3 Preparing London for the impact of automation and technological change

This chapter analyses the main trends, challenges and opportunities for the labour market in London, with a particular focus on three dimensions: i) labour productivity; ii) the implications of a changing future of work; and iii) the rise of non-standard work. In doing so, the chapter benchmarks London with other regions in the UK and with selected comparable metropolitan areas across OECD countries.

In Brief

Automation could change London's labour market significantly and its impact will likely be accelerated by the ongoing COVID-19 pandemic

- **London's labour productivity has been stagnant since the financial crisis, which holds back London's economy and prosperity.** Since the financial crisis, London has had low labour productivity growth compared to other OECD metropolitan areas. While many cities recorded an increase in labour productivity of more than 10% between 2008 and 2018, labour productivity only grew by 2% in London.

- **The COVID-19 crisis could accelerate the impact of automation and digitalisation.** A wide body of evidence shows that firms are more likely to invest in automation following economic crisis periods. Due to social distancing and lockdown measures, firms and employees in London have embraced remote-working and digital tools.

- **Automation could re-shape the labour market in London. Combined with COVID-19, the impacts could be a double whammy on disadvantaged groups, entrenching inequality.** OECD estimates show that a number of jobs are at high risk of automation in London (8% of total employment in 2018) but many more are likely to face significant change (21%). The impact of automation is concentrated on specific sectors of London's economy and certain vulnerable groups, in particular low-skilled and low-paid workers. Additionally, youth and immigrants face the highest automation risk. Encouragingly, recent job creation in London has mostly occurred in jobs and sectors that are less exposed to automation.

- **Driven by skills-biased technological change, London is experiencing a polarisation of the labour market, with the share of middle-skill jobs declining by 9 percentage points since 2000**. Most of those jobs have been replaced by high-skill jobs but middle-skill worker require learning and training opportunities to move into such occupations.

- **As most places in the OECD, London has seen a rise of non-standard forms of work, consisting of temporary, part-time or self-employed work.** While non-standard work offers new opportunities such as greater compatibility of family and professional life or an easier transition into the labour market for youth, it also creates new challenges. Individuals in non-standard work arrangement have less social protection, are less likely to benefit from training and adult learning opportunities, and are more vulnerable to economic shocks such as the current COVID-19 pandemic.

Introduction

Megatrends related to digitalisation, automation and artificial intelligence (AI) are driving one of the largest transformation of labour markets across the OECD in decades. These trends will change London's labour market profoundly. Their impact has already started to materialise and with the COVID-19 pandemic, digitalisation and automation are likely to accelerate. As social distancing and teleworking became the new normal for millions of workers, COVID-19 appears to be a catalyst for long-lasting change in the way firms operate and people work as they embrace technological change to find innovative solutions that allow them to work.

The impact of the future of work will put some people and sectors of London's economy more at risk than others. Furthermore, the crisis could exacerbate existing structural issues within London's labour market. Skills gaps and imbalances as well as sluggish labour productivity have been important challenges for London's economy. With new types of jobs and alternative work arrangements such as part-time work potentially on the rise, a concerted effort is needed to ensure that skills development in London is prepared for and tailored to these new developments. As London and the UK recover from the crisis, policy makers need to manage not only the direct effects of the pandemic but also provide solutions that address the structural labour market challenges to ensure a strong and sustainable economic recovery. In analysing these trends and challenges, this chapter is structured as follows. The first section provides an overview of London's productivity performance in recent years. The second section analyses the impact of automation on London's local labour market, and in particular on vulnerable groups. Furthermore, it describes how job polarisation affects the availability of different types of jobs. Finally, the third section shows trends in the growth of non-standard work, which creates both opportunities and new challenges for individuals.

## Stagnant labour productivity and changing skill needs pose challenges for London's economy

Besides having a direct impact on London's economy, the COVID-19 pandemic may exacerbate already existing structural challenges within London's labour market. Even before the pandemic started, London faced a number of significant challenges that inhibited its economic progress. Its labour productivity has been stagnant. Its labour market is changing rapidly, due to automation, digitalisation, and job polarisation. Finally, it is facing issues in terms of skills, with issues of skills shortages and mismatches, indicating that skills supply and labour market needs are not well aligned.

Sluggish labour productivity London leaves room for improvement

Compared to other large metropolitan areas in OECD countries, London's labour productivity has been sluggish over the past 10 to 12 years. While London records the seventh highest labour productivity in a comparison of 18 OECD metropolitan areas, it has virtually stagnated since the financial crisis (Figure 3.1). GDP per worker in London in 2018 was only 2% higher than it was in 2008. This subpar performance means that London recorded the fourth slowest growth in labour productivity of the metropolitan areas considered. The issue of stagnating productivity becomes even more apparent when compared to the significant gains made in many other cities in the OECD. Oslo, the best-performing OECD metropolitan area, increased its labour productivity by more than 30% between 2008 and 2018. Others, including Amsterdam, Barcelona, Copenhagen, Madrid, New York and Paris, also experienced significant progress, with labour productivity rising by around 10%.

Figure 3.1. Labour productivity in OECD metropolitan areas, 2008-18

Changes in labour productivity in selected metropolitan areas since 2008
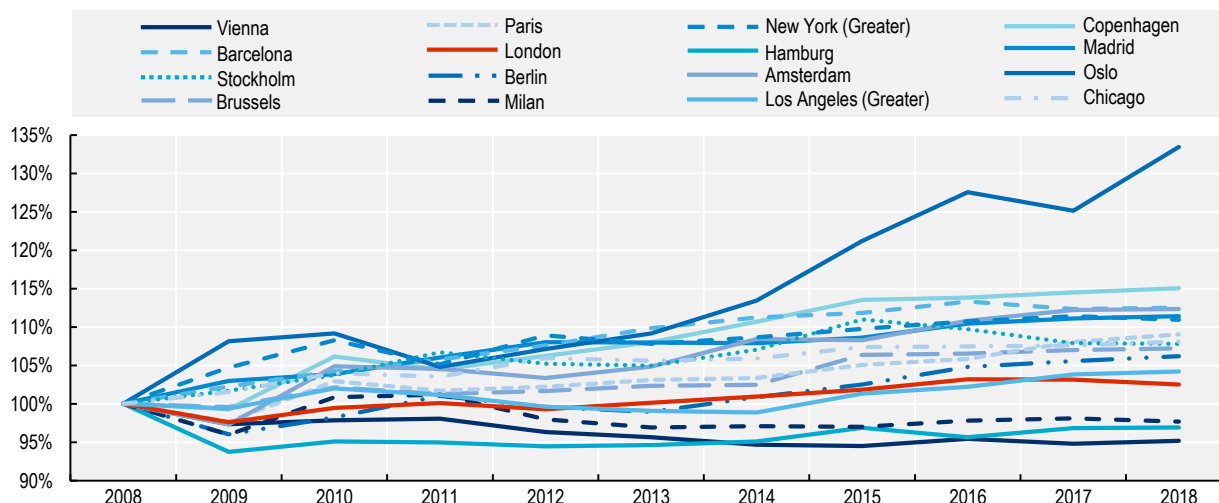
Note: Labour productivity is measured by GDP per worker in USD, constant prices, constant PPP, base year 2015. All values are presented relative to the starting point in 2008.
Source: OECD regional database and OECD metropolitan database.

The stagnation in labour productivity poses a risk for London's competitiveness as a place of business and work. Had the pre-crisis trend (2000-07) in productivity growth continued, output per worker would have been 47% higher in London than it was by 2018. The stagnant productivity in London holds back local living standards, as it inhibits the growth of real wages and real GDP per capita (OECD, 2017[1]). After adjusting for price inflation, London has experienced the largest reduction in median full-time earnings (real wages) of all UK regions over the period 2008-2019 as real wages fell by 6% (ONS, 2019[2]).

The looming impact of Brexit might yield a further shock to London's labour market. Through a combination of productivity gains and higher labour resource utilisation, immigration has helped to enhance living standards in the UK (OECD, 2017[1]). Compared to most other EU countries, EU migrants in the UK tend to have high levels of educational attainment (Kierzenkowski et al., 2016[3]), which is particularly true for London. As shown by recent research, migration has had a positive impact on productivity in the UK due to the fact that many EU migrants are skilled and offer complementarities to the skills of the UK population has (Wadsworth et al., 2016[4]). Since the Brexit referendum, net EU migration to the UK has fallen drastically by almost 75%, compared to peak levels in 2014 and 2015 (ONS, 2020[5]). As London is the destination of 30% of EU migrants to the UK, its economy is at risk of missing out on vital labour resources.

Digitalisation and tailored skills policies could help boost labour productivity in London. Through targeted policy measures, London could aim to address its stagnation in labour productivity. As discussed in Chapter 2, London now has devolved responsibility for adult learning, which can help raise skills of workers and contribute to a better match with employers' needs. Furthermore, technological progress via digitalisation and automation might drive productivity growth, if they are complemented with workers with the right type of skills. The next section examines the impact of automation on London's labour market.

The future of work: how is automation reshaping London's labour market?

Over recent decades, labour markets in OECD countries have undergone significant structural changes. New technologies and products drove the emergence of new types of jobs. At the same, some traditional

industries and jobs have been in decline. This has led to a shift in the type of skills that firms seek and workers need to thrive professionally. The increasing pace of global megatrends such as automation and digitalisation will further drive this structural transformation of the economy leading to a significantly different future of work. Additionally, the impact of the COVID-19 pandemic is likely to accelerate the speed of these developments, as the crisis has been a catalyst for change. Forced by global lockdown measures, firms and employees have embraced new solutions, ranging from the far-reaching increases in remote working to a sudden uptake of digital technology and services, which will fundamentally alter both how people work as well as what type of skills they need to have.

Automation threatens a third of jobs in London

Automation will cause one of the most significant transformation of labour markets in OECD countries in decades. On the one hand, it offers new opportunities such as enhancing productivity, thus raising prosperity and living standards. On the other hand, it poses new and unequal risks to workers. Automation is a skills-biased technological change that tends to benefit some workers (mainly high-skill) but potentially replaces the jobs of other workers (mainly low-skill or middle-skill). Automation will drive a replacement of certain tasks and jobs, creating a risk that some workers may miss out on the benefits that automation can generate. In particular, some workers might struggle to find new jobs given the changing labour market and skill needs (OECD, 2018[6]). Additionally, automation might exacerbate existing socio-economic inequalities by leading to lower wages for some jobs and further job polarisation across types of skills (Acemoglu and Autor, 2011[7]).

The current risk of job automation presents an uneven picture across metropolitan regions. While about 46% of jobs across the OECD are highly automatable (i.e., probability of automation of over 70%) or have a significant risk of being strongly affected by automation (Nedelkoska and Quintini, 2018[8]), these risks tend to be slightly smaller in metropolitan areas (Figure 3.2). However, several metropolitan areas in Spain, Italy, or Germany, face an even higher automation risk to jobs than the OECD average (Figure 3.2). For instance, in Barcelona and Madrid, more than 50% of jobs are likely to be automated or significantly transformed, which will change their skills requirements. In comparison, London's labour market is relatively well shielded to the pending effects of automation. In total, 8% of jobs in London are highly automatable and a further 21% are likely to be changed significantly by automation (see Box 3.1 for a detailed explanation of the computation of risks of automation).

Figure 3.2. Percentage of jobs at significant and high risk of automation by metropolitan areas, 2018

Share of jobs facing a high or significant risk of automation
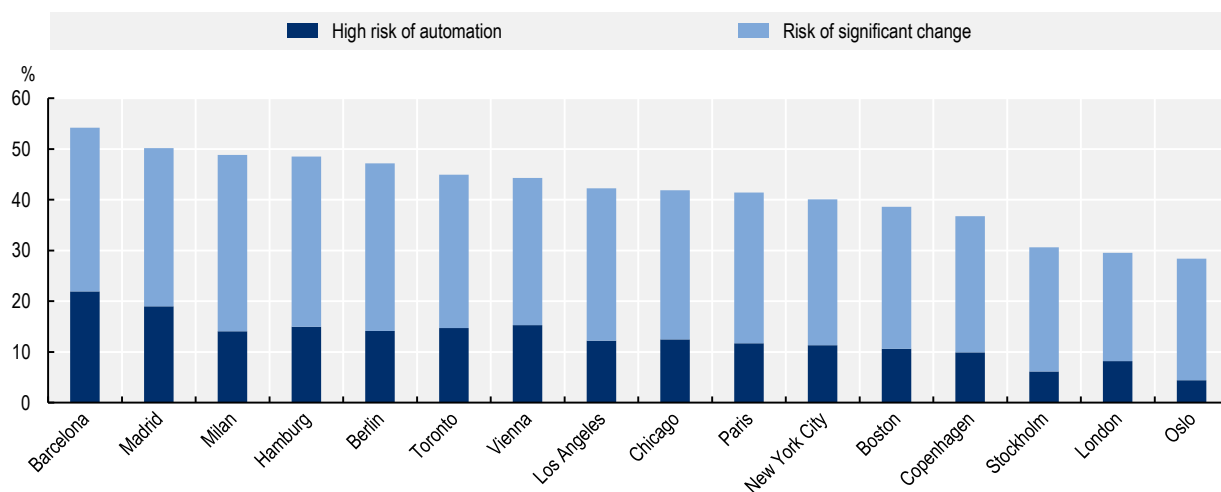
Note: The metropolitan regions are the corresponding TL2 regions. 'High risk of automation' refers to the share of workers featuring a risk of automation of 70% or above. 'Significant risk of change' reflects the share of workers with a risk of automation between 50% and 70%.
Source: OECD Calculations on EULFS and Census data.

Box 3.1. Estimating the risk of automation across OECD countries and metropolitan areas

(Frey and Osborne, 2017[9]) (FO) estimated the number of occupations at high risk of automation in the United States using a two-step methodology. They conducted a workshop with a group of experts in machine learning, whom they provided with a list of 70 occupations and their corresponding O*NET[1] task descriptions. Experts were asked "Can the tasks of this job be sufficiently specified, conditional on the availability of big data, to be performed by state of the art computer-controlled equipment?". This allowed for the coding of each occupation as automatable or non-automatable. FO then used a machine learning algorithm to find out more about the links between the coding to automate and the list of O*NET variables. They were able to identify those variables (and their associated bottlenecks) with higher prediction power. High scores on these bottlenecks are likely to mean that an occupation is safe from automation. They could then compute a "probability of computerisation" for each occupation in the US, leading to the aggregate estimate that 47% of US jobs have a probability of automation of more than 70%.

Table 3.1. Automation bottlenecks

Computerisation bottleneck	O*NET variable
Perception and Manipulation	Finger dexterity
	Manual dexterity
	Cramped workspace; awkward positions
Creative intelligence	Originality
	Fine arts
Social intelligence	Social perceptiveness
	Negotiation
	Persuasion
	Assisting and caring for others

Note: Please refer to (Frey and Osborne, 2017[9]) for further details on the definition of automation bottlenecks.
Source: (Frey and Osborne, 2017[9]), The Future of Employment: How Susceptible are Jobs to Computerisation?

Building on this approach, (Nedelkoska and Quintini, 2018[8]) (NQ) calculated the risk of automation across 32 OECD countries. The approach is based on individual-level data from the OECD Survey of Adult Skills (PIAAC), providing information on the skills composition of each person's job and their skillset. While drawing on FO, this methodology presents four main differences: (i) training data in the NQ model is taken from Canada to exploit the country's large sample in PIAAC; (ii) O*NET occupational data for FO's 70 original occupations were manually recoded into the International Standard Classification of Occupations (ISCO); (iii) NQ uses a logistic regression compared to FO's Gaussian process classifier; (iv) NQ found equivalents in PIAAC to match FO's bottlenecks. PIAAC includes variables addressing the bottlenecks identified by FO, but no perfect match exists for each variable. No question in PIAAC could be identified to account for job elements related to "assisting and caring for others", related to occupations in health and social services. This implies that risks of automation based on NQ could be slightly overestimated.

Table 3.2. Automation bottleneck correspondence

FO computerisation bottleneck	PIAAC variable
Perception and Manipulation	Finger dexterity
Creative intelligence	Problem solving (simple)
	Problem solving (complex)
Social intelligence	Teaching
	Advising
	Planning for others
	Communication
	Negotiation
	Influence
	Sales

Note: Please refer to the source below for further details on the definition of the PIAAC variables.
Source: (Nedelkoska and Quintini, 2018[8]), "Automation, Skills Use and Training", OECD Social, Employment and Migration Working Papers, No. 202.

Recent studies have pointed out the difficulty in predicting the risk of automation, as different models and variables come into play. Frey and Osborne's original examination of the impact of automation on jobs was focused on machine learning and mobile robotics, but these are not the only key technological developments likely to impact the future of skills. Others have identified the rise of various forms of telepresence and virtual/augmented/mixed forms of reality, as well as the expansion of digital platforms as trends that will have important impacts on the future. The inherent unpredictability of technological progress means that within the growing literature, estimates of the jobs at risk of automation can vary widely, and the timeframes within which these impacts are predicted to occur are similarly broad, ranging from 10 to 50 years. Both the shape disruption will take, and its extent, are uncertain. What is certain is that workers will need to learn new skills and develop new competencies to adapt to changes are on their way (Crawford Urban and Johal, 2020[10]).

Source: Based on (OECD, 2020[11]).

Across UK regions, London records the lowest share of jobs at risk of automation. On average, 11.7% of workers face a high risk of automation and another 26.0% work in occupations that are likely to see their task contents and necessary skills changed significantly due to automation (Figure 3.3). In London, the share of jobs at high risk of automation and the share of jobs that will be significantly changed are both lower than in any other UK region. Overall, Northern Ireland and North East England face the highest risks of automation, with a total of 37% and 36% of jobs with either high automation risk or significant change. However, this still places both regions markedly below the OECD average of 46% of jobs.

Figure 3.3. Risk of automation across UK regions

Share of jobs at significant and high risk of automation by UK region (%), 2018
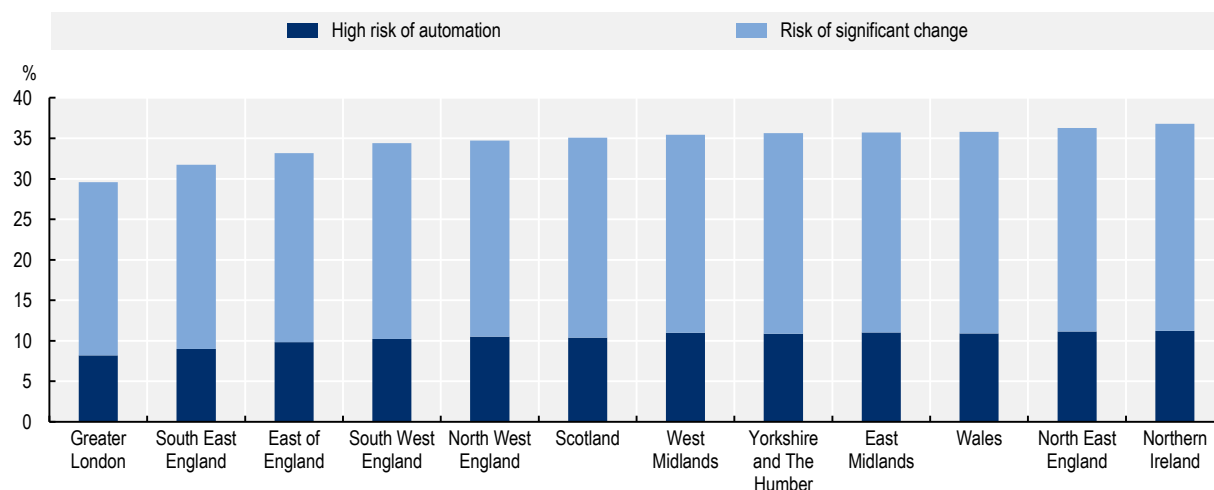
Note: The metropolitan regions are the corresponding TL2 regions. 'High risk of automation' refers to the share of workers featuring a risk of automation of 70% or above. 'Significant risk of change' reflects the share of workers with a risk of automation between 50% and 70%.
Source: OECD Calculations on EULFS and Census data.

Differences in the occupational profile of local labour markets drive the differences in the risk of automation both within the UK and across OECD metropolitan areas. Occupational differences mainly reflect different industrial structures of regions or metropolitan areas. For example, sectors such agriculture, construction, food and beverage services, manufacturing, or transport have a higher probability of losing jobs to automation (Box 3.1). UK regions that face a higher risk of automation than London also tend to rely more strongly on employment in such sectors. Almost 50% of employees in London work in a sector with low automation risks, whereas less than 13% work in high-risk sectors (Figure 3.4). In contrast, in Northern Ireland, the share of employees in industries with high automation risks amounts to almost 28% and is in fact larger than the share of employees in industries with low automation risks. Employees in London face lower risks of automation because many work in occupations and industries that involver fewer routine tasks. For instance, London is the UK region with the largest share of jobs in professional and scientific services, finance, or real estate.

Figure 3.4. Employment share in industries with the lowest and highest risk of automation

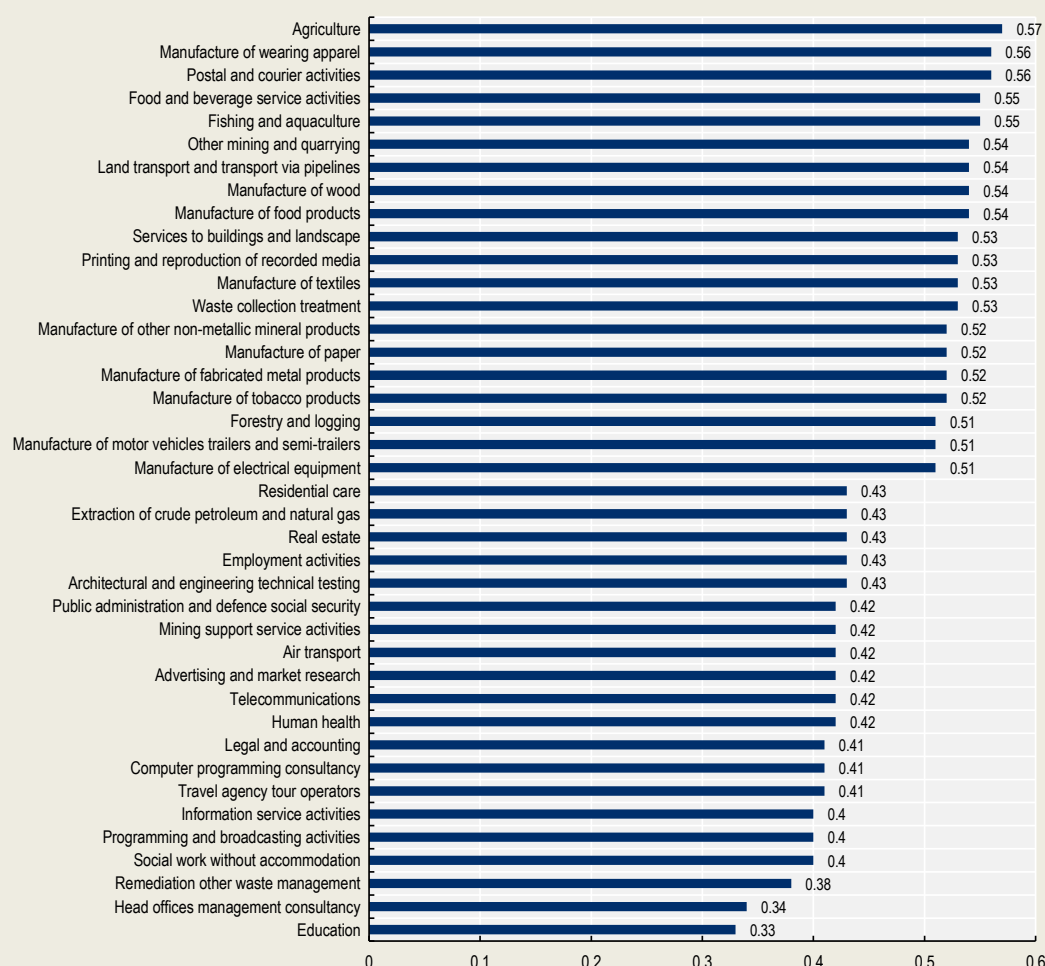Large (TL3) regions of the UK, 2017
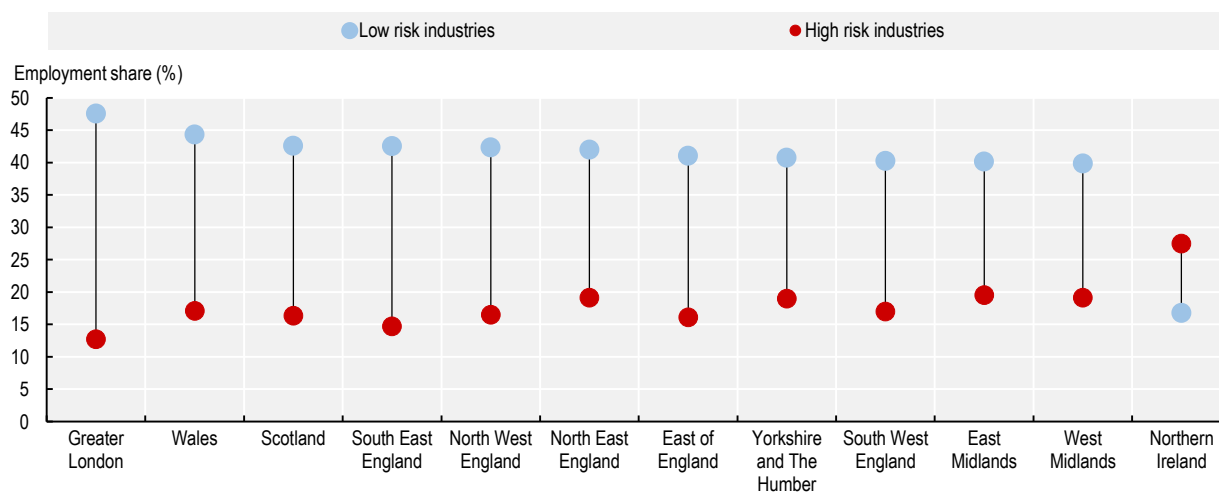
Note: The figure displays the employment shares in the 20 industries with highest average risk of automation and the 20 industries with lowest average risk of automation. Industries are classified according to the ISIC Rev. 4, 2-digit. Automation risks are presented in (Nedelkoska and Quintini, 2018[8]). Box 3.2 presents the top and bottom 20 industries in terms of automation risk.
Source: OECD elaboration based on the OECD.

Box 3.2. Which industries have the highest risk of automation?

The following table presents the 20 industries at highest average risk of automation and the 20 industries at lowest risk. The industries with high risk of automation belong mostly to the primary and the secondary sector. Few service industries face a high risk of automation, though exceptions include food and beverage services, land transport, waste collection and treatment, and services to buildings and landscape. In contrast, almost all industries with relatively low probability of automation belong to the service sector.

Figure 3.5. Mean probability of automation

Note: The figure only includes the 20 industries with highest average risk of automation and the 20 industries with lowest average risk of automation. The classification is ISIC Rev. 4, 2-digit.
Source: Survey of Adult Skills (PIAAC) 2012, 2015; (Nedelkoska and Quintini, 2018[8]).

Vulnerable groups are most exposed to automation risks, potentially leading to greater socio-economic disparities in London

While automation will affect fewer jobs in London than in most OECD metropolitan areas or regions of the UK, it might still aggravate disparities in London's labour market. The threat of automation will affect vulnerable segments of London's population the most. Youths and immigrants face the highest risk of being negatively affected by automation (Figure 3.6). Almost 43% of youths (15-24 year olds) face at least a significant risk of automation, making the young the most vulnerable group in London with respect to the effects of automation that might lead to job losses. Immigrants are the second most vulnerable group, with almost 41% facing significant risks of automation. This contrasts with all adults as well as women in London's labour market, among which 39% and 38% are in jobs that could be automated, respectively.

Figure 3.6. The impact of automation across groups, London

Average risk of automation by population group in Greater London, TL2, 2018
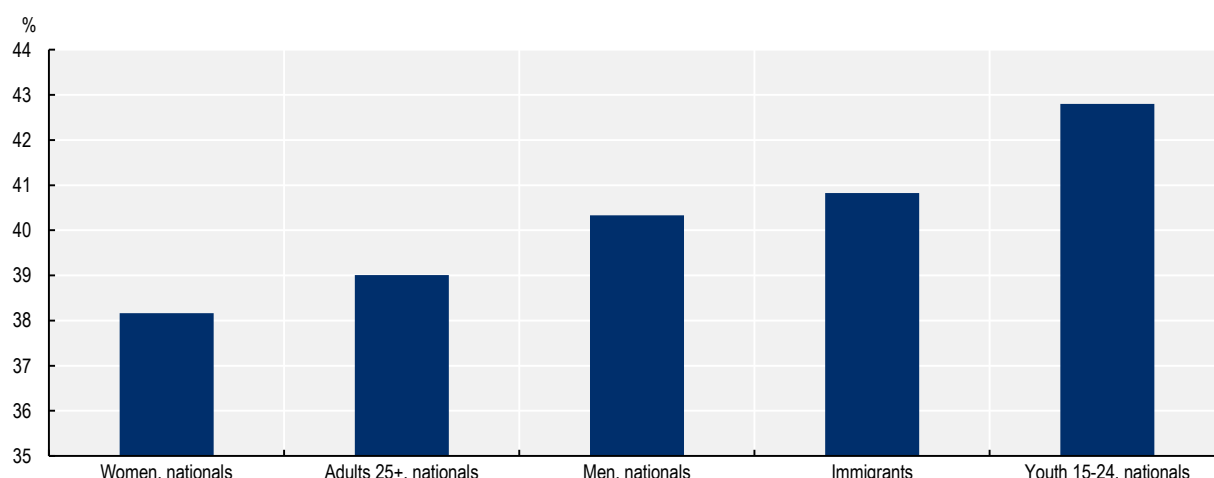
Note: Y axis is cut.
Source: OECD calculations based on Labour Force Survey data.

Low-skill professions make up the largest part of jobs with a significant risk of disruption or replacement by automation. The ten most affected occupations consist predominantly of jobs with low skills requirement and employ more than 260 000 people combined in London (Table 3.3). The two occupations with the highest risk of automation are drivers and mobile plant operators as well as sales workers, each accounting for almost 50 000 employees at risk. Other occupations with large numbers of employees at risk of automation are refuse workers and other elementary workers (26 700), labourers in mining, construction, manufacturing and transport (26 300), numerical and material recording clerks (24 000) and cleaners and helpers (23 800). Among the ten occupations with the greatest numbers of jobs with significant automation risks are only two occupations that predominantly compose high-skill jobs, Legal, Social and Cultural Professionals and Science and Engineering Professionals. However, those occupations record a markedly lower relative automation risk, as only a small share of employees in those occupations are affected.

Table 3.3. Number and % of people with jobs in high risk or in risk of significant change in London, 2018.

Occupation	High risk, % of occupation	Number of employed people in thousands at high risk of job destruction
Drivers and Mobile Plant Operators	33	47.4
Sales Workers	23	47.0
Refuse Workers and Other Elementary Workers	42	26.7
Labourers in Mining, Construction, Manufacturing and Transport	27	26.3
Numerical and Material Recording Clerks	20	24.0
Cleaners and Helpers	26	23.8
Customer Services Clerks	16	23.7
Personal Services Workers	11	17.2
Legal, Social and Cultural Professionals	6	16.2
Science and Engineering Associate Professionals	17	12.1

Note: Top 10 occupations looking at the number of people with jobs in high risk or in risk of significant change, 2018.
Source: OECD calculations based on the European Labour Force Survey data.

Automation risks are much higher for low-pay jobs than it is for high-pay jobs but automation can also generate great gains if workers can access new technology-driven jobs. Estimates by Frey and Osborne point out that automation risks are concentrated on individuals with low earnings. For example, jobs paying GBP 30,000 or less are five times more at risk of automation than jobs paying GBP 100,000 or more (Deloitte, 2015[12]). However, the same analysis also points out that the impact of technology has had delivered broad positive gains. According to 2013 UK earnings data, each new job that was created due to new technology pays approximately GBP 10,000 per annum more than the job it replaces. Helping displaced workers getting into those new, higher-paying jobs is a policy priority and requires support in terms of learning and training opportunities that allow workers to develop the necessary skills, especially given the impact of COVID-19 on low-skilled and vulnerable groups (see Box 3.3 for an example of targeted city policies for vulnerable labour market groups).

Box 3.3. Munich: retraining and career transition support to vulnerable groups

The city of Munich, Germany, established the Munich Employment and Qualification (MBQ) programme to deal with the impact of the COVID-19 pandemic, which has accelerated the move towards digitalisation and increased the need for lifelong learning. To address these changes, the MBQ programme seeks to provide learning opportunities for the workforce and increase job opportunities. The programme aims to assist vulnerable groups such as women, university graduates, migrants and the self-employed in need of re-schooling. The MBQ programme includes retraining offers, facilitating transitions across sectors and strengthening co-operation between the city and companies in the area such as job matching. To adequately address the city's challenges, the MBQ programme has four funding areas with specific target groups:

- Area 1: Reducing long-term unemployment; the target groups are long-term unemployed persons unable to find work, have fewer opportunities and who receive unemployment benefits.

- Area 2: Gender equality at the workplace; the target groups are women who are looking to change careers or who are preparing for self-employment, as well as women who are disadvantaged in the workplace.

- Area 3: Transition from education/higher education to the world of work; the target groups are young people, students, graduates and highly skilled international workers.

- Area 4: Knowledge and expertise development in companies and industries; the target groups are freelancers and entrepreneurs (often migrants) who run small and medium-sized enterprises.

In line with the global digital transition and the growth in healthcare sector opportunities, the MBQ programme is provided online and has incorporated digital skills learning and development for participants. The programme also includes skills development in the nursing sector such as a one-year preparation for nursing training and a two-year-support and training programmes to help promote specialist-nursing assistants.

Source: https://www.muenchen.de/rathaus/home_en/Department-of-Labor-and-Economic-Development/labormarket-policy.html.

Promisingly, recent job creation in London has mostly taken place in occupations with low risk of automation. Since 2011, job creation was concentrated in high-skill occupations that are less vulnerable to automation (Figure 3.7). For example, the number of jobs for business and administration professionals increased by around 150 000. Workers in this occupation are not only high skilled but also face a relatively low risk of automation. Similarly, London's economy created 50 000 jobs or more for teaching professionals or ICT professionals. Encouragingly, those low skill occupations that are more robust in light of automation, such as personal care, fared better than low skill occupations that are highly vulnerable. Overall, these trends leave London's labour market less exposed to the risk of automation compared to most of the OECD. However, the data on job creation also reveal that the low skilled are particularly affected by automation, as little to no growth in employment occurred in occupations that provide employment for people with low levels of educations.

Figure 3.7. Job creation compared to risk of automation in London, 2011-18

Breakdown of job creation by occupation and their average risk of automation
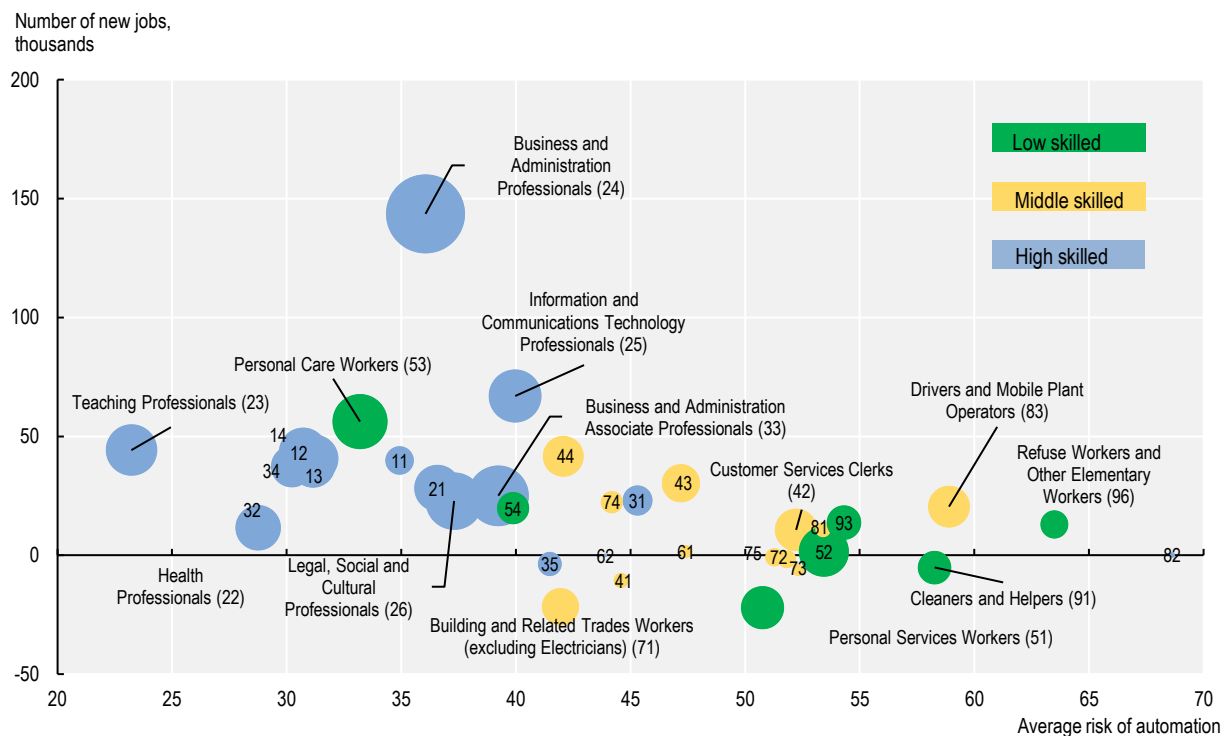
Note: The change in number of jobs in thousands is calculated between 2011 and 2018. Occupations (ISCO-08 code indicated in the bubble) are ranked from low to high risk of automation along the horizontal axis. Changes in the number of jobs for each occupation are reported along the vertical axis. Bubble size represents the share of jobs in the occupation with respect to total employment in the region.
Source: OECD calculations based on EU Labour Force survey data.

Automation and digitalisation make digital skills ever more relevant and London, especially for those groups that are most at risk of redundancy. To enhance employability of vulnerable groups in the labour market, London has started a new programme that aims to enhance digital skills (Box 3.4). Digital skills are essential for people to maximise life's opportunities, work efficiently in a job; and are crucial for ensuring productivity and growth in London's economy. According to estimates of the Department for Digital, Culture, Media and Sport, by 2030, 90% of all jobs will include some level of digitisation, making digital skills more and more important at every level for most workers, ranging from a high street retailer to workers in advanced manufacturing.

Box 3.4. Digital talent programme, London

To improve the quality and quantity of relevant digital skills, London has started a new programme, the *digital talent programme*. It aims to increase the digital skills and employment opportunities of young people, especially for females, disadvantaged groups as well as individuals from black and ethnic minority background (BAME). The programme consists of 10 projects designed to address several inequalities in the sector:

- Under-representation of female workers - just 17% of Tech/ICT workers in the UK are female, only one in ten females are currently taking A-Level computer studies;
- Under-representation of BAME workers - 15% tech workers are BAME; 8.5% senior management are BAME;
- Under investment in educators.

As of October 2020, the programme has exceeded its targets of reaching underprivileged groups. Most of the participating learners move on to a work placement or receive financial and mentoring support to start their own businesses, after completing training on the programme. As part of the programme, London also aims to increase the capacity and knowhow of SMEs in providing apprenticeships, with a stronger focus on digital skills.

Source: https://www.london.gov.uk/what-we-do/skills-and-employment/skills-londoners/digital-talent-programme.

Labour markets in London and other metropolitan areas are polarising, partly reflecting a shift in labour supply

Even before the onset of the COVID-19 pandemic, OECD economies experienced dramatic shifts in their labour markets. Labour markets across the OECD have become increasingly polarised over the last decades. The share of employment in middle-skill jobs has declined strongly relative to jobs with higher or lower skill levels (OECD, 2017[13]). High-skill jobs include managers, professionals and technicians; middle-skill jobs compose clerks, craft and related trades workers, machine operators and assemblers; and low-skill jobs include elementary occupations, service workers, and shop and market sales workers. In almost all OECD countries, job polarisation has been characterised primarily by a shift towards high-skill occupations (OECD, 2019[14]).

Job polarisation is part of the general public concern about growing inequality in OECD societies. Historically, middle-skill jobs were considered to be sufficient for achieving a middle-class lifestyle and offered socio-economic mobility for future generations. In recent years, growth in high-skill occupations has outpaced growth in middle- and low-skill occupations in OECD countries, shifting the overall labour market distribution towards higher-skill jobs. This has led to a change in the relationship between skills and income classes. Consequently, middle-skill workers are now more likely to be in lower-income classes than middle-income classes (OECD, 2019[14]). Furthermore, the wage structure in many OECD countries is now also observing a growing divide between top earners and other, instead of experiencing growth at both ends of the wage structure.

London has benefitted from a decade-long boom in employment, in particular in service sectors with many high skill jobs. Between 2008 and 2017, total employment in London grew by an annual rate of almost 2%, compared to 0.9% in the UK and 0.3% in the Euro Zone (Figure 3.8). This corresponded to the creation of almost 1 million new jobs in London. The two sectors that recorded the fastest employment growth in London were real estate activities and information and communication services, which grew by 4.8% and 4.0% per year, respectively. In total numbers, employment in public administration, education, and health

services grew the most, with more than 250,000 jobs created since 2008. In contrast, employment in manufacturing declined by more than 20,000, corresponding to an annual decrease of 1.5%.

Figure 3.8. Changes in employment by sector, 2008-17

Changes in employment by sector in terms of annual growth rates (left panel) and absolute growth (right panel)
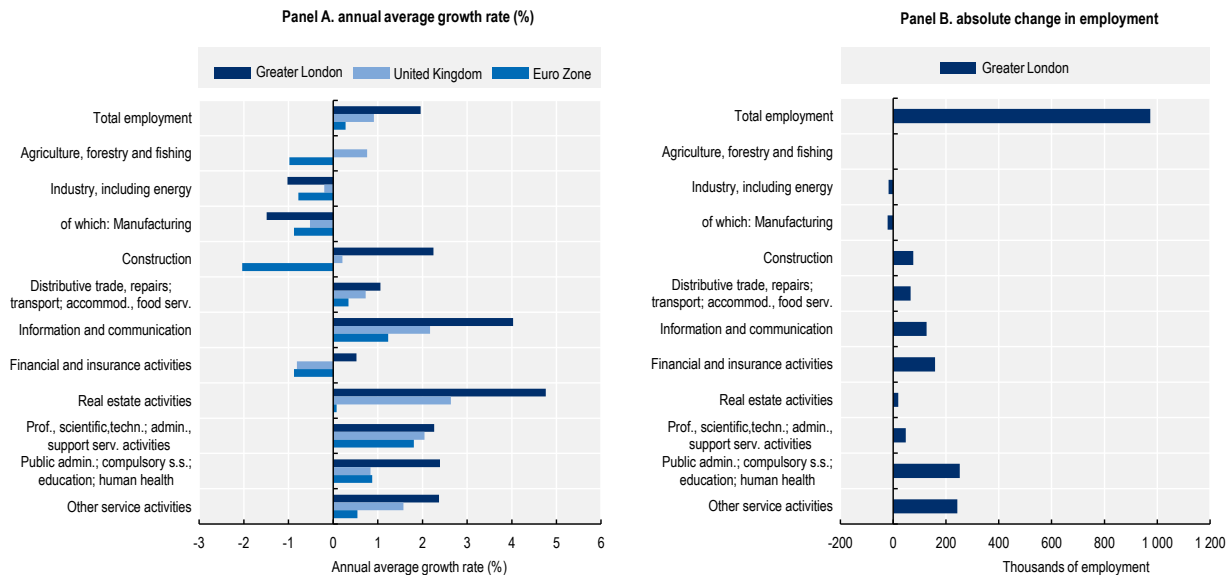
Source: OECD elaboration based on the OECD Regional Database.

Driven by skills-biased technological change, labour markets across the OECD are increasingly polarising. This is particularly noticeable in large cities, which tend to be at the forefront of labour market transformations. Across OECD metropolitan areas, labour markets are increasingly polarising. Overall, middle-skill jobs are rapidly disappearing. All the 17 OECD metropolitan areas considered have lost middle-skill jobs in relative terms since 2000 (Figure 3.9). On average, the share of workers in such jobs decreased by more than 7 percentage points between 2000 and 2018. Almost all of them have replaced them with both high-skill and low-skill jobs, with the former recording the largest relative increase in jobs. In fact, 16 metropolitan areas have mostly replaced middle-skill jobs with high-skill jobs.

Figure 3.9. Job polarisation in OECD metropolitan areas

Relative change in jobs by skill level across London and other metropolitan regions, 2000-18
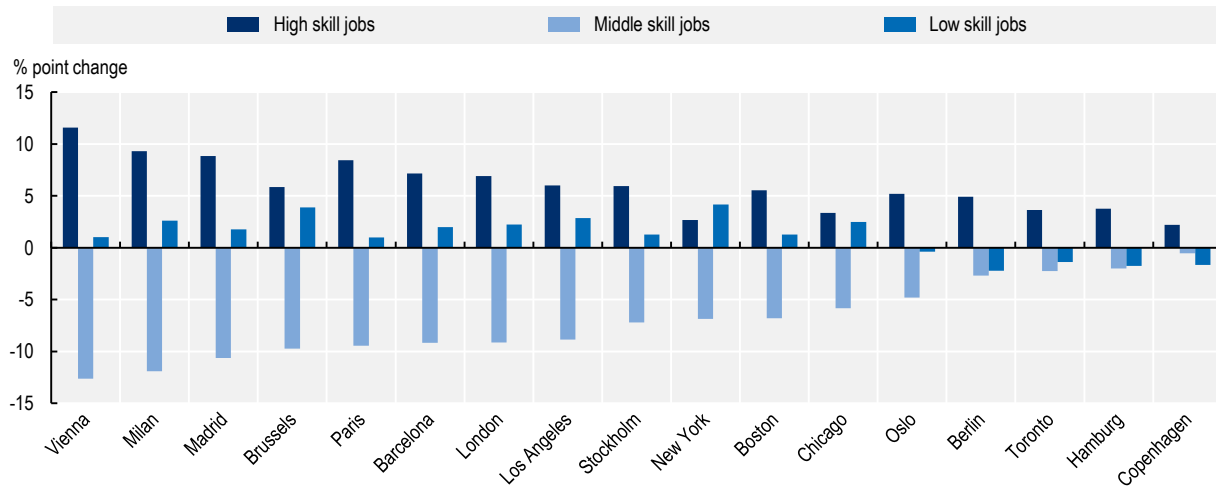
Note: The data correspond to the TL2 regions that compose the respective metropolitan area.
Source: OECD calculations based on Labour Force Survey data.

Middle skill jobs have disappeared in London by more than 9 percentage points since 2000 (Figure 3.9). The loss of middle-skilled jobs was primarily made up for by a significant rise in high-skilled jobs (+ 6.9 percentage points). However, the share of low-skilled jobs also increased by more than 2.3 percentage points. In a context of rising total employment, these changes correspond to increases of 940,000 high-skilled jobs and 349,000 low-skilled jobs, as well as a reduction of 64,000 middle-skilled jobs. Internationally, middle-skilled jobs in London have disappeared at a faster pace than the average rate in OECD metropolitan areas. Nationally, the polarisation of jobs in London is comparable to the UK average.

Technological change drives the disappearance of middle-skill jobs. While Information and Communication Technology (ICT) is believed to complement high-skill jobs, it typically offers a substitute for middle-skill jobs. Instead, technological developments and their capacity to replace routine tasks are drivers of job polarisation, as the impact of technology on jobs varies across the skills distribution. Across industries, occupations, and education levels, digitalisation is linked with reduced labour input of routine manual and routine cognitive tasks. Meanwhile, technological change and digitalisation are associated with an increase in non-routine cognitive tasks (Autor, Levy and Murnane, 2003[15]). As middle-skill jobs, such as clerical and production jobs, often entail routine tasks, they are easier to automate. In contrast, low-skill jobs often also involve non-routine manual tasks, which are more difficult to automate.

Job polarisation in London partly reflects a strong increase in the supply of high-skilled labour. Overall, educational attainment among 25-64 year olds in the Greater London area has shifted to higher qualifications over the last 18 years (Figure 3.10). Between 2000 and 2018, the share of 25-64 year olds with completed tertiary education has risen by almost 18 percentage points from 39.8% to 57.5%. During this period, the share of the adult population who attained only below upper secondary education more than halved, from around 31% to 14%. In contrast, the population share with upper secondary and post-secondary non-tertiary education remained stable.

Figure 3.10. Educational attainment in London over time

Educational attainment among 25-64 year olds in London, 2000-18
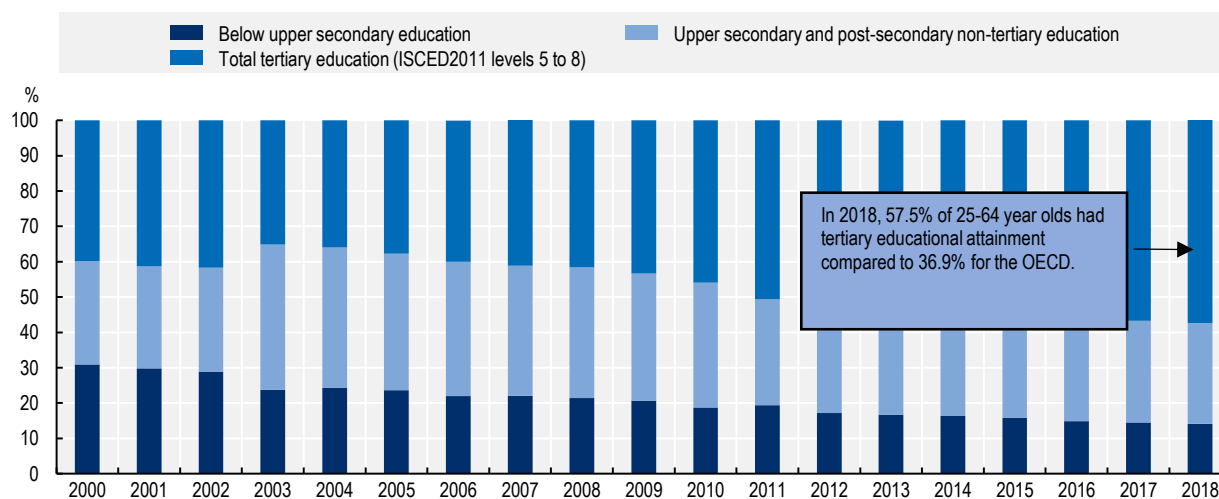
Note: Share of population 25 to 64 year-olds by educational attainment.
Source: OECD Regional Database.

What other challenges and opportunities could have an impact on London's labour market?

Non-standard forms of work can offer flexible work arrangements

Across OECD countries, labour markets have undergone a gradual transition away from traditional open-ended contracts. Instead, non-standard forms of work, including temporary, part-time, or self-employed work, have been on the rise (see Box 3.5 for information on the definition of non-standard work). Technological development and changing consumer preference are two important factors explaining the increase in non-standard work forms. Technological progress has enabled firms to adopt more job flexibility and outsourcing of tasks, including the hiring of temporary help or freelance contractors. Consumer preferences have shifted to more just-in-time delivery and customised services.

While non-standard work offers opportunities to some workers, it also creates new challenges such as a deterioration of working conditions for others. On the one hand, non-standard work arrangements can increase worker flexibility and enhance the compatibility of work and family life, enabling some workers who would otherwise have stayed out of the labour market – especially women – to have a job in the first place. Furthermore, it can be a stepping-stone for young people, allowing them to transition into the labour market and gain experience, which, in turn, can offer other job opportunities later on in life (OECD, 2018[16]). On the other hand, non-standard work might be associated with worse working conditions. Typically, non-standard work reduces job security, increases income volatility, and potentially hampers career progression.

Box 3.5. Defining non-standard work

Non-standard work (NSW) arrangements are defined by what they are not: full-time dependent employment with a contract of indefinite duration – or what is generally considered the "standard" work arrangement. NSW therefore includes:

- Temporary workers - workers in fixed-term contracts, including casual employees (duration is not fixed, but hours can vary), and seasonal workers;
- Part-time workers;
- The self-employed.

While this definition may be considered problematic – as it lumps together precarious and non-precarious forms of work – the convention is followed by a large part of academic research as well as by international organisations. For this reason, this chapter adopts this definition.

An additional challenge lies in the fact that the distinction between different forms of employment has become increasingly intricate. In particular, there is a growing grey area between self-employment and wage employment. The growing numbers of self-employed working for just one company represent a group on the border between two categories. While these blurred lines are at the heart of the current debate on the benefits and downsides of the gig economy, data that allows researchers to settle the debate is scarce

Source: (OECD, 2018[16]),Job Creation and Local Economic Development 2018: Preparing for the Future of Work, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264305342-en; (OECD, 2015[17]), "Non-standard work, job polarisation and inequality", in In It Together: Why Less Inequality Benefits All, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264235120-7-en.

Non-standard work employment has increased in most OECD countries since 2000. Temporary contracts have become more common in OECD countries, especially among young workers (Figure 3.11 Panel A). Compared to 1980, the share of OECD workers under the age of 26 in a fixed-term contract has risen from 17% to 25% in 2016. Moreover, the share of employees in part-time work has also increased significantly (Figure 3.11 Panel B). While a large part of this trend is due to the entry of women into the labour market that historically struggled to combine family and professional life, part-time work has also increased amongst men.

Figure 3.11. Non-standard employment across OECD countries, 2000-16

Share of temporary and part-time work, OECD countries

Panel A. Temporary work

Panel B. Part-time work
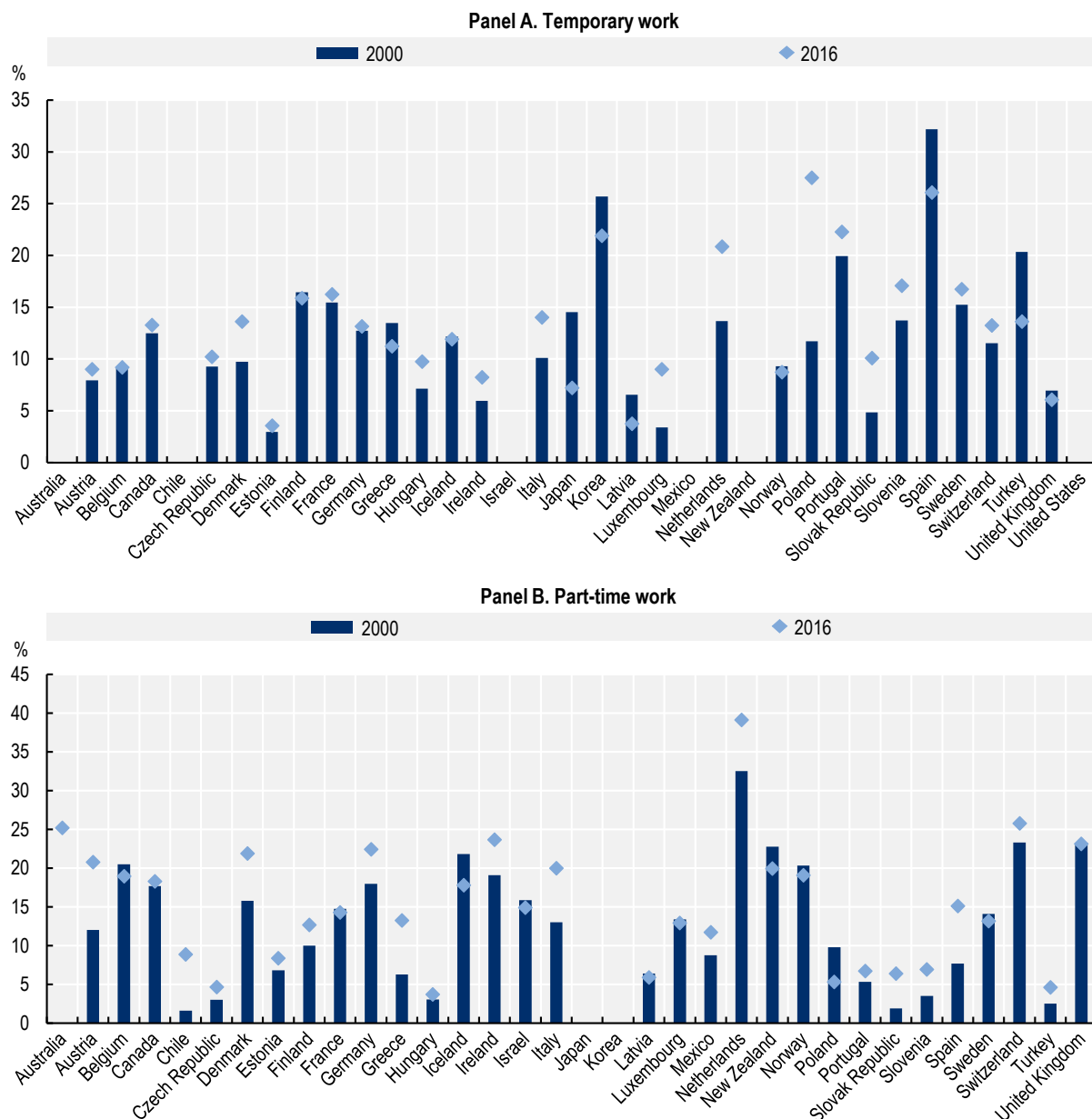
Source: OECD (2018), "Labour Market Statistics: Employment by permanency of the job & Full-time and part-time employment - common definition: incidence", OECD Employment and Labour Market Statistics (database), http://dx.doi.org/10.1787/lfs-data-en.

Part-time work has increased in London, the UK and across the OECD

Non-standard forms of dependent employment (i.e. jobs that are part time or of short duration) represent more than 28% of wage and salary workers in OECD countries. Part-time employment makes up the majority of non-standard dependent employment. Over the past two decades, the share of part-time workers has increased by 2 percentage points and now accounts for 16.5% of all employment. Among the young, non-standard work is even more common and rising faster. In the decade up to 2018, non-standard

dependent employment increased by 5 percentage points among employees aged 20 to 29, mostly drive by a rise in part-time employment (OECD, 2019[18]).

The share of part-time employment varies significantly across regions and countries. In countries such as the Netherlands, Switzerland, Germany, the United Kingdom or Norway, more than 25% of employment is part-time (Figure 3.12). In those countries, women's increases labour market participation partly explains the rise in part-time employment. Women are more than twice as likely as men to work part time and on average, almost one quarter of women – often mothers – work part-time (OECD, 2020[19]). Part-time employment can be an effective means of achieving work-life balance and making family and professional life compatible. However, part-time work often comes with significant disadvantages.

Figure 3.12. Share of part-time work across OECD regions, 2019

% of employment that is part-time – individuals aged 16-64
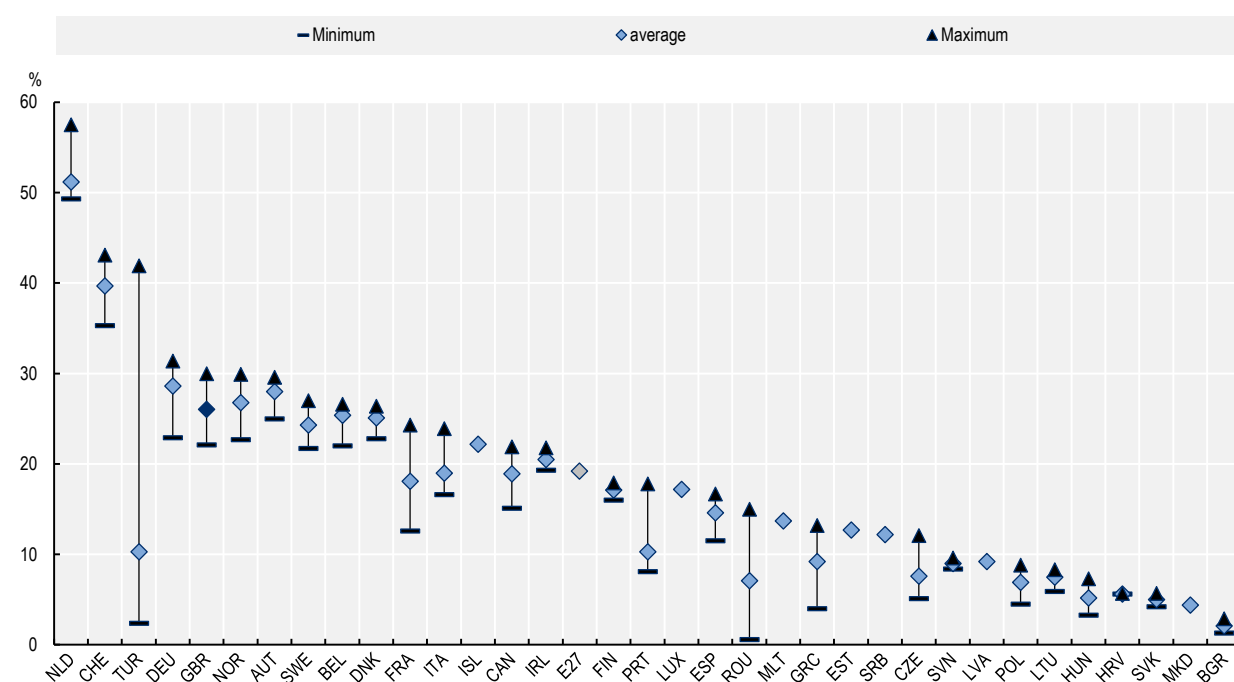
Source: OECD Regional Database, 2020.

Part-time employees face higher job security and tend to earn lower hourly wages in OECD countries (OECD, 2018[20]). Poverty rates tend to be higher for part-time workers than for standard employees. While on average 10% of part-time workers live in a household with an annual disposable income of less than 50% of the national median, this is only the case for 3% of standard employees (OECD, 2020[19]). Furthermore, part-time workers are less likely to participate in training, which has a negative impact on their future earnings. Lower training participation also means that part-time workers are less likely to adapt to the future of work and changing skills requirement. As pointed out in the previous section, automation and digitalisation change labour market needs and skill profiles that employers seek. Part-time workers are less able to react to these developments by using learning opportunities to re-train or up-skill.

In London, part-time employment has been growing but a slower pace than in the rest of the UK. In 2018, 13.4% of employment in London was part time, up from 12.3% a decade earlier. In comparison, UK-wide part time employment rose by more than 3 percentage points in 2008-18, reaching 23.2% in 2018. Overall, London has the lowest share of part-time employment among regions in the UK. The different industry and

occupational structure in London is only part of the explanation of London's lower share of part-time employment. Other factors might help further explain the gap (GLA Economics, 2015[21]). London has the highest childcare costs in the UK, which contributes towards higher opportunity costs from working. Furthermore, direct and indirect costs of travelling to work might also be a factor, with long commuting times being common in London.

Figure 3.13. Changes in part-time employment across UK regions

% in employment in part-time
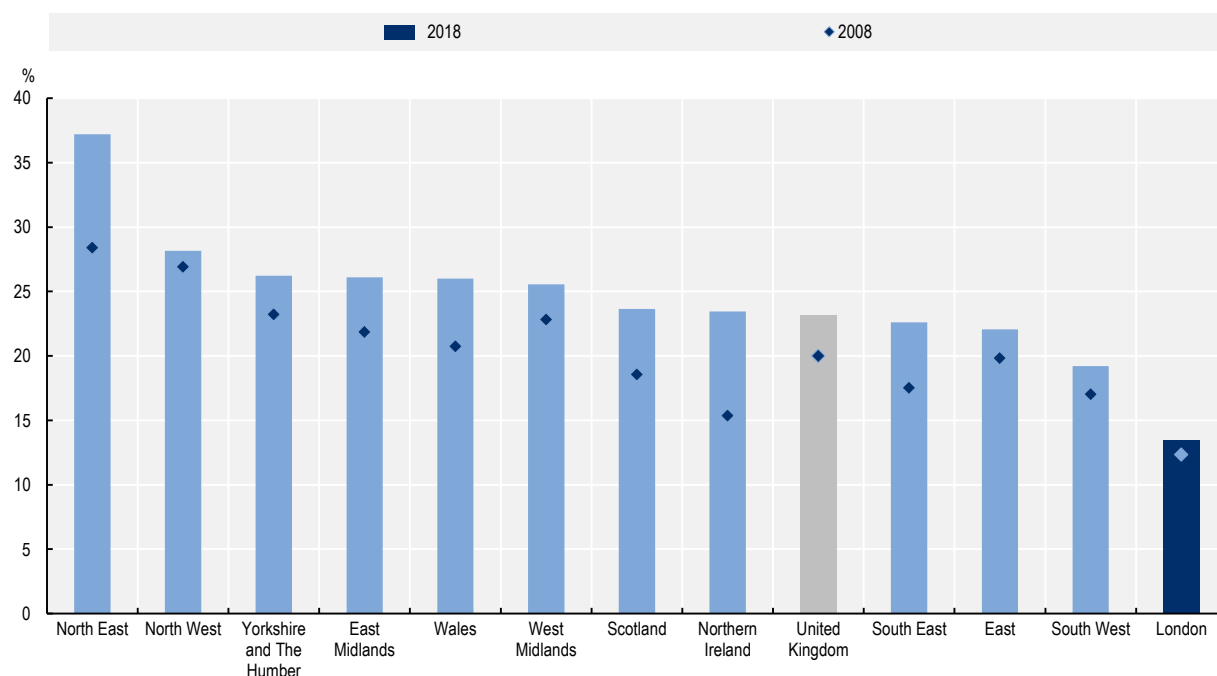
Source: OECD elaboration based on data from NOMIS (NOMIS, 2019[22]).

The number of self-employed are on the rise in London

The emergence of non-standard forms of work poses new challenges to employment regulations, which are mainly designed for traditional employer-employee relationships. Historically, workers' employment status functioned as a gateway to specific rights and social protection (OECD, 2019[18]). With the rise of non-standard work arrangements, many workers risk losing out on those rights and protection mechanisms. Furthermore, non-standard workers tend to have less access to training, which becomes a pressing concern in a world of work that is evolving rapidly as skills needs change and require up-skilling or re-training. These challenges are particularly relevant for the self-employed. The rise of the gig-economy has led to a proliferation of what some people call false self-employment. Individuals work for a company but are officially registered as self-employed, leaving them with limited social protection.

In the UK, London has the highest rate of self-employment and also records the highest increase in self-employed work. Around 14% of UK residents in employment currently work as self-employed. In London, almost 18% of workers are self-employed and their share is rising (Figure 3.14). Between 2004 and 2019, the share of self-employed of London's labour force has increased by 2.5 percentage points. The emergence of the digital economy is one factor that explains the rapid rise of self-employment in London. Some self-employed workers have used the new markets and opportunities the digital economic has created to find high-value added work, e.g. independent professionals, freelancers. However, other self-

employment in the digital economy takes on precarious forms with workers working for one client that is effectively their employer, without benefitting from the benefits of a formal employer-employee relationship including social security or work regulation that protects employees.

Figure 3.14. Changes in self-employment rate across UK regions, 2004-2019

% in employment who are self-employed - aged 16-64
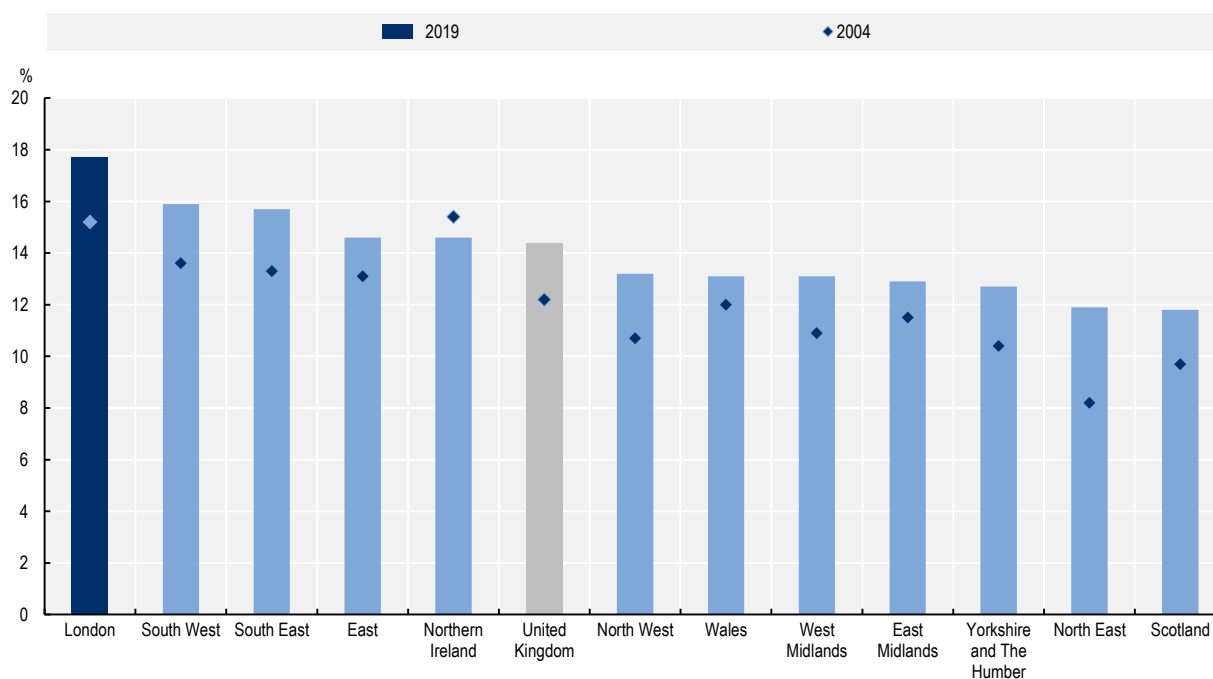
Source: OECD elaboration based on data from NOMIS (NOMIS, 2019[22]).

A boom of the "gig economy" via online platforms drives the rise in self-employment in London and the UK. Driven by new technology platforms, self-employment has become easier and more common, as technology has decoupled jobs from location, allowing people to work from anywhere, any time. Overall, the terms "gig economy" or "platform work" cover a wide range of jobs that are accessed using a laptop, smartphone or other internet-connected device and are found via a website or app such as Uber or Deliveroo. Platform workers offer labour supply for task-based demand for labour. Between 2016 and 2019, the number of people working in the gig economy has doubled in the UK. Nearly 1 in 10 (9.6%) working-age adults surveyed now work via gig economy platforms at least once a week, compared to around 1 in 20 (4.7%) in 2016 (TUC, 2019[23]).

False self-employment poses new challenges in ensuring quality jobs and labour market protection. False self-employment, also called disguised, sham, bogus or pseudo self-employment, refers to working arrangements that are essentially the same as those of employees but firms hire workers as self-employed workers to avoid regulations, taxes and unionisation. Due to its lack of regulation, false self-employment hurts workers as it shifts economic risks onto them. In many countries, including the UK, fiscal and regulatory differences between employment forms drive the deliberate misclassification by employers of workers, thus contributing to the growth in non-standard forms of work. Such misclassification does not only harm workers but also affects public finances due to lower tax revenues. In the United Kingdom, estimates suggest that the self-employed account for GBP 5billion of the GBP 7billion uncollected 'tax gap' for self-assessment income tax, national insurance contributions and capital gains tax combined (Adam,

Miller and Pope, 2017[24]). Consequently, some governments are taking action to combat false self-employment (see Box 3.6).

Box 3.6. Combatting "false" self-employment in the Netherlands

Description: The Netherlands is using regulatory and tax measures to clarify the differences between employees and the self-employed to fight false self-employment.

Problem addressed: Since 2004, self-employed workers submit an Employment Relationship Declaration (VAR) to the Tax Service that describes their work status. Those who hire the self-employed can then assume that the relation is not an employer-employee relationship. Consequently, the hiring company or individual does not have to pay any wages or cover the employee-insurance premiums for services purchased. This offers companies an incentive to work with the self-employed, especially since the self-employed person is held accountable for the accuracy of the VAR. However, this has led to an increase in false self-employment. A second problem that has arisen is that the confusion surrounding VAR-certified workers has led to some occasional conflicting decisions from the tax and social insurance authorities (Westerveld, 2012[25]).

Approach: To combat false self-employment, the government has adopted both short-term and long-term approaches. In the short term, one of the main actions has been to clarify the differences between employees and the self-employed by moving away from the VAR. As of April 2016, the Tax Authority now uses a model contract for the self-employed to help clarify their regulatory obligations and those of the company or individual hiring them *(DereguleringBeoordelngArbeidsrelaties).* This also attempts to remove the incentives for setting up false self-employment arrangements by shifting to a joint-accountability approach where both the employer and employee are legally responsible and accountable. In the longer term, the government is working to increase the attractiveness of hiring employees. Incentives have also been introduced for the self-employed to avoid false self-employment relationships, including the provision of access to a public pension (AOW), exemptions of pension savings in means-tested social assistance, improved access to sectoral training funds and voluntary insurance against sickness and/or disability.

Impact: Many of these measures are still being implemented so the scale and scope of their impact is unclear. However, in the longer term, the government is considering further changes to the tax and social security systems to remove differences in how the self-employed and employees are treated. For example, studies are underway to assess the effects of decreasing tax benefits for the self-employed vs. decreasing labour costs for employees, and increasing social security coverage for the self-employed vs. decreasing social security coverage for employees

Source: (OECD/European Union, 2017[26]).

Non-standard work can provide employment opportunities during the COVID-19 crisis but it might raise challenges in terms of job quality and job security. In times of economic crises, non-standard work can offer flexible employment arrangements as employers hesitate to create new full-time standard employment. Lower costs and greater flexibility can encourage employers to offer non-standard employment in economically difficult periods such as the current COVID-19 pandemic. However, non-standard work can pose challenges with respect to job quality and precarious working condition. During the COVID-19 outbreak, many non-standard workers had to continue working, due to inadequate social protection mechanisms and work regulation. For example, food delivery drivers worked during lockdowns despite often lacking protection against health risks and with little support from platform providers. Workers

in e-commerce, who often also have non-standard work contracts, have encountered increasing pressure and work strain as online retail soared because of social distancing rules.
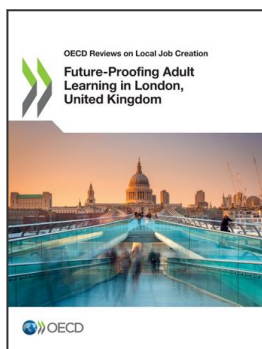
Non-standard workers are more vulnerable to health and economic shocks than standard workers. They are 40-50% less likely to receive any form of income support during an out-of-work spell than standard employees (OECD, 2019[18]). In addition, access to paid sick leave is often limited for non-standard workers. Instead, it relies on voluntary employer provisions that often imply lower coverage in part-time jobs and for employees on short-time contracts. Furthermore, both coverage of many labour law protections and access to collective bargaining are limited for non-standard workers. Recent OECD estimates point out that non-standard workers are also strongly affected by the pandemic as they account for a disproportionately large share of workers in sectors that have been hit hardest. On average across European OECD countries, non-standard workers represent around 40% of total employment in sectors most affected by containment measures (OECD, 2020[27]). The UK government has responded by extending access to sick leave and exceptional income support to non-standard workers. Going forward, the introduction of more permanent social protection schemes for non-standard workers after the crisis might help prevent that a rise in non-standard work forms leads to deteriorating job quality and job security in London and the UK.

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