Ref. Ares(2021)8018838 - 31/12/2021

Technequality

Understanding the relation between technological innovations and social inequality

The impact of structural skill change on marginal group employment: Theoretical considerations and empirical evidence for Europe, 1998-2016

Version 2.1 28-12-2021

Funded by the Horizon 2020 Framework Programme of the European Union

Deliverable	:	2.2
Title	:	The impact of structural skill change on marginal group employment: Theoretical considerations and empirical evidence for Europe, 1998-2016
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Document type	:	R
Document level	:	PU
Date	:	28 December 2021
Status	:	Complete

TECHNEQUALITY partners

ROA Universiteit Maastricht

TiU Stichting Katholieke Universiteit Brabant

UOXF The Chancelor, Masters and Scholars of the University of Oxford

CE Cambridge Econometrics Ltd.

SOFI Stockholm University

WZB Wissenschaftszentrum Berlin für Sozialforschung GGmBH

EUI European University Institute

TU Tallinn University

Document change log

Version	Date	Comments
1.0	24 June 2021	Draft for first review
2.0	3 September 2021	Draft for second review
2.1	28 December 2021	Final version

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 822330

Verification and approval

Name	Date	Comments
Tomas Korpi	5 July 2021	Comments on version 1.0
Mark Levels	21 December 2021	Comments on version 2.0

Description of deliverable (100 words)

In many advanced industrial countries, in Europe and beyond, marginal groups in the labor market are facing increasing difficulties in finding employment. Structural skill upgrading might hurt employment prospects of marginal workers whose relative lack of experience makes them vulnerable in job competition with more established workers. Empirical results, based on data from the EU Labour Force Surveys for 20 countries over the period 1998 to 2016, show that both matched skill upgrading and overeducation have a clear negative impact on the employment chances of youth and immigrants, while older workers and mothers appear less affected by structural skill change.

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1. Introduction

In many advanced industrial countries, in Europe and beyond, young people and immigrants are facing increasing difficulties in finding employment (Blanchflower and Freeman 2000, Blossfeld et al. 2005, 2009, Christopoulou 2013, Jean et al. 2010, Kesler 2006, Reyneri and Fullin 2009, Pastore 2015, Szulkin, Tåhlin and Westerman 2020, Tåhlin and Westerman 2020a). The present report aims at discovering why. These are burning social issues – the mental well-being of youth has deteriorated in tandem with their dwindling labor market prospects and international migration has in recent years reached record levels in response to global economic and political turmoil. Improving the employment chances of the young and the foreign-born requires understanding why their opportunities have worsened in recent years.

Our main hypothesis is that the upward shift in the skill structure of labor markets – the growing shares of jobs with high skill requirements and workers with high education – has made crossing the border into employment more demanding and might have affected youth and recent immigrants more than others. This hypothesis has not been evaluated before in a sufficiently systematic way. Aside from the young and immigrants it is important to examine how skill change affects the labor market prospects of other marginal groups. Accordingly, we assess how employment rates of older workers and female parents (mothers) are associated with structural skill shifts. As we argue below, the links between skill structure and employment chances are less clear theoretically for these groups than for youth and immigrants, but in order to provide a more comprehensive picture of marginal employment patterns we include all four categories in our empirical assessment.

In recent public debate on employment prospects of marginal groups the skill structure has been at the center of attention. Concerning labor demand, some argue that more low-skill jobs are needed to ease work-life entry; others argue that more high-skill jobs are needed to reduce the blocking of existing low-skill jobs by high-educated workers unable to find employment matching their skills. Yet others see a decline in mid-skill jobs as the problem. Concerning labor supply, some argue that young individuals and recent immigrants need to raise their skills to be more employable, while others fear that educational expansion is excessive leading to widespread overeducation relative to the skill level of available jobs.

These sharply diverging views on how the structure of skill supply and demand is related to the employment prospects of labor market entrants are based more on beliefs and assumptions than on robust research findings. In the present report we examine how employment rates of the young, the foreign-born and other marginal groups are linked, across countries and over time, to the skill structure of labor markets. We use labor force survey data from up to 20 European countries over a period of close to 20 years, from the late 1990s to the recent past. Our aim is to build a solid

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evidence base regarding associations between skill structure and employment inequality, a base that hitherto has been remarkably weak given the heavy weight of the issues.

The present report is organized as follows. We begin by reviewing previous research on the associations between structural change and employment chances of marginal groups in the labor market. We then describe the data and methods we use in our empirical analyses. Our empirical results are reported in separate sections for employment gaps between core and marginal workers of several different kinds, split by gender. Special attention will be given to youth and immigrants, since these are likely to be more affected than others by the structural change of skill. We conclude with a general discussion of how skill change affects labor market prospects of marginal groups.

2. Skill change and marginal group employment: previous research

We suggest that the long-term decline in youth and immigrant employment to a significant extent can be explained by the structural change of skill supply and demand. This structural change has two interrelated components that should be considered jointly: skill upgrading and skill mismatch. The skill structure has a demand side (jobs) and a supply side (individuals). Both skill demand and supply have grown significantly over the past several decades in most OECD countries (Handel 2012). By skill upgrading we mean a parallel rise in demand and supply, well matched to each other. In contrast, skill mismatch appears if skill supply and demand grow out of synch. In many European countries, educational expansion has been faster than the rise in job skill requirements, leading to overeducation (Handel 2012). This will amplify the rise in skill requirements via crowding-out: highly educated individuals unable to acquire a high-skill job turn downward in the structure and compete with the less skilled for low-skill jobs. Both upgrading and overeducation may thus hurt the employment chances of labor market newcomers because both affect the availability of entry-level jobs with limited skill requirements.

A link between long-run skill upgrading and the secular fall in youth employment has previously been suggested by Ryan (2001), with updates and extensions by Christopoulou and Ryan (2009) and Christopoulou (2013). Skills are formed not only through education but also by work experience, a key insight from human capital theory. As noted by Ryan (2001), while rising demand for educated workers could benefit youth, in so far as the young are relatively well (or at least more) educated, a parallel rise in demand for experience might exceed the education effect. Experience is more highly valued in jobs requiring high education than in other jobs; hence, net of individual education, job upgrading implies a loss of competitive capacity for labor market newcomers, both youth and recent immigrants.

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Our theoretical model and empirical analysis (see further below) are intended to provide as complete an account as possible of how the structural change of skill affects youth and immigrant employment in the countries and time period we examine. We make the following distinct contributions to existing research: First, we consider both skill demand and supply; second, we measure demand and supply with proximate rather than distal indicators by using data on occupation (indicating skill levels of jobs) and education (indicating skill levels of individuals); third, we include full skill distributions, from low to high, rather than focusing on single skill segments; fourth, both our theory and empirical model are explicitly dynamic, with hypotheses about the impact of the structural change of skill, not just of contemporaneous variation across countries in skill distributions; fifth, by the dynamic consideration of both skill demand and supply, we jointly take skill upgrading and skill mismatch into account; sixth, we use data from many countries, which allows replacing country names with country characteristics in statistical analyses of covariation; seventh, we use data from many time-points, with significant variation across time in country-level traits (structures of skill demand and supply), which allows inclusion of country-fixed effects in our empirical models; eighth, we consider both youth and immigrants, thus making more complete assessments of the employment chances of aspiring labor market entrants; and ninth, we estimate separate models by gender, thus taking full account of differences in employment chances of women and men.

Ryan (2001), Christopoulou and Ryan (2009) and Christopoulou (2013) emphasize skill upgrading but essentially ignore mismatch. In their empirical studies they use distal, technology-based measures of skill demand rather than more proximate occupational information, with mixed results. Gangl (2003) examines how labor market compositional factors tied to occupation and education affect school-to-work transitions in EU-15 countries in the 1990s. He finds, inter alia, that educational expansion is associated with lower occupational attainment of labor market entrants, perhaps due to increased job competition. Skill mismatch is viewed as a transitory imbalance with little apparent impact on youth unemployment in the countries and time period examined.

Regarding immigrant-native employment gaps, Kogan (2006) found that high demand for low-skilled labor appears to help immigrants enter the labor market in a set of European countries; Fleischmann and Dronkers (2010) report similar findings. However, these studies did not consider the impact of skill mismatch and their findings were restricted by data limitations regarding number of countries and time points.

The reviewed studies are rare examples of empirical analyses that examine links between skill structure and employment chances of youth and immigrants; while valuable, these studies have far from fully considered the relevant dimensions involved. We aim at providing a much more complete

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analysis, yet keeping empirical estimation parsimonious aided by good data and efficient model design. We spell out these properties of our analyses below. Before then, we briefly summarize previous research on youth and immigrant employment that has emphasized other factors than the structural change of skill. These factors are important to take into account in our own empirical models.

Other explanations of changes in youth and immigrant employment rates

A common explanation of declining employment of marginal groups has been falling general labor demand (see e.g. Blanchflower and Freeman 2000). Employment gaps between more and less established workers tend to widen in business downturns and diminish in upturns, both because reductions in job hirings precede job separations as general demand falls, and because employment cuts in downturns tend to be larger for low-skill – including low-experience – workers. If the rebound in labor demand in upturns less than fully compensates downturn losses, youth-adult and immigrant-native employment gaps will tend to widen over time.

Another explanation of employment decline of youth and immigrants is suggested by the literature on job polarization. As work involving mid-skill routine tasks declines, due to replacement by IT, a polarization of the labour market is expected to occur (Goos and Manning 2003; Autor 2010). The expected consequence is that mid-age or older mid-educated workers downgrade in the job structure when losing their mid-skill jobs and begin to compete with youth and recent immigrants for low-skill jobs (Smith 2011).

A third kind of explanation of changing employment gaps between more and less established workers is based on shifts in the size of youth cohorts and in the magnitude of immigration (see e.g. Korenman and Neumark 2000). If the number of aspiring labor market entrants grows, competition for certain types of jobs will tend to increase, especially jobs with low skill requirements. A competing hypothesis holds that labor supply size positively affects the number of low-skill jobs: a large supply of workers willing to accept low-skill jobs may create its own demand and thus slow down job upgrading (see e.g. Oesch 2015).

For immigrants, aside from general shifts in the skill structure, a more specific skill-related factor of relevance concerns the refugee migration share that might affect employment chances and varies strongly between countries (Hammarstedt and Aldén 2014, Flood and Ruist 2015) and time periods. Individual-level determinants of immigrants' disadvantage in labor market attainment include low education, foreign education, limited labor market experience in the new country, and deficient language skills (e.g. Cheung and Heath 2007). Accordingly, region of origin, time elapsed since arrival, and the reason for migration tend to be important for labor market attainment (van

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Tubergen *et al*. 2004, OECD 2015). These traits need to be taken into account in cross-national comparisons of immigrants' labor market outcomes.

At an institutional level, high minimum wages and strict employment protection may limit demand for marginal groups in the labor market by raising productivity barriers to employment entry, thus widening the divide between insiders and outsiders (Lindbeck and Snower 1988). Such factors are often seen as important for the labor market prospects of immigrants (see e.g. Bergh 2014, Kogan 2006; Jean et al. 2010; Kesler 2006; Reyneri and Fullin 2009; van Tubergen et al. 2004) and of youth (Breen 2005, Neumark and Wascher 2004). For youth, educational system properties are also important in shaping patterns of school-to-work transitions (Ryan 2001, Gangl 2003, Breen 2005, Pastore 2015).

3. The impact of skill change on youth and immigrant employment: Outline of a theory

The skill structure of labor markets has a supply side and a demand side, where supply consists of human capital and the demand side of human capital requirements of jobs. A common simplification of human capital measurement (Mincer 1974 and beyond) is to focus on education and experience, both assumed to enhance individual productive capacity via skill growth. Experience, aside from education, is thus seen as a key determinant of productive capacity. Indeed, historically, on-the-job learning rather than formal schooling has been the main source of skill formation (Mincer 1958).

We distinguish conceptually between two types of human capital formed through work experience: basic and advanced. The latter is tied to experience in complex jobs and the former to work experience in general (regardless of job complexity). Advanced experience-based skills are mainly cognitive and occupation-specific, partly substitutable by and partly complementary with schooling and formal training. In contrast, basic skills are informal and mainly non-cognitive, tied to generic individual traits such as reliability, judgment and work morale.

Similarly, the demand side of skill can be measured by requirements of education and experience at the job level. In low-skill jobs, requirements are tied to basic experience and basic schooling. In contrast, skill requirements in more complex jobs are both advanced and basic, indicated by higher educational attainment and advanced experience on top of basic skills.

In the present report, we empirically examine the association between the structural change of skill and the evolution of marginal group employment, with a focus on youth and immigrants, but also including older workers and female parents (mothers with children at home). The mechanisms we believe are at work in the causal processes of interest are spelled out in simplified form in the explanatory account below. While the mechanisms will not be explicitly included in our estimation

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models below, we will empirically assess their main implications. To ease presentation, the elements of our causal account are numbered.

1) Due to technological progress (in a wide sense), the skill structure of jobs is upgraded over time.[1]

2) Job upgrading increases the demand for experience since human capital requirements of jobs are positively correlated: jobs requiring relatively large amounts of education tend to require relatively large amounts of experience (as revealed by experience-wage gradients). Young people tend to be less experienced than others, and are therefore relatively less competitive in high-skill jobs (given education). Recent immigrants' education and work experience are often devalued, due to employers' lack of information. Rising experience requirements weaken the relative demand for youth and recent immigrants.

3) In response to job upgrading, educational expansion intensifies.

4) The upward trends in skill supply and skill demand need not be equal in magnitude. If skill supply grows faster, aggregate overeducation appears; if skill demand grows faster, aggregate skill deficits appear.

5) In recent decades, overeducation has been more common than skill deficits in most Western countries, with educational crowding-out as a consequence.[2]

6) Increased competition for low-skill jobs diminishes employment prospects of youth and immigrants, since they are more dependent than others on low-skill jobs.

7) In early phases of educational expansion, young people's education (almost by definition) grows more than in other age groups.

8) Due to ceiling (and floor) effects, educational expansion eventually slows.

9) When educational expansion slows, the youth advantage in education is reduced as young people of period 1 become mid-age in period 2.

10) When the schooling advantage of young individuals over mid-aged falls, youth are less able to compensate inferior experience with superior education, so skilled jobs increasingly go to skilled mid-age rather than to skilled young individuals. Skilled immigrants may lose the competition for skilled jobs partly due to lack of language proficiency, partly due to low valuation of foreign skills.

11) In response to losing out in competition for skilled jobs, skilled young individuals and skilled immigrants turn either to unskilled jobs or to additional education or drop into inactivity.

[1] See Katz and Margo (2014) for a detailed empirical analysis of long-term skill change of the occupational structure in the US, likely to resemble the evolution elsewhere among economically advanced countries. More recent determinants of changing skill demand include globalization and demographic shifts (Wilson 2013).

[2] Most research on crowding-out has focused on displacement of low-skilled workers rather than youth or immigrants. An exception is a study by de Lange et al. (2014), based on data from 29 countries, finding evidence of cyclical (short-term) crowding-out of young workers.

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12) In response to losing out in competition for unskilled jobs, unskilled young individuals and immigrants leave (or cannot enter) employment.

That completes our suggested theoretical outline. In abstracting from this fine-grained causal account, we state in simplified form the following hypotheses to be empirically tested:

1. Skill upgrading is associated with youth and immigrant employment decline
2. Rising overeducation is associated with youth and immigrant employment decline

With regard to the other two marginal groups whose employment prospects are examined in the present report, i.e., older workers and female parents (mothers), the two hypotheses just formulated would appear to be at least partially valid, yet probably less relevant than for youth and immigrants. As discussed below, while all four groups are certainly marginal relative to standard or core segments of the labor force, especially prime-age men, only youth and immigrants can be expected to be clearly hurt by growing skill demand and in particular by rising experience requirements.

Older workers tend to be less physically vital than younger workers, and perhaps also to some extent less intellectually vital, but can to a large extent compensate these relative weaknesses by longer experience. Rising skill and experience requirements are hence not necessarily bad for them; they might even be beneficial for their labor market prospects. Importantly, employment rates of older workers have actually increased in many countries in recent decades; in the Great recession of 2008-9 older workers were hurt much less than others (see e.g. Tåhlin 2013). One drawback for older workers in an increasingly high-skill environment is that there will be rising requirements for continuing on-the-job training (OJT), since skilled work is more OJT intensive than unskilled work is. High age is typically seen as negative for learning, and if such conceptions persist (valid or not) older workers might lose out as skill demands rise. And of course, older workers' education is older than that of young persons, and might therefore be viewed by employers as less useful. Still, as already underlined, older workers' employment rates have gone up in recent decades, not only relatively but also absolutely, so whatever the drawbacks of structural skill rise for older workers, they have not been strong or pervasive enough to depress employment levels. It is harder to say if skill rise has contributed positively to rising employment or if, alternatively, the impact of growing skill demand has not been sufficiently negative to counter other causes of rising employment. On the job side, these causes include less physically demanding work on the job side; on the workers side, they include less marked vitality loss with age, both physically and mentally, among recent cohorts. In any event, it is not clear that the net impact of structural skill rise is likely to be negative for older workers' employment prospects.

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What about parents, and especially mothers with dependent children? How might their labor market opportunities be affected by the structural change of skill, i.e., of upgrading and overeducation? Mothers in working life are characterized by having spent time away from paid work, perhaps for several or even many years, and are in that sense newcomers when they return to the labor market. But they are also more mature than young workers, and have gained experience outside paid work that might be valuable in many kinds of jobs. One drawback for them is that they often (are compelled to) prefer part-time work which is typically less available in skilled jobs, and thus tends to become more difficult to acquire as skill requirements grow. As in the case of older workers, the net outcome of these seemingly counteracting tendencies is not clear, i.e., it is hard to formulate clear hypotheses concerning how structural skill change is likely to affect the motherhood employment gap.

The present report contains two main empirical sections, each dealing with how marginal group employment is affected by the structural change of skill. In *section 1*, we examine changes in the employment chances of young individuals, as compared to the mid-aged. In line with the theoretical account above, we propose an explanatory model based on skill upgrading and mismatch as main causes of youth employment decline. Using data on 20 European countries from the EU Labor Force Surveys over the period 1998-2016 (see further below), we estimate associations between the structural change of skill and youth employment chances, while taking relevant factors identified in previous research into account (see the review above of previous research). As a complement to the comparison between young individuals and the mid-aged, we also assess the impact of skill change on the labor market fortunes of two other groups traditionally seen as marginal in the labor market: older workers and female parents (mothers with children in the household).

In a second empirical section, we turn to employment prospects of immigrants in European countries. To avoid small numbers in the data we limit our sample in these analyses to destination countries with a sizeable proportion immigrants of the population. We take the level of natives' employment in each country to indicate general labor market conditions. For recent immigrants structural and compositional factors might be decisive for employment chances, while for those more settled in the destination countries, general labor market conditions are likely to play a bigger role.

Most models in both sections are estimated separately by gender. Labor market processes tend to differ significantly between women and men, mainly due to gender variation in educational field of study, in occupational distributions and in labor force attachment linked to work-family relations. For immigrants, a further reason for separate analyses by gender is that employment rates in the

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destination country can be expected to be more affected by the region of origin for females than for males. While the norm of gainful work is close to universal for men, the work norm for women differs across contexts related to regional origins and destinations. Demand-side factors are also relevant for gender variation. For example, experimental studies indicate that discrimination in hiring decisions concerning culturally distant immigrants is more frequent for male than female job applicants (see e.g. Arai et al. 2015).

4. Data and methods

4.1 The European Union Labour Force Surveys: EU-LFS

The European Union Labour Force Surveys (EU-LFS) are a collection of nationally representative surveys with standardized indicators of, *inter alia*, employment, education and occupation; see Eurostat (2016). Data extend back to 1983 for some countries, but missing occupational information makes it difficult to achieve a sufficient country sample before 1998. The covered time period should be viewed as a recent-time excerpt from a long-term development (see Tåhlin and Westerman 2020a, 2020b).

Our comparative approach is to include countries that differ in focal dependent and independent variables but are otherwise similar (cf. Lijphart 1975). We hence focus on countries that (a) are similar regarding macro-economic conditions and institutional structure, yet (b) differ regarding changes in skill structure and employment rates over the covered time-period. On this basis 20 countries in three different regions of Europe (northwestern, eastern and southern) are selected: Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom. The country-year sample includes 376 observed country-years from 1998 to 2016 (20 countries times 19 years = 380 minus four observations: Germany, Ireland and the UK lack data for 1998 and France for 2016). The number of respondents varies widely between country-years, from around 15,000 (Denmark 2004) to 484,000 (Germany 2015); for details see Eurostat (2018c). Two countries in northwestern Europe, Iceland and Luxembourg, and two Baltic countries, Estonia and Latvia, are excluded from our comparison due to their small populations; two eastern countries, Bulgaria and Romania, are excluded due to their comparatively late economic development; and one southern country, Greece, is excluded because of missing data on several variables. For analyses of immigrant employment, the country-year sample is reduced due to a lack of standardized information in the EU-LFS regarding immigrant status before 2004 and because eastern European countries are omitted due to their relatively short (modern) history of immigration. For analyses of female parents (mothers), the Nordic countries (Denmark, Finland, Norway, Sweden) and

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Switzerland are excluded due to missing EU-LFS standardized information on household composition.

In order to further sharpen the comparative approach, all analyses are conducted both (a) for all 20 countries jointly and (b) separately for the three geographical regions: north-western Europe (NW), eastern Europe (EA) and southern Europe (SO). North-western Europe includes Austria, Belgium, Denmark, Finland, Germany, Ireland, the Netherlands, Norway, Slovenia, Sweden, Switzerland, and the United Kingdom; Eastern Europe includes Czechia, Hungary, Poland and Slovakia; and Southern Europe includes France, Italy, Portugal and Spain. France is placed in the south due to its hybrid institutional structure with significant southern European features (see e.g. Chevalier 2016). Slovenia, at the north-western border of Eastern Europe is included in the NW group; arguably, its labor market institutions and macro-economic conditions resemble Western more than Eastern Europe (Saar et al. 2008).

The EU-LFS data have a three-level hierarchical structure: individuals nested in countries and years. Several studies have investigated effects of institutions and economic cycles on age variation in employment by using time-series cross-sectional (TSCS) data of the EU-LFS kind (e.g. Neumark and Wascher 2004, Dieckhoff and Steiber 2012). A strength of these studies is the reduction of omitted variable bias by controlling for stable differences across countries or country-common variation over time through the inclusion of dummy (indicator) variables for countries (fixed effects). Thus, as alternative to OLS, we estimate the same models using a two-way-FE-estimator, i.e. including dummy variables for countries. Countries generally vary a great deal in overall average (time-invariant) levels of the used variables, related to e.g. youth labor market integration systems (Chevalier 2016) and labor market institutions (Breen 2005), which affect the smoothness of school-to-work-transitions and norms regarding labor market participation during young ages. The FE estimator cancels out this variation from the regression equation. However, if both the regressor and the regressed variable trend over time, the FE-estimator tends to incorporate this joint trend into the association. Hence, the model is augmented with a linear trend-parameter indicating time.[3]

A common statistical problem when estimating regression models with TSCS data is serial correlation, violating the assumption of independent observations. For example, the employment

[3] An alternative would have been to include dummies also for years, and thus estimate a two-way fixed effects model. Some recent research on the topic however concludes that "it is impossible to simultaneously adjust for unobserved unit-specific and time-specific confounders" (Imai and Kim 2019, p. 12). We interpret this as additional advice against overreliance on the FE-estimator when making panel regressions (see e.g. Hill et al. 2020). Nevertheless, we still find the two-way FE-model suitable as a robustness check, and results indeed do not differ other than marginal between models including dummies indicating time and model with a linear parameter (cf. Tåhlin and Westerman 2020a, 2020b; Szulkin, Tåhlin and Westerman 2020).

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level in a given country and year likely depends on macro-economic conditions in the current year as well as the country's employment level in the previous year. As a solution, the regression equation can be transformed by taking serial correlation of the first order (one time-point back) into account; this is known as the Prais-Winsten transformation (see e.g. Wooldridge 2008). Another common problem is heteroscedasticity of residual error terms and dependence across time and countries. Beck and Katz (1995) recommend using panel-corrected standard errors as a solution in such cases, a suggestion we follow here.

4.2 Outcome variables: Measuring labor market participation

Our measure of labor market participation is the employment rate, i.e., the employed share of the population in a given group and given year. An alternative measure is the unemployment rate. The unemployment rate, often used in empirical research on economic integration of immigrants, is problematic since it is (usually) expressed as a proportion of the labor force. Individuals not actively looking for a job, including discouraged workers, are thus excluded from this measure. We therefore see the employment rate as the best activity measure for the adult population. To minimize the problem of how to classify students when analyzing young workers, we define youth as age 25-29, thus setting the lower age limit above the modal point of schooling completion, including tertiary education. We define immigrants as all individuals born outside the host country, older workers as 55-65-year-old workers, and mothers as all females with children under the age of 15 in the household.

We consistently use mid-age male workers as comparison group in the descriptive analyses and control variable in the regression analysis. We compute all structural variables on the age group 30-39 (both males and females) in order to not mechanically conflate independent and dependent variables in the regression analysis.[4] For all analyses concerning immigrants' employment chances, we further omit all immigrants from the structural variables and the mid-age male comparison group.

4.3 Explanatory variables: Measuring change in the skill structure

According to our theoretical outline, it is important to estimate the separate employment effects of skill upgrading and mismatch in a joint model. Duncan and Hoffman (1981) decompose attained education (in years) into three parts: (a) education required in the worker's current job, (b)

[4] For female parents, this was however unavoidable since omitting also men from the structural variables would have severely biased these variables.

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education attained by the worker that exceeds current job requirements, and (c) education required by the current job that exceeds what the worker has attained. This model (known as ORU: Over-Required-Under) thus allows estimation of the separate payoffs to education dependent on the nature of the job match.

We apply the ORU model to aggregate data on occupation and education at the country-by-year level. Skill demand is indicated by ISCO (International Standard Classification of Occupations) categories of the jobs held by individual workers. Similarly, on the basis of individual education (ISCED categories; International Standard Classification of Education), a measure of skill supply is constructed. Three skill levels of both education and occupation are distinguished: high, medium and low (for level definitions, see table 1). The individual-level match between skill supply and demand is measured by cross-classifying educational and occupational levels; all observed jobs are sorted into this 9-cell (3 by 3) matrix. For each country-year, the nine proportions (estimated from individual-level data) sum to unity (i.e., all non-vacant jobs).

Table 1. Match categories in an education-by-occupation skill matrix based on ISCED and ISCO.

The size of the nine categories indicated in table 1 is determined by using data on women and men (combined), age 30-39. This age group is selected in order to avoid conflation of determinants and outcomes in the regression models based on data for youth (age 25-29) and mid-aged (40-49). Three continuous match measures are constructed on the basis of proportions of all employed workers in the nine education-occupation cells, as follows:

Matched education = LL*0 + MM*0.5 + HH*1

Overeducation = ML*0.5 + HM*0.5 + HL*1

Undereducation = LM*0.5 + MH*0.5 + LH*1

While the ORU specification is comprehensive in measuring the entire match structure, and efficient in reducing the nine cells in the education-by-occupation matrix to three variables, it is a fairly abstract representation of the associations between employment gaps and the structural change of skill. A more concrete alternative is to use a specific education-occupation combination as a simplified structural indicator. The selected measure is the cell indicating the proportion of all workers who have a low education and occupy a low-skill job, i.e., the combination labelled LL. This specific match combination is especially illuminating for two reasons. First, it indicates the main point in the general structure at which crowding out from employment occurs, according to our explanatory account (see above). Second, it correlates highly – close to .90 – with the employment impact of the entire ORU structure, more strongly than any other single cell. We interpret this strong

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correlation as indicating that the LL proportion relatively well reflects both the overall skill level of the labor market and over-education, i.e., the most important aspect of skill mismatch in our explanatory account. Since the sum of LL, ML and HL is the total proportion of all workers who occupy low-skill jobs, LL reflects "available" low-skill jobs net of over-education (ML and HL), assuming that low-skill jobs occupied by skilled workers do not indicate real options for individuals with small skill-related resources.

In figure 1, the structural change of skill from the late 1990s to the recent past in the 20 countries considered – all countries together as well as grouped by region – is displayed. Three rates are shown: matched skill upgrading, overeducation and the low-skill-occupation-low-education (LL) share of all employment, all defined as stated above.

Figure 1. The structural change of skill in 20 European countries, 1999-2015. Source: EU-LFS.

It is evident that all three rates indicate skill rise in all three country groups. In the northwestern countries matched upgrading has been slightly faster than the rise in overeducation, while these two rates have grown more in parallel in both eastern and southern countries. The overall pace of change has been somewhat slower in the East than elsewhere, while the decline in the share of available low-skill jobs (LL) has been most marked in the South.

In general, the pattern of change indicates that labor market entry requirements have increased considerably over recent decades, which according to our theoretical expectations should imply deteriorating employment prospects for marginal groups, in particular youth and immigrants, but perhaps for other traditionally vulnerable categories of the labor force as well, including older workers and mothers. We turn now to examining the extent to which these expectations are borne out by the empirical evidence based on EU-LFS data, beginning with an assessment of youth employment.

5. Empirical section 1: The impact of skill change on employment of youth, older workers and female parents and methods

5.1 Empirical results, youth (male and female)

We begin the report of empirical results regarding associations between structural skill change and marginal group employment by looking at how the low-skill-occupation-low-education (LL) share of all employment is linked to the employment rate of male youth. In figure 2, all 376 country-year observations (20 European countries by 19 years, 1998-2016, with four country-year observations missing; see data section above) are placed in the 2-dimensional space given by the LL share on the

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horizontal axis and the youth male employment gap (the difference between youth male employment and mid-age male employment) on the vertical axis, with higher gap levels indicating worse employment prospects for youth.

Figure 2: Low-skill job availability (LL) and the youth male employment gap. 20 countries in Europe 1998-2016; EU-LFS.

This descriptive association is clearly negative in all three country groups. Hence, as the share of available low-skill jobs (indicated by LL) of all employment falls, the employment chances for male youth apparently decline, in line with the expectations formulated above. When all countries are considered together, the association reverses direction and becomes positive. This is clearly a composition effect: the southern countries have relatively high rates of available low-skill jobs as well as a relatively large youth employment gap; and so when these country-year observations are included in the overall picture without taking country-specific factors into account, a pattern likely to be spurious appears. In other words, the comparatively large youth employment gap in southern Europe is probably (as e.g. indicated by the region-specific pattern in figure 2) due to other factors than the skill structure of these countries, and without adjusting for those factors the overall country-year picture is biased, at least more biased than the within-region pictures (cf. the comparative logic discussed above).

While the descriptive patterns displayed in figure 2 are interesting and useful in providing a concrete picture of actual (statistically unadjusted) empirical associations, they are also paradoxically abstract in the sense that they do not allow a separation of the two distinct aspects of structural skill change that we have argued are important to separate in order to achieve a better understanding of the processes at work in marginal employment evolution. As discussed above, it is for the purpose of such separation that we use the ORU models of estimating the association between skill structure and youth employment. Results are shown in table 2.

Table 2: ORU regressions of youth (age 25-29) male employment. 20 countries in Europe 1998-2016; EU-LFS.

The results show that both matched skill upgrading and overeducation significantly depress the employment chances of young men in north-western Europe (see coefficient columns 3 and 4 in the table). This pattern is found both with and without fixed effects for individual countries and a global (country-common) trend parameter. In the other two regions, eastern and southern Europe, the results are much less clear. While negative (expected) effects dominate for these regions as well, they are mostly not statistically significant. When all countries are analyzed together, significant negative effects appear, probably due to the large weight of the north-western region (containing 12

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of the 20 countries examined). Among the significant effects, matched skill upgrading and overeducation seem to be of roughly equal importance judging by coefficient sizes. This underscores the central point discussed above that not only the number of jobs at different skill levels should be taken into account to understand the implications of skill structure for youth employment chances; the matching between these jobs and individuals with differing amounts of education also needs to be considered. Apparently, educational expansion can have serious negative effects at the aggregate level, regardless of how beneficial it might seem from the viewpoint of individuals acquiring more schooling.

In figure 3 and table 3 we carry out the same type of analysis for young women. As in the case of males, we begin by giving a descriptive picture and then turn to estimating ORU models.

Figure 3: Low-skill job availability (LL) and the youth (age 25-29) female employment gap (relative to men, age 40-49). 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.
Table 3: ORU regressions of youth (age 25-29) female employment. 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.

Overall, the results for female youth resemble those for young men shown above, although there are also some differences. The association between the low-skill-occupation-low-education (LL) share of all employment and the employment rate of young women (see figure 3) is negative (as expected) in all three country regions, and turns weakly positive when all countries are considered together. The likely reasons for this reversal are similar to the male case. At any rate, the descriptive pattern indicates that both for female and male youth, the availability of low-skill jobs is linked in an expected manner to prospects of finding employment.

The ORU estimates in table 3 again, as for males, show that especially in north-western Europe both matched skill upgrading and rising overeducation are detrimental for young women's employment chances. This pattern is evident in the fixed effects models but not in the models unadjusted for country-specific factors and a time trend, probably due to a more positive evolution of female than of male employment for reasons unrelated to skill change. The same is true for eastern and southern Europe: some significantly negative effects appear in the FE models, but not when estimates are unadjusted for time and country (in the latter case significantly positive estimates appear, probably reflecting joint but substantively unrelated growth). In general, though, effects are clearly stronger in the North-west than elsewhere, with matched skill upgrading and overeducation of equal importance. In eastern Europe, only the negative impact of overeducation is significant while only the negative estimate of matched upgrading is (marginally) significant in the southern European case.

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5.2 Extended empirical analyses of youth employment

In this section, based on Tåhlin and Westerman (2020a), we present extended empirical results regarding youth employment. We begin by providing ORU model estimates based on in-depth analyses of EU-LFS data from 10 northwestern countries (the 12 NW countries included above except Norway and Switzerland). We then assess the robustness of the findings by using an alternative outcome measure (see further below), and finish by briefly evaluating alternative explanations of youth employment decline.

In tables 4 and 5, parameter estimates from the ORU model are shown, for men and women respectively, indicating the separate effects of matched skill upgrading, overeducation and undereducation on youth employment. In model 1, youth employment is predicted by the ORU components only, without country-year fixed effects and regardless of the mid-age employment rate. As hypothesized, both matched upgrading and overeducation are negatively associated with youth employment. This applies to both males and females but the effects are weaker for women. When model 1 is estimated with OLS (results not shown), more than half of the variation in male youth employment is accounted for by the ORU parameters (R^2=0.55), and one fourth of the corresponding variation for women (R^2=0.26).

Tables 4 and 5: ORU regressions of male and female (respectively) youth employment on matched skill upgrading and overeducation. 10 countries in northwestern Europe, 1998-2016; EU-LFS.

As discussed earlier, omitted variable bias may occur due to unobserved influence of stable differences across countries and time-bound country-common influences. In model 2, these differences are controlled for by using fixed effects for countries and years. The ORU parameter estimates, especially for women, are stronger in this model specification than in the previous one, suggesting that stable differences between countries and country-common change bias the association between skill structure and youth employment downwards.

In model 3, mid-age male employment is entered as a covariate, for both males and females. This model hence predicts the gap between youth and mid-age employment. The ORU coefficients differ very little between models 2 and 3 for both men and women (with the exception of undereducation for men). This indicates that upgrading of the skill structure increases the youth employment gap primarily because it worsens youth employment prospects, not because it improves mid-age employment prospects.

In model 4, education is held constant between youth and mid-age individuals. Accounting for education in this manner results in slightly stronger associations, among both men and women,

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between changes in the skill structure and youth employment chances. The education advantage of the young relative to the mid-aged apparently contributes to some (but quite limited) closure of the youth employment gap (the remaining part presumably being tied to a deficit in experience), since the gap grows when education is held constant.

In order to facilitate interpretation of the results in tables 4 and 5, model 3, figures 4 and 5 show youth employment rates as predicted by the ORU parameter estimates (with other covariates held constant) and observed proportions of each of the nine education-occupation cells in the ORU model.[5] Predicted employment rates are indicated on the vertical axes and observed education-occupation shares on the horizontal axes; the dots in the figures indicate the location of the 177 country-year units in this space.

With regard to matched skill upgrading, the figures imply that an observed growth in HH jobs (high education, high occupation) markedly widens the youth employment gap while an observed growth in LL (low education, low occupation) and MM (mid-level education, mid-level occupation) jobs closes the gap. This pattern accords well with our theoretical expectations, supporting the hypothesis of skill upgrading leading to youth employment decline. The associations involved are strong. For instance, a one percentage point decrease in LL jobs is associated with about one percentage point larger male youth employment gaps. With regard to skill mismatch, growth in HL and HM jobs (both indicating overeducation) widens the youth employment gap, in line with the crowding-out hypothesis.

Figures 4 and 5: Predicted male and female (respectively) youth employment and observed changes in education/occupation combinations. 10 countries in northwestern Europe, 1998-2016; EU-LFS.

5.3 A robustness test concerning the role of students

An important robustness check of the results concerns the role of current students. Our main measure of labor market participation is the employment rate, i.e., the employed share of the population in a given age group. Two alternative measures are the unemployment rate and the NEET ('Not in Education, Employment or Training') rate. Unemployment as an indicator of non-activity among young people is problematic since it is (usually) expressed as a proportion of the labor force; both non-employed students (a large group among youth) and non-employed non-students (NEETs, also a large group) are thus excluded (unless they are actively looking for a job). The NEET measure is also less than ideal for our purposes, since it equates education and employment as activities

[5] We use model 3 rather than model 4 in order to capture all implications of educational expansion for youth employment, including the (limited) positive effects from the youth advantage in educational attainment.

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without taking into account that schooling may be a second-best option in the face of waning employment options. We therefore see the employment rate as the best activity measure among youth. To minimize the problem of how to classify students, we define youth as age 25-29, thus setting the lower age limit above the modal point of schooling completion, including tertiary education. As a robustness check, we use an alternative outcome measure combining the employment and NEET rates, EMP / (EMP + NEETs), thus netting out current students rather than including them on either side of the activity / non-activity border; we call this alternative measure ERNEST (Employment Rate NEt of STudents).[6]

Relative to the standard case, the ORU estimates (not shown) tend to be slightly stronger with ERNEST as outcome. We thus conclude that the tight link between the structural change of skill and youth employment decline is not primarily accounted for by a shift from employment to education among the young, but rather by a rise in youth inactivity (NEET).

5.4 Assessment of alternative explanations

Several alternative explanations of youth employment decline have been suggested in the literature. First, a (supposed) long-term decrease in general labor demand might especially have disfavored marginal groups such as youth (e.g. Blanchflower and Freeman 2000). Second, a (supposed) long-run fall in the mid-skill job share of all employment relative to high-skill and low-skill jobs ('job polarization'; Goos and Manning 2007, Autor 2010) might have compelled mid-age, mid-educated workers to downgrade in the job structure, thereby competing with youth for low-skill jobs (e.g. Smith 2011). Third, growing immigration into many western countries in recent decades might have affected youth employment negatively via intensified job competition at labor market entry points (e.g. Smith 2012). These three alternative accounts can be called the stagnation, polarization and immigration stories, respectively.

We do not find support for these explanations. First, cyclical fluctuations aside, general labor demand has apparently been quite stable during recent decades in the countries we consider. This is evident both from overall employment rates and from the average hours worked per capita in the population of working age; see OECD (2017). Second, the role of changes in mid-skill employment in the process of youth employment decline appears to be quite limited. This can be seen in figures 1:4 a and b above (visualizing predicted values from the ORU regression models) in which all boxes

[6] Information on current studies is available in the EU-LFS data from 2004. For 2004-15 we can thus compare models with two different outcomes: (a) the standard youth employment gap and (b) the youth ERNEST gap.

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involving mid-levels of occupation and education display a much less distinct pattern than those involving only the lower and higher skill levels. Third, immigration appears to play some role for the change in youth employment chances, but its negative impact appears to be small or non-existent. When controlling for the immigrant share of employment, the ORU parameter estimates hardly change at all (results not shown). Interestingly, the main effect of the immigrant share (net of the ORU parameters) is positive, indicating that youth and immigrant employment tend to grow together rather than trade off.

5.5 Empirical results, older workers (male and female)

As a complement to examining youth employment, we next consider the associations between structural skill change and employment among older workers. In line with the discussion above, theoretically based expectations regarding these associations are much less clear in this case than for the young. While there are certainly several conceivable mechanisms involved in the relation between skill structure and employment prospects of older workers, these mechanisms tend to go in different directions, sometimes counteracting each other. It is hence reasonable, based on our theoretical account, to expect that the estimated associations will generally be weaker than for youth. In evaluating this expectation, we first consider older male workers (see figure 6 and table 6) and then turn to older female workers.

Figure 6: Low-skill job availability (LL) and the older male employment gap. 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.
Table 6: ORU regressions of older male employment. 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.

Figure 6 reveals that relative employment rates of older men are not linked negatively to the decline in availability of low-skill jobs (indicated by the LL share). This is in clear contrast to the pattern among young men. In fact, the slope is positive in both north-western and eastern European countries, as well as in all countries considered together, although negative in southern Europe. From the ORU regressions in table 6, we can see that the estimated skill-employment associations are almost uniformly significantly positive in the unadjusted models. This presumably reflects the fact that old-age employment has grown in most countries in recent decades, in parallel with – although not necessarily (or even likely) caused by – structural skill rise. None of these positive associations survive adjustment for country-specific factors and a time trend in the fixed-effects models, implying that the structural change of skill is not an active causal factor behind the growth of old-age employment, or at least that if the skill structure does play a causal role its impact is

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probably mixed, with counteracting mechanisms involved. This empirical pattern is hence compatible with our earlier discussion. While most of the coefficients in the fixed-effects regressions are negative, only two are significant: those of matched skill upgrading in the general country model and in the southern country model.

In figure 7 and table 7, the corresponding empirical outcomes for older female workers are shown.

Figure 7: Low-skill job availability (LL) and the older female employment gap. 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.

Table 7: ORU regressions of older female employment. 20 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.

According to figure 7, the association between the decline in low-skill job availability (LL) and employment rates of older women is positive in north-western Europe and in all countries considered together, and essentially zero in eastern and southern Europe. There is thus no indication in this descriptive pattern that structural skill rise hurts old-age female employment prospects. While there are some minor differences, the general pattern is fairly similar to that of older men shown above.

Table 7 shows ORU regression estimates. Just as for older men, almost all effects in the unadjusted models, regardless of region, are significantly positive. Once again, the explanation is likely to be that the skill structure and old-age employment have both tended to grow in recent decades, although probably without being causally connected in any clear direction. This interpretation is supported by the fixed-effects models, showing only one (marginally) significant positive effect (that of overeducation in the north-western countries), three significantly negative effects (of matched skill upgrading in eastern and southern Europe and among all countries together) and the remaining four non-significant. In sum, and as expected, the overall pattern of associations between skill structure and employment rates is less clear for older than for young workers, although there is a slight tendency of structural skill rise to be negative not only for youth (with large effects at least in north-western Europe) but also for old-age employment.

5.6 Empirical results, female parents (mothers)

In figure 8 and table 8, the associations between skill structure and the female parent (mother) employment gap (relative to mid-age men) are shown.

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Figure 8: Low-skill job availability (LL) and the maternal (mothers with children in the household) employment gap. 15 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.
Table 8: ORU regressions of maternal (mothers with children in the household) employment. 15 countries in northwestern, eastern and southern Europe 1998-2016; EU-LFS.

As in the case of older workers, theoretically based expectations concerning the link between skill structure and employment prospects for mothers are less clear in direction than for youth. Again, there are several conceivable mechanisms involved, some of which might counteract each other. In essence, the issue is therefore empirical and partly exploratory, although obviously important. Figure 8 shows a markedly mixed pattern, with no general tendency across country regions. The decline in low-skill job availability (or the structural rise in skill requirements) is positive for female parents' employment in north-western Europe but negative for mothers' employment in eastern Europe, with no visible association in the South. The ORU regressions in table 8 also display a mixed pattern. In the North-west and South, the unadjusted models show significantly positive effects, for reasons likely similar to those discussed above for older workers. In the fixed-effects models, there are significantly negative effects of matched skill upgrading in north-western and southern countries, but a significantly positive effect in the East, with a uniformly non-significant impact of overeducation. Overall, there appears to be little of a systematic association between structural skill change and maternal employment prospects. This lack of a clear pattern is presumably due to a mix of counteracting mechanisms, which in turn is likely related to the considerable heterogeneity of mothers as a labor force category, not least with regard to education and work-life experience.

6. Empirical section 2: The impact of skill change on immigrant employment[7]

In response to global economic and political turmoil, international migration have reached record levels in recent years. Several European countries now host a large proportion foreign-born individuals. New immigrants are coming to a continent of aging populations and low fertility (Eurostat 2018a). Immigration of working-age people might potentially relieve European welfare systems from the fiscal burdens of costly internal demographic change. However, research on how immigrants fare in the labor market of their destination countries shows that employment rates are relatively low and unemployment rates high among the foreign-born across Europe, but also that there is considerable variation between countries in this regard (see e.g. Dustmann and Frattini 2011, OECD 2018).

[7] The following text, until the empirical section, is based on Szulkin, Tåhlin and Westerman (2020).

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There are several factors that might explain why employment and unemployment rates among immigrants vary across countries. Different countries attract (and accept) immigrants with different levels of education and other individual productivity enhancing characteristics (Borjas 1999, Pichler 2011). Previous research emphasizes also the importance of institutional or other country-specific traits, such as the supply of low-skill jobs (of special interest for the analyses carried out in the present report), the structure of the welfare state, the political complexion of the government, the labor market's degree of flexibility, the level of the lowest wages in the economy, the design of unemployment insurance, and the extent of discrimination (Fleischmann and Dronkers 2010, Jean et al. 2010, Kesler 2006, Kogan 2006, Meyer Christensen and Pavlopoulos 2010, OECD 2007, Reyneri and Fullin 2009). A major problem faced by comparative research in this area is that the number of reasonable country-level determinants tends to be greater than the number of countries examined. The findings hence become sensitive to the choice of what institutional variables to include in (or exclude from) the analyses and to the sample of countries examined.

The analyses of the present report contribute in two main ways to the literature on immigrants' employment chances. First, we examine the importance of the skill structure of receiving countries' labor markets by jointly considering supply and demand factors. There are strong reasons to believe that the availability of low-skill jobs affects the employment rate of immigrants, especially among recent arrivals (see, e.g., Kogan 2006, Fleischmann and Dronkers 2010). However, a narrow focus on the demand side – the declining proportion low-skill jobs of all employment – neglects another important development in the skill structure over recent decades: educational expansion on the supply side. If skill supply rises faster than skill demand, highly educated individuals unable to find jobs at their own skill level are compelled to accept jobs at lower levels; over-education hence appears. In turn, as further spelled out below, such educational mismatch may limit employment prospects for immigrants and other marginal workers due to crowding-out. Previous comparative research on immigrant employment has in general not considered this interplay between supply and demand factors.

Our second contribution is to apply fixed-effects (FE) models at the country-year level to data from the European labor force surveys (EU-LFS) for 16 countries in north-western and southern Europe covering the period 2004 to 2016. Previous research on the association between skill structure and immigrant employment has been limited by a short time-frame that has ruled out FE models. With yearly updates of EU-LFS, FE models have gradually become more viable, an opportunity that we exploit here. This modelling allows a more efficient elimination of potentially confounding factors and thus increases confidence in more causal interpretations than what is feasible with standard covariate models. While FE models are obviously not sufficient for causal identification in the more

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strict sense of eliminating endogeneity bias, they are a significant step forward relative to standard estimation models.

6.1 Decline of the low-skill job share: Potential consequences for immigrant employment

The rate at which the low-skill job sector declines in contemporary labor markets is determined by several factors. Technological change in recent decades has been skill-biased, i.e., the share of high-skill jobs has grown relative to the low-skill job share (see e.g. Acemoglu 2002). The process of technology-induced skill upgrading starts with productivity growth in the manufacturing sector which leads to wage increases in the whole economy via the interplay between supply and demand in the general labor market (Baumol 1967). In turn, rising relative wage costs in sectors with limited productivity growth, including large parts of the service industries, brings falling general demand for low-productive and thus low-skill labor.

Descriptive accounts of advanced economies from the 1960s to date (e.g. Handel 2012) show that this development has led to increasing shares of engineers and technicians relative to manual workers in manufacturing and construction as well as an expansion of high-skill service sector occupations in finance, insurance, education and health care. A general skill upgrading thus implies a gradual shift of labor demand from low-skill to high-skill work. This trend is potentially reinforced by globalization that brings about a movement of manufacturing jobs (of which many are low-skill) overseas, especially noticeable in countries with a relatively compressed wage structure (such as most European countries as compared to the United States) making low-skill jobs relatively expensive and thus profitable to eliminate or move to less costly environments (Krugman 1994).

A labor market increasingly dominated by highly qualified labor matched to jobs with high skill requirements contributes to a highly productive economy and a large share of high-skill work. However, a less bright side of this process is that the reduction of the low-skill sector may lead to declining employment opportunities for less resourceful groups in the labor market. One example is immigrants to economically advanced countries who tend to have lower educational attainment than the native population (OECD 2014, Eurostat 2018b) and are therefore relatively dependent on low-skill rather than high-skill jobs. Insufficient educational attainment in a context of upgrading skill structures may thus partly explain immigrants' employment disadvantage in western labor markets. Additional individual-level factors explaining immigrants' disadvantage in the labor market are foreign education, limited labor market experience in the new country, and deficient language skills (see, e.g., Heath and Cheung 2007). Relatedly, prospects of attaining work in the new country are influenced by age at – and time elapsed since – arrival, and whether migration is motivated by economic concerns, family reunification or by experience of persecution. Moreover, country of

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origin and outright discrimination may also be important (van Tubergen *et al*. 2004, OECD 2015, 2018). Several categories of immigrants, i.e., not only the formally low-skilled, are hence perceived by employers as relatively less productive than natives.

Jobs in the low-skill sector are usually low-paid and insecure, even if the labor market is regulated, and the appreciation of human capital is less important in this sector, which means that the competition from native workers is less intense (Piore 1986, Kogan 2006, Fleischmann and Dronkers 2010). For many immigrants, a low-skill job may thus constitute a stepping stone for future labor market progress (Kogan 2006), and its attainment may therefore be useful for integration regardless of the person's qualification level.[8]

In sum, the availability of low-skill work is likely to be essential for immigrants' labor market integration, especially for the low-educated but also more generally. As often discussed, in countries with comparatively limited low-skill sectors, such as in Scandinavia, it may be especially difficult for immigrants to find work (cf. Devitt 2011). Accordingly, we expect better labor market opportunities for immigrants in countries with larger low-skill sectors. In previous research, this expectation has been borne out regarding unemployment risks for third country immigrants to the ´old´ EU[9] (Kogan 2006) and for immigrants in general and their offspring in the 'old' EU-countries (Fleischmann and Dronkers 2010).[10]

6.2 The interplay between skill demand and supply

Earlier research on the link between the labor market's skill structure and immigrants' employment chances has tended to focus on the demand side, i.e., the share of low-skill jobs in the economy. However, as indicated above, the supply side of skill – individuals' human capital – is also essential to consider. It is thus important to take into account which individuals are hired to the positions seemingly available in the labor market. As outlined in this section, the relative supply of native well-educated workers might have a strong impact on immigrants' labor market prospects.

[8] However, it should be noticed that it is an empirical question whether unqualified jobs are stepping stones or traps. The future prospects of highly qualified immigrants who take up low-skill positions may very well be limited. Immigrants are often compelled to accept low-skill and low-quality jobs regardless of their individual qualifications. Accordingly, immigrants have a higher incidence than natives of over-education implying relatively small returns to education (OECD 2014).

[9] According to the EU vocabulary third country immigrants are residents who are not EU citizens and therefore lack the right of free movement between EU countries.

[10] Kogan's analysis is based on the European Labour Force Surveys (1992-2000); Fleischmann and Dronkers use the second wave of the European Social Survey (2004).

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In European countries, the rise in demand for high-skill work has generally been exceeded by an even more rapid growth in the supply of highly educated individuals (see, e.g., Tåhlin and Westerman 2020a). This development is partly political, partly driven by rational individual behavior. It is common among policy makers to see educational expansion as an instrument with many virtues – raising social mobility, boosting economic growth, providing productive alternatives to unemployment in cyclical downturns – and few drawbacks. At the individual level, expanding educational opportunities sets a process of self-fulfilling prophecy in motion. Due to an excess supply of educated individuals, people with high qualifications are increasingly compelled to accept low-skill work; they will choose not to wait for a qualified job as the queue to these jobs is gradually extended. Meanwhile, due to the abundance of skill supply among job applicants, employers raise educational requirements for entry to positions with work tasks that in reality can be carried out without much schooling or training. The low-educated are hence crowded out into non-employment and average educational attainment among workers in the low-skill sector rises. This compositional change provides a signal for the next generation of students that a higher education is necessary for attaining not only a high-skill job, but any kind of employment. When educational attainment beyond the compulsory level *appears* from an individual viewpoint to be necessary for achieving any type of employment, it *will* become increasingly required also at the aggregate level. Hence, the educational composition will gradually shift upwards, both generally and especially within the low-skill sector, with each generation of labor market entrants. As a consequence, the *availability* of low-skill jobs for less resourceful individuals, who are particularly dependent on such work because they cannot compete for more skilled jobs, will continue to decline, even if the actual share of low-skill jobs would stop falling (Tåhlin and Westerman 2020a).

Previous studies (e.g. Gesthuizen and Wolbers 2010, Abrassart 2015) have mainly analyzed crowding-out of the low-educated. As argued above crowding-out related to structural over-education is consequential also for young workers, due to their lack of work experience, since high-skill jobs typically require more experience than do low-skill jobs. Below, this line of reasoning is extended to immigrants. We suggest that a relatively low appreciation of immigrants' human capital (acquired in their origin countries), including their experience, as well as their (possible) deficits in (receiving country) language skills, make them a relatively disadvantaged group in the competition for jobs, especially for high-skill work. The availability of low-skill jobs is hence expected to be crucial for them, but this availability is reduced not only by a falling share of such jobs but also by rising over-education.

In sum, we extend previous research on immigrants' labor market opportunities by simultaneously considering demand-side and supply-side factors. More specifically, we expect that (a) when the

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number of jobs with low skill requirements is increasingly limited and (b) when the low-skill jobs that remain to a growing extent are occupied by relatively well-educated native workers, the prospects for successful economic integration of immigrants diminish.

6.3 Empirical results, immigrants (male and female)

In parallel fashion to the results reported above on youth, older workers and mothers, figure 9 displays the association between low-skill job availability (the LL share) and the immigrant male employment gap (the difference between the employment rates of immigrant men and native mid-age men). But in the case of immigrants, eastern European countries are not included in the analyses due to their relatively recent history of immigration, with still very low rates in international comparison. Also, the examined time period is shorter than in the analyses above, since standardized information on immigrant status did not become available in the EU-LFS until 2004 (see data section above).

Figure 9: Low-skill job availability (LL) and the immigrant male employment gap. 16 countries in northwestern and southern Europe 2004-2016; EU-LFS.

The descriptive picture shows negative associations among all countries (northwestern and southern) together, and especially in southern Europe, indicating that – as expected – the relative employment rate of immigrants falls in tandem with a decline in availability of low-skill jobs. In contrast, the corresponding line of association in northwestern Europe is essentially flat. ORU regression estimates are shown in table 9.

Table 9: ORU regressions of immigrant male employment. 16 countries in northwestern and southern Europe 2004-2016, EU-LFS.

All coefficients are negative, in line with expectations, except the unadjusted estimates for the northwestern countries. In the fixed effects models, including adjustment for country-specific factors and a time trend, there are uniformly large negative effects of overeducation on immigrant male employment, although the estimate for southern Europe is not statistically significant. The impact of matched skill upgrading is apparently less strong, yet significantly negative among northwestern countries. We return to the large overeducation effects below in reporting extended empirical analyses of immigrant employment.

Figure 10 and table 10 display the corresponding associations concerning employment rates of female immigrants.

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Figure 10: Low-skill job availability (LL) and the immigrant female employment gap. 16 countries in northwestern and southern Europe 2004-2016; EU-LFS.
Table 10: ORU regressions of immigrant female employment. 16 countries in northwestern and southern Europe 2004-2016; EU-LFS.

As in the case of men, a decline in availability of low-skill jobs (a fall in the LL share) is negatively related to employment chances among immigrant women in all countries viewed together and in southern Europe; see figure 10. In the Northwest the association is instead weakly positive, perhaps reflecting a joint movement over time in the two rates due to factors untied to their causal interrelation.

Estimates from ORU regressions (see table 10) with fixed effects for individual countries and time reveal a negative impact – in line with expectations – of both matched skill upgrading and overeducation on immigrant female employment among all countries examined together and among northwestern countries, although the overeducation effects are not statistically significant. In contrast, the estimates for southern Europe examined separately tend to be weak and non-significant.

Next, we turn to a number of more extensive empirical analyses of how structural skill change and immigrant employment are related. As with regard to youth, the theoretical case for expecting a systematic relationship between the skill structure and immigrants' employment chances is strong, stronger than for some other marginal groups including older workers and female parents. It is hence useful to probe a bit deeper into the empirical pattern of immigrant labor markets that we have done so far in the present report.

6.4 Extended empirical analyses of immigrant employment[11]

The countries included in the extended analyses reported below are EU15 except Luxembourg and Greece plus Switzerland and Norway, i.e., the sample of countries contains Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.[12] The analytical sample includes 194 country-year

[11] This section is based on Szulkin, Tåhlin and Westerman (2020).

[12] Recent EU member countries are not included since they have a relatively short (modern) history of immigration. Norway and Switzerland are included due to the relatively extensive long-term immigration into these countries as well as their economic integration with the EU15 countries. We exclude Greece because of missing data on several variables and Luxembourg due to its very small population.

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units of observation from 2004 to 2016.[13] The number of respondents for any country-by-year combination varies from around 15,000 to around 500,000 (for details see Eurostat 2018c).

In the analyses, we take the gap between immigrants and natives as an indicator of the employment success of immigrants. Gaps can emerge due to a low employment level among immigrants, but also due to a high employment level among natives. A large gap may thus indicate favorable labor market conditions for natives, rather than labor market integration problems of immigrants. By applying fixed effects for countries and years (see further below) such stable country-specific traits are taken into account, as well as fluctuations in cross-nationally general conditions.

In the following, we first estimate associations – both with and without fixed effects of countries and years – between the structure of skill demand (the low-skill share of all jobs) and the immigrant-native employment gaps for (a) all immigrants, (b) separately for males and females, and (c) separately for sub-groups according to origin country, time since arrival and educational attainment.

In a second step, we repeat the procedure with joint supply-demand models, thus estimating separate effects of matched skill upgrading and over-education.

In our analyses, we include prime-age persons only, 25-54 years old. In this way, we reduce the impact on the results of the variation between countries in retirement age and the age when young people usually finish their education.

6.5 Low-skill labor demand

Previous research on the link between the skill structure of labor markets and the employment chances of immigrants has focused on the demand side rather than jointly considering skill demand and supply. In order to provide an empirical context that allows comparisons with earlier studies (reviewed above), we begin our extended explanatory analyses by estimating the associations between the proportion low-skill jobs and the native-immigrant employment gap, before turning in the next section to matching models. When estimating these associations, we control for compositional differences between immigrants and natives in productivity-related individual characteristics (indicated by age and education), for country-specific economic change (indicated by GDP per capita), and for migration reason (indicated by granted asylums).

As explained above (see the section on data and methods), low-skill labor demand is measured by the proportion working in ISCO one-digit categories 5, 6, 8 and 9 (service, agricultural, factory and elementary workers, respectively). According to the theoretical discussion, we expect a positive association between this variable and immigrant employment prospects, i.e., that immigrants'

[13] Ireland lacks data for 2004.

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chances of employment (relative to natives) increase with the size of the low-skill job sector (and hence diminish as the low-skill share of all jobs declines).

In Table 11, we present results for all immigrants, as well as separately for men and women. Estimates in models without fixed effects (1a, 2a, 3a) point in the expected direction, in line with earlier studies (Kogan 2006, Fleischmann and Dronkers 2010). A large low-skill job share narrows the employment gap between natives and immigrants. The associations are statistically significant for all immigrants taken together and for female immigrants (models 1a and 3a) but non-significant for males (model 2a). The (significant) regression coefficients indicate that an increase in size of the low-skill job sector with ten percentage points narrows the native-immigrant employment gap by three to six percentage points; hence a substantively strong association.

Table 11. Regression of native-immigrant employment gaps on the low-skill job share. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

As discussed earlier, omitted variable bias may occur due to unobserved stable differences across countries (e.g. tied to institutional variation and unaccounted compositional differences), as well as time-bound country-common influences (e.g. the financial crisis in 2008-2009). We therefore provide an additional set of tests by running models where stable differences between countries, as well as global trends, are controlled through the inclusion of fixed effects for countries and years. Apparently, the previous findings do not survive this test. The estimates change direction and are significant, with an unexpected sign, for all immigrants (model 1b) and for male immigrants (model 2b), indicating (surprisingly) that large low-skill job shares widen rather than narrow native-immigrant employment gaps. In contrast, the effects of GDP and granted asylums are (mostly) significant and in the expected direction, both with and without fixed effects: higher rates of economic growth and lower rates of refugee immigration tend to be positively associated with immigrants' employment opportunities.

In table 12 we run our models separately for three categories of immigrants that can be expected to be especially affected in a negative direction by a reduction of the low-skill job share. These groups include (a) immigrants with a (relatively) short period of residence in the host country, (b) those born outside Europe (and outside the English-speaking countries in North America and Oceania), and (c) those with low (only primary or less) educational attainment.[14]

Table 12. Regression of native-immigrant employment gaps on the low-skill job share. Three vulnerable subgroups. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

[14] For analyses taking account of country of origin of immigrants, Germany and Italy lack data for 2004. In the analyses of low-educated individuals, in contrast to all other analyses, educational weights are not applied.

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Estimates in all models without fixed effects for countries and years (4a, 5a, 6a) point in the expected direction. Labor markets with a comparatively small low-skill job share tend to have relatively large native-immigrant employment gaps; a larger low-skill sector thus results in a reduction of the gap (indicated by the negative b coefficient). This pattern applies to all three vulnerable immigrant categories (recent, non-European and low-educated); the association is strongest for non-European immigrants and weakest for recent immigrants.

Again, however, just as in the analyses reported in table 11, the findings are invalidated in the fixed-effects models (4b, 5b, 6b). The estimates change direction and are (except for non-European immigrants) significant with an unexpected sign.

In sum, the expectation that a reduction in demand for low-skill labor has a negative impact on labor market opportunities for immigrants is not confirmed. Empirical findings in earlier research indicating such an association are not validated in our analyses including fixed effects for countries and years. However, as discussed in the theoretical parts of the present report, we believe that an analysis of the process of matching persons to jobs is needed in order to firmly assess the association between skill structure and immigrant employment chances by taking joint account of skill demand and supply.

We suspect, specifically, that the significant associations reported in tables 11 and 12, with large low-skill job shares unexpectedly being tied to poor employment prospects for immigrants, are a net outcome of two underlying gross effects that need to be separated: one of matched skill upgrading and one of over-education. Both effects are negative for immigrants, but only the former (of matched skill upgrading) clearly reflects a small low-skill job share. The latter effect (of over-education) instead reflects a large low-skill job share: for any given level of skill supply (education), the rate of over-education grows – by definition – in tandem with the low-skill job share. Without separating these two gross effects, the estimated net effect will therefore be biased, not only in size but potentially also in direction. In the following analyses, we consider this potential bias through a specification that considers the interplay between skill demand and supply in the labor market, i.e., the matching between jobs and individual workers.

6.6 The interplay between skill demand and supply

In the analyses reported below, we provide estimates of how matched skill upgrading and over-education are associated with the native-immigrant employment gap. The matched skill upgrading parameter, by construction, tests the expectation that a reduction of the labor market's low-skill sector (low-skill jobs held by individuals with low education) is negative for immigrant employment

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prospects. The over-education parameter tests the additional expectation that crowding into low-skill jobs by individuals with more than compulsory schooling increases competition for these jobs, which is also negative for immigrant employment. In contrast to the analyses in the previous section, the ORU model specification (see above) allows separation between these two parameters, thus taking skill demand and supply into joint account.

Table 13 provides a demand-supply analysis similar in form to the demand-based model presented in table 11, first regressing the native-immigrant employment gap for all immigrants and then for male and female immigrants separately. We begin by including our indicators of the matching process (matched upgrading and over-education) with measures of country-specific business cycles (GDP) and the asylum immigration rate as control variables (7a, 8a, 9a).[15]

Table 13. Regression of native-immigrant employment gaps on matched skill upgrading and overeducation. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

In all three models the parameter estimates for matched skill upgrading are positive (i.e., widening the employment gap) and significant. Regarding over-education the association with the native-immigrant employment gap is also positive, but significant only in models for all immigrants. Immigrants' labor market prospects are thus comparatively bleak both (a) in a highly productive economy with a small low-skill sector, and (b) in a surplus schooling economy, with an excess rate of low-skill jobs relative to the supply of well-educated individuals. This implies that when we examine the association between skill structure and immigrant employment we need to consider not only the proportion of low-skill and high-skill jobs, but also the skill levels of individuals who compete for and occupy these jobs. A large share of low-skill jobs may do little for immigrants (and other unprivileged groups) if they have to compete with well-educated native workers when applying for them.

Next, we estimate models (7b, 8b, 9b) with fixed effects for countries and years, hence eliminating the influence of all time-constant variation across countries (stable institutional factors) and all internationally constant variation across years (country-common trends). In all models the parameters involving indicators of the matching process are – in line with theoretical expectations – positive and (except for over-education among women) statistically significant. For men (but not for women), the estimates for over-education are much stronger than those for matched upgrading. This contributes to explaining the unexpected negative association between immigrant employment

[15] All analyses are performed on data weighted by education and age which removes variation across countries and years, and between immigrants and natives within countries and years, in these variables.

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and the low-skill job rate that we found in the previous section. Apparently, at least in a fixed-effects setting, the low-skill job share is positively linked to the over-education rate (indeed, for given levels of skill supply, this must be the case); failing to take this link into account – i.e., failing to jointly consider the skill levels of jobs and individuals – leads to biased estimates, potentially not only in size but also in sign (direction).

So far the results clearly indicate that when we combine information on the demand for and the supply of skill we get a sharper picture of how the labor market works and, more specifically, how the interplay between skill demand and supply affects the opportunity structure for immigrant employment.

Table 14. Regression of native-immigrant employment gaps on matched skill upgrading and over-education. Three vulnerable subgroups. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

In the analyses in table 14 we turn to those groups of immigrants that can be expected to have especially vulnerable positions in the labor market. The estimates for recent immigrants, immigrants from non-European countries, and low-educated immigrants all point in the expected direction and are all statistically significant at conventional levels. This applies both to models without fixed effects (models 10a, 11a, 12a) and with fixed effects (models 10b, 11b, 12b). In all fixed-effects models, over-education is a stronger (judging by t-values) predictor of the gap between natives and immigrants than is matched skill upgrading. However, when we compare the results in table 14 with the results in table 13 (for men), the differences between estimates are rather small. Thus, there is no clear indication that conceivably more vulnerable groups of immigrants are especially affected by the skill structure; the processes analyzed here seem general rather than specific, although partially different for women and men.[16] One possible explanation is that – perhaps due to status-related considerations – low-skill jobs typically employed by female immigrants are less exposed to competition from native well-educated individuals than low-skill jobs typically employed by male immigrants, thus making the over-education effect weaker for women.

6.7 Visualizing the skill demand and supply dynamics

To clarify our main findings, and make them more concrete, we display predicted values from model 7b in table 13; see figure 11. These values include the two regression equation terms that are functions of matched skill upgrading and overeducation, respectively (see equations 1 and 2 above).

[16] Separate analyses for women and men within the examined vulnerable groups would of course be of interest but are not feasible given the limited number of cases.

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The two skill parameters are free to vary over the 194 country-year units (indicated as dots in the figure) while other covariates are held constant; the predicted values are shown on the vertical axes in the figure. On the horizontal axes, actual changes in the six proportions underlying the matched skill upgrading and over-education indicators are shown: LL (low-educated individuals in low-skill jobs), MM (mid- educated in mid-skill jobs), HH (high-educated in high-skill jobs), HL (high-educated in low-skill jobs), HM (high-educated in mid-skill jobs) and ML (mid-educated in low-skill jobs); see table 1 above. In figure 11 we can hence see how the actual pattern of skill demand and supply (indicated by occupational and educational distributions, including their individual-level match) is associated with the immigrant-native employment gap (as predicted by model 7b in table 13).

Figure 11. Predicted immigrant employment gaps over observed changes in education/occupation combinations. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

We focus on the cells involving low-skill jobs. A partition of the low-skill job share into one part with employment of low-skill workers (LL) and another part with employment of high-skill workers (HL) shows that these two cells have the strongest associations of all with predicted immigrant-native employment gaps. An (observed) increase of about five percentage points in the LL proportion is associated with a decrease of about four percentage points in the (predicted) native-immigrant employment gap. LL is crucial because it reflects the number of low-skill jobs that are available to low-educated – and plausibly other disadvantaged – individuals. For HL, i.e., low-skill jobs that employ high-skill workers, a rather modest (observed) increase of two percentage points is associated with an increase in the (predicted) employment gap of almost three percentage points. Hence, in attempting to understand how the job structure influences the labor market opportunities of immigrants it is crucial to take the match between skill demand and skill supply into account. A high rate of low-skill jobs is potentially a positive factor for immigrant employment but the potential is realized only if immigrants do not need to compete for these jobs with well-educated natives. The patterns in the other cells are less distinct yet provide some additional information. The pattern in the HH cell (high-educated individuals in high-skill jobs) mirrors the pattern of LL, with an opposite slope. The cell including mid-educated workers in mid-skill jobs (MM) shows a rather scattered shape, being on the border between the oppositely sloped LL and HH. Finally, an increase of mid-educated persons in low-skill jobs (ML) is negatively linked to immigrant employment prospects, again an indication of the negative role of over-education for the labor market prospects of immigrants.

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7. Concluding discussion

7.1 The impact of structural skill change on youth employment

Labor market prospects for youth have deteriorated significantly in many OECD countries over recent decades. This development has so far not been adequately explained. In the spirit of Ryan (2001), and consistent with standard human capital theory, we have proposed an explanatory account based on skill upgrading as a main cause of youth employment decline, and augmented this account with crowding-out mechanisms tied to skill mismatch, normally not considered in the human capital framework. Using data on ten northwestern European countries over the period 1998-2015, we have estimated associations between the structural change of skill and youth employment decline. The main conclusion is that both matched skill upgrading and overeducation are strongly and negatively linked to young people's employment chances. In concluding, we point to some issues that need further discussion and analysis.

First, it is important to note that youth is (obviously) not a homogeneous category. On the contrary: there is a very large variation among young people (as in other age groups) in resources of different kinds, related to family background, ethnicity, education, health, etc. Many young people today certainly have good long-term opportunities, maybe better than those of previous generations. While a majority of youth might do fine, delayed entry to – or long-term exclusion from – the labor market probably has strongly negative consequences for the least resourceful youth categories. Hence, inequality among young people is likely to increase as a consequence of deteriorating employment chances for youth, with potential repurcussions across the life-course. Therefore, widening youth employment gaps both reflect and increase more general inequality.

Second, what are the policy implications of our findings? Our main conclusion is that skill upgrading and skill mismatch tend to have negative consequences for youth employment. But skill upgrading is of course beneficial in many ways. Perhaps the most important lesson to be learned from our analysis is that employment difficulties for youth, at least relative to other age groups but probably also in absolute terms, are strongly linked to economic and technological advancement. In that sense, youth employment decline can be seen as a negative side-effect of a positive general development. A possible avenue forward would be to raise the general employment rate by subsidizing low-skill entry-level jobs in sectors where labor demand is high but wage floors are (prohibitively) high as well. While stimulating expansion of low-skill jobs reduces average productivity of the workforce, it might, by lifting the employment rate, raise average productivity of the population. This dynamic could be further improved by expanding opportunities for upward job mobility from the entry level, which is obviously easier said than done. Regardless of specific policy

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proposals, however, it is of course important to understand the general causes of secular change in youth labor markets in order to evaluate more long-run options.

With regard to skill mismatch it is easier to see ways in which policies might be usefully redesigned. Apparently, educational expansion can go too far, or at least go in a less than optimal direction. Here we seem to confront a problem of the 'tragedy of the commons' type: at the individual level, it is typically rational to pursue further education in order to become more competitive in the job market. And this is also the standard policy recommendation. But the more individuals in general increase their education, the tougher the competition will get for each specific person. According to our results, aggregate overeducation hurts young people's employment opportunities considerably. The paramount policy task is therefore hardly to expand education in general but in a more prudent manner with regard to both magnitude and composition.

7.2 The impact of structural skill change on immigrant employment

There is a long tradition of research on labor market processes that generate variation between different groups in society in access to jobs and job rewards. This tradition includes many studies of the differences in labor market prospects between immigrants and natives. There are several reasons why immigrants may be less competitive than natives in the labor market of the host country. Deficient human capital, but also a depreciation of the human capital that individuals bring to the new country, as well as outright discrimination, may be among the causes of immigrants' difficulties in working life.

Aside from these general factors, research studying variation between countries in immigrant employment rates has analyzed specific characteristics of the receiving countries' labor markets. Quite often, the size of the low-skill job sector has been at the center of policy discussions in this area. This is a reasonable approach given that immigrants are often overrepresented in low-skill jobs (as indicated also by a large literature on over-education among immigrants) and that these jobs may constitute ports of entry for groups that have problems in establishing themselves in the labor market. Cross-sectional studies have also shown that there is a positive association between the proportion low-skill jobs in the economy and immigrant employment chances. An important empirical result of the present report is that this relationship is conditional on the supply of educated native workers not being so large that existing low-skill jobs become unavailable through over-education. Studies of how the skill structure of labor markets affects opportunities for different groups should therefore consider both the demand for and supply of skills. Otherwise, unmeasured effects of supply (potentially involving over-education) will bias the measured effects of demand (the low-skill job share).

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We have performed analyses that combine information on the demand and supply sides of labor markets. Our results indicate that the size of the low-skill job sector is positively related to immigrants' employment if and only if those employed in this sector have low qualifications. Furthermore, in an economy where many well-educated native persons hold low-skill jobs, the prospects for immigrants tend to deteriorate. Thus, our over-arching conclusion is that the *availability* of low-skill jobs, as determined by the size of the low-skill job sector *as well as* the proportion of educated persons in that sector, affects the employment outcomes of immigrants (relative to natives). In other words, a situation where well-educated natives are compelled to accept low-skill jobs in an otherwise upgrading economy creates the most unfavorable conditions for immigrants with respect to their employment opportunities.

To get a job is of course a necessary step in the process of labor market integration of immigrants. However, concerns about the prospects of immigrants in the labor market of receiving countries may also include considerations of job quality, including earnings, on-the-job learning and training, promotion prospects, work intensity, and job autonomy. Recent comparative research analyzing "ethnic penalties" examines the relationship between favorable employment opportunities for immigrants and their job rewards once employed (Panichella 2018). One possible outcome is a trade-off: in countries with relatively high levels of immigrant employment their job quality and earnings may be comparatively low. Conversely, in countries with relatively poor prospects for gainful employment those immigrants who pass the selection process may have relatively high job rewards. Other logical but perhaps less probable possibilities are double penalties and no penalties at all. An analysis of how the interplay between skill demand and supply in the labor market influences the relationship between employment prospects and job rewards among immigrants in European countries would be an important complement to the research presented in the present report.

7.3 The impact of structural skill change on marginal group employment

We have outlined elements of a theory of how structural skill upgrading might hurt employment prospects of marginal groups, and singled out youth and immigrants as especially vulnerable labor force categories in this context. The crucial mechanism in this perspective is the rise in experience requirements accompanying the growth in skill demand. It is precisely the relative lack of experience that is potentially a weakness of young persons and recent immigrants as they compete with more established workers for job opportunities. Other traditionally marginal groups in the labor market, such as older workers and mothers with children in the household, cannot be expected to be hurt by structural skill upgrading to the same extent. The empirical results reported above are well in line

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with this difference in expected effects for different marginal groups. Arguably, the international variation in effects is also compatible with our theoretical view of the mechanisms involved. The clearest pattern of empirical associations between structural skill change and marginal group employment is found for northwestern Europe, with both eastern and southern countries display a less coherent set of findings. While probably in part due to a weaker data basis, with fewer countries examined, the less distinct findings for the East and South are perhaps to be expected in view of the larger influence of institutional factors unrelated to the skill-based account that we have used as theoretical guide. Eastern European countries still have considerably less mature labor markets than in the Northwest, and in Southern Europe traditional institutions such as the family and non-formal employment continue to play relatively strong roles, not least for youth and immigrants.

Of course, the theoretical outline and empirical analysis of the present report need much further elaboration. We have suggested a model for the underlying causes of employment decline among marginal groups, especially youth and immigrants, a widespread and important contemporary social problem that has so far eluded explanation, and found considerable empirical support for our proposed account. In contrast, as far as we can determine, alternative explanations suggested in the literature essentially lack empirical foundation. Still, our theory and findings at this stage are both limited and preliminary. We anticipate future advances along these and other lines in the years ahead.

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Table 1. *Combinations of education (ISCED) and occupation (ISCO) into nine match categories*.

		Education		
Occupation		Low (ISCED 0-2)	Medium (ISCED 3-4)	High (ISCED 5-8)
	Low (ISCO 5,6,8,9)	Low-skill jobs held by Low-skill workers (LL)	Low-skill jobs held by Mid-skill workers (ML)	Low-skill jobs held by High-skill workers (HL)
	Medium (ISCO 3,4,7)	Mid-skill jobs held by Low-skill workers (LM)	Mid-skill jobs held by Mid-skill workers (MM)	Mid-skill jobs held by High-skill workers (HM)
	High (ISCO 1,2)	High-skill jobs held by Low-skill workers (LH)	High-skill jobs held by Mid-skill workers (MH)	High-skill jobs held by High-skill workers (HH)

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Table 2. Prais-Winsten regressions of youth male employment on matched skill upgrading and

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overeducation. 20 countries in North-western (NW), Eastern (EA) and Southern (SO) Europe, 1998-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	EA	EA FE	SO	SO FE
Mid-age male employment	1.054*** (16.17)	1.153*** (28.32)	1.098*** (18.71)	1.287*** (20.91)	0.845*** (9.48)	1.109*** (10.18)	1.355*** (10.97)	1.387*** (13.63)
Matched skill upgrading	-0.173* (-2.45)	-0.178*** (-3.47)	-0.329*** (-5.98)	-0.278*** (-4.53)	-0.222 (-1.11)	-0.051 (-0.19)	0.023 (0.15)	-0.273* (-2.00)
Overeducation	-0.231** (-2.64)	-0.175*** (-3.56)	-0.320*** (-5.13)	-0.314*** (-5.21)	-0.466* (-2.56)	0.275 (0.82)	-0.075 (-0.50)	-0.123 (-0.46)
N (country-years)	376	376	225	225	76	76	75	75

Notes: Panel-corrected z-values within parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

Table 3. Prais-Winsten regressions of youth female employment on matched skill upgrading and overeducation. 20 countries in North-western (NW), Eastern (EA) and Southern (SO) Europe, 1998-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	EA	EA FE	SO	SO FE
Mid-age male employment	0.754*** (10.98)	0.613*** (9.38)	0.565*** (5.57)	0.526*** (5.68)	0.240** (3.14)	0.652*** (6.41)	0.829*** (4.73)	0.862*** (5.39)
Matched skill upgrading	0.186** (2.89)	-0.268*** (-4.14)	-0.093 (-1.49)	-0.388*** (-4.67)	0.640*** (4.39)	0.100 (0.49)	0.151 (0.66)	-0.331* (-1.97)
Overeducation	0.060 (0.70)	-0.099 (-1.41)	-0.139 (-1.76)	-0.330*** (-3.70)	0.458** (3.01)	-0.688* (-2.41)	0.676** (2.80)	0.699 (1.71)
N (country-years)	376	376	225	225	76	76	75	75

Notes: Panel-corrected z-values within parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

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Table 4. ORU regressions of male youth employment. 10 countries in northwestern Europe, 1998-2016; EU-LFS.

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	b	**t**	**b**	**t**	**b**	**t**	**b**	**t**
Matched educ.	-0.33	-2.81	-0.45	-3.51	-0.46	-5.77	-0.58	-6.75
Overeducation	-0.54	-4.53	-0.67	-3.11	-0.70	-5.43	-0.78	-6.02
Adult employment	No		No		Yes		Yes	
Country/year fixed effects	No		Yes		Yes		Yes	
Individual education weight	No		No		No		Yes	
N = 177 (country-years)								

Table 5. ORU regressions of female youth employment. 10 countries in northwestern Europe, 1998-2016; EU-LFS.

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	b	**t**	**b**	**t**	**b**	**t**	**b**	**t**
Matched educ.	-0.23	-1.91	-0.71	-4.78	-0.74	-5.59	-0.99	-6.30
Overeducation	-0.35	-1.99	-0.99	-3.63	-0.98	-3.96	-1.20	-4.60
Adult employment	No		No		Yes		Yes	
Country/year fixed effects	No		Yes		Yes		Yes	
Individual education weight	No		No		No		Yes	
N = 177 (country-years)								

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Table 6. Prais-Winsten regressions of male older worker employment on matched skill upgrading and overeducation. 20 countries in North-western (NW), Eastern (EA) and Southern (SO) Europe, 1998-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	EA	EA FE	SO	SO FE
Mid-age male employment	0.786***	0.682***	0.802***	0.610***	1.463***	0.984***	0.157	0.439***
	(10.83)	(11.30)	(7.41)	(6.57)	(16.09)	(8.89)	(1.13)	(3.73)
Matched skill upgrading	0.267**	-0.284***	0.320***	-0.122	0.493*	-0.496	-0.301	-0.597***
	(3.23)	(-3.34)	(3.54)	(-1.21)	(2.18)	(-1.60)	(-1.54)	(-3.66)
Overeducation	0.519***	-0.075	0.421***	0.113	0.937***	-0.128	0.645**	-0.209
	(4.92)	(-0.79)	(3.82)	(0.89)	(4.87)	(-0.37)	(3.20)	(-0.72)
N (country-years)	376	376	225	225	76	76	75	75

Notes: Panel-corrected z-values within parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

Table 7. Prais-Winsten regressions of female older worker employment on matched skill upgrading and overeducation. 20 countries in North-western (NW), Eastern (EA) and Southern (SO) Europe, 1998-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	EA	EA FE	SO	SO FE
Mid-age male employment	0.449***	0.247***	0.681***	0.365***	0.566***	0.341*	-0.047	-0.059
	(6.12)	(5.19)	(7.01)	(5.30)	(4.16)	(2.54)	(-0.35)	(-0.94)
Matched skill upgrading	0.654***	-0.193*	0.901***	-0.034	0.951***	-0.616*	0.116	-0.741***
	(7.93)	(-2.36)	(8.68)	(-0.39)	(3.53)	(-2.12)	(0.54)	(-5.85)
Overeducation	0.935***	0.110	1.207***	0.220*	1.453***	-0.551	0.931***	-0.036
	(9.17)	(1.31)	(11.37)	(2.26)	(4.82)	(-1.48)	(5.90)	(-0.22)
N (country-years)	376	376	225	225	76	76	75	75

Notes: Panel-corrected z-values within parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

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Table 8. Prais-Winsten regressions of female parent employment on matched skill upgrading and overeducation. 20 countries in North-western (NW), Eastern (EA) and Southern (SO) Europe, 1998-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	EA	EA FE	SO	SO FE
Mid-age male employment	0.672*** (13.82)	0.498*** (9.73)	0.630*** (8.61)	0.427*** (6.35)	0.658*** (11.11)	0.819*** (13.71)	0.566*** (4.94)	0.550*** (5.53)
Matched skill upgrading	0.425*** (7.91)	-0.071 (-1.73)	0.188** (3.16)	-0.208** (-2.98)	-0.110 (-0.92)	0.394** (3.14)	0.292* (1.99)	-0.371*** (-4.06)
Overeducation	0.252*** (3.65)	0.218** (2.88)	0.191* (2.50)	-0.039 (-0.53)	-0.124 (-0.84)	0.276 (1.36)	0.848*** (5.76)	0.396 (1.50)
N (country-years)	376	376	225	225	76	76	75	75

Notes: Panel-corrected z-values within parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

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Table 9. Prais-Winsten regressions of immigrant male employment on matched skill upgrading and overeducation. 16 countries in North-western (NW) and Southern (SO) Europe, 2004-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	SO	SO FE
Mid-age male employment	0.809***	1.357***	0.810***	0.966***	1.433***	1.677***
	(7.24)	(15.00)	(4.52)	(6.32)	(10.90)	(15.01)
Matched skill upgrading	-0.211**	-0.099	0.047	-0.256*	-0.040	0.141
	(-2.69)	(-1.39)	(0.35)	(-2.16)	(-0.30)	(1.10)
Overeducation	-0.302***	-0.320**	0.079	-0.434**	-0.254	-0.051
	(-3.76)	(-3.18)	(0.49)	(-3.25)	(-1.76)	(-0.14)
N (country-years)	194	194	143	143	51	51

Notes: Panel-corrected z-values in parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

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Table 10. Prais-Winsten regressions of immigrant female employment on matched skill upgrading and overeducation. 16 countries in north-western (NW) and southern (SO) Europe, 2004-2016. Source: EU-LFS.

	ALL	ALL FE	NW	NW FE	SO	SO FE
Mid-age male employment	0.467***	0.578***	0.545***	0.370*	0.493*	0.689***
	(3.53)	(4.75)	(3.51)	(2.44)	(2.52)	(6.34)
Matched skill upgrading	0.017	-0.232**	0.137	-0.336**	-0.073	0.060
	(0.18)	(-2.88)	(1.29)	(-2.94)	(-0.30)	(0.55)
Overeducation	-0.006	-0.242	0.214	-0.250	-0.045	0.532
	(-0.04)	(-1.88)	(1.35)	(-1.66)	(-0.14)	(1.39)
N (country-years)	194	194	143	143	51	51

Notes: Panel-corrected z-values in parentheses; FE models include country dummies and a linear global (country-common) trend parameter.

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Table 11. Regression of native-immigrant employment gaps on the low-skill job share. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

	All immigrants		Men		Women	
	M1a	M1b	M2a	M2b	M3a	M3b
Low-skill job share	-0.309*	0.209*	-0.206	0.264*	-0.580***	0.076
	(-2.55)	(2.09)	(-1.55)	(2.15)	(-5.37)	(0.74)
GDP per head	-0.001**	-0.002**	-0.001**	-0.002***	-0.001**	-0.001
(000s of $ PPPs)	(-2.84)	(-3.10)	(-3.23)	(-3.50)	(-2.61)	(-1.70)
Granted asylums	0.036**	0.036**	0.044**	0.029*	0.046***	0.044***
	(3.09)	(3.12)	(3.10)	(2.10)	(4.58)	(3.32)
Fixed effects (countries, years)		Yes		Yes		Yes
N	194	194	194	194	194	194

*** p < .001 ** p < .010 * p < .050

Data: European Labour Force Surveys (EU-LFS) 2004-2016; panel-corrected z-values in parentheses. Included countries: Austria, Belgium, Denmark, Finland, France, Germany (omitted in regressions for non-European immigrants; see tables 3 and 5), Ireland (no data 2004), Italy (2004 omitted in regressions for non-European immigrants; see tables 3 and 5), the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. All models are estimated with country-specific auto-correlation parameters. All outcomes are weighted in order to eliminate compositional differences across country-years in educational attainment and age.

Table 12. Regression of native-immigrant employment gaps on the low-skill job share. Three vulnerable subgroups. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

	Recent immigrants		Non-European immigrants		Low-educated immigrants	
	M4a	M4b	M5a	M5b	M6a	M6b
Low-skill job share	-0.274*	0.340*	-0.471***	0.255	-0.371*	0.564**
	(-2.09)	(2.25)	(-4.85)	(1.82)	(-2.43)	(2.84)
GDP per head	-0.003***	-0.003***	-0.000	-0.001	-0.002*	-0.001
(000s of $ PPPs)	(-4.44)	(-3.63)	(-0.42)	(-0.84)	(-2.24)	(-0.67)
Granted asylums	0.056***	0.030	0.068***	0.046**	0.068**	0.052*
	(3.41)	(1.57)	(6.03)	(2.82)	(3.02)	(2.29)
Fixed effects (countries, years)		Yes		Yes		Yes
N	194	194	180	180	194	194

Notes: See table 11.

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Table 13. Regression of native-immigrant employment gaps on matched skill upgrading and over-education. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

	All immigrants		Men		Women	
	M7a	M7b	M8a	M8b	M9a	M9b
Matched skill upgrading	0.331***	0.219**	0.250**	0.298*	0.407***	0.176*
	(4.41)	(2.90)	(2.89)	(2.52)	(4.31)	(2.33)
Over-education	0.317***	0.447***	0.217	0.645***	0.160	0.190
	(3.69)	(4.76)	(1.91)	(5.26)	(1.46)	(1.82)
GDP per head (000s of $ PPPs)	-0.002***	-0.001**	-0.002***	-0.001*	-0.002***	-0.001
	(-4.27)	(-2.64)	(-4.07)	(-2.38)	(-4.13)	(-1.37)
Granted asylums	0.027*	0.029**	0.031*	0.017	0.039***	0.043***
	(2.41)	(2.65)	(1.96)	(1.25)	(3.30)	(3.29)
Fixed effects (countries, years)		Yes		Yes		Yes
N	194	194	194	194	194	194

Notes: See table 11.

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Table 14. Regression of native-immigrant employment gaps on matched skill upgrading and over-education. Three vulnerable subgroups. 15 countries in northwestern and southern Europe, 2004-2016; EU-LFS.

	Recent immigrants		Non-European immigrants		Low-educated immigrants	
	M10a	M10b	M11a	M11b	M12a	M12b
Matched skill upgrading	0.390***	0.301*	0.562***	0.310**	0.311**	0.317**
	(3.70)	(2.00)	(5.17)	(2.59)	(2.96)	(2.68)
Over-education	0.272*	0.514***	0.212*	0.615***	0.328*	0.697***
	(2.32)	(3.40)	(2.32)	(3.96)	(2.20)	(4.12)
GDP per head (000s of $ PPPs)	-0.004***	-0.002**	-0.002*	-0.000	-0.002**	-0.001
	(-7.22)	(-2.77)	(-2.04)	(-0.40)	(-2.90)	(-0.62)
Granted asylums	0.047**	0.021	0.058***	0.038*	0.057*	0.045*
	(2.58)	(1.13)	(4.32)	(2.38)	(2.53)	(1.98)
Fixed effects (countries, years)		Yes		Yes		Yes
N	194	194	180	180	194	194

Notes: See table 11.

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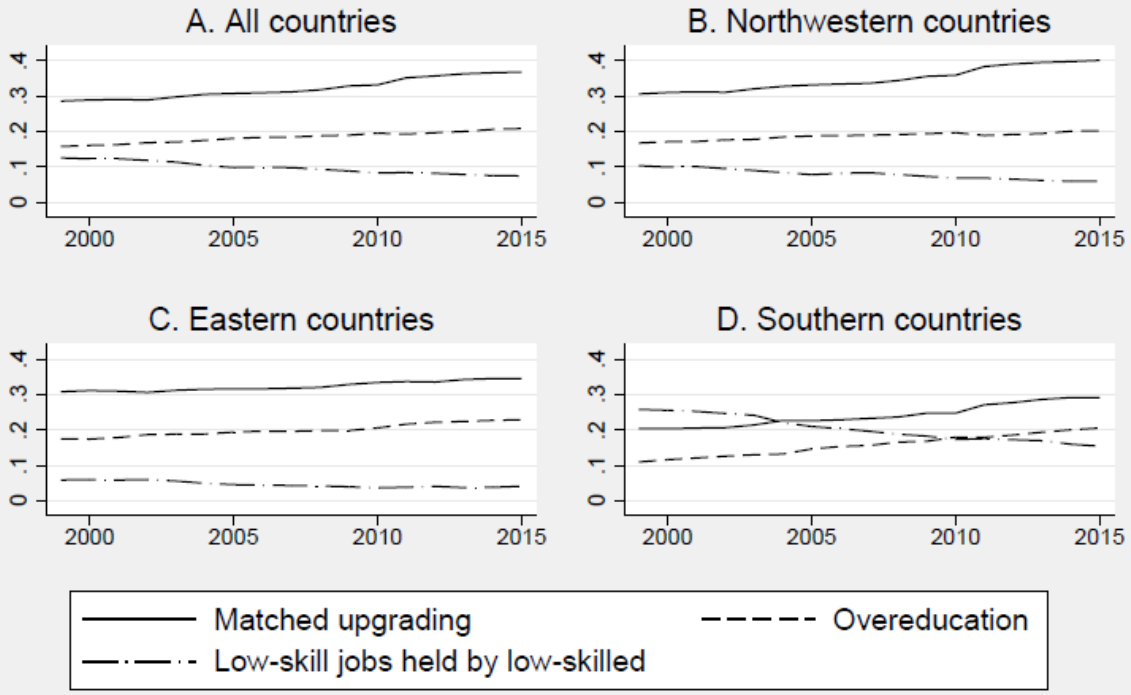
Figure 1.
Indicators of structural change. Averages for all countries and by region



Data: Eulfs 1999-2015

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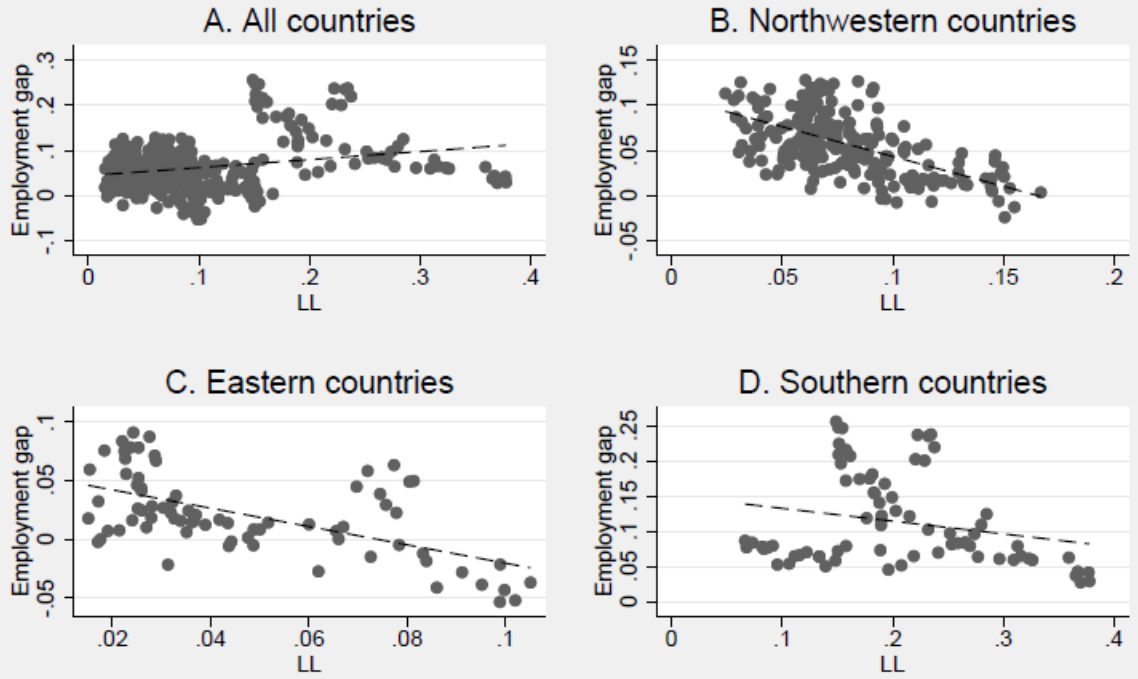
Figure 2.
Youth male employment gap over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 1998-2016

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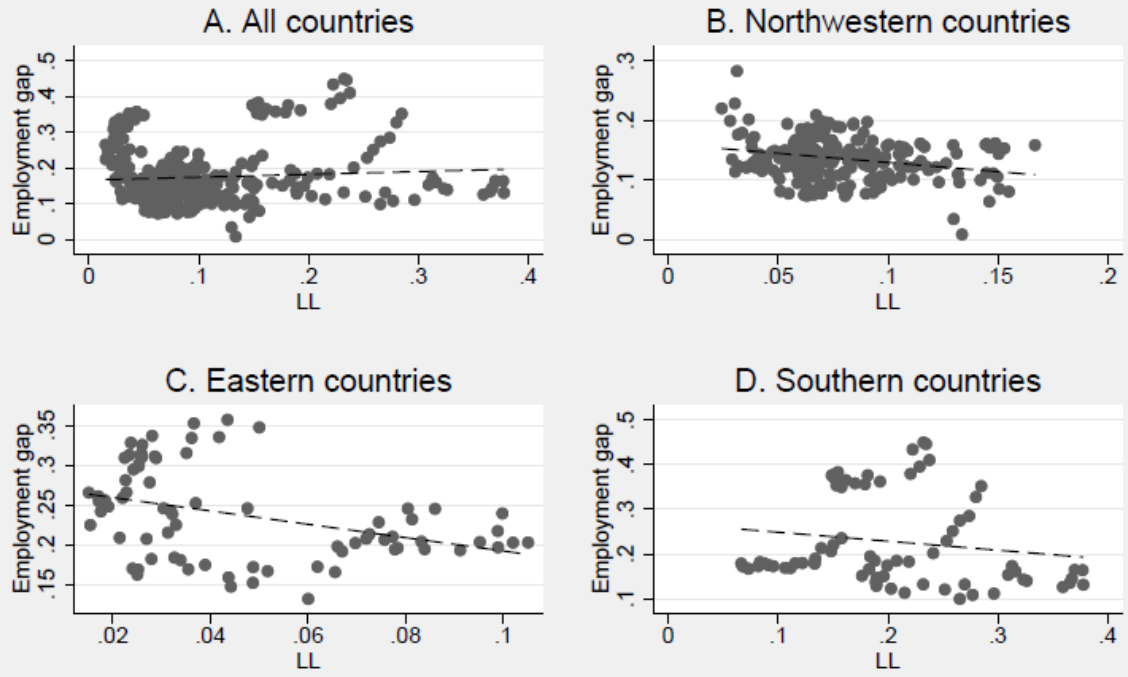
Figure 3.
Youth female employment gap over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 1998-2016

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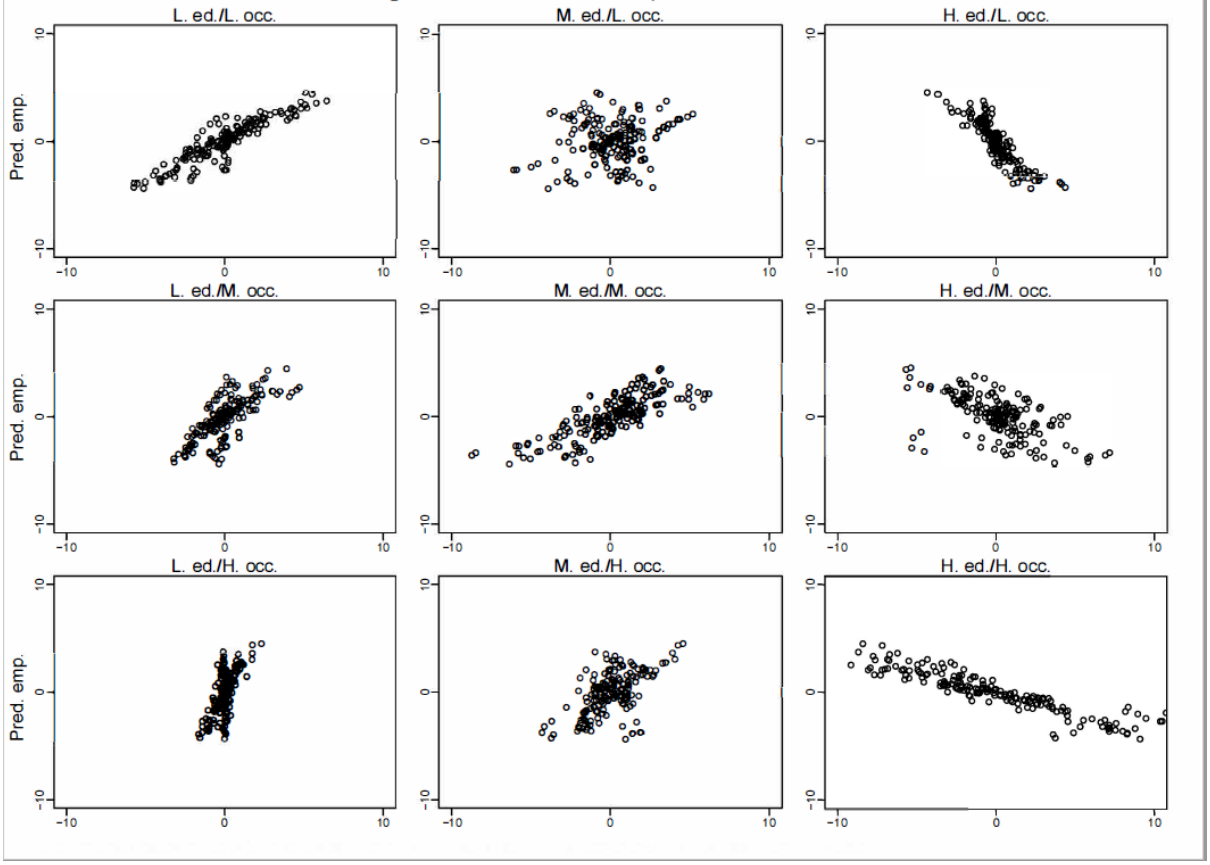
Figure 4. Predicted male youth employment and observed changes in education/occupation combinations



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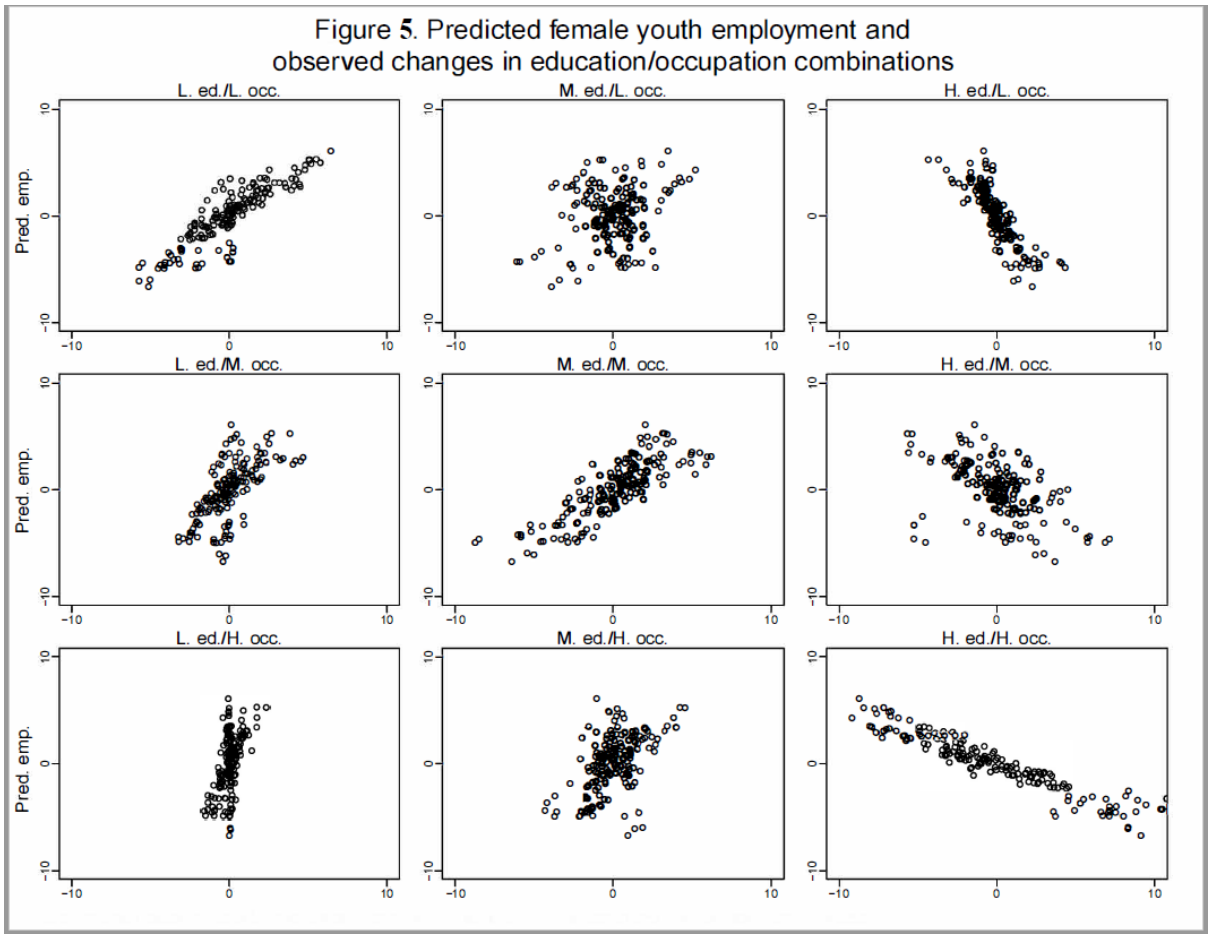

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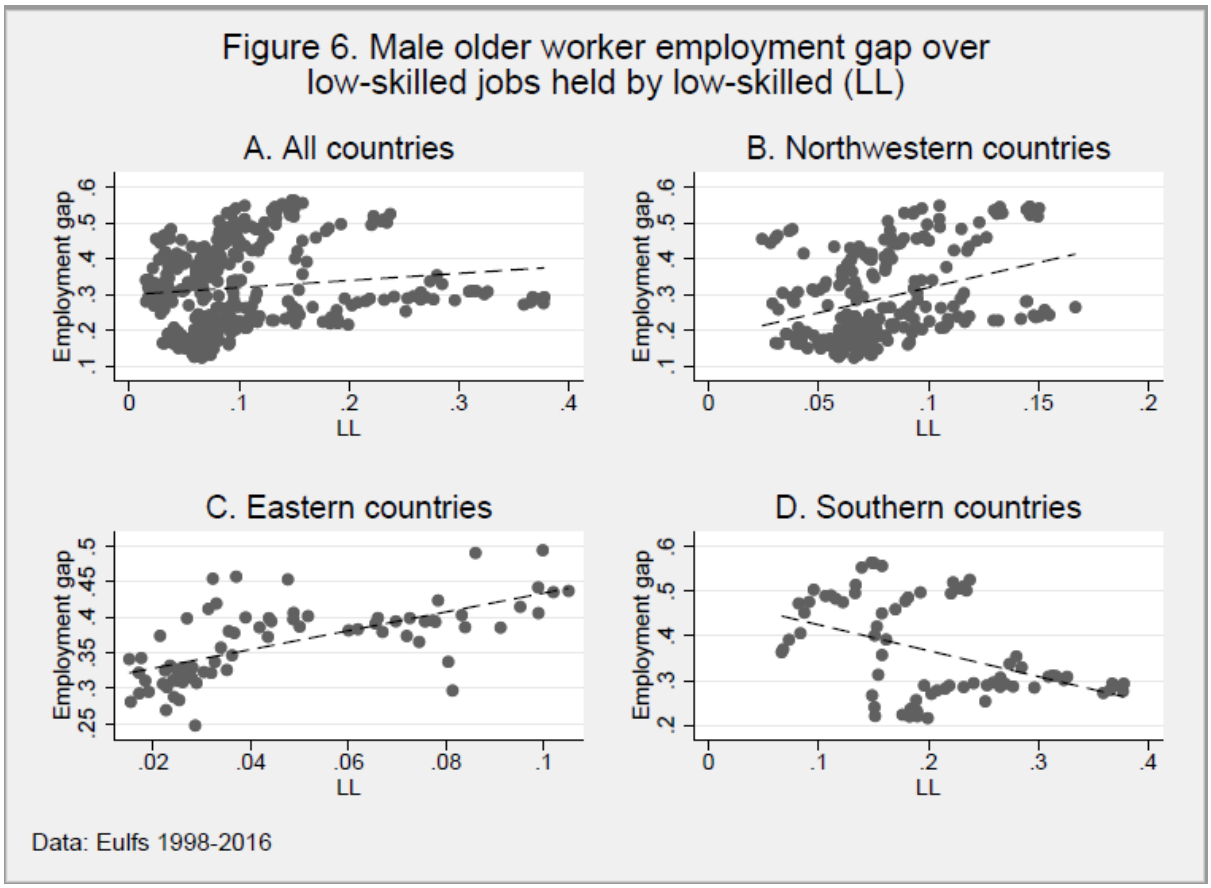

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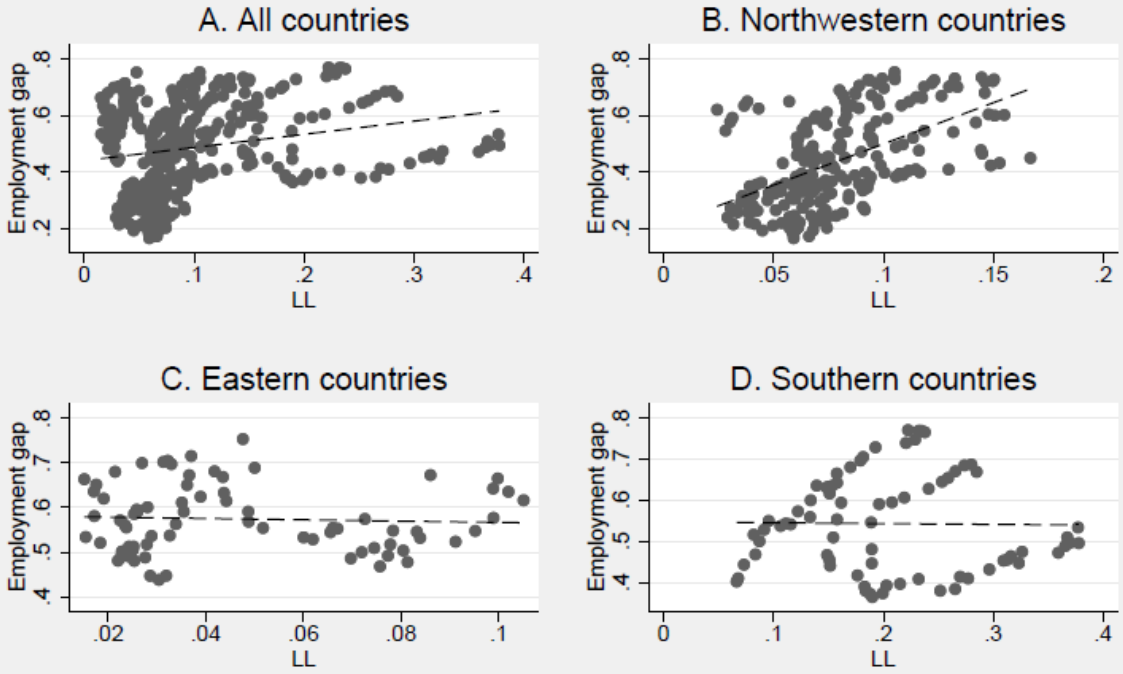
Figure 7. Female older worker employment gap over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 1998-2016

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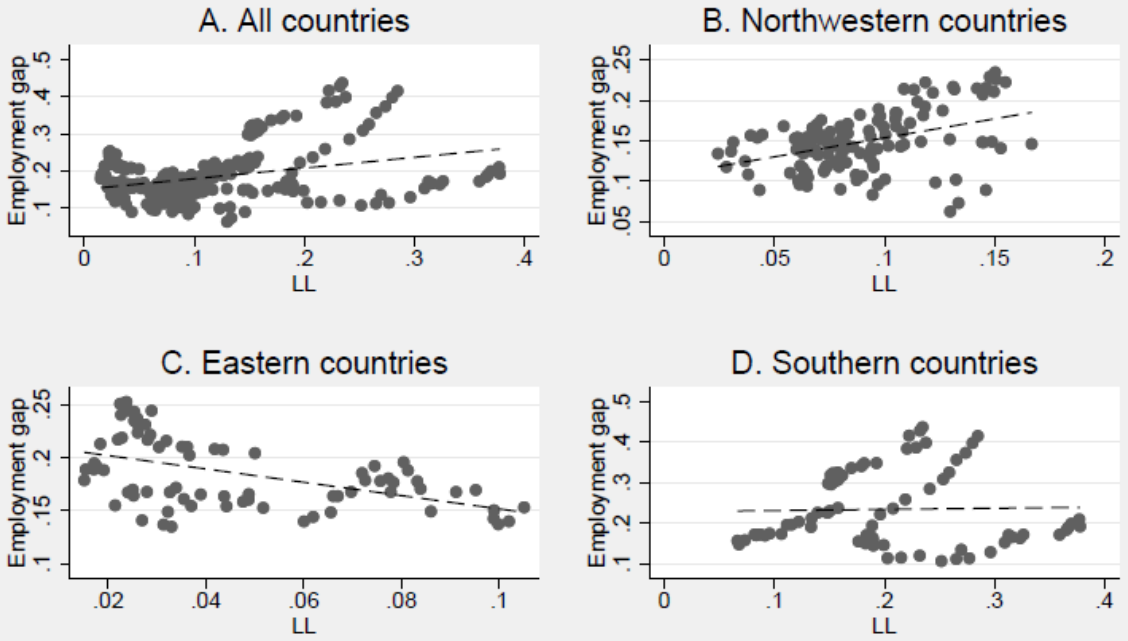
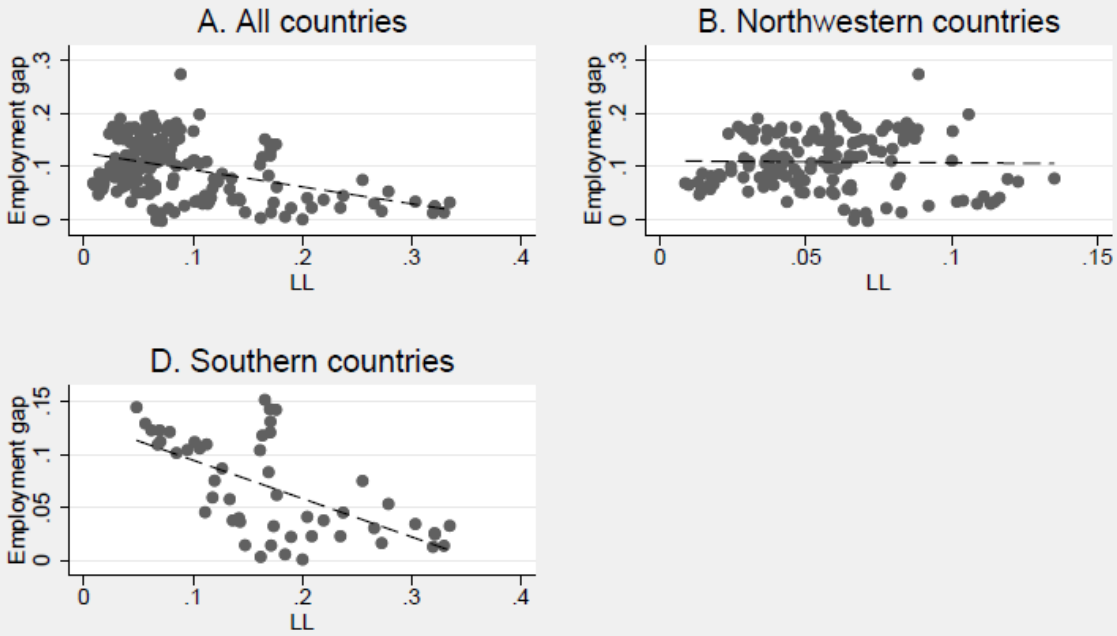
Figure 8.
Female parent employment gap
over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 1998-2016

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 822330

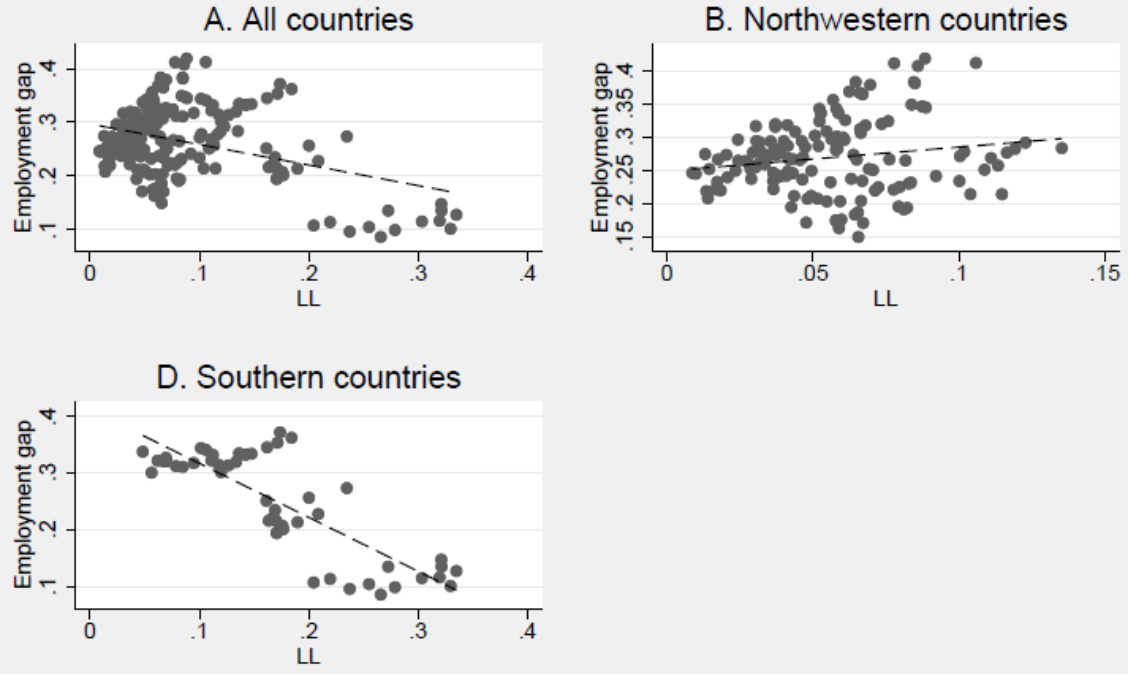
Figure 9.
Immigrant male employment gap
over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 2004-2016

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 822330

Figure 10. Immigrant female employment gap over low-skilled jobs held by low-skilled (LL)



Data: Eulfs 2004-2016

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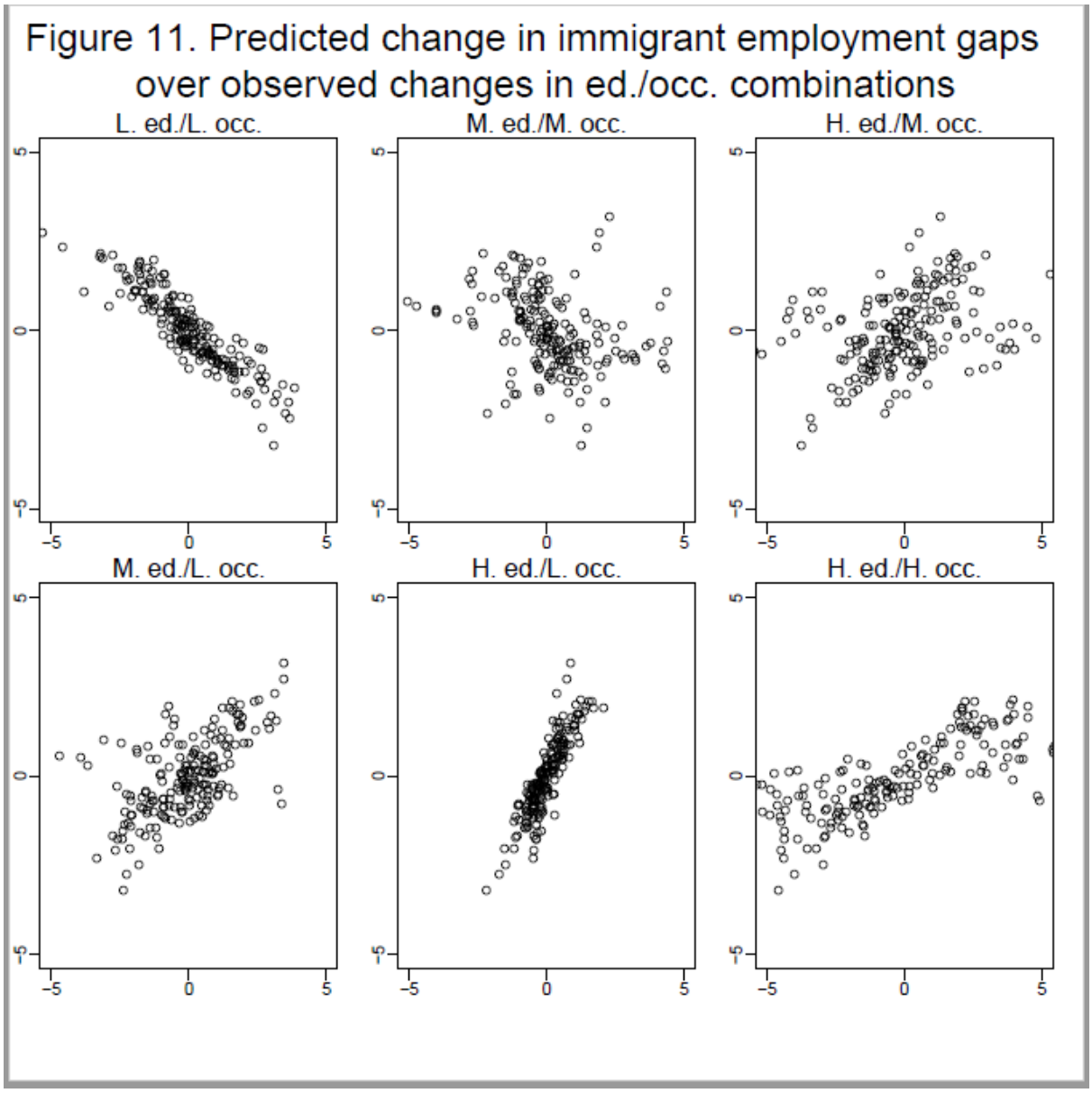

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