Essential Work, Migrant Labour: What Explains Migrant Employment in European Key Sectors?*

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Abstract. Amidst the COVID-19 lockdowns, it became obvious that migrants play a critical role in economic sectors that are essential to the functioning of everyday life. Are they over-represented in these sectors, and how is the use of migrant labour linked to structural factors in the provision of essential services? Using micro data from the EU Labour Force Survey (EU-LFS) 2011-2020 for 17 countries, this paper investigates the extent and the drivers of migrants' over-representation in key sectors (e.g. health, long-term care, food supply) relative to the rest of the economy. We measure the difference in the probability of working in key sectors for various types of migrants to similar natives across countries of destination. Our results show that in most countries, migrants are over-represented with respect to native-born workers after accounting for individual characteristics. We also provide an overview of the correlation between this residual over-representation and potential structural factors. We find a strong and robust correlation between migrants' relative employment probability in key sectors and precarious job conditions, the degree of autonomy and flexibility at work, as well as attitudes to migrants, both at the country-level and across sub-national regions.

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1 Introduction

During the COVID-19 pandemic, it became apparent that essential services – those linked to basic societal and economic functions – often relied on foreign-born workers in many EU countries and beyond. Migrants working in health, long-term care, the food supply chain, logistics, transport and energy, among other essential services, had suddenly become much more visible, irrespective of their precise role.[1] This highlighted how much essential services in many developed countries relied on migrant labour in order to function. In fact, it emerged from the first quantitative studies that migrants are often over-represented: in many countries, their share in essential occupations is higher than their share in total employment (Fasani and Mazza, 2020 and 2023 for the EU; Gelatt, 2020, Kerwin and Warren, 2020 as well as Allen et al., 2023 for the United States).

This paper studies some of the factors driving the over-representation of migrants in essential occupations, drawing on cross-country micro data for EU-15 countries (including the United Kingdom) as well as Norway and Switzerland. We propose several ways in which both labour demand and labour supply might make migrants more likely than native-born to work in essential occupations. Some of these mechanisms are linked to the very nature of essential work, which we show is not just a label but captures observable differences from non-essential work. Before investigating such structural factors at the meso and macro-level, we consider socio-economic factors at the individual level in order to account for the composition of the labour force. For example, high migrant shares among low-skilled persons would mechanically produce over-representation of migrants in low-skill occupations. The first-stage of our empirical analysis therefore provides a detailed account of the residual over-representation of migrants that remains after accounting for individual factors. In the second stage of our analysis, we investigate how this residual over-representation can be explained by structural variables such as job characteristics and attitudes towards immigrants. To the best of our knowledge, this paper is the first quantitative analysis showing how structural labour market characteristics matter to explain the reliance of European key sectors on migrant labour.

We know of only a few previous attempts at uncovering reasons for migrants' observed distribution over sectors or occupations: why do migrants work where they work? After investigating a handful of factors including pay and skill requirements, Aldin et al. (2010) found that these variables could hardly explain the observed distribution of migrants in the United Kingdom. Based on cross-country comparisons, the OECD reported that especially recent migrants are concentrated in some sectors (Breem and Liebig, 2020). Nevertheless, migrants' distribution is not deemed to result directly from immigration policy, as few migration schemes explicitly favour particular sectors. Studying a related

[1] For example, they became the subject of a viral video and a U.S. parliamentary hearing.

issue, Guzi et al. (2021) look at how institutions and policies affect the gap in employment and labour market participation between migrants and native-born.

This paper contributes to this literature in two ways. First, we offer a comparative and consistent analysis of the resilience and dependence of key sectors on foreign labour for 16 Western European countries in the past decade (2010-2020). More specifically, we estimate foreign-born migrants' relative probability to work in key sectors as compared to native-born workers, and paint a comprehensive picture of the over-representation of immigrants in key sectors and the structural factors associated with this phenomenon. We also provide a detailed account of the type of foreign labour for which this over-representation is more likely using migrant-specific attributes such as their place of education, their origin and the time they have spent in their destination country. Second, we analyze host country specific factors that may be related to differences in patterns of over-representation in Western European countries. In this context, we provide a rich description by documenting the variation in over-representation pattern across countries and by exploring correlates of such variation. A rather wide range of structural factors is investigated, using indicators constructed from the micro data as well as extraneous indicators, and several patterns across countries do emerge. Throughout the paper, our analyses also go beyond an aggregate-level approach and explore several dimensions in the data. Firstly, we do not only consider all essential occupations together but also a sub-group of more low-skilled occupations as well as four clusters (occupations related to health, food, cleaning and transport). Secondly, we do not only analyse the over-representation of migrants overall but also document important differences between EU and non-EU migrants, between migrants who arrived before the age of 15 and those arriving later, among others. Thirdly, we replicate our analysis at the regional level, which allows us to check the consistency of the cross-country results.

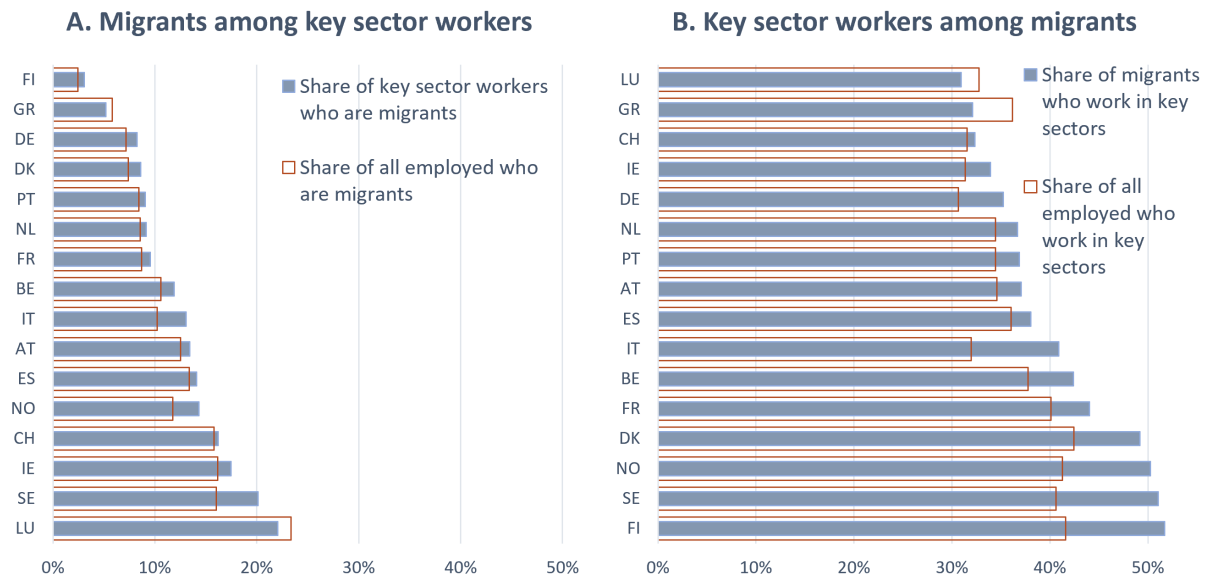
While this analysis does not aim at establishing causality, it sheds light on how job characteristics shape the reliance of key sectors on migrant labour. As countries across the world are drawing the lessons from the COVID-19 pandemic, they seek to bolster the resilience of their critical infrastructure against the next crisis. In fact, geopolitical developments since 2020 have dramatically increased the likelihood of crisis situations in the years ahead, notably linked to food insecurity, political unrest, war and energy shortages. Given the role that migrants in essential occupations have visibly played during the pandemic, it seems high time to understand their role for the resilience of key sectors and why it differs across countries. If the determinants for migrant recruitment and employment were identified, this would also highlight policy levers and might uncover ways in which migrant employment contributes to resilience (e.g. by filling important jobs with difficult working conditions) but also how migrant employment can reflect risks in key sectors (e.g. reliance on precarious jobs with high turnover).

The rest of the paper is structured as follows. Section 2 builds on the literature to derive theoretical expectations for our empirical analysis. Section 3 presents the data and some descriptive statistics. Sections 4 and 5 contain respectively the first-stage and the second-stage empirical analyses. Section 6 reflects on the policy implications of our findings and Section 7 concludes.

2 Literature review and theoretical expectations

Existing studies (such as Fasani and Mazza, 2020 and 2023; Kerwin and Warren, 2020) report that migrants' share in key sectors is often higher than their share in total employment (Panel A of Figure 1). From another and perhaps more striking angle, it emerges that key sectors often account for significantly larger shares of all employed migrants than of all employed (Panel B). We go beyond the existing literature by analysing why this over-representation arises, and we consider two types of potential drivers. Firstly, demographic factors, which can be expected to matter strongly in this context. Secondly, structural factors that can shed light on how the provision of essential services, labour market dynamics, institutional settings and public policies affect migrant's employment in key sectors. We define migrants throughout as foreign-born persons, and we refer to native-born persons also as 'natives' for simplicity. While we use "key sectors" and "essential occupations" interchangeably, our analysis relies on occupational data.

Figure 1. Shares of migrants among key sector workers and vice versa, 2020



Note: All included individuals are aged 15-74 and employed. Table A1 in the Annex provides the underlying figures. Source: authors' calculations based on micro data of the European Labour Force Survey, see section 3 below for details on the data.

2.1 A role for demographic factors

The simple share of employees who are migrants is a readily understandable measure of migrant employment in key sectors but its analytical use is very limited because it partly, perhaps even mainly reflects the share of migrants in the population. For example, to gauge whether a 15% employment share of migrants in a given occupation is high or not, it would have to be compared to their share in total employment. The same logic may be spun further: migrants might account for an unusually large share in an occupation where employees are often young and male, which could simply reflect that the country's migrant labour force is more often young and male than the native-born labour force.

More generally, workers in key sectors may be drawn from demographic groups where migrants are relatively frequent. This implies a role for demographic factors in both the analysis and interpretation of migrants' over-representation in key sectors. Specifically, we account for potential differences in representation linked to age, gender, marital status, education and job tenure (as a proxy for prior work experience). As migration typically takes place early in life, migrants are often more concentrated in younger age groups than the native-born (d'Aiglepierre et al., 2020), which could lead migrants to be over-represented in key sectors that require manual or physically demanding labour, e.g. logistics, agriculture, cleaning and waste removal.

Next, men seem predominant among irregular migrants (e.g. Abel, 2022), and in the context of regular migration of families, men are often the first family members to migrate (Poeschel, 2020). Whenever such patterns lead to migrants being more often male than the native-born, this could contribute to migrants being over-represented in male-dominated occupations. Marital status is included because labour supply behaviour often differs between singles and married persons, e.g. lower labour market participation of married women with children (Turon, 2023). If migrants are less often married than the native-born, this may contribute to them being over-represented in employment.

While education can matter for labour market outcomes in many ways, we include job tenure mainly as a proxy for work experience. In EU countries, the share of low-skilled among migrants is often higher than among the native-born (Eurostat, 2023), and migrants' foreign qualifications and work experience may be difficult to transfer to the host country (e.g. Friedberg, 2000). This seems to be especially frequent for non-EU migrants (OECD/European Commission, 2023). One might therefore expect to find that migrants - and perhaps especially non-EU migrants - are over-represented in occupations that are accessible to workers with a low level of formal education and little or no relevant work experience, including key sectors such as logistics, cleaning and grocery sales. Many of these jobs might require only limited knowlegde of the host-country language, which would make them particularly accessible to migrants (however, our data do not allow us to account explicitly for the level of language proficiency).

2.2 A role for structural factors

Migrants' over-representation in key sectors might also reflect structural factors in both labour supply and demand. In other words, work and recruitment in key sectors may be such that migrants are more likely to be found in these jobs. Conceivable reasons include formal rules and institutions such as labour market regulations, welfare policies, sector-specific policies (that determine e.g. the type of the social care system), migration and integration policies as well as 'informal' structural variables anchored in people's values, norms and attitudes (Ruhs and Anderson, 2010).

The COVID-19 pandemic highlighted that essential work must not stop, in sharp contrast to other kinds of work that were locked down or at least disrupted by a shift towards work from home. In the case of healthcare and long-term care, the fatal consequences of even a temporary suspension of this work are rather obvious, but grave problems would also quickly arise if e.g. the sale of groceries and rubbish collection were to stop. This nature of essential work might *per se* have implications for the employment of migrants in key sectors. The work often involves non-standard working hours such as night work or weekend work, and migrants may be more likely to have such hours (Giuntella, 2012). Essential work such as long-term care also involves personal services, including in various low-skill roles. Such aspects might make work in key sectors less desirable for native-born persons but more accessible for migrants.

Efforts to ensure the quality of essential services have led to licensing requirements (notably in healthcare but also driving licenses in logistics, for example) and sometimes a tight regulatory framework. When some shortage of staff arises in key sectors, such licensing requirements can make it difficult to expand the domestic supply of qualified workers in the short term, and the regulatory frameworks might prevent workarounds or using technology instead. Since essential work nevertheless must not stop and staff shortages need to be addressed quickly, employers in key sectors might recruit migrants as a short-term response to any kind of shortages (e.g. Wright and McLaughlin, 2024). Several studies find that the recruitment of migrants relies especially often on referrals (e.g. Drever and Hoffmeister, 2008), which might provide employers with faster access to candidates than more formal recruitment procedures.

While not unique to essential work, its location and working conditions might mean that migrants are over-represented in the relevant labour supply. Essential work might be concentrated in or near urban areas, e.g. in hospitals, old-age homes, hubs for logistics and wholesale groceries. Urban areas are known to attract more migrants than rural areas (e.g. Hyndman et al., 2006) so that migrants would be over-represented in the local urban labour supply, compared to the national average. In addition, uniform nominal wages in some essential occupations (e.g. nursing) could make such jobs in expensive urban areas less attractive for native-born workers. At the same time, migrants are known to be especially mobile in response to economic opportunities (Basso and Peri, 2020). When

vacancies in key sectors grow, e.g. due to demographic change and more demand for health and care services, migrants might more readily take up these opportunities, being less attached to their current location.

With regards to working conditions, drawbacks of some jobs in key sectors may deter migrants less than native-born workers (Nivorozhkin and Poeschel, 2022). Comparatively unattractive jobs (low skill requirements, low pay, low prestige) may be more acceptable to migrants because better alternatives are unattainable and the pay is still good compared to wages in the home country (Pioré, 1979). This could also matter in the context of other jobs in key sectors where regulation and public procurement procedures lead to cost caps that limit wages. Migrants might in fact care less about low prestige or even stigma of jobs e.g. in long-term care, cleaning and waste removal because their peer group abroad does not know about it (Fan and Stark, 2011). Similarly, migrants might often not mind non-standard working hours because they are single or their family is abroad. Migrants even exhibit a tendency to work more often in occupations with higher health risks (Fan and Qian, 2017).

Another factor could be that migrants are under greater pressure than the native-born to accept or keep comparatively unattractive jobs, and observing this, employers might sometimes prefer migrants in such jobs. Migrants, and especially recently arrived migrants, might accept unattractive, temporary or especially demanding jobs because they have comparatively few other options, their family urgently needs remittances (Le Dé et al., 2016), they can use such jobs as stepping stones (Jahn and Rosholm, 2013) or they cannot afford waiting for a better job offer. Migrants might keep such jobs longer than the native-born because their residence status is tied to this job or to having some job (Hussein et al., 2011), they cannot rely on social safety nets as much as the native-born (Verschueren, 2016), or they cannot generate a new job offer as quickly. Employers might appreciate migrants' tolerance for and commitment to unattractive or demanding jobs (Anderson and Ruhs, 2010), and among other things, migrants under pressure may be more likely to accept relatively low wages and less likely to insist on their rights as employees. When valuable foreign qualifications and experience are not recognised in the host country, migrants can be employed at lower levels and wages than are warranted by the quality of their work (Pecoraro and Wanner, 2019). In addition, employers might perceive migrant employees who are young and single (or whose family is abroad) as especially flexible, unlikely to fall ill, etc.

Finally, at the level of society, attitudes of the public towards migration might affect the employment of migrants, and especially in the case of key sectors. According to Lee et al. (2022), attitudes to migration are highly correlated with migrants' labour market integration. This could result from less discrimination that migrants encounter in the labour market when public attitudes are more positive, or from legislation that facilitates the recruitment of migrants, possibly including low-skilled migrants. Insofar as cultural and ethnic distance plays a role in this context, attitudes might be especially important

for the employment of non-EU migrants. Since Allen et al. (2023) present experimental evidence that attitudes are more positive towards recruiting migrants for work in key sectors, effects stemming from attitudes might partly explain the over-representation of migrants in essential work.

3 Data

We use the European Labour Force Survey (EU-LFS), assembled by Eurostat from surveys that were carried out in EU Member States, EFTA countries, the United Kingdom and beyond. Access to the micro data was granted under project number RPP 309/2021-LFS. The EU-LFS uses essentially harmonised definitions and notwithstanding some remaining discrepancies, this makes the data directly comparable across countries.[2] They are collected on a quarterly basis through computer-assisted interviews, in person or by telephone. In 2020, the quarterly sample size approached 1.5 million persons across all participating countries and 1.2 million in EU Member States. While this sample size allows the EU-LFS to be representative of the population aged 15-74 in many respects, a caveat arises for recently arrived migrants, generally a hard-to-reach group. As only private households are contacted in the data collection process, recent migrants are undercovered to the extent that they live in group accommodation or are not yet registered as residents. We define migrants throughout as persons born outside of the country where they are surveyed.

We use the data for the years from 2011 onwards, grouping them in two periods of equal length: 2011-2015 (henceforth "period 1") and 2016-2020 ("period 2"). Across the countries participating in the EU-LFS, sample sizes can vary considerably, resulting in variation in the statistical reliability of estimations at country level. We focus our analysis on 17 Western European countries: 15 that were members of the European Union in 1995 and during the period of analysis (Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, the United Kingdom) as well as Norway and Switzerland. These countries arguably have relatively homogeneous institutions and levels of economic development. The Eastern and Central European countries that acceded from 2004 are not included, as they are a more heterogeneous group and their experience as immigrant-receiving countries is very recent, resulting in a very limited number of observations on migrants. Collectively about 12.6 million observations are available at the individual level, across the two periods.

Table 1 offers some descriptive statistics by sector of work and migration status. Migrants tend to be younger, are more often married and far more often live in cities than native-born employees. Interestingly, migrants in key sectors are more often female than their native-born colleagues, while the opposite holds in non-key sectors. Migrants more

[2]For details on data collection and quality, see the Eurostat metadata and Eurostat (2022).

often have a low level of education, work more often in low-skill occupations and more often have low net wages. Only in key sectors, part-time work is more widespread among migrants than among their native-born colleagues.

Table 1. Descriptive statistics for the sample

	employees in key sectors			employees in non-key sectors		
	all	native-born	migrants	all	native-born	migrants
female	50%	49%	55%	45%	45%	40%
aged 15 to 34	28%	28%	29%	32%	32%	35%
aged 35 to 55	53%	53%	58%	52%	52%	54%
aged 55 and older	18%	19%	14%	16%	16%	11%
median age (years)	42	42	42	42	42	37
married	54%	53%	59%	51%	50%	58%
children < 15 in household	35%	34%	43%	34%	33%	43%
living in a city	43%	40%	60%	43%	41%	57%
citizen of the country	91%	100%	36%	92%	100%	35%
low education level	20%	19%	28%	20%	19%	28%
medium education level	38%	38%	34%	48%	50%	39%
high education level	42%	43%	37%	31%	31%	33%
working in a low-skill occupation	29%	26%	48%	25%	23%	34%
with net wage in bottom 30%	31%	28%	47%	29%	29%	35%
with net wage in top 30%	32%	34%	21%	29%	30%	22%
working part-time	25%	24%	31%	21%	21%	21%
median weekly working hours	38	38	38	40	40	40
with a temporary contract	15%	14%	18%	14%	13%	18%
working in shifts	18%	18%	18%	15%	14%	18%
working (sometimes) at night	17%	17%	17%	11%	11%	13%
working (sometimes) from home	19%	20%	14%	16%	16%	15%
in a firm with up to 10 employees	22%	20%	30%	27%	27%	32%
in a firm with > 10 employees	78%	80%	70%	73%	73%	68%
with supervisory responsibilities	22%	23%	16%	26%	27%	22%
median job tenure (years)	7	8	4	7	7	4
self-employed	12%	12%	9%	14%	14%	15%
working for a temp agency	2%	2%	3%	2%	2%	4%
having a second job	5%	5%	5%	4%	4%	3%
observations (N)	4,464,689	3,871,299	593,390	8,163,757	7,230,872	932,885

Every year, the EU-LFS includes a different ad-hoc module with additional questions on a particular topic. Our analyses at Stage 2 draw on modules on the labour market situation of migrants and their descendants (2014), reconciliation between work and family life (2018), work organisation and working time arrangements (2019) as well as accidents and health problems at work (2020). Since not all countries participate in each ad-hoc module, data from the 2014 module are missing for Denmark, Germany, Iceland, Ireland and the Netherlands, and data from the 2020 module are missing for the United Kingdom.

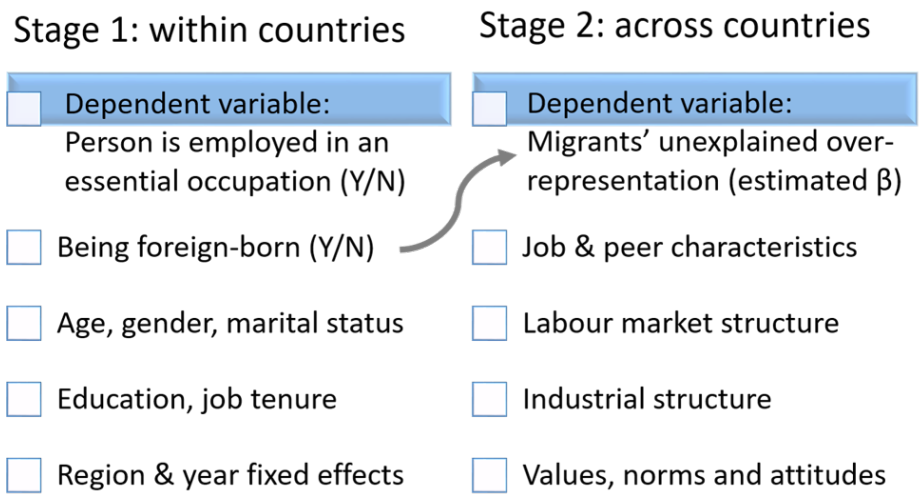
To investigate some further potentially relevant aspects, we introduce data from extraneous sources that we match to our the EU-LFS data at the level of occupations, regions or countries. As explained in further detail in Section 5.3, this includes information from

the European Values Study on attitudes of the population to immigration, as well as the Standard International Occupational Prestige Scale. Table A3 in the Annex list the structural variables, with details on how they were defined and what structural aspects they are thought to capture.

4 Stage One: Accounting for demographic factors

As explained in the previous section, the empirical analysis considers two kinds of drivers: demographic factors (observed at the individual level) and structural factors (observed at the occupational, regional or national level). As the demographic factors reflect the composition of the country's labour force, their effects are estimated within countries. In contrast, effects from structural variables are estimated across countries, as they need to be based on a comparison of the key sectors in one country to the corresponding key sectors in another country. Therefore we approach the estimation in two stages, as shown in Figure 2. Both the empirical strategy and the results for the second stage are presented in Section 5 further below.

Figure 2. Empirical approach using two stages



4.1 First stage empirical strategy and methods

A relative measure of migrant employment in key sectors should account for migrants' basic socio-demographic characteristics that can mechanically determine their employment shares, by reflecting the socio-demographic composition of the migrant population. To this end, we compare relative employment probability in key sectors between natives and migrants while holding constant their observable characteristics: age and gender, marital status, education and job tenure (Panel B of Figure 1 makes this comparison without accounting for characteristics). A linear probability model (LPM) relates the dependent

variable, being employed in an essential occupation (Y/N), to these controls and a variable for being foreign-born (Y/N). The estimated coefficient β for being foreign-born provides the relative measure we seek, which may be called estimated conditional relative employment probability (ECREP). It captures observed differences between migrants and native-born after accounting for socio-demographic characteristics. We estimate the model:

$$Y_{it} = \beta D_{it} + X'_{it}\gamma + y_t + R_i + u_{it} \tag{1}$$

for each country, where Y_{it} is a dummy for being employed in an essential occupation, D_{it} is an indicator for being foreign-born, X is a vector of controls including age, age squared, sex, civil status, educational attainment and job tenure (as a proxy for work experience). The error term u_{it} captures random disturbations, while y_t and R_i refer to year and region fixed effects, respectively. Errors are clustered at the sub-national regional level.

The sign of the estimated β indicates whether migrants appear over (> 0) or underrepresented (< 0) in the occupation in question.[3] For example, if migrants and native-born all had exactly the same socio-demographic characteristics and migrants were nevertheless significantly more likely to work in health-related occupations, then a positive and significant β should result in the estimation for health-related occupations. Running such estimations for each destination country in the data, for several regions in that country and for both time periods produces a set of estimates for β.

4.2 First stage results

4.2.1 At the aggregate level

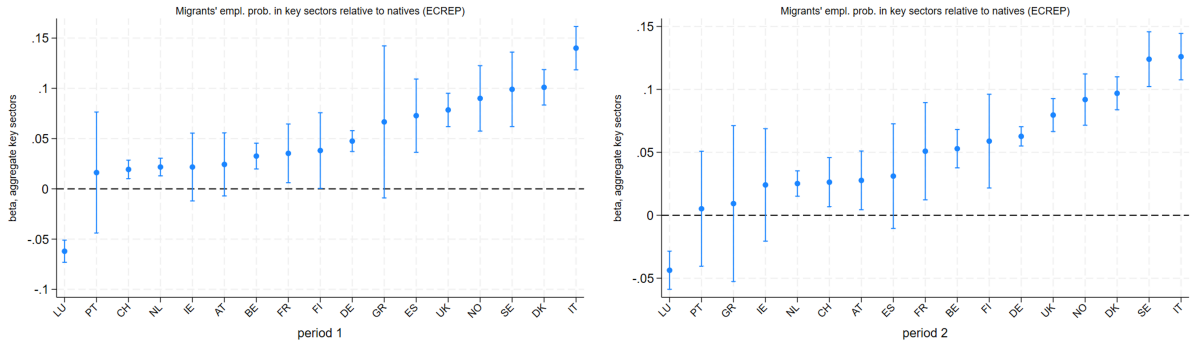
The estimation at the first stage was run separately for each of the 17 countries in the data set (the EU15 countries including the United Kingdom as well as Norway and Switzerland) and for both periods (2011-2015 and 2016-2020). The first period includes potential effects in the years following the financial crisis of 2008/2009, and potential effects of the refugee crisis of 2015/2016 fall into the second period. In each estimation, the key parameter of interest is β, the reliance on migrant labour after accounting for socio-demographic characteristics.

Figure 3 shows the results for the most aggregate-level estimation, where the dependent variable is whether an employee works in any of the essential occupations (Y/N). The point estimates for β are shown together with the 95% confidence interval. In Panel B, for example, after accounting for socio-demographic characteristics, migrants in Belgium appear about 5.5% more likely than the native-born to work in essential occupations,

[3]The estimated β should not be thought of as an adjusted share of migrants among the employees in essential occupations. It is instead linked to the share of migrant employees in an essential occupation among all employed migrants, compared to the share of native-born employees among all employed native-born. Nevertheless, the two measures are correlated.

which is the middle value of a confidence interval from about 4% and almost 7%. Values outside this interval (i.e. clearly below 4% or 7% and more) can be ruled out with 95% certainty. In the case of France, Panel B shows essentially the same point estimate as for Belgium, but with a larger confidence interval, indicating that the point estimate for France is less certain than for Belgium. Where confidence intervals include 0%, it cannot be ruled with 95% certainty that there is actually no difference ($\beta = 0$) between migrants and native-born.

Figure 3. First-stage results on the over-representation of migrants in key sectors



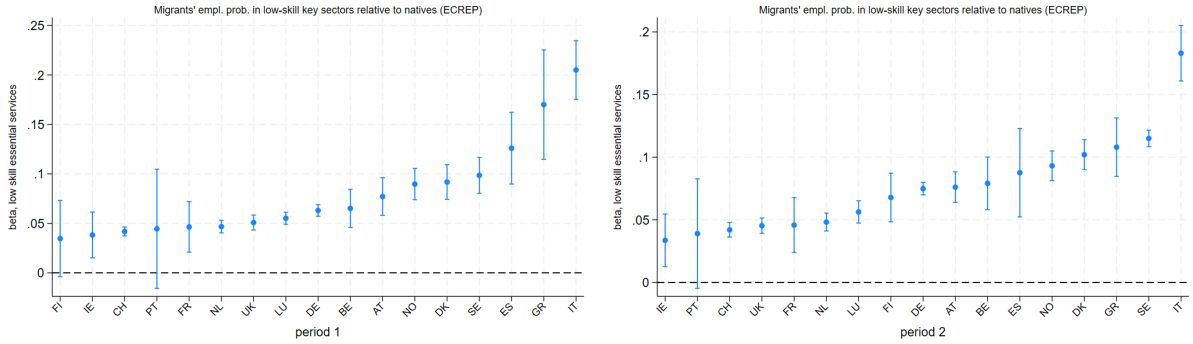
The overall finding is the same in both periods: in roughly a third of all countries shown in Figure 3, it cannot be ruled out that there is no difference between migrants and native-born, while in two thirds of the countries, migrants are more likely than native-born to work in essential occupations (with 95% certainty). Only for Luxembourg, entirely negative confidence intervals result in both periods, so that migrants here seem less likely to work in essential occupations than native-born. However, the β for Luxembourg is likely wrong in so far as very many migrant workers in Luxembourg live outside the country and commute instead (i.e., cross-border workers), which means that the data for Luxembourg do not cover them and they do not enter the estimation. The countries with the highest estimates for β are largely the same in both periods: in Italy, Sweden, Denmark, Norway, the United Kingdom and Germany, migrants always seem at least 5-7% more likely to work in essential occupations, possibly up to almost 15% in Italy and Sweden. As confidence intervals in the two periods overlap, it cannot be ruled out that the true β remained the same in almost all countries – except in Germany (a significant increase over time).

These results are not in contradiction with the employment shares reported by Fasani and Mazza (2020) in their Figure 4. In that figure, the combined shares of EU and non-EU migrants working in essential occupations likely exceed the share of native-born in about two thirds of the countries covered in both their and our samples. The difference seems especially large in Italy, Sweden and Denmark, while migrants' share in Luxembourg seems to remain below that of native-born, which is in line with our results. No case of a strong divergence in results arises. This agreement at the aggregate level arguably

lends credibility to our approach, and the divergence in results might grow significantly at sub-aggregate levels (such as occupational groups) where employees may be more strongly selected on socio-demographic characteristics. In addition, our approach produces results that are directly comparable across countries.

As a first step beyond the aggregate level, Figure 4 shows our results for the group of low-skill essential occupations only. [4] In this context, there are hardly any countries where no difference between migrants and native-born cannot be ruled out. In fact, in almost all countries, migrants are more likely than native-born to work in low-skill essential occupations, and migrants being less likely does not arise in any of the countries covered (with 95% certainty). Compared to the aggregate level, the results for period 2 in Figure 4 are also more pronounced in another way: while confidence intervals overlap for many countries, the estimated β in Figure 4 is far higher than in Figure 3 for Greece and Luxembourg, and now rules out a zero difference from native-born in the case of Spain and Ireland. The countries with the highest estimated β are largely the same as at the aggregate level, still including Italy, Sweden, Denmark, and Norway.

Figure 4. First-stage results on the over-representation of migrants in low-skill key sectors



Overall, migrants tend to have a greater probability of working in essential occupations than native-born, at aggregate level and especially when considering only low-skill occupations. The countries where migrants' probability exceeds that of native-born most markedly are the Nordic countries, Italy and the United Kingdom, arguably followed by Germany. In contrast, migrants have almost never a lower probability than native-born. Where their probability is significantly higher, the estimates vary substantially across countries, although our approach has accounted for variation linked to socio-demographic characteristics. This remaining variation warrants further analyses, and the next section identifies several factors that appear to matter strongly.

[4] Jobs in sales and services and elementary occupations (ISCO 5 and 9) are considered as low skill based on the OECD classification (OECD, 2019). Note that this definition groups workers by the skill requirement of their occupations and does not necessarily reflect the actual skill levels defined by workers' formal education.

4.2.2 Migrant-specific indicators

As seen previously, migrants' over representation in key sectors is highly correlated with their employment probability in low-skill occupations within these sectors.[5] A plausible explanation behind this phenomenon is migrants' initial disadvantage in the labor market of the host country. Indeed, migrants often have limited knowledge of its language and culture, their professional skills are not easily transferable, they may lack host-country educational credentials and labor market experience, they have limited access to information and social networks, and they may face limited job opportunities due to their legal status or discrimination from employers. Against this backdrop, we next investigate whether their relative employment probability in key sectors varies with migrant-specific characteristics that correlate positively with economic integration.

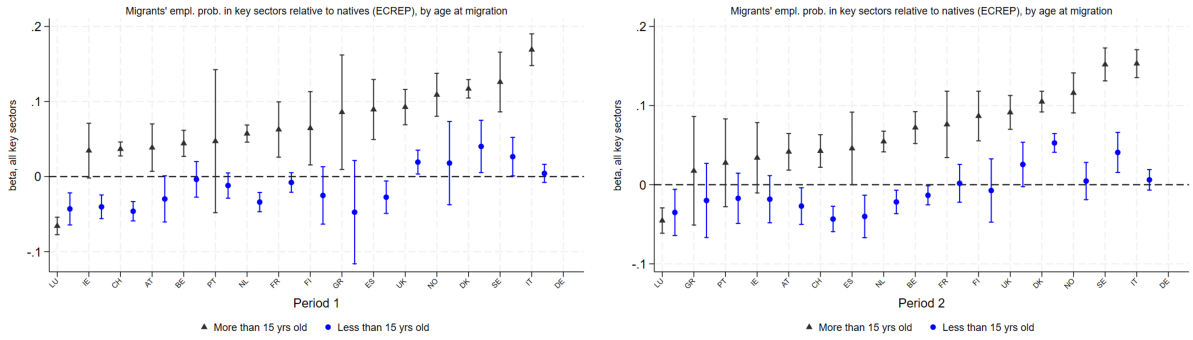
Age at migration. We first differentiate between migrants based on their age at arrival in their host country. Various papers find that migrants can only apply their high skills if they also have a good language level (Chiswick and Miller, 2003 and Berman et al, 2003). Age at the time of migration allows to distinguish between migrants who grew up and went to school at destination, therefore gaining a significant advantage in learning the host-country language. In fact, while we do not observe language proficiency in our data, age at migration undoubtedly highly correlates with it. Growing up at destination also provides greater cultural as well as educational capital (e.g. Åslund et al., 2015) and often easier access to citizenship, which can correlate with migrants' labour market outcomes.

Unsurprisingly, we find that for almost all countries where migrants are over-represented, individuals who migrated before the age of 15 are significantly and sometimes very substantially less likely to be employed in key sectors than those who arrived later (Figure 5). In fact, we find virtually no differences between migrants who arrived at destination before the age of 15 and natives. The only exceptions are Scandinavian countries (Denmark and Sweden mostly for period 2 in the wake of the 2015 refugee crisis). A clear picture emerges: Across the EU, migrants who migrated at a young age are just as likely as natives – and sometimes even slightly less likely – to be employed in key sectors when comparing workers with similar characteristics and employed in similar regions. In contrast, with the exception of Denmark and Sweden, the over-representation of migrants in key sectors is entirely driven by migrants who did not grow up in their host country.

Where education was obtained. Focusing next on the benefits of skill recognition, we explore education credentials: Training acquired in the host country fosters the creation of networks and provides a better recognition of skills. Young migrants receiving post-secondary and professional training in the host country are therefore likely to acquire

[5] Fasani and Mazza (2020) show that this over-representation is only salient for occupations with low qualifications, whereas natives are actually more likely to be employed in high-skilled occupations within key sectors across the EU.

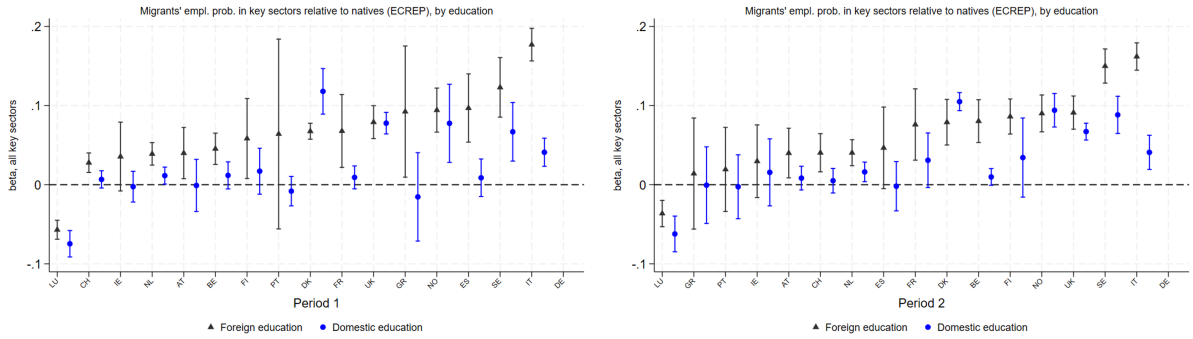
Figure 5. Age at migration and the over-representation of migrants in key sectors



human capital that helps them integrate in the labour market (Basilio et al. 2017, Zorlu and Hartog, 2012). A recent report has shown that across OECD countries, 27% of highly educated migrants were not in employment (vs 20% of those holding a domestic qualification) and 28% were overqualified (vs 18%).

Figure 6 below shows the difference between immigrants who completed their highest level of education before migrating, and those who acquired it at destination. For both time periods, the vast majority of countries where migrants are no more likely to work in key sectors show no significant differences between immigrants with foreign or domestic qualifications. However, in several countries where migrants are indeed more likely to be employed in key sectors, this probability is significantly larger for migrants holding foreign qualifications. For instance, in Belgium, France, Spain, Austria, and Switzerland, foreigners who completed their education in the host country are no more likely to work in key sectors than natives, in contrast with their counterparts holding foreign qualifications. In Italy and Sweden, both types of migrants are still more likely to work in key sectors, but the gap between immigrants with domestic qualifications and those without is significant and positive. The country where this gap is the largest is Italy, where immigrants with foreign credentials are around 13% more likely to work in key sectors than those who finished their education at destination.

Figure 6. Foreign education and the over-representation of migrants in key sectors

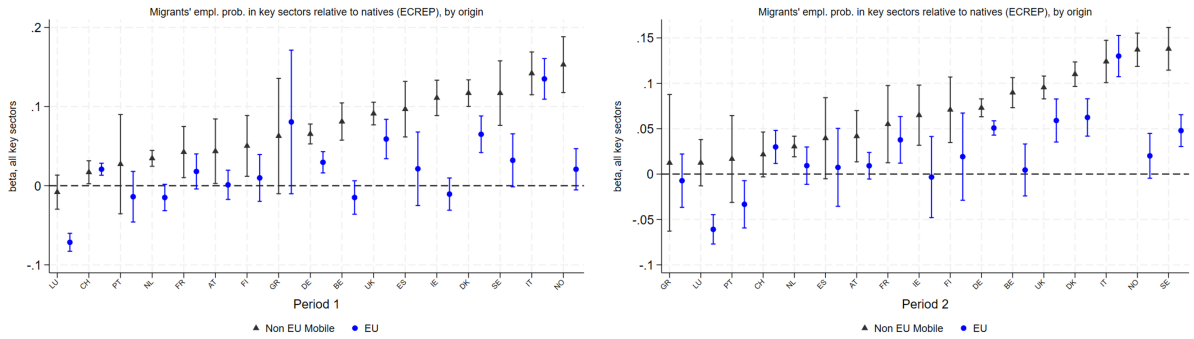


Notes: In this context, data for Germany were not available.

Country of origin. Finally, we explore whether migrants' country of origin matters in this context. Migrants with easily transferable skills and coming from countries of origin culturally and economically similar to their destination may be better equipped to integrate in the labour market. Indeed, the EU has worked towards facilitating and promoting automatic mutual recognition of higher education diplomas and professional qualifications across member countries. For instance, the Bologna Process ensures comparability in the standards and quality of higher-education qualifications between European countries. Professions including nurses, midwives, doctors and dentists as well as pharmacists also benefit from a system of automatic recognition of professional qualifications at the EU level.

With the exception of Luxembourg, where EU immigrants are significantly under-represented among key workers, Figure 7 below reveals no significant differences between EU and non-EU immigrants in countries where immigrants are no more likely than natives to be employed in key sectors. In contrast, in countries where migrants' over-representation is more marked, a similar pattern to that found in Figure 6 emerges. Immigrants from EU member countries appear to be significantly less likely to work in key sectors than those from outside the EU. In fact, in Belgium, Spain, Ireland and Norway, the probability of EU immigrants to work in key sectors is similar to that of natives. In the United Kingdom, Sweden, Denmark, and Germany, this probability is higher, but significantly lower than that of immigrants from non-EU countries. One notable exception is Italy, where EU and non-EU immigrants are roughly equally over-represented among key workers (12%).

Figure 7. EU vs non-EU origin and the over-representation of migrants in key sectors

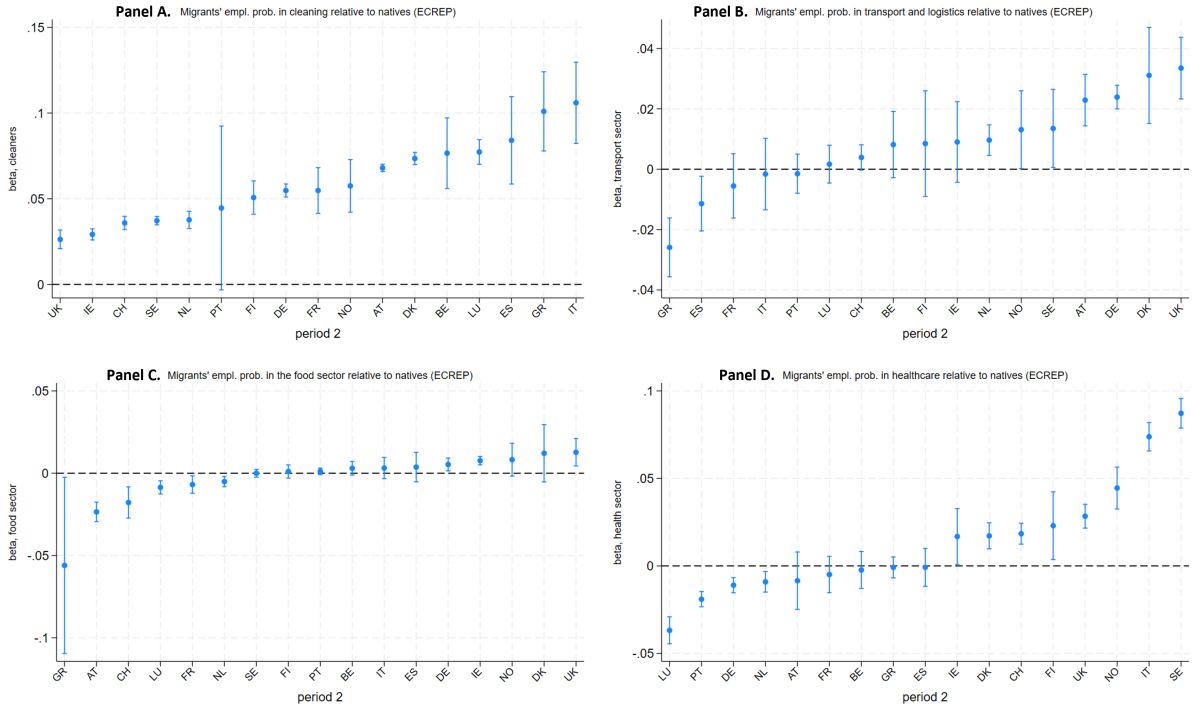


4.2.3 For occupational groups

To further explore the drivers of migrants' greater probability to work in essential occupations, and especially in low-skill essential occupations, we consider specific occupational groups. The panels in Figure 8 show the estimated β from regressions with being employed in the respective occupational group (Y/N) as the dependent variable. For brevity,

only results for Period 2 are shown. Among the selected occupational groups, cleaning as well as transport and logistics may be considered more low-skilled occupations, in contrast to the groups for the food industry and healthcare.

Figure 8. First-stage results on the over-representation of migrants in occupational groups



Cleaning appears to be an extreme example: across the countries covered, migrants are almost always more likely than native-born to work in this occupational group (Panel A of Figure 8). Some of the largest differences arise in Italy and Greece, where migrants appear 8-15% more likely to work in cleaning. In contrast to the earlier results for all essential occupations and for the low-skill ones, the Nordic countries and the United Kingdom exhibit smaller differences in this context. Only in Portugal, migrants probability to work in cleaning is not significantly different from that of the native-born.

Migrants are more likely to work in transport and logistics in about half of all countries covered (Panel B of Figure 8). However, the difference does not seem to exceed 5%, which might be reached in the United Kingdom and Denmark, followed by less than 4% in Germany, Austria and Sweden. On the other hand, only in Greece and Spain are migrants less likely than the native-born to work in transport and logistics. Next, migrants are almost never more likely to work in the food industry (Panel C of Figure 8), with the only significantly positive result arising for the United Kingdom. In about one third of the countries, migrants are in fact less likely to work in the food industry. The estimated β for this occupational group is generally more compressed, with confidence intervals ranging from -3% to 3% (except for Greece).

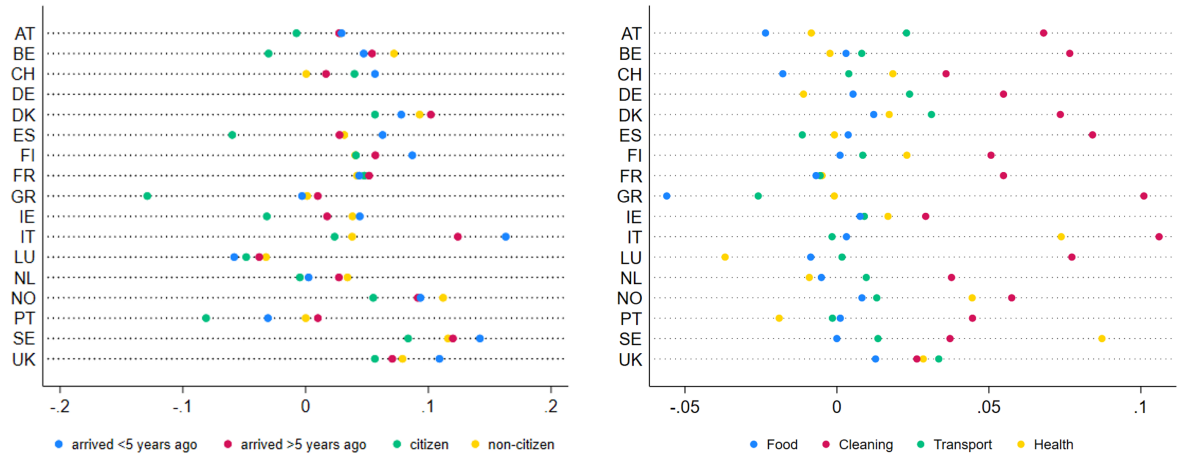
A dichotomous situation is found for healthcare occupations (Panel D of Figure 8):

in about half of all countries covered, migrants are more likely to work in healthcare, a differences of 7-9% are estimated for Italy and Sweden, followed by up to 5% in two Nordic countries and around 3% in the United Kingdom. In a quarter of the countries, however, migrants appear less likely to work in healthcare occupations. This notably holds for Luxembourg (around -4%) but also includes smaller differences in Portugal, the Netherlands and Germany. A comparison with the corresponding results for Period 1 suggests that the polarization has increased over time, on both ends.

4.2.4 Patterns across individual results

Figure 9 explores patterns that link up some of the results obtained above on migrants' over-representation after accounting for demographic factors. From the left panel, it emerges across countries that ECREP tends to be lower for migrants who arrived more than 5 years ago (the red dots are normally to the left of blue dots) and who are citizens (green dots to the left of yellow dots). As citizenship is typically acquired only after a number of years in the destination country, these results reinforce each other: both suggest that migrants' over-representation declines with duration of stay in the host country.

Figure 9. Patterns in the over-representation of migrants in key sectors



While the same kind of process might therefore be unfolding within countries over time, this does not by any means explain the cross-country variation in migrants' over-representation in key sectors. The left panel also shows that, within countries, ECREP is often similar for the four groups of migrants considered (the dots being rather close together, notwithstanding some outliers for migrants with citizenship and recent migrants). However, the 'location' of the group of estimates varies considerably between countries (compare, for example, Luxembourg and the United Kingdom).

In contrast, the right panel of Figure 9 shows wide differences in over-representation within countries, across specific key sectors, while estimates for some key sectors (food

and transport) almost align countries (the blue and green dots almost forming horizontal lines). The estimates for cleaning are also 'in agreement' across countries in so far as they represent the largest ECREP in almost every country. Even in countries where migrants are hardly over-represented in other sectors, they can still be strongly over-represented in cleaning. These patterns point to sector-specific variables as important determinants for migrants' over-representations. Yet estimates for the health sector exhibit a wide variation, relative to both estimates for other sectors in the same country and to estimate for the health sector in other countries. For example, migrants' over-representation in the health sector can be high even where their over-representation in food and transport is low (e.g. in Italy, Norway and Sweden).

5 Stage Two: Institutional and macro-level factors

The large variation observed in ECREP coefficients across individual and migrant-specific characteristics suggests that socio-demographic individual factors or differences in returns to human, social, or ethnic capital alone are unable to account for variations in key sector employment between migrants and natives. Instead, macro-level factors could play a crucial role in understanding this pattern.

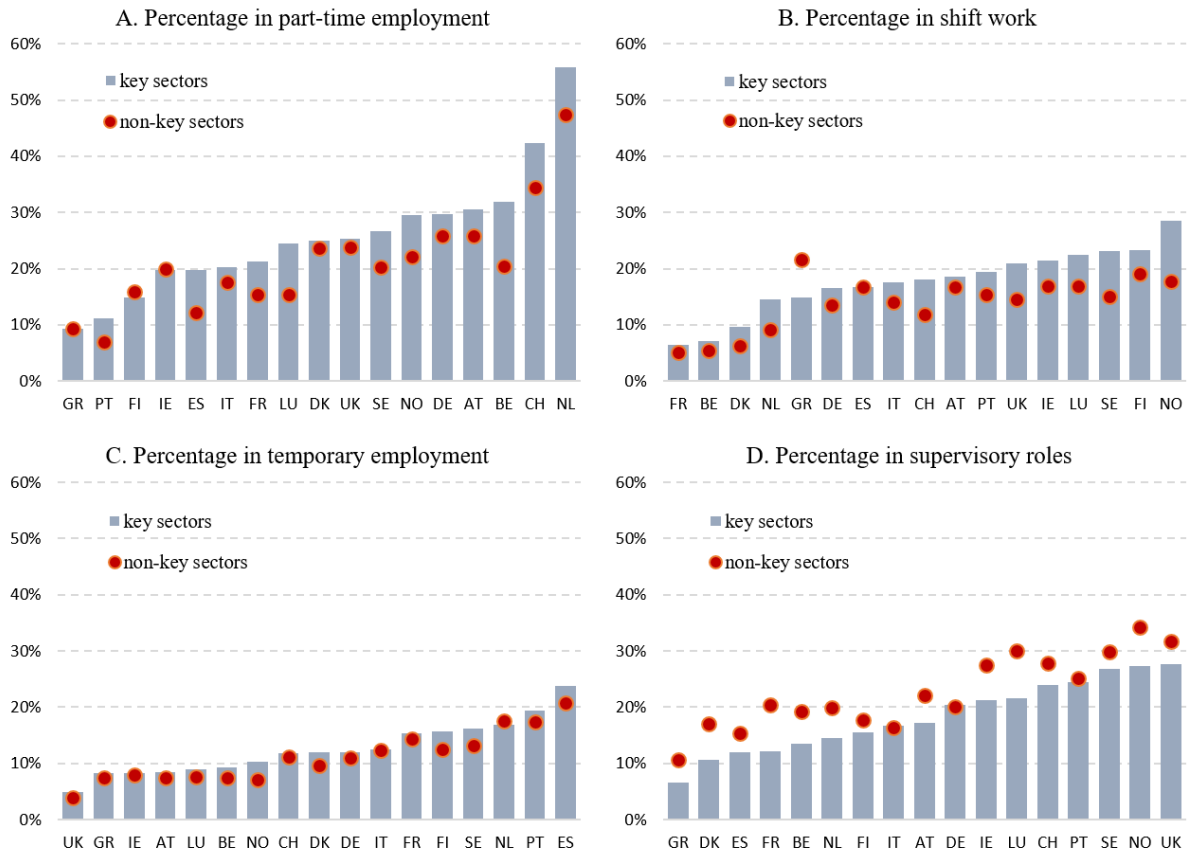
5.1 Structural differences between key and non-key sectors

From a simple comparison of employment in key sectors to employment in non-key sectors (always including both native-born and migrants), a number of differences emerge that may be considered *structural*, i.e. linked to the nature of the work in key sectors, how these sectors operate and how they are organised. Such structural aspects may result from regulations, institutions and policies that differ between sectors, and they might help further explain the over or under-representation of migrants in key sectors.

It turns out that some differences between key and non-key sectors arise in most or even all countries we analyse, in contrast to other differences that, although sometimes large, arise only in few countries while the opposite may be observed in other countries. Figure 10 highlights four highly consistent patterns: in all 17 countries except Finland and Ireland, part-time employment is more common in key sectors than in non-key sectors (Panel A), and in all except Greece, shift work is more common in key sectors (Panel B). Similarly (not shown), employment in key sectors appears to involve evening work more often and slightly more often weekend work. In addition, a slightly larger proportion of employees in key sectors hold a second job.

In all countries but the Netherlands, temporary jobs appear to be more common in key sectors, although the differences to non-key sectors are normally not large (Panel C of Figure 10). Similarly, short-term employment contracts up to 12 months seem slightly more common in key sectors. Supervisory roles are less common in key sectors, except

Figure 10. Structural differences between key sectors non-key sectors



in Italy and Germany (Panel D). A pattern also emerges for wages: employment in key sectors is slightly more often associated with above-median net wages, which might reflect that median job tenure in key sectors tends to be higher. Finally, employees in key sectors are more often hired with involvement of the public employment service and more often attend courses or further training.

5.2 Second stage empirical strategy and methods

We analyze whether country-level structural differences between key and non-key sectors are associated with immigrants' relative employment in European key sectors. To do so, we use the over-representation of migrant labour that is not explained at the first stage (i.e., the estimated β) as dependent variable at the second stage of our empirical strategy, where we investigate potential effects from structural variables that are defined at the level of countries, regions or occupations. Given the low number of available estimates, the second stage relates β to only one structural variable SV at a time.

Wee investigate unconditional correlations between the estimated over-representation of migrants in key sectors and structural variables. We run a panel regression where the structural variable enters the estimation as a ratio of its value in key sectors to its value

in non-key sectors within the same country for each of the two periods:

$$\widehat{\beta_{it}} = c + \rho \frac{SV_{it}^{KS}}{SV_{it}^{non-KS}} + e_{it} \quad (2)$$

where e_{it} represents the residual in this estimation and c is a constant. We thereby explore whether the over-representation is stronger in some countries than in others because of cross-country variation in the structural differences between key and non-key sectors. These structural variables refer to labour market institutions, industrial structure as well as job and peer characteristics (see Annex Table A3). Given the small number of observations in each regression we include one factor at a time in estimating its partial correlation. While some are obtained from extraneous data sources, most are constructed from the micro-data. The inverse of the variance of the beta coefficients estimated in equation 1 are used as weights and errors are clustered at country level to capture correlation within country.[6]

While the second-stage analysis primarily describes correlations and does not establish causality, its goal is to point towards noteworthy associations, serving as a preliminary work to identify relevant factors. We acknowledge the potential influence of omitted variables and reverse causality on our estimates.[7] Nevertheless, this exploratory analysis yields valuable insights into the associations between various structural variables and migrants' over-representation in key sectors across countries. In what follows, we first estimate the correlation between migrants' ECREP and structural variables at the national level. Because of the small number of observations (only 32 in most regressions), we then test the robustness and consistency of our findings using a larger sample, where the first-stage ECREP coefficients $\widehat{\beta_{it}}$ are estimated at the regional level (see section 5.3.2).

5.3 Second stage results

In the light of the systematic differences between key sectors and non-key sectors, structural variables might help explain the over-representation of migrants that often remains after accounting for socio-demographic factors. While the latter analysis was performed within countries and regions, the analyses on structural variables are across countries and regions because we need to compare a single value for the key sector of a country or region to the corresponding values for key sectors in other countries or regions. In order to account for a priori different levels of structural variables across countries and regions, each value for a key sector is constructed as the ratio of the key-sector value to the non-key-sector value in the same country or region, except for attitudes to migration

[6] This weighing technique is standard in the literature, see e.g. Blau (1992) or Aleksynska (2011).

[7] In particular, cross-country differences in migrants' residual over-representation can not only be explained by differences in structural variables but also by compositional differences in terms of professional occupations and clusters.

and migrants' unemployment rate (which refer to the entire country or region).

Additionally, we include variables capturing local attitudes towards migrants' integration on the labour market. A few recent papers also show that local attitudes matter greatly for the integration of refugees and migrants in the labour market (Edin et al., 2003 for Sweden; Aksoy et al., 2020 for Germany, Lee et al., 2022), with negative attitudes undermining integration. We use the European Values Study (EVS), which asks respondents to rate their agreement with the following statement: 'When jobs are scarce, employers should give priority to (nation) people rather than immigrants". The responses are coded so that higher values represent more opposition towards the economic inclusion of immigrants. This variable is ordinal with a three-point scale but re-scaled to a 0-1 scale and averaged at NUTS1 level using survey weights.

5.3.1 Country-level correlates

Table 2 presents the coefficients $\widehat{\beta_{it}}$ estimated in equation (2) and capturing the correlation between migrants' ECREP and structural variables. We present these coefficients for all migrants as well as analogous estimations focusing on the following sub-groups: migrants working in low-skill occupations, migrants whose highest degree was obtained in a foreign country, non-EU migrants and recently arrived migrants (who have spent less than five years ago). We refrain from giving an interpretation to the estimated effect sizes, as they will very often suffer from omitted variable bias, given the lack of further covariates in these estimations. In other words, the observed correlations could arise because the structural variable under consideration acts as a proxy for other, related variables. In addition, one has to keep the sample size in mind: at most 34 (17 countries observed in two time periods) but sometimes even less when variables are not filled for all countries. Luxembourg is not included because ECREP is probably not well estimated in this case, due to the strong yet unobserved role of cross-border commuters. Figure 11 depicts some of the correlations we investigate.

A first result emerging from several significant correlations is that migrants' over-representation in key sectors appears stronger when key sectors are characterized by more **transitory and precarious jobs**, always compared to non-key sectors in the same country (Part A of Table 2). This likely includes entry-level jobs accessible to newly arrived migrants. Notably, a positive correlation is found between migrants' ECREP and the share of temporary jobs for migrants working in low-skill occupations as well as non-EU migrants and those with foreign credentials. Strong positive correlations also arise with the share of employees with less than a year on the job and the share of employees looking for another job (which can indicate that the current job is temporary or undesirable). Accordingly, strong negative correlations are found with average job tenure. In addition, recent migrants appear to be over-represented in countries where the feeling of being overqualified is relatively more wide-spread among key-sector workers. Indeed, over-qualification is indeed considered an often temporary phenomenon, a step-

stone towards jobs with a better fit (Ramos et al, 2022). These results suggest that immigrants are more likely, and perhaps more willing than natives, to fill jobs in key sectors with more transitory employment, lower job security and higher staff turnover.

We do not find that health risks at work are significantly correlated with migrants' ECREP (Part B of Table 2). While non-EU foreign workers are over-represented where key sectors exhibit a higher share of jobs associated with more health issues, this correlation vanishes when tested on a more robust sample of observations (see Section 5.3.2 below).

Instead, migrants working low-skill jobs in key sectors seem more likely than natives to fill those jobs when they imply a greater amount of evening or night shifts than the rest of the jobs in the economy. However, based on Panel C, we cannot conclude that migrants' over-representation in key sectors can be explained by a higher share of **demanding jobs**. If anything, migrants' ECREP correlates negatively with the share of jobs involve significant time pressure, based on employees' own assessment.

Another issue regards **autonomy and flexibility at work** (Part D). For all migrants and every sub-group, ECREP is negatively correlated with the share of jobs that offer high job autonomy, based on employees' own assessment. Although this correlation is only significant for migrants with a foreign degree, an identical pattern is found, and with strong statistical significance, when replicating the analysis at the regional level (see below). The over-representation of migrants working in low-skill occupations, recent migrants and those with foreign credentials also correlates negatively with the share of jobs in self-employment in key sectors. Our results also suggests a positive correlation between the share of part-time employment in low-skill jobs among key sectors and the over-representation of migrants.[8]

[8] An attempt to further distinguish between voluntary and involuntary part-time employment did not yield significant results.

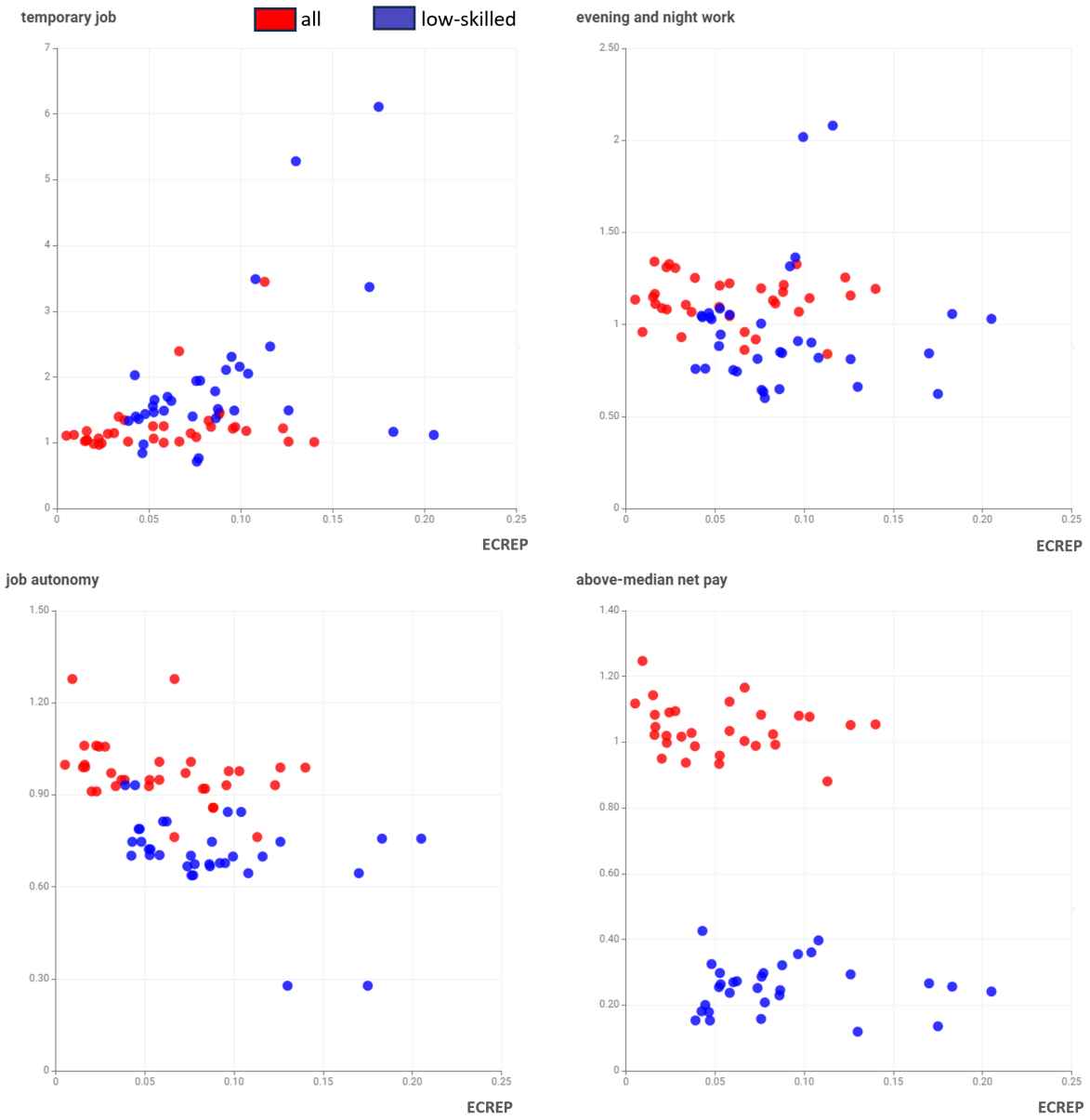
Table 2. Second stage results: correlations across countries between migrants' over-representation and structural variables

Structural variable	All migrants	Low-skilled	Arrived less than 5 yrs ago	With foreign degree	Non-EU
A. Job security and turnover					
% temporary job	0.0959	0.0328***	0.0840	0.125***	0.172***
(s.e.)	(0.0604)	(0.00799)	(0.0743)	(0.0246)	(0.0421)
N	32	32	30	30	32
% hired less than 12 m. ago	0.189*	0.0501*	0.412**	0.232**	0.0829
(s.e.)	(0.106)	(0.0238)	(0.147)	(0.0923)	(0.114)
N	32	32	30	30	32
% who want another job	0.185**	0.0161	0.268**	0.134*	0.158*
(s.e.)	(0.0642)	(0.0107)	(0.0990)	(0.0741)	(0.0833)
N	32	32	30	30	32
avg. job tenure	-0.247*	0.0521	-0.527**	-0.267***	-0.147
(s.e.)	(0.118)	(0.108)	(0.221)	(0.0557)	(0.149)
N	32	32	30	30	32
% who feel overqualified	0.176**	0.0110	0.223***	0.184	0.155*
(s.e.)	(0.0764)	(0.0220)	(0.0650)	(0.115)	(0.0826)
N	24	24	24	24	24
B. Health risks at work					
% with job-related accident	0.0343	0.00157	0.132	0.0918	0.0691
(s.e.)	(0.0602)	(0.0185)	(0.103)	(0.0807)	(0.0475)
N	30	30	28	28	30
% with job-related health issue	0.124	-0.0214	0.145	0.0550	0.172*
(s.e.)	(0.107)	(0.0254)	(0.120)	(0.0633)	(0.0854)
N	30	30	28	28	30
C. Demanding work					
% with evening or night work	-0.0398	0.0356**	-0.0911	-0.0649	-0.0392
(s.e.)	(0.106)	(0.0134)	(0.101)	(0.0761)	(0.141)
N	32	32	30	30	32
% with demanding job	-0.0641	0.0339	-0.0536	0.0255	-0.0188
(s.e.)	(0.123)	(0.0483)	(0.128)	(0.0671)	(0.127)
N	32	32	30	30	32
% working under time pressure	-0.178*	-0.0579	-0.190	-0.105	-0.252***
(s.e.)	(0.0966)	(0.135)	(0.114)	(0.0847)	(0.0658)
N	32	32	30	30	32
D. Autonomy and flexibility at work					
% with high job autonomy	-0.0683	-0.154	-0.186	-0.208**	-0.151
(s.e.)	(0.166)	(0.109)	(0.162)	(0.0852)	(0.213)
N	32	32	30	30	32
% in supervisory role	0.0348	-0.0669	0.0436	0.0482	0.00405
(s.e.)	(0.0589)	(0.0516)	(0.147)	(0.0549)	(0.0611)
N	32	32	30	30	32
% without fixed workplace	-0.00688	-0.00685	-0.161**	-0.0336	-0.0214
(s.e.)	(0.0302)	(0.0221)	(0.0666)	(0.0449)	(0.0342)
N	32	32	30	30	32
% self-employed	-0.0384	-0.143***	-0.117**	-0.0587*	-0.0451
(s.e.)	(0.0382)	(0.0415)	(0.0423)	(0.0291)	(0.0373)
N	32	32	30	30	32
% with flexible work time	0.0659	-0.0796*	0.0210	-0.0622	-0.00782
(s.e.)	(0.110)	(0.0400)	(0.231)	(0.145)	(0.156)
N	32	32	30	30	32
% part-time	-0.0506	0.0521***	-0.0687	-0.0101	-0.0216
(s.e.)	(0.0293)	(0.0138)	(0.0405)	(0.0310)	(0.0439)
N	32	32	30	30	32
E. Pay, prestige and language requirements					
% with above-median income	0.180*	0.157**	0.253	-0.0381	0.171
(s.e.)	(0.0954)	(0.0719)	(0.151)	(0.107)	(0.142)
N	28	28	26	26	28
avg. occupational prestige	0.112	0.0290	0.00909	-0.191	0.121
(s.e.)	(0.234)	(0.137)	(0.295)	(0.193)	(0.289)
N	32	32	30	30	32
% migrants w/ high language skills	0.0155	0.0105	-0.00838	-0.0669	-0.135
(s.e.)	(0.108)	(0.175)	(0.145)	(0.0877)	(0.126)
N	24	24	24	24	24
F. Context indicators (not specific to key sectors)					
% natives with neg. attitudes	-0.0334	-0.0828*	-0.0591	-0.0359	-0.0232
(s.e.)	(0.0797)	(0.0432)	(0.108)	(0.0341)	(0.0630)
N	32	32	30	30	32
unemployed migrant labour force	-0.0415	0.630***	0.340	0.0651	-0.120
(s.e.)	(0.457)	(0.157)	(0.452)	(0.267)	(0.292)
N	32	32	30	30	32

Reported estimates refer to ρ as in equation (2). A * indicates statistical significance at the 10% level, ** at the 5% level and *** at the 1% level.

Surprisingly, migrants' ECREP is positively correlated with the proportion of workers in key sectors earning more than the median national income. This finding, however, is not robust to testing on a sample of regional coefficients (see Section 5.3.2).

Figure 11. Migrants' over-representation in key sectors and selected structural variables



For reasons of readability, the dependent variables (the estimated β) is placed on the horizontal axis here.

Our results in Panel F of Table 2 also support the hypothesis that the over-representation of foreign-born migrants in low-skill occupations in key sectors is due to a relatively higher unemployment rate (with respect to native-born workers). Greater unemployment is usually associated with greater stiffness on the labor market, which creates barriers to entry into the labor force, disproportionately affecting migrant workers and reducing opportu-

nities for migrants' economic integration (Angrist and Kugler, 2003; Kugler and Pica, 2006). Against this backdrop, foreign workers may, as a default option, find it beneficial to seek employment in low-skill key occupations where there is a high demand for labor.

We also find that greater support for labour market discrimination against foreign-born workers correlates negatively with their presence in low-skill jobs in key sectors. This hostility may lead to a substitution effect where domestic workers are preferred over foreign workers in essential service sectors. This preference could prompt employers to prioritize hiring domestic workers to perform crucial tasks in essential services, thus decreasing the relative presence of foreign workers.

It is worth stressing that our coefficients for both unemployment and attitudes are based on variables that are not built separately for key and non-key sectors. As a result, it is well possible that these findings are driven by country-wide public policies that protect domestic workers' employment opportunities, particularly in essential service sectors and in countries those sectors are under public management. These types of policies are likely to correlate at the national level with both migrants' unemployment rate and hostility towards immigration.[9]

5.3.2 Regional-level analysis

Because of the small number of observations – only 32 in most regressions – at the national level, we conduct a similar analysis at the regional level to test the consistency of our results on a larger sample of observations. Indeed, most cross-country correlations in the previous section are noisy and usually statistically insignificant. Even when they reach statistical significance, they may be driven by outliers suffer from a small sample bias.

We consider sub-national regions in European countries as the places of destination for migrant workers. We then estimate the ECREP for all types of migrants in each of these local areas. We use the Nomenclature of Territorial Units for Statistics (NUTS2) as regional geographical units. The more aggregate NUTS1 level refers to broad areas while the NUTS2 level includes administrative units usually called "regions" in most countries. We use both levels, depending on the national availability, to analyze the association between structural factors, attitudes towards immigrants and the presence of migrant workers in key sectors.

To maintain a large enough sample, we estimate migrants' ECREP for a single time period (2011 - 2020) using regional regressions mirroring those in equation (2). Because this nomenclature was not available for the Netherlands, it is excluded from the regional analysis. We also drop four regions in which the total number of observations is too small to permit meaningful analysis.[10] Our final sample includes 159 regions in 15 countries.

[9] In fact, our measure of attitudes towards foreign-born workers and the MIPEX labour market policy index, which captures equal rights and opportunities to access jobs and improve their skills for immigrants, are highly correlated.

[10] These regions are Ceuta and Melilla (ES63 and ES64), the French overseas department Mayotte

With the exception of Austria, Denmark, and Ireland, all regions are defined at the NUTS2 level. The same set of explanatory variables as in the country-level analysis is included.

Table 3 reports the results of the regional analysis. The coefficients are broadly consistent with the country-level estimates. They confirm the strong and positive association between migrants' over-representation in key sectors and the relative share of transitory and precarious jobs in key sectors. All of the five structural variables used to proxy job security are significantly correlated with migrants' ECREP. These results indicate that the over-representation of foreign-born workers is not, however, associated with the salience of health issues or demanding work conditions in key sectors. In addition, the coefficients associated with job autonomy and self-employment (Panel D of Table 3, provide consistent evidence that migrants are more likely to be over-represented in key sector jobs that are characterized by relatively less autonomy and flexibility.

Moreover, regional coefficients indicate a strong and negative correlation between migrant's ECREP and the relative occupational prestige of key sector jobs as compared to the rest of the economy.[11] If domestic workers are reluctant to accept those jobs in essential services that carry social stigma or be perceived as less desirable, then migrants, who prioritize economic and social integration, may be more likely to fill them.

Further, we find no evidence that unemployment is correlated with migrants' employment in key sectors. This suggests that the strong, positive correlation documented in Table 2 could be driven by omitted variables that are likely to influence migrants' ECREP at the country-level such as national policies and regulations limiting the mobility of migrants on the labour market.

Finally, our findings confirm the negative association between natives' support for discrimination of foreign workers on the labour market and migrants' over representation in key sectors. The fact that local attitudes are correlated with migrants' labour market position is in line with the findings of Lee et al. (2022) that the local environment can be very important for immigrant economic integration. In particular, the literature has shown that attitudes as well as racial and ethnic discrimination may affect immigrants' labour force participation and labor market outcomes (Dorn and Zweimmüller, 2021; Bertrand and Duflo, 2018). Since this correlation appears to be driven by the coefficient for non-EU migrants, our results could be interpreted as a sign that greater ethnic discrimination on the labour market lowers access to key sector jobs for immigrant workers relative non-key sector jobs.

(FRM0), and Àland, a Finnish an autonomous and demilitarised region (FI20).

[11] see the Standard International Occupational Prestige Scale (SIOPS), Ganzeboom et al., 1992.

Table 3. Second stage results: correlations across regions between migrants' over-representation and structural variables

Structural variable	All migrants	Low-skilled	Arrived less than 5 yrs ago	With foreign degree	Non-EU
A. Job security and turnover					
% temporary job	0.115*	0.0126	0.0910	0.0747	0.148**
(s.e.)	(0.0610)	(0.0121)	(0.0799)	(0.0946)	(0.0554)
N	159	159	143	143	159
% hired less than 12 m. ago	0.300***	0.0553	0.356***	0.394***	0.284***
(s.e.)	(0.0605)	(0.0359)	(0.0418)	(0.0376)	(0.0602)
N	159	159	143	143	159
% who want another job	0.139**	0.0395	0.167**	0.211***	0.108*
(s.e.)	(0.0629)	(0.0259)	(0.0744)	(0.0679)	(0.0529)
N	159	159	143	143	159
avg. job tenure	-0.359***	-0.164	-0.472***	-0.529***	-0.377***
(s.e.)	(0.106)	(0.174)	(0.110)	(0.123)	(0.105)
N	159	159	143	143	159
% who feel overqualified	0.0974*	0.0301	0.124*	0.145**	0.0976**
(s.e.)	(0.0520)	(0.0188)	(0.0570)	(0.0618)	(0.0430)
N	131	131	131	131	131
B. Health risks at work					
% with job-related accident	0.00392	0.00353	0.0157	0.0305	-0.000500
(s.e.)	(0.0187)	(0.00492)	(0.0249)	(0.0263)	(0.0156)
N	147	147	131	131	147
% with job-related health issue	-0.00257	0.00632	0.00328	0.00460	-0.00551
(s.e.)	(0.0120)	(0.00676)	(0.0104)	(0.0138)	(0.00989)
N	147	147	131	131	147
C. Demanding work					
% with evening or night work	-0.0494	0.0211	-0.0303	-0.00619	-0.0641
(s.e.)	(0.0658)	(0.0171)	(0.0693)	(0.0841)	(0.0690)
N	159	159	143	143	159
% with demanding job	0.0114	0.0292**	0.00173	-0.0116	0.0114
(s.e.)	(0.0355)	(0.0122)	(0.0457)	(0.0450)	(0.0368)
N	159	159	143	143	159
% working under time pressure	-0.117	-0.0594	-0.132	-0.165	-0.117
(s.e.)	(0.0772)	(0.0665)	(0.0999)	(0.120)	(0.0676)
N	159	159	143	143	159
D. Autonomy and flexibility at work					
% with high job autonomy	-0.230***	-0.0725*	-0.233***	-0.258***	-0.259***
(s.e.)	(0.0641)	(0.0385)	(0.0430)	(0.0488)	(0.0603)
N	159	159	143	143	159
% in supervisory role	0.100	-0.0472	0.188**	0.204**	0.0583
(s.e.)	(0.0585)	(0.0731)	(0.0685)	(0.0842)	(0.0456)
N	159	159	143	143	159
% without fixed workplace	0.00213	-0.00787	-0.0136	-0.00383	0.00559
(s.e.)	(0.0169)	(0.0163)	(0.0303)	(0.0358)	(0.0143)
N	159	159	143	143	159
% self-employed	-0.0921**	-0.101	-0.115**	-0.132**	-0.0996**
(s.e.)	(0.0345)	(0.0668)	(0.0389)	(0.0461)	(0.0367)
N	159	159	143	143	159
% with flexible work time	-0.0558	-0.0195	-0.0153	0.0252	-0.117
(s.e.)	(0.0659)	(0.0388)	(0.123)	(0.145)	(0.0715)
N	159	159	143	143	159
% part-time	-0.0198	0.0390	-0.0216	-0.00553	-0.0281
(s.e.)	(0.0374)	(0.0246)	(0.0421)	(0.0504)	(0.0284)
N	159	159	143	143	159
E. Pay, prestige and language requirements					
% with above-median income	-0.0933	0.107	-0.0973	-0.130	-0.133***
(s.e.)	(0.0620)	(0.118)	(0.0701)	(0.0732)	(0.0386)
N	144	144	128	128	144
avg. occupational prestige	-0.462*	-0.317	-0.505**	-0.689**	-0.471*
(s.e.)	(0.251)	(0.193)	(0.230)	(0.231)	(0.242)
N	159	159	143	143	159
% migrants w/ high language skills	-0.0177	0.0396	-0.000601	0.0262	-0.0192
(s.e.)	(0.0247)	(0.0334)	(0.0273)	(0.0258)	(0.0241)
N	131	131	131	131	131
F. Context indicators (not specific to key sectors)					
% natives with neg. attitudes	-0.132**	-0.0217	-0.115	-0.118	-0.159***
(s.e.)	(0.0588)	(0.0590)	(0.0691)	(0.0692)	(0.0497)
N	141	141	125	125	141
unemployed migrant labour force	0.111	-0.0267	-0.0185	0.0218	0.00677
(s.e.)	(0.221)	(0.339)	(0.204)	(0.190)	(0.193)
N	159	159	143	143	159

Reported estimates refer to ρ as in equation (2). A * indicates statistical significance at the 10% level, ** at the 5% level and *** at the 1% level.

Figure 12. Migrants' over-representation in key sectors and selected structural variables, at the level of NUTS2 regions

For reasons of readability, the dependent variables (the estimated β) is placed on the horizontal axis here.

6 Policy implications

The structural variables that we analysed in this paper are, at least in part, the result of national institutions and policies including labour market policies, welfare policies, housing policies, and a range of sector-specific policies that shape the nature of work, working conditions and labour demand and supply in specific sectors and occupations. Our analysis thus suggests that the degree of reliance on migrant labour in particular

sectors and occupations is not simply driven by demographic factors and changes but – crucially – also by policy-making and policy choices of host countries. Put differently, the degree of over-representation of migrants in particular sectors is not a 'demographic inevitability' or simply due to permissive immigration policies. It also reflects, at least in part, the types of labour market and, more broadly, the type of economy that is encouraged and shaped by policy-making over the years. While this insight is not new (see e.g. Ruhs and Anderson, 2010; Migration Advisory Committee, 2012), it was previously mainly based on qualitative evidence. To the best of our knowledge our paper provides the first piece of quantitative evidence for the importance of structural (and therefore also institutional and policy) factors in shaping reliance on migrant labour.

Our results have important implications for public policy debates and policy-making related to migrants in European labour markets. Immigration has over the past two decades, and especially since the large inflows of asylum seekers and other migrants in 2015-16, become a highly salient and divisive issue in European and domestic politics across EU member states. The rise of anti-immigration parties has led to increasing political pressure to reduce immigration, or at least to slow the pace of change. These pressures have, at least in some countries, also led to debates about what some (especially those wanting to reduce immigration) perceive as an over-reliance on migrant workers in certain sectors and occupations. A key implication of our study is that, if there is a political preference for reducing reliance on migrant labour in particular sectors and occupations, this will require a change in the broader (i.e. non-migration related) national institutions and policies that help generate this over-reliance. But this then raises important normative and political questions about trade-offs: is it desirable to change these national institutions – e.g. to increase regulation of national labour markets – in order to facilitate a lower (or less rapidly growing) reliance on migrant labour? Debates about these inter-relationships and trade-offs are critical but mostly missing from current policy debates.

A related second implication of our study for policy debates relates to COVID-19 and, more generally, the resilience of European economies and societies to external shocks. Since the outbreak of the pandemic, European (and other) countries have been actively considering how to strengthen their resilience strategies. The European Commission now requires each EU Member State to develop a resilience strategy by 2026 (European Parliament and Council of the EU, 2022), which has also been encouraged (already prior to the pandemic) at the global level by the UN's Sustainable Development Goals (see e.g UN SDG 9 "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation"). There has been increasing recognition of the role that the employment of migrants can play in affecting a country's resilience to external shocks (e.g. Anderson et al., 2021). We interpret our results to suggest that, in isolation, efforts to use migrants 'strategically' to enhance the resilience of particular sectors and occupations may have little lasting effect because they could in some cases be undermined by inter-

actions between the employment of migrants and particular structural and institutional factors. If aligned, however, the two might reinforce each other's impact on resilience.

7 Conclusion

We estimate the probability for migrants to be employed in key sectors, compared to natives, where we control for demographic characteristics such as age, education and marital status. While some such characteristics are critical for explaining migrant employment in key sectors, a certain unexplained over-representation of migrants remains. Our second step then links this residual over-representation to structural aspects in key sectors (working hours, pay, contract duration, autonomy, flexibility, prestige etc.) after we demonstrate that these aspects can differ systematically between key sectors and non-key sectors.

The results of the first step confirm that migrants have a greater probability of working in key sectors than native-born persons, and especially in the context of low-skill occupations. The countries where migrants' probability exceeds that of native-born most markedly are the Nordic countries, Italy and the United Kingdom, arguably followed by Germany. There is hardly any country where migrants have a lower probability of working in key sectors than native-born. However, we find that migrants who arrived before the age of 15 are significantly less likely to be employed in key sectors than migrants who arrived later. Similarly, EU migrants appear to be significantly less likely to work in key sectors than non-EU migrants.

Analysing the remaining unexplained over-representation of migrants in key sectors, the results of the second step identify a number of structural variables in key sectors that are associated with more migrant employment. Specifically, migrants' over-representation in key sectors appears stronger when key sectors involve more transitory, precarious or hazardous jobs. In contrast, their over-representation is lower when key sector jobs exhibit relatively high degrees of autonomy and flexibility, for example. The over-representation of foreign-born immigrants in key sectors can also be affected by attitudes towards the economic integration of immigrants in their country or region of destination. These findings imply that sector-specific institutions, regulations and policies partly determine how many key sector jobs will be filled by migrants. In other words, different ways in which societies organise their key sectors come with different degrees of reliance on migrants to keep these sectors running.

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A Appendix

Table A1. Unconditional shares of migrants and key sector workers, 2020

Country	Share of key sector workers who are migrants	Share of all employed who are migrants	Share of migrants who work in key sectors	Share of all employed who work in key sectors
Austria	13.4%	12.5%	37.0%	34.6%
Belgium	11.9%	10.6%	42.4%	37.8%
Denmark	8.6%	7.4%	49.2%	42.5%
Finland	3.1%	2.5%	51.7%	41.6%
France	9.6%	8.7%	44.0%	40.1%
Germany	8.2%	7.2%	35.2%	30.6%
Greece	5.2%	5.8%	32.1%	36.2%
Ireland	17.5%	16.2%	33.9%	31.4%
Italy	13.1%	10.2%	40.9%	32.0%
Luxembourg	22.1%	23.4%	30.9%	32.8%
Netherlands	9.2%	8.6%	36.7%	34.4%
Norway	14.3%	11.7%	50.3%	41.3%
Portugal	9.0%	8.4%	36.9%	34.5%
Spain	14.1%	13.4%	38.0%	36.0%
Sweden	20.1%	16.0%	51.0%	40.6%
Switzerland	16.2%	15.8%	32.3%	31.5%

Table A2. List of essential occupations used in the analyses

Occupation	ISCO3D code
Life science professionals	213
Engineering professionals (excluding electrotechnology)	214
Medical doctors	221
Other health professionals	226
University and higher education teachers	231
Vocational education teachers	232
Secondary education teachers	233
Primary school and early childhood teachers	234
Other teaching professionals	235
Software and applications developers and analysts	251
Database and network professionals	252
Physical and engineering science technicians	311
Mining, manufacturing and construction supervisors	312
Process control technicians	313
Life science technicians and related associate professionals	314
Ship and aircraft controllers and technicians	315
Medical and pharmaceutical technicians	321
Nursing and midwifery associate professionals	322
Information and communications technology operations and user support technicians	351
Telecommunications and broadcasting technicians	352
Travel attendants, conductors and guides	511
Other personal services workers	516
Child care workers and teachers' aides	531
Personal care workers in health services	532
Market gardeners and crop growers	611
Animal producers	612
Mixed crop and animal producers	613
Fishery workers, hunters and trappers	622
Food processing and related trades workers	751
Food and related products machine operators	816
Locomotive engine drivers and related workers	831
Car, van and motorcycle drivers	832
Heavy truck and bus drivers	833
Ships' deck crews and related workers	835
Domestic, hotel and office cleaners and helpers	911
Vehicle, window, laundry and other hand cleaning workers	912
Transport and storage labourers	933
Refuse workers	961

Table A3. List of structural indicators used in Stage 2 analyses

Structural variable	Detailed definition	Indicator or proxy for	Data source
A. Job security and turnover			
% temporary job	Weighted average of an indicator variable that equals 1 if the person reports the main job to be fixed-term rather than with a permanent contract	Extent of fixed-term or short-term employment in an occupation; room for career development; insider-outsider contrast	EU-LFS, 2011-20
% hired less than 12 months ago	Weighted average of an indicator variable that equals 1 if the person reports having been in the main job for less than 12 months	Frequency of short-term or newly created jobs in an occupation; extent of worker turnover or short-lived firms	EU-LFS, 2011-20
% who want another job	Weighted average of an indicator variable that equals 1 if the person reports to be looking for another job	Extent of turnover and job dissatisfaction in an occupation; underlying poor working conditions; short-term employment or short-lived firms	EU-LFS, 2011-20
average job tenure	Weighted average of the total time a person reports to have worked for the current employer or as self-employed in the main job, possibly in different roles	Tendency towards long employment relations in an occupation; the extent of worker turnover or short-lived firms	EU-LFS, 2011-20
% who feel overqualified	Weighted average of an indicator variable that equals 1 if person reports to subjectively feel overqualified for the current tasks in the main job	Risk of self-perceived over-qualification and associated frustration in an occupation	EU-LFS ad-hoc module 2014. DE, DK, IE and NL not included
B. Health risks at work			
% with job-related accident	Weighted average of an indicator variable that equals 1 if person reports a work-related accident in the current job during the previous 12 months	Risk of accidents in an occupation, due to inherent dangers of the work or inadequate safety standards	EU-LFS ad-hoc module 2020. UK not included
% with job-related health issue	Weighted average of an indicator variable that equals 1 if person reports having one or more health problems that were caused or aggravated by the main job	Risk of strain injuries or chronic illness in an occupation, due to inherent dangers of the work or inadequate safety	EU-LFS ad-hoc module 2020. UK not included
C. Demanding work			
% with evening or night work	Weighted average of an indicator variable that equals 1 if the person reports usually working in the evening or at night	The occupation's degree of inconvenience and challenges related to work schedules; incompatibility with family	EU-LFS, 2011-20
% with demanding job	Weighted average of an indicator variable that equals 1 if the person reports that work is hard to reconcile with family or care responsibilities due to long hours, unpredictable or difficult schedules, or the job being "demanding or exhausting"	Difficulty of meeting expectations in an occupation; risk of employees' exhaustion; incompatibility with family	EU-LFS ad-hoc module 2019
% working under time pressure	Weighted average of an indicator variable that equals 1 if person reports to be always or often working under time pressure in the main job.	Incidence of work-related stress in an occupation; the risk of employees' exhaustion	EU-LFS ad-hoc module 2019

D. Autonomy and flexibility at work			
% with high job autonomy	Weighted average of an indicator variable that equals 1 if the person reports having some or large influence on both the order and the content of tasks in the main job	Chances in an occupation of having some autonomy at work; attractiveness of the occupation and prospects of job satisfaction due to such autonomy	EU-LFS ad-hoc module 2019
% in supervisory role	Weighted average of an indicator variable that equals 1 if the person reports having supervisory responsibilities in the main job	Extent and importance of hierarchies in an occupation; room for career advancement	EU-LFS, 2011-20
% without fixed workplace	Weighted average of an indicator variable that equals 1 if the person reports the place of work to be "non-fixed" such as working in vehicles, delivery etc.	The occupation's degree of inconvenience and challenges related to a mobile or frequently changing workplace	EU-LFS ad-hoc module 2019
% self-employed	Weighted average of an indicator variable that equals 1 if the person reports to be self-employed in the main job	Prevalence of dependent employment in an occupation; room for entrepreneurship	EU-LFS, 2011-20
% with flexible work time	Weighted average of an indicator variable that equals 1 if the person reports the freedom to vary the start or end of a working day in the main job, to reconcile it with family/care responsibilities	Rigidity of work schedules in an occupation; chances to reconcile working in the occupation with other objectives; frequency of flexible working time	EU-LFS ad-hoc module 2018
% part-time	Weighted average of an indicator variable that equals 1 if the person defines the main job as a part-time job	Incidence of and room for part-time roles in an occupation; frequency of flexible working time; compatibility with family or care responsibilities	EU-LFS, 2011-20
E. Pay, prestige and language requirements			
% with above-median income	Weighted average of an indicator variable that equals 1 if the person reports a monthly net wage from the main job that is found to fall into the upper 50% of	Wage prospects in an occupation; its attractiveness based on wage levels; returns to skills or experience	EU-LFS, 2011-20
avg. occupational prestige	Average of occupational prestige scores (12-78), based on surveys in 55 countries on the prestige associated with job titles and adapted to match the ISCO classification	Prestige of an occupation or occupational group; its attractiveness based on prestige or based on the factors that determined its prestige	Standard International Occupational Prestige Scale (SIOPS), 1996
% migrants w/ high language skills	Weighted average of an indicator variable that equals 1 if a migrant reports having an advanced level in the host-country language	Frequency of job profiles that commonly involve or require a good proficiency in the local language	EU-LFS ad-hoc module 2014. DE, DK, IE and NL not included
F. Context indicators (not specific to key sectors)			
% natives with neg. attitudes	Country-wide or region-wide weighted share of native-born persons who report unfavourable opinions in survey questions on migrant employment	Degree of openness of the local population to hiring and working with migrants; risk for migrants of discrimination, racism or xenophobia	European Values Study (EVS), 2017
unemployed migrant labour force	Share of those not employed but seeking employment, in the foreign-born population of working age that is either employed or seeks employment	Migrants' statistical probability of finding a job; degree of job competition migrants might face	EU-LFS, 2011-20