.6%. The positive and strongly significant coefficient on the female dummy confirms previous findings in the literature on the disproportionate negative effect of the ongoing pandemic recession on women, which gave rise to the definition of "she-cession" (Albanesi and Kim, 2021; Alon *et al.*, 2021). Finally, the negative coefficients on middle and high education suggest that the risk of job separation has more intensively affected workers with low levels of human capital: workers with middle and with high levels of education are 46% (1.2 p.p.) and 84% (2.2 p.p.) less likely to become unemployed, respectively. This first set of results imply that migrants, women and low-educated individuals have disproportionately endured negative employment effects from the 2020 pandemic. The results also underscore the double penalty that migrant women where subject to. The combined effect of the gender and migrant gap translated into a probability of job termination which was more than twice that of native men. In columns 2 to 4 of Table 2, we alternatively include the three job characteristics - i.e. key occupation, temporary contract and low teleworkability - that we have discussed in section 3.3. The estimated coefficients on these three variables are all statistically significant and display the expected sign: being a key worker reduce the job loss probability by 23% (0.6 p.p.) while having a temporary contract and being employed in a non-teleworkable occupations imply large increases in job loss hazard. The effect is particularly large for temporary workers (8.3 p.p., higher), but it is also sizeable for low teleworkable occupations (0.9 p.p. or 35% relative to the baseline). Finally, in column 5 we jointly condition on all three job characteristics at the same time: the estimated coefficients remain virtually unaffected in both size and statistical significance compared to columns 2-4, implying that each feature captures a distinct and independent dimension of occupational heterogeneity. The inclusion of these controls for job characteristics tends to reduce the estimated gaps between migrants and natives - and between women and men - suggesting that differential sorting into occupations may partially explain the disadvantage migrants and women face in their exposure to the pandemic.

Table 2: Probability of Job Separation in 2020

	(1)	(2)	(3)	(4)	(5)
Migrants:					
-EU	0.017***	0.018***	0.015***	0.016***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
-Extra EU	0.025***	0.026***	0.022***	0.024***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Women	0.003***	0.003***	0.002***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Middle education	-0.012***	-0.012***	-0.008***	-0.010***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High education	-0.022***	-0.021***	-0.020***	-0.016***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Key worker in 2019		-0.006***			-0.008***
		(0.000)			(0.000)
Temporary contract in 2019			0.083***		0.083***
			(0.002)		(0.002)
Low teleworkable job in 2019				0.009***	0.010***
				(0.000)	(0.000)
Constant	0.034***	0.036***	0.026***	0.026***	0.020***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Country FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Obs.	480,219	480,219	480,219	480,219	480,219
R^2	0.014	0.015	0.033	0.015	0.034
Mean of Y	0.026	0.026	0.026	0.026	0.026

Note: In this table, we regress an indicator variable for having lost a job during year 2020 on a set of individual covariates. Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

In Table 3, we further explore the role of job characteristics and sorting into industries in explaining the differential exposure to employment termination risk. We do so by using the employment risk index that we discussed in section 3.3 - which summarizes our three occupational dimensions of interest - and by alternatively conditioning on fixed effects for

industry, occupation and the combination of the two. We hold the sample constant throughout the specifications to allow comparability with column 1, where we report the estimates from the baseline specification. In column 2, we include our proposed employment risk index. The estimated coefficient, positive and strongly significant, suggests that one unit increase in the index implies a 2 p.p. increase in the probability of job loss in 2020, for an index that varies between 0 (low risk) and 3 (very high risk). The inclusion of the risk index in the regression implies approximately a 10% reduction in both coefficients on the migrant dummies, suggesting that the higher exposure to job loss of migrants is partially explained by the sorting into more risky occupations. We then alternatively include fixed effects for industry, occupation, and the combination of the two (columns 3-5). A more substantial reduction in these coefficients is visible in column 3, when we include industry fixed effects. Accounting for sorting into "risky industries" accounts for 30 to 40% of the immigrant gaps estimated in the baseline specification reported in Column 1. The addition of occupation fixed effects in column 4 actually increases the EU migrants gap while leaving the coefficient for Extra EU migrants unaffected. Finally, in column 5 we fully account for selection in industry and occupations together with our exposure index. Note that the exposure index is still identified because of variation in temporary contracts within industry/occupation cells, while both the key worker and low teleworkability features are fully absorbed by the occupation fixed effects. This extended model is able to capture about half of the gap that we estimate in the baseline model leaving the other half unexplained. Interestingly, the gender gap estimated in Table 3 displays a very different pattern with respect to the migrant gaps: not only it increases when the employment risk index is included (column 2) but it then completely vanishes once sorting into occupation is taken into account (column 4).

Our discussion about the contribution of each group of covariates to shrinking rather than widening the migrant-native gap in the probability of employment separation may depend on the specific sequential inclusion of controls that we follow. In order to deal with path-dependency, we perform an order-invariant decomposition proposed by Gelbach (2016). The results we obtain from this decomposition clearly suggest that the order matters and, in our case, leads to an underestimation of the role played by occupational characteristics. In Table 4, we compare the estimated gaps in the baseline model in Column 1 and the full model in Column 5 of Table 3 for both migrant groups. The first raw of the table shows the explained gap, i.e. the estimated drop in the gap after the inclusion of the exposure index, industry and occupation dummies. Both drops are statistically significant and of similar size: 0.009 for EU migrants and 0.011 for Extra EU migrants. We then decompose these explained gaps into the changes implied by the inclusion of three groups of controls: i) employment risk index; ii) industry FEs; iii) Occupation FEs. For both EU and Extra EU migrants, the employment risk index and the industry FEs each account for approximately 50% of the explained migrant-native gap in probability of job separation, while occupations FEs play a minor role.

Table 3: Probability of Job Loss in 2020: Employment Risk Index and Sorting

	(1)	(2)	(3)	(4)	(5)
Migrants:					
-EU	0.018***	0.016***	0.010***	0.012***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
-Extra EU	0.025***	0.023***	0.017***	0.017***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Women	0.003***	0.005***	0.002***	-0.000	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Middle education	-0.012***	-0.008***	-0.005***	-0.004***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High education	-0.022***	-0.006***	-0.003***	-0.006***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Employment risk index		0.021***	0.020***	0.051***	0.051***
		(0.000)	(0.000)	(0.001)	(0.001)
Constant	0.034***	-0.002*	-0.001	-0.042***	-0.042***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Country FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Industry FE			✓		✓
Occupation FE				✓	✓
Obs.	477,694	477,694	477,694	477,694	477,694
R^2	0.014	0.022	0.032	0.034	0.040
Mean of Y	0.026	0.026	0.026	0.026	0.026

Note: In this table, we regress an indicator variable for having lost a job during 2020 on a set of covariates. Robust standard errors in parentheses:***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

Table 4: Gelbach (2016) Decomposition of the Explained Gap

	EU Migrants		Extra EU Migrants	
	Δ Coeff.	% Expl.	Δ Coeff.	% Expl.
Total	**0.009****		**0.011****	
	(0.000)		(0.000)	
Employment risk index	0.005**	55	0.005**	45
	(0.000)		(0.000)	
Industry FEs	0.005**	55	0.006**	55
	(0.000)		(0.000)	
Occupation FEs	-0.001**	-10	0.001*	5
	(0.000)		(0.000)	
Obs.	477,694		477,694	

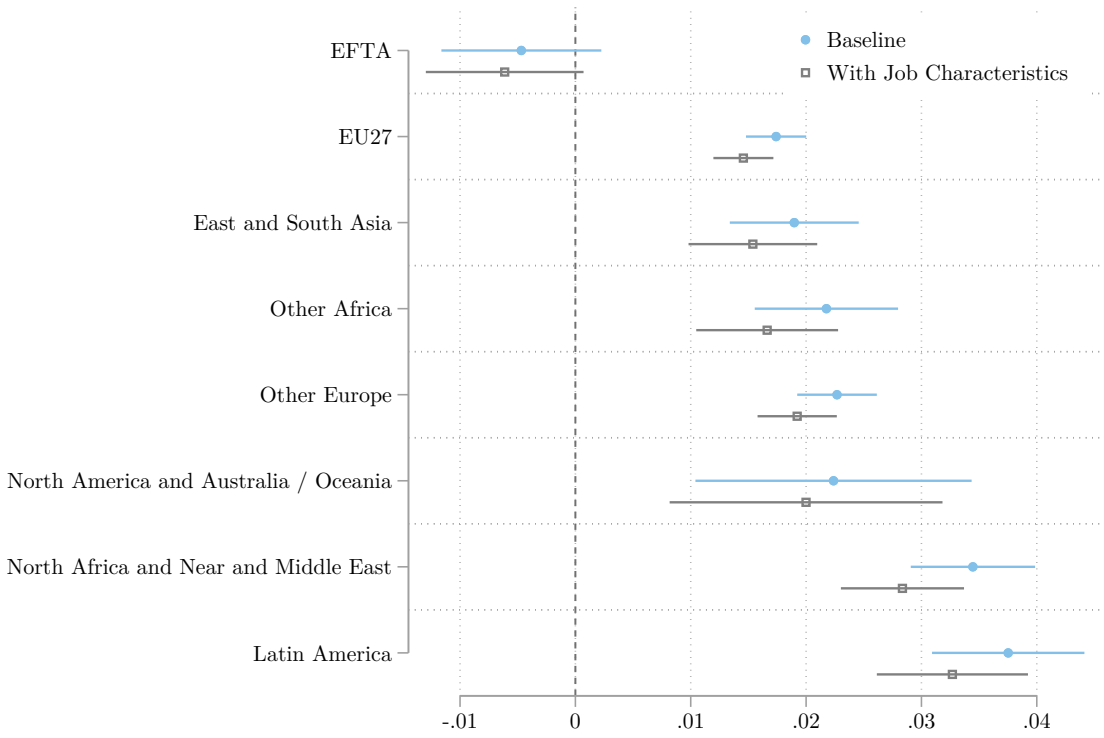
Note: The table reports estimates from a Gelbach (2016) decomposition of the explained gaps for EU and Extra EU migrants reported in Table 3. The baseline specification corresponds to column 1 in Table 3 and the full specification - which conditions on the employment risk index, industry and occupation fixed effects - corresponds to column 5 in Table 3). Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively

4.2 Further Results

4.2.1 Heterogeneous Effects by Area of Origin

Since the Extra EU migrants are a highly heterogeneous group, we can disaggregate them into finer macro-areas of origin to identify which migrant groups were mostly affected by the pandemic. We adopt the most detailed break-down of origin areas that is available in the EU-LFS data: this allows us to distinguish Extra EU migrants into seven groups (EFTA, Other Europe, North Africa and Near/Middle East, Other Africa, East and South Asia, Latin America, North America and Australia/ Oceania) while EU migrants cannot be further disaggregated. In Figure 5 we report the coefficients for each macro-area from estimating specifications with baseline controls and with job characteristics (column 1 and 5 of Table 2, respectively). All migrant groups - with the exception of those from EFTA countries - experienced a significantly higher probability of job separation than natives: we estimate the smallest gap for EU27 nationals and the largest for migrants from North Africa, the Middle East and Latin America, reflecting their well known vulnerabilities that predate the pandemic. In all cases, controlling for job characteristics tends to reduce the estimated native-immigrant gaps.

Figure 5: Migrant-Native Gap in Probability of Job Loss, by Macro Region of Origin



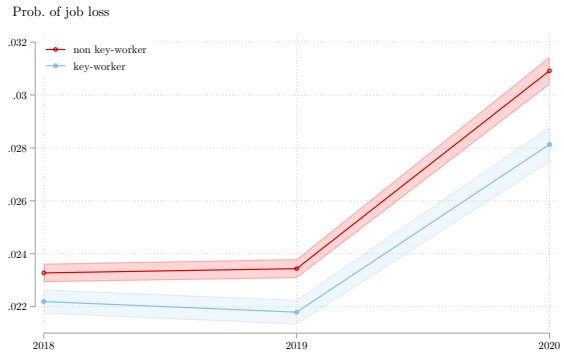
Note: Each dot represents the estimated coefficient on a macro-region of origin dummy from a LPM regression of the probability of employment separation. The specifications are as in column 1 ("baseline") and column 5 ("with job characteristics") of Table 2. The bars represent the 95% confidence intervals. Standard errors robust to heteroskedasticity. EFTA countries are: Iceland, Liechtenstein, Norway and Switzerland.

4.2.2 Predicting Employment Separations in Pandemic and Pre-Pandemic Years

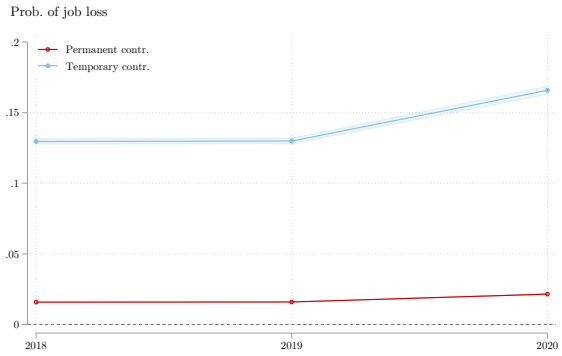
We argued in section 3.4 that sorting into the three occupational dimensions which are the focus or our study implied consequences during the pandemic that were only partially predictable before the first COVID-19 contagion wave started. Indeed, while being on a temporary contract always exposes workers to higher job separation hazard, being in an essential occupation or in a non-teleworkable job did not necessarily imply any differential employment risk for workers in a pre-pandemic labor market. We investigate this conjecture by assessing to which extent the ability of these three occupational characteristic to predict employment separations changed after the pandemic started. In order to do so, we repeat the same empirical exercise discussed so far for the two years before 2020. Using previous waves of the EU-LFS, we focus on workers who were employed at the beginning of each year (in 2018, 2019 and 2020) and estimate the effect of being in a key occupation, having

a temporary contract and holding a low teleworkable job on the probability of employment separation during the year of reference.

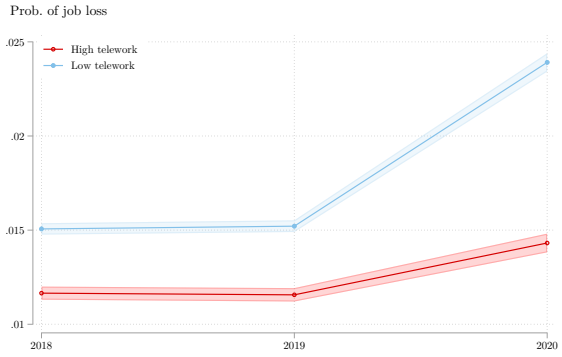
Figure 6: Predicted Probability of Job Separation by Job Characteristic, by Year (2018-2020)



(a) Key Workers



(b) Temporary Contracts



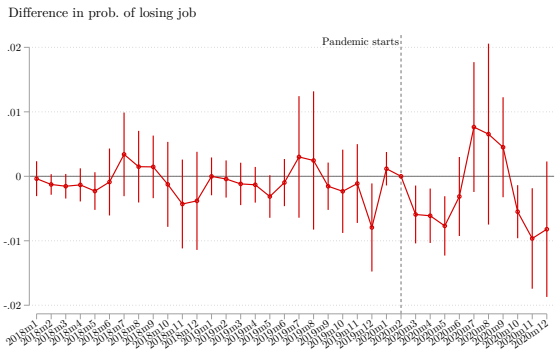
(c) Low Teleworkability

Note: The figure reports the predicted probability of job loss for the three job characteristics in 2018, 2019 and 2020. The coefficients are estimated using the 2019, 2020 and 2021 waves of the EU-LFS, with a model similar to our baseline augmented by the inclusion of interaction terms between a year indicator and an indicator for job characteristic. The shaded areas represent the 95% confidence interval. Standard errors robust to heteroskedasticity.

Panel 6a shows that the predicted probability of job separation is fairly flat in 2018 and 2019 for both key and non-key workers, whilst it sharply increases for both groups in 2020. Albeit the estimates imply a slightly higher job loss probability for non-key workers than for key workers in both 2018 and 2019, the gap tripled in 2020 when being an essential worker significantly reduced the exposure to employment termination risk. Panel 6b clearly points at workers with temporary contracts having a substantially higher probability of job loss than workers in open ended contracts in both 2018 and 2019, but the gap clearly widens in 2020. Notably, the profile for non-temporary workers remains flat in the first year of the pandemic, while that of temporary workers becomes substantially steeper, implying that the pandemic-induced employment losses were concentrated almost exclusively on this latter group. Finally, panel 6c focuses on the effect of being employed in occupations that are not amenable to remote working. The estimates for 2018 and 2019 show that low teleworkable occupations implied a higher probability of job loss than more teleworkable jobs - possibly because these

occupations are often relatively low skilled - although the difference is small and flat across the two years. In 2020, instead, we observe an increase in the job loss probability for both types of occupations, but the effect is far stronger on the low teleworkable ones, which confirms the evidence on this feature having taken central stage in predicting employment uncertainty in the pandemic.

Figure 7: Difference in Probability of Job Separation by Job Characteristic, by Month



(a) Key Workers

(b) Temporary Contracts

(c) Low Teleworkability

Note: The figure reports the difference in the probability of job loss for the three job characteristics by reference month compared to January 2020. The coefficients are estimated in a model similar to our baseline augmented by the inclusion of interaction terms between a reference month indicator and an indicator for job characteristic. The bar represent the 95% confidence interval. Standard errors robust to heteroskedasticity.

We take a closer look at these effects in Figure 7. In this figure, we report an event-study type graph where we compare the difference in the probability of job loss between workers with and without one of our three job characteristics of interest before and after February 2020 (which marks the outbreak of the pandemic in Europe). The coefficients displayed are obtained from a regression similar to that on which we based figure 6, but we now estimate month-specific coefficients instead of yearly ones. Note that all graphs in Figure 7 study the probability of being unemployed in each month conditional on having been in employment at the start of each year: if positive, the effect of a job characteristic thus tend to cumulatively increase during the year (determining the upward trend that we clearly observe in both Panel 7b and Panel 7c). Panel 7a shows that the job loss probabilities of key

and non-key workers were moving in parallel before the pandemic started. In both the first (spring 2020) and the second (autumn 2020) wave of the pandemic, instead, key workers had a statistically significant lower probability of job separation. On the contrary, the difference in the probability of job losses between temporary and non-temporary occupations displays a similar pattern across the years, although the effect becomes larger in 2020. Finally, the differences between occupations characterized by different degree of teleworkability is higher for occupations hard to telework in 2018 and 2019, but the effect has grown substantially larger over the months after the first pandemic outbreak in February 2020 (Panel 7c).

4.2.3 Heterogeneous Effects of Occupational Characteristics

After having shown that pre-pandemic sorting into key, temporary and low-teleworkable jobs significantly affected employment separation hazard in 2020, we now assess whether these characteristics produced differential effects for natives and migrants. We do so by interacting job characteristics and migrant dummies and we report our estimates in Table 5. According to these estimates, being employed in an essential occupation is associated to an additional decrease in job loss risk for EU migrants only - whose size equals that of the main effect - while the effect is not statistically different for natives and Extra Eu migrants (column 1). Also, EU migrants enjoyed a slightly lower job loss hazard associated to being on a temporary contract than natives and Extra EU migrants (column 2). As far as the degree of teleworkability is concerned, we find that migrants suffered a large additional penalty from having sorted into jobs that are not amenable to remote working. According to our estimates, being in a low-teleworkable occupation at the onset of the pandemic implied a probability of employment separation that was 2.1 times for EU migrants, and 2.4 times for Extra EU migrants, higher than for natives (column 3). This result might have implications for the future of migrants' employment in Europe. If the share of jobs done from home is bound to grow in the future (see Barrero *et al.* (2021), for example), migrants' employment might suffer from the combined effect of their high share in a declining segment of the labor market and their higher propensity to be dismissed within those occupations.

We further explore native-migrant differential effects of occupational characteristics by using the employment risk index discussed above (see section 3.3. We do so by including interaction terms between origin dummies and dummies for each level of the employment risk index. Estimated coefficients for these interaction terms for natives, EU migrants and Extra EU migrants are reported in Appendix Figure A.2. The graphs shows that the effect of the risk index on the probability of being laid off increases linearly between 0 and 2 and then suddenly becomes steeper when the index takes value 3. Workers who were employed at the start of year 2020 in jobs that were vulnerable on all the three dimensions (i.e. *essentiality*, *temporariness* and *teleworkability*) faced a probability of becoming unemployed that was 2.5-4 times larger than that experienced by workers who were exposed on just two or one of those dimensions. The graph also points at a stronger effect of the employment risk index on migrants - Extra EU migrants in particular - at all levels of risk but the highest one.

At this level, the impact of having a "risky job" does not seem to differentiate natives from migrants.

Table 5: Probability of Job Separation in 2020: Migrant-Native Differential Effects of Job Characteristics

	(1)	(2)	(3)
Migrants:			
-EU migrant	0.020***	0.017***	0.010***
	(0.002)	(0.001)	(0.002)
-Extra EU migrant	0.027***	0.022***	0.015***
	(0.002)	(0.001)	(0.002)
Key worker × EU migrant	-0.005**		
	(0.003)		
Key worker × Extra EU migrant	-0.003		
	(0.002)		
Temporary contract in 2019 × EU migrant		-0.015**	
		(0.007)	
Temporary contract in 2019 × Extra EU migrant		-0.002	
		(0.005)	
Low teleworkable job in 2019 × EU migrant			0.009***
			(0.002)
Low teleworkable job in 2019 × Extra EU migrant			0.011***
			(0.002)
Key worker	-0.005***		
	(0.000)		
Temporary contract in 2019		0.084***	
		(0.002)	
Low teleworkable job in 2019			0.008***
			(0.000)
Obs.	480,219	480,219	480,219
R^2	0.015	0.033	0.015

Note: In this table, we regress an indicator variable for having lost a job during 2020 on a set of individual covariates. Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively. All regressions include sex, education, age and country dummies.

Table 6: Additional Outcomes: Hours Worked and Labor Income

	Hours Worked				*Top Half Income*	
	(1)	(2)	(3)	(4)	(5)	(6)
Migrants:						
-EU migrants	0.416***	0.460***	0.960***	0.943***	-0.101***	-0.092***
	(0.116)	(0.116)	(0.113)	(0.113)	(0.004)	(0.004)
-Extra EU	-0.682***	-0.636***	0.082	0.064	-0.131***	-0.122***
	(0.087)	(0.087)	(0.084)	(0.084)	(0.003)	(0.003)
Woman	-5.782***	-5.819***	-5.851***	-5.836***	-0.253***	-0.263***
	(0.046)	(0.046)	(0.045)	(0.045)	(0.002)	(0.002)
Middle education	1.271***	1.184***	0.956***	0.991***	0.206***	0.181***
	(0.065)	(0.065)	(0.063)	(0.064)	(0.002)	(0.002)
High education	2.682***	2.343***	2.074***	2.210***	0.503***	0.416***
	(0.071)	(0.076)	(0.070)	(0.074)	(0.002)	(0.002)
Employment risk index		-0.460***		0.185***		-0.115***
		(0.036)		(0.035)		(0.001)
Constant	30.667***	31.443***	31.735***	31.425***	0.438***	0.632***
	(0.060)	(0.085)	(0.058)	(0.083)	(0.002)	(0.003)
Country FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓
Obs.	477,156	477,156	464,589	464,589	283,800	283,800
R^2	0.040	0.041	0.043	0.043	0.229	0.251
Mean of Y	29.241	29.241	30.032	30.032	0.551	0.551

Note: Columns 1 and 2 report a regression of hours effectively worked in the reference week on a set of covariates. Columns 3 and 4 report regression results of the probability of earning an income in the top half of the income distribution on the same set of covariates. Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

4.3 Additional Outcomes: Hours Worked and Labor Income

As displayed in Figure 2b above, European workers experienced a sharp reduction in hours worked in the first months of the pandemic, followed by an equally fast recovery before the summer 2020, and then by fluctuations that mirrored those of the pandemic intensity. The figure also points at relatively minor differences in the trend of hours worked between natives

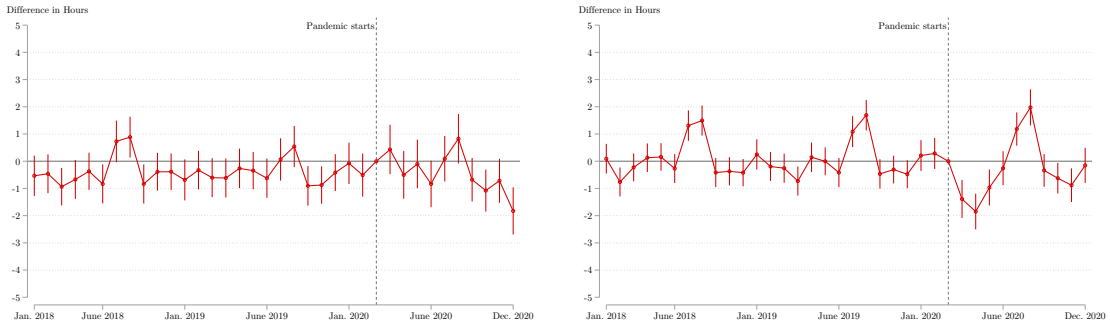
and migrants. In this section, we take a closer look at migrant-native gaps in hours worked in 2020 and, in addition, we study labor income. We explore how these two variables were affected by the pandemic and compare their evolution in 2020 to that observed in the last two pre-pandemic years. Our empirical analysis is based on a set of regressions similar to equation (1), where we replace the dependent variable *JobSep* with hours worked in the week before the interview and with an indicator dummy for belonging to the top half of the labor income distribution.[11] The sample - i.e. respondents who were employed at the beginning of the year and whose occupation characteristics could be observed at that point - is the same as the one used so far.

We present our estimation results in Table 6. The first four columns focus on hours worked while the last two on workers' position in the income distribution. When looking at hours worked, we first use the full sample (columns 1-2), and then restrict it to individuals who were employed at the time of the interview (columns 3-4). In the first case, we consider both the extensive and intensive margin of employment, while in the second we focus exclusively on the latter. For each outcome, we first estimate models that do not condition on the employment risk measure (odd columns) and then specifications which include this index (even columns). Columns 1-2 in Table 6 show that EU migrants have worked, on average, 0.4 more hours per week than natives. The effect gets larger (0.9 hours) once we concentrate exclusively on the intensive margin (columns 3-4), implying that EU migrants were more likely to leave employment than natives in 2020 (as shown in section 4.1), but they worked almost one hour more per week conditional on remaining employed. The pattern is quite distinct for Extra EU migrants: overall, they worked 0.6 less hours per week than natives (column 1-2) and the effect is entirely driven by the extensive margin, showing a non-significant difference in hours worked for those who remained in employment (columns 3-4). These yearly average gaps mask substantial month-to-month variation, as shown in Figure 8. Using data from the 2019, 2020 and 2021 EU-LFS (survey years 2018 to 2020), in these figures we report the coefficients - and corresponding robust standard errors - of a month-origin interaction term in regressions similar to those presented in Table 6. We take as reference February 2020, the last pre-pandemic month, so that all coefficients need to be interpreted as changes relative to this month. In Figure 8a we see that if we compare the two preceding years to February 2020, EU migrants tended to work fewer hours than natives, but the difference always hovered around zero and only in a handful of months it was statistically significant. The difference remained close to zero in the first months of 2020, but became larger, negative and statistically significant in the autumn of 2020 in correspondence of the breakout of the second COVID-19 wave in Europe. For Extra EU migrants (Figure 8b) we observe no significant pre-pandemic differences with natives in most months, with the notable exception of the summer months, when they usually work more hours than natives. This has to do on the one hand with the increase in work intensity for a, predominantly Ex-

[11] The EU-LFS records only income deciles for each respondent, not the exact amount. Income is defined as monthly take home pay from main job. Information on labor income is not available in Austria, Germany, Spain and Sweden, reducing our sample size to approximately 283,000 observations.

tra EU, seasonal workforce employed in agriculture and hospitality, and, on the other, with the concurrent holiday period enjoyed by native workers. As the pandemic erupts, Extra EU migrants suffer larger losses at the intensive margin compared to natives. In the spring of 2020 we estimate an Extra EU migrants-natives gap between one and two hours worked per week. As usual, however, the gap reverted in the summer.

Figure 8: Difference in Hours Worked by Month, Migrants vs. Natives



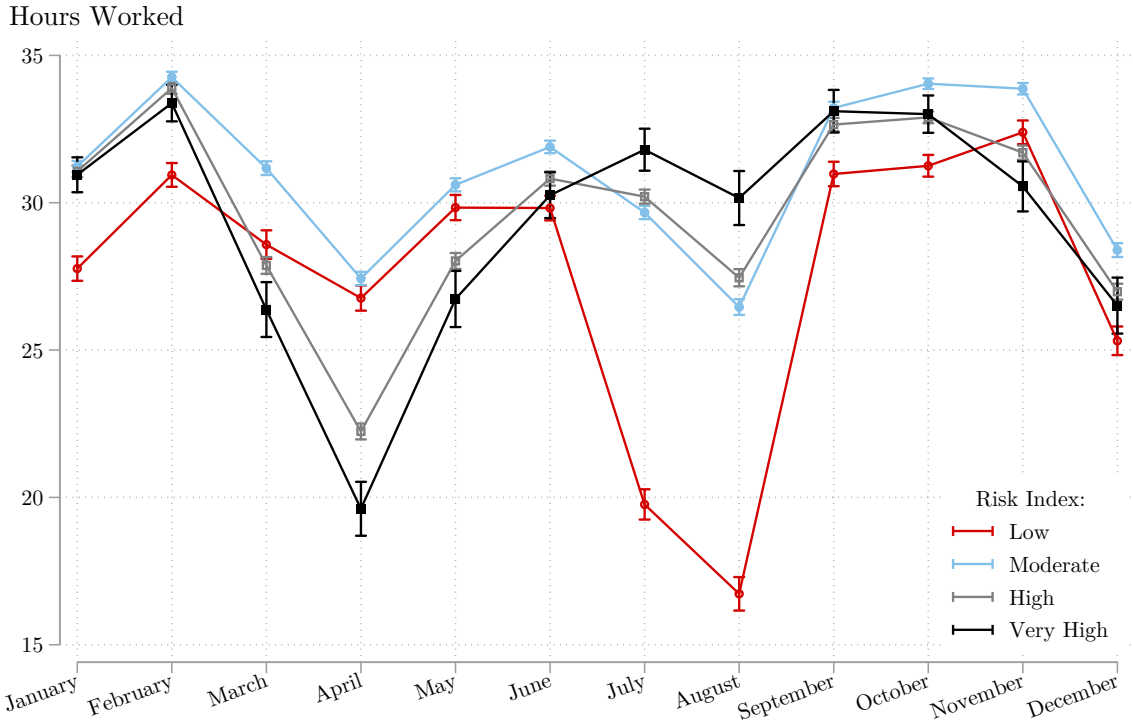
(a) EU Migrants (b) Extra EU

Note: The figure reports the difference in hours worked by reference month compared to January 2020. The coefficients are estimated in a model similar to our baseline augmented by interacting the origin dummies with the reference month. The bars represent the 95% confidence intervals. Standard errors clustered by country.

We now focus on the effect of the pre-pandemic sorting - as measured by the employment risk index - on hours worked. As Table 6 shows, the estimated coefficient on the employment risk index is negative and significant when we consider the full sample (column 2), a finding which is consistent with the positive effect on the probability of employment separation that we document in Table 3. The coefficient turns positive - and remains significant - when we focus on the intensive margin (columns 3-4): conditional on not having experienced a job separation, being placed in a high employment risk category implied an increase in hours worked in 2020. To understand this somehow surprising result, we study the effect of the employment risk index on hours worked in each month of 2020 in Figure 9. The reported estimates - obtained from interacting each risk category with month dummies and then predicting hours worked - clearly show that our employment risk index accurately captures the sudden drop in hours worked at the onset of the Covid-19 crisis - when severe lockdown measures were imposed throughout Europe between February and April 2020 - and the far stronger negative effect on workers belonging to the two highest risk groups (i.e. "very high" and "high"). All groups recovered in May and June, but those belonging the low risk group displayed a large drop in July and August and then caught-up with the other groups after the summer. Being in a low risk occupation thus prevented a strong fall in hours at the onset of the pandemic and, at the same time, allowed workers to enjoy longer holidays

over the summer. Those in "high risk" occupations faced instead large initial reductions in hours but then worked longer hours over the rest of the year, clearly acting as "buffer employment" in the pandemic.

Figure 9: Predicted Hours Worked in 2020, by Employment Risk Category



Note: The dots represent weekly hours worked in 2020 predicted via a model similar to that displayed in column 4 of Table 6, where reference month dummies are interacted with dummies for each employment risk category. The bar represent the 95% confidence intervals.

Finally, in Table 6 we analyze labor income dynamics in 2020 and study the probability of belonging to the top half of the income distribution (columns 5-6). As expected, we estimate a negative income gap for migrants relatives to natives, which is smaller for EU migrants (10 percentage points lower probability of belonging to the top half of the income distribution) than for Extra EU migrants (13 percentage points lower probability). The gap marginally shrinks for both migrant groups when we account for their pre-pandemic sorting into employment risk (column 6). Unsurprisingly, higher employment risk is associated with a lower probability of earning an income in the top half of the income distribution: each step in the risk index decreases this probability by about 11 percentage points.[12] Taken together with the previous results on hours worked, our findings on labor income imply that

[12]Using data from the 2019, 2020 and 2021 EU-LFS (survey years 2018 to 2020), in Appendix Figure A.3

employed migrant workers in Europe suffered larger income losses relative to comparable natives despite working a similar - or even larger - amount of hours than native workers.

5 Policy Discussion and Concluding Remarks

Drawing from the most recent release of harmonized micro-data on European labor markets covering the continent in the first year of the pandemic, in this paper we focus on the labor market impact of the pandemic on migrant workers in EU14 countries. We find that migrant workers, especially those born outside of the European Union, have suffered larger employment losses than natives. After accounting for differences in observable socio-demographic characteristics, we estimate that the probability of job separation in 2020 for Extra EU migrants was almost twice as large as that of natives. In the case of Latin American, North African and Middle Eastern workers, the difference was even larger, approaching 2.5 times. We estimate a smaller gap for EU migrants, whose probability of leaving employment was 1.6 times larger than that of comparable natives. We also estimate a double penalty for migrant women who had to face high probabilities of job terminations as a consequence of their sex and origin. In trying to identify the source of this disparity we focus on three job characteristics that have been identified as salient in the COVID-19 crisis: whether the worker is employed in a key occupation, holds a permanent contract, and is employed in a job which is amenable to distance working. We show that these job characteristics significantly affect the probability of job loss and are relevant in explaining the European labor market dynamics in 2020. We estimate that pre-pandemic sorting into these job characteristics account for around 50% of the explained native-migrants gaps in the risk of employment termination; the other half being accounted by differential sorting into industries. Even within narrow occupation/industry cells, however, more than half of the difference in job separation probabilities remains unexplained.

The picture we draw of the impact of the COVID-19 pandemic on migrants workers in Europe is more nuanced than one could have anticipated at its very start. Migrants have certainly lost ground relative to natives in 2020, but their fall has been halted by a quick recovery that was already felt in the second half of 2020. At the onset of the crisis, migrants' prospects looked extremely dire. In 2020, the World Bank predicted that remittance flows to low- and middle-income countries (LMICs) would have declined by 7.2 per cent (minus $ 40 billion) in 2020, followed by a further decline of 7.5 per cent (minus $ 40 billion) in 2021 (World Bank, 2020a). What actually happened to global remittances was a remarkable resilience of flows in the second half of 2020 which almost fully compensated for the contraction suffered during the first half of the year: overall, remittances flows in 2020 declined by a modest 1.7 percent in the face of one of the deepest global recessions ever

we repeat the same analysis presented for hours worked in Figure 8, but we now focus on the probability of earning incomes in the top half of the income distribution. For both groups of migrants a positive, and mostly significant, pre-pandemic trend disappears as the pandemic erupts.

observed. In 2021, the World Bank upward revised its forecast of remittance flows to low- and middle-income countries (LMICs), which are expected to reach $589 billion in 2021, a 7.3 percent increase over 2020 (World Bank, 2021). Echoing these initial concerns, the urgency of implementing measures to support migrant workers during the pandemic crisis was advocated by organizations such as the World Bank (2020b) and the OECD (2020).

Recognizing the severity of the shock, European governments have implemented a series of interventions aiming at cushioning the worst consequences of it. In addition to generous fiscal stimuli and accommodating monetary policies, virtually all of them have deployed one kind or another of joint retention schemes (JRS) to avert severe labor market contractions (Gruss *et al.*, 2022). These schemes took on different forms depending on the country, ranging from blanket bans on economic layoffs (e.g. in Italy, Greece and Spain) to adjustments to the unemployment benefit system (e.g. in Belgium, Ireland and Sweden). JRS were mostly available to natives, EU and Extra EU migrants alike, but some additional interventions were targeted at migrants and migrant workers, specifically.[13] For example, in most European countries foreign born workers were offered longer periods of job search in case of dismissal before withdrawing their residence permits: in Italy, Portugal and Spain, for instance, residence permits for third country citizens were extended automatically. In case of loss of income, even though having sufficient means of subsistence remained a precondition for the renewal of residence permits, a certain degree of flexibility was introduced. European governments also tried to facilitate migrants' access to healthcare during the pandemic by removing some of the existing barriers. In many EU countries, governments launched information campaigns aimed at increasing foreign citizens' awareness about their entitlement to healthcare access. At the same time, undocumented migrants were offered more access to emergency health care services.

As we show in this paper, employment rates in Europe have fallen, but at a lower rate than in the US. Migrants have suffered larger losses than natives, they have served as a form of "buffer" employment at the height of the crisis, when their employment and hours worked where slashed promptly, but they recovered quickly once containment measures were gradually lifted. This evidence seems to suggest that, even though costly, these schemes have helped European labor markets averting a far deeper contraction. The quick rebound is a good indication that the "scarring" effect of the COVID-19 recession should be minor. On the other hand, we also uncover that in occupations where working from home is difficult, migrants have suffered disproportionate losses. As many commentators suggest that the share of jobs done from home will grow in the future (Barrero *et al.*, 2021), this phenomenon might pose a threat to migrants employment prospects for the medium and long run. Focusing on the present, though, our findings imply that migrant workers in Europe would have experienced vastly more negative consequences than natives had the economic contraction lasted longer.

[13]See EMN/OECD (2020) and EMN/OECD (2021) for detailed reviews of interventions in support of migrants in EU and other OECD countries

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Appendix A Appendix Tables

Table A.1: Table of Descriptives

(a) First Set of Countries

	AT	BE	DE	DK	ES	FI	FR
Became unemployed in 2020	0.03	0.02	0.01	0.02	0.05	0.03	0.03
	(0.17)	(0.13)	(0.10)	(0.15)	(0.22)	(0.16)	(0.16)
Women	0.47	0.50	0.48	0.50	0.50	0.50	0.52
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Education:							
Low education	0.12	0.14	0.11	0.13	0.28	0.05	0.15
	(0.33)	(0.34)	(0.32)	(0.33)	(0.45)	(0.22)	(0.35)
Middle education	0.71	0.39	0.57	0.48	0.38	0.54	0.59
	(0.46)	(0.49)	(0.50)	(0.50)	(0.48)	(0.50)	(0.49)
High education	0.17	0.47	0.32	0.40	0.34	0.41	0.26
	(0.37)	(0.50)	(0.47)	(0.49)	(0.47)	(0.49)	(0.44)
Origin:							
-Natives	0.81	0.82	0.87	0.91	0.90	0.96	0.90
	(0.40)	(0.39)	(0.34)	(0.29)	(0.30)	(0.19)	(0.30)
-EU	0.09	0.09	0.05	0.03	0.03	0.02	0.03
	(0.29)	(0.29)	(0.22)	(0.17)	(0.16)	(0.15)	(0.16)
-Extra EU	0.10	0.09	0.08	0.06	0.07	0.02	0.07
	(0.30)	(0.29)	(0.28)	(0.24)	(0.26)	(0.13)	(0.26)
Obs.	65,132	12,604	45,964	33,453	28,074	6,716	34,377

Table A.1: Table of Descriptives, continued.

(b) Second Set of Countries and Total

	EL	IT	LU	NL	PT	SE	Total
Became unemployed in 2020	0.03	0.03	0.02	0.01	0.03	0.02	0.03
	(0.17)	(0.17)	(0.12)	(0.07)	(0.18)	(0.14)	(0.16)
Women	0.47	0.48	0.48	0.49	0.53	0.49	0.49
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Education:							
Low education	0.15	0.28	0.16	0.14	0.42	0.08	0.20
	(0.36)	(0.45)	(0.37)	(0.34)	(0.49)	(0.27)	(0.40)
Middle education	0.46	0.49	0.39	0.41	0.30	0.53	0.50
	(0.50)	(0.50)	(0.49)	(0.49)	(0.46)	(0.50)	(0.50)
High education	0.39	0.23	0.45	0.46	0.28	0.39	0.30
	(0.49)	(0.42)	(0.50)	(0.50)	(0.45)	(0.49)	(0.46)
Origin:							
-Native	0.91	0.86	0.50	0.93	0.91	0.86	0.87
	(0.28)	(0.35)	(0.50)	(0.25)	(0.29)	(0.35)	(0.34)
-EU	0.02	0.04	0.39	0.02	0.02	0.04	0.05
	(0.12)	(0.21)	(0.49)	(0.13)	(0.15)	(0.19)	(0.21)
-Extra EU	0.07	0.10	0.10	0.05	0.07	0.10	0.08
	(0.26)	(0.30)	(0.31)	(0.22)	(0.26)	(0.31)	(0.28)
Obs.	35,283	126,840	3,528	26,179	38,397	23,672	480,219

Note: Standard deviations in parentheses.

Table A.2: Reason for Job Termination in 2020

	.
Dismissed or made redundant	0.20
	(0.40)
A job of limited duration has ended	0.30
	(0.46)
Looking for children or incapacitated children	0.03
	(0.16)
Other personal or family responsibilities	0.02
	(0.15)
Own illness or disability	0.09
	(0.29)
Education or training	0.05
	(0.21)
Early retirement	0.06
	(0.25)
Normal retirement	0.12
	(0.32)
Compulsory military or community service	0.00
	(0.04)
Other reasons	0.13
	(0.33)
Obs.	155,002

Note: The table displays the share of workers who have left their previous employment in 2020 by reason of job termination. Standard deviations in parentheses.

Table A.3: Key Workers Occupations

ISCO-08 2 digits	**ISCO-08 3 digits**
Science and Engineering Prof.	Life science professionals Engineering professionals
Health Professionals	Health professionals Medical doctors Nursing and midwifery Traditional and compl. medicine Paramedical practitioners Other health professions
Teaching Professionals	University and higher education teachers Vocational education teachers Secondary education teachers Primary school and early childhood teachers Other teaching professionals
ICT Professionals	Information and communication technology Software and applications developers Database and network professionals
Science & Eng. Associate prof.	Sci. and engineering assoc. professionals Physical and engineer science technicians Mining, manufacturing and constructions Process control technicians Life science technicians Ship and aircraft controllers and technicians
Health associate professionals	Medical and pharmaceutical technicians Nursing and midwifery
ICT Technicians	Information and communications technicians ICT operations and user support technicians Telecommunications and broadcasting technicians
Personal Service Workers	Travel attendants, conductors and guides Other personal services workers
Personal Care Workers	Personal care workers Child care workers and teachers' aides Personal care workers in health services
Market-oriented Skilled Agricultural Workers	Market-oriented skill agricultural workers Market gardeners and crop growers Animal producers Mixed crop and animal producers
Market-oriented Skilled Forestry Fishery	Fishery workers, hunters and trappers
Food Processing, etc.	Food processing and related trades workers
Stationary Plant and Machine Operators	Food and related products machine operators
Drivers and Mobile Plant Operators	Locomotive engine drivers Car, van and motorcycle drivers Heavy truck and bus drivers Ships' deck crews
Cleaners and Helpers	Domestic, hotel and office cleaners and helpers Vehicle, window, laundry and other cleaning workers
Labourers in Mining, Construction, Manufacturing	Transport and storage labourers
Refuse Workers	Refuse Workers

Table A.4: Shares of Workers in Each Employment Risk Group, by Origin.

	Native	EU migrants	Extra EU
Employment Risk Category:			
Low	0.12	0.08	0.06
	(0.32)	(0.27)	(0.23)
Moderate	0.47	0.49	0.44
	(0.50)	(0.50)	(0.50)
High	0.38	0.39	0.44
	(0.48)	(0.49)	(0.50)
Very High	0.04	0.04	0.06
	(0.19)	(0.20)	(0.25)
Obs.	436,873	23,160	43,373

Note: The table reports the distribution of workers (by origin) across employment risk groups, as defined in Table 1. Standard deviations in parentheses. Source: EU-LFS 2020.

Table A.5: Main Regression Regional FEs

	(1)	(2)	(3)	(4)
Migrants:				
-EU	0.018***	0.018***	0.016***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)
-Extra EU	0.026***	0.026***	0.022***	0.025***
	(0.001)	(0.001)	(0.001)	(0.001)
Women	0.003***	0.003***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Middle education	-0.011***	-0.012***	-0.008***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
High education	-0.022***	-0.021***	-0.020***	-0.016***
	(0.001)	(0.001)	(0.001)	(0.001)
Key worker in 2019		-0.006***		
		(0.000)		
Temporary contract in 2019			0.082***	
			(0.002)	
Low teleworkable job in 2019				0.009***
				(0.000)
Constant	0.034***	0.036***	0.026***	0.025***
	(0.001)	(0.001)	(0.001)	(0.001)
Country FE	✓	✓	✓	✓
Age FE	✓	✓	✓	✓
Region (NUTS II) FE	✓	✓	✓	✓
Obs.	480,219	480,219	480,219	480,219
R^2	0.016	0.017	0.035	0.017
Mean of Y	0.026	0.026	0.026	0.026

Note: In this table, we regress an indicator variable for having lost a job during 2020 on a set of covariates. Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

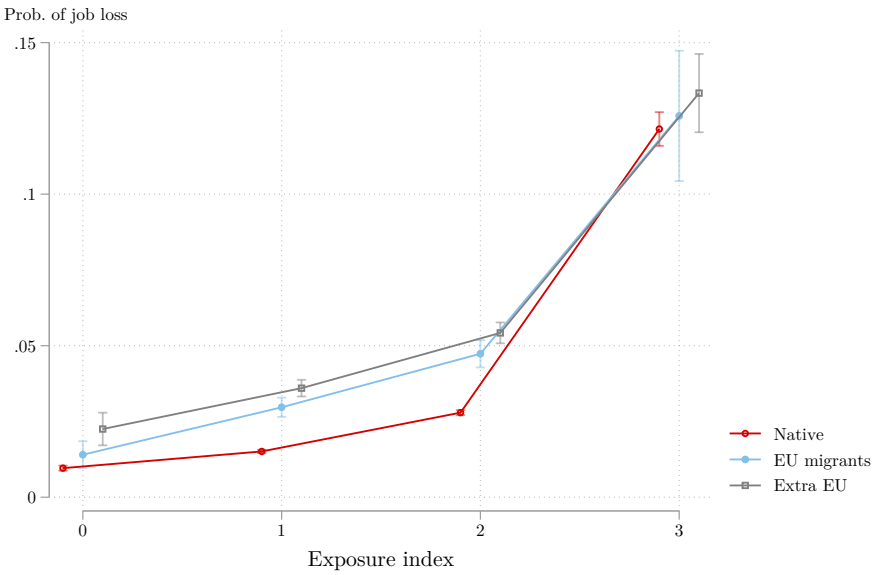
Appendix B Appendix Figures

Figure A.1: Employment Rates (2006-2021), by Origin and Sex

(a) Women (b) Men

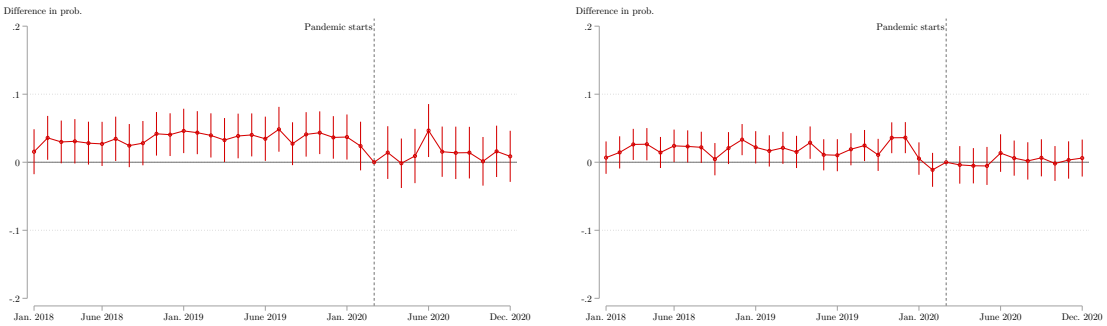
Note: The figure reports the employment rates for the three origin groups from the first quarter of 2006 to the third of 2021, by sex. The vertical dotted line marks the beginning of the pandemic. Source: Eurostat ergacob series.

Figure A.2: Probability of Losing Job by Risk Level and Origin



Note: Each dot represents the coefficient of an interaction term between the origin dummy and a dummy for each risk level in a regression similar to our baseline model. The bars represent the 95% confidence intervals. Standard errors robust to heteroskedasticity.

Figure A.3: Difference in Probability of Earnings Above Median by Month, Natives vs. Migrants



(a) EU Migrants (b) Extra EU

Note: The figure reports the difference in the probability of earning a monthly take home pay above the median by reference month compared to January 2020. The coefficients are estimated in a model similar to our baseline augmented by interacting the origin dummies with the reference month. The bars represent the 95% confidence intervals. Standard errors clustered by country.