

**DIRECTORATE FOR EMPLOYMENT, LABOUR AND SOCIAL AFFAIRS
EMPLOYMENT, LABOUR AND SOCIAL AFFAIRS COMMITTEE**

What is happening to middle skill workers?

JEL Classification: J24, J21, J62, I26

**Authorised for publication by Stefano Scarpetta, Director, Directorate for Employment,
Labour and Social Affairs**

Andrew Green, andrew.green@oecd.org, 01 85 55 47 87

JT03448007

OECD Social, Employment and Migration Working Papers

www.oecd.org/els/workingpapers

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on which the OECD works. Comments on Working Papers are welcomed, and may be sent to els.contact@oecd.org.

This series is designed to make available to a wider readership selected labour market, social policy and migration studies prepared for use within the OECD. Authorship is usually collective, but principal writers are named. The papers are generally available only in their original language – English or French – with a summary in the other.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

© OECD 2019

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for commercial use and translation rights should be submitted to rights@oecd.org.

Acknowledgements

This working paper is part of a series of papers released around the launch of the 2019 Employment Outlook examining the future of work. This paper received support from the German Federal Ministry of Labour and Social Affairs. It has also benefited from the comments and suggestions of Stijn Broecke, Andrea Salvatori, Mark Keese and participants in an internal OECD ELS brownbag seminar. This study uses the weakly anonymous Sample of Integrated Labour Market Biographies (Years 1975 - 2014). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data access. All errors and omissions are my own.

Abstract

This report asks what is happening to middle-skill workers. Driven by mega trends such as automation, ageing and offshoring, the share of jobs whose wages placed them firmly in the middle of the wage distribution has been declining. Termed job polarisation, economists have observed the decline in the share of middle-skill jobs in the majority of OECD labour markets. One little explored question is where are these workers going? This report examines what workers are doing who in the past would have been employed in middle-skill jobs. The report first examines the traits of previous middle-skill workers to build a picture of the “typical” middle-skill worker. Using this profile, the report next examines what types of jobs a worker with the typical middle-skill profile is taking, and how likely such a worker is to be working. The study then analyses different metrics of job stability and compensation to put in perspective what shifts out of middle-skill work imply for labour market outcomes.

Résumé

Ce rapport demande ce qui arrive aux travailleurs moyennement qualifiés. Sous l'effet de méga tendances telles que l'automatisation, le vieillissement et la délocalisation, la part des emplois dont les salaires sont fermement au centre de la répartition des salaires a diminué. Appelé polarisation de l'emploi, les économistes ont observé le déclin de la part des emplois moyennement qualifiés dans la majorité des marchés du travail des pays de l'OCDE. Une question peu étudiée consiste à regarder où vont ces travailleurs. Ce rapport examine ce que font les travailleurs qui, par le passé, auraient occupés des emplois moyennement qualifiés. Le rapport examine d'abord les caractéristiques des travailleurs ayant une compétence moyenne dans le passé pour se faire une idée de ce qu'est le travailleur « typique » d'emplois moyennement qualifiés. À l'aide de ce profil, le rapport examine ensuite les types d'emplois occupés par un travailleur possédant le profil « moyennement qualifié » typique, ainsi que la probabilité qu'un tel travailleur soit employé. L'étude analyse enfin différents paramètres de stabilité d'emploi et de rémunération pour mettre en perspective ce que l'abandon du travail moyennement qualifié implique pour le marché du travail.

Key Findings

- The share of middle-skill jobs declined in OECD countries over the last two decades. These were jobs that paid wages in the middle of the wage distribution. Up until the crisis, the decline in middle-skill occupations was gradual and the result of natural attrition. The crisis accelerated the decline in the middle-skill employment share by directly shedding jobs in middle-skill occupations.
- Who were these workers affected by the decline in the share of middle-skill employment? Education was the characteristic most associated with a middle-skill worker. Specifically, middle-skill jobs were held by workers without a tertiary degree. The question of where middle-skill workers are going is analogously a question of employment prospects for workers without a tertiary degree.
- Workers without a tertiary degree are increasingly working in low-skill jobs. The rise in the propensity to work in low-skill employment for workers without a tertiary degree mirrors the decline in their propensity to work in middle-skill jobs across OECD countries. Changes in the propensity to be working are modest, and the propensity to work in high-skill jobs is essentially unchanged for workers without a tertiary degree.
- A low-skill job comes with a significant decline in job quality compared to middle- or high-skill employment. Low-skill employment has substantially less job stability as measured by job tenure. The use of fixed-term contracts is also more prevalent in low-skill jobs. Finally, workers in low-skill employment are much more likely to be part-time for economic reasons in addition to lower wages for the hours they do find.

The dynamics of declining middle-skill employment

- The share of middle-skill jobs declined in OECD countries over the last two decades. From the mid-1990s (1994-1996) to the present (2014-2016), the share of middle-skill occupations – truck drivers and machine operators for men, cashiers and secretaries for women – declined over 11 percentage points. This compares to growth in high-skill occupations (8.6 percentage points) and low-skill occupations (3.0 percentage points).
- Up until the crisis, the decline in middle-skill occupations was gradual. Employment in middle-skill occupations held steady with just as many new hires to replace workers who left middle-skilled occupations. The employment share of middle-skill occupations declined because employment growth was stronger in low- and high-skill occupations.
- The crisis accelerated the decline in the middle-skill employment share by shedding jobs in middle-skill occupations. While low- and high-skill occupations continued to add jobs during the crisis and immediate aftermath, middle-skill

employment declined due to a spike in separations. Younger workers bore the brunt of this adjustment, but workers of all ages experienced increased separations.

Who were middle-skill workers?

- Twenty years ago, education was the characteristic most associated with a middle-skill worker. Across OECD countries, slightly more than 90% of middle-skill workers lacked a tertiary degree with the share increasing to over 95% in ten of the countries.
- Middle-skill jobs were also dominated by men. Among middle-skill workers without a tertiary degree, a little less than two thirds were men on average across the OECD. Men without an upper-secondary degree comprised a higher share of middle-skill workers than women with an upper-secondary degree.
- Middle-skill workers were most likely to be working in manufacturing. For both men and women in middle-skill work, manufacturing represented the modal industry, employing 37.7% of men, and 35.3% of women in middle-skill occupations.
- Middle-skill women were most likely to be employed as secretaries, cashiers and book keepers or auditing clerks. For men, the most likely occupations were drivers, building finishers, and machinery mechanics and repairers.

Where are middle-skill workers going?

With the profile of the “typical” middle-skill worker set, the question turns to where these workers are increasingly employed. One complicating factor is the changing composition of the population over the past 20 years. Specifically, the working-age population has become more highly educated.

- The analysis confirms that changes in population composition are a contributing, if secondary factor to the declining share of middle-skill employment. The decline in the share of middle-skill employment can be decomposed into the part due to composition changes, 2.0 percentage points, and a decreased propensity to work in middle-skill jobs within groups, 4.6 percentage points.
- Middle-educated men have seen their propensity to work in middle-skill jobs drop the least. The share of middle-educated men working in middle-skill occupations declined by 2.9 percentage points over the past 20 years. Low-educated men experienced a much steeper decline of 7.8 percentage points. The share of middle-educated women in middle-skill jobs dropped 6.0 percentage points and the share of low-educated women fell 5.5 percentage points.
- The propensity of women without a tertiary degree to work in low-skill occupations increased dramatically. Middle-educated women’s propensity to work in low-skill occupations increased from 18.1% to 28.0% from the mid-1990s to the mid-2010s. Part of this increase was driven by an increase in women’s labour force participation. Middle-educated women’s employment as a share of the population increased 4 percentage points over this time period.

- For low-educated women, the increased propensity to work in low-skill jobs was more modest, growing from 17.2% to 22.4%. This was not a result of increased labour force participation. Low-educated women's propensity to be employed did not change over this time period.
- Men without a tertiary degree saw a more muted, but still substantial, propensity to work in low-skill occupations compared to women. Low-educated men's propensity to work in low-skill occupations increased from 12.0% to 14.8%. For middle-educated men, the increase was larger, rising from 11.3% to 15.4%.
- The propensity to work in high-skill occupations remained unchanged for all groups without a tertiary degree. The propensity declined by less than a percentage point for middle-educated men, and was essentially unchanged, on average, for middle-educated women. For low-educated men, the change was a decline of 0.25 percentage points – essentially zero. Low-educated women saw a decline of 0.7 percentage points. Workers with low-education were never particularly likely to work in high-skill occupations.
- Across the demographic groups most associated with middle-skill occupations, only low-educated men experienced a large increase in non-employment. Among low-educated men, the rate of non-employment increased from 47.1% to 53.3%.

What does it mean to be employed in a low-skill job compared to a middle-skill job?

The typical middle-skill worker is more likely today to be working in low-skill occupations. The question turns to what this implies for labour market outcomes in terms of job quality.

- Measures of job stability vary greatly between occupation-skill groups. A downwards shift from a middle- to low-occupation job represents a drop of 2.4 years of tenure or about a 32% decline. Shifting from a high- to a middle-occupation job represents a drop of only one year or about 10%.
- Low-skill occupations have the highest incidence of fixed-duration contracts. In the mid-2010s, 19.6% of workers in low-skill occupations were employed on a fixed-duration contract compared to 13.0% for middle-skill occupations, and 9.5% for high-skill occupations. However, across all skill groups the rate of use of fixed duration contracts increased by just under 25% for high-skill workers and over 30% for low- and middle-skill workers over the past twenty years.
- Part-time work is most prevalent in low-skill occupations. For low-skill workers the share working part-time stands at 33.3 %. The share of middle-skill workers working part-time is 12.3 %. For high-skill occupations, the part-time share is 13.7 %.
- More worryingly, workers who are part-time because they cannot find full-time work are mostly found in low-skill occupations. 11.8% of workers in low-skill occupations report being part-time for economic reasons compared to 3.7% and 3.3% for workers in middle- and high-skill occupations. For workers increasingly shifting towards low-skill occupations, full-time hours are not assured.
- On average, the difference between occupation-skill categories represents a large change in the average wage. Low-occupation wages average 82.9% of middle-occupation wages in the mid-2010s. High-occupation wages are 44.3%

greater than middle-occupation wages. These differences remained stable over the previous ten years on average across OECD countries.

Table of contents

OECD Social, Employment and Migration Working Papers.....	2
Acknowledgements	3
Abstract	4
Résumé	5
Key Findings	6
The dynamics of declining middle-skill employment.....	6
Who were middle-skill workers?	7
Where are middle-skill workers going?	7
What does it mean to be employed in a low-skill job compared to a middle-skill job?	8
1. Introduction	12
2. How are middle-skill jobs changing?.....	14
2.1. The share of middle-skill jobs declined	14
2.2. What drives the fall in the share of middle-skill jobs?	16
3. Who were middle-skill workers?	20
3.1. Middle-skill workers are predominantly workers without a tertiary degree.....	21
3.2. Both male and female middle-skill workers were most likely to work in manufacturing	22
4. Where are middle-skill workers going?.....	26
4.1. The decline in middle-skill employment is not due to changing demographics.....	26
4.2. Workers without a tertiary degree are more likely to be employed in low-skill occupations.....	28
4.3. Differential labour market entry of younger workers is important	37
4.4. What policies may be promoting higher propensities to work in high-skill occupations?	39
5. How has job quality changed across occupation-skill groups?	44
5.1. Work is more precarious in low-skill occupations.....	44
5.2. Wages and hours have not converged for low- and middle-skill occupations.....	47
6. Conclusion.....	52
References.....	54
Annex A. Data Sources	57
Annex B. Additional Figures	58

Tables

Table 2.1. Middle-skill employment held steady until the crisis.....	17
--	----

Table 2.2. Middle-skill employment adjustment led by younger workers	19
Table 3.1. Middle-skill occupations varied greatly by gender	25

Figures

Figure 2.1. Employment shares of middle-skill work declined sharply	15
Figure 3.1. Middle-skill workers were workers without a tertiary degree	22
Figure 3.2. Male and Female middle-skill workers were concentrated in manufacturing	24
Figure 4.1. Shrinking share of middle-skill employment due to diminished propensity to work more than changing composition.....	28
Figure 4.2. The propensity to work in middle-skill occupations fell for all workers without a tertiary degree.....	29
Figure 4.3. Women without a tertiary degree more likely to work in low-skill occupations	31
Figure 4.4. Men without a tertiary degree are also increasingly in low-skill occupations	32
Figure 4.5. Middle-education men are slightly less likely to work in high-skill occupations.....	33
Figure 4.6. Men without an upper-secondary degree are now less likely to be working	36
Figure 4.7. Propensities to work in different skill groups driven by younger cohorts	39
Figure 4.8. Vocational training leads to higher employment, but not in high-skill jobs	42
Figure 5.1. Tenure decreases by occupation-wage group	45
Figure 5.2. Low-skill workers much more likely to work on fixed contracts	47
Figure 5.3. Wage drop from middle- to low-skill occupations varies	48
Figure 5.4. Low-skill work contains a disproportionate share of part-time workers who want more hours	51

Boxes

Box 2.1. Defining skill	15
Box 4.1. Using administrative data from Germany to directly follow middle-skill workers	34
Box 5.1. The wages of middle-skill separations.....	49

1. Introduction

1. Since at least the 1970s, employment in OECD economies shifted from manufacturing to service industries. At its peak, manufacturing employed millions at wages solidly in the middle of the pay distribution which helped support a strong middle-class across industrialised nations. In addition, the share of employment in middle-skill occupations within industries steadily declined. While these jobs declined, employment grew in high-skill occupations such as human resource administrators and information technology support. Low-skill service jobs exemplified by janitors, home health aides and retail sales associates flourished as well. Employment moved from assembling cars on the shop floor to stocking shelves on the sales floor.

2. Economists and policy makers termed this trend job polarisation. Defined by the average wage in an occupation a few decades earlier, job polarisation is the finding that employment shares of lower and higher-skill occupations have increased, while shares of employment in middle-skill occupations declined (Autor, Levy and Murnane, 2003^[1]; Goos and Manning, 2007^[2]; Goos, Manning and Salomons, 2009^[3]). Subsequent research identified automation as the main cause of the polarising occupational structure (OECD, 2017^[4]; Autor and Dorn, 2013^[5])¹. Increasing penetration of information technology, artificial intelligence and robotics have diminished jobs consisting of routine tasks. These routine jobs were traditionally situated in the middle of the skill distribution.

3. Although the decline of middle-skill employment intimates distress for workers who held those jobs, this need not be the case. If job polarisation is in fact due to increased automation, job polarisation should go hand in hand with increased productivity growth. When OECD countries experienced increased productivity growth in the recent past, they have also generally enjoyed higher employment and rising wages (Autor and Salomons, 2018^[6]). Moreover, the theory of job polarisation and the history of job destruction is ambiguous with respect to overall employment and wages in the long run (Autor, 2015^[7]; Autor, 2015^[8]; Acemoglu and Restrepo, 2018^[9]). The important question is then how are middle-skill workers who need to transition to new jobs affected by job polarisation?

4. This analysis is concerned with where middle-skill workers are going in the face of a shrinking share of middle-skill jobs. Are they reskilling or otherwise quickly transitioning to high-skill occupations? Alternatively, are they finding work in low-skill occupations or exiting employment entirely? Finally, for workers remaining in middle-skill jobs or transitioning, how do skill and job stability vary by occupation type?

¹ The causes of job polarisation are not uniformly agreed upon. Researchers noted that the U-shaped pattern underpinning job polarisation does not hold across time periods. In addition, changes in occupation shares do not explain skill patterns as the theory intended (Schmitt, Shierholz and Mishel, 2013^[27]). This report notes the existing research and makes no original claims about why the shares of middle-skill occupations are declining.

5. This report is a first comparison of the experience of middle-skill workers across OECD countries. Previous studies examined individual countries. By looking across countries, this study moves the discussion towards which countries are faring better than others, and hints at what types of labour market policies allow for better outcomes for affected workers.

6. The analysis begins by briefly documenting the near universal trend of job polarisation, and disentangling the dynamics of the shifting share of jobs across occupation groups (Section 2.). In Section 3. the report turns to building the profile of the “typical” middle-skill worker of the past. The report identifies the characteristics associated with middle-skill work two decades prior.

7. Section 4. uses the profile of middle-skill workers to show where they are going. Specifically, the analysis shows in what types of occupations workers of different demographic groups are working compared to two decades prior. The analysis also shows whether and to what extent middle-skill workers are exiting employment, as well as how this transition is taking place. The analysis in this section is most similar to Cortes, Jaimovich and Siu (2017^[10]) who perform a similar analysis for the United States. Researchers have performed similar analyses for Germany (Bachmann, Cim and Green, 2018^[11]), Finland (Maczulskij and Kauhanen, 2017^[12]), and the United Kingdom (Salvatori, 2015^[13]).

8. The final section examines the differential compensation and job stability workers can expect at different skill-occupation levels. The difference in compensation and job stability and what that portends for changes in workers’ welfare for those affected by job polarisation is the focus of Section 5. The analysis also quantifies how wages, tenure and hours have changed for workers remaining in middle-skill occupations. Section 6. offers some concluding remarks.

2. How are middle-skill jobs changing?

9. Before focusing on where middle-skill workers are going, this section provides descriptive evidence on how the quantity of middle skill jobs has changed over the preceding decade. The analysis in this section confirms that the share of employment in middle-skill jobs (defined by occupation groups) declined across OECD countries over the previous decade. A shrinking share of middle-skill jobs can be explained by either an increase or decrease in the absolute number of middle-skill jobs. In the former case, middle-skill jobs can simply grow more slowly compared to low- or high-skill jobs which decreases the share of middle-skill jobs while the absolute number grows or remains steady. The analysis in this section shows that the absolute number of middle-skill jobs held steady for most of the last twenty years. The crisis represented a sharp exception where the quantity of middle-skill jobs declined, in contrast to low- and high-skill employment.

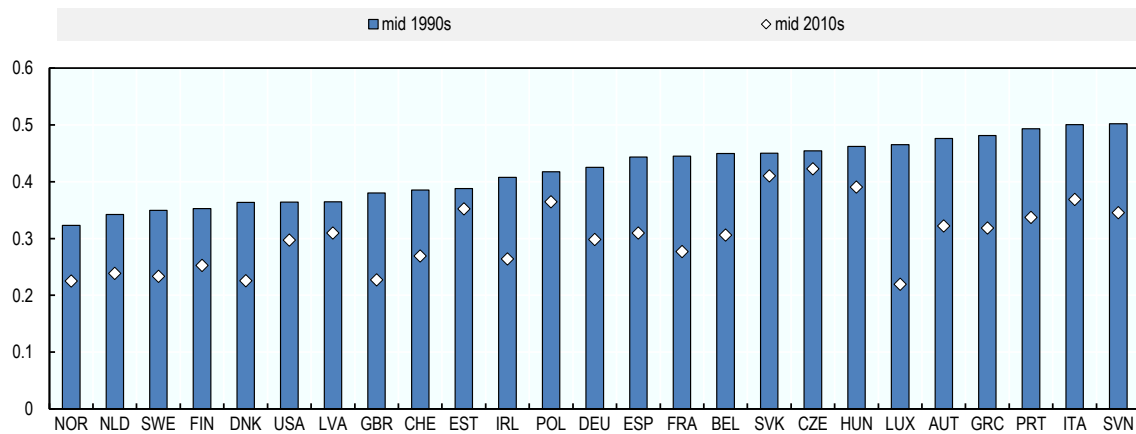
2.1. The share of middle-skill jobs declined

10. Confirming earlier analyses, the share of employment in middle-skill occupations in OECD countries declined from the mid-1990s (1994-1996) to the mid-2010s (2014-2016). Figure 2.1 depicts the share of employment in middle-skill jobs at both time periods for a broad swath of OECD countries. Across countries, the share of middle-skill employment declined by over 11 percentage points. This compares to increasing shares of high-skill employment (8.6 percentage points) and low-skill employment (3.0 percentage points).

11. The fall in the share of middle-skill jobs across countries precipitated an increase in high- and low-skill employment shares. Two decades earlier, middle-skill employment comprised slightly less than 41.9% of employment in OECD countries compared to 34.5% and 23.6% for high- and low-skill employment, respectively. In twenty years the share of middle-skill employment fell to be closer to low-skill employment than high-skill, with the shares averaging 30.3%, 43.1% and 26.6% for middle-, high- and low-skill employment respectively. For countries such as Poland, Portugal, Spain, and Italy, middle-skill employment lost its status as a plurality of employment (compared to high- and low-skill employment) by the mid-2010s.

Figure 2.1. Employment shares of middle-skill work declined sharply

Employment in middle-skill occupations as a share of total employment, mid-1990s and mid-2010s



Notes: Mid 1990s are 1994, 1995, and 1996. Mid-2010s are 2014, 2015, and 2016. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and Czech Republic), 2002 (Poland).

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

Box 2.1. Defining skill

Mapping an academic classification to labour market outcomes

The term middle-skill seems simple, but it typically means different things depending on who one asks. The original research from Autor, Levy and Murnane (2003^[1]) who documented the declining share of middle-skill jobs defined "skill" by the average wage of an occupation in 1980 for the United States. A worker whose occupation had an average wage in the middle of the occupation-skill distribution would be classified as middle-skilled regardless of their formal education, training, or labour market experience. Further research on job polarisation has adhered to the convention of using rank of the average wage in an occupation synonymously with skill.

There are problems with using the average wage of an occupation as a proxy for skill. First and foremost is semantic: most people define skill as a learned capacity – education or on the job training, or some combination – through which one can improve their productivity and/or labour market outcomes. The wage is a labour market outcome. Defining skill by the wage causes confusion by equating skill with an outcome, where most people define it colloquially as an input.

At its simplest, this report is concerned with how educational achievement maps into wage-based rankings of occupational outcomes, and how this relationship has changed. When referring to measures of education the following terms will be employed:

- High-education. This refers to a person who has at least a tertiary degree corresponding to ISCED level 5 and above.
- Middle-education. For persons with at least an upper-secondary degree corresponding to ISCED levels 3-4.
- Low-education. This refers to all persons without an upper-secondary degree. ISCED level 2 and below.

This report will use “skill” or “occupation” as short-hand for an occupation-based ranking of jobs. The occupation groups follow the classification defined in Goos, Manning and Salomons, (2014^[14]), who define ISCO occupations by their average wage. The authors use EU-SILC data, which has wage information, to define the occupations by their average wage at the same occupation level available in the EU-LFS. This report uses the same EU-LFS data, and therefore employs the same classification:

- High-skill, or high-occupation. ISCO one-digit occupations 1-3.
- Middle-skill, or middle-occupation. ISCO one-digit occupations 4, 7, 8.
- Low-skill, low-occupation. ISCO one-digit occupations 5, 9.

The report uses a similar occupation-based grouping for the United States. U.S. Census occupation codes are harmonised across years using Dorn, (2009^[15]). The U.S. classification scheme shares many characteristics with classifications which group occupations based on tasks or wages (Smith, 2013^[16]).

2.2. What drives the fall in the share of middle-skill jobs?

12. To answer where middle-skill workers are going, it is important to understand how the share middle-skill jobs declined. The share of middle-skill employment can decline for several reasons, which may not be constant across time periods. First, the rate of separations out of middle-skill employment can increase. If the rate of hiring does not increase as well, this will lead to a decline in the share and quantity of middle-skill employment. Similarly, if the hiring rate decreases and the separation rate does not fall with it, the share of employment in middle-skill occupations will also decrease. In either scenario, the quantity of jobs would decrease along with the share, and there would be an increase in the number of formally middle-skill workers experiencing job loss and likely a period of non-employment.²

13. Alternatively, the hiring and separation rate could remain stable, but growth in low- and high-skill employment would exceed it. In this case middle-skill employment shares shrink due to slower employment growth compared to other skill groups. Where middle-skill workers are going in this scenario is more subtle. With slower employment growth, workers who in the past would likely have been employed in middle-skill jobs

² To be more precise, an increase in the separation rate, all things equal, would lead to an increase in workers formerly employed in middle-skill occupations either moving to non-employment *or* to another job either in middle-skill employment or in another skill level. In practice, an increase in the separation rate will likely lead to both.

gradually find jobs in occupation groups where work is more plentiful. In addition, younger workers entering the labour market will be more likely to enter low- and high-skill occupations.

14. The distinction between gradual adjustment through differential growth, and brute adjustment through shrinking employment is a central question addressed in this report. In a gradual adjustment scenario, workers slowly transition into other occupations groups. This is primarily driven by new cohorts of workers entering the labour force by starting in low- and high-skill occupations at higher rates than previous cohorts. In the case of adjustment via separation, workers reallocate to other skill groups due to increased separations in middle-skill employment. The two different paths both lead to a diminished middle-skill employment share, but they point to different policy responses. In OECD labour markets over the past 20 years, adjustment took place gradually until the crisis. Separation rates then spiked for middle-skill workers during the crisis before mostly returning to pre-crisis levels.

2.2.1. *The crisis led to increased separations of middle-skill workers*

15. Middle-skill employment held mostly steady until the crisis, however employment growth was more robust in low- and high-skill employment. Table 2.1 shows average rates of hires and separations across OECD countries for four time periods.³ The time periods roughly align to the 1990s, 2000s pre-crisis, the crisis and immediate aftermath, and post-crisis. On average across countries before the crisis, middle-skill hiring and separation rates were about equal, while hiring rates greatly exceeded separation rates for low- and high-skill occupations. This implies that employment in absolute numbers was growing in low- and high-skill occupations before the crisis, while remaining more or less constant for middle-skill employment. The higher employment growth rate in low- and high-skill employment led to a decreasing share of middle-skill employment before the crisis.

Table 2.1. Middle-skill employment held steady until the crisis

Hiring and separation rates by skill grouping in four time periods.

	Low skill		Middle skill		High skill	
	Hires (%)	Separations (%)	Hires (%)	Separations (%)	Hires (%)	Separations (%)
1994-2000	0.236	0.215	0.164	0.159	0.138	0.108
2001-2007	0.228	0.207	0.158	0.158	0.124	0.106
2008-2012	0.215	0.204	0.144	0.182	0.114	0.104
2013-2016	0.219	0.210	0.151	0.152	0.117	0.101

Note: For the derivation of hiring and separation rates, see endnote 3. Crisis time period is 2008-2012.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany.

³ Employment flows for each group i , are derived following OECD (2009_[28]): $\Delta Emp_i = Hires_i - Sep_i$, Where ΔEmp_i is the net employment change in group i between years t and $t - 1$. $Hires_i$ is the gross hires for group i at time t , which is determined by the number of workers with tenure less than one year. Sep_i is the number of gross separations and is pinned down by the identity. In practice gross hires and separations are presented as a rate by dividing by average employment in years t and $t - 1$.

16. During the crisis, middle-skill employment declined, while high and low-skilled occupations continued to add jobs. For all occupation groups across countries, hiring rates have gradually declined over the past twenty years.⁴ For low- and high-skill occupations, separation rates remained remarkably consistent, and below hiring rates. The crisis resulted in a sharp increase in the separation rate for middle-skill workers. In the years during the recovery, separation rates for all groups returned to their pre-crisis levels. For the dynamics of employment adjustment across occupation groups, the crisis accelerated the declining share of middle-skill employment by actually destroying jobs, rather than simply growing more slowly than other occupation groups as happened in the 15 years preceding the crisis.

17. Employment adjustment across skill groupings is a tale of two time periods. Before 2007, OECD labour markets experienced a declining share of middle-skill jobs caused by higher rates of growth in low- and high-skill occupations. The quantity of middle-skill employment remained mostly constant. During the crisis, low- and high-skill employment continued to grow, but at slower rates than pre-crisis. The quantity and share of middle-skill employment declined, precipitated by a spike in separation rates. During the recovery, separation and hiring rates largely returned to their pre-crisis averages. Back of the envelope calculations suggest that the crisis deepened the decline in middle-skill employment share by approximately 7% on average.⁵

2.2.2. Younger workers were disproportionately affected by the spike in separation rates for middle-skill workers

18. In addition to how employment is adjusting across skill groupings, the question of who is responsible for the adjustment is just as important. Younger workers are still climbing job ladders and finding their way in the labour market (Haltiwanger, Hyatt and McEntarfer, 2017^[17]). The decline in middle-skill work could mostly be borne by younger workers differentially entering different skill groupings. Alternatively, the large employment declines experienced by middle-skill workers during the crisis could mostly be the product of prime age and older workers already established in middle-skill careers. This could portend long lasting scarring and difficulty finding suitable replacement work. By examining labour market flows by age, this report illuminates who is moving out of middle-skill work.

⁴ This is a longer term trend, which is well documented in the United States (Hyatt and Spletzer, 2013^[29]), with varying trends in other OECD countries (Flaco, Green and MacDonald, 2019^[31]).

⁵ The counterfactual decline in middle-skill employment was performed by applying the average annual rates of hires and separations across OECD countries that prevailed from 1994-2007 to the crisis period of 2008-2012 for each age group. The actual rates of hires and separations were then used for 2013-2016 and employment shares of each group were recalculated for 2014-2016.

Table 2.2. Middle-skill employment adjustment led by younger workers

Hiring and separation rates for middle-skill workers by age in four time periods.

	Younger Workers		Older Workers	
	Hires (%)	Separations (%)	Hires (%)	Separations (%)
1994-2000	0.315	0.323	0.102	0.097
2001-2007	0.315	0.322	0.104	0.105
2008-2012	0.291	0.362	0.098	0.126
2013-2016	0.319	0.328	0.104	0.104

Note: For the derivation of hiring and separation rates, see endnote 3. Younger workers are those age 16-29, older workers are aged 30-64.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany.

19. The adjustment out of middle-skill work was mostly born by the young. Table 2.2 presents the same hiring and separation rates as Table 2.1 but limited to middle-skill workers and further divided into workers who are less than 30 years old and those that are 30 years old and older. The rate of hires and separations is much higher for workers younger than 30 than those that are older. This is expected as younger workers have more volatile employment histories due to increased job hopping, and generally trying to find their way in the labour market. Younger workers experienced declining employment (separation rate exceeding the hiring rate) in all time periods analysed in the sample. For older workers, with the exception of the crisis, employment remained basically flat. Outside of the crisis period, employment declines in middle-skill occupations were concentrated among younger workers.

20. The crisis led to decreased middle-skill employment in all age groups including prime age and older workers. The impact was much stronger for younger workers. During the crisis hires declined and separations increased for both older and younger middle-skill workers. The magnitudes differed greatly with younger workers experiencing a net employment loss of 0.7% annually compared to 0.3% for older workers. In sum, both older and younger middle-skill workers experienced serious employment declines during the crisis, but younger workers incurred a disproportionate burden.

21. The results in this section comport well with the previous literature, which finds that polarization is a result of differential hiring rates, as well as layoffs. Earlier research from the United States found that the decline in middle-skill employment was concentrated during the past two recessions (Jaimovich and Siu, 2014_[18]). The work in this report suggests that the crisis acted as an accelerant for job polarisation on average across OECD countries as well. The results further generalize the finding – again, previously found in the United States – that job polarisation is the result of higher flows into low- and high-skill occupations, and lower flows into middle-skill occupations, with the pattern most pronounced among the young (Smith, 2013_[16]).

3. Who were middle-skill workers?

22. At first glance it would appear easy to describe where middle-skill workers are going. Using panel data that allows for tracking workers over time, one can observe transitions from middle-skill occupations and determine into what types of jobs these workers transition. Transitions into, and time out of employment would also be readily observable. Data of this type are either contained in surveys with limited sample sizes, or administrative data with restricted access. While excellent for studies of individual countries, using data of this type limits the breath of cross-country comparisons.

23. However, looking at only the transitions of current middle-skill workers misses the labour market decisions of new cohorts entering the labour market. As the previous section showed, this is just as important for the shifting shares of skill groups.⁶ As the share of middle-skill occupations declines, the probability of any given worker finding a middle-skill job also declines and the probability she finds a job in either high- or low-skill occupations increases. To account for the full picture of where middle-skill workers are going, one must consider what workers are doing today who in the past *would have been* a middle-skill worker when jobs in middle-skill work were more plentiful.

24. To remedy this non-observable difference in cohorts, it is essential to define the profile of the “typical” middle-skill worker. Using variables which best identify a middle-skill worker in the period when job polarisation began, this report sketches the profile of a middle-skill worker from twenty years prior. The next section will examine workers with this profile to compare how their labour market outcomes compare to workers with the same profile twenty years prior. This approach helps remedy the problem of non-observability of counterfactual outcomes for cohorts who enter the labour market in times of more or fewer middle-skill jobs.

25. The rest of this section is concerned with identifying the characteristics that best describe a middle-skill worker from times past. The following analysis paints a picture of a typical middle-skill worker which remains relatively constant over time and does not change with shifts in the labour market. Section 4. then describes the changing labour market prospects for a worker with this profile, and provides descriptive evidence for where workers are going.

⁶ To be clear, such an analysis is equally feasible with panel or administrative data.

3.1. Middle-skill workers are predominantly workers without a tertiary degree

26. To determine where middle-skill workers are going, it is necessary to find a set of characteristics that best predict work in middle-skill occupations. These characteristics should ideally be independent of labour market conditions and outcomes.⁷

3.1.1. Education was the strongest indicator of middle-skill work

27. Education was the single best predictor of being a middle-skill worker twenty years prior. Figure 3.1 shows the share of middle-skill workers divided into four categories: men and women separately who have at least an upper secondary degree but no tertiary degree, and men and women with less than an upper secondary degree. The shares are an average for each country of the years 1994-1996 (years vary depending on availability, see figure notes). Across OECD countries, slightly more than 90% of middle-skill workers lacked a tertiary degree with the share increasing to over 95% in ten of the countries. The Czech Republic and Austria have the highest share lacking a tertiary degree while Estonia and Belgium have the lowest shares with 83.0 and 86.8%, respectively.

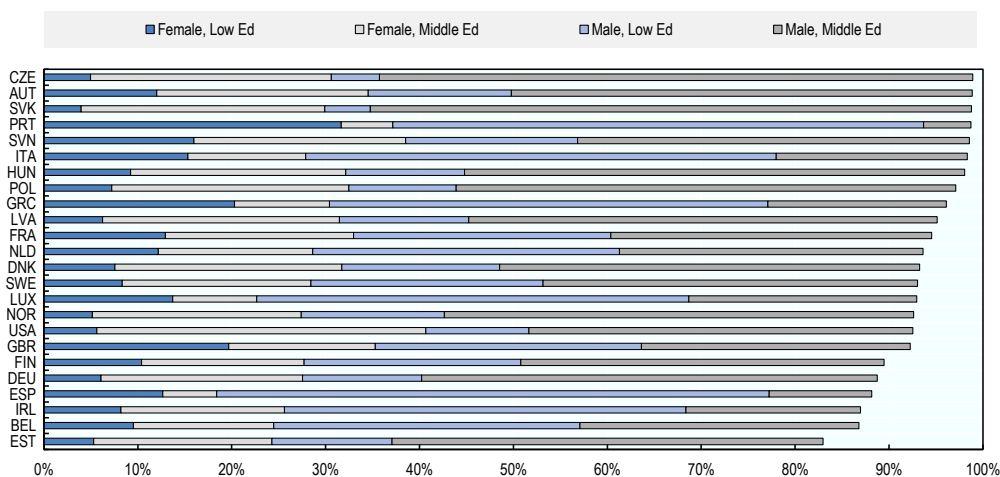
28. Among those without a tertiary degree, a majority of middle-skill workers did have at least an upper secondary degree and/or some further education. On average in the OECD, 56.8% of middle-skill workers possessed an upper secondary education. The highest shares were in the Slovak Republic, Poland and the Czech Republic, while the lowest shares of middle-skill workers holding at least an upper secondary diploma were found in Portugal, Spain and Greece. Over a third of middle-skill workers possessed less than an upper secondary diploma implying that middle-skill jobs were accessible to even those with little education.⁸

⁷ For example, age, and for the most part gender are fixed and pre-determined at birth, and do not change with labour market conditions. Education and region of residence are more problematic and partly reflect local labour market conditions. Both also involve high switching costs, and may reflect exogenous factors such as historical family ties (place of residence) and labour market conditions many years prior to observation (education). Given their importance in predicting middle-skill workers, both are included in the set of possible predictors. Variables conditional on employment, such as industry and occupation, are not included as predictors. Skill groups are determined by occupation, and its inclusion will make any inferences about occupation tautological. Due to the strong correlation between occupations and industry, industry is not included for similar reasons to occupation. Industry and occupation will be explored to complete the picture of the typical middle-skill worker from 20 years prior, but they will be excluded from defining a middle-skill worker

⁸ As noted, education is included as one of the main predictors, but its inclusion is problematic. Education is an endogenous choice for young workers or young people deciding whether to enter the labour force or pursue further schooling. If a given young person is, for example, confronted with satisfactory job opportunities once she obtains an upper-secondary degree, she may decide to forgo further education. That same person entering a labour market at a different, hypothetical, point in time may instead pursue further schooling in the face of a poor job market. This choice for people at the margin of pursuing further education complicates the interpretation of the outcomes of education cohorts at different points in time. Fixing this problem is non-trivial, and all results should be interpreted with this in mind.

Figure 3.1. Middle-skill workers were workers without a tertiary degree

Share of middle-skill workers by gender and education, 1994-1996 (average)



Note: For countries with no data in 1994 the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and the Czech Republic), 2002 (Poland).

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

3.1.2. Middle-skill workers were more likely to be male

29. Middle-skill employment was also dominated by men. Among middle-skill workers without a tertiary degree, a little less than two thirds were men on average across the OECD. The highest shares were found in Italy and Luxembourg, which had male shares of middle-skill workers without a tertiary degree of over 70 %. The lowest shares were found in the United States and United Kingdom. Despite having the lowest shares of men, men still exceeded 50% of middle-skill workers in each of these countries.

30. Further enforcing the gender disparities in middle-skill work, the share of men in middle-skill work without an upper secondary degree exceeded the share of women with one. Men without an upper secondary degree made up 26% of middle-skill workers on average. Women who held at least an upper secondary degree, but less than a tertiary degree, comprised only 18.6% of middle-skill workers. The disparity was greatest in the United Kingdom, the Netherlands and Finland. Conversely, in the United States, Slovak Republic and the Czech Republic, middle-skill workers sorted much more strongly by education and men without an upper secondary education comprised a significantly lower share of middle-skill workers than women with at least an upper secondary degree.

3.2. Both male and female middle-skill workers were most likely to work in manufacturing

31. Although substantial gender differences existed among middle-skill workers, both men and women were most likely to work in manufacturing. Figure 3.2 shows the share of middle-skill workers for men and women, respectively, in the three industries they were most likely to work in. For both men and women in middle-skill work,

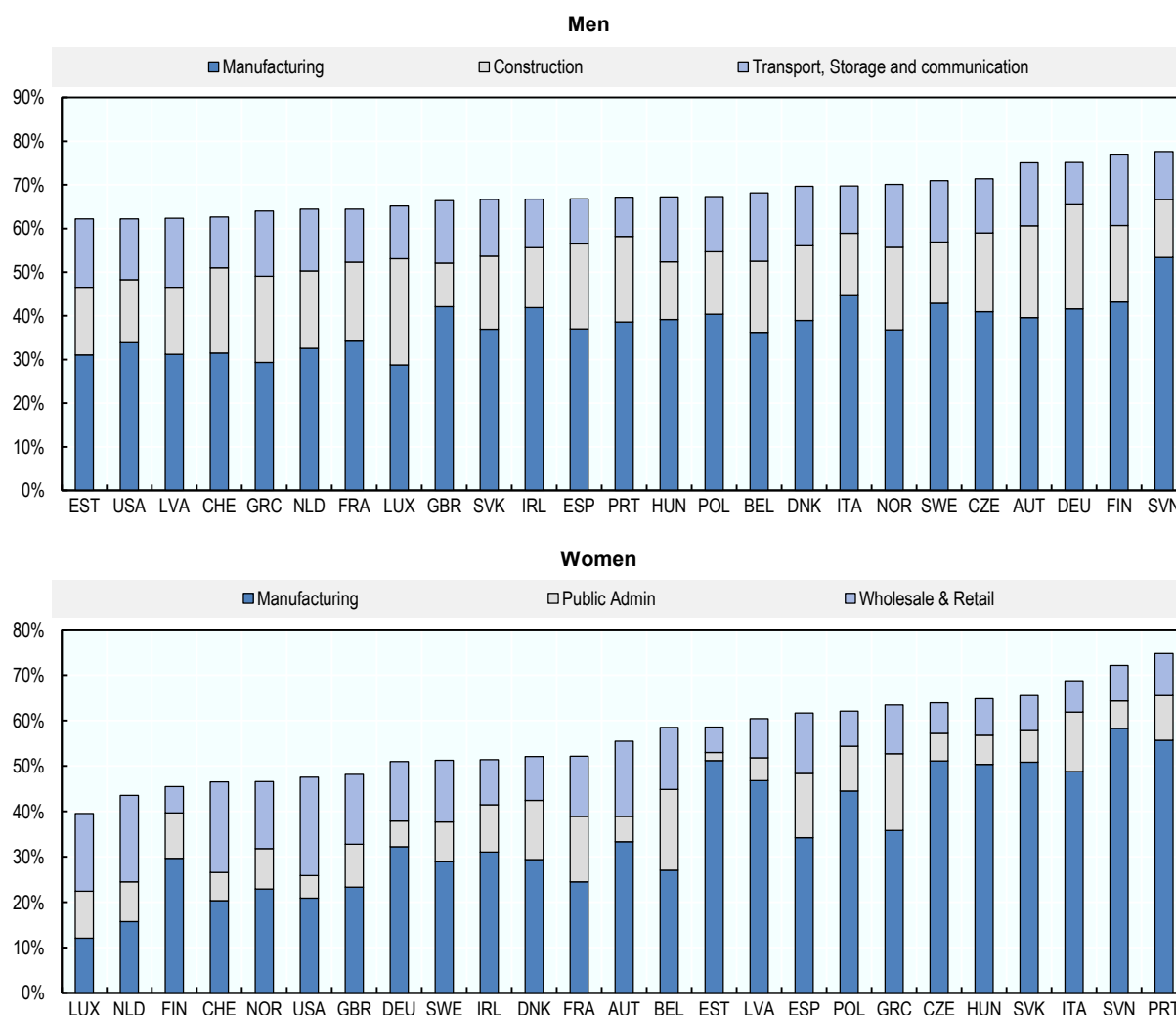
manufacturing represented the modal industry, employing 37.7% of men, and 35.3% of women. Slovenia and Italy employed the highest share of male middle-skill workers in manufacturing. For women, Slovenia and Portugal employed the highest share of middle-skill women in manufacturing, with 58.3 and 55.7 %, respectively.

32. The gender differences for middle-skill workers are most apparent in industries other than manufacturing. For women, the next most probable industry was wholesale and retail trade which averaged 11.7% of women in middle-skill employment followed by public administration with 9.4 %. The United States and the Netherlands employed the largest share of middle-skill women in wholesale and retail trade with 21.6 and 19.1 %, respectively. For public administration, Belgium with 17.8 %, and Greece with 16.9 %, employed the highest shares.

33. Middle-skilled men were more likely to be employed in construction, as well as in transportation and storage. After manufacturing, construction employed the largest share of middle-skill male workers across the OECD followed by transportation and storage with 16.8 and 13.3 %, respectively. The highest share of workers in construction were found in Luxembourg and Austria, with 24.3 and 21.0 respectively. For transportation and storage, the highest shares of middle-skilled male workers were found in Finland and Latvia with a little over 16% in both countries.

Figure 3.2. Male and Female middle-skill workers were concentrated in manufacturing

Share of middle-skill workers by industry and by male (top panel) and female (bottom panel), 1994-1996 (average)



Notes: Industry share of middle-skill workers in mid-1990s, 1994-1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland).

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

3.2.1. Occupations differed greatly for middle-skill workers by gender

34. For men, the industry distribution of middle-skill workers was reflected in their most common occupations. Table 3.1 shows the three most likely occupations across OECD countries for middle-skill workers from two decades prior by gender. The most likely occupations were drivers, building finishers, and machinery mechanics and repairers. The three most likely occupations are indicative of the three most likely industries: transportation & storage, construction, and manufacturing.

Table 3.1. Middle-skill occupations varied greatly by gender

Most common middle-skill occupations by gender, 1994-1996 (average).

Women	Men
Secretaries	Truck, Delivery Drivers
Cashiers	Machine Operators
Bookkeepers and Accounting Clerks	Building Finishers (floors, roofing, insulation)

Note: For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and the Czech Republic), 2002 (Poland).

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

35. The occupations most likely to be held by middle-skill women did not follow as clearly from the most likely industries to employ middle-skill women. Middle-skill women were most likely to be employed as secretaries, cashiers and book keepers or auditing clerks. The latter two reflect two of the modal industries most likely to employ female middle-skill workers: wholesale and retail trade, and public administration. The most likely occupation, secretaries, are employed across industries and therefore make up the modal occupation without any explicit tie to the modal industry, manufacturing.⁹

⁹ While the decline in manufacturing shifted the industry distribution of middle-skilled workers, perhaps surprisingly, the modal occupations remained relatively consistent compared to 20 years prior.

4. Where are middle-skill workers going?

36. The previous section established the profile of a middle-skill worker from twenty years prior. First and foremost, middle-skill workers were middle-education workers. The characteristic most associated with a middle-skill worker was the lack of a tertiary degree. The typical middle-skill worker held at least an upper-secondary degree with some further schooling, although many workers without even an upper-secondary degree were employed in middle-skill occupations.

37. Middle-skill workers were also more likely to be male. For low-educated men in particular, many found work in middle-skill occupations where the same could not be said for low-educated women. The greater propensity for men, all things equal to, to be employed in middle-skill work does not make the declining share of middle-skill employment a problem reserved exclusively for men. Many women – especially middle-educated women – found work in middle-skill jobs. For a given level of education, men were simply more likely to be in middle-paid work.

38. Using this profile, the analysis moves to establish how the labour market outcomes of the “typical” middle-skill worker changed in the intervening years. Put differently: this section establishes where the typical middle-skill worker of the past is working considering the declining share of middle-skill employment.

39. This section first shows that changes in the composition of the employed population are not the main cause of the declining share of middle-skill employment. It instead establishes that groups likely to have been middle-skill workers in the past experienced a decreased propensity to work in middle-skill jobs. The rest of the section shows that groups who were previously likely to work in middle-skill jobs are now more likely to work in low-skill employment. Low-education workers have also experienced a greater propensity to leave employment.

4.1. The decline in middle-skill employment is not due to changing demographics

40. The working-age population is more highly educated today than twenty years prior. This shift alone may account for the decline in middle-skill employment. To answer the question of whether or not shifts in the demographic composition of the working-age population are causing the shares of middle-skill employment to shrink, the analysis turns to a shift-share analysis.¹⁰ The shift-share analysis decomposes the change in the share of middle-skill employment into shifts induced by changes in the composition of the workforce and changes in propensity to be employed in middle-skill employment within groups. The analysis also includes an interaction term.¹¹

¹⁰ See Annex B for a depiction of the changing education shares of the working-age population.

¹¹ The shift share decomposes the change in the share of middle-skill employed according to:

41. A simple example helps to explain the shift-share and argue for its importance. From section 3, it is apparent that workers with a tertiary degree are less likely to work in middle-skill jobs compared to workers with less education. If workers increase their education over time, and the labour force contains a higher share of workers with a tertiary degree, the share of employment in middle-skill work will likely decline. In this case, middle-skill workers are not “moving.” Workers across the education distribution are possibly employed in different skill groups at the same rates as before, but the shift in composition makes it look like middle-skill employment has declined.

42. A key part of the shift-share is the division of workers into distinct groups. The analysis divides workers into mutually exclusive and collectively exhaustive groups based on education and gender. The analysis in the previous section found that they are the best predictors of middle-skill employment. The association between these predictors and middle-skill employment is the deciding factor for their inclusion. They are similar to the demographic characteristics used in Cortes, Jaimovich and Siu (2017_[10]) who follow the same methodology for the United States.¹²

43. The results of the shift-share show that both changes in composition and changes in the propensity to work in middle-skill jobs contributed to the decline in the share of middle-skill employment. Across OECD countries in the sample, the share of middle-skill employment declined by 5.6 percentage points.¹³ That decline can be decomposed into the part due to composition changes, 2.0 percentage points, and decreased propensity to work in middle-skill jobs within groups, 4.6 percentage points.¹⁴ The decrease in middle-skill employment due to compositional changes is not surprising given the increased share of the population with a tertiary degree.¹⁵

$\bar{\pi}_1^j - \bar{\pi}_0^j = \sum_g \Delta w_{g1} \pi_{g0}^j + \sum_g w_{g0} \Delta \pi_{g1}^j + \sum_g \Delta w_{g1} \Delta \pi_{g1}^j$. The term $\bar{\pi}_t^j$ is the share of the population in skill group j at time t . The term w_{gt} is the share of the population in demographic group g at time t , and π_{gt}^j is the share of group g in skill group j at time t . The left-hand side of the equation is the change in the share of the population in skill group j . The three terms on the right-hand side of the equation are (from left to right) the composition, propensity and interaction effects, respectively. See Cortes, Jaimovich and Siu (2017_[10]) for an expanded explanation.

¹² Other analyses include age as an important factor in middle-skill employment (Autor and Dorn, 2009_[26]). The analysis also undertook the shift-share using age as a factor. All results are qualitatively similar. The change in propensities are stronger for younger workers, however. Results for the shift-share including age, and propensities for prime-age education by sex groups to be employed in different skill groups is available in Appendix 1.B.

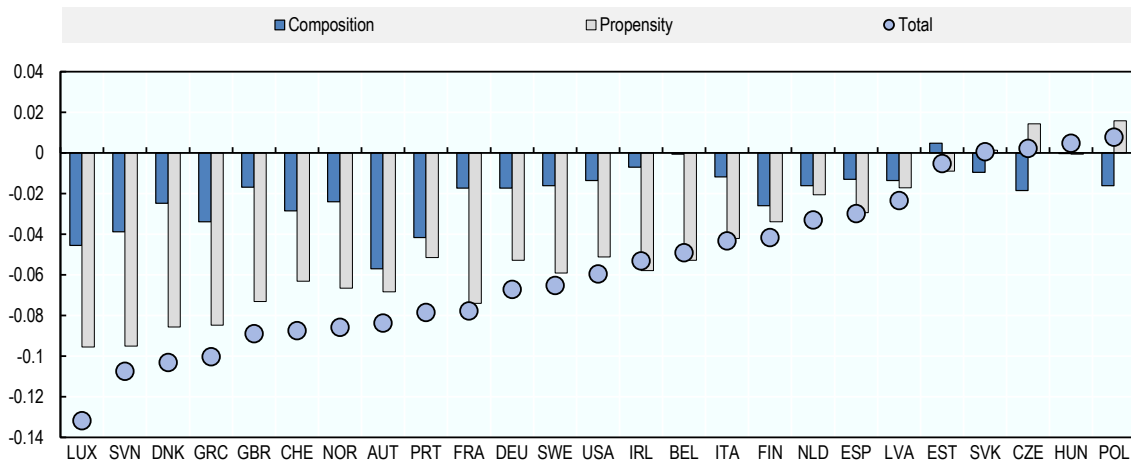
¹³ This is significantly more modest than the percentage point decrease presented at the beginning of Section 2. In the first section, the shares are defined as shares of the employed as originally constructed in the literature (Autor, Levy and Murnane, 2003_[11]). The formulation here constructs the shares as a share of the working-age population, which allows the shift-share to account for shifts out of employment.

¹⁴ The interaction effect slightly increased the share of middle-skill employment by 1.0 percentage points.

¹⁵ For some perspective, across OECD countries in this report, the share of the population aged 16-64 without an upper-secondary degree decreased from 38.5% to 24.5%, while the population with at least a tertiary degree increased from 15.9% to 28.9%. The share with at least an upper-secondary degree but without a tertiary degree went from 44.7% to 45.8%.

Figure 4.1. Shrinking share of middle-skill employment due to diminished propensity to work more than changing composition

Change in share of middle-skill employment due to composition and propensity, mid-1990s to mid-2010s



Note: For a more detailed description of the shift-share analysis, see endnote 11.

a) Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

44. Decreases in the propensity to work in middle-skill employment exceed compositional effects in all but two countries. Compositional changes dominated propensity effects only in the Czech Republic and Slovak Republic (Figure 4.1). Those two countries along with Poland and Hungary were the only countries in the sample to see the share of middle-skill employment rise. Luxembourg, Slovenia, and Denmark saw the largest declines in middle-skill employment due to decreased propensity in absolute numbers. The countries with the largest declines in propensity as a share of the total decline in middle-skill shares were Estonia, Ireland and Belgium.

4.2. Workers without a tertiary degree are more likely to be employed in low-skill occupations

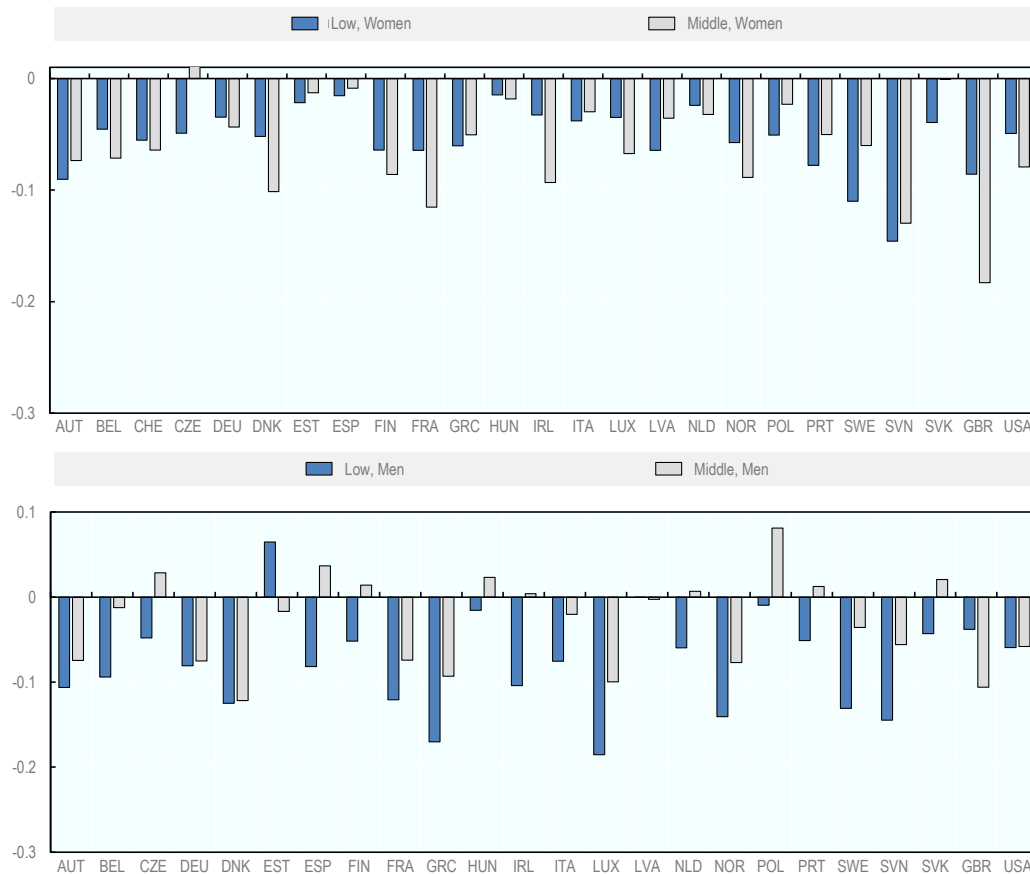
45. The preceding shift-share analysis confirmed that propensity to work in middle-skill jobs contributed to the decline in middle-skill work. Changes in composition of the labour force – greater educational achievement and women's increased participation – are a contributing, if secondary factor. The analysis did not show where workers are increasingly likely to work. To see where they are working, this analysis digs deeper into the changing propensities of where workers likely to be middle-skill are employed.

4.2.1. Workers without a tertiary degree are less likely to work in middle-skill jobs

46. Across OECD countries, workers without a tertiary degree have become less likely to work in middle-skill occupations. This is not entirely surprising given the decline in middle-skill employment overall. However, it was not a given that all groups would experience a drop in their propensity to work in middle-skill occupations. Middle-educated men have been the least affected with the share of the working-age population in middle-skill occupations dropping from 40.4% in the early 1990s to 37.5% on average between 2014 and 2016. Low-educated men experienced a much deeper decline (Figure 4.2). Across OECD countries, 33.9% of low-educated men were employed in middle-skill occupations in the mid-1990s. By the mid-2010s that propensity fell to 26.0%.

Figure 4.2. The propensity to work in middle-skill occupations fell for all workers without a tertiary degree

Change in propensity to work in middle-skill jobs by gender-education groups, mid-1990s to mid-2010s



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and the Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

47. The decline in middle-skill employment was much sharper for women without a tertiary degree. On average in the OECD, women with a middle-education saw their propensity to work in middle-skill occupations decline from 22.6% to 16.6%. Compared to middle-educated men, middle-educated women were already less likely to work in middle-skill occupations and their propensity declined further as well. For low-educated women the drop in propensity to work in middle-skill occupations was large as well. In the mid-1990s 14.7% of low-educated women worked in middle-skill occupations. By the mid-2010s that share had dropped to 9.2%.

48. Although the propensity to work in middle-skill occupations declined in most countries and most demographic groups, there are some notable exceptions. For middle-educated men, who experienced the slightest decline, a few countries stand out where the share of middle-skilled workers increased. Poland, Hungary, the Czech Republic and the Slovak Republic saw modest increases in the share of middle-educated workers working in middle-skill occupations. The increase is perhaps due to the relatively strong manufacturing employment each country has maintained.

4.2.2. Low- and middle-educated workers are much more likely to be in low-skill employment

49. As the share of middle-occupation employment has declined, workers without a tertiary degree are increasingly likely to work in low-skill occupations. The shift is most pronounced for women. The propensity of employed middle-educated women to work in low-skill occupations increased from 18.1% to 28.0% twenty years later. For low-educated women the increase was more muted. Low-educated women saw their propensity to work in low-skill occupations grow from 17.2% in the mid-1990s to 23.4% in the mid-2010s.

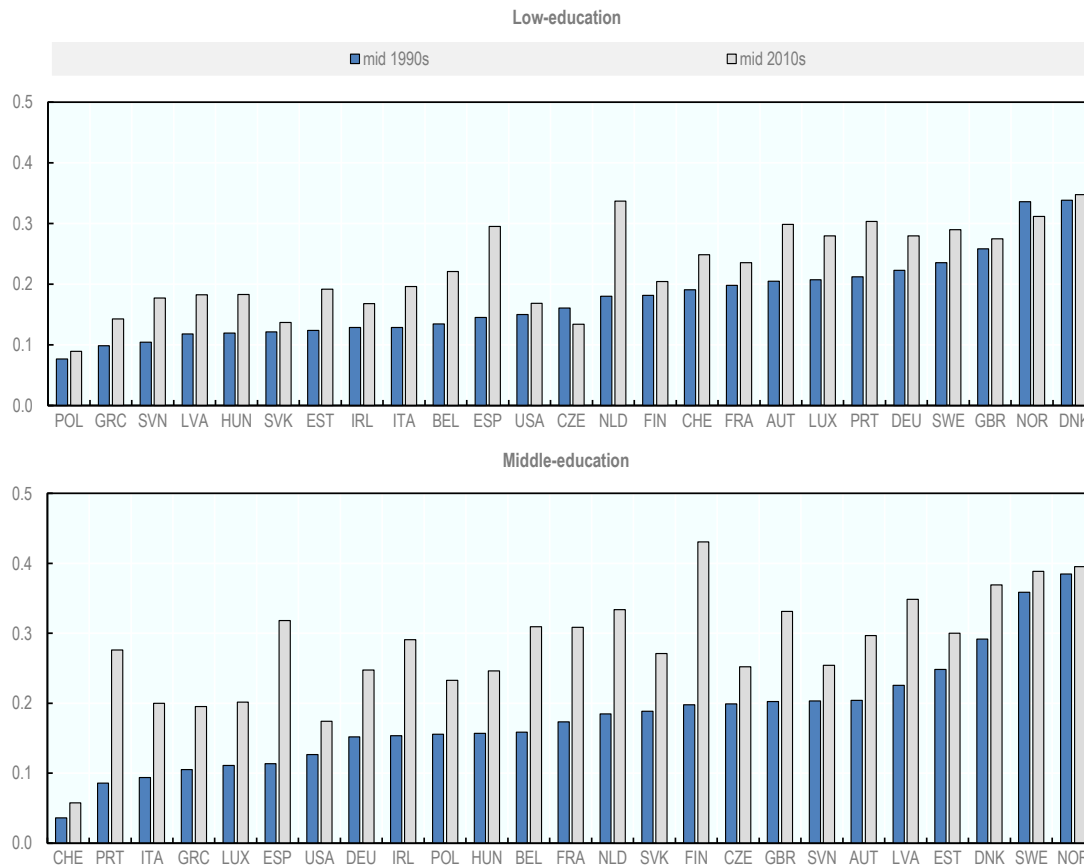
50. The increase in propensity for middle-educated women to work in low-skill employment was partly the result of increased rates of employment. Middle-educated women increased their propensity to be in employment by four percentage points over the past twenty years from 60.3% to 64.3%. Low-educated women saw no meaningful increase in their employment to population ratio.

51. Figure 4.3 shows the percentage point increase in the propensity to work in low-skill occupations for women without a tertiary degree. The figure further divides employed women into those without an upper secondary degree, and those with at least an upper secondary degree, but no tertiary degree. Middle-educated women in Finland, Portugal and Spain experienced the largest increase in the propensity to work in low-skill occupations. The percentage point increase in all three countries exceeded 19%. Low-educated women experienced the largest increase in the share working in low-skill occupations in Slovenia, Latvia and Belgium. With the exception of low-educated workers in the Czech Republic and Norway, the propensity to work in low-skill occupations increased for all women in the sample without a tertiary degree.¹⁶

¹⁶ Low-educated women in the Czech Republic and Norway also saw a large increase in their propensity to be not working, which likely explains the decline in low-skill employment.

Figure 4.3. Women without a tertiary degree more likely to work in low-skill occupations

Propensity to work in low-skill occupations for women by education, mid-1990s and mid-2010s



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

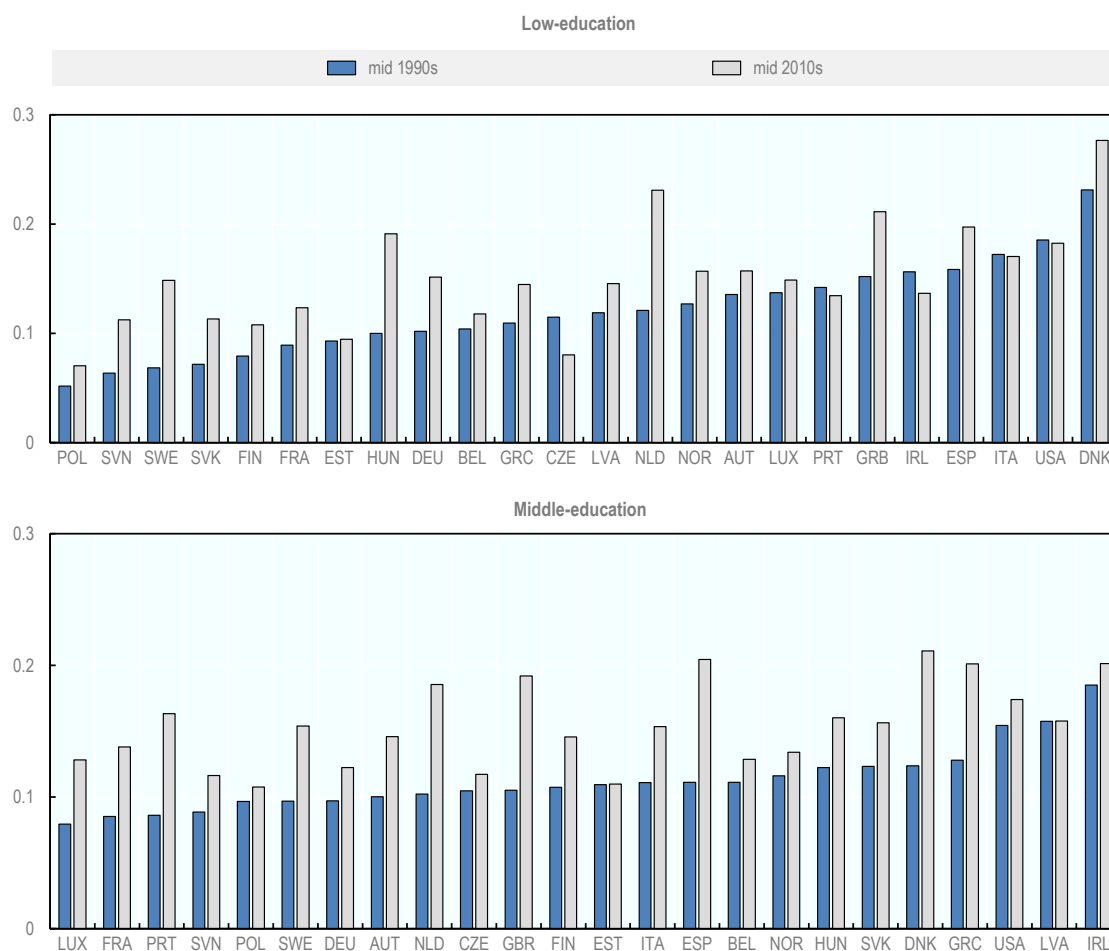
Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

52. The propensity for employed men without a tertiary degree to work in low-skill occupations also increased across OECD countries. Though still large, men saw a more muted shift towards low-skill occupations compared to women. Low-educated men’s propensity to work in low-skill occupations increased from 12.0% to 14.8% over the previous twenty years across OECD countries. For middle-educated men, the increase was larger, rising from 11.3% to 15.4%.

53. Figure 4.4 shows the change in propensity for employed male, middle- and low-educated workers to work in low-skill occupations. Low-educated men in the Netherlands, Sweden and Hungary experienced the largest increase in the propensity to work in low-skill occupations. Their propensities increased by 11.0, 8.0 and 9.1 percentage points, respectively. Male, low-educated workers in Italy, Portugal and the Czech Republic saw a decreased propensity to work in low-skill occupations. For middle-educated men, the greatest increase occurred in Denmark, the United Kingdom and Spain, where increases topped 8.5 percentage points in each country.

Figure 4.4. Men without a tertiary degree are also increasingly in low-skill occupations

Propensity to work in low-skill occupations for men by education, mid-1990s and mid-2010s



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

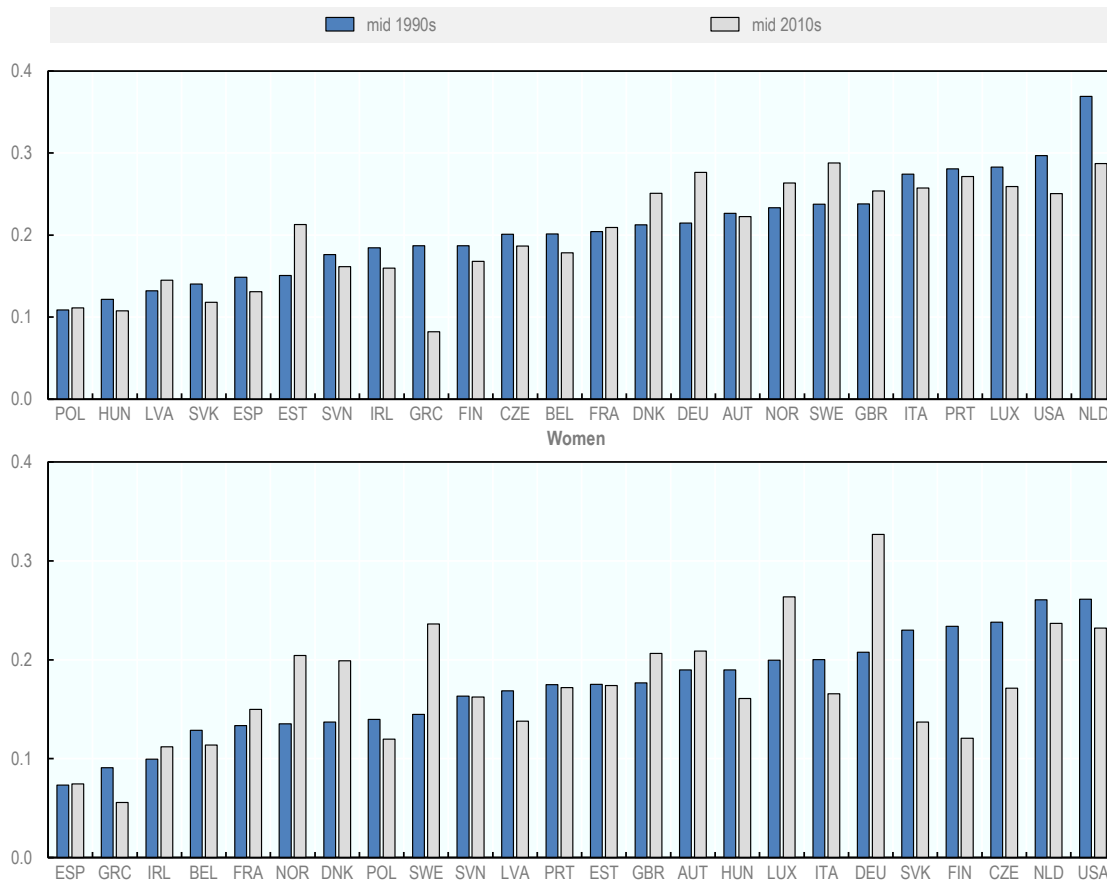
Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

4.2.3. Middle-educated workers of both genders are less likely to work in high-skill occupations

54. There is not a symmetric increase in the propensity to work in high-skill occupations. Across OECD countries, the propensity to work in high-skill occupations declined by 0.5 percentage points for middle-educated men, and 0.4 percentage points for middle-educated women. For low-educated men, the change was a decline of 0.7 percentage. Low-educated women in OECD countries saw no change in the propensity to work in high-skill jobs.

Figure 4.5. Middle-education men are slightly less likely to work in high-skill occupations

Propensity of middle-educated workers to work in high-skill occupations by gender, mid-1990s and mid-2010s



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, and Slovenia), 1997 (Sweden, Finland, Estonia, and Hungary), 1998 (Latvia, Slovak Republic, and Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

55. Low-educated workers never had more than a trivial propensity to work in high-skill occupations. This is likely the reason for the relatively modest decrease in propensity to work in high-skill occupations for low-educated workers of both sexes. In the mid-1990s the share for both men and women averaged around 5%. For middle-educated men the propensity was 20.2% and for women 19.1% (Figure 4.5).

56. Although propensities to work in high-skill occupations declined for all groups without a tertiary degree, there were some countries that saw substantial increases in the share of workers in high-skill occupations. In Sweden, Norway, Germany and Denmark the share of middle-educated women in high-skill occupations increased by 9.2, 6.9, 11.9 and 6.2 percentage points, respectively. Estonia, Norway, Denmark, Germany, and Sweden also had the largest increases in the share of middle-educated men moving into high-skill occupations over the preceding twenty years.

Box 4.1. Using administrative data from Germany to directly follow middle-skill workers

Middle-skill workers are increasingly moving into low-skill employment

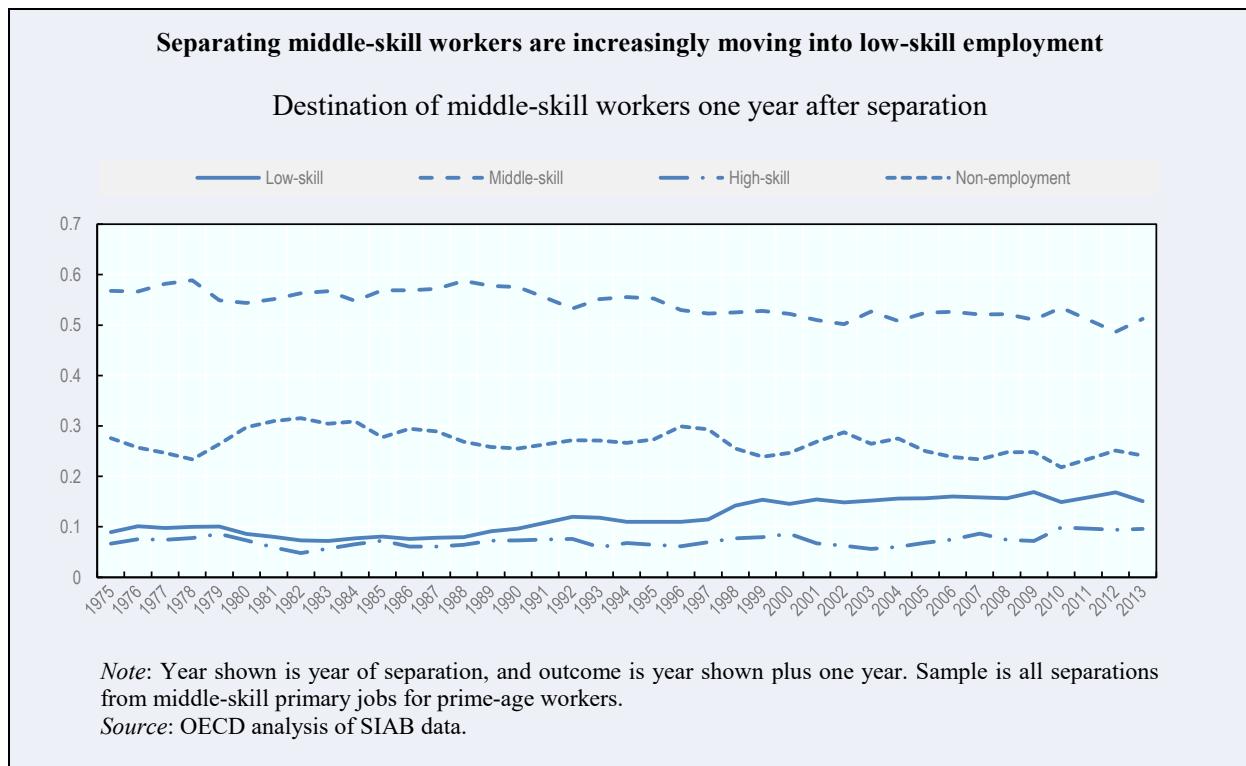
A different approach to exploring where middle-skill workers are going is to use panel data to follow them directly. This report relies on cross-sectional labour force surveys to show characteristics of likely middle-skill workers, and what types of jobs they are taking over time. Due to their comparatively large sample sizes and ease of access, labour force surveys allow an analyst to track cohorts of workers defined by certain characteristics (age, education) over time, and provide for large coverage of countries. Cross-sectional surveys do not allow the tracking of individuals over time, so the best one can say is how the outcomes of certain groups have changed. To observe directly whether middle-skill workers are moving into low-skill jobs, one needs to use data which tracks the same workers over time.

Administrative data from Germany confirm that middle-skill workers are moving into low-skill employment. The data are a two percent sample drawn from German social security records, among other sources. They allow the tracking of individuals' employers, wages, and various non-employment states to the day from 1975-2014 (Antoni, Ganzer and vom Berge, 2016^[19]). This report uses the data to ask what workers who separate from a middle-skill job are doing exactly one year later. Are they working, and if so, in what type of skill group are they employed?

Separating middle-skill workers are now more likely to be employed one year later than in the past. Between 1975 and 1994, approximately 27.5% of separating prime-age middle-skill workers remained out of employment one year later. On average between 2005 and 2013, the share of separating middle-skill workers who were not working one year later decreased to just over 24 %.

Middle-skill workers were also less likely to be employed in middle-skill jobs one year later. The majority of separating middle-skill workers are working in middle-skill jobs one year later. That has not changed, but the share has declined. The share working in middle-skill jobs one year later remained steady at just over 56% between 1975 and 1994, but declined to a little over 51% by 2013.

Separating middle-skill workers are now more likely to be working in low-skill jobs one year later. There has also been a slight, more recent uptick in middle-skill workers moving into high skill employment. Between 1975 and 1984, a little less than 8% of workers who separated from middle-skill jobs were working in low-skill occupations one year later. Between 2005 and 2013 that rate grew to over 15 %. Transitions into high-skill occupations remained relatively constant at just under 7% until climbing to over 9% by 2013.



4.2.4. Low-education men are more likely to not be working compared to 20 years before

57. Another possible outcome for workers faced with a declining share of middle-skill occupations is non-employment. The previous section showed how among the employed population, workers who fit the profile of a middle-skill worker increasingly are working in low-skill occupations. Some of these workers may instead decide to exit employment. This could be due to difficulty finding a suitable job similar to their previous position, leading to prolonged spells of unemployment. For other workers, especially those in thinner labour markets without many suitable options, they may simply exit the labour market altogether. This part of the analysis will not draw a distinction between unemployment and labour market exit, but will consider the general case of non-employment.

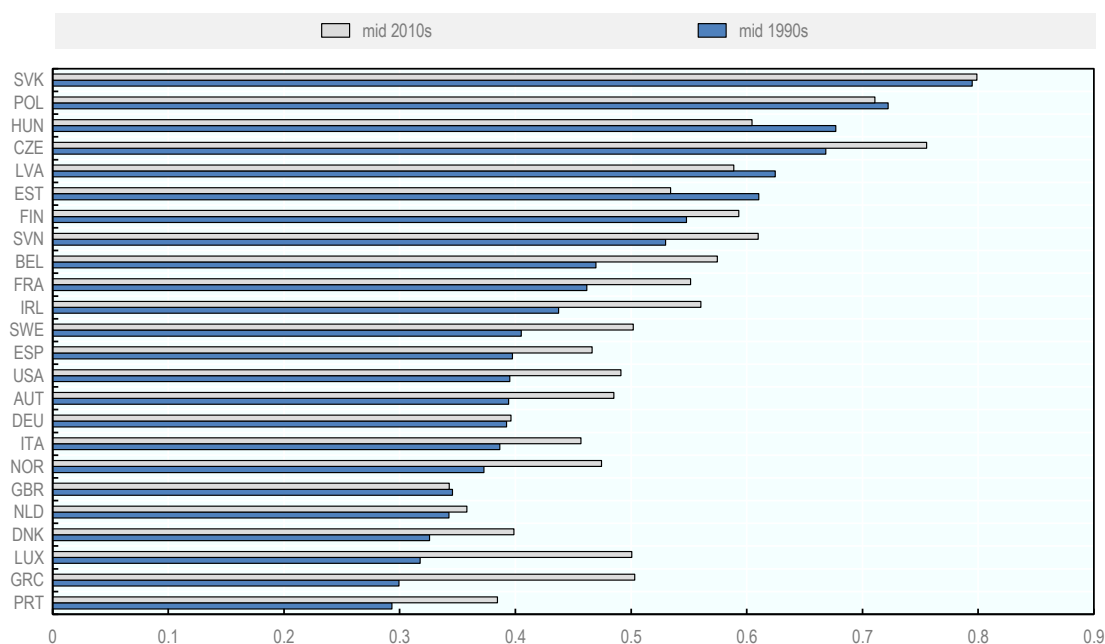
58. In addition to the first-order consequences of changes in propensity to be employed, large changes in the employed share of a given group may affect the reported propensities to work in different skill groupings. It is generally understood that job loss is not random, and younger, less skilled, or workers with less latent ability will be more likely to lose their jobs. If particular demographic groups experience a large increase in non-employment, it could alter the reported propensities to work in different occupation-skill groups of the *employed* for no other reason than the exit from employment was not uniformly distributed across skill groups. Conversely, a large decrease in the non-employment rate could have the opposite effect.

59. Across the demographic groups most associated with middle-skill occupations, only low-educated men experienced a large increase in non-employment. Among low-educated men, the rate of non-employment increased from 47.1% in the mid-1990s to 53.3% in the mid-2000s. Greece, Luxembourg and Ireland experienced the largest

increases in non-employment with all seeing increases of over 12 percentage points (Figure 4.6). In only three countries did low-educated men experience an increase in employment: Estonia, Latvia and Poland.

Figure 4.6. Men without an upper-secondary degree are now less likely to be working

Propensity to be non-employed for low-education men, mid-1990s and mid-2010s



Note: Non-employed is defined as the share of the working-age population not in employment. Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid-1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

60. Of the remaining demographic groups likely to be employed in middle-skill occupations, the changes in non-employment were modest over the previous two decades. For middle-educated men, non-employment decreased from 26.7% to 26.1%. Women without an upper-secondary degree similarly experienced little change in non-employment. Low-educated women's propensity to be non-employed increased slightly from 60.9% to 61.6%. Middle-educated women experienced a larger decline from 39.7% to 35.7%. The increased propensity for middle-educated women to be working is a contributing factor to their concomitant rise in propensity to work in low-skill occupations.

61. The few countries which saw increases in the propensity for middle-educated workers to work in high-skilled occupations did not experience large increases in non-employment rates. With a large increase in the non-employment rate, one might worry that selection effects are large, and workers with high latent abilities would be left in the pool of employed. This does not appear to be the case. For middle-educated women

in Denmark and Sweden the share of non-employed decreased by 3.9 and 3.8 percentage points, respectively. In Norway the share increased by less than one percentage point.

62. For middle-educated men the story was largely the same. Sweden and Estonia saw increased propensities to work in high-skill occupations accompanied by declines in non-employment of over four percentage points. Denmark's share of middle-educated men experienced almost no change in non-employment. Norway experienced a modest increase in non-employment for middle-educated men of 2.5 percentage points. The sum of the evidence suggests that countries which experienced increases in middle-educated workers employed in high-skill occupations is not a result of selection into employment.

4.3. Differential labour market entry of younger workers is important

63. The previous parts of this section showed where middle-skill workers are working compared to 20 years previous, but they leave the picture incomplete. The analysis looked at workers with the characteristics of middle-skill workers and showed how their propensities to work in different skill groups changed over the last 20 years. As mentioned previously, this suffers from problems with composition. The analysis assumed that workers of a given education level remain the same over time. In practice, workers take into account the labour market as well as other factors when making education decisions. This implies that workers with the same education qualifications now and 20 years ago are unlikely to possess the same latent abilities.

64. In addition to the difficulties wrought by selection, the previous analysis left open the question of how propensities to work in different skill groups have changed. Although the previous analysis examined education, the exact mechanism for how propensities are changing – explicit separations or differential labour market entry – is not easy to see. To remedy the weakness in the previous analysis this section examines workers by birth cohort to see how propensities to work in different skill groups change when workers first enter the labour market, and how their propensities change with age compared to other birth cohorts.

4.3.1. Examining consistent cohorts strengthens the importance of differential youth entry

65. By examining workers by birth cohort, the analysis decomposes the propensity to work in different skill groups by labour market entry and labour market history. Figure 4.7 shows the propensity to work in low-, middle-, and high-skilled occupations as well as non-employment by birth cohorts. The analysis uses four different birth cohorts of six contiguous years with the number and size of the cohorts determined by the 20 years of available data.¹⁷ Each panel of the figure displays a propensity for a given skill group and non-employment. Each line represents one of the four birth cohorts. The figures present the propensities such that they allow comparison for each cohort at the same age.

66. For each skill group, later cohorts enter each skill group at propensities consistent with the shift-share analysis. Workers ages 25-29 work in middle-skill occupations at a

¹⁷ The size of each birth cohort is limited by sample size in the survey data. Ideally one would use each year as the size of a birth cohort, but that would leave too small a sample with labour force surveys. The number of age ranges is similarly limited by sample size, but also the maximum span of the surveys to 20 years of data.

decreasing rate for each successive cohort. Workers born between 1965 and 1970 found jobs in middle-skill occupations at a rate of 32.3%. The latest cohort, workers born between 1983 and 1988, worked in middle-skill employment with a propensity of 21.9% at the same age of 25-29.

67. Propensities to work in low- and high-skill occupations proceeded in the same pattern but at an increasing rate. Workers in the earliest cohort entered low-skill employment at a rate of 16.0% as 25-29 year olds, which increased progressively with each later cohort terminating at 18.8% for workers born between 1983 and 1988. A similar pattern held for propensities to work in high-skill jobs progressing from 23.6% for the oldest cohort to 31.2% for the youngest cohort. For high-skill employment the second youngest cohort actually had a slightly higher propensity to work in high-skill employment as 25 to 29 year olds, which is likely due to the youngest cohort entering the labour market right in the aftermath of the crisis.¹⁸ Finally, there does not appear to be a discernible successive pattern for non-employment, with trajectories stabilising and achieving parity at ages 30 to 34 for each cohort.

68. Although each successive cohort entered skill groups at different rates, their career trajectories followed markedly similar paths. Put differently, when examining Figure 4.7, the lines showing different propensities at different ages for each cohort are largely parallel. Conditional on propensities at entry, each cohort has progressed in the labour market similarly. For example, all cohorts increased their propensity to work in high-skill occupations as they aged, which then flattened by around age 40-44. The exception is the propensity to work in low-skill occupations, where propensities do not seem to be increasing for younger cohorts as they did for the oldest cohort.¹⁹ In sum, the cohort analysis shows that much of the different propensities to work in different skill groups over time is due to different propensities for younger workers entering the labour market, and not different trajectories conditional on labour market entry.²⁰

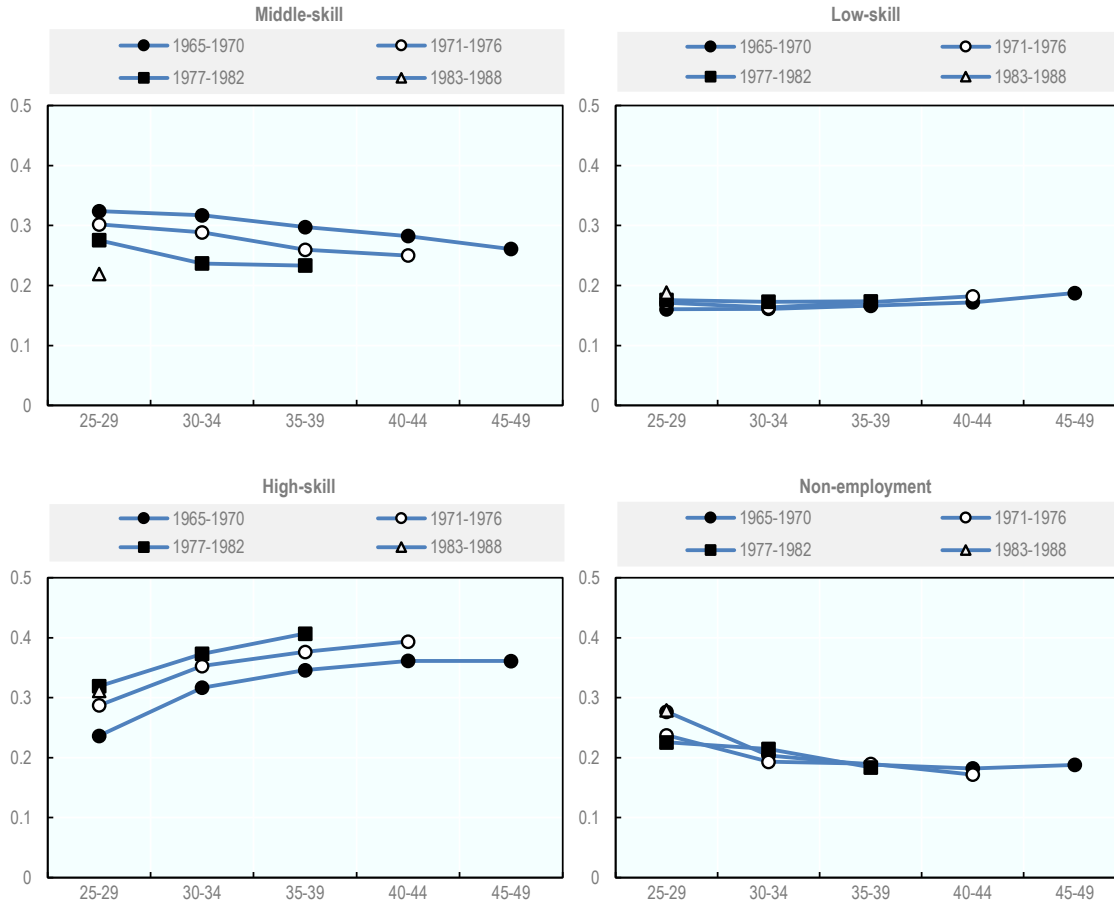
¹⁸ This is possibly due to the crisis. The only data point for birth cohort 1983-1988 is for age 25-29. This places this data point entirely in the post-crisis period, 2008-2017 (truncated by one year). A similar pattern is detectable for birth cohort 1965-1970 aged 45-49. Without comparable age groups for younger cohorts, it is unclear if this is a normal trajectory, due to the crisis, or simply noise.

¹⁹ This is likely due to paucity of data and the lack of the full trajectory for younger cohorts.

²⁰ Trajectories are similar and do not vary by education levels with same pattern holding of differential entry. The levels are obviously different, and the results follow the same pattern as suggested in the shift-share analysis.

Figure 4.7. Propensities to work in different skill groups driven by younger cohorts

Propensity to work in different occupation-skill groups at different ages by birth cohort



Note: Pooled data represents unweighted country averages. Data encompass years 1994-2016.
Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

4.4. What policies may be promoting higher propensities to work in high-skill occupations?

69. Although propensities to work in high-skill occupations remained largely the same for all groups without a tertiary degree, section 4.2.3 showed there were some countries which experienced increases in the share of workers employed in high-skill occupations. In Sweden, Norway, Germany and Denmark the share of middle-educated women moving into high-skill occupations increased. Estonia, Norway, Denmark, Germany and Sweden also had the largest increases in the share of middle-educated men in high-skill occupations over the preceding twenty years. Despite sizeable decreases in employment in middle-skill occupations, Germany, Norway, Sweden and Switzerland saw middle-educated women increase their propensity to work in high-skill occupations more than low-skill occupations. For middle-educated men, this occurred in Estonia, Norway, Germany and Latvia.

70. The countries concerned have similar features characterising their labour markets. Many of the countries whose middle-educated workers enjoyed an increased propensity to work in high-skill occupations have strong vocational training programs. These vocational programs, typified by Germany's strong emphasis on apprenticeships, give workers hands-on training in addition to formal schooling. The training and apprenticeships are designed with significant input from employers ensuring that training meets the current needs of employers. With this institutional design, it is plausible that training is better able to keep pace with the needs of employers, and better enables middle-educated workers to move into high-skill jobs.²¹

71. In addition to advanced vocational training systems, the countries where middle-educated workers are increasingly found in high-skill jobs have strong collective bargaining institutions at the sectoral and firm-level. In these systems employers and employees set a general framework at the national or sectoral level, but also ensure an important role for dialogue and bargaining over skills, benefits and staffing needs at the firm level. This allows co-ordinating action and spreading best practices, while leaving some margins of adjustment for firms' specific needs. This contrasts to systems where firm-level bargaining is rare and limited to very large companies, or firm-level systems where bargaining is not co-ordinated, and coverage is spotty. In systems characterized by strong sectoral and firm-level bargaining, firms and employees can in theory work collaboratively to move workers into high-skill occupations when their jobs are made redundant by new technologies or production processes.

4.4.1. Vocational training decreases non-employment and keeps workers in middle-skill jobs

72. The prevailing academic hypothesis concerning vocational education and labour market outcomes posits a trade-off. The theory (and some evidence) holds that vocational education helps workers early in their careers transition from school to work by giving them specific, hands-on education in a particular occupation. Vocational training will therefore result in higher employment rates and wages for workers earlier in their careers. Workers who forgo vocational education for general studies, all things equal, will have more difficulty breaking into the labour market, but their general education will provide them with more flexibility as skill demands change. This will result in higher employment rates and wages later in their careers compared to workers with vocational education (Hanushek et al., 2017_[20]). The theory boils down to a trade-off between greater employment prospects right after schooling (vocational education) versus greater flexibility and opportunities later in one's career (general studies).

73. How this trade-off maps into employment in high-skill occupations for workers without a tertiary degree is ambiguous. If vocational education programs are flexible, and they are providing up-to-date training for high-skill occupations, they should boost

²¹ This report finds that differential entry into occupations groups from younger workers is principally responsible for the changing propensity to work in middle-skill occupations. Vocational training tends to take place early in one's career, or before entering the labour market. This report therefore analyses the relationship between vocational education, and propensities to work in high-skill occupations, which connects naturally with changing employment patterns of younger workers. It should also be noted that there is an emerging consensus that life-long learning throughout one's working career is an important aspect of ameliorating the negative effects associated with declining middle-skill occupations (OECD, 2019_[35]).

employment rates. Conversely, if vocational education programs cannot keep up with current skill demands, or the training they provide proves less flexible for workers later in their careers, one would expect workers with vocational education to be employed in high-skill occupations at lower rates than similar workers who complete general education programs.

74. Whether vocational training helps middle-educated workers find high-skilled jobs is an empirical question. This analysis again looks at propensity to work in occupation-skill groupings for middle-educated workers, but broken down by those who have received vocational training, and those who have not. Due to data limitations, the results are only available for 2014-2016, which leaves how propensities have changed over time an open question.

75. Vocational training increases the propensity to work in general, and specifically in low- and middle-skill jobs. Figure 4.8 shows the percentage point difference in propensity to work in low-, middle-, and high-skill occupations as well as to be in non-employment by vocational status for middle-educated workers. Across countries, middle-educated workers with some vocational training are much more likely to be working in low- and middle-skill jobs than middle-educated workers without. On average, 26.4% of workers with vocational training work in low-skill occupations compared to 20.5% of middle-educated workers who have did not have vocational training. For middle-skill employment, the propensities were 31.1% and 26.6% for middle-educated workers with vocational and without vocational training, respectively.

76. The increased propensity to work in these occupations came mostly from a decreased propensity to be not working. Middle-educated workers with vocational training are more likely to be working in general compared to those without vocational training. On average, workers with vocational training were non-employed at a rate of 26.8% compared to 33.2% for those without vocational training. Luxembourg and Germany have the largest differences with workers over 20 percentage points more likely to be employed in those countries if they had some vocational training. In Italy and the Czech Republic, workers with vocational training were actually less likely to work.

77. Although vocational training correlates with higher rates of employment, it does not appear to be associated with a higher incidence of high-skill employment. Across OECD countries, 15.7% of middle-educated workers with vocational training worked in high-skill occupations compared to 19.7% of middle-educated workers without vocational training. There were some exceptions. In Germany, Greece, Latvia and the Slovak Republic middle-educated workers with vocational training have a higher propensity to work in high-skill occupations.

Figure 4.8. Vocational training leads to higher employment, but not in high-skill jobs

Difference in propensity to work in different skill-occupation groups by whether worker has had vocational training, mid-2010s



Note: Figures show the difference in propensity for middle-educated workers to be in various groups by whether they have received vocational training. (Vocation - no Vocation). Mid-2010s is the average for 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany,

78. This analysis represents only a cursory look at vocational training and the allocation of labour across occupation-skill groupings. It is far from the final word and many caveats are in order. First, there are likely strong selection issues baked into the analysis of vocational training, which this study does not try to address. Workers, but more often potential labour force entrants, select into vocational training based on their unobserved abilities, motivations and social class (Ryan, 2001^[21]). The higher propensity for workers who do not participate in vocational education may be interpreted as evidence for the hypothesis that general courses of study better allow workers to adapt and gain access to high-skill occupations. Alternatively, workers without a tertiary degree who do

not take part in vocational training but work in high-skill employment have unobserved personal circumstances which negate the need for vocational education.²²

79. Second, many vocational training systems are designed specifically to help workers into employment. The evidence presented here confirms this goal. To point out that they do not help workers into high-skill occupations is to rate them on an outcome for which they were likely never designed. Current academic research with cleaner research designs confirms the results in this report, finding higher employment rates and wages when comparing workers with vocational education to those with general studies.²³ To reiterate, the results linking vocational training and skill-based employment are only a quick summary, and should not be the last word.

4.4.2. Collective bargaining and strong social dialogue show promise

80. In addition to vocational training, countries that experienced an increase in middle-educated workers employed in high-skill occupations have strong, collaborative collective bargaining systems. Denmark, Sweden, Norway and Germany emphasise social dialogue and centralized collective bargaining in labour relations (OECD, 2017^[22]). Although nascent, recent research points to a role for social dialogue to move workers in occupations threatened by automation into high-skill employment.

81. Research from Germany finds that the worker-level adjustment to automation happens across occupations at the firm or establishment level. Firms appear to reassign workers to different occupations within the same firm rather than resulting to lay-offs. The research also finds that the results are stronger for enterprises with firm-level collective bargaining (Dauth et al., 2018^[23]).

82. Further research from Germany finds that collaborative social dialogue and vocational training may work best in tandem. Battisti, Dustmann and Schönberg (2017^[24]) examine what happens to firms hit by technological and organizational changes that reduce employment in middle-skill occupations. They then look at workers in those firms and find little employment and wage losses. The result is due to firms who have a history and culture of job training. These firms train affected workers to move into higher-skill occupations. The result is even stronger when they look at firms which recognize a union and agree to collectively bargain.

²² More recent evidence from Austria suggests that selection issues may not be as profound as many posit (Fersterer, Pischke and Winter-Ebmer, 2008^[36]).

²³ There is pretty clear consensus on the early career employment and wage benefits of vocational education, though the evidence is mixed as to whether a trade-off later in one's career exists. Almost all studies find diminished efficacy of vocational training, but some studies find little trade-off (Hall, 2016^[33]; Brunello and Rocco, 2017^[32]), while others finding generally greater opportunities late in one's career for workers with general education (Golsteyn and Stenberg, 2017^[34]; Hanushek et al., 2017^[20]).

5. How has job quality changed across occupation-skill groups?

83. To this point, the findings of this report can be summarized briefly. Shares of middle-skill employment declined across OECD economies and the question outstanding is where are workers who used to hold those jobs going? Workers who held jobs in middle-skill occupations were primarily workers without a tertiary degree. Workers without a tertiary degree are more likely today than 20 years prior to be working in low-skill occupations than middle-skill occupations with little change in the propensity to work in high-skill occupations. Workers entering different occupation-skill groups at different rates early in their careers are primarily responsible for these shifts, but job changes mid-career also play a role.

84. These findings do not by themselves portend less prosperity for the affected workers. Over the past twenty years productivity grew steadily in most OECD countries. The occupation-skill groups were set at or more than 20 years prior. It could be the case that skills and job amenities grew faster for low-skill occupations in the intervening years. The result is that a worker in a low-skill occupation today may see compensation and job amenities similar to workers in middle- and high-skill occupations. In this scenario, a greater propensity for low- and middle-education workers to work in low-skill occupations would result in little to no loss in living standards. Alternatively, the variance in job quality between occupation-skill groups could be growing. The fall from middle- to low-skill occupations in this case would represent a decline in labour market outcomes for workers without a tertiary degree.

85. This section finds that across multiple measures of job stability and compensation, the gulf between low- and middle-skill employment is significant. For job stability, the report compares average tenure and the incidence of fixed duration contracts across occupation-skill groups. When comparing compensation across occupation-skill groups, this report looks at both hourly wages and hours of work. Across occupation-skill groups, job stability and compensation decline monotonically with the skill group. With the exception of wages, the gap in compensation and amenities is much larger between middle- and low-skill occupations than middle- and high-skill occupations. The drop from middle- to low-skill occupations represents a marked decline in labour market outcomes.

5.1. Work is more precarious in low-skill occupations

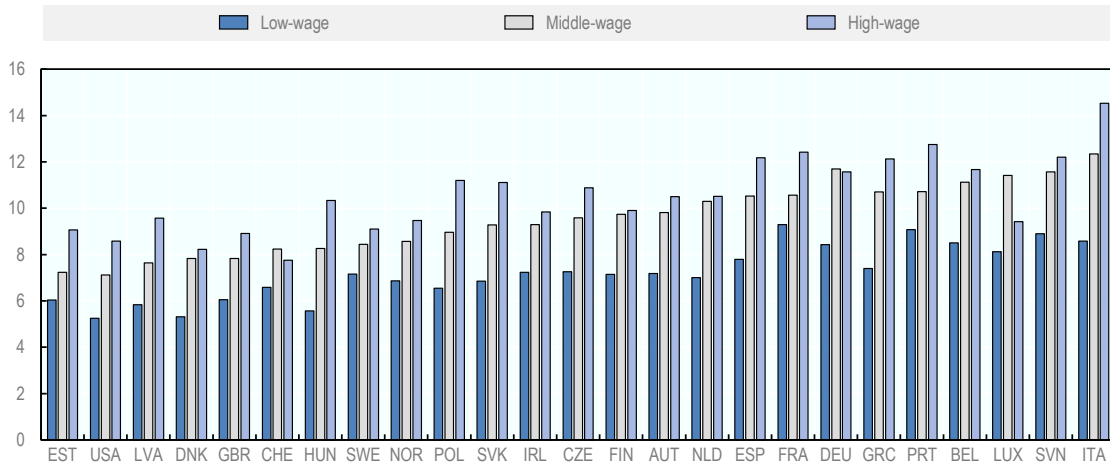
5.1.1. Tenure is lower for low-skill occupations

86. Job stability, or the length of time a worker is in their current job, is an important indicator for job quality and worker welfare. One of the most commonly used indicators for job stability is job tenure, or the length of time a worker has been in her current job. Workers in jobs that are stable, and where the probability of separation is low, tend to have relatively higher tenure. Jobs that are more precarious, where workers have less

security of keeping their job from one day to the next, will on average have lower tenure.²⁴

Figure 5.1. Tenure decreases by occupation-wage group

Average tenure by occupation-wage group, 2014-2016 (average)



Note: Wage groups are synonymous with skill groups as used in the paper. Tenure denoted in years with current employer. USA is average of 2014 and 2016 with 2015 excluded.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) tenure supplement for the United States.

87. Job tenure declines across occupation-skill groups on average. Workers in low-skill occupations had tenure averaging 7.2 years in the mid-1990s and that has remained constant in the following two decades. For workers in middle-skill occupations tenure has also remained relatively constant increasing to 9.6 years from 9.5 years. The same is true of high-skill occupations with tenure increasing to 10.6 years in the mid-2010s from 10.5 years in the mid-1990s. Within countries, the differences in tenure levels – particularly low-skill occupations – are far greater than shifts over time.²⁵

88. For workers who increasingly find themselves in low-skill occupations, the decline in job tenure is large. The difference between low- and middle-skill occupations is 2.4 years, and low- and high-skill occupations is 3.4 years. The smallest

²⁴ In addition to the threat of separation, lower quality jobs – lower wages and non-pecuniary benefits – will on average have lower tenure. In this case the cause is not the threat of involuntary separation, but workers are more likely to quit these jobs. Tenure is therefore both a proxy for threat of separation, but also indirectly job quality.

²⁵ The estimates use 2014-2016, which is still in the recovery from the crisis. The estimates likely contain some of the cyclical effects, particularly for the young, which will artificially depress tenure for lower-skilled workers compared to middle- and high-skilled workers, as well as over time (Bachmann and Felder, 2017_[30]).

differences between low-skill and middle-skill occupations are found in Estonia, France and Sweden with differences under 1.3 years (Figure 5.1). Italy, Greece and the Netherlands had the largest differences in the mid-2010s with each over 3.3 years. Countries experiencing the largest shifts into low-skill occupations are also the ones with the largest jumps in job stability from middle-skill to low-skill occupations.

5.1.2. Low-skill occupations have a much higher incidence of fixed-duration contracts

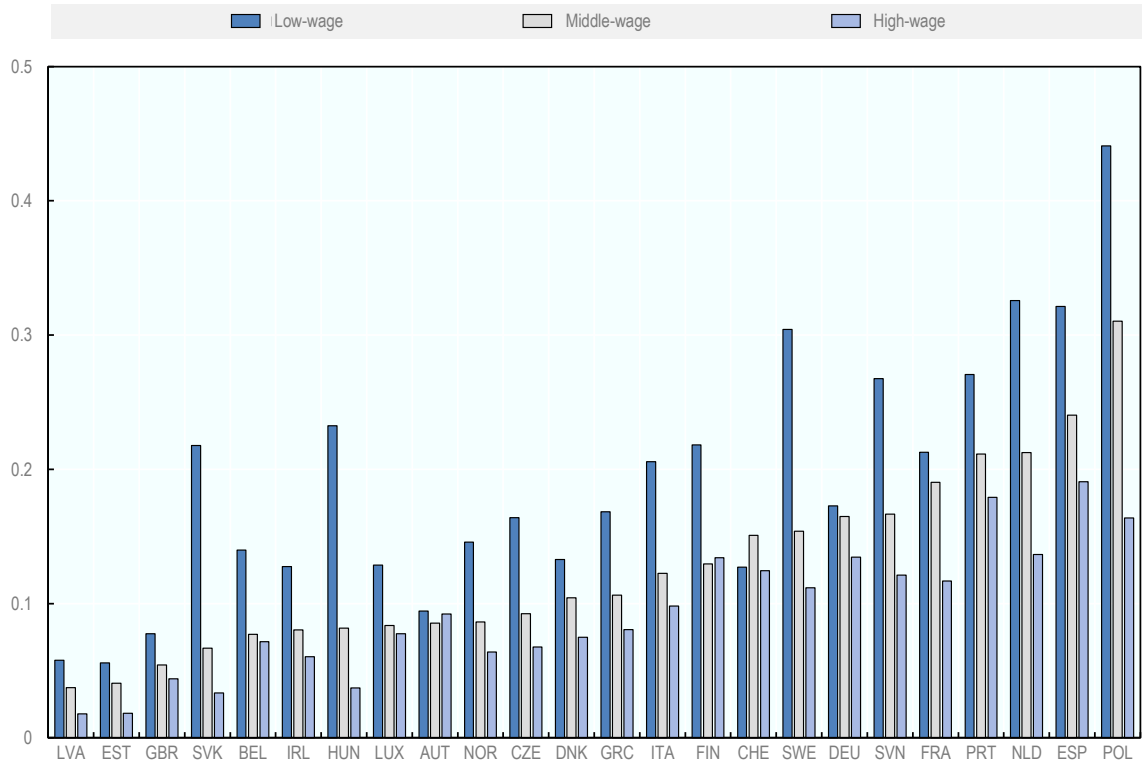
89. A major trend driving the perception of declining job stability as well as declines in job tenure is the proliferation of fixed-term contracts. Many OECD countries operate two-tiered labour markets where firms employ workers on either a contract of indefinite length, or a contract of a pre-specified, fixed duration. The specifics vary by country, but in general, workers on indefinite contracts enjoy strong employment protection and security from layoff. In contrast, workers on a fixed duration contract often need to secure other employment at the end of the contract.

90. Low-skill occupations have the highest incidence of fixed duration contracts across the OECD. In the mid-2010s 19.6% of workers in low-skill occupations were employed on a fixed duration contract compared to 13.0% of workers in middle-skill occupations and 9.5% of workers in high-skill occupations. Poland, the Netherlands, and Spain have the highest share of low-skill occupation workers on fixed duration contracts with shares of 44.1%, 32.6% and 32.3%, respectively (Figure 5.2). In general, countries with the highest incidence of fixed-duration contracts in low-skill occupations also have a high incidence among middle- and high-skill occupations.

91. The share of workers on fixed duration contracts has increased in all occupation groups, though especially in low- and middle-skill occupations. Across OECD countries the share of workers on fixed-duration contracts increased by 4.7 percentage points in low-skill occupations as well as 3.2 and 1.8 percentage points in middle- and high-skill occupations, respectively. The Netherlands and Portugal saw the largest increases in both low- and middle-skill occupations. In 11 of the 24 countries in the analysis, workers in middle-skill occupations have a higher incidence of work on fixed-duration contracts than a low-skill worker in the same country twenty years prior.

Figure 5.2. Low-skill workers much more likely to work on fixed contracts

Incidence of fixed-duration contracts by occupation-skill group, 2014-2016 (average)



Note: Wage groups are synonymous with skill groups as used in the paper. Fixed-duration contract defined as any contract with a determinate end date.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany.

92. Workers in low-skill occupations are confronted with more precarious terms of employment than middle- or high-skill occupations. Workers in low-skill occupations have lower job stability with the difference appreciably greater compared to middle-skill occupations than from middle- to high-skill occupations. In addition, workers in low-skill occupations are more likely to be working on fixed duration contracts than either middle- or high-skill occupations.

5.2. Wages and hours have not converged for low- and middle-skill occupations

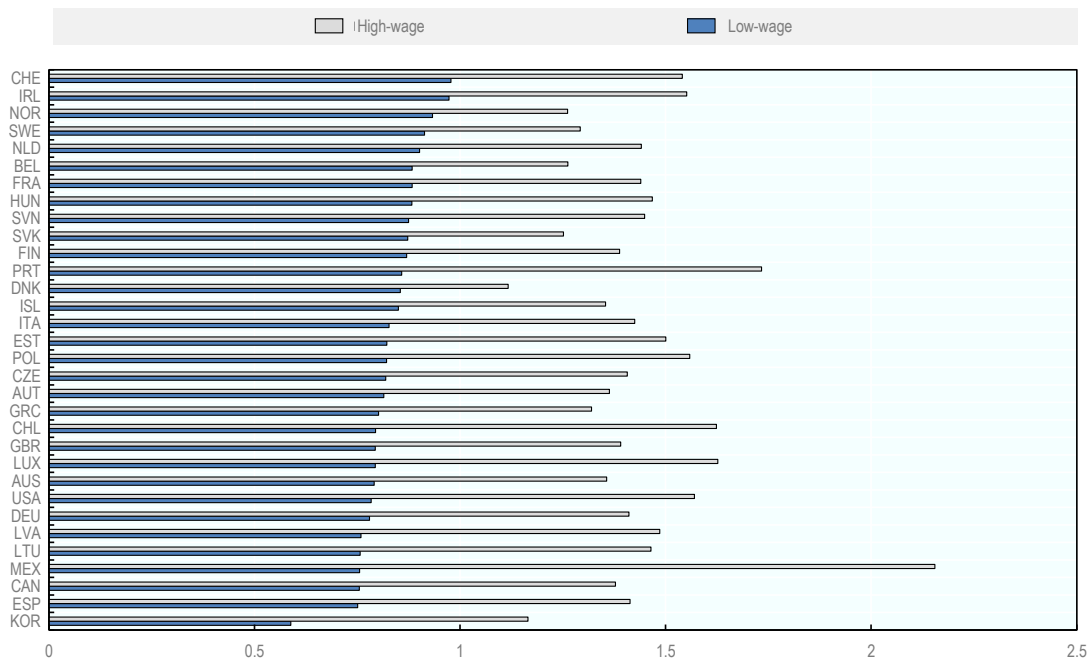
5.2.1. Significant gaps in average wages exist between skill-occupation groups

93. The difference in pay between low- and middle-skill occupation jobs is greater than the difference between middle- and high-skill occupations. Figure 5.3 shows the average wage for high- and low-skill occupations as a share of the average middle-occupation wage in 2016. Across OECD countries in the sample, low-occupation wages average 82.9% of middle-occupation wages. High-occupation wages are 44.3% greater than middle-occupation wages representing a greater separation than from middle-occupation to low-occupation average wages. Workers falling from middle-skill to low-skill occupations can expect to earn less than middle-skill occupations, but moving a middle-occupation worker into a high-skill occupation results in an even higher pay bump.

94. There is large variation across countries in the difference in average wages between occupation groups. When moving from a middle-skill occupation to a low-skill occupation, workers in Korea, Spain and Canada can expect the largest drop in average wages. Low-occupation wages in Korea are 58.9% of middle-occupation wages. In Spain and Canada, they are 75.1% and 75.5%, respectively. In the Netherlands, Sweden, Norway, Ireland and Switzerland, the average wage for low-skill occupations is over 90% of middle-skill occupations. For the jump from middle-skill to high-skill occupations, Denmark, Korea and Slovak Republic have the smallest gap in wages, which are 11.7%, 16.5% and 25.1% higher than middle-skill wages, respectively. On the other end of the spectrum, Mexico, Portugal, Luxembourg and Chile have high-skill wages over 60% higher than middle-skill wages.

Figure 5.3. Wage drop from middle- to low-skill occupations varies

High and low-skill average wages as a share of middle-skill occupations, 2016 (average)



Note: Wage groups are synonymous with skill groups as used in the paper. Low- and high-skill average wages expressed as a% of average middle-skill average wages in 2016.

Source: EU SILC (European Union countries except Germany); Canadian LFS (Canada); CPS ORG (USA); HILDA (Australia); ENOE (Mexico); CASEN (Chile); KLIPS (Korea).

95. Countries that have done comparatively better moving middle-skill workers into high-skill employment have small gaps between low- and high-skill average wages. In Denmark, Sweden, and Norway the percentage point gap between low- and high-skill average wages is the lowest in the sample and below 38 percentage points (Belgium and Slovak Republic are included in this group). One exception is Germany, which has seen almost equal propensity increases for many low- and medium-educated workers to work in high-skill occupations as low-skill. Germany’s gap is slightly above average at 63.1%.

96. It is possible that low across occupation-group variance in wages is causal for a country's propensity to move middle-skill workers into high-skill jobs. In this scenario, the low wage gap would imply that firms in these countries have a smaller marginal cost of moving middle-skill workers into high-skill occupations. This lower cost increases their propensity to do just that. Sweden, Norway, Denmark and Germany all have relatively high levels of social dialogue and vocational training. Section 4. discussed research showing how firms in these countries move workers to new occupations within the same firm. The difference in wages between middle- and high-skill occupations likely plays an important role in this calculation.

Box 5.1. The wages of middle-skill separations

Middle-skill workers moving to low-skill jobs have seen declining wages in Germany

An open question is whether workers who find themselves in low-skill employment are earning less than if they had been in middle-skill employment. Average wages in the occupation-skill groups increase with skill, but in practice there is a wage distribution associated with each group. Job transitions to low-skill occupations could still be associated with wage gains.

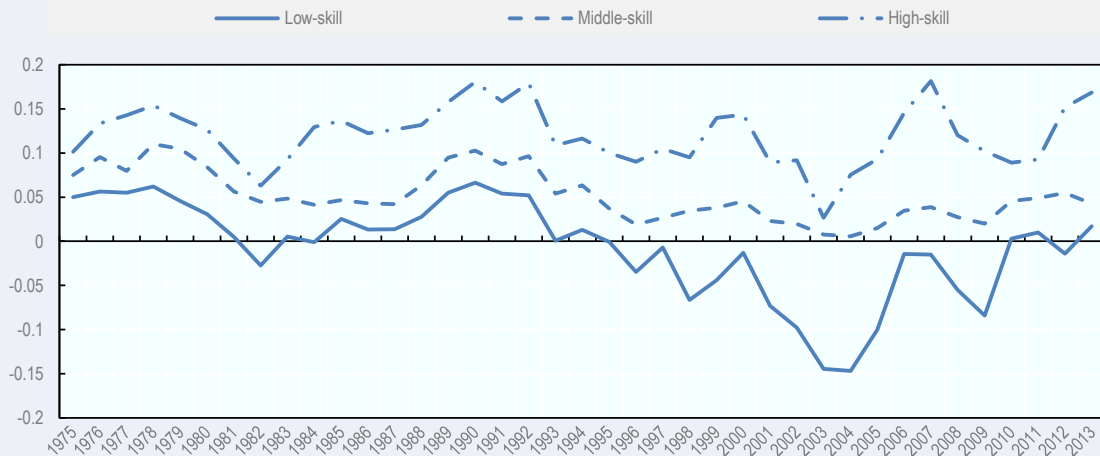
Workers transitioning from middle-skill to low-skill jobs increasingly experienced declining wages. Examining the same set of workers followed in Box 3.1, this analysis looks at the median wage change for workers who left middle-skill jobs and then were employed one year later. Workers who moved to low-skill jobs generally saw small positive wage gains until the late 1980s. The median wage change then began to fall, and became negative starting in the mid-1990s where it remains today.

Middle-skill workers moving to middle-skill or high-skill jobs saw a much smaller decline in wage changes, and median wage changes remained positive. From 1975 until 1994, the median wage change associated with separating from middle-skill employment into middle-skill jobs was about 7%. That change fell to between 2.5 and 3.5% in the following two decades. For those moving into high-skill jobs, the median wage change has fluctuated, but between 2005 and 2013 the median wage change held at about a 10% increase.

When following workers over time, middle-skill workers are increasingly finding themselves moving into low-skill jobs. In Germany, the median wage change associated with those transitions has been falling, and workers now moving into low-skill jobs will on average experience a negative nominal wage cut. Two decades prior, middle-skill workers moving into low-skill jobs generally enjoyed a wage increase.

The wages of middle-skill separations

Median nominal wage change for separating middle-skill workers who are employed one year later



Note: Wage change is year-over-year nominal change in the average daily wage. Year shown is year of separation, and outcome is year shown plus one year. Sample is all separations of prime-age workers from middle-skill jobs employed one year later. Due to data quality concerns, year 1991 is an average of 1990 and 1992 and 2011 is an average of 2010 and 2012.

Source: OECD analysis of SIAB.

5.2.2. Low-skill occupations have a higher incidence of part-time work

97. Wages are just one side of total take-home pay. Hours of work are the other determining factor in total monetary compensation. Although workers in many OECD countries have standard 35-40 hour work weeks, for an increasing share of workers a full work week is not guaranteed. Firms are increasingly employing workers on a part-time or flexible basis, with hours not guaranteed from one week to the next. Even if wages are rising across the skill distribution, there is no guarantee that total take-home pay will as well.

98. Part-time work is most prevalent in low-skill occupations and rising. Across OECD countries in the mid-1990s, 25.1% of workers worked part-time. By the mid-2010s this share rose to 33.3%. Middle- and high-skill occupations saw an increase as well though the rise was smaller. The share of middle-skill workers working part-time increased from 8.4% to 12.3%. For high-skill occupations, part-time employment rose to 13.7% compared to 9.7% two decades later. Both the level and rise in the incidence of part-time work among low-skill occupations sets it apart from middle- and high-skill occupations.

99. Part-time work in low-skill occupations is not solely due to demand factors. Much of the rise in part-time work is the result of women entering the labour force. Many European countries enacted policies during the last two decades to increase labour force participation for older workers, and prime-age women (OECD, 2010_[25]). Although firms

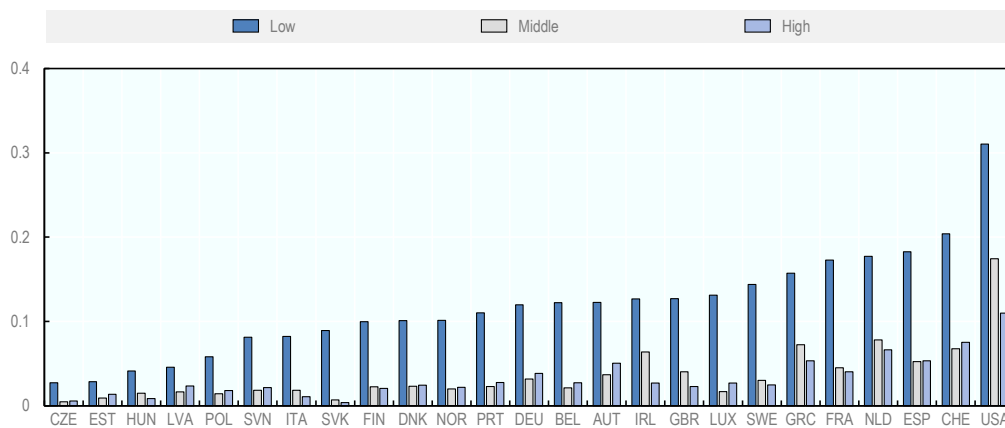
are increasingly structuring their labour force to include more part-time workers to better manage demand, the large incidence in part-time work partly reflects worker preference.

5.2.3. For a large portion of low-skill workers, part-time work is not their preference

100. Many part-time workers would also like to work full-time hours, which are not available from their employer. This is known as workers part-time for economic reasons, which is different from workers who choose to work part-time for child or elder care, or to attend school. These workers are constrained by the hours offered by their employer, and even though they would like to work more, for various reasons, their employer will not let them work a full work week.

Figure 5.4. Low-skill work contains a disproportionate share of part-time workers who want more hours

Incidence of part-time by economic reason of employed by occupation-skill group, 2014-2016 (average)



Note: Part-time for economic reason is defined as part-time workers who say that would like to be full-time, or increase their hours of work.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

101. Workers who are part-time for economic reasons are mostly found in low-skill occupations. In the mid-2010s, 11.8% of workers employed in low-skill occupations reported being part-time for economic reasons. This compares to 3.3 and 3.7% for workers in high- and middle-skill occupations, respectively. The highest share of low-skill workers who are part-time for economic reasons are found in the United States, Switzerland and Spain. The lowest shares are found in the Czech Republic, Estonia and Hungary (Figure 5.4). For workers with less than a tertiary degree, who are increasingly finding themselves in low-skill occupations, full-time hours are not assured.

6. Conclusion

102. There has been a steep decline in the propensity for workers without a tertiary degree to hold relatively good jobs. These are workers who share many of the same characteristics as middle-skill workers. Previously, employment in middle-skill occupations provided many workers with a good standard of living. The decline in employment opportunities in these occupations has meant that workers who previously would have held these jobs are increasingly employed in low-skill occupations or out of work entirely. This shift is leaving too many workers with too little income after a day's work or with no work at all.

103. The crisis of good jobs for middle-skill workers is analogously a crisis of good jobs for workers without a tertiary degree. In order to determine where middle-skill workers are going, this report identified characteristics of middle-skill workers. The best predictor of working in middle-skill jobs was the lack of a tertiary degree.

104. Workers without a tertiary degree are sliding down the job ladder. Compared with twenty years ago, workers without a tertiary degree are less likely to work in middle-skill occupations. The drop in the probability to work in middle-skill occupations has been accompanied by an almost one to one increase in the propensity to work in low-skill occupations. Men without an upper secondary degree also experienced a concomitant shift out of employment.

105. The increased probability of working in low-skill occupations results in an increased risk of relatively low compensation and job stability. Workers in low-skill occupations enjoy much less job stability as measured by job tenure compared to workers in middle- and high-skill occupations. This is partly due to the greater propensity of employers to hire low-skill workers on fixed-term contracts. In addition to reduced stability, workers in low-skill occupations earn less than middle- and high-skill occupations. Adding to the lower wages, workers in low-skill occupations are much more likely to be employed part-time further reducing take-home earnings.

106. The share of middle-skill jobs in OECD labour markets has declined for at least the past three decades. Once constituting a plurality of employment, automation and offshoring have reduced the share of middle-skill employment relative to low-skill occupations and high-skill employment. Termed "job polarisation", what is happening to workers who could have previously expected to be employed in middle-skill occupations is an enduring and perplexing question for OECD governments.

107. Although the answer to this question appears bleaker than expected, some countries are performing well to mitigate the adverse effects of polarisation. Over the past two decades in Sweden, Germany, Norway and Denmark, the rise in the propensity of middle-skilled workers to be employed in high-skill occupations was almost as big the rise in their propensity to be employed in low-skill occupations. That they did so without any appreciable decline in employment rates serves as an encouraging example.

108. The relative success of a few countries shows that policy can provide good jobs for formerly middle-skill workers. Automation and globalisation have reduced the number of good employment opportunities for workers without a tertiary degree. However, greater awareness and a vigorous policy response can improve employment opportunities for middle-skill workers.

References

- Acemoglu, D. and P. Restrepo (2018), “Artificial Intelligence, Automation and Work”, *NBER Working Paper Series*, No. 24196, NBER, Cambridge, MA. [9]
- Antoni, M., A. Ganzer and P. vom Berge (2016), *Sample of Integrated Labour Market Biographies (SIAB) 1975-2014. FDZ data report, 01/2013 (en)*, Institute for Employment Research - Institut für Arbeitsmarkt- und Berufsforschung. [19]
- Autor, D. (2015), *Polanyi’s Paradox and the Shape of Employment Growth*. [7]
- Autor, D. (2015), “Why are there still so many jobs? The history and future of Workplace automation”, *Journal of Economic Perspectives*, Vol. 29/3, pp. 3-30. [8]
- Autor, D. and D. Dorn (2013), “The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market”, *American Economic Review*, Vol. 103/5, pp. 1553-1597. [5]
- Autor, D. and D. Dorn (2009), “This Job is “Getting Old”: Measuring Changes in Job Opportunities using Occupational Age Structure”, *American Economic Review Papers and Proceedings*, Vol. 99/2, pp. 45-51. [26]
- Autor, D., F. Levy and R. Murnane (2003), “The Skill Content of Recent Technological Change: An Empirical Exploration”, *The Quarterly Journal of Economics*, Vol. 118/4, pp. 1279-1334, <https://economics.mit.edu/files/11574> (accessed on 8 December 2017). [1]
- Autor, D. and A. Salomons (2018), “Is Automation Labor-Displacing: Productivity Growth, Employment, and the Labor Share”, *Brookings Papers on Economic Activity*, Vol. Spring. [6]
- Bachmann, R., M. Cim and C. Green (2018), “Long-run Patterns of Labour Market Polarisation: Evidence from German Micro Data”, *Ruhr Economic Papers*, No. 748, RWI. [11]
- Bachmann, R. and R. Felder (2017), “Job Stability in Europe Over the Cycle”, *International Labour Review*, <http://dx.doi.org/10.1111/ilr.12053>. [30]
- Battisti, M., C. Dustmann and U. Schönberg (2017), “Technological and Organizational Change and the Careers of Workers”. [24]
- Brunello, G. and L. Rocco (2017), “The Labor Market Effects of Academic and Vocational Education over the Life Cycle: Evidence Based on a British Cohort”, *Journal of Human Capital*, Vol. 11/1, pp. 106-166, <http://dx.doi.org/10.1086/690234>. [32]
- Cortes, M., N. Jaimovich and H. Siu (2017), “Disappearing Routine Jobs: Who, How, and Why?”, *Journal of Monetary Economics*, Vol. 91, pp. 69-87. [10]
- Dauth, W. et al. (2018), “Adjusting to Robots: Worker-Level Evidence”, https://drive.google.com/open?id=1o1GrDu2R3BOD9m2_nb5x5fUNungr3Fgj. [23]

- Dorn, D. (2009), “Data Appendix”, in *Essays on Inequality, Spatial Interaction, and the Demand for Skills*, Dissertation University of St. Gallen no. 3613, September., https://www.ddorn.net/data/Dorn_Thesis_Appendix.pdf (accessed on 17 April 2019). [15]
- Fersterer, J., J. Pischke and R. Winter-Ebmer (2008), “Returns to Apprenticeship Training in Austria: Evidence from Failed Firms”, *Scandinavian Journal of Economics*, Vol. 110/4, pp. 733-753, <http://dx.doi.org/10.1111/j.1467-9442.2008.00559.x>. [36]
- Flaco, P., A. Green and D. MacDonald (2019), “Are Jobs Becoming Less Stable?”. [31]
- Golsteyn, B. and A. Stenberg (2017), “Earnings over the Life Course: General versus Vocational Education”, *Journal of Human Capital*, Vol. 11/2, pp. 167-212, <http://dx.doi.org/10.1086/691798>. [34]
- Goos, M. and A. Manning (2007), “Lousy and Lovely Jobs: The Rising Polarization of Work in Britain”, *The Review of Economics and Statistics*, Vol. 89/1, pp. 118-133, <http://www.mitpressjournals.org/doi/pdf/10.1162/rest.89.1.118> (accessed on 4 August 2017). [2]
- Goos, M., A. Manning and A. Salomons (2014), “Explaining Job Polarization: Routine-Biased Technological Change and Offshoring”, *American Economic Review*, Vol. 104/8, pp. 2509-2526, <http://dx.doi.org/10.1257/aer.104.8.2509>. [14]
- Goos, M., A. Manning and A. Salomons (2009), “Job Polarization in Europe”, *American Economic Review*, Vol. 99/2, pp. 58-63, <http://dx.doi.org/10.1257/aer.99.2.58>. [3]
- Hall, C. (2016), “Does more general education reduce the risk of future unemployment? Evidence from an expansion of vocational upper secondary education”, *Economics of Education Review*, Vol. 52, pp. 251-271, <http://dx.doi.org/10.1016/J.ECONEDUREV.2016.03.005>. [33]
- Haltiwanger, J., H. Hyatt and E. McEntarfer (2017), “Who Moves Up the Job Ladder?”, *NBER Working Paper*, No. 23693, National Bureau of Economic Research, Cambridge, MA, <http://dx.doi.org/10.3386/w23693>. [17]
- Hanushek, E. et al. (2017), “General Education, Vocational Education, and Labor-Market Outcomes over the Lifecycle”, *Journal of Human Resources*, Vol. 51/1, pp. 48-87. [20]
- Hyatt, H. and J. Spletzer (2013), “The recent decline in employment dynamics”, *IZA Journal of Labor Economics*, Vol. 2/1, p. 5, <http://dx.doi.org/10.1186/2193-8997-2-5>. [29]
- Jaimovich, N. and H. Siu (2014), “The Trend is the Cycle: Job Polarization and Jobless Recoveries”, *NBER Working Paper Series*, No. 18334, NBER, <http://www.nber.org/papers/w18334>. [18]
- Maczulskij, T. and M. Kauhanen (2017), “Where do workers from declining routine jobs go and does migration matter?”, *Työpapereita Working Papers*, No. 314, Labour Institute for Economic Research. [12]
- OECD (2019), “Re-engineering skills systems”, in *OECD Skills Strategy 2019: Skills to Shape a Better Future*, OECD Publishing, Paris. [35]

- OECD (2017), “Collective bargaining in a changing world of work”, in *OECD Employment Outlook*, OECD, Paris, https://doi.org/10.1787/empl_outlook-2017-8-en. [22]
- OECD (2017), “How technology and globalisation are transforming the labour market”, in *OECD Employment Outlook 2017*, The Organisation for Economic Co-operation and Development, Paris, <http://pac-files.oecd.org/acrobatebook/8117081e.pdf> (accessed on 28 August 2017). [4]
- OECD (2010), “How Good is Part-Time Work?”, in *OECD Employment Outlook 2010: Moving beyond the Jobs Crisis*, OECD Publishing, Paris, http://dx.doi.org/10.1787/empl_outlook-2010-5-en. [25]
- OECD (2009), *OECD Employment Outlook 2009: Tackling the Jobs Crisis*, OECD Publishing, Paris, https://dx.doi.org/10.1787/empl_outlook-2009-en. [28]
- Ryan, P. (2001), “The School-to-Work Transition: A Cross-National Perspective”, *Journal of Economic Literature*, Vol. 39/1, pp. 34-92, <https://www.jstor.org/stable/2698454>. [21]
- Salvatori, A. (2015), “The anatomy of job polarisation in the UK”, *IZA Discussion Paper*, No. 9193, IZA, <https://www.iza.org/publications/dp/9193>. [13]
- Schmitt, J., H. Shierholz and L. Mishel (2013), “Don’t Blame the Robots”, *EPI-CEPR Working Paper*, Economic Policy Institute, Washington, DC, <https://www.epi.org/publication/technology-inequality-dont-blame-the-robots/>. [27]
- Smith, C. (2013), “The Dynamics of Labor Market Polarization”, *Finance and Economics Discussion Series*, No. 2013-57, Federal Reserve Board, <https://www.federalreserve.gov/pubs/feds/2013/201357/201357abs.html>. [16]

Annex A. Data Sources

Unless otherwise noted, all samples use the working-age population defined as individuals ages 16-64. Some samples further restrict the age range to younger workers (ages 16-24), prime-age (25-54) and older workers (55-64).

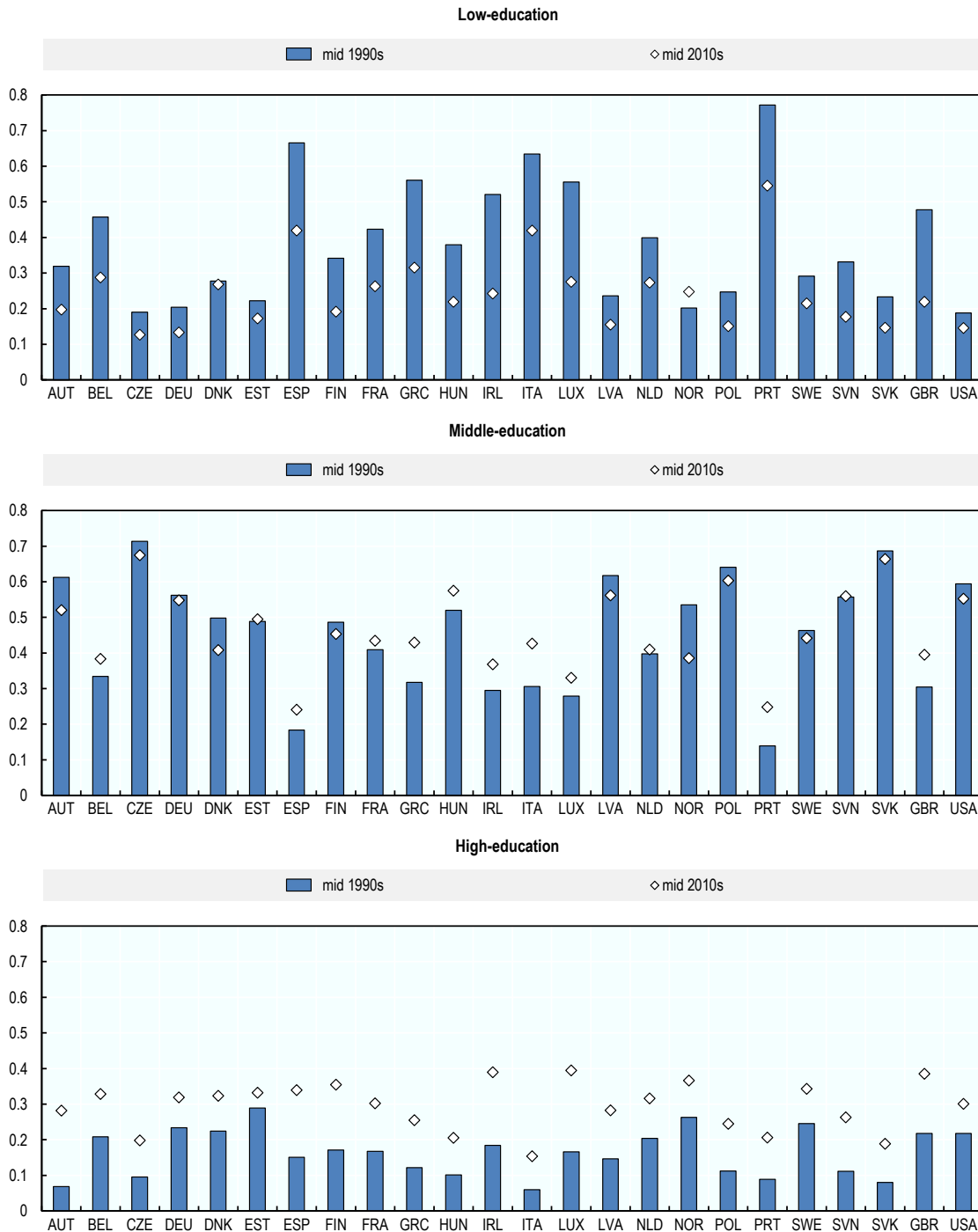
One figure examining relative wages between occupation-skill groups uses a larger set of countries than the rest of the report. This work draws on the following datasets: EU SILC (European Union countries except Germany); Canadian LFS (Canada); HILDA (Australia); ENOE (Mexico); CASEN (Chile); KLIPS (Korea). The rest of this report relies on the data sources to follow.

- **European Labour Force Survey (EU-LFS).** The EU-LFS is the largest European household sample survey covering labour force participation of people aged 15 years and older as well as people outside the labour force. The national statistical institutes design and execute their own respective labour force surveys. Eurostat harmonises and distributes the microdata in consultation with the respective national statistical institutes. All OECD members who are members of the European Union or are EFTA countries are included in this study with the exception of Iceland and Germany.
- **German Socio-Economic Panel (GSOEP).** The GSOEP is a longitudinal survey of private households in Germany from 1984 to 2016. The database is produced by the Deutsches Institut für Wirtschaftsforschung (DIW). The survey covers labour force topics, as well as household composition, health, and satisfaction. This is the primary source of Germany labour force data for this report.
- **Current Population Survey (CPS) including supplements.** The CPS is a monthly household survey conducted by the U.S. Census Bureau on behalf of the Bureau of Labor Statistics. The survey provides labour force information on household members age 15 years and older. In addition to the main questionnaire, each month one fourth of respondents rotate out of the survey and provide information on earnings. This report also uses the tenure supplements from 2014 and 2016.

Sample of Integrated Labour Market Biographies (SIAB). The SIAB is a 2% (over 1.7 million worker biographies) sample of the Integrated Employment Biographies (IEB) produced by the Institut für Arbeitsmarkt und Berufsforschung (IAB) in Germany. The IEB is a database primarily consisting of employment subject to social security coverage in Germany, but it also includes an individual's history of benefit receipt, job seeking status (unemployment), and participation in labour market training. The data cover 1975-2014 and allow for following workers over the entire time span, and over different labour market states and employers.

Annex B. Additional Figures

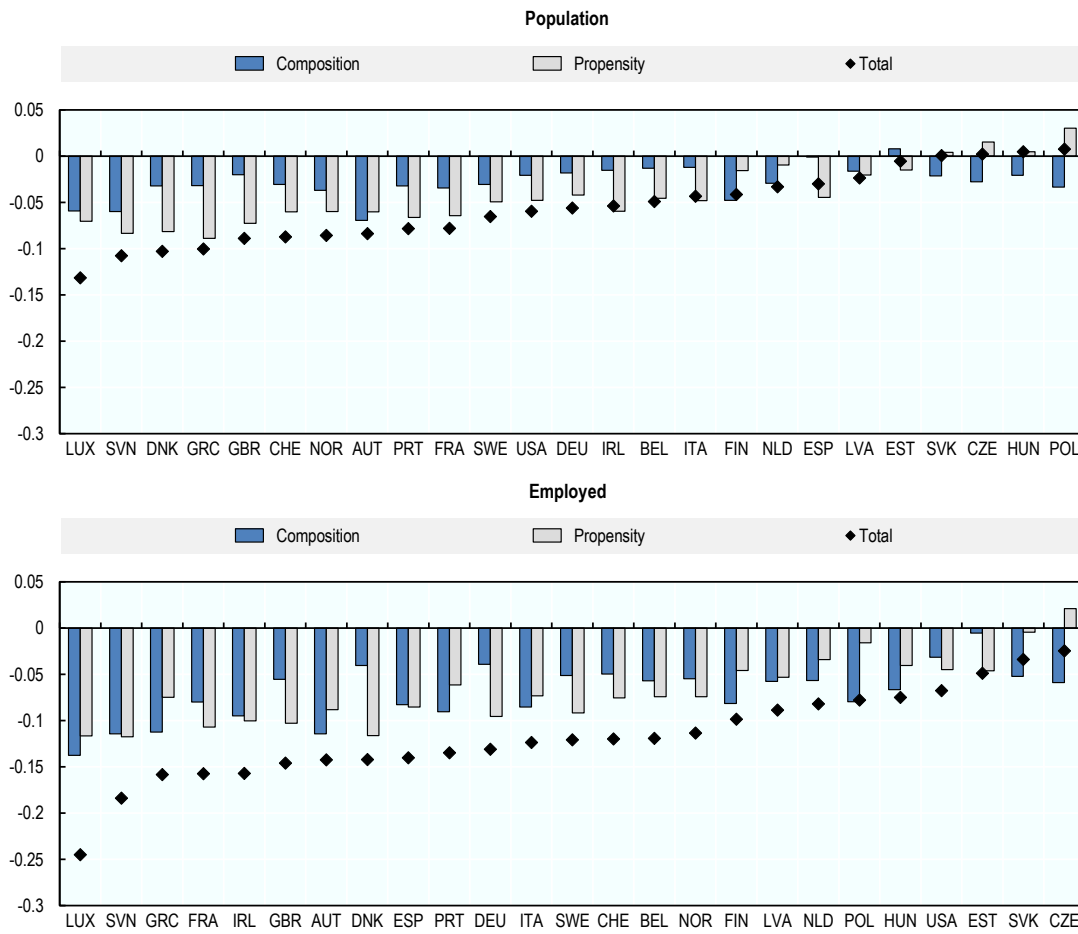
Figure B.1. Education shares of the working-age population



Note: Education shares are of population ages 15-64.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

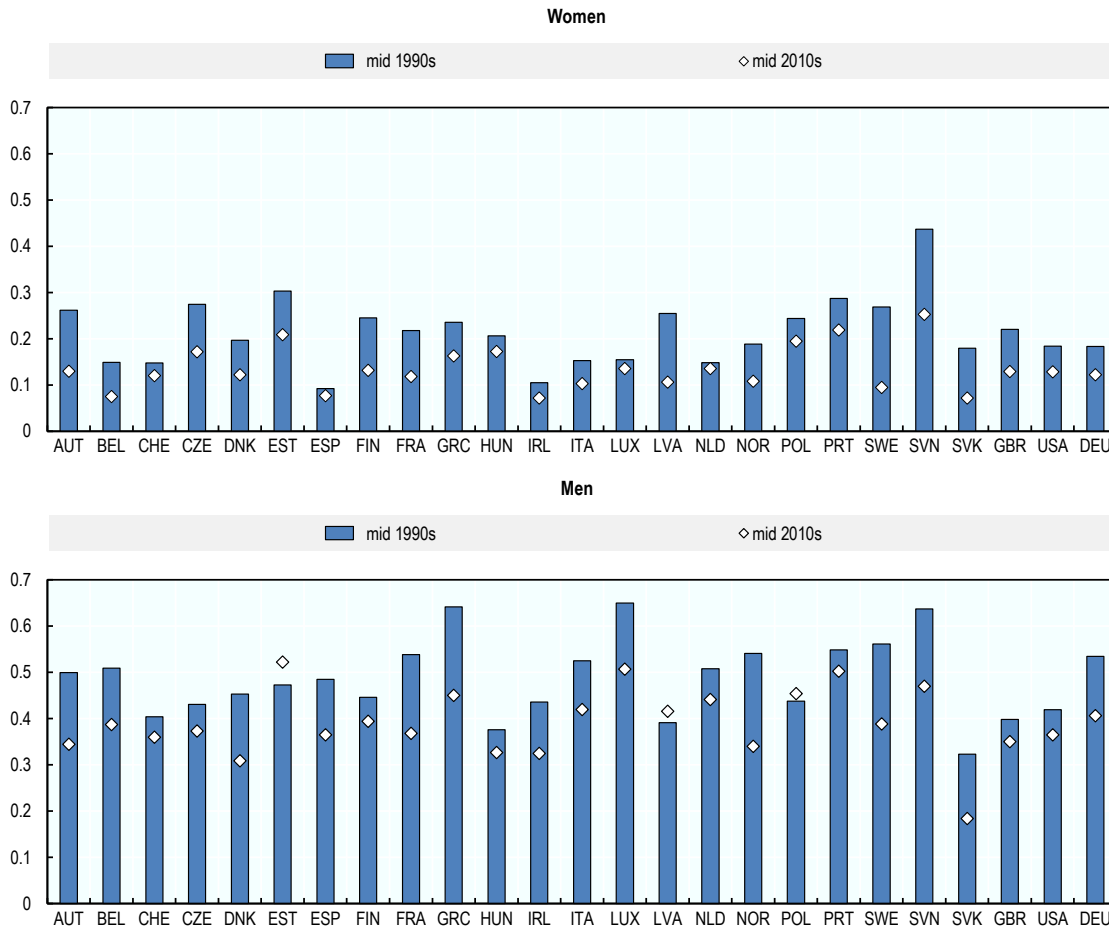
Figure B.2. Alternative shift-share analyses



Note: Both shift-share analyses include age (young, prime, old) in addition to sex and education. The top panel (population) decomposes changes in the share of middle-skill workers for the working-age population. The bottom panel (employed) does the same for the working-age employed only. Shift-share is from mid-1990s to mid-2010s.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

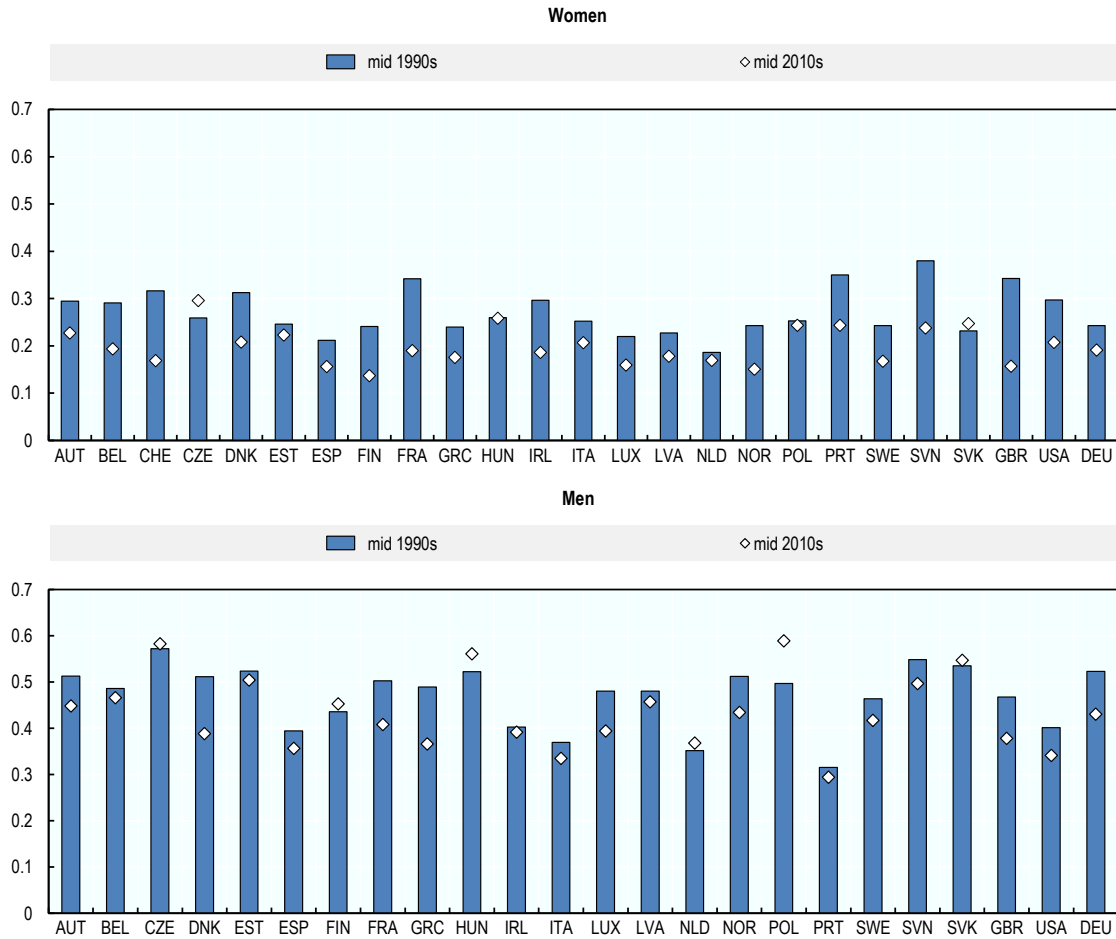
Figure B.3. Propensity of low-education, prime-age workers to be in middle-skill employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

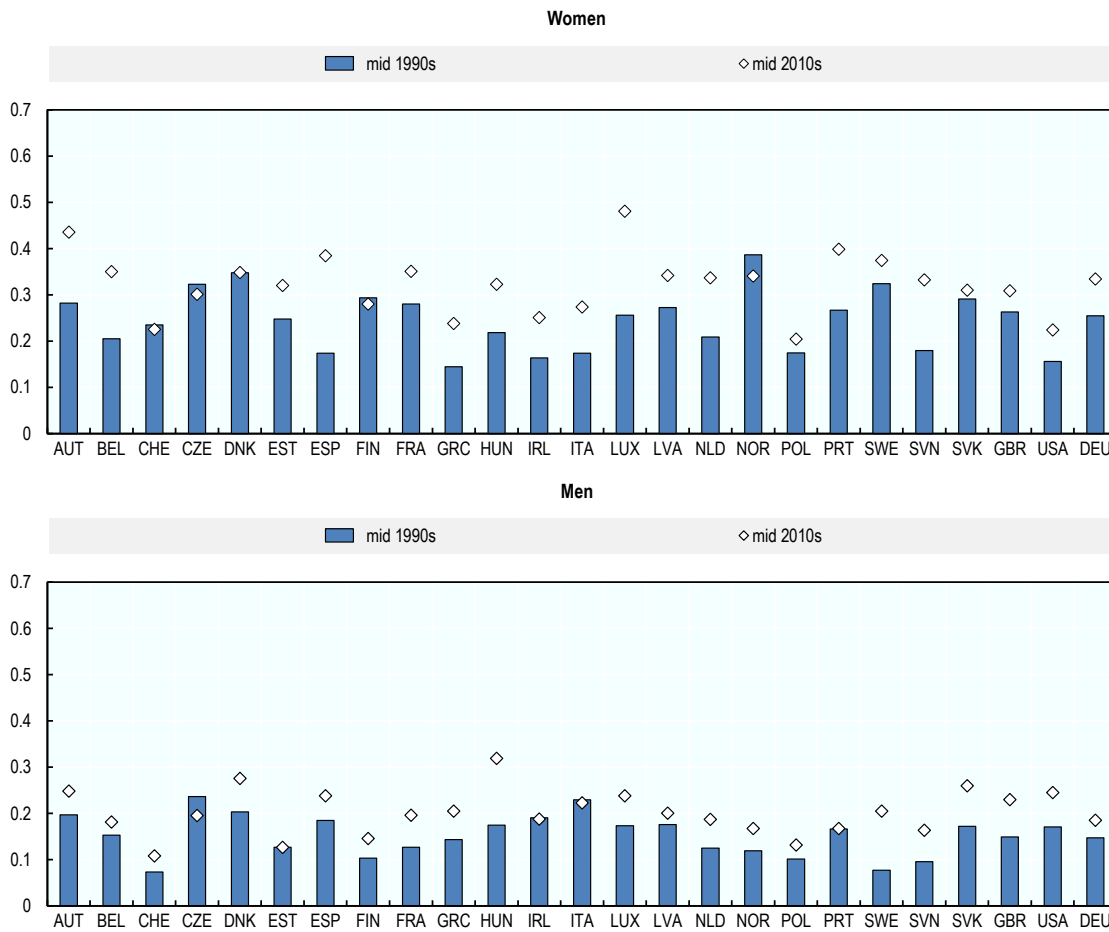
Figure B.4. Propensity of middle-education, prime-age workers to be in middle-skill employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

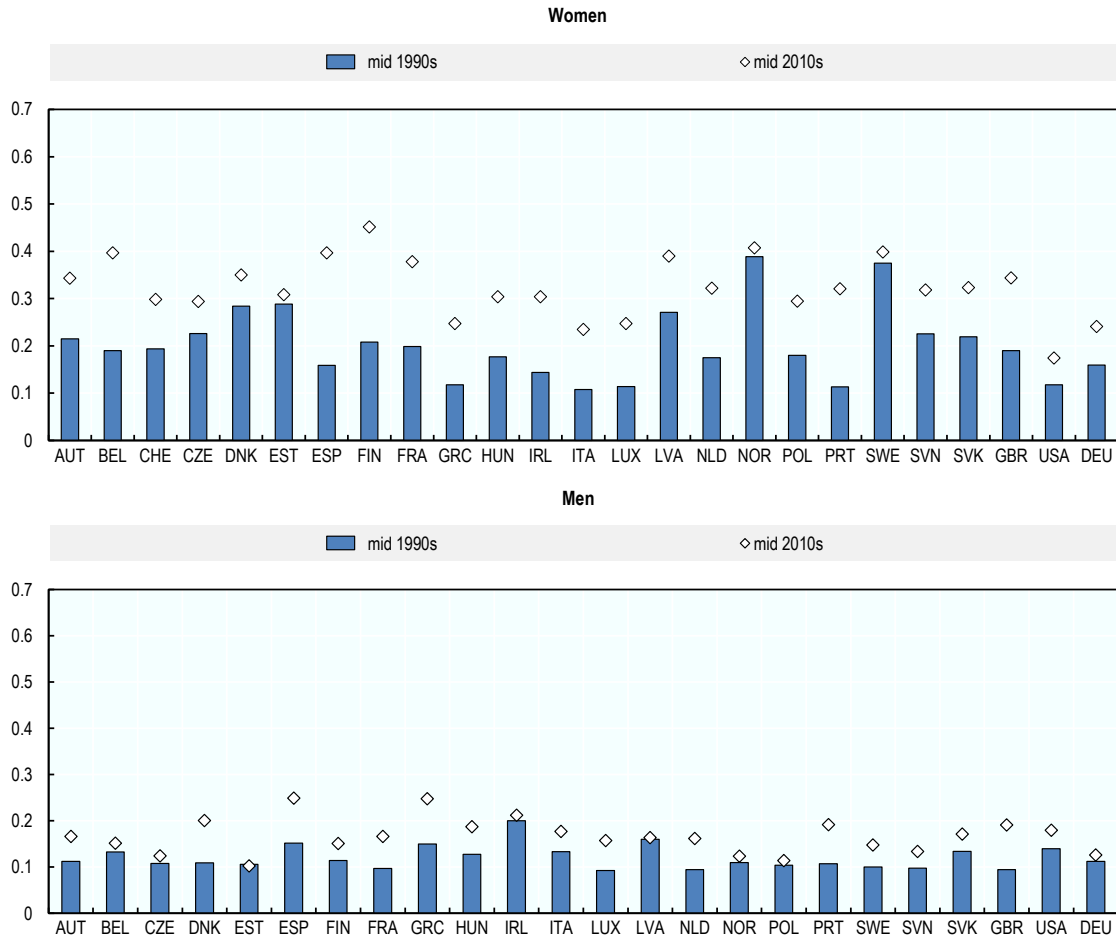
Figure B.5. Propensity of low-education, prime-age workers to be in low-skill employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

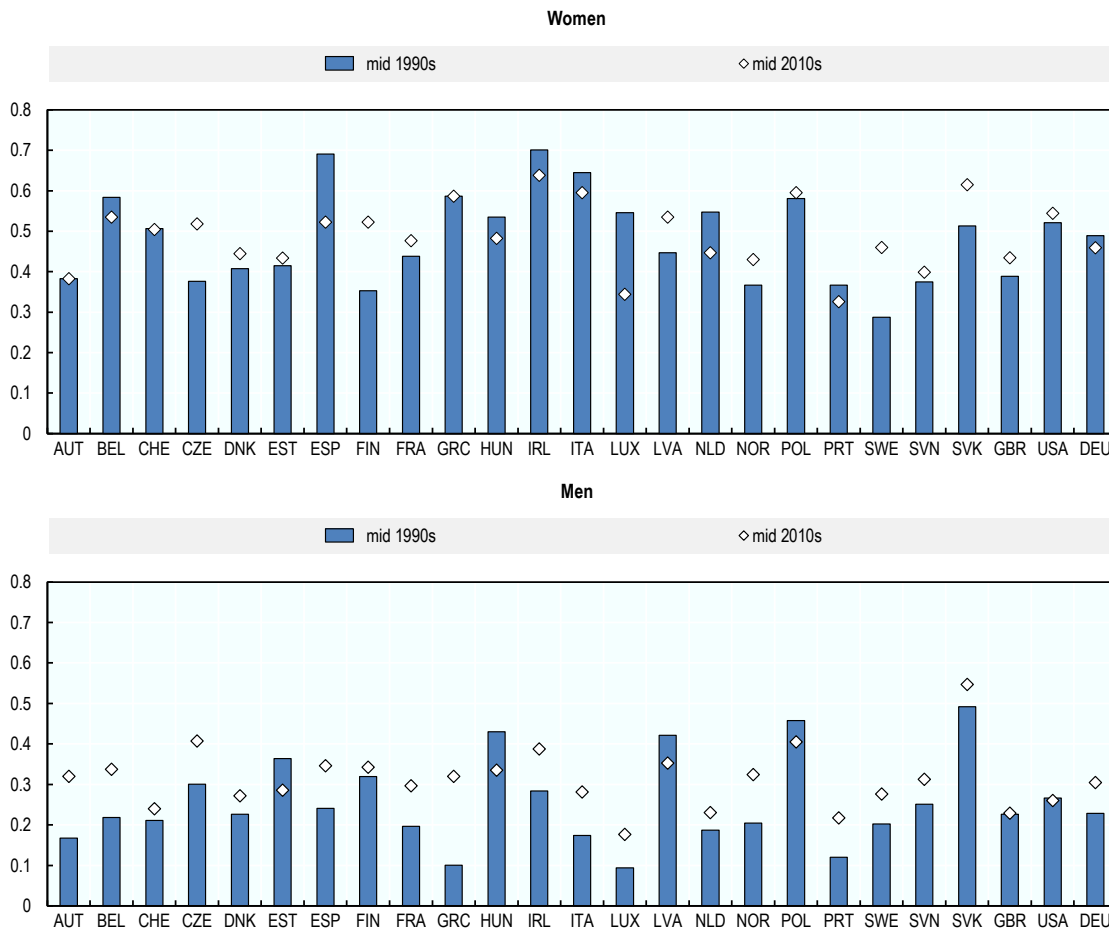
Figure B.6. Propensity of middle-education, prime-age workers to be in low-skill employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

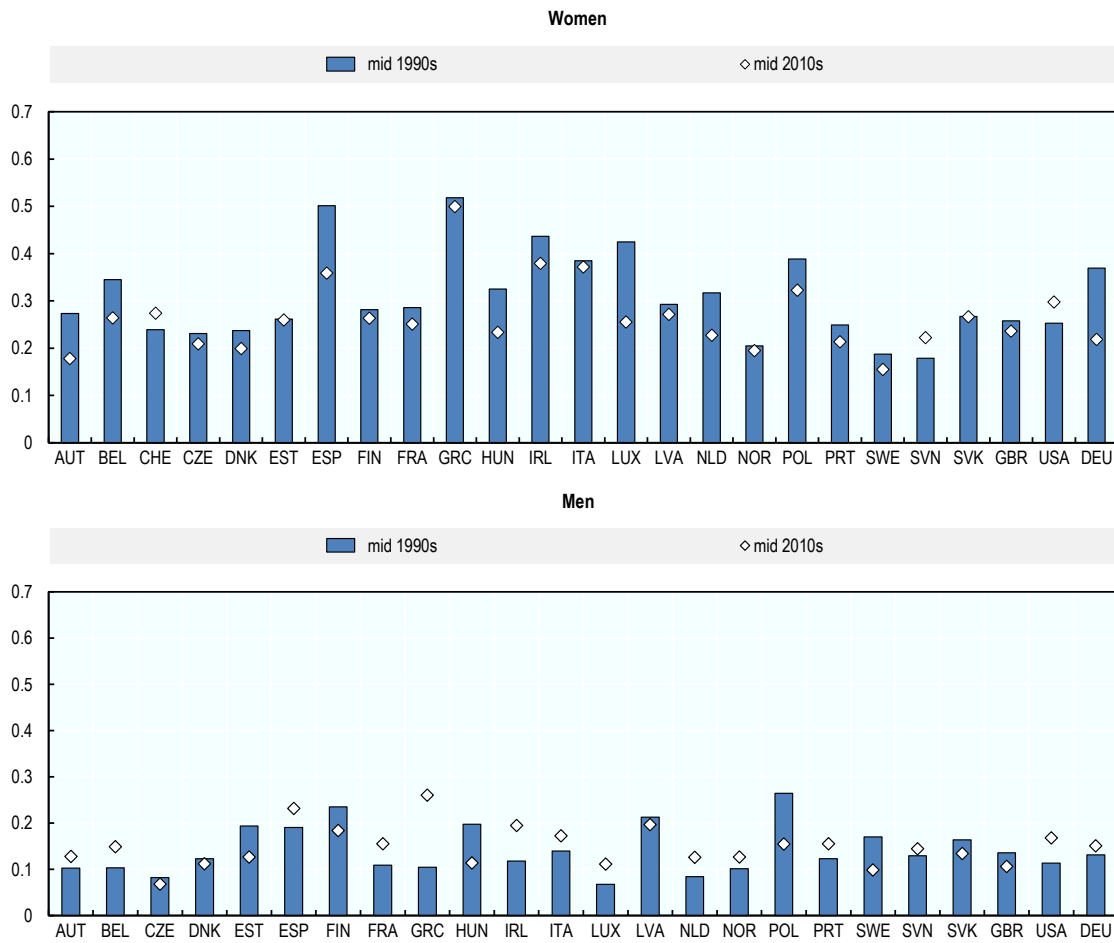
Figure B.7. Propensity of low-education, prime-age workers to be in non-employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.

Figure B.8. Propensity of middle-education, prime-age workers to be in non-employment



Note: Mid-1990s are 1994, 1995, and 1996. For countries with no data in 1994, "mid 1990s" is the three earliest years of data. From earliest year they are: 1995 (Austria), 1996 (Norway, the Netherlands, Switzerland, Slovenia), 1997 (Sweden, Finland, Estonia, Hungary), 1998 (Latvia, Slovak Republic, Czech Republic), 2002 (Poland). Mid-2010s are 2014-2016.

Source: European labour force survey (EU-LFS), The German Socio-Economic Panel (SOEP) for Germany, and the Current Population Survey (CPS) for the United States.