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

Francesco Fasani and Jacopo Mazza

ISSN 1473-0278

Working Paper No. 918 December 2020

School of Economics and Finance

Queen Mary University of London

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

Francesco Fasani
Queen Mary University of London, CEPR, CReAM and IZA

Jacopo Mazza*
European Commission Joint Research Centre

December 10, 2020

Abstract

We provide a first timely assessment of the pandemic crisis impact on the labour market prospects of immigrant workers in Europe by proposing a novel measure of their exposure to employment risk. We characterize migrants' occupations along four dimensions related to the role of workers' occupations in the response to the pandemic, the contractual protection they enjoy, the possibility of performing their job from home and the resilience of the industry in which they are employed. We show that our measure of employment risk closely predicts actual employment losses observed in European countries after the first wave of the COVID-19 pandemic. We estimate that, within industries and occupations, Extra-EU migrants and women are exposed to higher risk of unemployment than native men and that women are losing jobs at higher rates than equally exposed men. According to our estimates, more than 9 million immigrants in the EU14+UK area are exposed to a high risk of becoming unemployed due to the pandemic crisis, 1.3 million of which are facing a very high risk.

JEL Codes: F22, J61, J20
Keywords: employment risk, COVID-19, key occupations.

*Corresponding author at the KCMD, European Commission Joint Research Centre, Via Enrico Fermi, 2749, 21027 Ispra (VA), Italy. We thank Peter Backus, Matias Cortes and Tommaso Frattini for helpful comments. Computer programs are available on request. The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the European Commission or of any other person associated with the European Commission.

1 Introduction

With around 50 million cases confirmed globally and more than 1 million people known to have died due to the coronavirus so far, the human cost of the pandemic is dramatic. Its economic cost is also huge. Global GDP contracted by 10 per cent in the first half of 2020, while major European countries experienced drops in both their output and private consumption of up to 20 per cent (OECD, 2020). Economies contracted much faster than during previous major negative shock such as the Great Depression or the Great Recession. However, the pace of recovery has also been unprecedentedly high, with most economies rapidly rebounding in the second half of 2020, as soon as restrictions were lifted (De Grauwe and Ji, 2020). According to OECD estimates, world real GDP growth will be around minus 4.5% in 2020, with all countries but China experiencing negative growth with respect to the previous year (OECD, 2020). In the absence of other major shocks, the overall outlook will improve only in 2021, when economies are expected to strongly recover, although the output will remain below its levels at the end of 2019.

Governments around the globe are facing the unsettling reality of a long second wave of COVID-19 contagion affecting their populations over the next months. If most countries managed to fend off the first wave of the pandemic by imposing strict social distancing measures, the gradual relaxation of these costly restrictions left citizens vulnerable to the spread of the disease. While waiting for a vaccine, and beyond preventive interventions such as face mask mandates, severely constraining individual mobility and social interactions is one of the few policy options currently available to governments. The socio-economic costs of these restrictions, however, steeply increase with their duration. Shutting down industries that have already suffered important losses during the previous shutdown again will dramatically increase the chances of permanently driving firms out of business, potentially leading to mayor layoffs and spikes in unemployment. While most governments have created schemes to support firms, integrate households' income and preserve jobs during the first wave of lock-downs, whether these measures will be financially viable for a second round of closures (and for how long) is still an open question. Social costs are also expected to be higher, ranging from heightened mental health distress to the permanent damage produced on generations of young citizens by the loss of additional months of education.

Evidence from previous recession episodes shows that some population groups disproportionately bear the brunt of economic downturns (Hoynes, Miller and Schaller, 2012). Similarly, early evidence on the impact of social distancing measures during the first coronavirus outbreak has unveiled the unequal labour market consequences experienced by individuals with different socio-demographic characteristics. Unsurprisingly, the detrimental economic effects of the pandemic tend to reinforce existing inequalities in societies, hitting harder individuals whose labour market participation is more vulnerable and whose savings and wealth are inadequate to weather the effects of a lasting recession. In the U.S., Cortes and Forsythe (2020b) show that pandemic-induced job losses were concentrated among low-wage industries and occupations, young workers, those low educated, women and ethnic minori-

ties. Focusing on the latter aspect, Couch, Fairlie and Xu (2020) observe disproportionately negative impacts on unemployment of black and Latin-American workers, further widening pre-existing gaps with respect to natives. Alon, Doepke, Olmstead-Rumsey and Tertilt (2020) and Hupkau and Petrongolo (2020) emphasize that the combination of social distancing measures (that disproportionately affect sectors with high female employment) with school closures (that dramatically increase child care needs at home) will likely produce detrimental effects on gender equality. Further, Adams-Prassl, Boneva, Golin and Rauh (2020) show heterogeneity both across countries and across individuals within the same country. In their data, women and low-educated workers are significantly more likely to have lost their jobs. Inequalities in the pandemic effects are not limited to unemployment risk. Using data for both the U.S. and Europe, Basso, Boeri, Caiumi and Paccagnella (2020) show that more economically vulnerable workers are concentrated in occupations that expose them to higher risk of contagion. In the UK, Proto and Quintana-Domeque (2020) find that male members of ethnic minorities are experiencing a higher deterioration in mental health compared to White individuals (while the effect is similar for women), while Platt and Warwick (2020) observe that most minority groups suffered excess mortality compared with the majority group. Policy interventions can counteract these inequality-enhancing effects of the pandemic crisis, as shown in Cortes and Forsythe (2020a) for the U.S. Understanding who will be affected by the economic consequences of the epidemic is of primary importance to design effective welfare policies specifically aimed at those most in need.

Immigrant workers are vulnerable along several dimensions. As relative new-entrants in the labour market who typically face linguistic and institutional barriers to access occupations, migrants are generally more likely to have non-standard or informal contract, shorter job tenure and low-skilled occupations than comparable natives (Kerr and Kerr, 2011; de la Rica, Glitz and Ortega, 2015). The combination of all these factors make their employment status particularly sensitive to business cycle fluctuations, increasing their vulnerability during economic downturns (Dustmann, Glitz and Vogel, 2010; Orrenius and Zavodny, 2010). Immigrants are also more concentrated in low-pay jobs than natives with similar characteristics: having relatively low earnings and transferring a large fraction of their income abroad through remittances, migrants typically have limited savings in host countries and are therefore poorly equipped to sustain long periods of unemployment. Further, migrants' residence status typically determines their entitlement to welfare state provisions and public health care, limiting their access with respect to natives (Avato, Koettl and Sabates-Wheeler, 2010). In addition, residence permits are often tied to their employment status: being laid off may then force them to return home or remain illegally in the host country without any welfare coverage. A few factors, however, may partly offset these weaknesses. Migrants' higher mobility across occupations and areas, may potentially enable them to more effectively respond to local negative shocks than natives (Borjas, 2001; Cadena and Kovak, 2016). Also, migrants can potentially rely on insurance from family abroad (Yang, 2011), a resource that can be extremely effective when shocks in host and source countries are uncorrelated. Both mechanisms, however, break down when the recession is at a global scale, like the ongoing

one. The evidence on migrants' performance and conditions in the midst of this crisis is still extremely scarce. A notable exception is work by Borjas and Cassidy (2020) showing that immigrants in the US are experiencing a particularly severe decline in employment. They quantify that about a third of this relative decline is explained by migrant workers having jobs that are less "remotable" than natives and they find that undocumented men were particularly hard hit by the pandemic, with their rate of job loss far exceeding the rate of job loss of legal immigrants. Further, Basso *et al.* (2020) show that foreign born workers are disproportionately concentrated in unsafe occupations (i.e. occupations that expose them to a higher risk of contagion) than natives. In the context of low- and middle-income countries (LMICs) such as Nepal and Bangladesh, Barker *et al.* (2020) observe that migrant households suffer a double fallout: their income dropped due to reduced migration of households members and fewer remittances, while their health hazard increased due to the return of members from national and international destination areas more affected by the pandemic.

In this paper, we provide a first timely assessment of how the pandemic crisis is impacting the labour market prospects of immigrant workers in Europe.[1] In the absence of harmonized micro-data covering the continent since the COVID-19 outbreak, in this paper we propose a measure of exposure to employment risk that can be used to asses the risk of dismissal at the individual level. We do so by exploring individual level data from the latest available wave of the European Labour Force Survey (EU-LFS 2018) for EU14+UK countries and by characterizing migrants' occupations along four dimensions that have become pivotal in predicting workers' vulnerability in the current COVID-19 crisis: i) *essentiality*; ii) *temporariness*; iii) *teleworkability* and iv) *industry resilience*. We first account for the distinction between *essential* and *non-essential* 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 essential 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 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 the firm or the sector (Blanchard and Landier, 2002; Boeri and Garibaldi, 2007). A third factor that we analyse is 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, 2020; Adams-Prassl, Boneva, Golin and Rauh, 2020). While the prevalence of temporary contracts is directly observed in our data, we characterize the degree of "teleworkability" of occupations by combining EU-LFS data with information on occupation characteristics from the US Department of Labor's Occupational Information Network (O*NET) data and by following Dingel and Neiman (2020) to construct occupation-specific measures for the

[1]This paper builds on earlier evidence discussed in Fasani and Mazza (2020a) and Fasani and Mazza (2020b).

possibility to work from home. Finally, we factor in the additional uncertainty associated to differential exposure to the pandemic crisis across industries. Following Pagano, Wagner and Zechner (2020), we characterize industries as resilient to the crisis or not based on the degree of teamwork, interaction with customers and physical presence required by the occupations in each industry. According to this definition, industries whose occupations require high levels of interaction with colleagues and customers and of physical presence are less resilient to the social distancing effects and for this reason, are expected to suffer more and for longer.

After identifying and discussing these four potential dimensions of vulnerability, we quantify the share of migrant workers in each of the EU14+UK countries that are at risk of losing their jobs in the near future. We do so by ranking workers' employment uncertainty based on the number of dimensions they are vulnerable to. Within our framework, workers who are employed in non-essential occupations, with temporary contracts, in jobs that require physical presence and in industries that are not resilient to the crisis, face the highest risk of being laid off. By comparing the available macro data on European labour market performance for the first half of 2020 to our measure of exposure to risk, we show that we are able to capture a large part of the labour market contraction currently experienced by migrant workers in Europe. Remarkably, our measure of employment risk has no predictive power in the pre-pandemic period, when occupational dimensions such as teleworkability of tasks or the intensity of social interactions at the workplace were orthogonal to job stability. The share of high risk workers varies widely across our sample of European countries, being higher than 40% in Germany and down to less than 20% in Luxembourg. We explain these cross-country variations with differences in industry structure and diffusion of temporary contracts, as well as in migrants' concentration in different sectors and occupations across countries. Based on our analysis, we estimate that approximately 1.3 million of migrant workers in the EU14+UK area are at *very high risk* of losing their jobs as a consequence in the pandemic-induced recession; this number swells to more than 9 million if we consider also those workers that we classify as being exposed to *high risk*. In the final part of our paper, we compare the conditional migrant-native gap in the probability of being a high risk worker. While we do not find migrant workers to be more exposed to employment risk in general, when we look within occupations and industries, we estimate that Extra-Eu migrant workers are 1.8 percentage points (or 5.3%) more likely to belong to the high risk category than comparable natives. The gap is not statistically significant for EU mobile workers. In line with the (mostly US focused) recent literature on the different impacts of COVID-19 across genders, we find that native women are 2.6% more likely to be exposed to employment risk than men with comparable characteristics, although the gender gap flips sign if we do not take into account selection in occupations and industries. Despite the favorable sorting, European women are losing jobs at higher rates that their exposure to risk would predict: we estimate their job losses to be 10 per cent larger than those of equally exposed men.

The paper unfolds as follows. Section 2 presents our data and briefly describes our methodology. Section 3 focuses on essential and non-essential migrant workers, discussing their distribution across European countries and assessing their vulnerability. Section 4

quantifies the share of migrant workers exposed to labour market risk - and the degree of their exposure - in our sample of European countries. We then validate our measure against actual data on employment loss in Europe (section 4.1), we estimate the conditional migrant-native gap in the probability of being at risk (section 4.2) and we discuss national and sub-national variation in migrants' employment risk (section 4.3). Finally, section 5 discusses some policy implications of our findings.

2 Data and Definitions

We use individual-level data from the 2018 wave of the EU Labour Force Survey (EU-LFS). We restrict the sample to employed workers aged 15-64 and distinguish two groups of migrant workers based on their country of birth: EU (i.e. workers born in a EU Member State other than the one where they currently work and reside) and Extra-EU migrants (i.e. workers born outside of the Union). Further, we define as native anyone who was born in the current country of residence. We focus our analysis on the EU-14 countries and the UK.[2] Our sample includes 1,304,274 individuals, of which 1,124,310 (86.2%) are natives, 67,950 (5.2%) EU-mobile and the remaining 112,014 (8.6%) are Extra-EU workers.

We use the following definitions for the four dimensions of workers' vulnerability to the Covid-19 pandemic that we study in this paper.

1. *Essential workers.* For the definition of essential - or 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[3] supplemented with the Dutch definition of key workers.[4] We identify key workers based on ISCO-08 occupations at three digits, which is the most detailed classification available in the EU-LFS.[5]

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

[2] In Fasani and Mazza (2020b) we consider all 27 European Union countries and exclude the UK.

[3] https://ec.europa.eu/social/main.jsp?langId=en&catId=89&furtherNews=yes&newsId=9630

[4] https://www.government.nl/topics/coronavirus-covid-19

[5] A full list of our definition of key profession is provided in the appendix Table A.3. 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.

the cross-walk provided in the replication package by Dingel and Neiman (2020)[6] 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.[7]

4. *Industry resilience.* We borrow the definition of *industry resilience* from Pagano, Wagner and Zechner (2020) to characterize how negatively affected an industry can be by the ongoing crisis and by its future developments based on the characteristics of its pool of jobs. We define an industry as "resilient" if the number of jobs in that industry that are "affected" by the pandemic crisis (and by social distancing measures) is below the median of the national distribution, and "non-resilient" if it lies above. To identify "affected" occupations, we follow Koren and Peto (2020) and use three characteristics of occupations that likely predict how negatively affected they will be by the persistence of social distancing measures: i) the level of teamwork required, ii) the intensity of contact with customers, and iii) the need for physical presence from the worker. The more interactions with colleagues and customers are required and the less teleworkable an occupation is, the more affected it will be by the pandemic, both in the short and in the medium-long run. We therefore construct an "affected" occupation index, which is a composite index of three sub-indices (teamwork, customer proximity and physical presence). The sub-indices take value one if the underlying measures are above given cutoff values, as in Koren and Peto (2020). Finally, the composite index takes value one if at least one of its sub-indices is equal to one. We modify the definition of industry resilience proposed in Pagano, Wagner and Zechner (2020) by taking into account the information on whether occupations are essential or not. Since essential workers are relatively protected from possible lay-offs during the pandemic, we account for their status by setting their index equal to zero. This implies that, differently from Pagano *et al.* (2020), industries with many "affected" workers could still be resilient if the share of essential workers within the industry is sufficiently high.

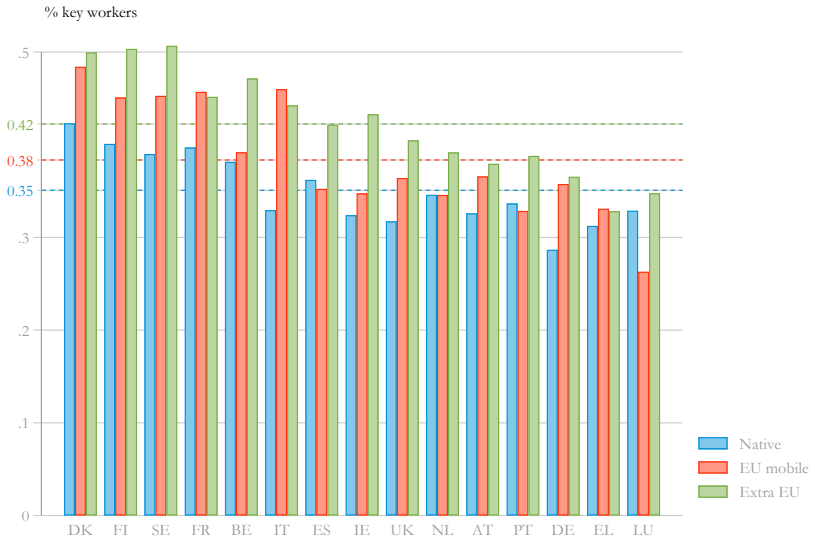
3 Essential and non-Essential Migrant Workers

Essential workers are at the front line of Europe's COVID-19 response, performing the crucial tasks of keeping European citizens healthy, safe and fed during the pandemic. The recognized importance of their functions shields their jobs from labour market contractions induced by social-distancing measures and by the ongoing recession, while potentially heightening their social interactions and thus their risk of contagion. In particular, the health hazard will be higher for those key-workers whose functions cannot be performed from home, and whose job requires them to work in close proximity to others (colleagues, customers or patients). While essential sectors are fully operational during the crisis, non-essential sectors are bound to suffer major revenue losses due to the combined effect of shutdown measures,

[6] https://github.com/jdingel/DingelNeiman-workathome

[7] In the same way, we construct a measure of physical proximity, that we discuss in Section 3.2

Figure 1: Share of Key Workers, by Host Country and Origin



Note: Each bar represents the share of key workers within each origin in each host country. The dashed lines represent the EU14+UK average for each group: natives (35%), EU mobile (38%) and extra EU (42%).

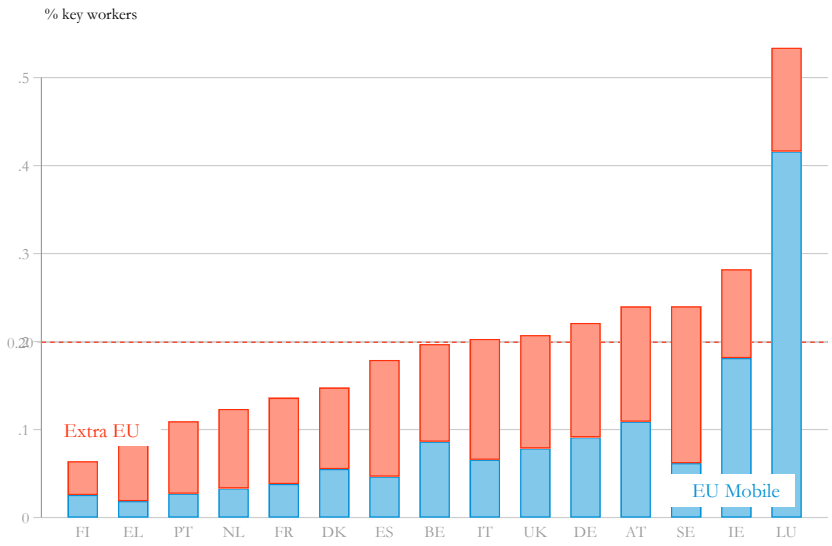
social distancing restrictions and spontaneous drops in consumers' demand. Workers in non-essential occupations will thus experience an increased risk of being laid off. This risk will be even higher for workers employed in activities that require their physical presence on the workplace and frequent interactions with others (colleagues and/or customers), since these are the type of businesses that are more likely to be restricted for health reasons during the pandemic.

In this section, we first describe how many migrants are employed in key-occupations in the EU-14+UK area, discussing in which countries and occupations they are relatively overrepresented (Section 3.1). We then assess the vulnerability of both essential and non-essential migrants workers with respect to comparable natives (section 3.2).

3.1 Key Migrant Workers: How Many, Where, in Which Jobs?

Figure 1 reports the share of key workers among natives, EU mobile workers and extra-EU workers in EU14+UK countries. According to our definitions and estimates, on average approximately 35% of native employed individuals are key workers, increasing to 38% and 42% among EU and Extra-EU migrants, respectively (see dashed lines in Figure 1). The share of essential workers displays considerable variation both across countries and origin. Notably, in all EU14+UK countries (except Greece) migrants - of both origin groups (red and green bars) - tend to be relatively overrepresented in key occupations than natives (blue

Figure 2: Share of Immigrants among Key Workers, by Country



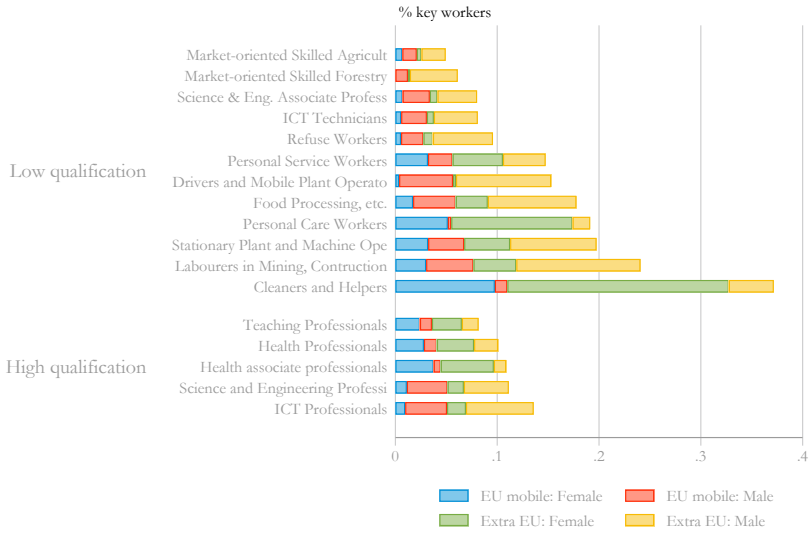
Note: The bars report the percentage of immigrants over total key workers in each country.

bars). Figure 2 shows that migrant workers account on average for 20% of essential workers in the EU14+UK area, with this percentage varying widely across host countries depending on the size of the migrant population as well as on their relative concentration among key occupations. 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 are sizeably 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 essential industries while making up approximately 17% of the employed workforce (Gelatt, 2020). We observe wide variation across countries: The share of immigrant key workers is around 5% in Finland and Greece, while it fluctuates around 20% in countries such as Italy, Belgium, Germany, Sweden, the U.K. and Austria. The largest figures are observed in Ireland (26%) and Luxembourg (53%). In most countries, the share of Extra-EU key workers is larger than the EU-mobile one.

Figure 3 looks at the presence of migrant workers in key occupations, separating high and low qualifications based on the median level of education of the workers employed in each ISCO 2-digits occupation.[8] The graph highlights how heavily some key occupations rely on migrant workers. If foreign born workers account for 19% of key workers in our sample of countries (see Figure 2), in many key occupations we observe shares which are substantially

[8]We define high skilled occupations all those occupations whose workforce median educational level is above ISCED level 3, while low skilled occupations are those whose workforce median level of education is equal or below that.

Figure 3: Share of Immigrants among Key Workers, by Gender and Occupation



Note: The bars report the percentage of immigrants over total key workers (by national group and gender) for each occupation.

higher. Notably, all the key occupations in which migrants are over-represented are low qualified ones. For example, more than a third of cleaners and helpers, more than a quarter of labourers in mining and construction sectors, stationary plant and machine operators and one in five workers in food processing are migrants. Extra-EU citizens alone account for more than 25% of cleaners and helpers, 17% of mining and construction workers and 14% of personal care workers. The figure also reports the gender composition of the migrant labour force within key occupations. As expected, women account for the majority of cleaners and helpers, personal care workers and teachers, while labourers in mining and constructions, drivers and mobile plant operators or ICT professionals are mostly men.

3.2 Migrant-Native Gap in Migrant Workers' Vulnerability

We now evaluate the vulnerability of migrant workers in essential and non-essential occupations relative to native workers with similar characteristics along four attributes of their jobs: i) whether they are employed with a temporary contract, ii) the wage they earn, iii) the physical proximity to colleagues or clients on the workplace and iv) the possibility to perform one's tasks remotely from home. While the first two outcomes measure the economic uncertainty workers may face, the latter two variables proxy the health hazard they are exposed to. We define the following binary outcomes: i) having a temporary contract; ii) being in the top half of the earning distribution; iii) being in an occupation that requires physical proximity (i.e. the index of physical proximity is above the cutoff value of 60); iv)

being in an occupation that is teleworkable (i.e. the index of teleworkability is above the cutoff value of 60).[9]

Our estimates reported in Appendix A.1 show that migrant key workers, especially the extra EU ones, are more insecure in their jobs and are paid less than their native counterparts. Compared to natives, EU male migrants are less likely to be employed in professions requiring close physical proximity to other people, but are also less likely to be employed in professions that can be performed from home. Looking at gender differences, we see that female key-workers are in a more precarious situation than native men due to their higher share of temporary contracts, lower wages and higher share in occupations requiring close physical proximity. Within migrants instead, the probability of holding a temporary contract as well as earnings is very similar between genders. Women are less likely to be able to work from home, but are also relatively less likely to work in occupations requiring close physical proximity. Remarkably, within extra EU migrants, women key workers seem to be *less* vulnerable than men.

Results are very similar when we consider non-essential workers. The main difference being that health risk is much higher for migrants than for natives. Among EU non-key workers women are as vulnerable as men, while for Extra-EU migrants, women outperform men in terms of wages, have the same probability of having a temporary contract, the same probability of being employed in jobs requiring physical proximity and have similar probabilities of being able to work from home.

4 The Employment Risk of Migrant Workers

To characterize the employment risk that migrant workers are facing during the pandemic crisis in the EU14+UK area, we combine information on essential occupations, temporariness of employment contracts, teleworkability of tasks and industry resilience (see Section 2 for definitions) and assign migrant workers to different risk categories based on how exposed they are to a potential lay-off due to the pandemic.

We first separate workers employed in essential occupations and treat them as a completely distinct group from non-essential workers. As we discuss in section 3, we would expect key workers to be exposed to a substantially lower risk of becoming unemployed than non-key workers since the restrictive measures that affect the latter generally do not apply to the former. We then proceed to assign non-essential workers to four categories of employment risk: i) very high, ii) high, iii) moderate and iv) low. In our definition, workers at *very high risk* of becoming unemployed are those vulnerable along all the four dimensions we identified: these are workers employed in non-essential occupations, with a temporary contract, whose work is not teleworkable and in an industry which is not resilient to the pandemic. A worker is instead considered to be at *high risk* if her job is not essential and if

[9] In Appendix A.3 we show the physical proximity and teleworkability indices for each key ad non key profession.

at least two out of the other three conditions (temporary contract, non-teleworkable job, low-resilience industry) are satisfied. Finally, we distinguish the remaining non-essential workers into *intermediate risk* and *low risk*: the former group includes individuals that meet only one of the vulnerability conditions (i.e. are either temporary, their job is not teleworkable or their industry is not resilient) while the latter group includes non-essential workers who are not vulnerable along the other three dimensions (i.e. they have a permanent contract, a teleworkable occupation and are employed in a resilient industry). [10] Table 1 summarises the criteria of our classification.

Table 1: Classification of Workers by Employment Risk Group

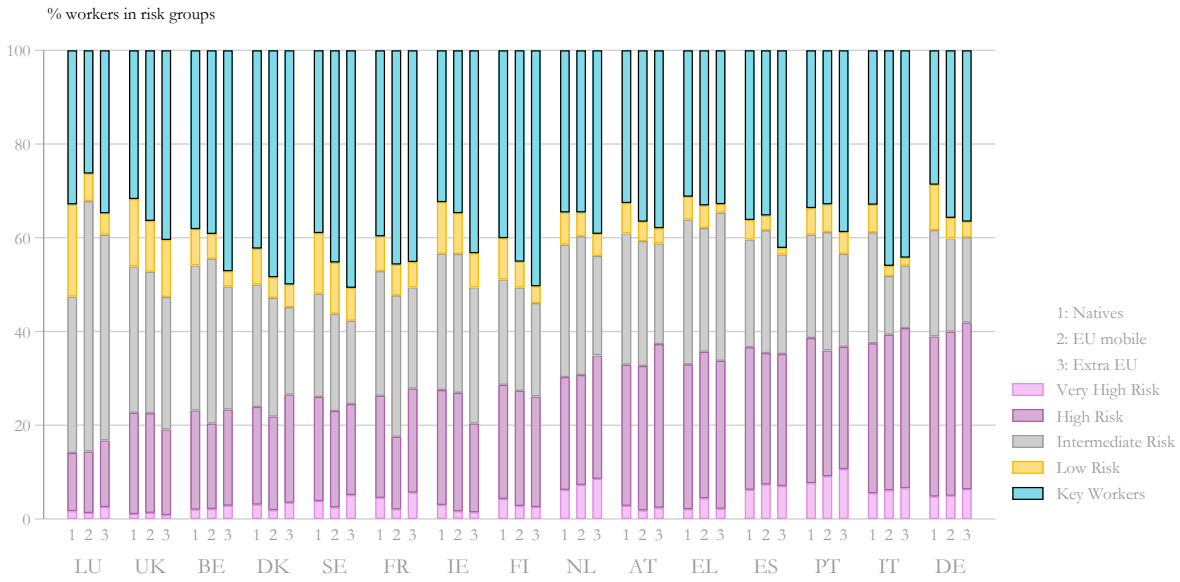
Vulnerability Dimension:	**Non-essential Workers Risk Category:**				**Essential Workers**
	Very high	**High**	**Interm.**	**Low**	
Key Occupation	No	No	No	No	Yes
Permanent Contract	No			Yes	-
Teleworkable Occupation	No	2 No / 1 Yes	1 No / 2 Yes	Yes	-
Resilient Industry	No			Yes	-

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

In Figure 4, we show how workers are distributed in the different employment risk categories across EU14+UK countries. We distinguish native, EU mobile and Extra EU workers (denoted in the graph with numbers 1, 2 and 3, respectively). Countries are ordered according to the total share of "*workers at risk*" that we define as the sum of the workers belonging to the two highest categories of risk (very high and high risk). The share of "workers at risk" fluctuates widely across European countries, being around 20% of all employed workers in countries such as Luxembourg, the UK, France and Denmark, while approaching (and even exceeding) 40% in Austria, Portugal, Spain, Germany and Italy. Table 2 clarifies what determines this cross-country heterogeneity by reporting the share of workers in each country for each of the four components of our risk exposure measure. For example, in Italy - which is the country displaying the highest share of "workers at risk" - workers are less frequently defined as essential, they are more likely to be employed with a temporary contract, and have a substantially lower probability to be employed in high resilience industries (minus 10 p.p) and to have a teleworkable occupation (minus 4

[10] As far as employment risk is concerned, we would expect workers in key occupations to be generally less exposed than those in the non-key occupations, other things equal. If we compare workers that are similar along all the other three vulnerability dimensions (i.e. temporariness, teleworkability and industry resilience), being considered as "essential" certainly reduces the risk of being laid off. The ranking is less obvious if we compare essential workers who are vulnerable along some of the other dimensions (e.g. have temporary contracts) with non-essential workers who are more resilient on these other dimensions. Also, we do not distinguish differential exposure to employment risk of essential workers.

Figure 4: Share of Workers in Risk Groups, by Host Country and Origin



Note: The figure reports the distribution of employed workers across the five categories of employment risk we identified, by host country and origin area. The countries are ordered according to the sum of the shares of workers at very high and high risk.

p.p). Workers in Germany are also (5 percentage points) less likely to be defined as key compared to the average, but their high exposure is mostly a product of a very low share of employment in highly resilient industries (17 percentage points below the cross-country average). At the other extreme, the safer situation for U.K. workers is mostly due to the very low share of temporary contracts and the very high share of workers in resilient industries and in occupations that can be performed from home.

Table 2: Share of Workers for Each Component of Exposure Measure, by Country

	Key Workers	Temp. Contracts	High Resilience	Teleworkable
AT	.37	.09	.39	.36
BE	.42	.09	.53	.41
DE	.32	.13	.26	.36
DK	.45	.11	.51	.42
ES	.4	.26	.50	.32
FI	.43	.17	.50	.40
FR	.43	.17	.46	.38
EL	.44	.11	.51	.33
IE	.37	.10	.49	.39
IT	.39	.17	.42	.34
LU	.32	.10	.49	.52
NL	.38	.21	.43	.41
PT	.36	.22	.42	.34
SE	.42	.16	.51	.44
UK	.36	.05	.55	.44
Total	.39	.14	.47	.39

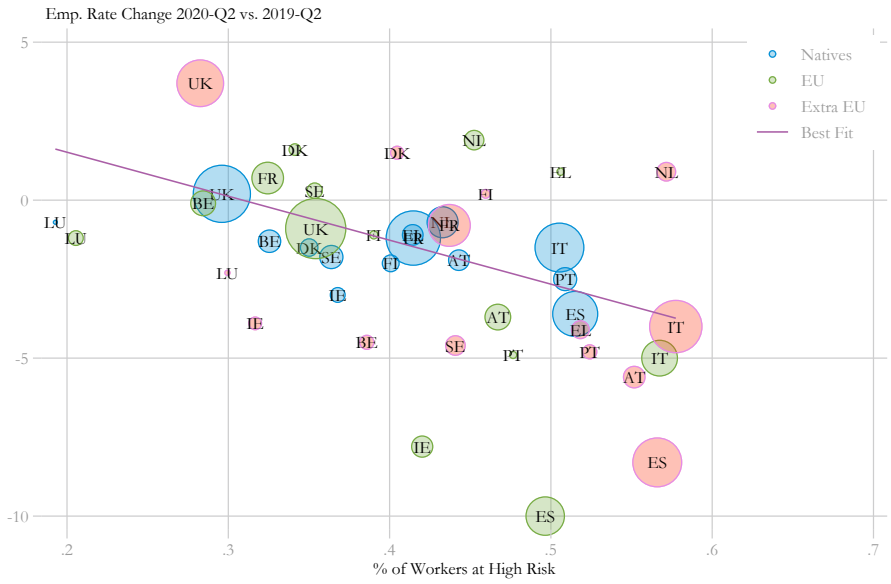
Note: The table reports the share of workers in each country for each of the four components of the risk exposure measure: key occupations, temporary contracts, industry resilience and teleworkability.

4.1 Testing the Employment Risk Measure

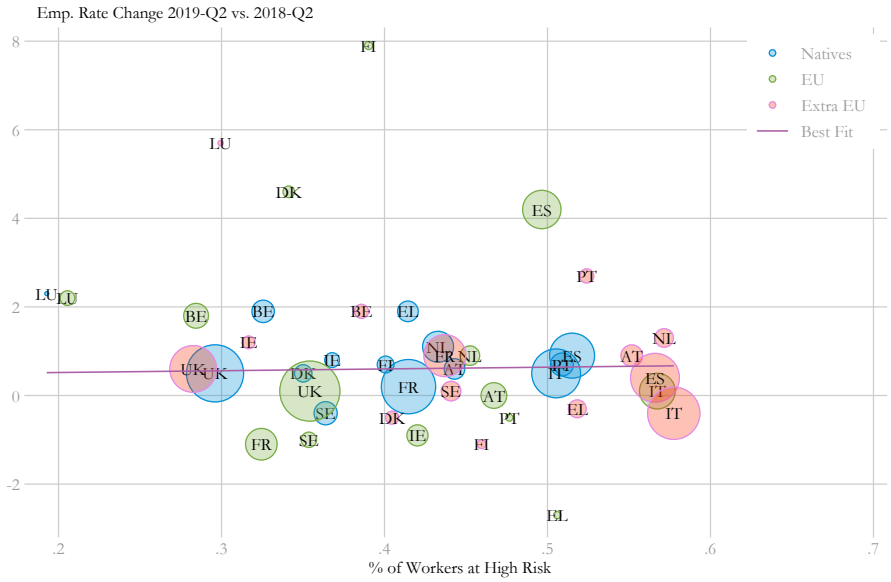
Before discussing further aspects and implications of our proposed measure of exposure to employment risk, in this section we test its predictive power against data on actual employment losses. In particular, we test the reliability of our composite indicator by assessing how well it captures the dynamics of the European labour markets observed in the months immediately following the first pandemic outbreak. In fact, even if individual data covering this period are not yet accessible in Europe, aggregate data on labour markets outcomes at the country level and by nationality have recently become available.[11]

[11]Employment rate data are taken from Eurostat datasets LFSQ_ERGACOB, last accessed 27/10/2020. Data are available for all countries in our sample with the exception of Germany for which employment rates in the second quarter of 2020 by national groups are not available.

Figure 5: Risk Measure and Employment Rate Changes



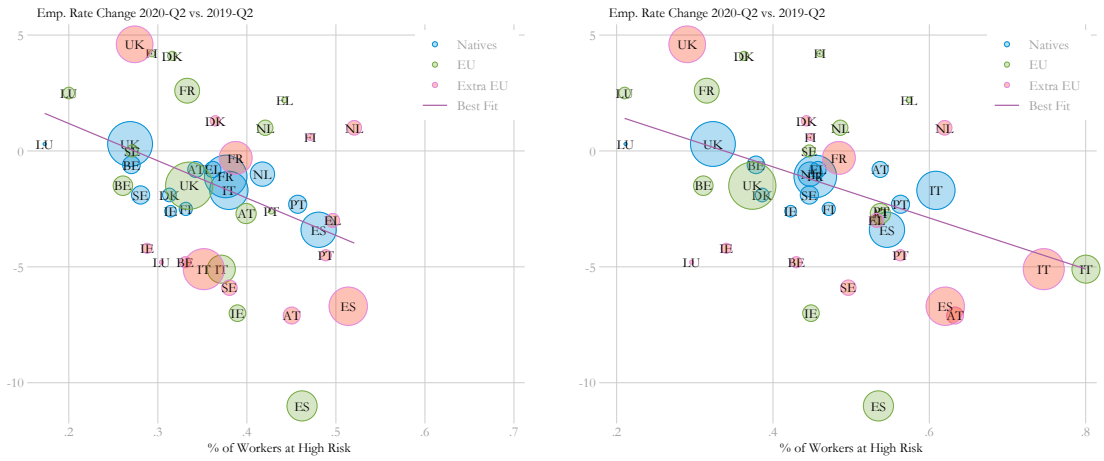
(a) **Post Pandemic (Q2 2020 - Q2 2019)**



(b) **Pre-Pandemic (Q2 2019 - Q2 2018)**

Note: The figure reports scatter plots of changes in employment rate (vertical axis) against the percentage of workers in the high/very high risk group (horizontal axis) disaggregated by host country and origin group (native, EU mobile and Extra-EU migrants). Changes in employment rate are computed between the second quarters of 2019 and of 2020 in panel (a) and between the second quarters of 2018 and of 2019 in panel (b). Markers' area is proportional to country's population aged 16 to 65 for each nationality.

Figure 6: Risk Measure and Employment Rate Changes - Post Pandemic; by Gender



(a) Women (b) Men

Note: The figure reports scatter plots of changes in employment rate (vertical axis) against the percentage of workers in the high/very high risk group (horizontal axis), disaggregated by host country, origin group (native, EU mobile and Extra-EU migrants) and gender. Area of marker proportional to country's population aged 16 to 65 for each nationality.

In Figure 5a, we plot the changes in employment rate between the second quarters of 2019 and of 2020 (vertical axis) against the percentage of workers in the high/very high risk group (horizontal axis) for each host country and origin group (native, EU mobile and Extra-EU migrants). The figure displays a clear negative relationship: the countries and nationalities for which we predicted the largest shares of workers at risk of job loss actually experienced the sharpest drops in employment during the first wave of the pandemic. To probe our measure further, we replicate the same graph, but we now use the change in employment rate observed between the second quarters of 2018 and 2019. Since our measure of employment risk captures occupational features (essentiality, teleworkability and physical proximity) that are distinctively relevant in the context of the current pandemic, we would not expect our measure to have predictive power in a pre-pandemic world in which those attributes had not direct bearing on the probability of being in employment. The flat line in Figure 5b confirms our conjecture, showing that before the Covid-19 outbreak our employment risk measure and actual changes in employment were totally uncorrelated.

We separately look at the relationship of our measure with recorded employment losses for women (panel a) and men (panel b) in Figure 6. The figure shows that our measure is able to capture the recorded dynamic equally well across genders, although the slope of the relationship is steeper for female than male workers.

In order to more formally test the relationship between the two variables, in Table 3 we

regress actual changes in employment rates on the share of workers at risk. The estimation sample pools observations for fourteen host countries and three national groups (native, EU mobile and Extra-EU workers), which are the same data used for the scatter plots in Figure 5. In the last two columns (columns 5-6), we disaggregate our analysis by gender, doubling the number of observations. We use post-pandemic changes in employment rate (i.e. Q2 2020-Q2 2019) in columns 1-2 and 5-6, and pre-pandemic changes (i.e. Q2 2019-Q2 2018) in columns 3-4.

According to the estimated coefficient in column 1 of Table 3, a 10 percentage points increase in our measure of risk exposure for any given worker group is associated to a drop of approximately 1.3 percentage points in its employment rate in the first quarter of 2020 (relative to the same quarter in 2019). The coefficient barely changes when we include dummies for migrant groups (column 2). The estimate for our parameter of interest is significant at the 1% level and the R^2 of this simple regression is about 0.5 (columns 1-2). It is remarkable how well our intuitive measure of employment risk is able to explain the observed employment rate changes. There is instead virtually no correlation between the two variables when we look at employment changes occurred between 2018 and 2019: the coefficient is small and not statistically different from zero and the R^2 is close to zero (columns 3-4). This analysis effectively shows that our exposure measure is able to capture the peculiar labour market dynamics induced by the social distancing measures adopted throughout the continent without being mechanically correlated to long run labour market performances in the countries analysed. The coefficients estimated on the "EU mobile" and "Extra EU" dummies - see columns 2 and 6 - suggest that the effect of being in an occupation at risk may lead to larger employment losses for migrants than for natives, although the effects are not statistically significant. The coefficient of the female dummy in columns 5-6, instead, clearly shows that women are suffering higher employment losses than men. Equal levels of exposure to risk translate into a 10 per cent larger employment loss for women than for men. Women's employment is undermined by the double effect of higher losses at equal risk exposure levels and by higher exposure to risk, as we will see in Section 4.2. Column 6 suggests that these additional job losses are driven primarily by native women. Our data do not allow us to discern if these additional job losses are voluntary or involuntary separations, but they are in line with the emerging literature on the unequal labour market consequences of this contraction across genders.

Whether employment risks translates into actual layoffs is, among other factors, influenced by the severity of the pandemic in each country and the different policies adopted to stymie it. Figure 7 attests to this. In the figure, we plot the recorded change in GDP between the second quarters of 2019 and 2020 (vertical axis) against the percentage of workers at high/very high risk (horizontal axis) in each country. Arguably, GDP changes are heavily influenced by the severity of the pandemic and can be used as a proxy for its intensity. Four of the countries hardest hit by the pandemic - France, Italy, Spain and the U.K. - are also the countries experiencing the most severe drop in GDP during the first wave, but the job

Table 3: Realized Employment Losses and Exposure Measure

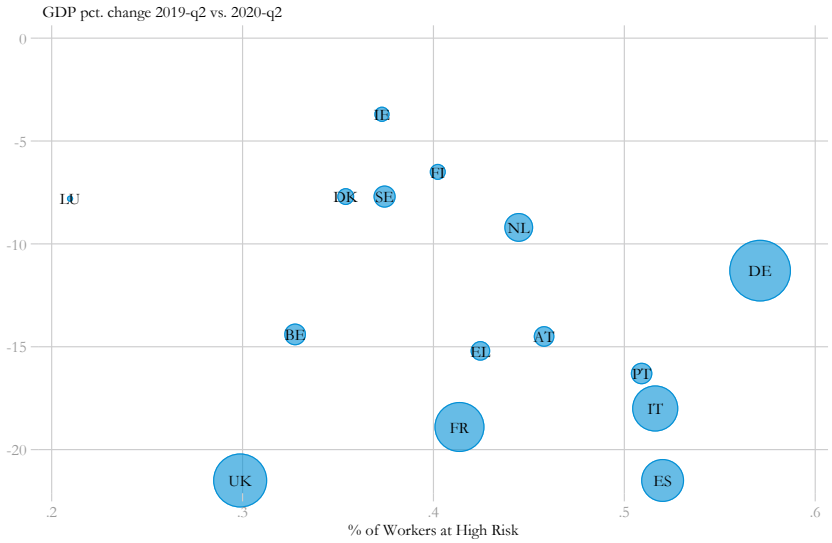
	Δ Empl. 2020 vs. 2019		Δ Empl. 2019 vs. 2018		Δ Empl. 2020 vs. 2019, by Gender	
	(1)	(2)	(3)	(4)	(5)	(6)
% of Workers at High Risk	-13.918***	-13.811***	0.399	0.505	-12.611***	-12.546***
	(2.934)	(3.075)	(0.907)	(0.915)	(2.311)	(2.428)
EU mobile		-1.601		0.163		-1.664
		(1.113)		(0.637)		(1.251)
Extra EU		-0.543		-0.232		-0.196
		(1.333)		(0.276)		(1.235)
Females					-1.325***	-1.287***
					(0.268)	(0.269)
EU mobile × Female						0.035
						(1.803)
Extra EU × Female						-0.658
						(1.958)
R^2	0.489	0.531	0.003	0.014	0.430	0.474
Obs.	42	42	42	42	84	84

Note: In this table, we regress changes in employment rates between the second quarters of 2020 and 2019 (columns 1-2 and 5-6) and of 2019 and 2018 (columns 3-4) on the share of workers at risk (high and very high risk) and other controls (national groups and gender). We pool observations by host country and national group (native, EU mobile and Extra-EU workers) and, in columns 5-6, we further disaggregate by gender. Germany is not included in the sample because data on employment rates in the second quarter of 2020 by national groups are not available. All regressions are weighted using countries' population in 2019. Robust standard errors in parentheses. ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

market consequences in these countries differ substantially as we are able to see by looking at the employment rate changes in Figure 5a. Workers in Italy and, particularly, Spain - who are two of the most exposed workers according to our measure - have suffered far more employment losses than workers in France and the U.K. where the percentage of workers at high risk is half. Germany, instead, has managed to control the severity of the contagion. Lock down measures have been less strict and German GDP has contracted far less. For this reason, even if the share of workers at risk in Germany is the highest in our pool of countries, we would not expect the German labour market to contract as heavily.[12]

[12]Unfortunately, data on German labour market for Q2 of 2020 are still not available.

Figure 7: Risk Measure vs. GDP Change in Q2 2020



Note: The figure reports the scatter plot of the recorded change in GDP between the second quarters of 2019 and 2020 (vertical axis) against the percentage of workers at high/very high risk (horizontal axis) in each country. Area of marker proportional to country's population aged 16 to 65.

4.2 Migrant-Native Gap in Employment Risk

Migrant workers tend to be overrepresented in key professions which we assume being exposed to relative low risk of layoff during the pandemic crisis (see section 3.1). Nevertheless, both essential and non-essential migrants workers tend to be more vulnerable than comparable natives when it comes to features of their occupations such as contract duration, earnings, physical proximity on the job and teleworkability (see section 3.2). These two findings run in opposite directions in determining the risk migrants face of becoming unemployed during the COVID-19 pandemic crisis relative to natives. In this section, we thus analyse the migrant-native gap in employment risk by regressing an indicator variable recording whether the worker belongs to the category at risk on the same set of controls we used in section 3.2 (i.e. dummies for gender, age, education, national group, host country, occupation and industry). Our definition of employment risk is based on the categories discussed in Section 4 and we set the indicator variable equal to one if the worker belongs to either the very high or the high risk category.

Table 4 reports the estimated migrant-native gaps in employment risks. According to the model in column 1, where we condition on individual demographics and country dummies, migrant workers are as exposed as similar natives to employment risk while women are half a percentage point less likely to be at high risk. The latter coefficient corresponds to a 15 per cent lower probability of being at risk with respect to the baseline probability of men which

Table 4: Probability of being exposed to employment risk

	(1)	(2)	(3)	(4)	(5)	(6)
EU mobile	-0.006	-0.009**	-0.001	0.024***	-0.006	0.003
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Extra EU	-0.003	0.005*	0.015***	0.037***	0.007*	0.018***
	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)
Female × EU mobile				-0.059***	-0.006	-0.008
				(0.007)	(0.006)	(0.005)
Female × Extra EU				-0.085***	-0.004	-0.007
				(0.006)	(0.004)	(0.004)
Female	-0.053***	0.001	0.008***	-0.041***	0.002	0.009***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Country FE	✓	✓	✓	✓	✓	✓
Occupation FE		✓	✓		✓	✓
Industry FE			✓			✓
Age and Education FE	✓	✓	✓	✓	✓	✓
R^2	0.102	0.569	0.614	0.103	0.569	0.614
Obs.	944,731	943,165	938,264	944,731	943,165	938,264

Note: In this table, we regress an indicator variable for being in the high risk or the very high risk category on national group dummies, gender and a full set of fixed effects (age, education, host country, occupation, industry). All regressions are weighted using person weights from the LFS. Robust standard errors in parentheses: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively.

is equal to 34 per cent in our sample. Estimated coefficients on the two dummies for migrant groups change when we include occupation (column 2) and industry fixed effects (column 3), accounting for differences in workers' selection in jobs and sectors. The change is especially pronounced for Extra EU migrants: within industry and occupation, Extra EU migrants are 1.5 percentage points more likely than natives to be at high risk (around 4.4% increase). For female workers, the inclusion of occupation and industry fixed effects reverts the sign of the coefficient and makes them almost 1 percentage point more likely to be at high risk. The specifications in columns 4 to 6 extend our benchmark model by including an interaction term between the female dummy and origin dummies. In column 4, we compare women to men across occupations and industries, but within origin groups: in all groups, women show a lower probability of being at high risk compared to men of the same origin. Within occupations (column 5) and industries (column 6), however, we see women's risk increasing

and becoming higher than for men. In our final specification (column 6), native women are almost 1 percentage points (2.6 per cent) more likely to be at high risk than native men, while we do not observe an analogous gender gap in exposure to risk for migrant workers. These results suggest that native women tend to be employed in occupations and industries at lower employment risk, but once we condition on that selection, they are more exposed to employment risk than comparable men. As we have seen in Section 4.1, this higher exposure to risk interacts with women's higher chances of dismissal for any given exposure to risk level, further depressing their employment prospects. As far as migrant workers are concerned, estimates in column 6 imply that Extra EU workers are 1.8 p.p. (approximately 5.3%) more likely to belong to the high/very high risk category than natives, while the difference is smaller and not statistically different for EU mobile workers.

4.3 National and Regional Variation in Migrant's Employment Risk

Based on our measure of employment risk, we can provide an estimate of the numbers of workers whose jobs are threatened by the pandemic by nationality and we can describe how these workers are geographically distributed.

In Table 5, we use data from Eurostat on foreign born employed workers residing in each EU14+UK country (in 2019), together with our estimates of the share of migrants workers at risk of being laid off to quantify how many immigrants are currently facing high risk of becoming unemployed in Europe. According to our calculations, there are approximately 3.1 million EU mobile workers in employment in EU14+UK countries who are at risk of becoming unemployed due to the pandemic, accounting for 31% of the 10.2 million employed workers in the region. Among these workers at risk, 395 thousand face a very high risk of being laid off. As far as Extra-EU migrants are concerned, more than 6.1 million workers may become unemployed due to the pandemic, 32.7% of the 18.9 million individuals employed in EU14+UK countries. Almost a million of them (974 thousand) fall in the very high risk category. These figures point at a total population or more than 9 million foreign born workers - slightly less than one third of their total employment in the EU14+UK area - that are employed in jobs and sectors that may be severely affected by the pandemic-induced crisis. For more than 1.3 million of them the risk is extremely high.

In order to get a better sense of the size of these populations at risk and to gauge the likelihood that their labour market status will actually turn into unemployment, we can contrast our estimates for the number of employed workers at risk with the actual employment losses that have recorded in EU+14 countries after the first pandemic wave. We do so in Appendix Figure A.4, where we produce a scatter plot of employment losses (2020-Q2 relative to 2019-Q2) versus the number of employed workers at risk (upper panel) and at very high risk (lower panel) of becoming unemployed. In each panel, the continuous straight line is the equality line. While the upper panel shows that realized employment losses in the first two quarters of 2020 are substantially smaller that the number of employed workers

at risk (all points lie well below the 45 degree line), the two variables are of comparable magnitude when we focus on employed workers who face very high risk (lower panel). In this case, most of the points lie close to the equality line and several of them are even above the line, implying that the number of workers who became unemployed in the first semester of 2020 in those countries has already exceeded the number of workers at very high risk that we predicted. In total, the reduction in employment measured at the end of the second quarter of 2020 relative to the same quarter in the previous year is 587 thousand workers for EU mobile and 573 thousand for Extra-EU migrant. Note that the number for EU mobile is inflated by the UK - which contributes to almost half of the total employment loss - where EU mobile employment is on a downward decline which is mostly attributable to the Brexit. If we thus focus exclusively on Extra-EU migrants, we can conclude that more than half of the 970 thousand workers we considered at very high risk (see Table 5) may have already lost their job due to the first wave of the pandemic.

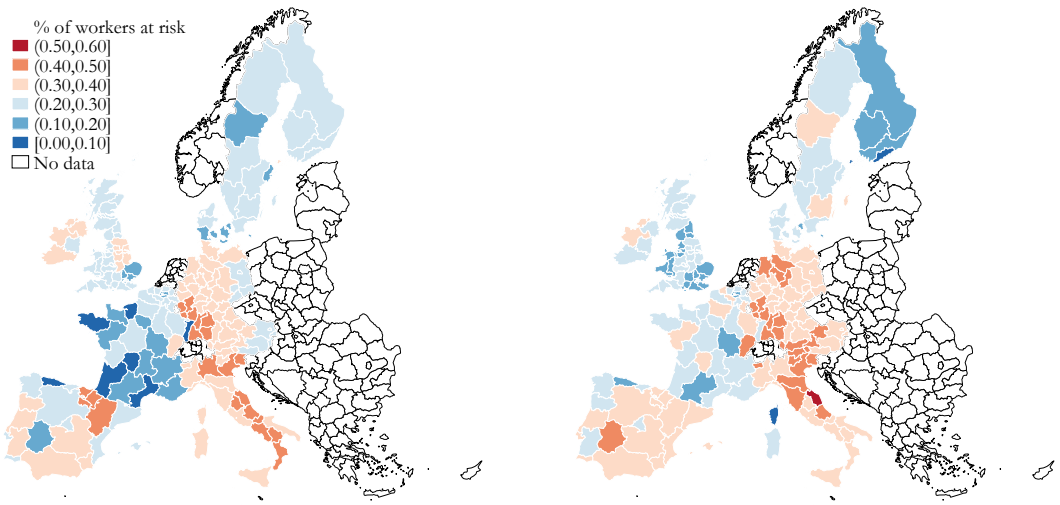
The share of migrants at high risk is large both in countries with a typically healthy labour market like Germany and in countries with a sluggish labour market like Italy and particularly Spain. This suggests a weak relationship between the fundamental strength of a labour market and its vulnerability to the pandemic induced contraction. This conjecture is confirmed by looking at the regional breakdown of migrant workers at risk in Figure 8. It is interesting to look at Germany and Italy two countries with marked regional inequalities and the two countries with the highest share of migrant workers at risk. In both cases, the most vulnerable regions are some of the wealthiest such as Baden-Württerrnberg in Germany or Veneto, Emilia-Romagna and Lombardy in Italy. The lack of relationship between past unemployment rates and the employment risk specific to the pandemic is displayed in Figure 9 where we plot the regional unemployment rate against the regional share of workers at high risk for EU migrants in panels 9a and for extra EU migrants Panel 9b. Figure A.5 in Appendix A.5 shows a more pronounced association between our risk measure and the share of migrants employed in the industrial sector instead, suggesting that areas whose economy is particularly specialized on manufacturing and where manual jobs are plentiful are those poised to suffer more from social distancing measures.

Table 5: Employed workers at risk, by Host Country and Migrant Group

	EU mobile				Extra EU			
	% at risk	Total employed ('000s)	At risk ('000s)	at very high risk ('000s)	% at risk	Total employed ('000s)	At risk ('000s)	at very high risk ('000s)
AT	*32.6*	422.7	138.0	7.7	*37.3*	488.6	182.3	11.8
BE	*20.3*	396.2	80.6	8.4	*23.4*	437.6	102.3	12.4
DE	*39.9*	3,099.8	1,239.1	153.7	*41.9*	4,617.5	1,935.6	292.2
DK	*21.8*	90.8	19.9	1.7	*26.6*	198.4	52.7	6.9
EL	*35.7*	48.0	17.1	2.1	*33.8*	265.7	89.7	5.8
ES	*35.3*	943.6	334.0	69.5	*35.2*	2,509.3	883.4	176.4
FI	*27.4*	58.4	16.0	1.6	*26.2*	102.2	26.7	2.6
FR	*17.5*	791.4	138.9	16.3	*27.8*	2,450.1	681.7	137.9
IE	*26.9*	250.8	67.6	4.1	*20.4*	320.3	65.2	4.6
IT	*39.3*	991.8	389.9	60.7	*40.7*	2,296.7	935.5	151.1
LU	*14.4*	131.1	18.9	1.7	*16.8*	32.9	5.5	0.8
NL	*30.7*	281.5	86.5	20.4	*35.0*	744.6	260.3	63.8
PT	*36.0*	117.5	42.3	10.7	*36.7*	399.6	146.7	42.5
SE	*23.0*	254.8	58.7	6.3	*24.5*	761.0	186.6	38.8
UK	*22.6*	2,373.4	535.4	30.9	*19.1*	3,282.9	628.1	27.0
Total	*31.0*	10,251.7	3,182.7	395.9	*32.7*	18,907.2	6,182.2	974.5

Note: The table reports for EU mobile (left panel) and Extra Eu workers (right panel), and for each host country in the EU14+UK area, the share of workers at risk (i.e. the sum of the shares of workers at very high and at high risk), the total number of employed workers (measured in 2019; from Eurostat database), the number of employed workers at risk (equal to the share at risk times total employment) and the number of employed workers at very high risk (equal to the share at very high risk times total employment).

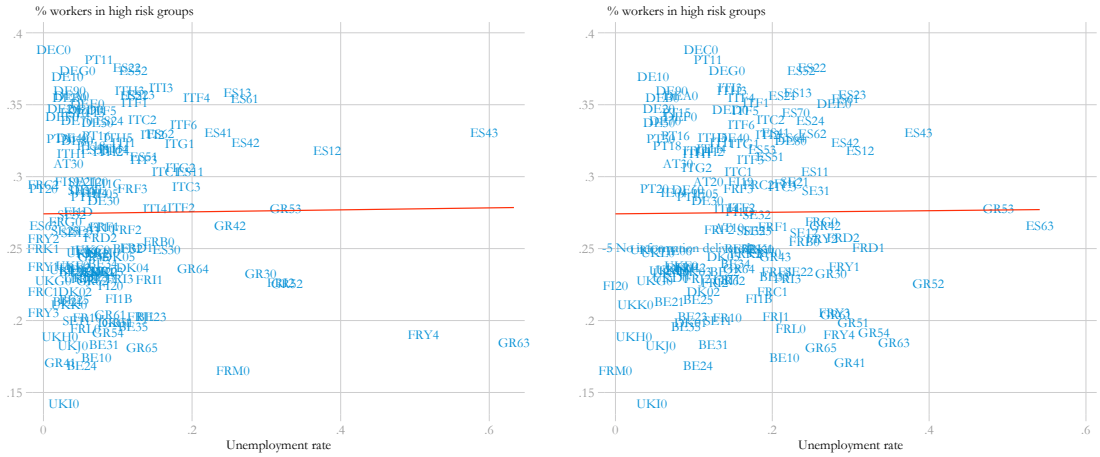
Figure 8: Workers at high risk of job loss, by region and origin



(a) EU Mobile (b) Extra EU

Note: Information on NUTS-2 regions in the EU-LFS is absent for Greece and The Netherlands. Panel 8a shows the share of EU workers at very high risk of losing their job for each NUTS-2 region while Panel 8b show the same share for extra EU migrants.

Figure 9: Regional labour markets and workers at high risk



(a) EU Mobile (b) Extra EU

Note: Panels 9a and 9b plot the regional unemployment rate against the share of EU and extra EU workers at high risk, respectively. Lines of best fit in red.

5 Concluding Remarks

More than other areas, Europe has been hit hard by the first wave of the COVID-19 pandemic. Facing the prospect of seeing their health system overwhelmed, most governments resorted to partial or total lockdown of their economies. These measures played an important role in curbing the spread of the virus, but the costs exacted in terms of employment losses on European economies are still to be quantified, as are their distributional impacts.

In the absence of harmonized micro-data covering the continent since the outbreak of the pandemic, drawing on emerging literature, in this paper we propose an exposure to employment risk measure that can be used to assess the risk of dismissal at the individual level. We measure the accuracy of our indicator against the already available macro data on European labour markets for the second quarters of 2020, showing that it is able to capture remarkably well the observed employment losses and the distinct nature of this economic crisis. We find large differences in the size of workforce at high risk of dismissal in our sample of countries. For example, in Germany, Italy, Portugal and Spain, around 40% of the workforce is at high risk while this percentage halves in the U.K. and Belgium. With this measure, we are able to focus on the employment consequences of the pandemic on migrant workers. We find that migrants are exposed to a lower risk of job loss than natives. This result is explained by the over-representation of Extra EU migrants among the essential workers and by their sorting in safer industries and occupations. In fact, within industries and occupations, Extra-EU migrants are at higher risk of dismissal. We calculate that up to 9 million migrants are currently at high risk of dismissal (1.3 million of which at very high risk) and we determine where these workers at risk are located.

The evidence produced in this report calls for policy actions targeted at migrant workers that should possibly differentiate according to whether they have been defined as essential or non-essential workers. The concentration of migrant workers in fixed-term contracts that we document, for instance, points at interventions on employers' incentives - via reduced taxation or subsidies - to renew these contracts and retain their workers. Migrants' lower earnings suggest the need for policy action on income support schemes, which may take the form of widening migrants' access to existing welfare programs as well as of creating new schemes that specifically target foreign workers. Finally, migrants' exposure to the contagion and to health hazard calls for interventions that remove - at least temporarily - existing barriers to full health care access for non-citizens. Not only migrants' welfare is at stake here, but it is also in the interest of hosting societies to create the conditions for migrant workers to keep contributing to the solution of the ongoing crisis and to the future recovery. The urgency of implementing measures to support migrant workers during the pandemic crisis has been advocated by organizations such as the World Bank (2020b), the OECD (2020) and the Overseas Development Institute (ODI).[13] Of particular concern are also the detrimental repercussions on migrant flows origin areas: according to the latest

[13]See the ODI's initiative on "Migrants' contribution to the Covid-19 response" at: https://www.odi.org/migrant-key-workers-covid-19/.

World Bank estimates (World Bank, 2020a) remittance flows to low- and middle-income countries (LMICs) are projected to decline 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.

The pandemic may also offer a possibility of identifying weak spots in current migration policies and thinking about improvements and solutions. For example, Fernandez-Reino, Sumption and Vargas-Silva (2020) estimate that 40-50 per cent of current foreign born workers employed in essential occupations in the UK would not qualify for a working visa according to the new migration rules that the British government is planning to introduce after having left the EU. The widespread emphasis in the migration policy debate on attracting high-skilled migrants may need some re-thinking since the ongoing crisis has shown that migrants are playing an essential role also in so-called low-skilled occupations.

References

Adams-Prassl, A., Boneva, T., Golin, M. and Rauh, C. (2020). 'Inequality in the impact of the coronavirus shock: Evidence from real time surveys', *Journal of Public Economics*, vol. 189, p. 104245, ISSN 0047-2727, doi:https://doi.org/10.1016/j.jpubeco.2020.104245.

Alon, T., Doepke, M., Olmstead-Rumsey, J. and Tertilt, M. (2020). 'The impact of covid-19 on gender equality', National Bureau of Economic Research, doi:10.3386/w26947.

Avato, J., Koettl, J. and Sabates-Wheeler, R. (2010). 'Social Security Regimes, Global Estimates, and Good Practices: The Status of Social Protection for International Migrants', *World Development*, vol. 38(4), pp. 455–466.

Barker, N., Davis, C.A., López-Peña, P., Mitchell, H., Mobarak, A.M., Naguib, K., Reimão, M.E., Shenoy, A. and Vernot, C. (2020). 'Migration and the labour market impacts of covid-19', .

Basso, G., Boeri, T., Caiumi, A. and Paccagnella, M. (2020). 'The new hazardous jobs and worker reallocation', OECD.

Blanchard, O. and Landier, A. (2002). 'The Perverse Effects of Partial Labour Market Reform: Fixed-Term Contracts in France', *The Economic Journal*, vol. 112(480), pp. F214–F244.

Boeri, T. and Garibaldi, P. (2007). 'Two tier reforms of employment protection: A honeymoon effect?', *Economic Journal*, vol. 117(521), pp. F357–F385.

Borjas, G.J. (2001). 'Does Immigration Grease the Wheels of the Labor Market?', *Brookings Papers on Economic Activity*, vol. 32(1), pp. 69–134.

Borjas, G.J. and Cassidy, H. (2020). 'The Adverse Effect of the COVID-19 Labor Market Shock on Immigrant Employment', National Bureau of Economic Research, Inc.

Cadena, B.C. and Kovak, B.K. (2016). 'Immigrants equilibrate local labor markets: Evidence from the great recession', *American Economic Journal: Applied Economics*, vol. 8(1), pp. 257–90.

Cortes, G.M. and Forsythe, E. (2020a). 'Impacts of the covid-19 pandemic and the cares act on earnings and inequality', Institute of Labor Economics (IZA).

Cortes, G.M. and Forsythe, E.C. (2020b). 'The heterogeneous labor market impacts of the covid-19 pandemic.', Upjohn Institute for Employment Research.

Couch, K.A., Fairlie, R.W. and Xu, H. (2020). 'Early evidence of the impacts of covid-19 on minority unemployment', *Journal of Public Economics*, p. 104287, ISSN 0047-2727, doi:https://doi.org/10.1016/j.jpubeco.2020.104287.

De Grauwe, P. and Ji, Y. (2020). 'A tale of three depressions', *VoxEU.org*.

de la Rica, S., Glitz, A. and Ortega, F. (2015). 'Chapter 24 - immigration in europe: Trends, policies, and empirical evidence', in (B. R. Chiswick and P. W. Miller, eds.), *Handbook of the Economics of International Migration*, pp. 1303 – 1362, vol. 1 of *Handbook of the Economics of International Migration*, North-Holland.

Dingel, J. and Neiman, B. (2020). 'How many jobs can be done at home?', Becker Friedman Institute.

Dustmann, C., Glitz, A. and Vogel, T. (2010). 'Employment, wages, and the economic cycle: Differences between immigrants and natives', *European Economic Review*, vol. 54(1), pp. 1–17.

Fasani, F. and Mazza, J. (2020a). 'A Vulnerable Workforce: Migrant Workers in the COVID-19 Pandemic', Publications Office of the European Union.

Fasani, F. and Mazza, J. (2020b). 'Immigrant Key Workers: Their Contribution to Europe's COVID-19 Response', Institute of Labor Economics (IZA).

Fernandez-Reino, M., Sumption, M. and Vargas-Silva, C. (2020). 'From Low-Skilled to Key Workers: The Implications of Emergencies for Immigration Policy', *Oxford Review of Economic Policy*.

Gelatt, J. (2020). 'Immigrant Workers. Vital to the U.S. COVID-19 Response, Disproportionately Vulnerable', Migration Policy Institute (MPI).

Hoynes, H., Miller, D.L. and Schaller, J. (2012). 'Who suffers during recessions?', *Journal of Economic Perspectives*, vol. 26(3), pp. 27–48.

Hupkau, C. and Petrongolo, B. (2020). 'Work, care and gender during the Covid-19 crisis', Centre for Economic Performance, LSE.

Kerr, S.P. and Kerr, W.R. (2011). 'Economic Impacts of Immigration: A Survey', *Finnish Economic Papers*, vol. 24(1), pp. 1–32.

Koren, M. and Peto, R. (2020). 'Business disruptions from social distancing', mimeo.

Mongey, S., Pilossoph, L. and Weinberg, A. (2020). 'Which workers bear the burden of social distancing policies?', National Bureau of Economic Research, doi:10.3386/w27085.

OECD (2020). *OECD Economic Outlook, Interim Report September 2020*.

OECD (2020). 'What is the impact of the COVID-19 pandemic on immigrants and their children?', OECD.

Orrenius, P. and Zavodny, M. (2010). 'Mexican immigrant employment outcomes over the business cycle', *American Economic Review*, vol. 100(2), pp. 316–20.

Pagano, M., Wagner, C. and Zechner, J. (2020). 'Disaster resilience and asset prices', CEPR.

Platt, L. and Warwick, R. (2020). 'Covid-19 and ethnic inequalities in england and wales', *Fiscal Studies*, vol. 41(2), pp. 259–289.

Proto, E. and Quintana-Domeque, C. (2020). 'COVID-19 and Mental Health Deterioration among BAME Groups in the UK', Institute of Labor Economics (IZA).

World Bank (2020a). 'Phase II: COVID-19 Crisis through a Migration Lens', World Bank.

World Bank (2020b). 'Potential responses to the covid-19 outbreak in support of migrant workers', World Bank.

Yang, D. (2011). 'Migrant Remittances', *Journal of Economic Perspectives*, vol. 25(3), pp. 129–152.

Appendix A

Appendix A.1 The Vulnerabilities of Key and Non-key Migrant Workers

As discussed is Section 3, we evaluate the vulnerability of migrant key and non-key workers along four dimensions: i) the probability of holding a temporary ocntract; ii) wages; iii) physical proximity; iv) teleworkability. For each of these outcomes, we estimate the following linear probability model (LPM):

$$y_i = \alpha_i + \beta X_i + \gamma EU_i + \theta EXTRA_i + \psi_c + \epsilon_i \tag{A.1}$$

where y_i is an indicator variable for the outcome of interest, X_i a vector of variables recording personal characteristics (sex, age and educational level), EU_i and $EXTRA_i$ are indicator variables that identify EU and Extra-Eu migrants, respectively, and ψ_c are country fixed effects. In estimating this equation, we interact both migrant group dummies with a female dummy to assess gender differences in vulnerability.

In Table A.1, we report our results for the probability of having a temporary contract (columns 1-3), being in the top half of the earning distribution (columns 4-6), being in a job with high physical proximity (column 7) and being in a teleworkable job (column 8). For the temporary contract and earning outcomes we estimate the baseline specification that only controls for individual characteristics and country FE described in Equation A.1 (columns 1 and 4) and two additional specifications where we also include occupation and industry fixed effects. Since the proximity and teleworkability indices vary only at occupational level, we cannot include occupation fixed effects when looking at these two outcomes. Our estimates shows that migrant key workers, especially the extra EU ones, are more insecure in their jobs and are paid less than their native counterparts. In the baseline specification, EU male migrants (extra-EU migrants) are 3 (7) percentage points more likely to be in temporary employment and 6 (9) p.p less likely to earn wages in the top half of the income distribution. When we condition on occupation and industry fixed effects, the probability gap remains essentially unaffected for temporary employment (columns 2-3), while it shrink substantially for income (columns 5-6), suggesting that around half of the earning gaps are due to differential sorting of migrants and natives into occupations. For EU male migrants the picture is more blurred if we consider our proxies for health risk. On the one hand, they are 1 percentage points less likely to be in employed in professions requiring close physical proximity to other people (column 7), but they are also 5 percentage points less likely to be employed in professions that can be performed from home. For Extra EU male migrants, instead, the picture is unequivocally more unfavorable; they are both 2 percentage points more likely to be in close proximity to co-workers or clients and 5 percentage points less likely to be able to work from home. Table A.1 also allows us to asses the differential vulnerability of female and male workers by nationality. Our analysis shows that native female key-workers are in a more precarious situation than native men, being almost 4 percentage points more

likely to be employed with temporary contracts (mostly due to their occupational sorting as column 2 indicates), 10 percentage points less likely to earn top wages (once we condition for their occupation) and 10 percentage points more likely to be employed in occupations requiring close physical proximity. The disadvantage is less clear-cut if we compare EU migrant men and women. Within this group the probability of holding a temporary contract is very similar between the two groups; women are only 3 percentage points less likely earn top salaries, but the difference disappears once we account for differences in occupations between the two sexes; women are less likely to be able to work from home, but are also relatively less likely to work in occupations requiring close physical proximity. Remarkably, within extra EU migrants, women key workers seem to be *less* vulnerable than men. They are 3 percentage points less likely to hold a temporary contract and almost 2 percentage points less likely even within occupation-industry cells; they are around 1.5 percentage points less likely to earn top wages, but this gap turns in their favor once we account for differential occupational sorting; they are 3.6 percentage points less likely to be able to work from home, but they are also almost 7 percentage points less likely to have to work in close physical proximity to others.

In Table A.2, we re-estimate equation A.1 on a sample of non-essential workers for the same four binary outcomes (temporary contract, high earnings, proximity and teleworkability). As far as economic conditions are concerned, the results for men non-key workers are aligned with those for key workers: migrants are more likely than natives to be employed with temporary contracts - in our baseline specification (column 1), 4 percentage points and 8.2 percentage points for EU and extra EU migrants, respectively - and less likely to earn wages in the top half of the distribution - 3.6 and 7.5 percentage points difference (almost halved when conditioning on occupation and then industry fixed effects in columns 5 and 6). When considering proxies for exposure to the contagion, instead, our results clearly point at migrants being substantially more vulnerable than natives with similar characteristics. Not only they are more likely to be employed in occupations that require close physical proximity (3.3 and 5.4 percentage points more likely for EU and extra EU migrants, respectively; column 7), but they are also roughly 8-9 percentage points less likely to be able to work from home (column 8). Gender gaps among native non-key workers are also very similar than those that we estimate for key-workers. Women are more frequently employed with temporary contracts and less likely to earn wages even within the same occupations and industries; they are more likely to work in occupations requiring close proximity, but they are also more likely to work in jobs that can be performed from home. Among migrants, instead, gender differences are much less pronounced. Among EU non-key workers women are as vulnerable as men, while for extra-EU migrants, women outperform men in terms of wages, are only 1.5 p.p more likely to have a temporary contract, but this difference disappears once we condition for occupation, they have the same probability of being employed in jobs requiring physical proximity and are only 1.6 p.p less likely to be able to work from home than extra EU migrant men.

Table A.1: Key Workers: Migrant-Native Gaps in Job Attributes

	Temp. Contr.			Top earners			Proximity	Teleworkability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU mobile	0.034***	0.028***	0.029***	-0.052***	-0.012	-0.012	0.001	-0.065***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.006)	(0.007)
Extra EU	0.072***	0.064***	0.063***	-0.082***	-0.034***	-0.034***	0.043***	-0.063***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
Female × EU mobile	-0.005	-0.002	0.003	-0.036***	-0.016	-0.013	-0.038***	-0.042***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
Female × Extra EU	-0.032***	-0.026**	-0.018*	-0.006	0.017*	0.022**	-0.084***	-0.036***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Female	0.038***	0.006	0.003	-0.186***	-0.112***	-0.107***	0.110***	-0.011***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Occupation FE		✓	✓		✓	✓		
Industry FE			✓			✓		
Age FE	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.135	0.144	0.147	0.349	0.405	0.410	0.073	0.283
Obs.	332,110	332,110	330,436	332,110	332,110	330,436	332,110	332,110

Note: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively. All regressions include an educational level dummy. All regressions are weighted using person weights from the LFS. Robust standard errors in parentheses.

Table A.2: Non-Key Workers: Migrant-Native Gaps in Job Attributes

	Temp. Contr.			Top earners			Proximity	Teleworkability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU mobile	0.040***	0.023***	0.022***	-0.043***	-0.018***	-0.016***	0.033***	-0.094***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Extra EU	0.082***	0.066***	0.063***	-0.083***	-0.050***	-0.044***	0.051***	-0.095***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Female × EU mobile	-0.011	-0.003	-0.002	0.010	0.004	0.002	0.011*	0.001
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
Female × Extra EU	-0.015*	-0.007	-0.003	0.028***	0.024***	0.020***	0.006	-0.018**
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
Female	0.014***	0.014***	0.010***	-0.178***	-0.143***	-0.134***	0.060***	0.103***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Occupation FE		✓	✓		✓	✓		
Industry FE			✓			✓		
Age FE	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.169	0.186	0.189	0.317	0.358	0.366	0.137	0.258
Obs.	612,621	611,055	607,828	612,621	611,055	607,828	604,285	604,285

Note: ***, ** and * denote statistical significance at the 99.9, 99 and 95%, respectively. All regressions include a gender dummy and dummies for the highest educational level achieved. All regressions are weighted using person weights from the LFS. Robust standard errors in parentheses.

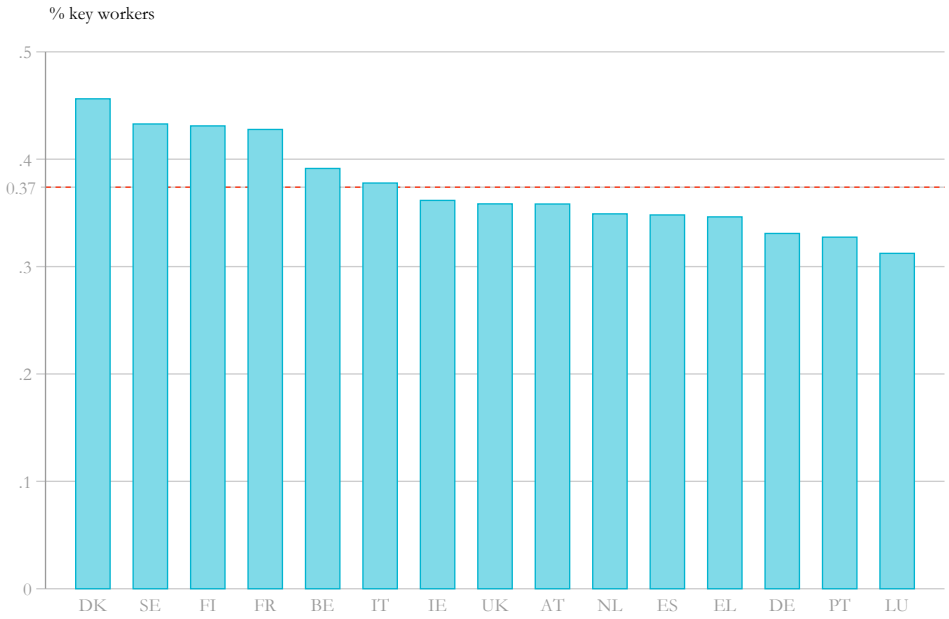
Appendix A.2 Key Occupations: Definition and Shares

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

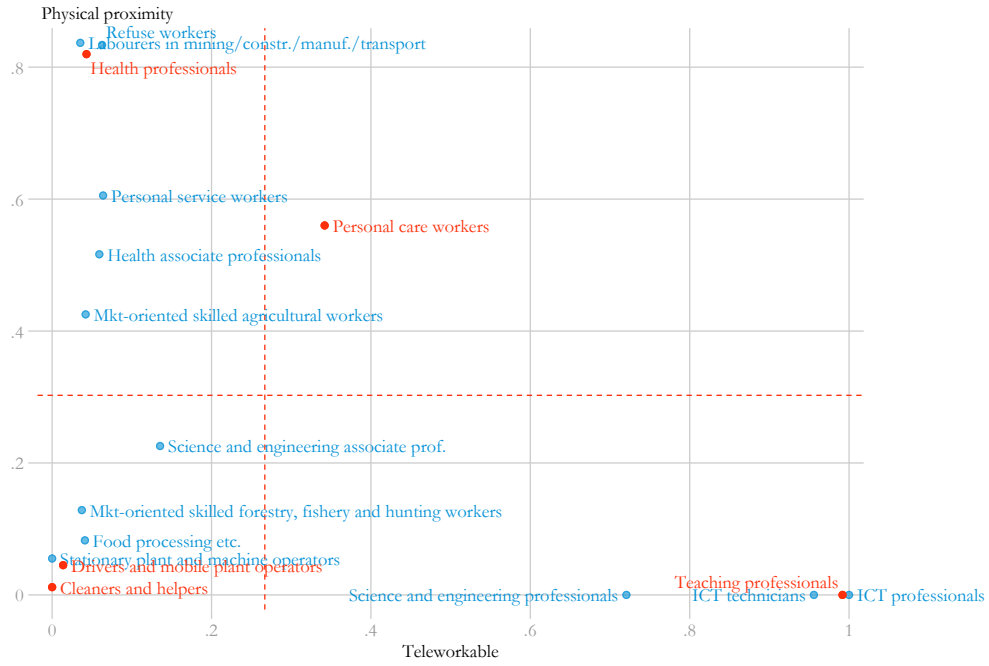
Figure A.1: Share of Key Workers, by Country



Note: The bars report the percentage of key workers over the employed population for each country. The red dotted line indicates the cross-country average of workers defined as key workers (37%).

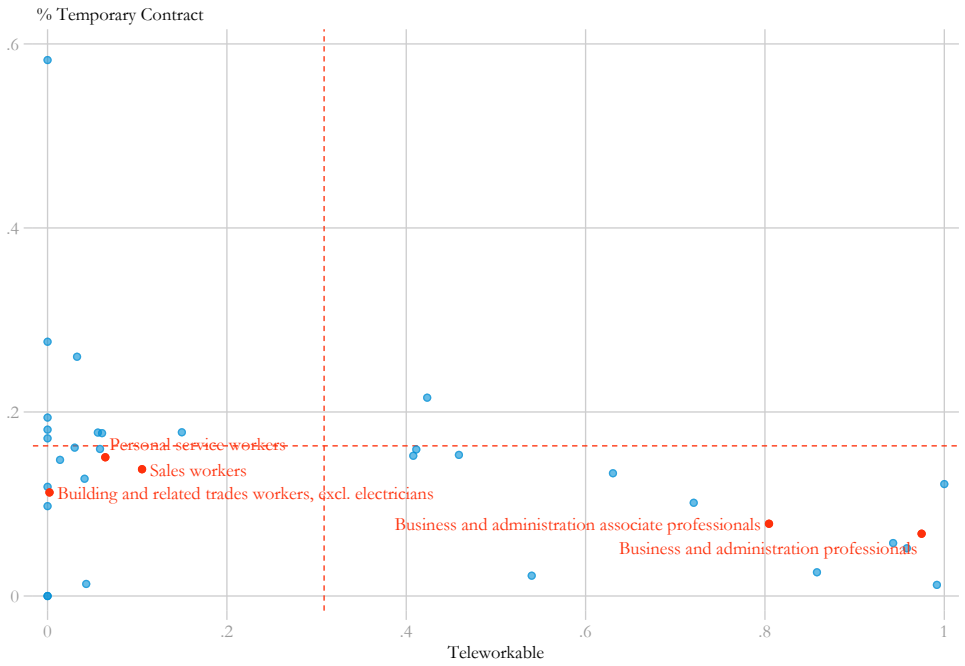
Appendix A.3 Teleworkability and physical proximity indices by occupation

Figure A.2: Key Occupations: Physical Proximity and Teleworkability

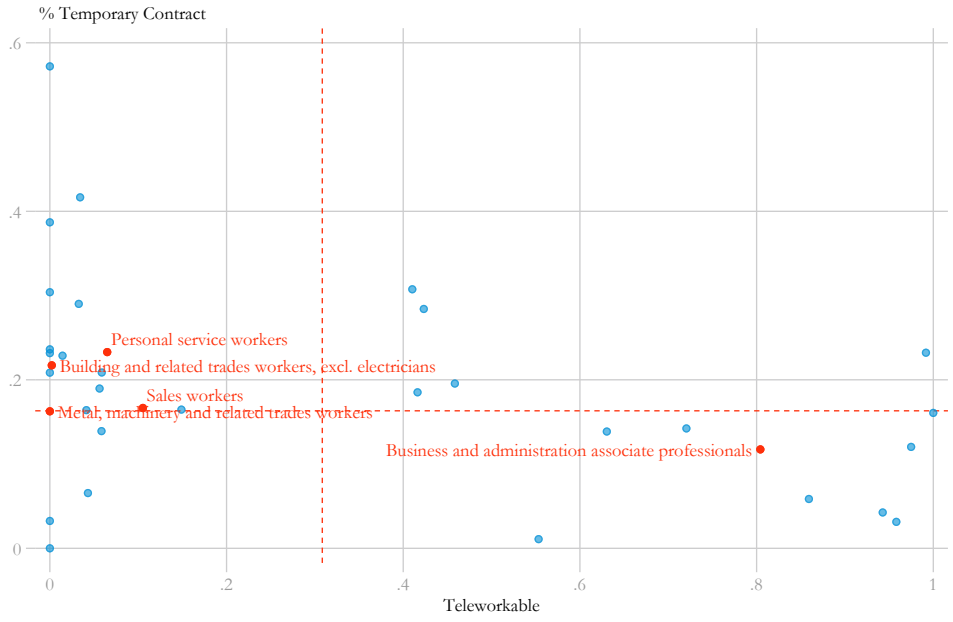


Note: The red dots represents the top 5 occupations for share of migrants. The vertical dashed line represents the average share of jobs that can be done at home by occupation; the horizontal dashed line represents the average for the physical proximity indicator.

Figure A.3: Other Occupations: Temporary Contracts and Teleworkability



(a) EU Mobile

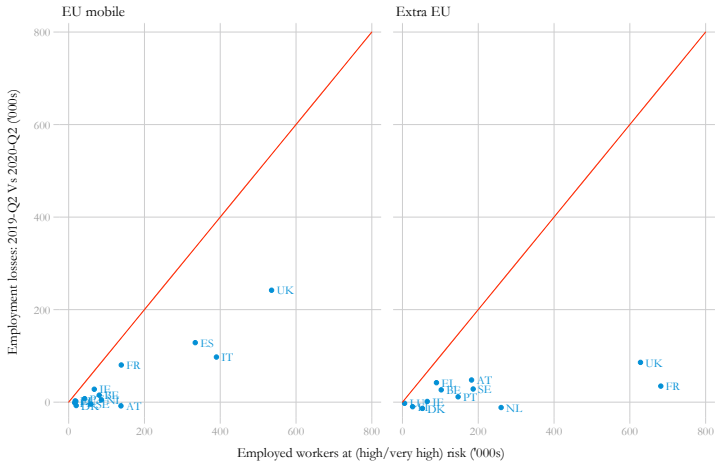


(b) Extra-EU

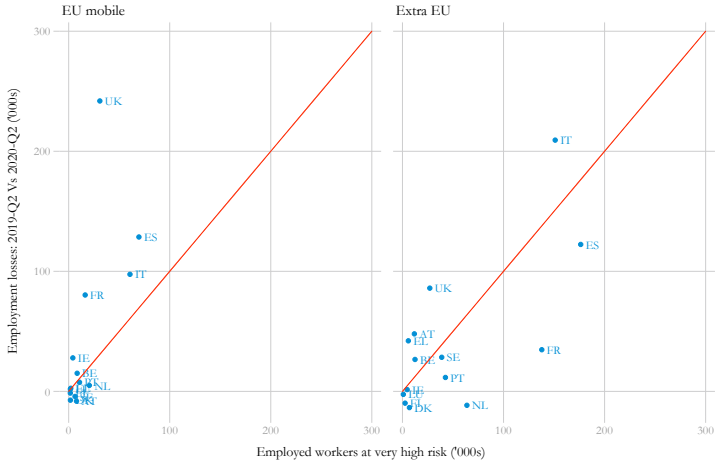
Note: The red dots represents the top 5 occupations for share of migrants. The vertical dashed line represents the average share of jobs that can be done at home by occupation; the horizontal dashed line represents the average share of temporary contracts by occupation for migrants.

Appendix A.4 Employed workers at risk and realized losses

Figure A.4: Realized employment losses (2020-Q2 relative to 2019-Q2) and number of employed workers at risk, by country and origin



(a) Employed workers at risk



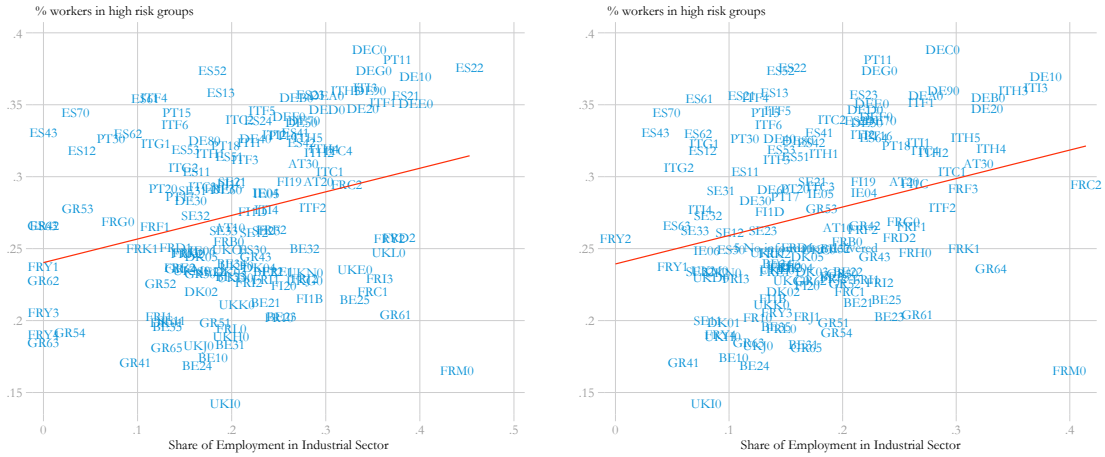
(b) Employed workers at very high risk

Note: The figures report a scatter plot of employment losses (2020-Q2 relative to 2019-Q2) versus the number of employed workers at risk (upper panel) and at very high risk (lower panel) of becoming unemployed. Note that we assign positive values to the employment losses and negative to employment gains. The continuous straight line is the equality line.

Appendix A.5 Risk exposure measure and size of manufacturing in regional labour markets

We define the industrial sector as categories 3, 4, 5 and 6 of the NACE 1-digit coding corresponding to the Manufacturing; Electricity, gas, steam and air conditioning supply; Water supply, sewage and waste management and Construction sectors. Jobs in these sectors are hardly teleworkable and often require physical proximity to co-workers.

Figure A.5: Workers at high risk of job loss, by region and origin



(a) EU mobile (b) Extra EU

Note: Panels A.5a and A.5b plot the regional share of employment in the industrial sector against the share of EU and extra EU workers at high risk, respectively. Lines of best fit in red.

School of Economics and Finance

This working paper has been produced by the School of Economics and Finance at Queen Mary University of London

School of Economics and Finance Queen Mary University of London
Mile End Road
London E1 4NS
Tel: +44 (0)20 7882 7356
Fax: +44 (0)20 8983 3580
Web: www.econ.qmul.ac.uk/research/workingpapers/