Global Employment Trends for Youth 2020

Technology and the future of jobs

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International Labour Office · Geneva

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▶ Preface

The ILO Centenary Declaration for the Future of Work, adopted by ILO constituents on the occasion of the Centenary of the International Labour Organization (June 2019), calls upon the ILO to direct its efforts to, inter alia, "developing effective polic ies aimed at generating full, productive and freely chosen employment and decent work opportunities for all, and in particular facilitating the transition from education and training to work, with an emphasis on the effective integration of young people into the world of work". The 2020 edition of the *Global Employment Trends for Youth* seeks to inform the design and implementation of such policies based on an update of key youth labour market indicators and in-depth assessments of trends and issues in the world of work facing young women and men.

The report also comes at a critical juncture. As part of efforts to achieve Sustainable Development Goal 8 to "[p]romote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all", the international community was called upon to, by 2020, (i) substantially reduce the proportion of youth not in employment, education or training (NEET); and (ii) develop and operationalize a global strategy for youth employment. As this report shows, at the start of a new decade, the target to meaningfully reduce the proportion of youth NEET will be missed, highlighting the need to redouble efforts to generate decent jobs for the next generation of workers. Furthermore, youth labour markets around the world face a number of important challenges: the global economy remains sluggish as geopolitical tensions, social unrest and global trade barriers have dragged on growth. Recent epidemics carry the potential to further slow economic activity. These developments are particularly detrimental to youth as their employment prospects, relative to older workers, are more sensitive to economic downturns.

This edition of the *Global Employment Trends for Youth* focuses on the impact of technological advances on youth labour markets. It analyses both opportunities and risks for youth in terms of job destruction and creation, the use of digital technology to improve labour market programmes, and sharing productivity gains. Policy responses to address the potential risks are also explored. I hope this report will be a valuable tool in shaping a future of work with full and productive employment and decent work for all women and men, including for young people.

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▶ Abbreviations

ECLAC	Economic Commission for Latin America and the Caribbean
EPR	employment-to-population ratio
EU	European Union
ICT	information and communications technology
ILO	International Labour Organization
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
LFPR	labour force participation rate
NEET	not in employment, education or training
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
O*NET	Occupational Information Network [United States]
PIAAC	Programme for the International Assessment of Adult Competencies [OECD]
PNMI	Potential Net Migration Index
PPP	purchasing power parity
SDGs	Sustainable Development Goals
STEP	Skills Toward Employment and Productivity [World Bank]
VDAB	Flemish Service for Employment and Vocational Training (Vlaamse Dienst voor Arbeidsbemiddeling en Beroepsopleiding) [Belgium]

▶ Executive summary

**The continuing decline in young people's engagement in
the labour market reflects not only the increasing enrolment
in education but also the persistence of the youth NEET challenge,
especially among young women**

The labour force participation rate of young people (aged 15–24) has continued to decline. Between 1999 and 2019, despite the global youth population increasing from 1 billion to 1.3 billion, the total number of young people engaged in the labour force (those who are either employed or unemployed) decreased from 568 million to 497 million. While this trend reflects growing enrolment in secondary and tertiary education, resulting in a better-skilled workforce in many countries, it also highlights the substantial numbers of young people who are not in employment, education or training (NEET), a large majority of whom are young women.

Although the global youth unemployment rate is 13.6 per cent, there is considerable regional variation, from under 9 per cent in Northern America and sub-Saharan Africa to 30 per cent in Northern Africa. Unemployment is more prevalent among young women in most subregions.

Significantly, young people are three times as likely as adults (25 years and older) to be unemployed. Although this is partly because their limited work experience counts against them when they are applying for entry-level jobs, there are also major structural barriers preventing young people from entering the labour market.

Approximately 41 million young people constitute the "potential labour force", including those who are either available for work but not actively seeking a job (often owing to discouragement) or those seeking but not available to start work immediately (if, say, they are still completing their studies).

Globally, one-fifth of young people currently have NEET status, which means they are neither gaining experience in the labour market, nor receiving an income from work, nor enhancing their education and skills. Clearly, their full potential is not being realized, though many may be contributing to the economy through unpaid work, which is particularly true of young women. Globally, young women are twice as likely as young men to have NEET status. The gender gap is even more pronounced in regions such as Southern Asia and the Arab States, where social and cultural norms prevent women from pursuing education or working outside the house. The youth NEET rate has not decreased significantly in any region since 2005, suggesting that target 8.6 of the Sustainable Development Goals, namely a substantial reduction in the proportion of NEET youth by 2020, will be missed. All these forms of labour underutilization in the early stages of a young person's career can lead to a number of scarring effects, including lower employment and earnings prospects decades later.

**Young workers continue to face high rates of poverty
and are increasingly exposed to non-standard,
informal and less secure forms of employment**

Even among young people who are engaged in employment, their situation is far from satisfactory. Of the 429 million young workers worldwide, around 55 million, or 13 per cent, are suffering extreme poverty (defined as living on an income below US$1.90 per day), while 71 million of them, or 17 per cent, live in moderate poverty (an income below

US$3.20 per day). While the incidence of extreme working poverty among young workers decreased by approximately 20 percentage points between 1999 and 2019 globally, it is still very high in certain parts of the world, notably sub-Saharan Africa and the Arab States. In the Arab States, between 1999 and 2019, the rate even increased sharply by 12 percentage points, reflecting the political turmoil besetting some countries in the region. Moderate working poverty, the incidence of which declined by just 8 percentage points between 1999 and 2019 among young workers worldwide, continues to affect millions of young people in Southern Asia and sub-Saharan Africa.

The poor quality of many jobs held by young people manifests itself in precarious working conditions, a lack of legal and social protection and limited opportunities for training and career progression. The fact that three in four young workers worldwide were engaged in informal employment in 2016 points to the scale of the problem. Informality is most pervasive in subregions such as sub-Saharan Africa and Southern Asia, where it affects close to 96 per cent of employed youth. In these and other subregions, own-account work and contributing family work, both of which are characterized by informality and income instability, remain pervasive. Even in wealthier European countries, which tend to have a high share of wage employment, the prevalence of new forms of work – often less secure forms of employment among young people – has increased rapidly in recent years, admittedly from a very small base, as a result of the expansion of the "gig economy", as discussed in the 2017 edition of the *Global Employment Trends for Youth* report.

Young people across the world are worried that new technologies – particularly robotics and artificial intelligence – may take away their jobs

The current edition of the *Global Employment Trends for Youth* report discusses how the technological advances of the "Fourth Industrial Revolution" present young people with both opportunities and challenges in the labour market. Paradoxically, despite being enthusiastic early adopters of new technologies, young people also tend to worry the most about the possibility of their jobs being replaced by robots and artificial intelligence. In both developed and developing countries, there is widespread concern that such technologies may not lead to the creation of new, better-paying jobs.

Such anxieties are understandable given that the risk of job automation peaks among young workers, who are more likely to be in occupations with a greater proportion of auto-matable tasks. The growing use of industrial robots in the manufacturing sector, in particular, threatens to reduce not only the employment share of middle-skilled workers but also the rate of hiring young jobseekers because firms may not create new vacancies when they experience natural turnovers.

There is a considerable digital divide between generations and regions

In general, younger people (aged 18–35) are more likely than older people (aged 36+) to use the Internet or own a smartphone, which reflects a "digital divide" between generations. Furthermore, younger people in developing countries are less likely to have access to such technologies than their contemporaries in developed countries. In the United Republic of Tanzania, for example, just 30 per cent of those in the 18–35 age group report using the Internet and/or owning a smartphone, compared with 100 per cent in several advanced economies.

Despite the transformations brought about by the Fourth Industrial Revolution, employers' and jobseekers' occupational preferences have remained quite stable ...

The relative stability of occupational preferences among both employers and jobseekers indicates that tasks within occupations are changing and becoming more technology-intensive instead of entire jobs being replaced. The share of entry-level jobs has increased significantly in several developed countries in recent years, suggesting that the destruction of jobs in some sectors due to automation has been offset by a net increase in jobs in other sectors, though the quality of these jobs may not always be high. Across all age groups, jobseekers' preferences have changed, albeit with a time lag, in response to changes in the occupations most sought after by employers.

... though applicants for jobs in most sectors are now expected to have digital skills

The lack of suitable openings for graduates reflects, to some extent, the hollowing-out of middle-skilled jobs in recent years – a trend to which technological change has contributed. On the other hand, survey data from several developed countries indicate that employers are currently seeking to fill more entry-level vacancies in health and social care than in the information technology sector. However, even for these and other non-technical roles, such as customer services and sales, applicants are expected to have computer literacy and a good knowledge of office software. Promoting the acquisition of digital skills alongside lifelong learning can help unemployed workers of all ages to take up new occupations in which more jobs are available.

Vocational training is more likely to lead to employment in jobs that are at risk of automation ...

Young people with vocational training are more likely to be working in an automatable job than those with a university degree. As there are few safe skill-related alternatives to occupations at high risk of automation, young people with lower skills and a vocational background may find themselves having to switch from one precarious job to another and may ultimately end up NEET. This reflects how the occupation-specific skills imparted by vocational training tend to become obsolete faster than the more general problem-solving skills taught at higher education institutions. Vocational training programmes need to be modernized so that young trainees are better able to adapt to the changing demands of the digital economy.

... while young graduates are having trouble finding entry-level jobs that match their qualifications

Although higher education does not provide immunity against the loss of one's job to automation – especially as young people are willing to work in jobs below their qualification level for a while to gain experience – those with degrees are certainly better placed to embark on further studies or training to find a job in a different field.

On the whole, there is a lack of adequate decent jobs for young people

Encouraging young women and men to go to university will not solve alone the problem of youth unemployment. It is important to ensure that university curricula are of high quality and also that there is sufficient demand for graduates' skills.

In recent years, however, the increase in the number of labour force participants with a degree has not been matched by a similar increase in the number of high-skilled jobs. This imbalance between the demand for and supply of university graduates is one of the main factors behind the trend that has seen private financial returns to tertiary education decrease in many countries since the GreatRecession of the late 2000s. It is critical to promote policies that generate decent jobs for young women and men.

The falling returns to tertiary education have dampened wages at the top for youth, influencing wage inequality among them

In most countries, wage inequality is higher among young workers than among prime-age workers, although it has been declining since the global economic and financial crisis. The lessening of wage inequality can be explained by a reduction in the returns to tertiary education, especially among the young. The positive effect of technological change on returns to education has been dampened by the rapid expansion of the graduate labour force, which in most countries has outpaced the demand for graduate labour.

The increase in the demand for skills caused by the emergence of new technologies is welcome, as are the rising levels of educational attainment among young people. Both can drive increases in productivity. However, policy measures are necessary to promote the expansion of job opportunities for highly educated young people so as to balance the expanding supply of graduates. Evidently, markets alone will not do this.

Effective policies are required to ensure that new technologies have a positive impact on youth employment

New technologies are disrupting labour markets across the world by both destroying and creating jobs. An integrated policy framework to support young people in securing decent jobs in this context is critical for future socio-economic progress.

Policies are required to generate a sufficient number of decent jobs to equip young people with the skills required for those jobs, to ensure that they enjoy social protection and have rights at work and to encourage them to join workers' and employers' organizations so that they are represented in tripartite dialogue. Failure to act would mean growing numbers of discouraged young people in many countries, ultimately undermining the socio-economic development of these countries.

Such policies should be part of an integrated strategy to create decent jobs for young people

An integrated policy framework should include interventions at the macro, meso and micro level. For instance, macroeconomic and sectoral policies are required to promote investment in key sectors, as well as in research and development for fostering innovation and creating jobs in new sectors, while raising productivity. This can spur aggregate demand and absorb new labour market entrants. It is also essential to update educational and vocational curricula so that they take into account labour market trends such as the growing importance of digital and soft skills. This would improve the school-to-work transition for young people. Employers' organizations play a key role in this transition because they know which qualifications and competencies young people need to have if they are to be attractive to employers. At the micro level, incentives should be created for young people to engage in technological entrepreneurship.

Prioritizing and sequencing policies for youth employment is critical

While developing the educational attainment and skills of young workers is key to progress, unless such supply-side measures are complemented or matched with demand-side measures for job creation, discouragement among youth can grow.

An integrated approach that includes macroeconomic and sectoral policies for job creation along with redistributive policies would be an effective way of promoting growth. Large-scale active labour market programmes for disadvantaged young people, which are likely to have an expansionary effect on labour demand above and beyond the direct effects on participants, are important in this context.

As is the need for better organization, voice representation and collective bargaining to ensure appropriate wages and working conditions for young workers …

As technological change continues to unsettle the labour market, policy-makers must ensure that young people are protected. This is important not only in developing countries, which tend to have large numbers of young people working in the informal economy, but also in high-income and emerging countries, where an increasing number of young people are engaged in new forms of work, especially in the gig economy. Workers' organizations could play a critical role in supporting young people in diverse employment relationships to organize and bargain collectively so that their rights are respected.

… along with gender-responsive approaches

Labour market policies introduced to harness new technologies for young women and men should also be sensitive to gender imbalances; young women comprise the lion's share of young people who find themselves in the NEET category.

Digital technologies present an excellent opportunity to strengthen employment services and job matching ...

Public employment services, a crucial intermediary between employers and jobseekers, are also being shaken up by new technologies. Globally, such services are increasingly being delivered through digital channels, particularly to young people. Because of the high penetration of mobile phones even in developing countries, digital technologies allow public employment services to overcome limited resources and provide access to hard-to-reach areas, including those living in remote areas.

However, in both developed and developing countries, it is essential to ensure that the digitally illiterate are not excluded: these are often people with little attachment to the labour market, such as the long-term unemployed and NEET youth. Moreover, surveys have found that young jobseekers still greatly value face-to-face contact with career advisers. Therefore, public employment service institutions should combine digital service delivery with traditional counselling based on regular meetings between caseworkers and jobseekers.

... which can help young people to cope better with the demands of the digital economy

The digitalization of public employment services includes the use of "deep learning" techniques and "big data" to make job matching more efficient, which is important not just to cater to the rapidly changing employer demands but also to tailor the services provided to the individual needs of jobseekers, particularly those from vulnerable groups. Digitalization, for example, enables more granular matching on the basis of competencies rather than qualifications. The valuable data collected by public employment services on gaps between jobs and skills among young people can feed into education and training programmes.

Digitalization also facilitates partnerships with private providers of employment services and collaboration with social welfare institutions to integrate hard-to-place young people and the long-term unemployed into the labour market. The adoption of digital technologies by public employment services in advanced economies and some emerging ones has, on the whole, increased the efficiency, transparency and inclusiveness of labour market intermediation. Public employment services are a key partner in helping young people to prepare for the volatile world of digital work.

Social dialogue must include the voices of young people

Tripartite consultation remains the basis of sustainable progress and social justice. It is essential that young people are included and represented in tripartite dialogue on the future of work, ideally as members of decision-making bodies. Young people must have a voice in current policy decisions that are shaping their future.

▶ Global and regional trends in youth employment

The general decline in labour market engagement among young people has continued in the past two years. This is partly because young people are spending more time in education, which is helping ensure that the future labour force will be better skilled and able to cope with the transformations in the world of work brought about by new technologies. However, it also reflects a significant degree of labour underutilization as approximately one-fifth of young people worldwide are not in employment, education or training. Other challenges requiring a strong policy response include persisting gender gaps in the labour market, the prevalence of informal employment, which affects more than three-quarters of young workers, and of working poverty, which affects almost one-third. The fact that millions of young people around the world would emigrate permanently if they had the chance highlights the urgent need for policy-makers to tackle the labour market barriers and precarious conditions at work faced by young people in many countries.

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Chapter 1. Global and regional trends in youth employment

Worldwide, there are approximately 1.3 billion young people between the ages of 15 and 24. Their transition into the labour market has long-term impacts on their lives as well as on the socio-economic development of their countries. It is thus essential to understand their pathways into the world of work and how they are engaging – or not, as the case may be – in employment.

Around 497 million young people, or roughly 41 per cent of the global youth population, are in the labour force (figure 1.1). Of these, 429 million are employed, while nearly 68 million are looking for, and are available for, work (these are defined as unemployed). More than half of young people – around 776 million – are outside the labour force, meaning that they are not in employment and are not looking and available for a job.[1] A considerable proportion of youth are pursuing an education; alongside their studies they may be employed, searching for a (part-time) job and hence considered un-employed, or abstaining from participation in the labour market. A useful broad measure of youth labour underutilization is therefore the number of young people who are not in employment, education or training (NEET), which stands at 267 million – a high figure reflecting how many young people around the globe are currently not contributing to self-development and to national development by acquiring skills or engaging in work.
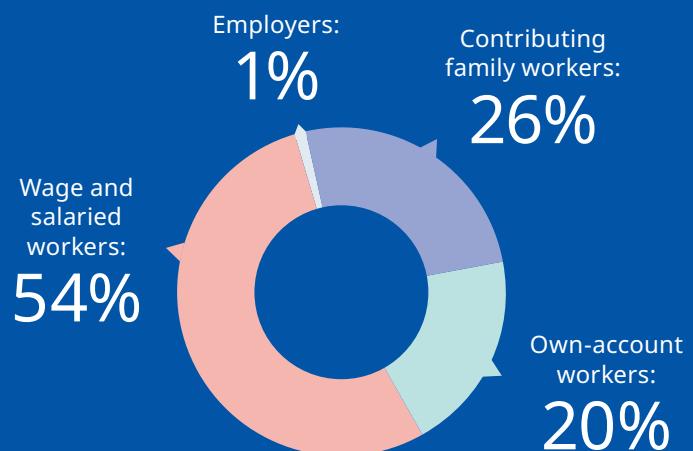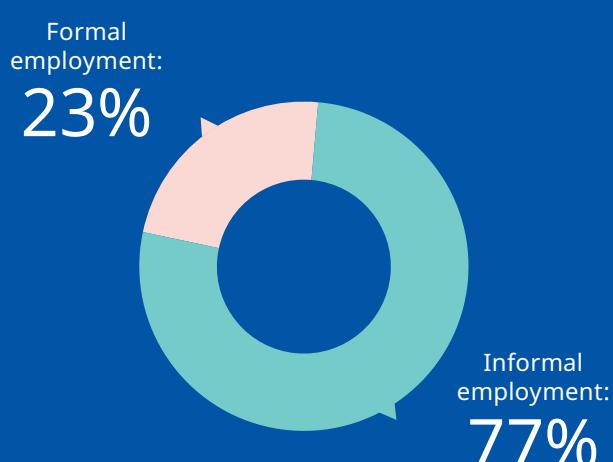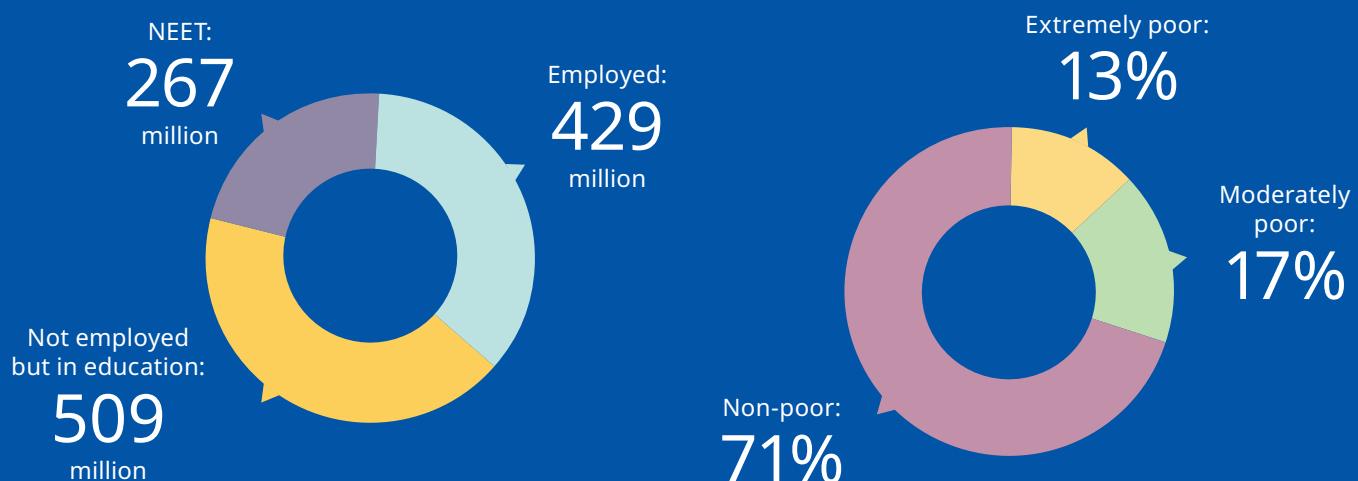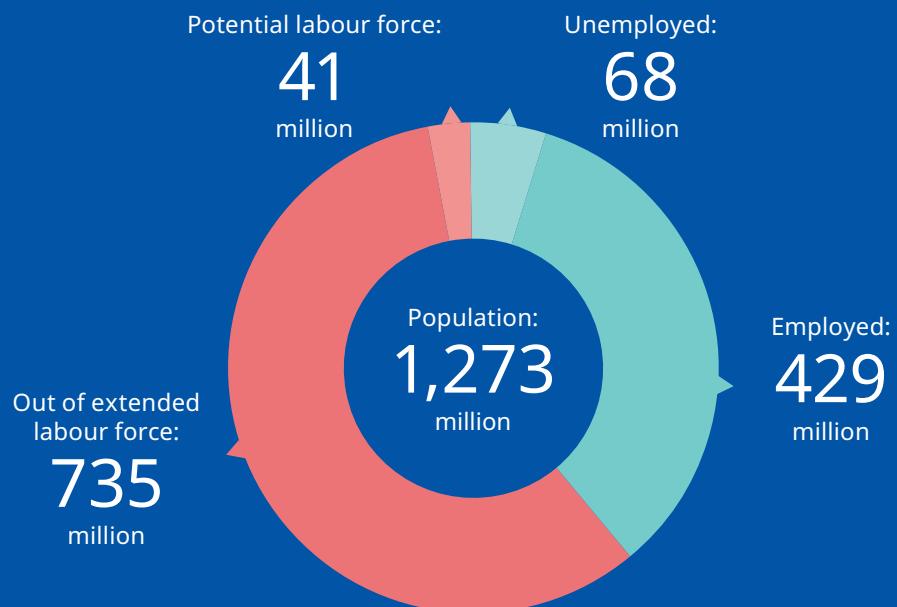
iStock.com/skynesher

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[1] Of these, approximately 41 million are in the potential labour force, meaning that they are either available for a job but not looking for one, or that they are searching but are currently unavailable to take up a job. To be considered unemployed – and thus part of the labour force – a person should both be looking for employment and be available to start work immediately.

Figure 1.1

Overview of the global labour market for youth, 2019

Potential labour force:
41
million

Unemployed:
68
million

Out of extended labour force:
735
million

Population:
1,273
million

Employed:
429
million

NEET:
267
million

Employed:
429
million

Not employed but in education:
509
million

Extremely poor:
13%

Moderately poor:
17%

Non-poor:
71%

Formal employment:
23%

Informal employment:
77%

Employers:
1%

Contributing family workers:
26%

Wage and salaried workers:
54%

Own-account workers:
20%

Note: "Youth" refers to the age cohort between 15 and 24 years. Percentages may not add up precisely due to rounding.

Source: ILO modelled estimates, November 2019; ILO calculations based on ILO harmonized microdata; ILO, 2018a.

Even for young people who are engaged in employment, not all is well. Around 126 million, or 30 per cent of employed youth, remain in extreme or moderate poverty despite having a job. In addition, over three-quarters of young workers are engaged in informal employment. Globally, some 46 per cent of young workers are own-account workers or contributing family workers, whereas nearly 54 per cent are wage and salaried workers, though often in non-standard arrangements. Jobs held by young people are frequently associated with low pay, limited legal and social security and poor working conditions.

The challenges faced by young people have been commanding increasing attention on the global agenda, as reflected in the Sustainable Development Goals (SDGs). Effectively addressing the challenges requires strong labour market information systems (see box 1.1). There is a direct link between decent employment and a dignified livelihood; as new entrants to the world of work, young people are particularly vulnerable (UNDESA, 2018). The kind of jobs that they are able to access – and the point in time at which they enter the labour market – influences not just their individual career and earning prospects but also the development trajectories of their countries. This chapter explores the multiple dimensions of young people's engagement or non-engagement in the labour market.

▶   **Box 1.1**

YouthSTATS: A new database on youth in the labour market

Progress towards the SDGs and better employment outcomes for young people requires strong labour market information systems. The ILO, in partnership with the Mastercard Foundation, is creating a new, regularly updated database called YouthSTATS that contains data on a comprehensive set of indicators related to the labour market situation of young people aged 15 to 29 around the world. The database was first produced by the ILO as part of its partnership with the Mastercard Foundation under the Work4Youth project, which concluded in 2014. As a central repository of international youth labour statistics, the new database will enhance knowledge of youth labour market transitions and facilitate the design of policies aimed at promoting the transition of young people to decent work. Originally composed of youth labour indicators obtained from school-to-work transition surveys, the new version draws on the ILO's stock of harmonized labour force survey microdata, which maximizes reliability and international comparability. Thanks to YouthSTATS, the ILO will be able to provide member States with more targeted technical support in the design of their labour force surveys. Specifically, the ILO will promote the inclusion of survey questions that make it possible to collect data on indicators related to the school-to-work transition.

1.1 The youth labour force participation rate is decreasing globally

Although worldwide about four in ten young people are engaged in the labour force (in other words, either employed or unemployed) (table 1.1), there are marked differences across subregions. Participation is highest in Northern America, at 52.6 per cent, followed by Latin America and the Caribbean and sub-Saharan Africa, at 48.9 and 48.2 per cent, respectively. The lowest rates of youth engagement are seen in Northern Africa and the Arab States, where only about 27 per cent of young people participate in the labour force.

Table 1.1

Youth labour force participation rates (percentages) and gender gaps (percentage points), global and by subregion and sex, 1999 and 2019
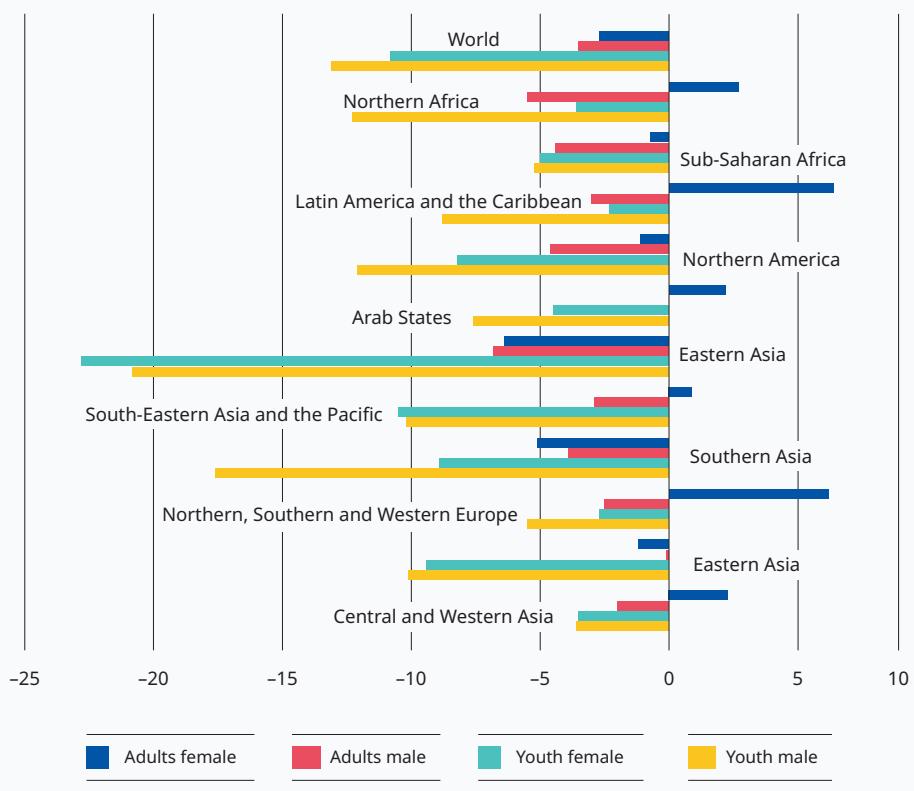
Region	Subregion	LFPR 1999			LFPR 2019			Gender gap (male–female), pp	
		Total	Male	Female	Total	Male	Female	1999	2019
World		53.1	62.2	43.7	41.2	49.1	32.8	18.5	16.2
Africa	Northern Africa	35.4	50.5	19.8	27.5	38.2	16.3	30.6	21.9
	Sub-Saharan Africa	53.3	55.6	51.0	48.2	50.5	46.0	4.6	4.5
Americas	Latin America and the Caribbean	54.3	66.7	41.9	48.9	57.9	39.6	24.8	18.3
	Northern America	62.7	65.1	60.3	52.6	53.0	52.1	4.8	0.9
Arab States	Arab States	33.6	53.3	12.8	27.7	45.6	8.3	40.5	37.3
Asia and the Pacific	Eastern Asia	67.0	67.3	66.6	45.2	46.5	43.8	0.7	2.7
	South-Eastern Asia and the Pacific	57.6	64.7	50.4	47.4	54.5	39.9	14.3	14.6
	Southern Asia	44.9	65.0	23.1	31.6	47.4	14.2	41.9	33.2
Europe and Central Asia	Northern, Southern and Western Europe	47.9	51.6	44.1	43.8	46.1	41.4	7.5	4.7
	Eastern Europe	41.9	45.9	37.7	32.2	35.9	28.3	8.2	7.5
	Central and Western Asia	46.4	56.2	36.4	43.0	52.6	33.0	19.8	19.7

Source: ILO modelled estimates, November 2019.

Despite these disparities, there has been a universal decline in labour force participation rates between 1999 and 2019. The global rate of participation fell by almost 12 percentage points over this period, from 53.1 to 41.2 per cent; the total number of young persons in the labour force declined accordingly from 568 to 497 million, even though during this period the youth population actually rose from 1 billion to 1.3 billion. Both young women and men experienced a decline in labour market engagement around the globe, though the labour force participation rate of female adults increased in many subregions (figure 1.2). Young people may be outside the labour market for various reasons, including education, family responsibilities, sickness or disability and discouragement (believing that there are no jobs available).

Figure 1.2

Change in female and male labour force participation rates, by age group and subregion, 1999–2019 (percentage points)

Adults female   Adults male   Youth female   Youth male

Note: "Youth" refers to persons aged 15–24 and "adults" to those aged 25 and older.

Source: Source: ILO modelled estimates, November 2019.

At 16.2 percentage points, the disparity in the rates of engagement of the two sexes in the labour market is considerable. The participation rate of young women is less than 1 percentage point lower than that of young men in Northern America, while it is over 37 percentage points lower in the Arab States, where only 8.3 per cent of young women are part of the labour force. Some progress has been made in bridging the gender gap in most subregions, as the decline in labour force participation rates among young women has been smaller than that among young men, but much remains to be done if full convergence is to be achieved. Despite significant improvements, the gender gap continues to exceed 20 percentage points in Northern Africa and 30 percentage points in Southern Asia. Although the gap has narrowed substantially in Latin America and the Caribbean, it is still large, standing at 18.3 percentage points. Improvements have also been seen in subregions where labour market outcomes are relatively even for both women and men, such as Northern America and Northern, Southern and Western Europe. By contrast, the gap has widened in Eastern Asia and in South-Eastern Asia and the Pacific.

1.2 The share of young people in employment is also declining

Trends in the share of the working-age population that is in employment, referred to as the employment-to-population ratio (EPR), are similar to those in labour force participation rates. This is because the majority of the labour force is employed, though variations in the EPR also reflect, to some degree, differences in unemployment rates (ILO, 2019).

Globally, 35.6 per cent of the young working-age population was in employment in 2019, down from 46.4 per cent in 1999 (table 1.2). The EPR among adults is almost 1.8 times that of youth, which may partly be explained by the latter group's participation in education. Northern America has the highest youth EPR (47.9 per cent), followed by sub-Saharan Africa (44.1 per cent), while in both Northern Africa and the Arab States the EPR is below 22 per cent. In the last two subregions, the low youth EPR reflects social and cultural norms that restrict young women's access to employment. The global gender gap in the youth EPR was 13.7 percentage points in 2019; however, this masks significantly greater disparities in subregions such as the Arab States and Southern Asia. Nevertheless, the gender gap has narrowed in these two as well as in several other subregions (exceptions include Central and Western Asia, Eastern Asia, South-Eastern Asia and the Pacific, and sub-Saharan Africa).

Table 1.2

Youth employment-to-population ratio (EPR), global and by subregion and sex, and adult EPR, 1999, 2019 and 2023

Region	Subregion	Youth total (%)			Youth male (%)			Youth female (%)			Adults (%) 25+		
		1999	2019	2023	1999	2019	2023	1999	2019	2023	1999	2019	2023
World		**46.4**	**35.6**	**34.6**	**54.2**	**42.2**	**41.0**	**38.4**	**28.5**	**27.8**	**66.0**	**63.2**	**62.1**
Africa	Northern Africa	25.4	19.2	18.7	36.9	28.1	27.9	13.5	9.8	9.1	47.7	47.1	46.9
	Sub-Saharan Africa	47.9	44.1	43.6	49.8	46.3	45.9	46.0	41.8	41.3	76.4	74.0	73.9
Americas	Latin America and the Caribbean	45.3	40.1	39.3	57.5	49.1	48.1	33.2	30.8	30.2	61.9	64.1	63.5
	Northern America	56.3	47.9	45.9	58.1	47.8	45.8	54.4	48.1	46.1	64.7	62.2	60.9
Arab States	Arab States	27.8	21.4	20.7	44.4	36.7	35.4	10.2	4.8	4.6	53.8	55.8	54.5
Asia and the Pacific	Eastern Asia	62.2	40.8	39.1	62.0	41.5	39.6	62.5	40.0	38.4	75.6	68.5	66.3
	South-Eastern Asia and the Pacific	51.5	42.4	41.2	57.8	48.9	47.7	45.0	35.6	34.4	72.3	71.7	70.9
	Southern Asia	38.1	25.7	24.8	55.2	38.5	37.3	19.5	11.6	11.1	60.8	55.7	55.0
Europe and Central Asia	Northern, Southern and Western Europe	38.9	37.3	36.1	42.3	38.8	37.6	35.4	35.7	34.6	53.1	56.3	55.7
	Eastern Europe	32.2	27.4	25.1	35.6	30.6	28.0	28.7	24.0	22.0	56.7	59.8	58.4
	Central and Western Asia	37.7	35.4	34.3	45.9	43.9	42.3	29.5	26.5	25.9	57.1	57.6	56.5

Note: Data for 2023 are projections.

Source: ILO modelled estimates, November 2019.

The youth EPR is expected to decline slightly by 2023 in all subregions, which can be explained by the continued decrease in labour force participation rates among young people (ibid.). For adults, the EPR is also projected to decline in all parts of the world; however, it will remain high relative to 1999 levels in some subregions such as the Arab States, Latin America and the Caribbean, and Europe.

1.3 Youth enrolment in education shows positive trends

The decline in labour force participation rates and employment-to-population ratios among young people can be partly attributed to the longer time spent in education. Currently, there are over half a billion young people engaged exclusively in education. The gross enrolment ratio in secondary education worldwide rose from 59 per cent in 1999 to 76 per cent in 2018; the corresponding ratio for tertiary education increased from 18 per cent to 38 per cent over the same period (UIS, 2019). This suggests that low labour force participation rates could result in a better-skilled adult labour force and possibly higher aggregate participation rates in the future (ILO, 2019).

However, educational enrolment has only a limited influence on variations in youth labour force participation rates across subregions. Although there is a natural decline in educational enrolment with age, and an increase in labour force participation, not all young people leave education at the same age to join the labour market (see box 1.2). In many cases, young people engage in the labour market while still studying – for example, through part-time work, apprenticeships or summer employment. This complex relationship between education and work is shaped by cultural norms and the characteristics of national labour markets and education systems (Eurostat, 2019). The biggest declines in youth labour market engagement have occurred in Asia, where participation is currently below that in Northern America and is on par with that in Northern, Southern and Western Europe. Still, the gross enrolment ratio in tertiary education in Asia remains considerably lower than in those two subregions despite a significant increase, from 14 per cent in 1999 to 46 per cent in 2018, for Eastern Asia and the Pacific (UIS, 2019). In sub-Saharan Africa, the rate of tertiary enrolment doubled during this period, but it still stood at just 9 per cent in 2018.

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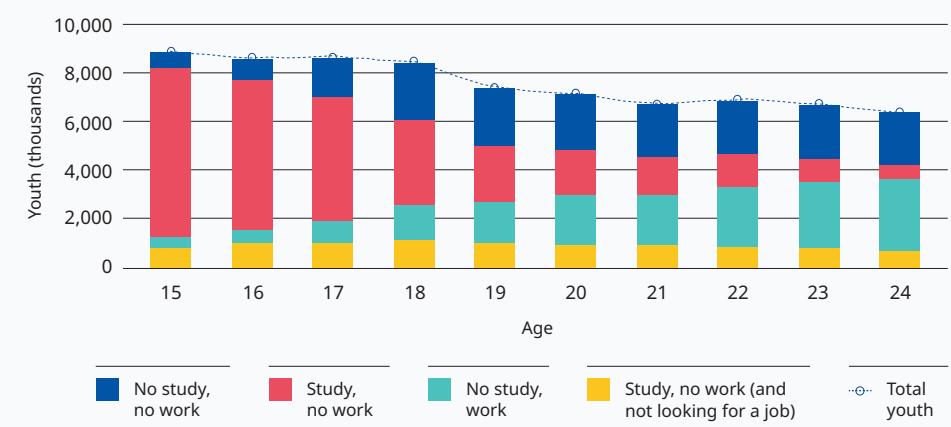
▶ **Box 1.2**

The school-to-work transition for youth in Latin America and the Caribbean

The transition from school to work is neither a simple process nor an irreversible one. Young people combine these two main sources of human capital accumulation across their life cycle, which is illustrated in figure 1.3.

Figure 1.3

Employment and educational status of young people in Latin America and the Caribbean by age, selected countries, 2018 (thousands)

Note: Includes data for 13 Latin American and Caribbean countries, namely Argentina, Plurinational State of Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Peru and Uruguay.

Source: ILO calculations based on national household and employment surveys.

Although most 15-year-olds are still studying and not working, by the age of 24 most young people start working exclusively. The share of youth in the "study, no work" group decreases consistently with age, while that of the "no study, work" group increases in a similar fashion. There are, however, significant differences across households. Young people from households in which the head of the family did not complete secondary school are most likely to start working at the age of 18 (i.e. without pursuing a post-secondary education).
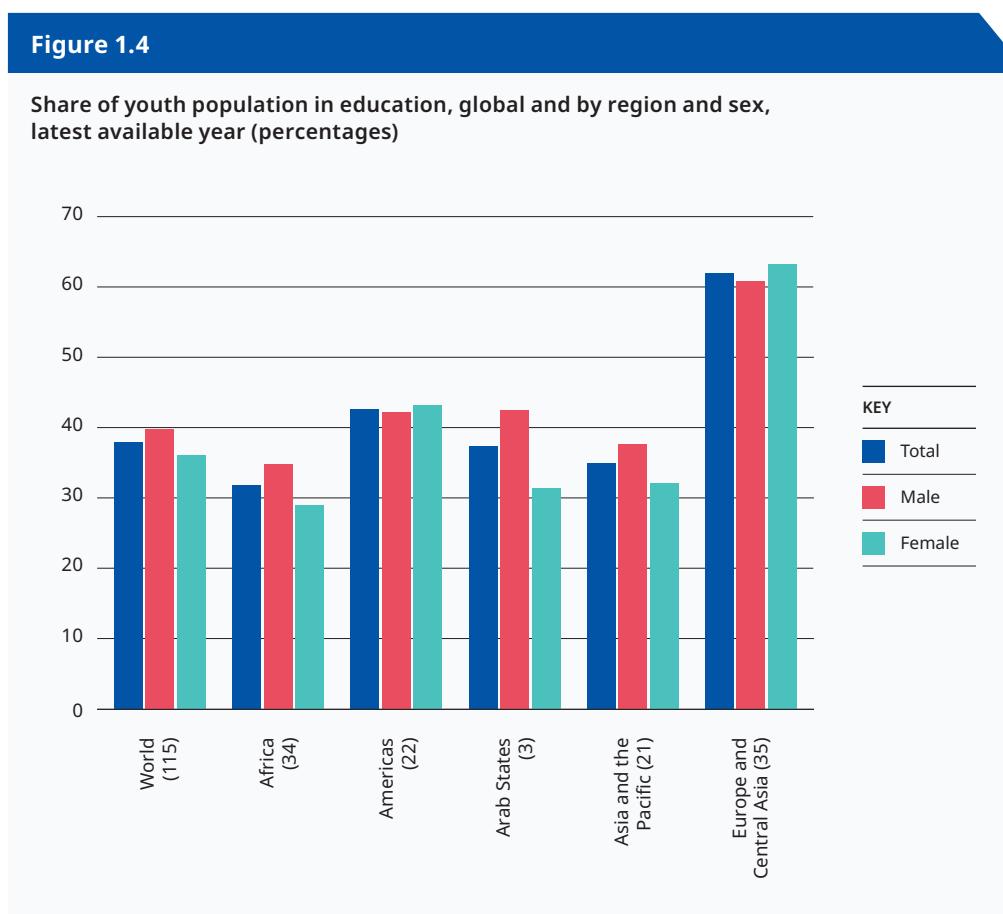
Still, a large proportion of young people aged 18 (the approximate age of completion of secondary school) and over are not in employment, education or training (NEET). In 13 countries of Latin America and the Caribbean, one in four young people between the ages of 15 and 24 has NEET status, with the ratio rising to one in three in the 18–24 age group. There are significant gender differences, with young women making up the majority of NEET youth in Latin America and the Caribbean. At the age of 15, the number of young women with NEET status exceeds that of young men by a ratio of approximately 1.5:1; by the age of 20, the ratio increases to 2:1; and by the age of 24, it is nearly 3:1. This highlights two concurrent challenges in the subregion: youth disaffection and gender inequalities.

Europe and Central Asia has the highest share of young people enrolled in education (around 62 per cent), Africa the lowest (around 32 per cent) (figure 1.4). The widest gender gap in youth enrolment in education was observed in the Arab States (more than 11 percentage points), the narrowest in the Americas and in Europe and Central Asia. In both these regions, the share of young women in education is slightly higher than that of young men (figure 1.4).

Although more girls and young women are in education than ever, gender gaps persist. Young women are less likely than young men to be enrolled in education in most regions, including Africa, the Arab States and Asia and the Pacific. Young women are particularly vulnerable owing to cultural and social norms (young women often enter into early marriage and are perceived mainly as caregivers and as a source of unpaid household labour), gender-based violence and lack of appropriate sanitation facilities, among other reasons (UNESCO, 2019a). Investing in education for young people across the globe and tackling gender gaps are critical for progress towards achieving the SDGs (see box 1.3).

Figure 1.4

Share of youth population in education, global and by region and sex, latest available year (percentages)

Note: The bars show the population-weighted average shares of young people attending education as identified by labour force surveys. The numbers in brackets refer to the number of countries within each region for which data are available; global estimates include 115 countries, accounting for approximately 70 per cent of the global population.

Source: ILO calculations based on ILO harmonized microdata.

▶ **Box 1.3**

**Investing in young people's skills and education
is critical to achieving the Sustainable Development Goals**

The importance of education is highlighted in SDG 4 ("Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"). This goal encompasses various dimensions that are critical to supporting young workers' transition into the labour market and career progression.

Target 4.3: "By 2030, ensure equal access for all women and men to affordable quality technical, vocational and tertiary education, including university."

High-quality vocational education and training (VET) prepares young people for the labour market and addresses the skill requirements of the workplace (OECD, 2016). A 2018 survey of employers in 43 countries found that skilled trades (including electricians, welders and mechanics) and technician roles were among the hardest to fill (ManpowerGroup, 2018). Yet, the rates of participation of 15–24-year-olds in technical and vocational programmes are relatively low, with wide variation across subregions, ranging from 1 per cent in Southern Asia and sub-Saharan Africa to 13 per cent in Central Asia (figure 1.5). In all subregions except for Eastern Asia, young men are more strongly represented in VET programmes.

Target 4.4: "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship."
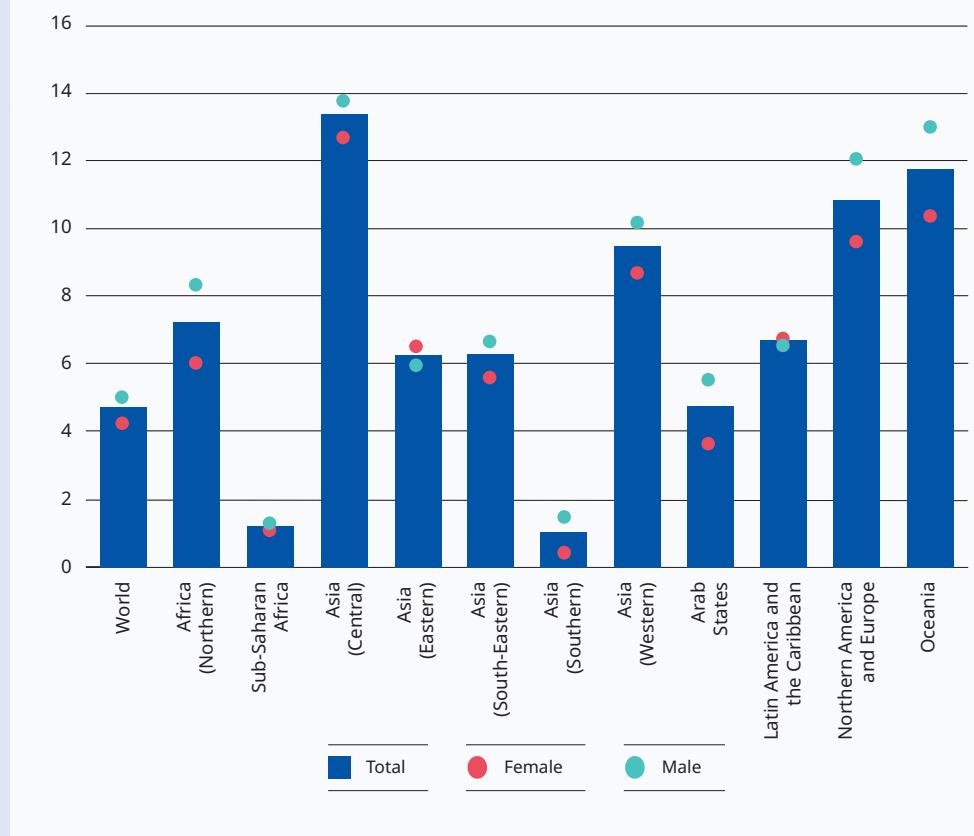
Information and communications technology (ICT) skills are crucial for people to be able to access new opportunities and adapt to the changing labour market requirements in the "Industry 4.0" era. SDG indicator 4.4.1 measures the share of youth and adults with various ICT skills. Unweighted global averages suggest that approximately 55 per cent of young people and adults have copied or moved a file or folder. The share of young people and adults who have prepared electronic presentations using software is just over 31 per cent, while just under 30 per cent have connected and installed new devices (UNESCO, 2019b, tables 10, 11 and 12).*

Efforts to achieve SDG target 4.5 ("By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations") are also critical. As seen earlier, young women lag behind young men in the rate of educational enrolment and are under-represented among those participating in VET programmes. There are also pronounced gender gaps in ICT education and jobs. In the European Union, in 2016, only one in six ICT students was female (Eurostat, 2018). Women are also under-represented among ICT specialists in the labour market: a recent OECD study concluded that men were four times more likely than women to be ICT specialists (OECD, 2018).

* These are unweighted averages based on available country-level data. Data on moving and copying files available for 61 countries; data on electronic presentations available for 62 countries and data on installing new devices available for 35 countries.

Figure 1.5

Share of 15–24-year-olds enrolled in vocational education, global and by subregion and sex, 2018 (percentages)

Legend: ■ Total ● Female ● Male

Note: The regional groupings for the Sustainable Development Goals have been used in this figure.
Source: UNESCO Institute for Statistics.

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1.4 Youth unemployment rates are stable but remain higher than those for adults

Unemployment affects 67.6 million young women and men, or 13.6 per cent of the youth labour force (table 1.3). Youth unemployment is highest in Northern Africa and in the Arab States, at around 2.2 and 1.7 times the global rate, respectively. In these two subregions, youth unemployment rates have been considerably higher than those in the rest of the world since at least 1991, suggesting that there are structural barriers preventing young people from engaging in the labour market (ILO, 2015; UNDESA, 2018). Despite having the lowest unemployment probability across all subregions, young people in sub-Saharan Africa and Northern America faced an unemployment rate of almost 9 per cent in 2019. Hence, there is a general need to help young people enter employment. The global youth unemployment rate is projected to rise by 0.1 percentage point in 2020 and a further 0.1 percentage point in 2021.

Table 1.3

Youth unemployment rates, global and by subregion and sex, 2019–21 (percentages)

Region	Subregion	Youth total (%)			Youth male (%)			Youth female (%)		
		2019	2020	2021	2019	2020	2021	2019	2020	2021
World		**13.6**	**13.7**	**13.8**	**14.0**	**14.0**	**14.1**	**13.0**	**13.1**	**13.2**
Africa	Northern Africa	30.2	29.8	29.6	26.4	25.7	25.3	39.6	39.8	40.3
	Sub-Saharan Africa	8.7	8.7	8.7	8.2	8.3	8.3	9.2	9.2	9.1
Americas	Latin America and the Caribbean	17.9	18.0	18.1	15.2	15.2	15.4	22.0	22.1	22.2
	Northern America	8.8	9.1	9.4	9.9	10.1	10.4	7.6	8.1	8.4
Arab States	Arab States	22.9	23.0	22.9	19.7	19.8	19.6	42.2	42.1	42.5
Asia and the Pacific	Eastern Asia	9.8	10.0	10.2	10.8	11.0	11.1	8.7	8.9	9.0
	South-Eastern Asia and the Pacific	10.5	10.9	11.0	10.3	10.6	10.7	10.8	11.2	11.5
	Southern Asia	18.7	18.8	18.9	18.7	18.9	19.0	18.4	18.5	18.6
Europe and Central Asia	Northern, Southern and Western Europe	14.8	14.8	15.1	15.8	15.6	15.9	13.8	13.9	14.2
	Eastern Europe	14.9	14.4	14.2	14.6	14.1	13.9	15.3	14.8	14.5
	Central and Western Asia	17.8	17.5	17.7	16.6	16.6	17.0	19.7	19.0	18.9

Source: ILO modelled estimates, November 2019.

▶ **Box 1.4**
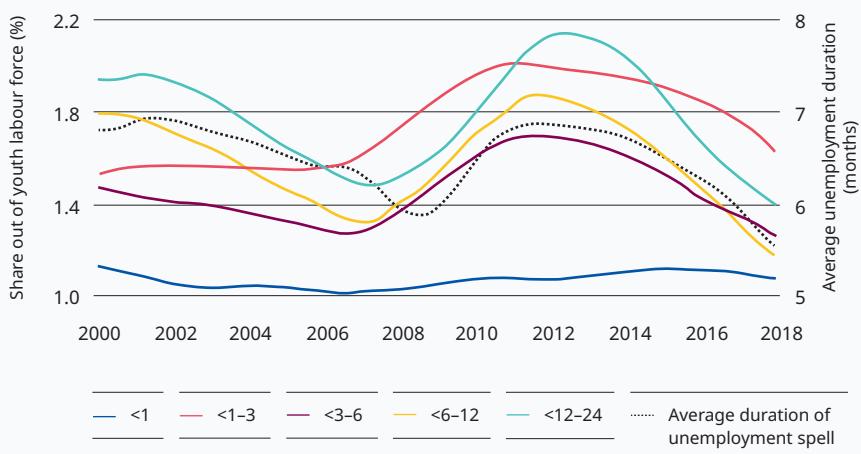
Finding the first job in times of crisis

Following the financial crisis of 2007–08, in Europe, unemployment rates for all durations of unemployment increased among young people (figure 1.6); they then started to decline as the economy recovered. By 2018, the rates of longer-term unemployment had actually fallen below 2007 levels, meaning that young people were less likely to be unemployed for six months or longer. Short-term unemployment rates remain slightly above pre-crisis levels.

The average duration of unemployment spells has decreased since 2012 (figure 1.6), which points to a more dynamic labour market, one in which young people can quickly find a job again after becoming unemployed. On the other hand, they are also potentially employed for shorter periods because of the rise in non-standard forms of employment (ILO, 2017).

Figure 1.6

Youth unemployment rate by duration of unemployment spell (percentages) and average duration of unemployment spell (months), selected countries, 2000–18

Note: The figure shows the share of the youth labour force facing unemployment spells of various durations (in months). The shares are estimated by applying a non-parametric, locally linear mean model to a sample of 19 (mostly European) countries with sufficient data coverage. The average duration of unemployment spell is the weighted average over the various duration groups (for each of these, the duration is taken to be the midpoint of the interval).

Source: ILO calculations, based on quarterly data on unemployment disaggregated by duration from the ILOSTAT database.

Gender gaps in the youth unemployment rate are quite small at the global level and in most subregions; in fact, in four of them unemployment rates for young women are lower than those for young men. Nevertheless, at around 13 and 22 percentage points respectively, the gender gap is very large in both Northern Africa and the Arab States – two subregions that also exhibit large gender gaps in the youth labour force participation rates. These disparities reflect social and cultural norms that limit young women's access to employment in general, and influence perceptions regarding which jobs are suitable

for women. On the whole, though, differences in the total youth unemployment rate across subregions are not driven to a significant extent by differences in the female rate, but by the rates for both sexes, which suggests that general problems related to youth unemployment are the underlying cause. As a result of the lower female youth labour force participation rate, the majority of young unemployed in the world are men, even though the unemployment rate is higher among women.
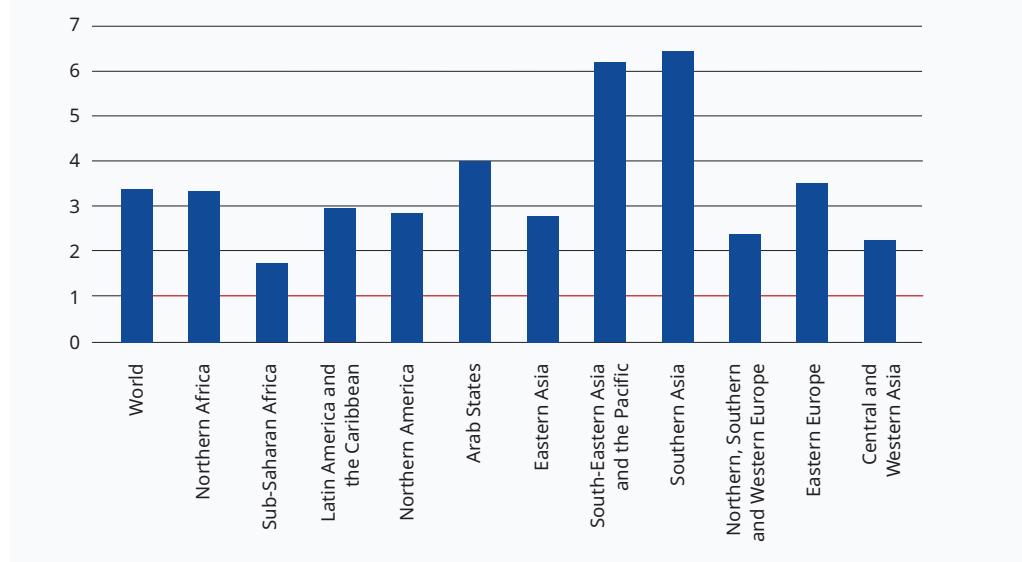
Demographic dynamics are reflected in unemployment trends in some subregions. In Eastern Asia, a contracting youth labour force points to a decline in the number of unemployed young people. In sub-Saharan Africa, a bulging young population and large numbers of youth in the labour market result in growing numbers of young unemployed, despite the stable youth unemployment rate.

Unemployment prevents young people from gaining job experience, with implications for their future employability, productivity and earning potential. Some short-term spells of unemployment are expected of new labour market entrants as they attempt to secure suitable jobs. Long periods of unemployment are of greater concern, given the long-term repercussions they have on young people's lives. In times of economic crisis, young people are particularly vulnerable. Box 1.4 discusses how the Great Recession of the late 2000s has had a lasting impact on how quickly young people are able to secure their first job.

Young people aged between 15 and 24 are three times as likely as adults (25 years and older) to be unemployed (ILO, 2019). This discrepancy is to some extent a result of their limited work experience, which counts against them when they are competing for entry-level jobs. It is also due to the relatively high turnover rate among youth as they attempt to access better positions – those who can rely on their families for financial support may opt for unemployment while searching for jobs that are in line with their aspirations (UNDESA, 2018). At 6.4, Southern Asia had the highest ratio of youth-to-adult unemployment rate in 2019, followed by South-Eastern Asia and the Pacific at 6.2 and the Arab States at 4.0 (figure 1.7).

Figure 1.7

Ratio of youth-to-adult unemployment rate, global and by subregion, 2019

Source: ILO modelled estimates, November 2019.

1.5 The potential of young people is not being fully harnessed

It is important to try to determine the extent to which an economy provides opportunities for harnessing the full potential of young people. The unemployment rate is a measure of the explicit demand for jobs, but it does not capture the entire extent of labour underutilization (ILO, 2018b). There is also untapped labour outside of the labour force. The "potential labour force" captures young people who are neither employed nor unemployed. Today, about 41 million young people are in the potential labour force: they are seeking employment but are not available to start work immediately (e.g. because they are still completing their studies), or they are available but not seeking employment (often owing to discouragement and the belief that there are no suitable jobs). In contrast, unemployed young people are both available and looking for work and are thus part of the labour force despite not having a job. The sum of the unemployed and the potential labour force, an indicator named LU3, can be used as an additional measure of labour underutilization among young people (see table 1.4). Another indicator of the potential of "idle youth" is the share of young people not in employment, education or training, known as the NEET rate.

Table 1.4

Combined rate of youth unemployment and potential youth labour force (LU3), global and by subregion and sex, 2005 and 2019 (percentages)

Region	Subregion	2005			2019		
		Total	Male	Female	Total	Male	Female
World		**18.8**	**17.8**	**20.3**	**20.2**	**19.6**	**21.2**
Africa	Northern Africa	41.5	34.8	55.9	44.2	37.7	57.4
	Sub-Saharan Africa	16.8	15.7	18.0	16.1	14.3	18.1
Americas	Latin America and the Caribbean	23.9	18.9	31.0	26.7	22.3	33.0
	Northern America	13.7	14.9	12.4	10.9	12.1	9.6
Arab States	Arab States	33.5	27.9	52.6	36.1	28.6	65.8
Asia and the Pacific	Eastern Asia	13.4	14.6	12.1	15.1	16.1	13.8
	South-Eastern Asia and the Pacific	20.1	17.5	23.3	17.8	16.3	19.9
	Southern Asia	18.3	17.0	22.0	23.4	23.0	24.8
Europe and Central Asia	Northern, Southern and Western Europe	25.5	24.6	26.6	22.6	23.2	21.8
	Eastern Europe	24.3	23.4	25.5	19.8	19.1	20.7
	Central and Western Asia	24.1	22.9	26.2	24.1	21.5	28.1

Note: Labour underutilization (LU3) is calculated as [(unemployed + potential labour force)/(labour force + potential labour force)] × 100. The values in the table refer to young people aged 15–24.

Source: ILO modelled estimates, November 2019.

1.5.1 Labour underutilization is more prevalent among youth than among adults

The combined rate of youth unemployment and potential youth labour force – the LU3 measure of labour underutilization applied to young people – currently stands at around 20 per cent worldwide (table 1.4).[2] It is lowest in Northern America (10.9 per cent), followed by Eastern Asia (15.1 per cent) and sub-Saharan Africa (16.1 per cent). At the other, high end of the spectrum, it is highest in Northern Africa (44.2 per cent), followed by the Arab States (36.1 per cent) and Latin America and the Caribbean (26.7 per cent). The mismatch between labour supply and demand is more acute for youth than for adults in all subregions. Globally, the share of underutilized youth is three times as high as the equivalent share among adults; this youth-to-adult ratio ranges from 2:1 in Central and Western Asia to more than 5:1 in Southern Asia.

In most subregions, labour underutilization is currently lower than it was in the years immediately before the global economic crisis. It is, however, higher today than that in 2005 in the Arab States, Eastern Asia, Latin America and the Caribbean, Northern Africa and Southern Asia. Labour underutilization affects young women more than young men in all subregions except for Eastern Asia, Northern America and Northern, Southern and Western Europe. In the Arab States, among young women it is more than twice as high as among young men. In Northern Africa and in Latin America and the Caribbean, it is approximately 50 per cent more common among young women than among young men.

1.5.2 Many young women and men are not in employment, education or training
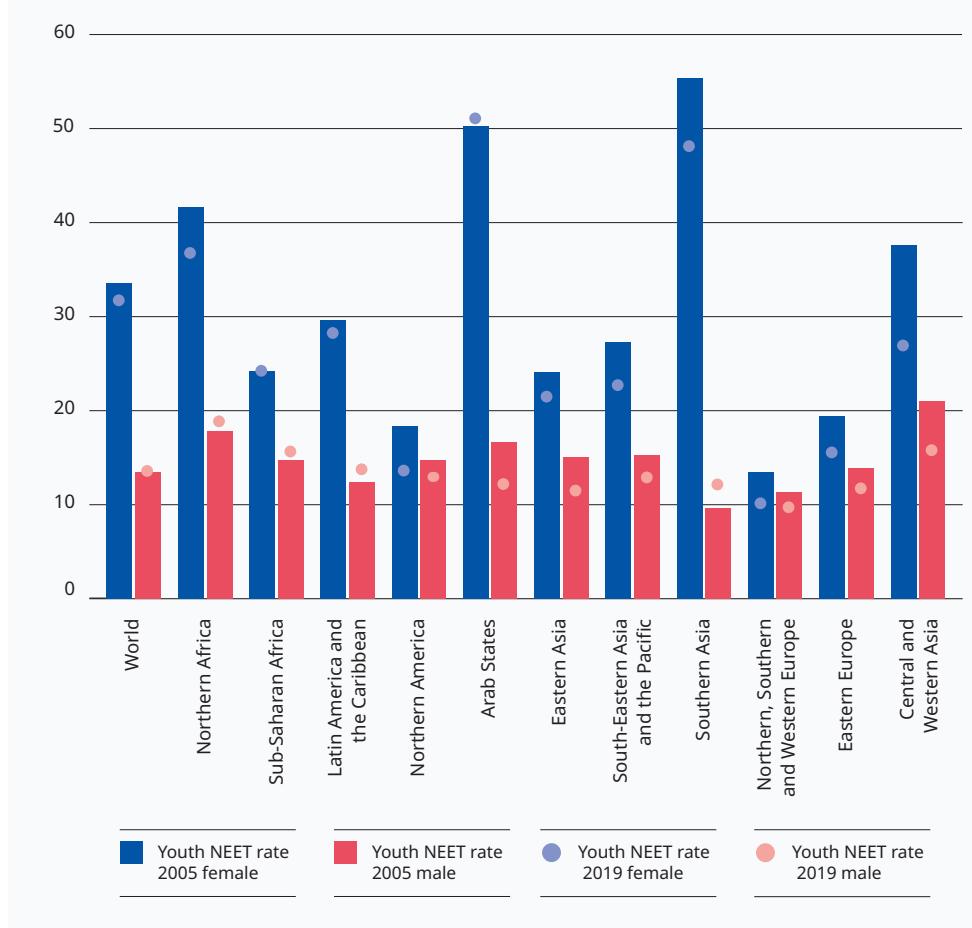
Although the decline in young people's engagement in the labour market is positively associated with enrolment in education, it also reflects insufficient progress in tackling the youth NEET challenge (ILO, 2019). Currently, around one-fifth of young people world-wide, or 267 million, have NEET status.

As a broad measure of youth underutilization, the NEET rate highlights various challenges faced by young people, including leaving school at an early age, discouragement and unemployment. When young people are NEET, they are unable to develop skills that are valued in the labour market, which reduces their future employment prospects and, in the long run, prevents their respective countries from achieving sustained economic growth and greater social cohesion (ILO, 2017). Many young people have failed to secure employment in the past, making them disheartened and leading to a belief that there are no suitable jobs for them. Others do not know how or where to look for jobs. Some are waiting for an opportunity that matches their aspirations, whereas yet others are unable to work owing to illness, disability or family responsibilities. Addressing these concerns, SDG target 8.6 calls for a substantial reduction in the proportion of youth with NEET status by 2020. With the global NEET rate projected to rise from 22.2 per cent in 2019 to 22.3 per cent in 2020 (and further to 22.5 per cent in 2021), it is highly unlikely that this target will be achieved.

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[2] LU3 is defined as the sum of the number of unemployed and the potential labour force divided by the extended labour force (i.e. the labour force plus the potential labour force).

Figure 1.8

Youth NEET rates, global and by subregion and sex, 2005 and 2019 (percentages)

Source: ILO modelled estimates, November 2019.

The global youth NEET rate declined by less than 3 percentage points between 2005 and 2019 for young women and by a mere 0.5 percentage point for young men (figure 1.8). The NEET rate has so far not decreased substantially in any subregion, with the exception of a 10 percentage point drop for young women in Central and Western Asia. Moreover, the global NEET rate for young women (31.1 per cent) is still more than double that for young men (13.9 per cent). The gender gap is especially wide in the Arab States and Southern Asia, where young women are between three and four times more likely than young men to have NEET status.

As young people with NEET status are a diverse group, the issues they face differ, as do the policies required to tackle these issues. Because many are not looking for work, this detachment from the labour market can reduce their likelihood of accessing decent employment in the future. By contrast, those who are unemployed are actively trying to gain a foothold in the labour market. Therefore, it is worrying that young women are more likely to have NEET status owing to the fact that they frequently remain inactive because of household and care responsibilities (Elder and Kring, 2016). This may also reflect cultural attitudes to women working. Almost three-quarters of currently inactive (non-student) young women worldwide expressed a desire to work in the future. In the Middle East and Northern Africa, however, this share was less than one-third, while in the other subregions it was more than two-thirds (ibid.).

1.6 Employment quality challenges persist

One in three young people worldwide, or 429 million, are employed. In theory, employed youth are gaining valuable work experience and practical skills that should set them on the path to a successful career and a bright future. In practice, however, many young workers engage in jobs of poor quality in order to survive. These young people are often engaged in jobs characterized by precarious working conditions, instability, a lack of legal and social protection and limited opportunities for training and career progression.
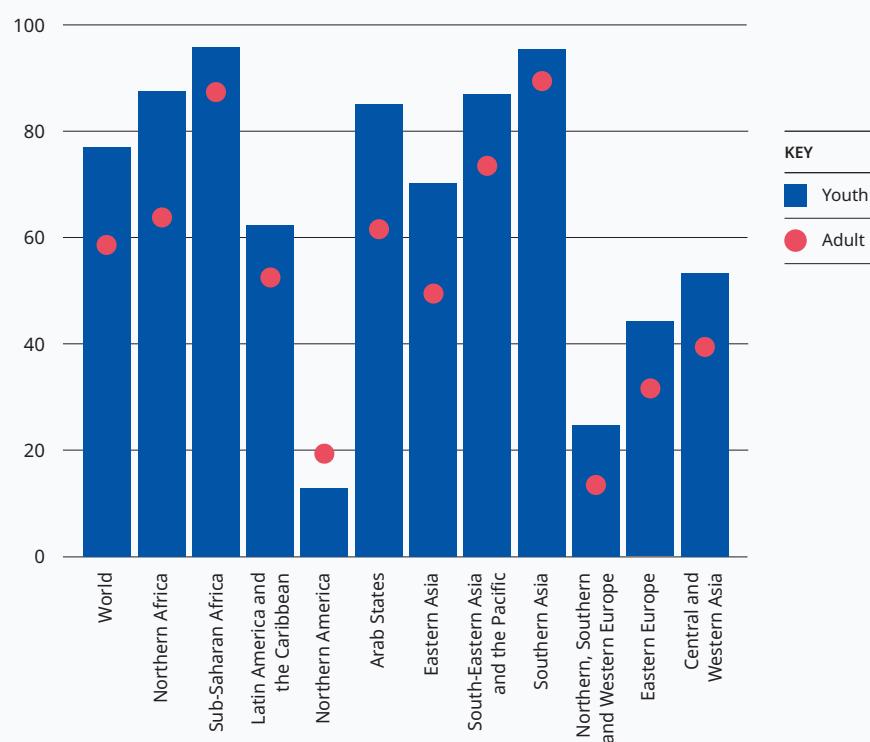
1.6.1 Informal employment is widespread among young people

Globally, more than three in four young workers had informal jobs in 2016 (figure 1.9). Though informality is comparatively less pervasive among employed adults, at 59 per cent, the rate is still quite high. Informal employment is rarely a choice despite being widespread. In most cases, informality is a necessity arising from the lack of opportunities in the formal economy and from weak mechanisms of social protection (Elder and Kring, 2016). Many young people are unable to achieve the transition from informal to formal arrangements and from the informal to the formal sector.

Informality is the rule for young women and men in sub-Saharan Africa and Southern Asia, where, in 2016, it affected more than 95 per cent of employed youth (see box 1.5 on informality in the Southern African Development Community). In the Arab States and Northern Africa, 85.1 and 87.5 per cent of working youth, respectively, were in informal employment in 2016, 24 percentage points more than working adults. Informality is much less widespread, but still significant, in Northern America and Northern, Southern and Western Europe, where it affected, respectively, 12.8 and 24.7 per cent of employed youth in 2016.

Figure 1.9

Youth and adult informality rates, global and by subregion, 2016 (percentages)

KEY
- ■ Youth
- ● Adult

Source: ILO, 2018a.

▶ **Box 1.5**

Informality in the Southern African Development Community

In some countries, including those in the Southern African Development Community (SADC), many young people are employed in informal production units. In particular, most agricultural employment (37–99 per cent) occurs in such units (table 1.5).

In several SADC countries, many young people are employed in agriculture. In the last year for which labour force survey data are available, for example, 55 per cent of young workers (aged 15–24) in the Comoros and 81 per cent in Madagascar were employed in that sector

Table 1.5

Share of informal employment (based on production unit), by industry and country, latest available year (percentages)

	AGO	COD	MDG	MUS	MOZ	NAM	TZA	SYC	ZAF	SWZ	ZMB	ZWE
Agriculture	99	99	98	–	87	82	99	65	73	37	75	45
Mining and quarrying	15	94	72	–	69	37	87	–	9	62	5	28
Manufacturing	58	91	75	44	88	63	61	13	36	23	46	42
Food, beverages and tobacco	–	92	80	51	87	67	40	5	–	25	36	9
Textiles and wearing apparel	–	92	51	35	90	71	70	9	–	25	86	58
Wood and paper	–	90	93	19	91	66	64	30	–	35	67	45
Coke, refined petroleum products and nuclear fuel	–	65	–	–	–	43	–	–	–	–	0	12
Chemicals, chemical products and pharmaceutical products	–	66	0	10	42	63	37	0	–	–	35	2
Rubber and plastic products	–	17	0	19	49	68	16	–	–	0	0	0
Non-metallic mineral products	–	97	100	32	95	58	74	0	–	0	72	85
Metal products	–	79	75	57	76	62	45	25	–	28	25	23
Electrical and other equipment and machinery	–	97	100	9	62	52	23	–	–	0	9	33
Transport equipment	–	84	49	0	57	45	74	–	–	–	26	19
Other manufacturing and recycling	–	95	73	66	88	69	75	43	–	10	64	51

Note: AGO = Angola (latest available year: 2011); COD = Democratic Republic of the Congo (2012); MDG = Madagascar (2015); MUS = Mauritius (2017); MOZ = Mozambique (2015); NAM = Namibia (2012); TZA = United Republic of Tanzania (2014); SYC = Seychelles (2018); ZAF = South Africa (2018); SWZ = Eswatini (2016); ZMB = Zambia (2017); ZWE = Zimbabwe (2011).

(table 1.6). The share of agriculture in employment among youth and young adults (aged 15–34) is comparatively smaller, highlighting the role of agriculture in absorbing labour market entrants until they transition to employment in other sectors (including, as is often the case, low-productivity services). Nevertheless, in the last year for which data are available, at least two-thirds of youth and young adults in Madagascar, the Democratic Republic of the Congo, Mozambique, the United Republic of Tanzania and Zimbabwe, and approximately 50 per cent in Angola, were employed in agriculture. Youth and young adults constituted approximately 50 per cent of the agricultural workforce of these countries, with young women accounting for over half of this group of workers.

	AGO	COD	MDG	MUS	MOZ	NAM	TZA	SYC	ZAF	SWZ	ZMB	ZWE
Electricity, gas and water	15	18	7	5	21	39	10	7	5	4	3	0
Construction	61	87	79	69	87	73	78	48	60	51	60	64
Wholesale and retail trade	86	93	73	45	93	66	66	21	59	38	68	65
Hotels and accommodation	22	90	44	31	62	66	75	10	59	30	29	49
Transport	60	64	38	45	74	51	44	16	43	42	45	24
Information and communications technology	2	38	54	11	31	23	9	11	–	0	2	12
Finance and insurance	12	61	7	6	26	26	7	1	14	16	2	1
Real estate	0	87	31	12	55	75	70	12	–	16	77	9
Professional and business services	18	60	38	20	42	46	19	19	36	15	23	9
Public administration	1	4	0	5	0	10	3	1	1	5	1	0
Education	1	5	2	19	4	10	3	2	6	8	5	4
Health and social services	7	31	22	10	37	18	17	10	23	20	7	8
Private households	76	–	–	–	100	83	100	41	100	42	15	16
Other services	52	80	87	52	89	66	56	20	40	47	68	60

Source: ILO calculations based on labour force surveys.

Table 1.6

Youth employment in agriculture, latest available year (percentages)

	Agriculture's share of employment by age group		Age group share of agricultural employment		Female share of youth and young adult employment in agriculture
	Youth (ages 15–24)	Youth and young adults (ages 15–34)	Youth (ages 15–24)	Youth and young adults (ages 15–34)	
AGO	60	50	29	49	56
BWA	31	20	18	38	26
COM	55	47	14	35	52
COD	72	70	21	47	61
MDG	81	77	29	51	49
MUS	5	5	6	21	21
MOZ	74	70	27	50	61
NAM	17	14	11	33	30
SYC	9	3	20	39	39
ZAF	7	6	10	42	33
SWZ	16	11	14	39	45
TZA	76	67	29	51	50
ZMB	31	24	22	50	39
ZWE	78	67	35	57	50

Note: AGO = AGO = Angola (latest available year: 2011); BWA = Botswana (2009); COM = Comoros (2012); COD = Democratic Republic of the Congo (2012); MDG = Madagascar (2015); MUS = Mauritius (2017); MOZ = Mozambique (2015); NAM = Namibia (2012); SYC = Seychelles (2018); ZAF = South Africa (2018); SWZ = Eswatini (2016); TZA = United Republic of Tanzania (2014); ZMB = Zambia (2017); ZWE = Zimbabwe (2011).

Source: ILO calculations based on labour force surveys.

iStock.com/rvimages
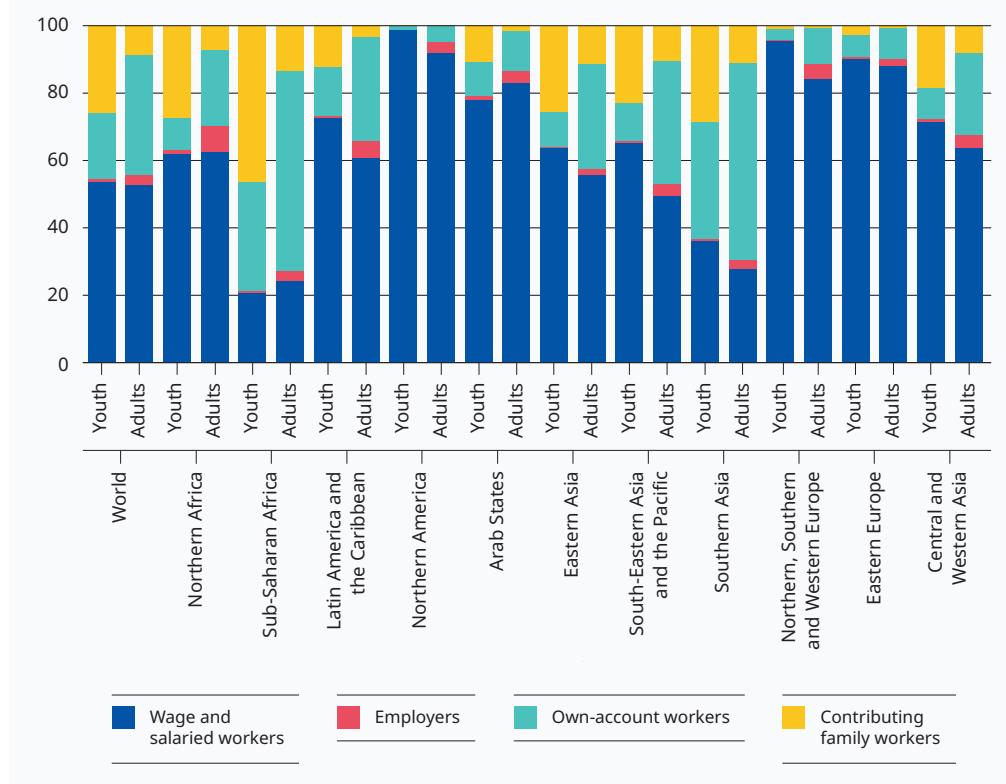
1.6.2 Young people are frequently in jobs associated with vulnerability

Employment status is closely associated with working conditions, providing an indication of job characteristics such as contract type, income security, access to employment benefits and legal and social protection. The higher incidence of informality among young workers compared to their adult counterparts partly reflects the large proportion of youth engaged in own-account work and contributing family work, both of which are associated with limited income stability and social security coverage. Although adults are more frequently engaged in own-account work than young people, unpaid family labour is more prevalent among younger than older workers in all subregions.

In Northern Africa, sub-Saharan Africa and the Arab States, the proportion of young workers in own-account work combined with contributing family work exceeds the corresponding share among adults (figure 1.10). In other subregions, young people are increasingly working as salaried employees, an employment status that has traditionally been linked to better employment quality, offering greater job security and better working conditions. However, the expansion of wage work among youth does not necessarily imply stable jobs with a secure income and legal and social protection. As highlighted in the preceding edition of this report (ILO, 2017), in low- and lower-middle-income countries the growth in the number of young employees has led to more casual wage employment, whereas in upper-middle-income countries it has been linked to a greater prevalence of temporary, casual and "gig" work.

Figure 1.10
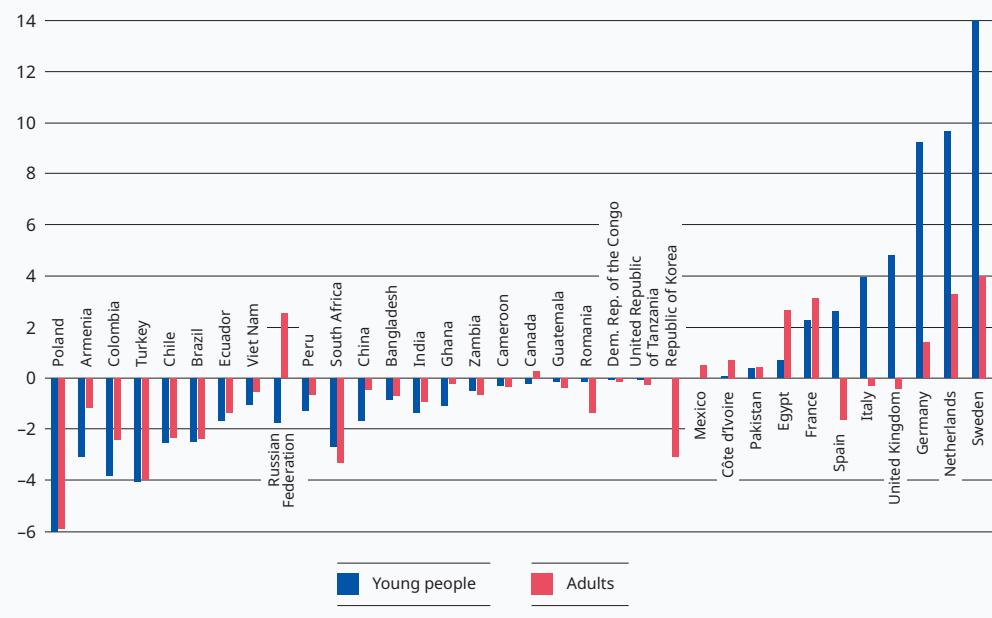
Employment status of youth and adult workers, global and by subregion, 2019 (percentages)

Source: ILO calculations based on ILO harmonized microdata.

Figure 1.11

Percentage change (annualized) in the prevalence of own-account and contributing family work among young people and adults before and after the global economic crisis of 2007–08, selected countries

Note: Young people refers to people aged 15–29 and adults to those aged 30–49. The bars show, for young workers (aged 15–29) and prime-age adult workers (30–49), respectively, the percentage change in the prevalence of own-account and contributing family work between 2006 and 2016 or closest years for which data are available.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

For the current edition it was possible to assemble a more extensive database of labour force surveys, such that some further nuances can be added to this general finding (see figure 1.11). While the (population-weighted) average prevalence of own-account and contributing family work among youth (aged 15–29) in the 41 countries covered by the new sample declined from 72.4 per cent before the 2007–08 crisis to 59.4 per cent afterwards, and from 62.4 per cent to 54.6 per cent among adults (aged 30–49), there is considerable variation across countries.[3] In Europe, in particular, the prevalence of these forms of employment has not only increased but, in proportional terms, has gone up very rapidly indeed. To be sure, this is from a very small base. For example, if we look at the three countries where the prevalence of own-account and contributing family work more than doubled between 2006 and 2016, we can see that in Sweden this meant an increase from 2.9 to 8.4 per cent of employed young people, in the Netherlands from 4.6 to 11.6 per cent, and in Germany from 2.4 to 5.7 per cent. Nevertheless, the trend is, and should be, of some concern; it is connected to the expansion of the gig economy and platform work, which was discussed in detail in the 2017 edition of this report. Moreover, the relative increase in vulnerability (measured as the prevalence of own-account and contributing family workers) among the young – where such increases occurred – is much more pronounced than among adults. By contrast, in countries where vulnerability has declined as a whole, the percentage fall is usually roughly similar for both younger and older workers. Judging by this criterion, the situation of young people relative to adults has generally deteriorated.

[3] The unweighted average would be an underestimate because of (a) the non-random (i.e. driven by data availability) selection of countries in our sample, in which high-income countries are overrepresented, and (b) the underestimation of large countries, such as India and China.

1.6.3 Working poverty continues to affect many young people

An estimated 12.8 per cent of employed young people across the world were living in households below the extreme poverty threshold (under US$1.90 per person per day at purchasing power parity) in 2019 (table 1.7). This means that around 55 million young workers are not earning enough to lift themselves and their families out of extreme poverty. This figure exceeds 126 million if the threshold is raised to include employed youth living in moderate poverty (between US$1.90 and US$3.20 per day). The challenge of overcoming poverty through work involves trade-offs between unemployment, low-income work and decent work among young people experiencing poverty (UNDESA, 2018).

Table 1.7

Trends and projections in extreme and moderate working poverty among young workers, global and by subregion, 1999, 2019 and 2023
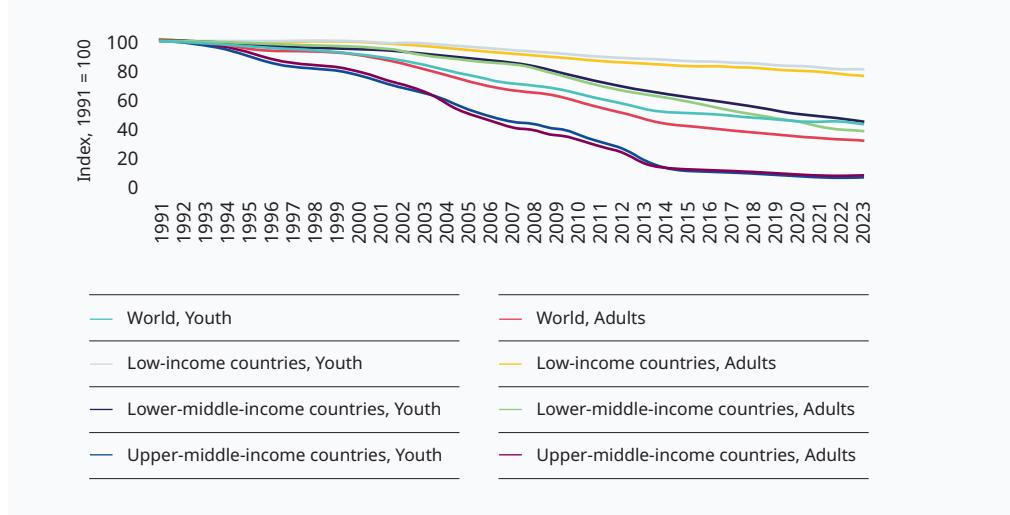
Region	Subregion	Extreme poverty rates (%)			Extreme poverty (millions)			Moderate poverty rates (%)			Moderate poverty (millions)		
		1999	2019	2023	1999	2019	2023	1999	2019	2023	1999	2019	2023
World		32.9	12.8	12.0	163.2	55.0	51.2	24.6	16.6	15.5	122.2	71.1	66.1
Africa	Northern Africa	5.6	1.4	1.3	0.5	0.1	0.1	22.2	8.2	7.4	2.0	0.6	0.6
	Sub-Saharan Africa	60.3	41.5	38.1	35.8	38.6	39.3	20.4	27.2	27.2	12.1	25.3	28.1
Americas	Latin America and the Caribbean	12.2	2.4	1.9	5.4	1.1	0.8	13.5	5.4	4.6	6.1	2.3	1.9
Arab States	Arab States	1.3	13.3	12.9	0.1	0.8	0.8	14.4	12.3	11.3	0.8	0.8	0.7
Asia and the Pacific	Eastern Asia	41.7	1.4	1.1	61.0	1.1	0.8	26.8	5.6	4.4	39.3	4.5	3.3
	South-Eastern Asia and the Pacific	32.1	3.9	2.4	17.7	1.9	1.2	31.4	13.5	9.9	17.3	6.6	4.7
	Southern Asia	38.4	12.0	8.9	41.0	10.8	7.9	38.5	33.5	29.8	41.2	30.2	26.3
Europe and Central Asia	Central and Western Asia	13.6	5.3	3.9	1.4	0.5	0.4	19.2	7.6	6.0	1.9	0.8	0.6

Note: Data for 2023 are projections. Working poverty refers to the share of workers living in moderate or extreme poverty in low- and middle-income countries. Moderate and extreme working poverty rates refer to the shares of workers living in households with income or consumption per capita between US$1.90 and US$3.20 per day, in purchasing power parity (PPP) terms, and less than US$1.90 per day (PPP), respectively.

Source: ILO modelled estimates, November 2019.

Figure 1.12

Working poverty (extreme and moderate) among young people and adults,
global and by country income group, 1991–2023 [index = 100 in base year, 1991]

Note: The figure shows the evolution of indices of working poverty over time – with 1991 as the base year in which the index is set to 100 per cent – for young people and adults in various country income groups.

Source: ILO modelled estimates, November 2019.

In 2019, young workers in sub-Saharan Africa were the most likely to be living in extreme poverty, with a rate of approximately 42 per cent, equivalent to 38.6 million young people. In this subregion, despite a significant decline in the share of working youth in extreme poverty, demographic trends – a growing youth population – have led to an increase in the number of young workers in extreme poverty. The second-highest rate of extreme working poverty is in the Arab States, where 13.3 per cent of young workers were estimated to be earning less than US$1.90 per day. In this subregion, the situation of young workers has deteriorated over the past two decades. In 1999, the incidence of extreme working poverty among young workers there was 12 percentage points lower than today, and this situation is expected to continue to worsen in the years up to 2023. This has to do with political instability and security issues, in particular in Syria and Yemen, which have had a considerable impact on many labour markets in the subregion (ILO, 2019). Extreme working poverty among young workers declined in all other subregions during the same period, with the global decline amounting to around 20 percentage points. The biggest reduction occurred in Eastern Asia, which experienced a decline of more than 40 percentage points between 1999 and 2019: extreme poverty has nearly been eradicated there.

The global decline in moderate working poverty (a threshold of US$3.20 per day) among young workers was much more modest. Between 1999 and 2019, the moderate working poverty rate among youth decreased from 24.6 to 16.6 per cent. This means that many young people are earning enough not to be considered extremely poor, but still not enough to leave poverty behind. Moderate poverty is most prevalent in Southern Asia, where it affects more than one-third of young workers. It is also widespread in sub-Saharan Africa, accounting for over one-fourth of young workers. The moderate

working poverty rate is lowest in Latin America and the Caribbean and in Eastern Asia, at around 5.5 per cent in both subregions.

The positive downward trend in working poverty has been more pronounced among adults than among young people (figure 1.12). In 1991, globally, the total (extreme and moderate) working poverty rate among youth was 13 percentage points higher than for adults (aged 25+): 64 per cent compared with 51 per cent. By 2023, the working poverty rate among young people is projected to be, at 28 per cent, almost double that of adults (16 per cent). There has been a remarkable reduction in extreme and moderate working poverty across all age groups; however, the relative size of the gap between young people and adults has also widened considerably.

Poverty and limited opportunities to access quality employment are among the most common reasons for labour migration (see box 1.6). Millions of young people around the world would emigrate from their countries permanently if they had the chance, regardless of their labour market situation (Esipova, Ray and Srinivasan, 2010).

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▶ **Box 1.6**

Youth migration: The desire to migrate and its implications for the labour market

Generally, when young people choose to migrate, the decision is driven by one or more of the following reasons: education, work or marriage. Many young people are forced to migrate to escape poverty or avoid violence or conflict, while others are displaced by the effects of climate change (UNDESA, 2016).
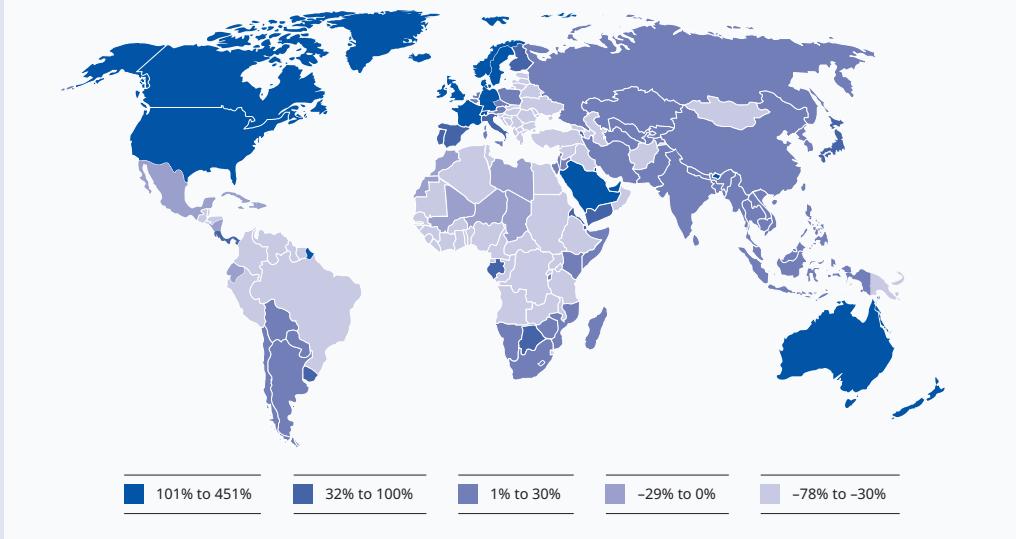
Globally, the total number of international migrants is estimated at 271.6 million, around 11 per cent of whom were in the youth age group in 2019, i.e. aged between 15 and 24. The share of young people in the international migrant stock increases to 21 per cent if the age limit is raised to 29. The share of youth and young adults (aged 15–29) among migrants was highest in Africa (27 per cent), followed by Latin America and the Caribbean (25 per cent) and Asia (23 per cent) (UNDESA, 2019). Recent regional studies confirm these trends. Thus, an Afrobarometer survey of 34 African countries found that young Africans between the ages of 18 and 25 were the most likely to have considered emigration, mainly to other African countries (Sanny, Logan and Gyimah-Boadi, 2019). A recent study by the Economic Commission for Latin America and the Caribbean found that young people under the age of 24 constituted the majority of emigrants from northern Central America (ECLAC, 2018).

Both influxes and exoduses of young people can be analysed by looking at the Potential Net Migration Index (PNMI) (figure 1.13). The higher a country's score, the larger the potential net population gain. Negative scores indicate net population loss (Gallup Analytics, 2018). According to a PNMI survey conducted in 2015–17, the top desired destinations for young people are Iceland, Singapore and Australia. The countries with the greatest numbers of young people wishing to emigrate are Sierra Leone, Liberia, Haiti and El Salvador. If all those wanting to emigrate did so, the youth population would be cut by 78 per cent in Sierra Leone, by 70 per cent in Liberia, by 68 per cent in Haiti and by 61 per cent in El Salvador.

The decision to emigrate permanently is significantly influenced by the opportunities available in the local labour market. Unemployment, working poverty and a lack of decent work opportunities are some of the main drivers of migration (ILO, 2016). For source countries, emigration can ease labour market pressures, but this often comes at the cost of "brain drain", inhibiting the development of human capital and productive capacity (Docquier, 2014). In destination countries, immigration can offset the decline in the working-age population, mitigating negative trends in employment-driven growth and lightening the burden on pension and health-care systems. However, immigration can also contribute to low wages and greater labour competition in the destination countries (UNDESA, 2018).

Immigration policies have become more severe for migrant youth in recent years, requiring compliance with a host of bureaucratic procedures. Those who immigrate without the necessary documents are likely to end up working informally and, as a result, to be vulnerable to abuse by their employers. Irregular migration also increases the likelihood of working without a contract, which often entails being paid irregularly and being exposed to the risk of not receiving any payment at all for services rendered. However, the considerable disparities in the quality and availability of work across countries mean that, unless labour market challenges are tackled, young people will continue to seek economic opportunities abroad, regardless of the legalities (ibid.).

Figure 1.13

Potential Net Migration Index scores for young people, 2015–17 (percentages)

101% to 451%	32% to 100%	1% to 30%	–29% to 0%	–78% to –30%

Note: Gallup's Potential Net Migration Index for young people measures the potential change to the youth population as a result of out- and in-migration, based on expressed desire on a scale ranging from –100 per cent (meaning that all young people aged 15–29 wish to leave the country) to infinity (meaning that the potential inflow of 15–29-year-olds into a country is unlimited). Gallup's migration indices are based on responses to the following questions: (1) "Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?"; and, for potential migrants, (2) "To which country would you like to move?". The survey results shown here were obtained through telephone and face-to-face interviews with 453,122 adults, aged 15 and older, in 152 countries from 2015 to 2017.

Source: Gallup Analytics, Potential Net Migration Index, 2018.

1.7 Technology is transforming labour market opportunities for young people but also presenting them with new challenges

Many young people are delaying their entry into the labour market, suggesting that the future adult labour force is likely to be better-skilled, leading potentially to a positive effect on socio-economic development. At the same time, young people who have entered the labour market continue to face numerous challenges in terms of the number and quality of jobs available to them. Unemployment rates are over three times those of adults, informal and vulnerable forms of employment are widespread and many young workers remain unable to lift themselves and their families out of poverty. Furthermore, much of the potential of young people remains untapped, as evidenced by the high combined rates of unemployment and potential labour force (an indicator of labour underutilization), as well as high NEET rates.

Technological advances – notably in such fields as automation, robotics, artificial intelligence, 3D printing, machine learning, the Internet of Things and blockchains will transform the labour market opportunities and challenges faced by young women and men. These changes are leading to the creation of entire new industries, jobs, goods and services, as well as an increase in productivity. By reducing the cost of production and delivery of services, new technologies are a potential means for low- and middle-income countries to "leapfrog" to more advanced stages of development. They can also play an instrumental role in promoting the United Nations 2030 Agenda for Sustainable Development. At the same time, continued advances in technology may also dislocate labour markets and disproportionately benefit countries that already have a strong technology base, resulting in even greater inequality. The next chapter examines these matters in more detail.

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▶ **Jobs for young people in an
evolving technological landscape**

Although young people are among the most willing to embrace
new technologies, many have deep-seated anxieties about the
impact that the most recent advances in robotics and artificial
intelligence could have on their future employment prospects.
These concerns are certainly justified as young people are more
likely to work in occupations at greater risk of automation and
are consequently more exposed to the risk of unemployment and
inactivity. Vocational training, in particular, is associated with
subsequent employment in jobs more liable to automation. This
highlights the importance of modernizing vocational education
and training programmes so that young people are better able
to meet the demands of the digital economy.

2

▶ # Chapter 2. Jobs for young people in an evolving technological landscape

2.1 Technological advances can both mitigate and exacerbate the employment challenges faced by young people

This chapter focuses on technological advances and their implications for youth employment. How is technological change affecting young workers and how is it expected to affect the millions of young women and men preparing for and entering the world of work? Equipping young people with the skills required to cope with the various transitions they will experience in the course of their lives (e.g. from school to work and between different jobs) ensures that they can look forward to a brighter future at work (ILO, 2019).

Young women and men are often willing to seize the opportunities provided by new technologies and become early adopters; however, at the same time, they face the greatest risk from automation. Other challenges they face include a drop in the number of middle-skill occupations for them to transition into and the fact that certain jobs that were available earlier are disappearing owing to increasing adoption of robots. Furthermore, the probability of becoming unemployed or inactive increases for young workers with experience in automatable jobs.

2.2 Technological anxieties are often more pronounced among the young
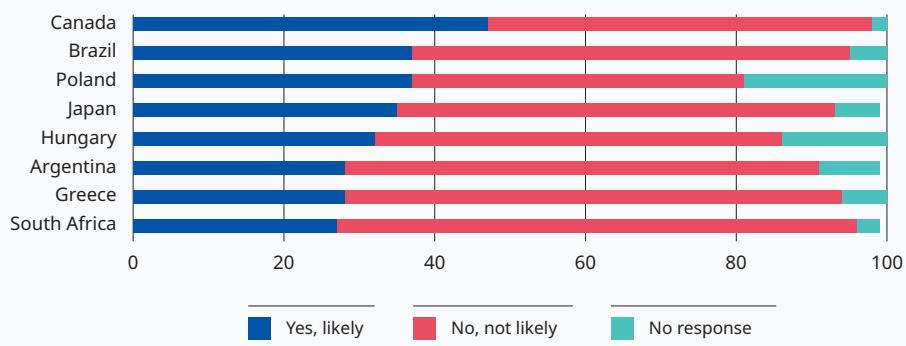
The need to enhance the ability of young women and men in both developing and developed countries to utilize the opportunities created by a rapidly evolving technological landscape comes on top of various existing challenges. As highlighted in Chapter 1, many young people across the world already face numerous obstacles in the transition from school to work, such as inadequate education and training, a greater likelihood of being unemployed compared with adults and having to settle for jobs in the informal economy because of a lack of opportunities for decent work. These challenges are undermining the hope traditionally held by each generation that later generations will enjoy improved socio-economic prospects. A recent survey, for example, finds that almost half (46 per cent) of young people aged 18–22 (commonly called Generation Z) expect to have fewer opportunities for a fulfilling career than their grandparents (the baby boomer generation, now aged 56–75).[1] Technological anxieties play a role in both developed and developing economies: there is widespread concern that the most recent advances may not lead to the creation of new, better-paying jobs (figure 2.1).

In many ways, such anxieties are not new. The mechanical innovations of the Industrial Revolution, the prolonged high levels of unemployment during the Great Depression of the 1930s and the more recent Great Recession of 2007–09 have all led to extensive debates on the impact of technology on employment, wages and the nature of work (Mokyr, Vickers and Ziebarth, 2015). In adopting the Employment Policy Convention, 1964 (No. 122) and Recommendation, 1964 (No. 122), ILO member States also recognized the potential labour market benefits and challenges arising from advances in technology. Thus, Recommendation No. 122 notes that "[e]mployment policy should take account of the common experience that, as a consequence of technological progress and improved productivity, possibilities arise for more leisure and intensified educational activities" and that "[m]embers should encourage the international exchange of technological

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[1] The respondents are from Australia, Canada, China, India, the United Kingdom and the United States. See Deloitte (2018).

Figure 2.1

Share of respondents who believe that there will be new, better-paying jobs if robots are able to take on much of the work currently performed by humans (percentages)

Source: Pew Research Center, 2018a.
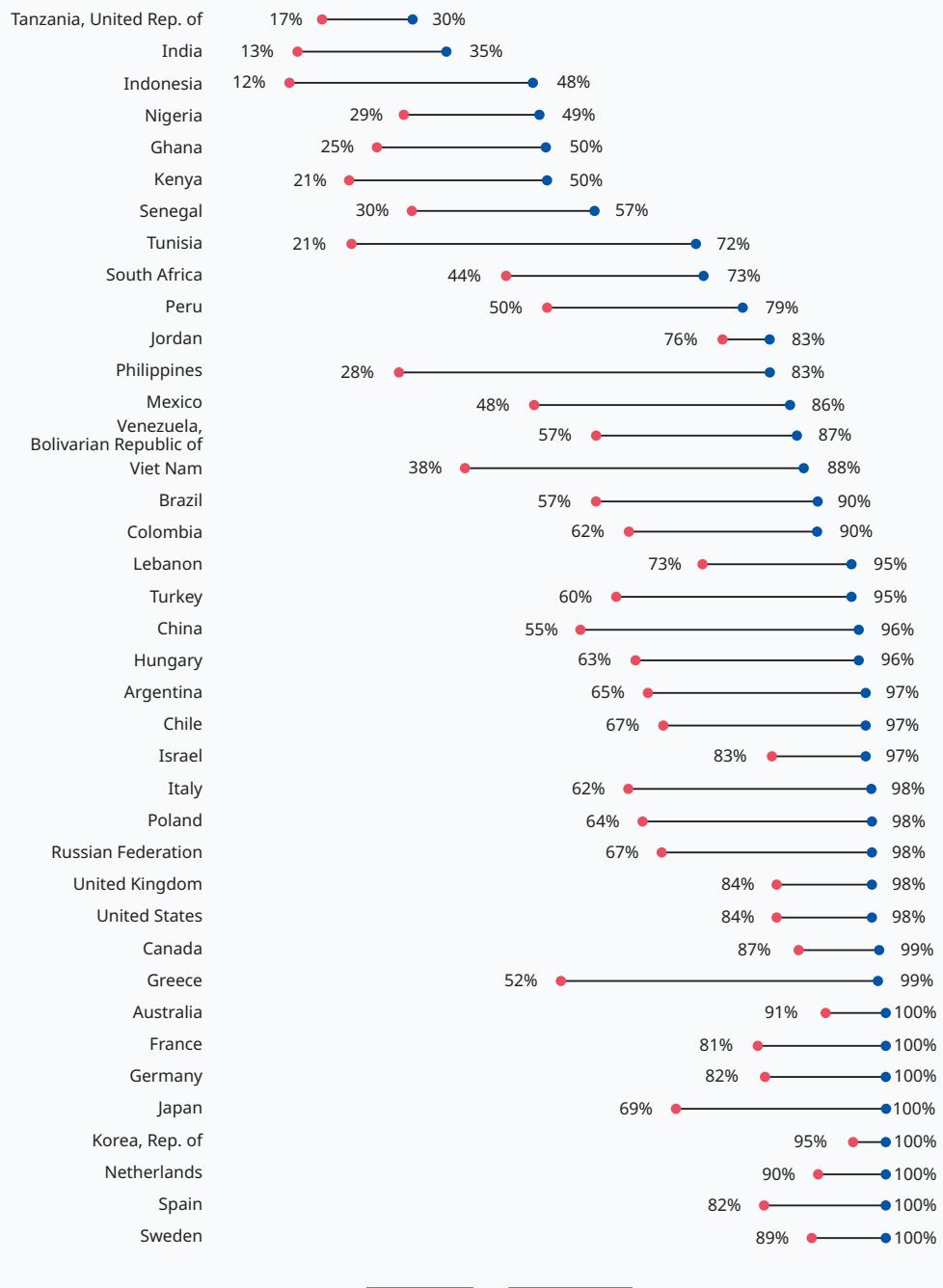
processes with a view to increasing productivity and employment, by means such as licensing and other forms of industrial co-operation".

The exponential acceleration in the development, convergence and adoption of new technologies in the past few decades is, however, reawakening technological concerns (UNCTAD, 2018). It is worth noting that there continue to be significant disparities in the uptake of technologies across countries and age groups. For example, younger people (aged 18–35) are in general more likely than older people (aged 36+) to use the Internet or own a smartphone, reflecting a "digital divide" between generations. Furthermore, younger people in developing countries are less likely to have access to such digital technologies than their contemporaries in developed countries. In the United Republic of Tanzania, 30 per cent of those in the 18–35 age group report using the Internet and/or owning a smartphone, compared with 100 per cent in several advanced economies (figure 2.2).

As illustrated by trends in the use of the Internet and smartphones, young people tend to be early adopters of technology. Even so, anxieties about the impact of technologies on jobs are often more pronounced among young women and men. In the European Union (EU), 22 per cent of those aged 15–24 believe that their current jobs could be done entirely or mostly by a robot or artificial intelligence, compared with 17 per cent of adults (figure 2.3a). Similarly, in Japan, 41.8 per cent of workers aged 20–29 fear that artificial intelligence and robotics could lead to the loss of their jobs, compared with just 23.9 per cent of those aged 50–59 (figure 2.3b). Young people's fears may be due to their clearer understanding of both the beneficial and destructive potential of new technologies and/or to the fact that they have more years ahead of them, compared with older age groups, and are therefore more exposed to the impact of these technologies. In any case, as early adopters of technology, young women and men play a critical role in the structural transformation process (see box 2.1).

Figure 2.2
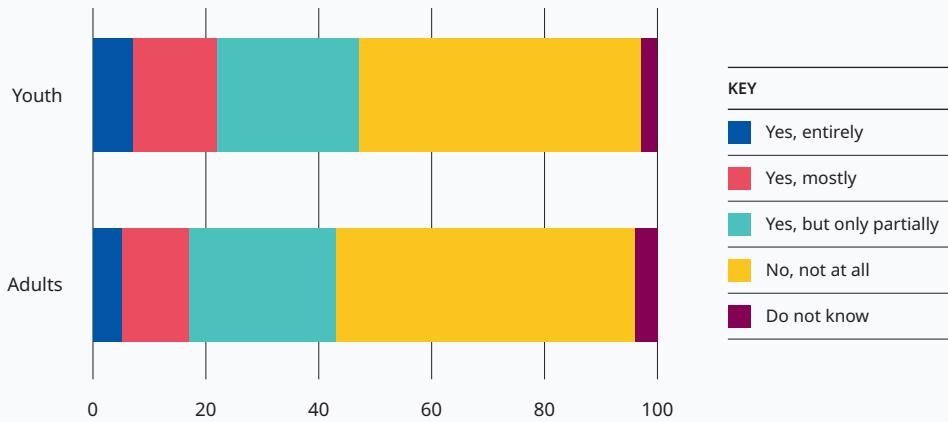
Share of respondents who report using the Internet at least occasionally and/or owning a smartphone (percentages)

	Age 37+	Age 18–36
Tanzania, United Rep. of	17%	30%
India	13%	35%
Indonesia	12%	48%
Nigeria	29%	49%
Ghana	25%	50%
Kenya	21%	50%
Senegal	30%	57%
Tunisia	21%	72%
South Africa	44%	73%
Peru	50%	79%
Jordan	76%	83%
Philippines	28%	83%
Mexico	48%	86%
Venezuela, Bolivarian Republic of	57%	87%
Viet Nam	38%	88%
Brazil	57%	90%
Colombia	62%	90%
Lebanon	73%	95%
Turkey	60%	95%
China	55%	96%
Hungary	63%	96%
Argentina	65%	97%
Chile	67%	97%
Israel	83%	97%
Italy	62%	98%
Poland	64%	98%
Russian Federation	67%	98%
United Kingdom	84%	98%
United States	84%	98%
Canada	87%	99%
Greece	52%	99%
Australia	91%	100%
France	81%	100%
Germany	82%	100%
Japan	69%	100%
Korea, Rep. of	95%	100%
Netherlands	90%	100%
Spain	82%	100%
Sweden	89%	100%

Source: Pew Research Center, 2018.

Figure 2.3a
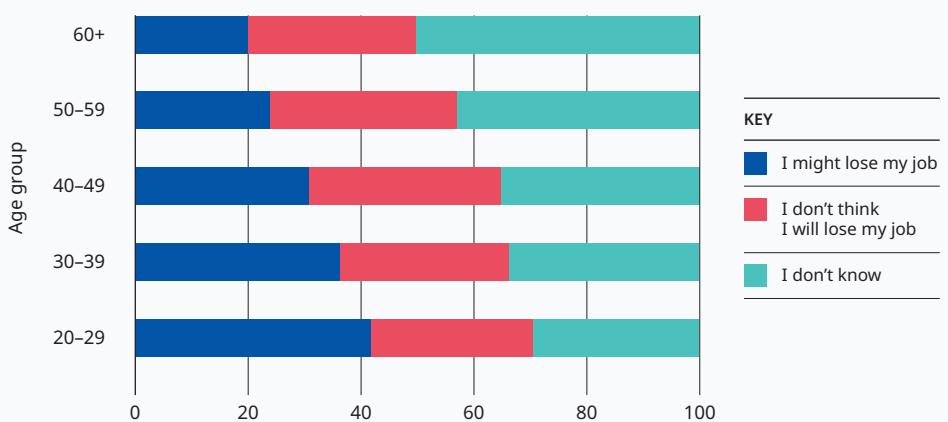
Perceptions in the European Union as to whether current job could be done by a robot or by artificial intelligence in the future (percentages)

KEY
- Yes, entirely
- Yes, mostly
- Yes, but only partially
- No, not at all
- Do not know

Source: ILO calculations based on EC, 2017.

Figure 2.3b

Perceptions among Japanese workers regarding the impact of artificial intelligence on the future of one's job (percentages)

KEY
- I might lose my job
- I don't think I will lose my job
- I don't know

Source: Morikawa, 2017.

► **Box 2.1**

Structural transformation and young workers

The movement of labour from low- to high-productivity activities, that is, structural transformation, has long been considered key to aggregate economic growth and development. Kuznets (1971), for example, identified structural transformation as one of the six characteristics of modern economic growth. More recently, its importance has been highlighted in the Sustainable Development Goals (SDGs), specifically in SDG target 8.2 ("Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors") and SDG target 9.2 ("Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries").

The critical role of technological change in the structural transformation process is widely recognized (see e.g. Herrendorf, Herrington and Valentinyi, 2015; Schumpeter, 1934). Perhaps less well recognized is the role of young women and men in driving that process, notably through the adoption and use of upgraded technologies. Kim and Topel (1995), for example, found that almost all of the intersectoral mobility that occurred in the Republic of Korea between 1970 and 1989, a period of rapid structural transformation, was due to young workers and new entrants to the labour force. In particular, young workers accounted for almost all of the growth in manufacturing employment. In an analysis of census data for a large number of countries and years, Hobijn, Schoellman and Vindas Quesada (2018) find that just over half of the structural transformation was driven by the replacement of old cohorts by new cohorts of workers in a sample of 59 countries.

Increasing automation in manufacturing – a sector that has acted as the engine of economic and employment growth in the classical pathway of structural transformation – may limit the developmental impact of new technologies if productivity growth is not accompanied by employment growth at a sufficiently high level to absorb new entrants to the labour force. In many developing countries, premature deindustrialization has already started to raise concerns about the impact of technology. On the other hand, technological advances can allow developing countries to leapfrog older technologies and embark on a new development pathway. For example, the enhancement of information and communications technologies has increased the tradability and value added of some services, which have the potential to catalyse economic and employment growth in developing countries (Dasgupta, Kim and Pinedo Caro, 2017; Dasgupta and Singh, 2005; Roncolato and Kucera, 2014).

2.3 Labour market impacts of technological advances differ across age groups

Is the relatively greater anxiety of younger workers over the impact of new technologies warranted? Building on the work of Autor, Levy and Murnane (2003), who characterized an occupation as a bundle of tasks (including cognitive, manual, routine and non-routine tasks), a growing number of studies have assessed the impact of technology on jobs (see Balliester and Elsheikhi, 2018, for a comprehensive review of the literature). Although most studies, including this chapter, focus on the technical feasibility of new automation technologies, their economic feasibility, particularly in low- and middle-income countries, also needs to be considered (Kucera, 2017). Moreover, most studies have not focused on youth. It would be important to do so, however, because labour markets globally are often segmented in terms of age groups (in addition to gender or race); therefore, it is very likely that the impact of technology on younger workers will be different from that experienced by older workers (see box 2.2).

For example, Nedelkoska and Quintini (2018) find that the risk of automation is highest among youth in OECD countries, principally because young women and men are more likely to be in elementary occupations, which have the highest probability of automation. Muro, Maxim and Whiton (2019) note that in the United States, younger workers (those aged 16–24) account for 29 per cent of workers in the food preparation and serving sector while making up only around 9 per cent of the national workforce. Moreover, within that sector, nearly half (48 per cent) of young workers are employed in the six occupational groups deemed to be highly automatable, compared with 34 per cent of adult workers. Similarly, Atkinson (2018) finds that younger workers face a slightly higher risk of job displacement than older workers, and argues that the next wave of technological advances may affect lower-skilled jobs to a greater degree. If this prediction is borne out, young people, who are over-represented in low-paid jobs and informal employment (see Chapter 1), will face an even greater impact. Examining how technological advances in the Republic of Korea between 2000 and 2014 have affected various groups of workers, Shim, Yang and Lee (2018) find that the elasticity of substitution between capital and workers is greater for workers aged 15–29 than for older workers. Furthermore, if the adoption of new technologies leads to displacements, young people are more likely than adults to be made redundant because they have less firm-specific human capital and are less costly to dismiss, as could be observed during the Great Recession of the late 2000s.

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▶ **Box 2.2**

Robots and youth employment

The increasing proliferation of robots – mainly in the manufacturing and transport sectors – raises a number of questions regarding their impact on employment. While the global stock of industrial robots is highest in developed countries (the Republic of Korea leads the field with a robot density of 710 robots per 10,000 employees; figure 2.4a), it is expected that the rate of installation of such robots in the next few years will be highest in developing countries (figure 2.4b). This reflects the continuing decrease in costs and the increasing dexterity of robots, with potential repercussions for the creation of jobs in the manufacturing sector in developing countries (Autor and Salomons, 2018). On the other hand, in a study of the implications of robotic technologies on employment in the clothing and apparel, electronics and retail warehousing industries and in call centres in a number of developing countries, Dasgupta, Kucera and de Mattos (forthcoming) conclude that, on the whole, there is no evidence of large-scale labour displacement.

Several recent studies have considered the implications of increased robot use for productivity and employment. For example, Graetz and Michaels (2018) examined 17 countries (14 European countries, Australia, the Republic of Korea and the United States) from 1993 to 2007 and found that increased robot use contributed around 0.36 percentage points to annual labour productivity growth. Furthermore, while no significant relationship was observed between the increased use of industrial robots and total employment levels, there was evidence that robots might be reducing the employment share of low-skilled workers.

Figure 2.4a

Number of installed industrial robots per 10,000 employees in the manufacturing industry, selected countries, 2017
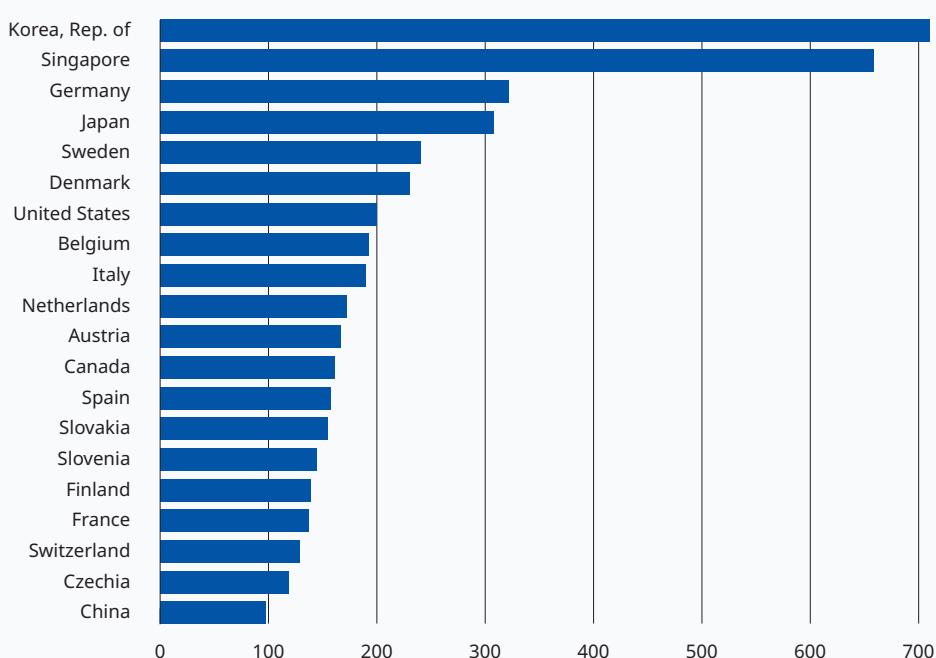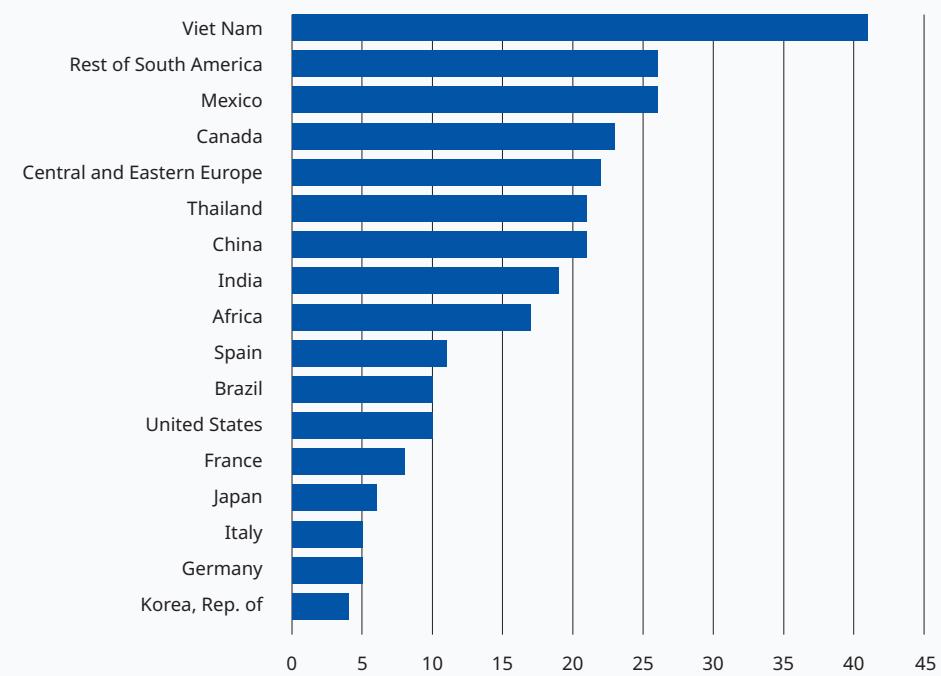
Source: IFR, 2018.

Figure 2.4b

Projected compound annual growth rate in annual shipments of industrial robots, selected countries and subregions, 2019–21 (percentages)

Source: IFR, 2018.

Acemoglu and Restrepo (2019) focused on the United States during a similar period (1990–2007) and found that one additional robot per 1,000 workers was associated with a reduction in the employment-to-population ratio of about 0.2 percentage points and a 0.37 per cent reduction in wages. It should be noted that the preceding two studies used the same data for the years up to 2007. However, there is evidence that automation in recent decades has become less labour augmenting and more labour displacing (Autor and Salomons, 2018).

Dauth et al. (2017) examine the German labour market between 1994 and 2014 to assess whether robots have affected the risk of workers being displaced from their jobs. They note that robots have changed the composition of employment – with job losses in manufacturing, though these are fully offset by job gains in other sectors, particularly in business services – but they do not find any meaningful impact on the aggregate level of employment in Germany. An important observation, however, is that robots reduce the rate of hiring of young jobseekers because firms do not create new vacancies when natural turnovers occur. As the authors put it, "robots 'foreclose' entry into manufacturing for young people" (ibid., p. 33). These findings point to yet another way in which the labour market outcomes of young women and men are being affected by technological advances.
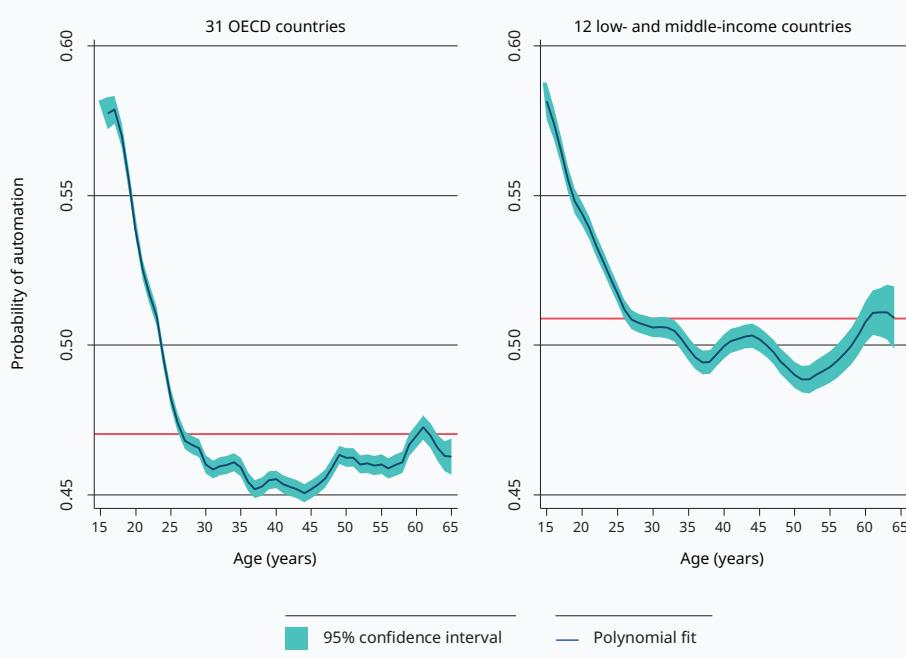
2.4 Risk of automation is highest in jobs held by young people

Building on Nedelkoska and Quintini (2018), who in turn follow the measurement approach of Frey and Osborne (2017), this section utilizes data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) and from the World Bank's STEP (Skills Toward Employment and Productivity) Skills Measurement Program to assess how the risk (probability) of automation is distributed across the types of job held by young people in both developed and developing countries. The risk of automation is modelled as a function of three types of engineering bottlenecks: social intelligence, creative intelligence and perception and manipulation (see Appendix D for more details on the methodology used in this assessment).

In both country groups, young workers face the highest risk of automation (figure 2.5). This risk is a result of two factors: the sorting of youth into occupations that are on average more automatable, and the fact that, within the same occupation, entry-level jobs held by young people tend to have a greater proportion of automatable tasks. The risk peaks among young workers in the 31 OECD countries and 12 low- and middle-income countries analysed; there is a second, less pronounced peak among older workers. The risk of automation among young workers converges to a mean level at around the age of 25 in both OECD countries and low- and middle-income countries. From there, it continues to fall until around the age of 45 (50 in low- and middle-income countries), when it starts to rise again. The average risk of automation is significantly higher in low- and middle-income countries than in OECD countries.
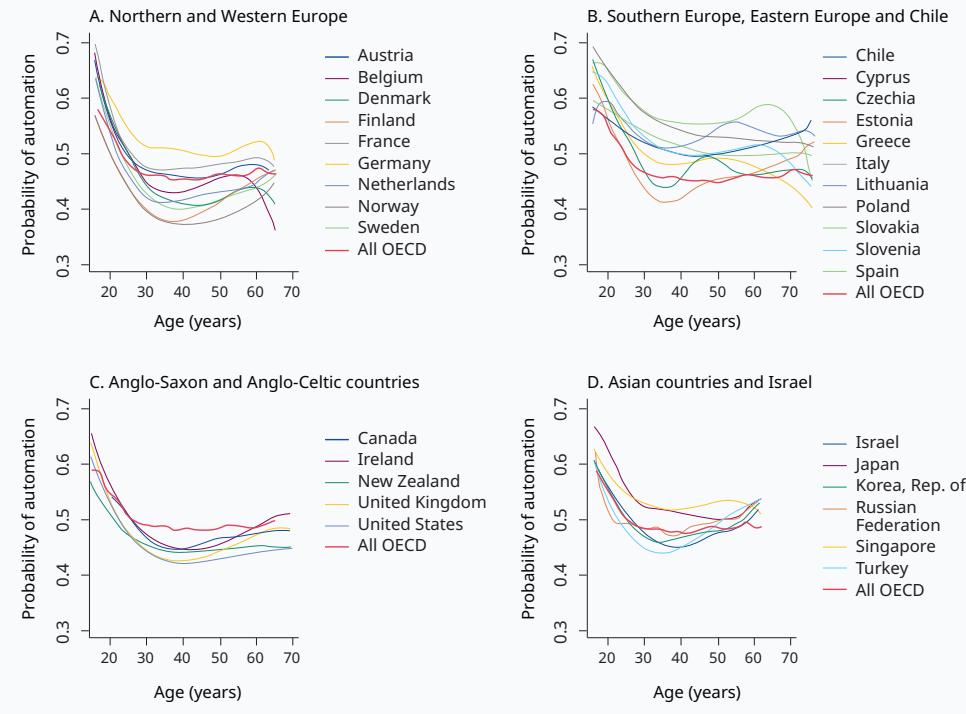
Figure 2.5

Probability (risk) of automation by age in OECD and low- and middle-income countries

Note: The reference line (in red) indicates the mean risk of automation in the sample. The graphs are based on cross-sectional data and do not show the evolution of the risk of automation for age cohorts over time.

Source: ILO calculations based on data from STEP Skills Measurement Household Survey (2012 and 2013) and from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

Figure 2.6

Probability (risk) of automation by age and country, OECD countries
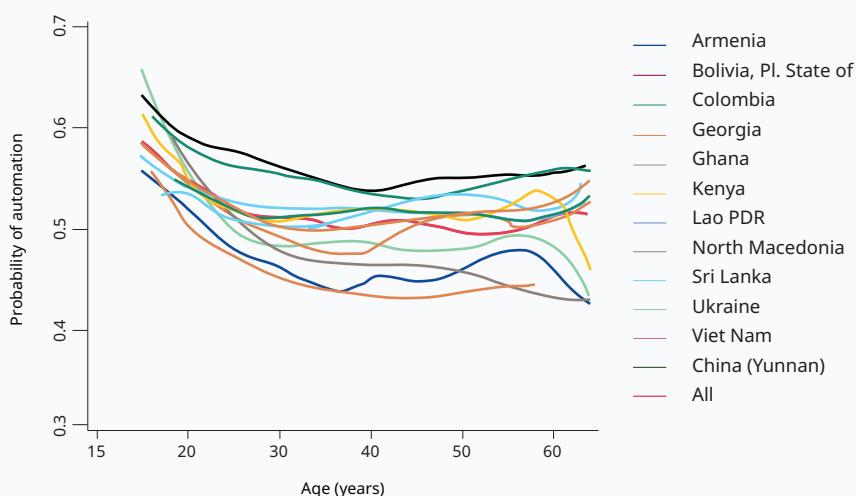
Note: The graphs are based on cross-sectional data and do not show the evolution of the risk of automation for age cohorts over time.

Source: ILO calculations based on data from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

Across both OECD countries and low- and middle-income countries, there are variations in the risk of automation by age. For better readability, OECD countries are divided into four groups: (A) Northern and Western Europe (excluding Anglo-Saxon and Anglo-Celtic countries); (B) Southern Europe, Eastern Europe and Chile;[2] (C) Anglo-Saxon and Anglo-Celtic countries; and (D) Asian countries and Israel (figure 2.6). Among Northern and Western European countries (including all Anglo-Saxon and Anglo-Celtic countries), the distribution of the probability of automation by age follows a U shape, with the second peak typically occurring among workers in their 60s; the exception is Belgium, where the risk peaks among workers in their 50s. The distribution for the group including Asian countries and Israel is also U−shaped. There are deviations from this pattern in Southern European and Eastern Europan countries. Thus, in Cyprus, Czechia, Estonia, Italy, Lithuania, Poland, Slovakia and Slovenia, there is an early second peak (sometimes already among workers in their 40s). On the other hand, the risk of automation in Greece and Spain does not seem to exhibit a second peak.

In low- and middle-income countries in the STEP survey (figure 2.7), the two Eastern European countries in the sample exhibit some of the deviations noted earlier: the second peak is found among relatively young workers in North Macedonia, while there is no second peak in Ukraine. In the Lao People's Democratic Republic (Lao PDR) and Sri Lanka, the probability of automation is high at any age. The distribution of risk of automation by age in China's Yunnan province is peculiar as the second peak is more pronounced than

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[2] Chile is the only Latin American country surveyed under PIAAC and is included in this group because its income per capita level is similar to those of the Southern and Eastern European countries.

Figure 2.7

Probability (risk) of automation by age and country, low- and middle-income countries

Note: The reference line (in red) indicates the mean risk of automation in the sample. The graphs are based on cross-sectional data and do not show the evolution of the risk of automation for age cohorts over time.

Source: ILO calculations based on data from STEP Skills Measurement Household Survey (2012 and 2013) and from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

the first. The two African countries (Ghana and Kenya) and the two Latin American countries (Plurinational State of Bolivia and Colombia) closely follow the average pattern.
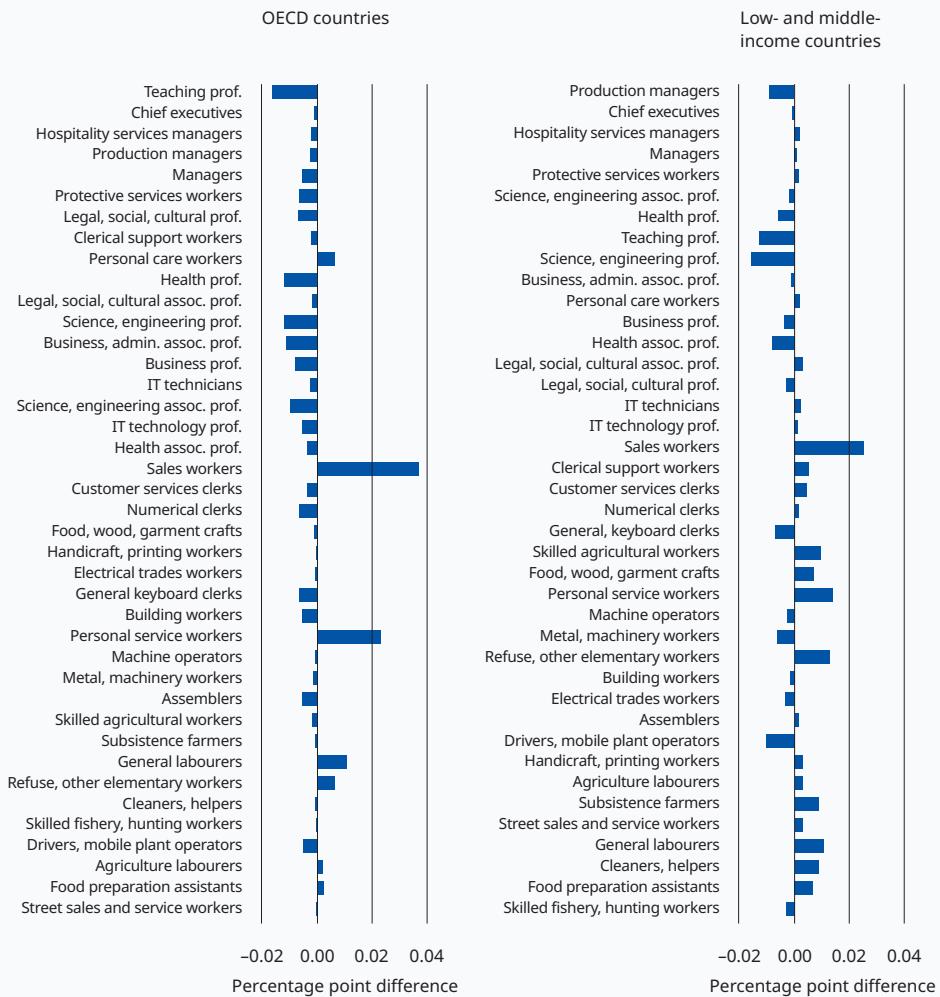
Among workers aged 15–29, there are considerable differences in the degree of job automation between the younger (15–24 years) and the older group (25–29 years), as can be seen from figure 2.8, which compares the employment shares in different occupations between these age groups in OECD countries and in low- and middle-income countries. The occupations are ordered by degree of automatability, with the most automatable at the bottom and the least automatable at the top. A positive difference in employment share for a given occupation, measured in percentage points, indicates the relative specialization of the younger group in that occupation. Conversely, a negative difference indicates the relative specialization of the older group. Negative differences are more common for the less automatable occupations (e.g. teaching professionals, health professionals and science and engineering professionals), in which there is greater specialization of the older group. Positive differences occur more frequently among the more automatable occupations (e.g. labourers, food preparation assistants, personal service workers and sales workers), in which there is greater specialization of the younger group.

The shift towards less automatable occupations with increasing age does not occur just because the older youth group is better educated on average. Even if the level of education is kept constant, the younger group tends to specialize in more automatable occupations, while those in the older group tend to specialize in less automatable ones.[3] Individuals often start their careers in more routine jobs and subsequently move to jobs with higher problem-solving content. This is independent of formal education; rather, it is driven by

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[3] Under a linear (ordinary least squares) model in which the individual probability of automation for the youth group is modelled as a function of the youth group (with the 15–24 age group being the reference group) and the country of work, belonging to the older youth group is associated with 6 percentage points lower probability of automation in OECD countries and with 3.3 percentage points lower probability in low- and middle-income countries. Adding education as a control (eight ISCED dummies and one dummy for vocational training) reduces the differences to 3.5 percentage points in OECD countries and 2.0 percentage points in low- and middle-income countries, but it does not eliminate them.

Figure 2.8

Difference in employment shares of young people aged 15–24 and those aged 25–29 in occupations arranged by automatability (percentage points)

Note: The occupations are ranked by their average risk of automation from high (bottom) to low (top). A positive difference for a given occupation indicates the relative specialization of young people aged 15–24 in that occupation; a negative difference indicates the relative specialization of young people aged 25–29. There are differences in the average risk of automation for occupations in OECD countries, on the one hand, and low- and middle-income countries, on the other, as reflected in the different ranking of occupations for the two groups of countries. These are due to differences in the educational composition of the various occupations in different countries (see Appendix D for more details on the estimation of the risk of automation in low- and middle-income countries).

Source: ILO calculations based on data from STEP Skills Measurement Household Survey (2012 and 2013) and from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

the level of accumulated work experience. The pattern is corroborated by the literature on educational mismatch (for a review, see Leuven and Oosterbeek, 2011), which indicates that education–occupation mismatches are more common among entry-level jobs. Transitioning from jobs at greater risk of automation to those at lower risk is an opportunity for young women and men to find work that best suits their interests and skills, and to progress to higher wages, better working conditions and improved career prospects. Yet, evidence from the United States, for example, indicates that the number of job-to-job transitions is declining among young people (see box 2.3).

▶   **Box 2.3**
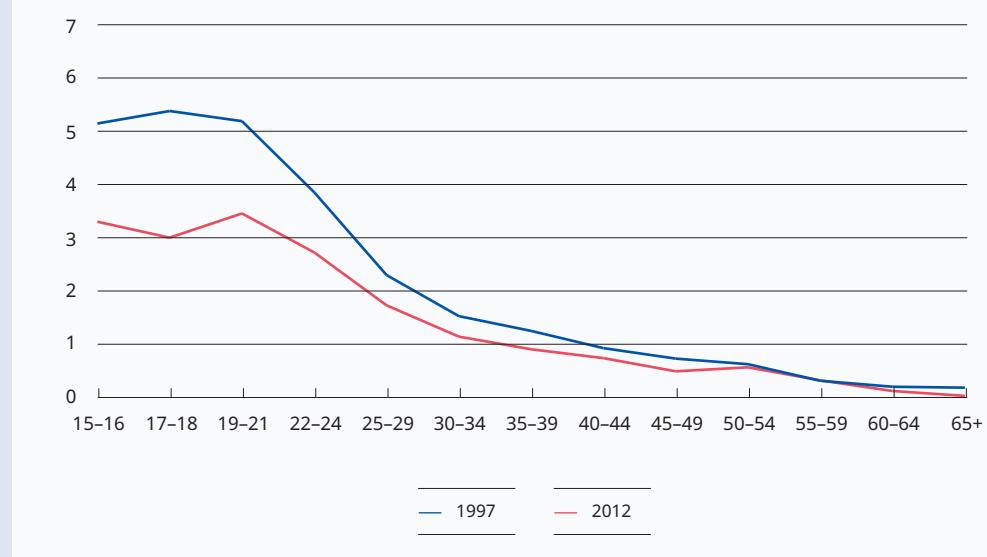
Job-to-job transitions among young workers in Europe and the United States

The school-to-work transition, which is often long and difficult (ILO, 2017), is an important stage in the lives of young people. Also important is the voluntary transition from one job to another, which provides an opportunity for young women and men to try new things and find work that best matches their interests and skills and in the process usually to secure higher wages and improved working conditions. In both Europe and the United States, the job-to-job transition rates are higher for young workers than for older ones. In Europe, 15 per cent of young workers aged 15–24 reported having changed jobs within the previous year, compared with 7 per cent of older workers (Eurofound, 2014). Transition rates are higher in European countries that have a higher incidence of non-standard forms of employment, such as part-time employment and temporary contracts. In the United States, job-to-job transition rates have decreased since the late 1990s, with the decline of the rate for young workers accounting for over 70 per cent of the total decline (figure 2.9). The job-to-job transition rate for workers under the age of 21 dropped from around 6 per cent to 4 per cent between 1997 and 2012. On the other hand, the rate has remained quite stable for older groups (aged 40+). The decline in job mobility has affected all occupations. Moreover, the dispersion in the job-to-job transition rates across occupations in 1997 had disappeared by 2012 (Bosler and Petrosky-Nadeau, 2016).

While the preceding trends could be indicative of young people making more effective school-to-work transitions, they may also reflect a lack of medium-level jobs for young women and men to transition into. Indeed, technological change has contributed to job polarization, with the share of employment in middle-skilled jobs declining in all country income groups between 1991 and 2018 (figure 2.10).

Figure 2.9
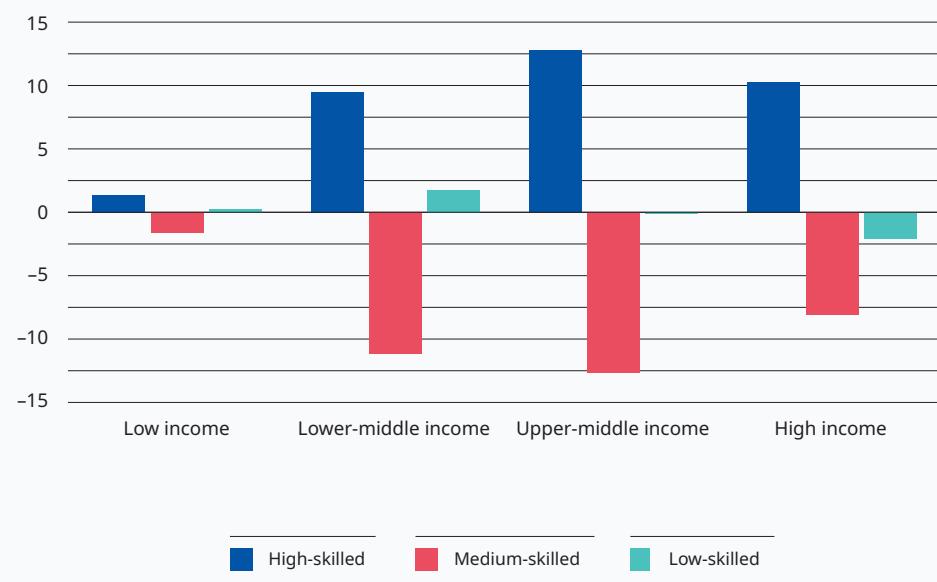
Job-to-job transition rates by age, United States, 1997 and 2012 (percentages)

Source: Bosler and Petrosky-Nadeau, 2016, based on the US Census Bureau's Survey of Income and Program Participation (SIPP).

Figure 2.10

Changes in the share of employment, by skill level and country income group,
1991–2018 (percentages)

Legend: High-skilled, Medium-skilled, Low-skilled

Source: ILO calculations based on ILOSTAT.

iStock.com/PeopleImages
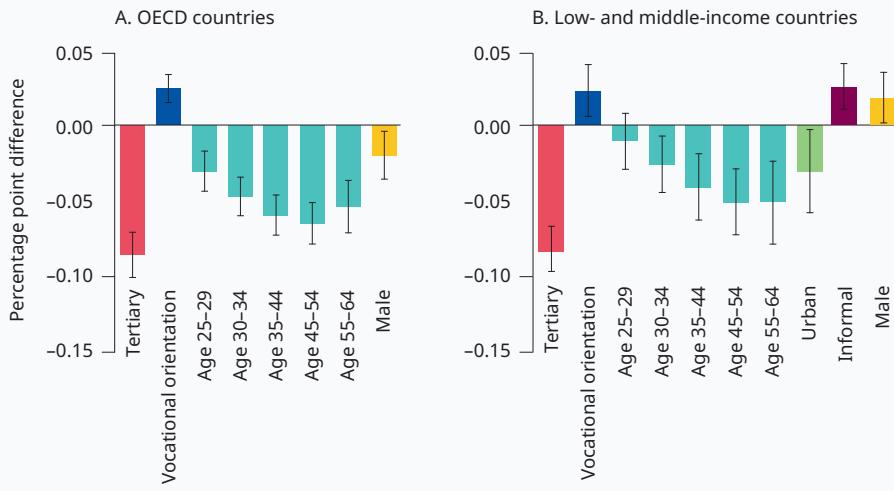
2.5 Higher education provides entry to less automatable jobs, while vocational training is associated with more automatable jobs

What is the relationship between educational attainment and the risk of automation of jobs? Our analysis reveals two noteworthy patterns. First, higher education gives entry to less automatable jobs. Second, conditional on one's level of education, vocational training gives entry to more automatable jobs (figure 2.11). Having tertiary education (as opposed to just upper secondary education) reduces the risk of automation by 8.8 percentage points in OECD countries and by 8.6 percentage points in low- and middle-income countries, while having vocational training increases the risk of automation by 2.5 percentage points in OECD countries and by 2.3 percentage points in low- and middle-income countries.[4] The finding that vocational training gives entry to more automatable jobs corroborates the conclusion drawn by Hanushek et al. (2017) that vocational training skills become obsolete more quickly than general education skills. While the finding is intriguing, further research is required given the importance of vocational training for youth employment; previous studies, on the other hand, have noted how vocational training – particularly the dual apprenticeship system in countries such as Germany and Denmark – facilitates young people's entry into the labour market (see e.g. Biavaschi et al., 2012). The general finding that vocational training is associated with greater risk of automation also needs to be examined further by taking into account cross-country differences in the approach to vocational training and sector-specific differences in vocational training (see e.g. Eurofound, 2019).

In comparison to women, men tend to work in less automatable jobs in OECD countries and in more automatable ones in low- and middle-income countries, *ceteris paribus*. Moreover, in low- and middle-income countries, informal jobs are more automatable and urban jobs less automatable, *ceteris paribus*.
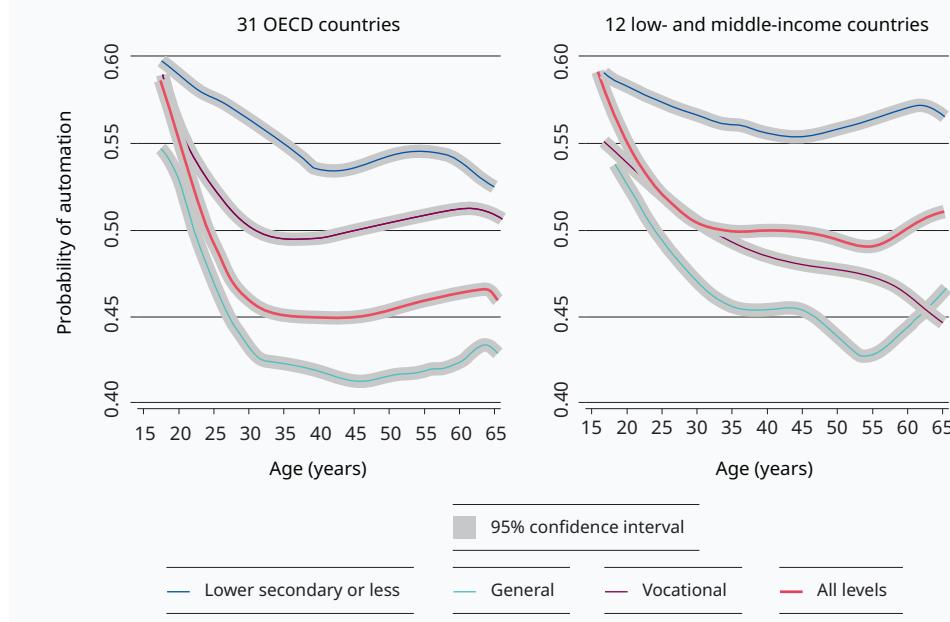
Figure 2.12 shows the risk of automation by type of education and age in OECD countries and in low- and middle-income countries. In both groups of countries, those with little education (lower secondary or less) are at a high risk of automation at any age, and this risk is on average higher than that of any other educational attainment group. However, workers whose highest level of education is vocationally oriented are at a significantly higher risk than those whose highest level of education is not vocationally oriented. This is the case at all ages and in OECD countries. This is particularly the case for prime-age workers (aged 25–55) in low- and middle-income countries. As illustrated in figure 2.12, among workers with a vocational orientation, the relationship between the risk of automation and age is U–shaped in OECD countries. In low- and middle-income countries, the risk of automation for those with vocational training monotonically declines with age, converging to the risk faced by those with general education at around the age of 60.

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[4] The reference category is a mix of upper secondary and post-secondary non-tertiary education (group of ISCED levels 3 and 4). ISCED levels 5 and 6 are considered tertiary education. ISCED level 2 and lower levels (lower secondary or less) are excluded from the analysis, as vocational training does not exist at such levels. Moreover, to create a common educational classification for the STEP and PIAAC data, ISCED levels 3 and 4 were grouped into a single category. ISCED level 3 (upper secondary) accounts for 84 per cent of the group in OECD countries, suggesting that the group average is driven by workers with upper secondary education.

Figure 2.11

Relationship between educational attainment and the risk of automation of workers' jobs

A. OECD countries

B. Low- and middle-income countries

Note: Results of two separate ordinary least squares regressions where the outcome variable is the probability of automation. Standard errors are clustered by four-digit codes under the International Standard Classification of Occupations (ISCO) (three-digit codes in the STEP surveys). The 95 per cent confidence intervals are presented here as whiskers. The reference groups are middle education and ages 16–24 (15–24 in the STEP surveys). The PIAAC estimates are based on data from 22 countries for which the four-digit ISCO classification is available (65,531 observations; adjusted R^2: 0.0994). Additional controls include 22 country dummies. The PIAAC data (unlike the data from the STEP surveys) do not provide information on the formality of a job and the urban/rural nature of the region. The countries included are Belgium, Chile, Cyprus, Czechia, Denmark, France, Greece, Israel, Italy, Japan, the Republic of Korea, Lithuania, the Netherlands, New Zealand, Norway, Poland, Russian Federation, Slovakia, Slovenia, Spain, Turkey and the United Kingdom. The STEP estimates are based on data from 12 countries (12,774 observations; adjusted R^2: 0.2316). Additional controls include 12 country dummies.

Source: ILO calculations based on data from STEP Skills Measurement Household Survey (2012 and 2013) and from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

Figure 2.12

Risk of automation by age and type of education

31 OECD countries

12 low- and middle-income countries

95% confidence interval

Lower secondary or less   General   Vocational   All levels

Source: ILO calculations based on data from STEP Skills Measurement Household Survey (2012 and 2013) and from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

2.6 Automatable jobs are associated with subsequently more difficult labour market transitions, particularly for young people

Entry-level jobs provide young women and men with a key opportunity to obtain a clearer idea of their preferences and capabilities while equipping them with valuable work habits, skills and networks that will support them in their career path. When young workers leave entry-level jobs, whether voluntarily or not, they sort themselves into employment and unemployment or leave the labour force altogether. In this section, we consider how the risk of automation in entry-level jobs relates to these labour market outcomes in 22 OECD countries. For this purpose, we draw on data from the PIAAC Survey of Adult Skills, which provide occupational information about the job last held for those respondents who were not employed at the time of the survey and occupational information about the current job for those who at the time of the survey were employed.[5]

The results indicate that the probability of being unemployed or inactive is higher for young workers with experience in automatable jobs than for those with experience in non-automatable jobs. Specifically, young workers with experience in automatable jobs are more likely to have NEET status or to be in informal training than to be employed. Moreover, having worked in an automatable job is associated with a greater likelihood of investing in additional formal education, but only for those with post-secondary quali-fications. For young workers with lower qualifications, no such tendency is apparent. These results should be interpreted with caution, however, as they are strictly correlational and do not provide information about the actual impact of working in automatable jobs on labour market outcomes. For example, workers choosing automatable jobs may be less prepared or motivated than those choosing non-automatable ones, even when they have similar levels of education and experience. Nevertheless, the results point to difficulties in adjusting to labour market transformations through education and job change. These difficulties are more easily overcome by young workers with a higher initial level of education as they are better positioned to return to education and reorient themselves to safer career paths.

At the time of the PIAAC survey (2012–14), 53 per cent of those with experience (past or current) in jobs that have an above-average risk of automation (automatable jobs) were employed, 6 per cent were unemployed, 10 per cent were in formal education and 31 per cent were inactive and not in formal education. By contrast, among those with ex-perience in jobs with below-average risk of automation (non-automatable jobs), 86 per cent were employed, while only 3 per cent were unemployed, 2 per cent were in formal education and 9 per cent were inactive. Using a different breakdown of labour market status, over 30 per cent of those with experience in automatable jobs were NEET; this was the case for only 8 per cent of those with experience in non-automatable jobs.
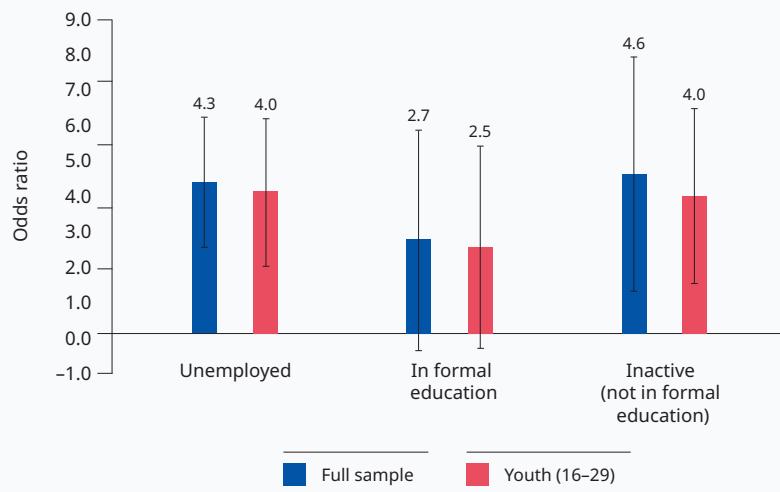
Using the PIAAC data, we explore how experience (current or past) in automatable jobs relates to individuals' current labour market status. For this purpose, labour market status is classified into three categories: "employment", "unemployment" and "inactivity". The "inactivity" category is further categorized into "NEET", "in education only" and "in training only".

Figures 2.13–2.16 display the results of comparing the labour market outcomes of those in automatable occupations with those in non-automatable occupations, while holding several important variables constant, namely, gender, age, level of education and country

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5 The PIAAC Survey of Adult Skills uses the same four-digit ISCO-08 codes to classify the last occupation held by those who are currently not working or who are inactive as for classifying the current occupation. However, those who were not employed at the time of the survey were not asked to report the frequency with which they used certain skills in their former jobs. Therefore, the risk of automation cannot be estimated directly for those who are not working. Instead, the average risk of automation is calculated across the various occupations using the sample of working adults, and these estimates are applied to the sample of non-working adults at the level of occupation. The STEP surveys aggregate such information into six occupational categories, precluding any meaningful analysis.

Figure 2.13

Odds of being unemployed, in formal education or inactive for workers with experience in automatable jobs compared to those with experience in non-automatable jobs

Note: Results from two multinomial logistic regressions (one for the full sample and one for the youth sample). The bars show regression coefficients, while the whiskers indicate the 90 per cent confidence intervals. The baseline category is "employed". The full sample has 125,772 observations, of which 35,858 are youth (aged 16–29). Controls include gender, age and age squared (only age for the youth sample), six ISCED dummies and 22 country dummies. The confidence intervals were calculated on the basis of standard errors clustered by four-digit ISCO codes.

Source: ILO calculations based on data from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

of work. Figure 2.13 shows that, on average, workers with experience in fully automatable jobs are 4.3 times more likely to be unemployed than those with experience in non-automatable jobs. Similarly, they are 4.6 times more likely to be inactive (and not in formal education). The pattern for young workers is similar to that observed in the full sample.
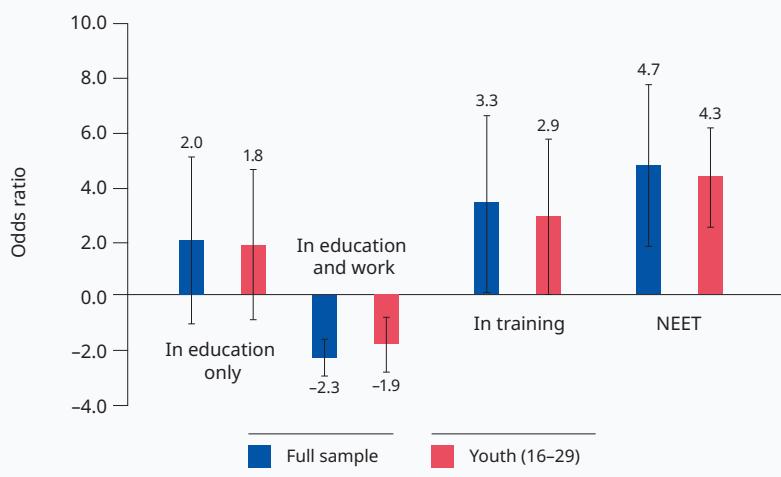
Based on a second breakdown of the labour market status of workers, figure 2.14 shows that those with experience in automatable jobs are 3.3 times more likely to be in training (as opposed to being in work only) than those with experience in non-automatable jobs. They are 4.7 times more likely to have NEET status and 2.3 times less likely to be simultaneously engaged in education and work. The pattern for young workers is again similar to that observed in the full sample.

There are significant differences in the likelihood of returning to formal education after working in an automatable job among people with different initial levels of education: this likelihood increases with the level of education (figure 2.15). Among the "post-secondary, non-tertiary" group of workers, the likelihood of being in formal education (relative to being employed) increases with the level of job automatability. After leaving a fully automatable job, workers with post-secondary qualifications are between 3.8 and 10.1 times more likely to return to formal education than to return to work.[6]

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[6] Furthermore, the likelihood of being unemployed and the likelihood of being inactive also increase with the level of education, although not as sharply as the likelihood of returning to formal education. This is probably driven by how people self-select into occupations (holding the level of education and other characteristics constant).

Figure 2.14

Odds of being in education, in education and work, in training or NEET for workers with experience in automatable jobs compared to those with experience in non-automatable jobs
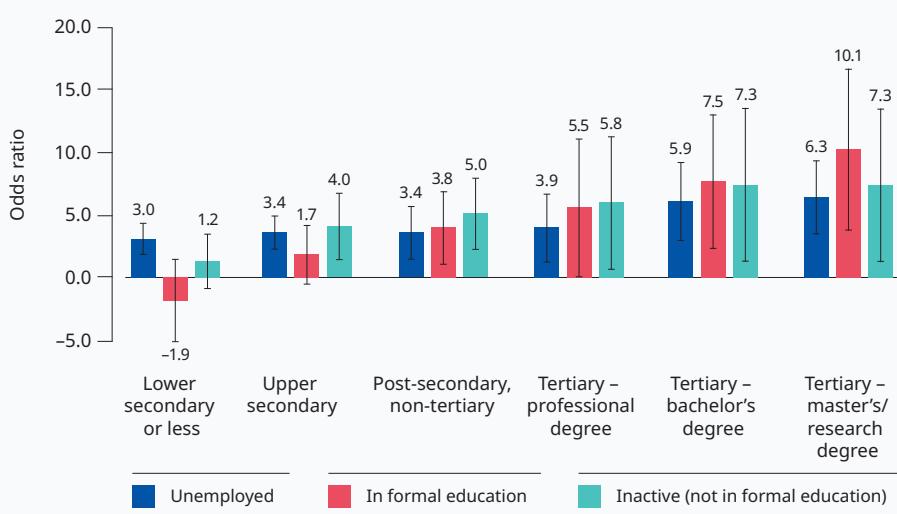
Note: Results from two multinomial logistic regressions (one for the full sample and one for the youth sample). The bars show regression coefficients, while the whiskers indicate the 90 per cent confidence intervals. The baseline category is "in work only". The full sample has 125,772 observations, of which 35,858 are youth (aged 16–29). Controls include gender, age and age squared (only age for the youth sample), six ISCED dummies and 24 country dummies. The confidence intervals were calculated on the basis of standard errors clustered by four-digit ISCO codes.

Source: ILO calculations based on data from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

Figure 2.15

Odds of being unemployed, in formal education or inactive for workers with experience in automatable jobs compared to those with experience in non-automatable jobs, by level of educational attainment

Note: Results from six multinomial logistic regressions, each estimated for a specific level of education. The bars show regression coefficients, while the whiskers indicate the 90 per cent confidence intervals. The baseline category is "employed". The samples are the same as those in figures 2.13 and 2.14 but divided into ISCED groups. Controls include gender, age and age squared, and 22 country dummies. The confidence intervals were calculated on the basis of standard errors clustered by four-digit ISCO codes.
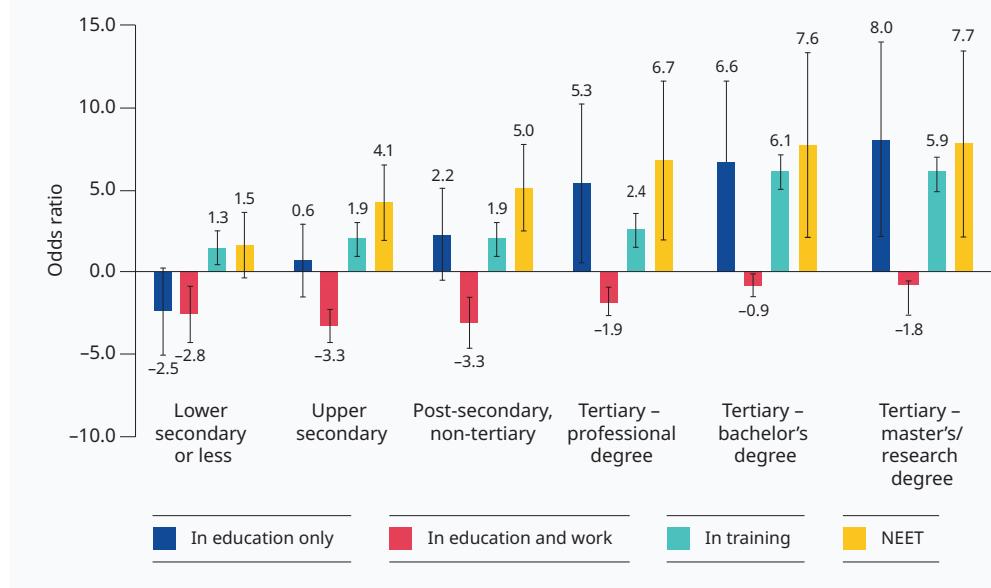
Source: ILO calculations based on data from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

Moreover, the likelihood of participating in training after being employed in an automatable job increases with the initial level of educational attainment. While workers with a lower secondary education or less and with experience of an automatable job are only 1.3 times more likely to be in training (as opposed to being in work only) than similarly educated workers with experience in a non-automatable job, those with a tertiary professional degree are 2.4 times more likely and those with a tertiary bachelor's or master's degree are 6.1 times more likely (figure 2.16). On the other hand, the likelihood of having NEET status also increases with the level of educational attainment.

Our analysis indicates that, overall, those with a higher education are better able to adjust to the changing labour market landscape than those with secondary education or less by returning to formal education and training. However, at any level of education, those with experience in automatable jobs find it more difficult to move to another job and often end up unemployed or inactive.

Figure 2.16

Odds of being in education, in education and work, in training or NEET for workers with experience in automatable jobs compared to those with experience in non-automatable jobs, by level of educational attainment

Note: Results from six multinomial logistic regressions, each estimated for a specific level of education. The bars show regression coefficients, while the whiskers indicate the 90 per cent confidence intervals. The baseline category is "in work only". The samples are the same as those in figures 2.15 and 2.16 but divided into ISCED groups. Controls include gender, age and age squared, and 22 country dummies. The confidence intervals were calculated on the basis of standard errors clustered by four-digit ISCO codes.

**Source:** ILO calculations based on data from PIAAC Public Use Files on Survey of Adult Skills (2012 and 2014).

2.7 Skill-related alternatives to automatable occupations are themselves at risk

Which career paths are available to individuals whose jobs are at a high risk of automation? The possibility of a career move can be examined from the perspective of the occupation hitherto pursued. This approach has been used in a number of studies of developed economies, particularly the United States (see e.g. Alabdulkareem et al., 2018; Allen et al., 2012; Mealy, del Rio-Chanona and Farmer, 2018; Nedelkoska, Diodato and Neffke, 2018; WEF and BCG, 2018). It is based on the idea that human capital is transferable across occupations (Gathmann and Schönberg, 2010; Poletaev and Robinson, 2008), implying that skills acquired in one occupation can enable entry into a different but skill-related occupation.

The most relevant of these studies is probably reported by Allen et al. (2012), who identified related occupations for career changers and career starters in the United States.[7] The lists of related occupations thus obtained can be used by individuals to decide which alternative occupations are similar to the one they are considering entering (starters) or leaving (changers). For instance, for the occupation "gas plant operator", the top 10 alternative occupations include manufacturing production technicians, transport vehicle and equipment inspectors, and signal and track switch repairers. Among the top 10 alternative occupations for "telemarketers" are receptionists, demonstrators and product promoters, and insurance claims clerks (table 2.1). Though the opportunities for transitioning into related occupations clearly vary in different countries, as do the formal qualification requirements, few countries provide information on occupational content that is as detailed as that of the United States.

It is also important to determine whether these occupational alternatives are themselves safe from automation. The fact that an occupation has many skill-related alternatives does not necessarily imply that workers displaced from it can easily enter another occupation. If most related occupations have a highly automatable skill content, then there are likely to be few "safe" job alternatives for displaced workers. As can be seen in figures 2.17 and 2.18, the non-random nature of the distribution of the risk of automation means that there are few safe skill-related alternatives to the occupations that are considered at high risk (Nedelkoska, Diodato and Neffke, 2018). Figure 2.17 displays a network of skill-related occupations, constructed analogously to the Career Changers Matrix of the Occupational Information Network (O*NET) in the United States. The occupations (represented by the nodes) have colours corresponding to their job families (listed in the legend), and their positioning is determined by the similarity of their job tasks to those of other occupations. The visualization clearly shows that occupations in the same job family tend to be closely clustered. The education cluster (orange), for instance, can be easily distinguished from the health cluster (pink). On the other hand, occupations are more intertwined in the job families of production; installation, maintenance and repair; transport; and construction. This suggests that it is relatively easy to change jobs between occupations within the education cluster, while it is relatively difficult to move from an occupation in the education cluster to an occupation in the health cluster. However, for some occupations in the production job family, it is relatively easy to switch to jobs in other families, such as repair, construction and transport.[8]

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[7] The National Center for O*NET Development in the United States calculates the similarity of occupations for *career changers* on the basis of job content information for approximately 1,000 occupational groups. The domains that describe these occupations and serve as the basis for the calculation of occupational similarity include knowledge, skills, work activities, work context and job zone. The Occupational Information Network (O*NET) uses an analogous method to calculate occupational similarity for those who are deciding on their initial career (career starters), but the job domains used are different, namely, abilities, interests, work styles and work values (Allen et al., 2012).

[8] Gathmann and Schönberg (2010), Mealy, del Rio-Chanona and Farmer (2018), and Nedelkoska, Diodato and Neffke (2018) demonstrate that skill-relatedness, determined by the job-task content of occupations, can be used to provide accurate predictions of the occupations to which individuals are likely to switch.
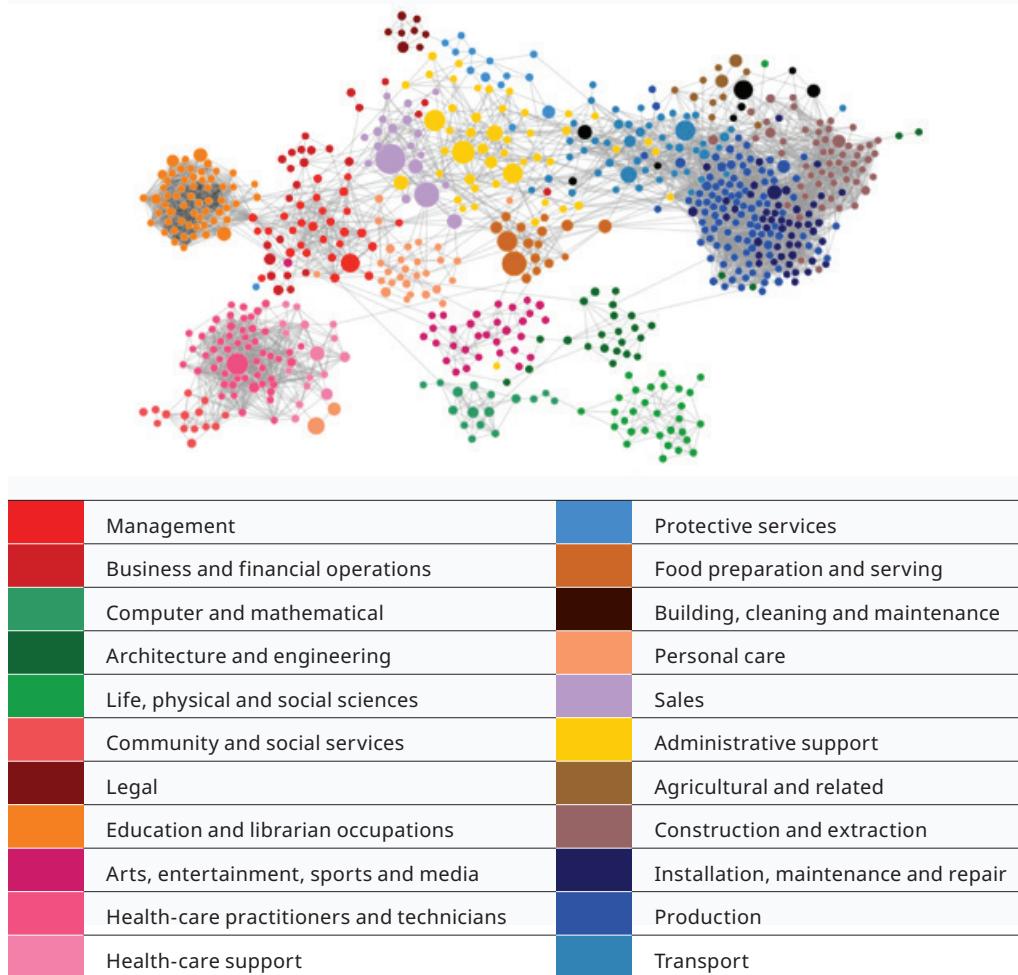
Table 2.1

Alternative career paths open to those in occupations at high risk of automation

Occupation	Risk of automation	Related occupations
Credit analysts	0.98	Accountants Budget analysts Insurance underwriters Compensation, benefits and job analysis specialists Personal financial advisers Financial analysts Bookkeeping, accounting and auditing clerks Brokerage clerks Auditors Loan interviewers and clerks
Loan officers	0.98	Insurance sales agents Customs brokers Tax preparers Loan interviewers and clerks Brokerage clerks Personal financial advisers Sales agents, financial services Real estate sales agents Credit authorizers Eligibility interviewers, government programmes
Cashiers	0.97	Hosts and hostesses, restaurants Waiters and waitresses Stock clerks, sales floor Counter and rental clerks Ushers, lobby attendants and ticket takers Combined food preparation and serving workers Cooks, fast food Counter attendants Gaming change persons and booth cashiers Amusement and recreation attendants
Telemarketers	0.99	Switchboard operators, including answering service Telephone operators Receptionists and information clerks Insurance claims clerks Bill and account collectors Customer service representatives Demonstrators and product promoters Locker room, coatroom and dressing room attendants Licence clerks Order fillers, wholesale and retail sales
Gas plant operators	0.78	Stationary engineers and boiler operators Gas compressor and gas pumping station operators Power plant operators Control and valve installers and repairers Manufacturing production technicians Pump operators, except wellhead pumpers Electrical and electronics repairers Transport vehicle, equipment and systems inspectors Petroleum pump system operators, refinery operators and gaugers Signal and track switch repairers

Note: Selected occupations at high risk of automation as calculated by Frey and Osborne, 2017.

Source: Allen et al., 2012.

Figure 2.17

Skill-relatedness of occupations

🟥	Management	🟦	Protective services
🟥	Business and financial operations	🟧	Food preparation and serving
🟩	Computer and mathematical	🟫	Building, cleaning and maintenance
🟩	Architecture and engineering	🟧	Personal care
🟩	Life, physical and social sciences	🟪	Sales
🟥	Community and social services	🟨	Administrative support
🟥	Legal	🟫	Agricultural and related
🟧	Education and librarian occupations	🟫	Construction and extraction
🟥	Arts, entertainment, sports and media	🟦	Installation, maintenance and repair
🩷	Health-care practitioners and technicians	🟦	Production
🩷	Health-care support	🟦	Transport

Source: Nedelkoska, Diodato and Neffke, 2018, using O*NET data.

Figure 2.18 shows the distribution of the risk of automation as calculated by Frey and Osborne (2017) applied to the network of skill-related occupations from figure 2.17. Darker hues indicate a higher risk of automation. Clearly, the risk is not randomly distributed across job families. Most occupations in the clusters of administrative support, sales and food preparation and serving are at a high risk of automation. Almost all occupations in the cluster comprising the job families of production; installation, maintenance and repair; construction; and transport are at a high risk of automation. Few occupations are at a high risk of automation within the job families of education; management; business and finance; life, physical and social sciences; architecture and engineering; and computer and mathematical. A range of assorted occupations are at risk within the following job families: legal; personal care; protective services; arts, entertainment, sports and media; and health. It is evident from this visualization that workers whose human capital is specific to the cluster of production, repair, construction and transport will find it difficult to find jobs outside that cluster without significant re-qualification (see box 2.4 for the example of gas plant operators and the risk of automation of skill-related occupations), while workers whose human capital is specific to the legal cluster may find it easier to switch occupations within the same job family.

Figure 2.18

Distribution of risk of automation across occupations

Source: Nedelkoska, Diodato and Neffke, 2018, using O*NET data and estimates of the risk of automation from Frey and Osborne, 2017.

▶   **Box 2.4**

Gas plant operators, skill-related occupations and the risk of automation

According to the US Bureau of Labor Statistics (BLS), there were about 17,000 gas plant operators in the United States in 2016 who earned a median wage of US$34 an hour or US$71,000 annually (National Center for O*NET Development, 2019). The number of jobs in this occupation is projected to grow slightly in the following decade (–1/+1 per cent), and the estimated probability of near-future automation is 0.78.

The data underlying figure 2.17 indicate that there are 26 occupations with skills similar to those required to work as a gas plant operator. Nearly all (20) are in the same job family (transport), while three are in production, two in protective service occupations and one in administrative support. The employment-weighted risk of automation of the 26 immediately neighbouring occupations is 0.95, and the total employment in these is projected to shrink by 93,000 jobs (6 per cent) by 2026 according to the BLS. In other words, should automation affect their occupation, gas plant operators are likely to be forced to move from one precarious occupation to another, unless they invest in re-skilling so that they can join a job family with a total lower risk of automation.

2.8 New policies are required to ensure a bright future of work for young women and men

Rapid technological advances are transforming the world of work, bringing both oppor-tunities and challenges. Young women and men play an important role in making the most of new technologies. However, even in the early stages of the most recent wave of technological innovation, young people expressed deep-seated anxieties over their future employment prospects. The accelerated development and adoption of new technologies has made questions such as "What am I going to do? What is my future?" even more pressing (ILO, 2012). The analysis in this chapter indicates the following:

▶ The risk of automation of jobs peaks among young people in both developed and developing countries; there is a second, less pronounced peak among older workers.

▶ As certain skills are being made obsolete by automation, so are some educational tracks that equip individuals with those skills. Specifically, current forms of vocational training are associated with more automatable jobs.

▶ Young people in automatable jobs face a higher likelihood of subsequent tran-sition into unemployment and inactivity. Furthermore, occupations at high risk of automation lack safe skill-related alternatives, potentially trapping individuals in a situation where they frequently have to switch from one precarious job to another.

Historical experience suggests that economies where innovation thrives can overcome the preceding challenges and re-invent themselves by creating new jobs (Autor, 2015). Designing and executing appropriate policies will be critical if a sufficient number of productive jobs is to be created for young people to transition into during their careers (see Chapter 5 for a more detailed discussion of policy implications). The digital economy that is being shaped today calls for new policies, including a macroeconomic policy framework that promotes full and productive employment, as well as structural trans-formation and sectoral strategies buttressed by an effective system of lifelong learning.

The sorting of young women and men into more automatable occupations and entry-level jobs points to the need to enhance the school-to-work transition, notably through better education and counselling regarding job opportunities and challenges arising from technological advances. In particular, the finding that vocational education, *ceteris paribus*, gives entry to more automatable jobs makes it clear that it is essential to modernize and adapt vocational education and training programmes so that young people are better able to meet the demands of the digital economy.

Skill-related alternatives to automatable occupations are themselves at risk and could trap individuals in situations where they are forced frequently to switch from one pre-carious job to another, or where they are discouraged from participating in the labour market altogether. This highlights the importance of re-skilling and lifelong learning, as well as the need for effective systems of social protection. Furthermore, the increasing difficulty of progressing from entry-level jobs to middle-skill roles, along with the higher likelihood of young people in automatable jobs subsequently transitioning into unemployment and inactivity, calls for a reinvigoration of active labour market policies. Governments, workers, employers and educational institutions need to join forces to build and finance an effective lifelong learning "ecosystem" (ILO, 2019) and to strengthen public employment services, as explored in the next chapter.

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▶ Occupational changes and the role of public employment services in helping young people to navigate the labour market

Technology, combined with other labour market drivers such as ageing, is influencing the jobs that are available to young people. The ability to respond to, and prepare for, changes in the demand for labour is an important factor if young people are to achieve successful transitions into and within the labour market. Public employment services are successfully adapting their business models, especially by using new technologies, to support young people more effectively. The occupational preferences of employers and jobseekers, however, are not changing as swiftly as one would expect with rapid technological change. This may point either to a time lag in adjusting to new conditions or to a situation in which it is the nature and content of jobs, rather than the occupations themselves, that are changing. Demand for entry-level jobs in more traditional sectors, such as health and social care, retail and food, accounting and financial services, is currently greater than demand for such jobs in the information technology sector. With respect to changes in demand, the occupational preferences of jobseekers are changing, but there is a noticeable time lag.

3

Chapter 3. Occupational changes and the role of public employment services in helping young people to navigate the labour market

As discussed in Chapter 1, young people in both developing and developed countries continue to face disproportionate disadvantages in the labour market compared with adults. Moreover, as argued in Chapter 2, they are at greater risk of automation because they tend to be concentrated in easily automatable occupations. One would expect the rapid automation of jobs – if it is indeed occurring – to have an effect on the types of vacancies issued by employers, including the work experience that they expect applicants to have. Additionally, given that entry-level jobs are more liable to automation, the share of such jobs, which are often filled by younger workers, should be declining.

In this chapter, we analyse the changes in occupational preferences among employers (demand) and jobseekers (supply), using data on entry-level jobs from Burning Glass Technologies. Since these data cover mostly advanced countries in Europe and Northern America, along with Singapore, we have also drawn on data from three public employment services – in Belgium (Wallonia region), Morocco and the Republic of Korea – to gain a better understanding of the aggregate trends observed in the first data set. (The lack of comparable data from the public employment services of developing countries remains a key constraint in this chapter.) Finally, we consider whether public employment services are sufficiently well prepared to assist young people in coping with labour market transitions caused by digitalization and other emerging trends.

The chapter is organized as follows: the first section examines which occupations are in most demand for entry-level jobs (though it should be noted that the data do not allow for analysis of their task composition). The second section considers the (potential) impact of digital technologies on public employment services, and reviews good practices in the delivery of services to young people and other labour market participants. The third section discusses the problems faced by employment services when adopting new technologies as well as the challenges that these pose in terms of integrating jobseekers into the labour market. The fourth and final section provides some conclusions.
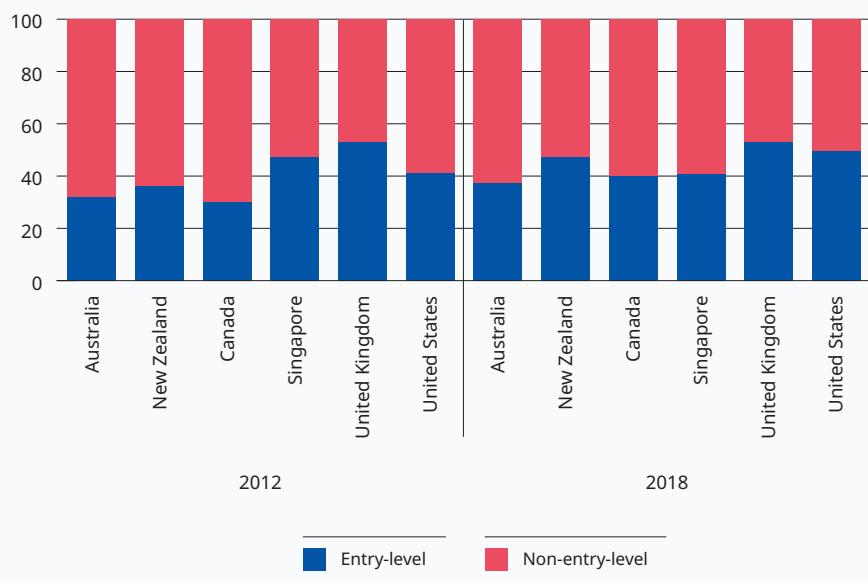
3.1 Shifts in occupational demand for entry-level jobs

3.1.1 The share of entry-level jobs is increasing in advanced economies

The literature on the impact of technology on employment suggests that routine jobs are increasingly liable to automation, while middle-skilled jobs are being hollowed out. At the same time, the skill requirements of high-level jobs are rising further. Moreover, studies indicate that youth jobs tend to be highly automatable and that the risk of being trapped in a precarious situation as a consequence is high. One of the original objectives of the present report was to use data from public and private employment agencies to investigate the recent evolution of entry-level jobs (defined as up to two years of work experience) in terms of the types of job that are available, their skill and technological content and their quality, as well as to identify the changes in jobseekers' preferences. Owing to data limitations, however, we have had to focus on changes in the occupations most in demand among jobseekers, on the one hand, and employers, on the other. We draw on microdata obtained from the analytics software company Burning Glass Technologies and three public employment services, as mentioned earlier.

Figure 3.1a

Share of job vacancies by level of experience, selected countries, 2012 and 2018 (percentages)

Source: ILO calculations based on microdata from Burning Glass Technologies.

A comparison of entry-level job vacancies posted between 2012 and 2018 shows that, in the six countries covered by the Burning Glass Technologies data, the share of such vacancies increased in all countries except Singapore, where there was a drop of 6.5 percentage points. In the United Kingdom, the share remained stable, at around 53 per cent, while New Zealand and Canada registered the highest increase (figure 3.1a).[1]
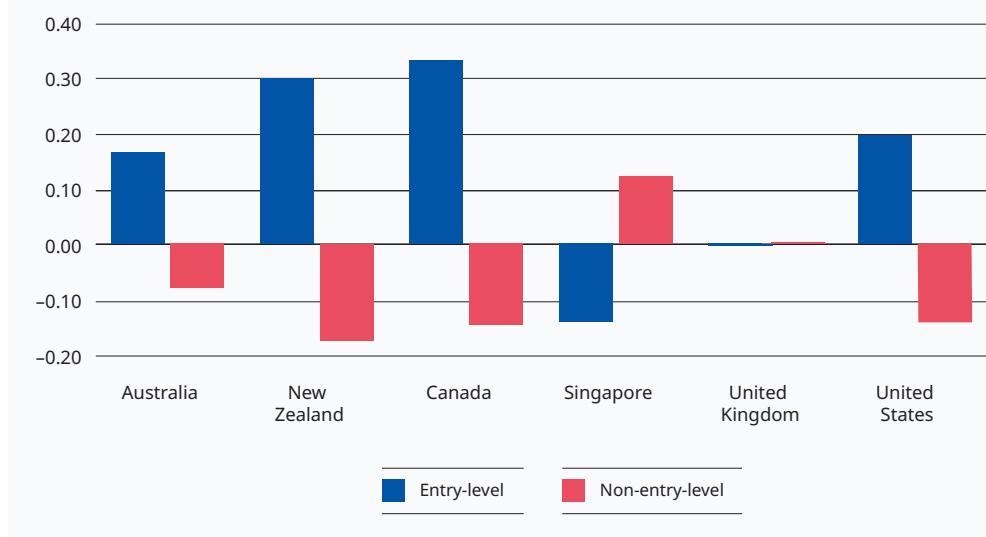
Figure 3.1b presents the rate of change in the number of entry-level and non-entry-level job vacancies between 2012 and 2018. In four of the six countries, the number of entry-level vacancies increased while the number of vacancies for jobs requiring more experience declined. In New Zealand, the United States, Canada and Australia, the number of vacancies for jobs requiring more experience declined by between 8 and 17 per cent, while, over the same period, the number of entry-level vacancies increased by between 17 and 33 per cent. In Singapore, entry-level vacancies decreased while non-entry-level vacancies increased. In the United Kingdom, the numbers for both types of vacancies remained unchanged.

The data from India (not included in figure 3.1b) show that the number of entry-level vacancies increased by 1,700 per cent between 2015 and 2019, while that of non-entry-level vacancies increased by 185 per cent. These remarkably high increases almost certainly have to do with the fact that India's public employment service (the National Career Service) launched a national online job portal for the first time in 2015. Once the job portal was launched, many vacancies were transferred to the new portal from manual or local records.

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1 The analysis was performed by Fernanda Bárcia de Mattos.

Figure 3.1b

Change in the share of job vacancies by level of experience, selected countries, 2012 and 2018 (percentages)

Source: ILO calculations based on microdata from Burning Glass Technologies.

As can be seen in figure 3.2, out of the total number of vacancies posted on India's online job portal, the share of entry-level vacancies (requiring zero to two years of experience) has been consistently growing over the past years, increasing from 43 per cent in 2015/16 to 67 per cent in 2018/19.
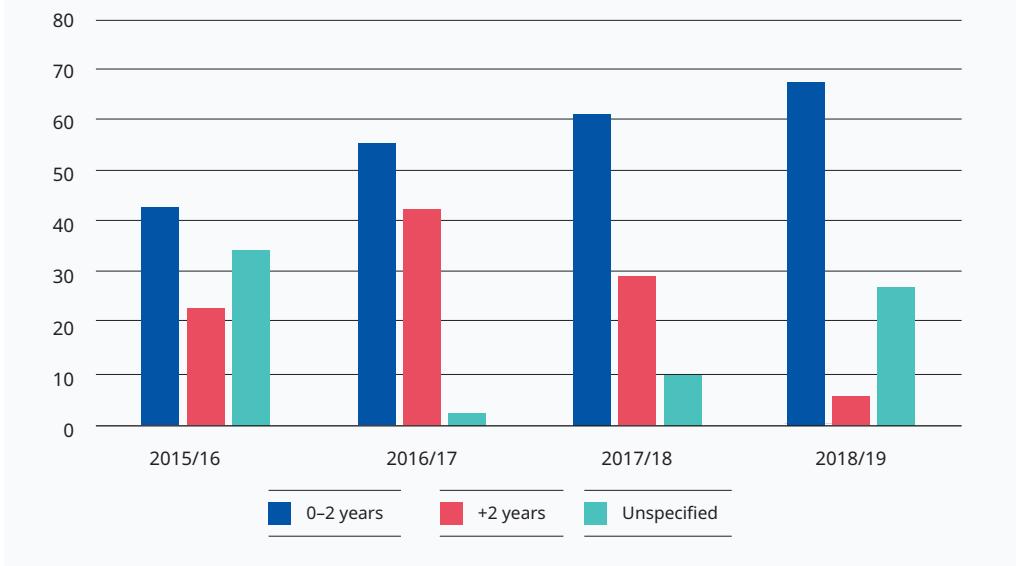
However, it should be noted that the data in figure 3.2 cover only the cross-section of India's labour market captured by the National Career Service's job portal. It is likely that employers also use private portals and other means of recruitment to fill non-entry-level vacancies for more skilled jobs. The educational qualifications required for jobs have not changed significantly in India over the period considered. As no data are available on the tasks contained in the occupations, it is possible that the task composition has changed while the occupations themselves have yet to change.

As noted earlier, in all countries covered by figures 3.1a and 3.1b, except for Singapore, the share of entry-level jobs increased at a higher rate than that of jobs requiring more experience. This could reflect either an increase in the creation of entry-level jobs or a growing preference to advertise such jobs on online portals of public employment services. It is worth noting that the data in figures 3.1a and 3.1b come from advanced countries whose output growth has generally recovered since the economic and financial crisis of 2007–08. This output recovery has been accompanied by a decline in unemployment and moderate-to-high growth in employment, implying that, along with automation, several other factors may be influencing the creation and destruction of entry-level jobs. For example, the types of contracts offered to new employees are changing. There is also a trend towards more entry-level jobs that are of shorter duration.

Moreover, some jobs may be disappearing altogether: for example, in the United Kingdom, according to the Office for National Statistics (2019a), 25.3 per cent of all

Figure 3.2

Job vacancies by level of experience, India, 2015–19 (percentages)

Source: ILO calculations based on data provided by the Ministry of Labour and Employment, India.

supermarket checkout assistant jobs disappeared between 2011 and 2017, mainly because of automation. Other entry-level jobs whose numbers have decreased by 15 per cent or more as a result of automation include laundry workers, farm workers and tyre fitters. Yet, unemployment levels in the United Kingdom have steadily declined: in June 2019, the unemployment rate was as low as 3.9 per cent (Office for National Statistics, 2019b), suggesting that the effects of automation are being masked by the availability of other jobs. Moreover, the proliferation of atypical jobs, such as zero-hour contracts and similar forms, is likely to account for some of the growth in entry-level jobs, as is the general expansion of the gig and sharing economies.

3.1.2 Educational requirements in job vacancies are generally increasing in advanced economies

In 2018, the majority of vacancies for workers with all experience levels posted in Australia, Canada, New Zealand, Singapore and the United Kingdom required a minimum of 16 years of education (equivalent to a bachelor's degree or higher). In Australia, Canada, Singapore, the United Kingdom and the United States, higher education levels were required of more experienced workers than of those entering the labour market for the first time. In contrast, in New Zealand, entry-level vacancies required applicants to have 16 or more years of education slightly more often than vacancies for more experienced workers. Demand for highly educated entry-level workers is also high in Australia, where over 71 per cent of entry-level vacancies required a minimum of 16 years of education in 2018, slightly down from 74 per cent in 2012. The difference in educational requirements in vacancies for entry-level and more experienced workers was the widest in Canada, Singapore and the United States. Anecdotal evidence from India also points to increased demand for specialized technical skills (see box 3.1).

▶ **Box 3.1**

**Most frequently advertised jobs and skills shifts
in the private sector in India**

An analysis conducted by TeamLease of vacancies advertised on private job portals in India over the last four months of 2018 showed that nine technology-related jobs topped the list: CAD Technician, Java Developer, CAD Designer, Mechanical Designer, Mechanical Engineer, Quality Engineer, Design Engineer, Junior Software Engineer and CAD Drafter (in descending order). Most of these do not appear to be entry-level jobs (except for Junior Software Engineer).

There has been an apparent shift in demand towards specialized high-end technical skills (e.g. artificial intelligence, automation, cloud technology, Internet of Things) and soft skill sets (e.g. analytical and problem-solving, interpersonal, communication and ability to work in teams). The sectors in which demand for jobs has increased are information technology, e-commerce, financial technology, health care, logistics and the automotive industry.

Source: Data provided by TeamLease, India.

3.1.3 The list of top 20 occupations for entry-level jobs remains stable

Using data from Burning Glass Technologies on vacancies posted online by employers seeking to hire entry-level jobseekers and more experienced workers, we identified the 20 most sought-after occupations in 2012 and 2018 for Australia, Canada, New Zealand, Singapore, the United Kingdom and the United States.

Overall, there were slightly more changes in the vacancies posted for more experienced workers for occupations most in demand than for entry-level jobseekers. On average, 15 out of the 20 most sought-after occupations in advertisements for entry-level positions were the same in 2018 as in 2012, compared with 14 for more experienced workers. Labour demand was more stable in Canada, Singapore, the United Kingdom and the United States than in Australia and New Zealand.

3.1.4 There is a noticeable shift in demand to non-ICT related occupations for entry-level jobs

There is growing demand for entry-level workers, likely to be young workers, in occupations related to health and social care (particularly for registered nurses), accounting for 20 per cent of the top 20 occupations for entry-level jobs and for 5–10 per cent of the top 20 occupations for experienced workers. Demand for applicants in sales and marketing positions is strong in all countries for both entry-level and more experienced workers. Employers continue to look for entry-level workers in retail and food services in five of the six countries studied; however, demand for more experienced workers is not as high. There is stable demand for entry-level and more experienced workers in accounting and bookkeeping, which feature among the top 20 occupations for all six countries in 2012 and 2018. Employers are also keen to fill entry-level positions in human resources. Occupations in logistics and distribution provided opportunities for entry-level workers in all six countries in 2018, with at least one occupation among the most frequently advertised (including truck and forklift drivers, material handlers and stock clerks); however, logistics and distribution are not so important for employers looking for experienced workers. All the countries

have at least one entry-level ICT occupation among the 20 most advertised in 2012 and 2018. Five of the six countries have three ICT occupations in the top 20, though the specific occupations do vary by country. ICT occupations are even more prominent among the vacancies issued by employers looking for more experienced workers, accounting for between three and six of the top 20 occupations in all the countries. One interesting trend is the declining demand for engineers: four of the six countries had at least one engineering occupation among the most advertised online in 2018, compared with all six countries in 2012. No engineering occupation is ranked in the top 20 most advertised entry-level positions in 2018 (down from one in 2012).
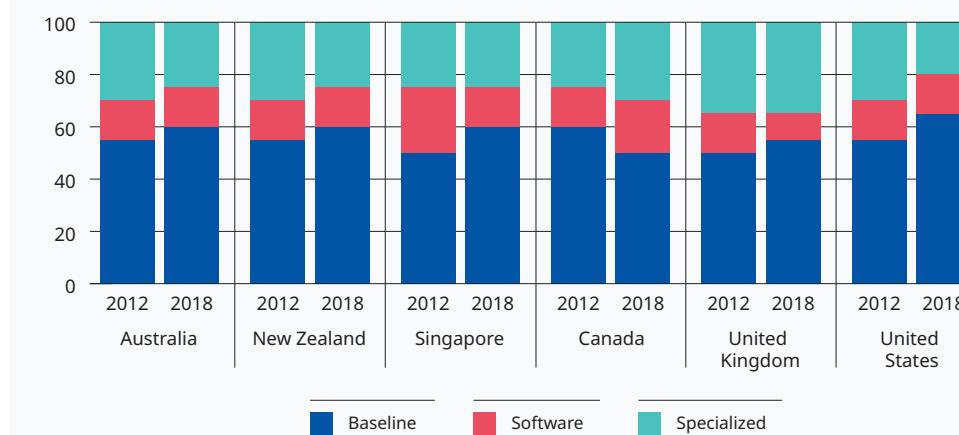
3.1.5 Wider skill set now required for entry-level jobs

The data suggest that employers are looking for workers with a range of skills, including (a) baseline or general skills (e.g. writing and ability to work in a team); (b) software skills related to computer literacy and technology; and (c) specialized skills for specific occupations such as accounting and sales (figures 3.3a and 3.3b). Overall, in 2012 and 2018, the skills most in demand were similar across all six countries. In 2012, the skills required for entry-level jobs included communication skills, customer service orientation, teamwork, problem-solving, organizational skills, planning and proficiency in computer applications such as Microsoft Word and Excel. Two more skills, namely, sales and writing, were added to the list in 2018. It is worth noting that, in terms of technological content, employers expect all potential employees to have general ICT skills such as computer literacy and a good knowledge of word processing and basic data processing programs. In all countries except Canada the share of job vacancies requiring baseline skills has increased, while the share of vacancies requiring software skills has declined or remained constant.

Analysis of the rate of change in skill sets most sought after by employers for entry-level vacancies during the period considered yields similar results (figure 3.3b, panel A). Except for Canada, demand for baseline skills has increased in all countries (with the highest increases in Singapore and the United States), while demand for specialized skills has declined in three countries and remained constant in two. Interestingly, demand for software skills has declined in Singapore and the United Kingdom, increased in Canada and remained constant in Australia, New Zealand and the United States.

Figure 3.3a
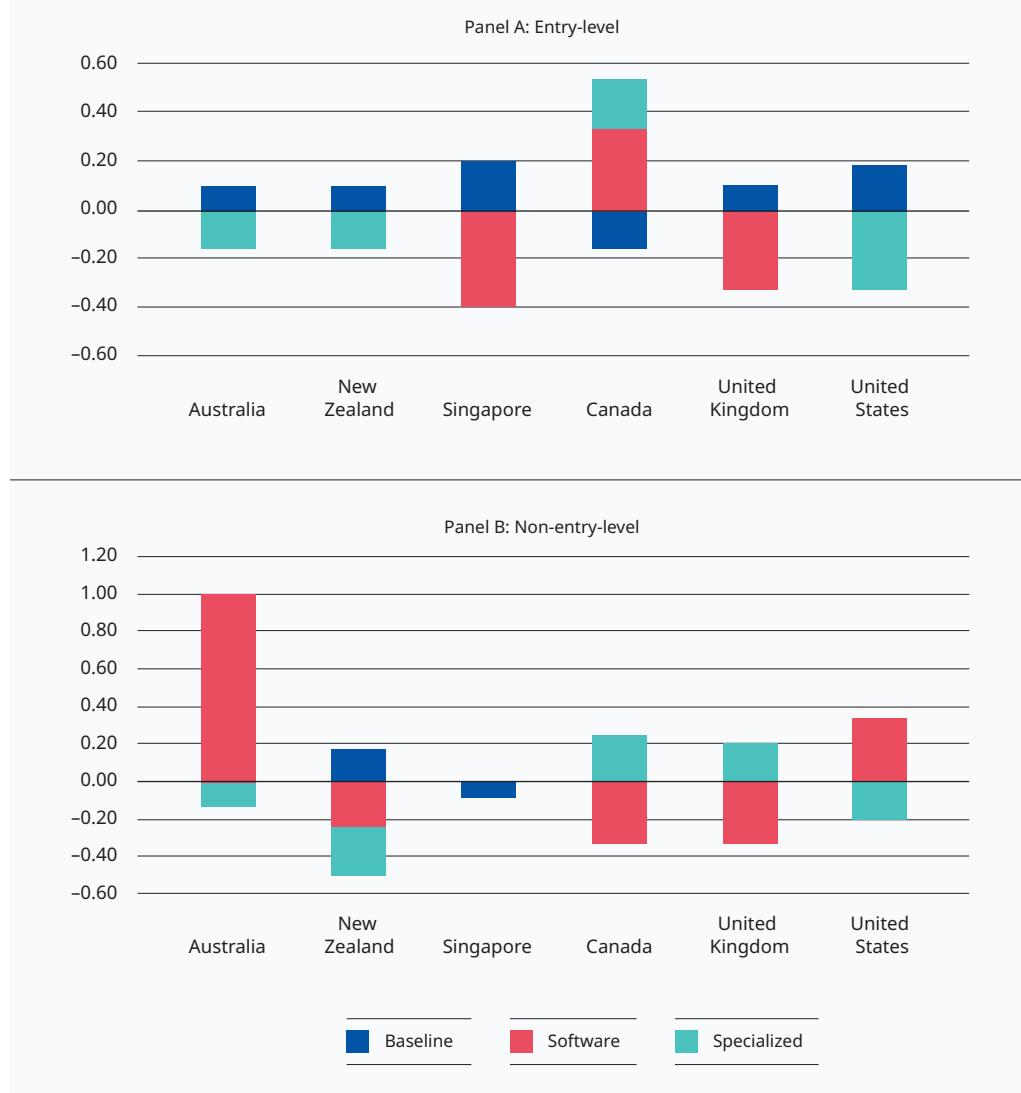
Skills most sought after by employers, by type, selected countries, 2012 and 2018
(percentage share of top 20 skills mentioned in entry-level job vacancies)

Source: ILO calculations based on microdata from Burning Glass Technologies.

Figure 3.3b

Rate of change in skills most sought after by employers, by type, 2012–18

Panel A: Entry-level

Panel B: Non-entry-level

■ Baseline   ■ Software   ■ Specialized

Source: ILO calculations based on microdata from Burning Glass Technologies.

iStock.com

Demand for baseline skills in vacancies requiring more than two years' experience (figure 3.3b, panel B) has remained constant in four of the six countries; however, it increased in New Zealand and declined in Singapore. Demand for software skills in non-entry-level vacancies has decreased in three countries and increased in two, while demand for specialized skills has increased in two countries and decreased in three. In Singapore, demand for both types of skills remained constant.

3.1.6 Country-level data from public employment services corroborate occupational stability findings

To investigate country-level trends in youth jobs, we requested and obtained relevant information from public employment services in a number of countries across all regions.[2] In this and the following subsections we present the results of our data analysis spanning the years 2013–18 from three countries: Belgium (Wallonia region), the Republic of Korea and Morocco.

This analysis corroborates the findings discussed earlier regarding the stability of occupational preferences. Thus, we find that there is a high concentration of jobseeker and employer preferences in the top 10 occupations, and that these preferences have remained stable over the last five to six years in all three countries. However, jobseekers' occupational preferences tend to lag behind those of employers. We also examined the responsiveness of jobseekers' occupational preferences to changes in the occupational demand of employers, disaggregated by age (young jobseekers) and education (graduates). In general, there is a positive correlation between jobseeker preferences and excess demand in Belgium and the Republic of Korea; however, there is no evidence that young jobseekers are less responsive than jobseekers in the full sample.

There is a high concentration[3] of occupations in the top 10 occupations aspired to by jobseekers, ranging from 66 per cent in Morocco to 42 and 32 per cent in Belgium and the Republic of Korea, respectively. The concentration in the 10 most in-demand occupations as far as employers are concerned is lower in Belgium (30 per cent) and Morocco (41 per cent), higher in the Republic of Korea (35 versus 32 per cent). The composition of the top 10 occupations prized by employers has changed to a greater extent in Belgium than in the other two countries.

The differences in the stability of employers' and jobseekers' occupational preferences highlight the fact that a large number of jobseekers have had jobs before and are keen to pursue the same occupation. Jobseekers' preferences, therefore, tend to be more stable than those of employers, who are more interested in changing their occupational profiles over time; it is also necessary to take into account the turnover caused by firm openings and closures. Differences in the occupational preferences of employers and jobseekers also reflect the fact that educational and training curricula tend to lag behind developments in labour demand. In some countries, the correlation between firms' and workers' preferences appears to weaken over time. Similarly, we find very limited matching or overlap between the occupations most in demand among employers and those most strongly represented among jobseekers, with the partial exception

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[2] Owing to the complexity of this information (or the lack thereof in some cases), and because of the differences in the classification systems where they existed, the only analysis possible was one based on occupations. Data were provided by public employment services in Belgium (Wallonia region), India, the Republic of Korea, Mexico, Morocco, Namibia and South Africa, albeit at different times and with varying levels of comprehensiveness. A comparative analysis of the data was hampered by differences in the metadata, some of which did not relate to any standard classification. It was not possible to conduct an analysis by sector for any of the countries (except for India, which provided aggregated data). This was also true of the data provided by Burning Glass Technologies.

[3] As indicated by the share of the top 10 occupations in the total number of occupations aspired to by jobseekers or demanded by employers.

of the Republic of Korea. These observations highlight the importance of lifelong learning, which enables unemployed workers to acquire new skills and take up new occupations in which more jobs are available.

3.1.7 Young jobseekers are not necessarily more responsive to occupational changes in the demand for labour than others

We analysed the responsiveness of jobseekers' preferences to vacancy gaps using a novel (but simple) methodology using absolute and relative changes to vacancy gaps.[4] We analyse the extent to which the number of jobseekers responds over time to baseline gaps between jobseeker and vacancy numbers. For instance, in an efficient labour market, we would expect jobseeker growth to be smaller or even negative in occupations that exhibit in an initial, baseline period larger mismatches (namely, a number of jobseekers that greatly exceeds the number of vacancies, that is, "excess supply") and vice versa, other things being equal. We consider the following three data sets: the full sample of jobseekers, subset of young jobseekers (aged 29 or younger) and subset of graduate jobseekers. This makes it possible to assess whether those two specific jobseeker groups exhibit greater responsiveness to changes in the labour market than the full sample of all jobseekers (regardless of age or education level). In Belgium and the Republic of Korea, jobseekers displayed greater preference for occupations for which there was excess demand. However, we did not find evidence for the responsiveness of young jobseekers being greater than that of the full sample. This may, again, reflect the fact that educational and training curricula tend to lag behind changes in vacancy profiles. An alternative (or complementary) explanation is the targeted nature of some vacancies, which may, for example, be directed at older jobseekers. On the other hand, responsiveness is highest among graduates (many of whom are also young workers), suggesting that there is greater awareness of trends in labour market demand in universities than in secondary schools.

3.2 Impact of digital technology on public employment services

3.2.1 Online portals are more effective as a means of service delivery when combined with high quality information

A few studies have analysed the impact of online delivery of employment services on labour market outcomes, including the probability of finding a job, earnings and hours worked. For example, Dammert, Galdo and Galdo (2013 and 2014) examined a sample of new jobseekers registered with the Peruvian labour exchange network, CIL-ProEmpleo – which is run by the Ministry of Labour and whose database covers a relatively youthful population (with an average age of around 25 years) – to study the effects of digital labour market intermediation. The authors sought to establish which was more important: the speed of provision of information (through the Internet or text messages) or the scope and novelty of the information provided. They found that jobseekers who received enhanced information (i.e. information not just on vacancies posted by the public employment service but also on vacancies from other sources) achieved better employment outcomes. Thus, it was the quality of the information (inclusion of vacancies from other sources), rather than the digital channel itself, that mattered the most.

The Abdul Latif Jameel Poverty Action Lab conducted an experimental study in India among a sample of jobseekers registered with a private job-matching portal and recent vocational graduates from a government training institute run by the National Skill

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[4] "Vacancy gaps" were calculated as the difference between the number of jobseekers and vacancies in the respective occupations.

Development Corporation (NSDC) (JPAL South Asia, 2016). The jobseekers already registered on the private portal were divided into a treatment group and a priority treatment group (who received more information than the rest). The graduates from the NSDC institute (average age of 23 years) were divided into a control group, a treatment group (enrolment in the private portal) and a priority treatment group (priority access to the portal). The study found that jobseekers in the two priority treatment groups were more likely to find a job than those receiving normal services, although both groups were less likely to be employed than the control group. Women were more likely than men to find a job; moreover, their reservation wages increased halfway through the survey period. The study concludes that digital channels can counteract the inequality inherent in traditional job searches based on informal networks, and that job portals are more effective for some groups of labour market participants than others.

3.2.2 Public employment services are taking advantage of technological advances to tailor services to the needs of young people

Public employment services, in collaboration with private and third-sector providers of such services, play a crucial role in helping young people, including those with NEET status, to access the labour market and enhance their employability.[5] The technological advances of the Fourth Industrial Revolution, characterized by an unprecedented pace, present both opportunities and challenges for public employment services. These institutions have to adapt to technological changes to align their services with the needs of an online clientele (especially young people), take into account new forms of work and be able to compete with a range of new digital platforms that are now available to jobseekers.

If they are to remain key players in the labour market, public employment services should embrace technological innovations to improve their performance. They also have to be able to cater to the rapidly changing demands of employers and to the needs of jobseekers during their multiple life-course labour market transitions. Accordingly, the Global Commission on the Future of Work calls upon governments to invest in public employment services for them to support labour market transitions, including by adopting a customized and optimal combination of digital and personal counselling and mediation services, and to ensure that they have up-to-date labour market information system (Mwasikakata, 2019).

Public employment services are tasked by governments to act as intermediaries between jobseekers and potential employers. Technological developments can enable all state institutions to work more effectively and efficiently. Indeed, the rate of adoption of new technologies by public employment services and their level of digitalization are closely linked to overall government policy on technology and innovation. Public employment services can become more inclusive by using new channels to reach out to vulnerable groups in the labour market, including young people. However, the use of new technologies also has its disadvantages, notably the exclusion of those who lack digital skills – often people with little attachment to the labour market, such as the long-term unemployed, NEET youth and other marginalized groups.

3.2.3 Digitalization enables public employment services to improve the collection and analysis of labour market data

Digitalization of employment services enables exploitation of "big data" with the potential to improve job matching and tailoring of employment services to individual needs, as well as providing more accurate analysis of the labour market at the national and

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[5] In Benin, for example, using public employment services, working while in school and having more years of education significantly increases the probability of transitioning to a first job (Ndenzako, forthcoming).

regional level (Lee, 2018). In many advanced economies, public employment services have set up, or are setting up, systems for collecting big data, especially by linking databases on jobseekers and registered vacancies, and gathering data on job matching, unemployment insurance, training, wages, benefits and compensation for industrial accidents and occupational diseases. In the Republic of Korea, for example, the employment information network managed by the Korea Employment Information Service (KEIS) comprises several databases and systems: Work-Net (which contains information on all job openings in the country); the Employment Insurance (which provides information on unemployment benefit services); the Human Resources Development Network (which deals with vocational education and training); the BaroONE system (which integrates welfare and employment services); the Employment Permit System (which deals with foreign workers); the Employment Information Service (which provides an integrated analysis of employment information and statistics on the labour market); and the ILMOA network (which provides integrated information on jobs in public employment programmes and supports management of such jobs) (Chung, 2018; Lee, 2017). Thus, the country's public employment service makes detailed information available to jobseekers and employers. By tracking jobseekers throughout their working lives, as the Republic of Korea does, public employment services can meet their needs more effectively.

In Estonia, the data exchange system X-Road, launched as part of the "e-Estonia" strategy, makes it possible to share information on individuals across all government agencies and participating companies. As far as the country's public employment service is concerned, the benefits of using X-Road are many, including timely and informed decision-making, automatic processes, reduced paperwork and more time for case-workers to focus on hard-to-place jobseekers. In emerging and developing countries, digitalization can help provide information for labour market signalling, given the lack of up-to-date and time series data.

3.2.4 Digitalization can help public employment services to bridge skills gaps more effectively

Although skill development is generally the responsibility of educational institutions, the role of employment services in promoting employability has long been recognized, becoming more prominent in recent years. Three aspects are important in this regard:

▶ As public employment services have direct access to information about vacancies and jobseekers, they are in an excellent position to identify skill requirements and shortages.

▶ Public employment services provide career advice and recommend courses to help jobseekers improve their skills. They also advise employers, especially small and medium-sized enterprises, on their human resource management, including ways to improve the employability of their staff.

▶ Public employment services offer their own skill development and training programmes, covering, inter alia, job interviews, digital skills and CV-writing. In recent years, they have increasingly been using off-the-shelf online learning platforms, such as Google for Education, along with massive online open courses and webinars, to train jobseekers (Finn and Peromingo, 2019; Peromingo, 2018).

The public employment service in the Flanders region of Belgium, VDAB, is a good example of a service that combines all the preceding functions. It undertakes two annual research projects to gauge the scarcity of certain skills in the Flemish labour market. Moreover, VDAB monitors the progression of recent graduates and reports on their success in finding a job one year after entering the labour market. Thus, it guides young people as they decide which subjects to study at secondary school and university.

VDAB discusses its vacancy database with employers' organizations and reports on the relative difficulty of filling vacancies (based on a qualitative and quantitative assessment). This information is taken into account by VDAB when designing training courses for jobseekers on subjects such as computer-aided design, cloud computing, bookkeeping, housekeeping and welding (Csillag and Scharle, 2019).

3.2.5 Advanced algorithms make it possible to match young people to jobs on the basis of competencies rather than educational qualifications

Like VDAB, many public employment services are moving away from job matching based on qualifications and towards matching based on skills or competencies. The main idea behind this is that, in a labour market characterized by greater fluidity, it is more important to find a jobseeker with the right skills, combined with motivation, for a job requiring proficiency in a specific set of tasks. It is assumed that, with some additional on-the-job or off-the-job training, a newly recruited employee who may not be formally qualified for the job is likely to be successful. Competence-based matching can help firms overcome skill shortages by providing them with a larger pool of jobseekers to choose from (ibid.). Thanks to this new competence-based approach, in 2017 VDAB achieved the highest satisfaction rate of employers in the history of the service (above 84 per cent) (Peromingo, 2018).

3.2.6 Digitalization allows for more personalized services, expanded coverage and more effective management

Public employment services can use digital technologies to increase their efficiency, effectiveness and coverage. Specifically, they can better diagnose the needs of young people and improve targeting and profiling by using biometric and spatial data together with real-time labour market information. Furthermore, they can improve job matching and counselling by complementing face-to-face interviews with online interactions. In addition, they can use new technologies to improve programme monitoring and coordination with other service providers. This should help tackle both employment and labour market participation barriers in an integrated manner. The relatively low cost of ICT-based labour market intermediation implies that developing countries can extend employment services to a far greater number of people than in the past. This does, however, require progress to be made on increasing the rate of Internet penetration. In recent years, many emerging and developing countries have launched online job portals, including India, Mexico, Morocco, Namibia, Oman, Peru, the Philippines, South Africa, the United Republic of Tanzania and Tunisia (Mwasikakata, 2018). In francophone Africa, the sophistication of online services has increased significantly (Alix, Barbier and Ratsima Rasendra, 2016). The greater productivity resulting from digitalization can lead to higher remuneration and a reduction in working time (Muñoz de Bustillo, Grande and Fernández Macías, 2017).

Two key areas in which public employment services have benefited from the adoption of new technologies are process automation and information digitization in their back offices. As a result, staff have more time to help clients in other ways, focusing on their specific needs and capabilities, rather than dealing with complicated data searching (Ejler and Sidelmann, 2016).

Not surprisingly, youth employment initiatives focus on digital channels and the Internet. Glick, Huang and Mejia (2015) point out that Internet use can enable employment services to reach more remote areas and reduce administrative costs. They cite "Ta3mal" – a web-based network developed jointly by Microsoft and Silatech, a leading NGO dealing with the problem of youth employment in the Middle-East and Northern Africa – to show how this can be achieved in developing countries. First introduced in

Egypt and then expanded to cover Iraq and Tunisia, "Ta3mal" is designed to provide young people with free access to online resources, including help with preparing a CV, career guidance and advice on how to launch one's own business (ibid.).

The matching of jobseekers to vacancies is an area in which effectiveness has already increased significantly thanks to digitalization. In Flanders, Belgium, for example, the automated matching platform "Elise" can compare registered CVs against millions of vacancies in real time, resulting in more accurate matches than any human could ever achieve. The potential savings as a result of digitalization are considerable. Dilmegani, Korkmaz and Lundqvist (2014), for example, have estimated that digitalization of the government sector could result in an annual productivity gain of up to US$1 trillion worldwide. Across the EU, a "digital-by-default" strategy for service delivery could save between €6.5 billion and €10 billion annually (Davies, 2015).

Because of the high penetration of mobile phones in developing countries, digital technologies allow public employment services to overcome a lack of resources and reach people with limited attachment to the labour market, especially in remote areas.

However, digitalization also presents certain difficulties for public employment services. In a review of digital strategies deployed across the EU under the European Network of Public Employment Services, Pieterson (2018) concludes that, while digitalization and automation lead to more efficient workflows, some institutions are being held back by a lack of resources and by internal resistance to change. Additionally, in general, public employment services face many of the same challenges affecting labour markets, such as the changing nature of jobs, which calls for re-skilling or upskilling of employees. Also important are less tangible factors such as the role of leadership, encouraging employees to adopt new practices and having access to high-quality data.

In developing countries, where a large proportion of the population, the majority of whom are young people, lives in rural areas, the adoption of technologies not tailored to the local level of development and infrastructure may lead to the alienation of young rural inhabitants. For example, in Namibia, the rate of mobile phone subscription is as high as 200 subscribers per 100 people, while Internet penetration is below 20 per cent. In upgrading the Namibia Integrated Employment Information System, the Government is taking into account this reality by building in an option for offline registration and introducing mobile apps that do not require an Internet connection.

3.2.7 Digitalization enables better services to employers and more effective partnerships with other entities

Before the advent of online portals operated by public employment services and other providers, employers had to visit employment centres in person, make telephone calls and send letters or emails when announcing vacancies or looking for candidates. Online job matching systems allow employers to post vacancies, review CVs and connect directly with jobseekers. Many public employment services are setting up dedicated websites to provide employers with advice and information (Finn and Peromingo, 2019). By targeting employers looking for candidates with specific skills, employment services can attract more vacancies and improve job matching. Moreover, it has been argued that the digitalization of employment services improves transparency, reduces friction in the labour market and – thanks to more efficient job matching – promotes economic growth and boosts labour demand (JPAL South Asia, 2016; Martins, 2017).

Digitalization also facilitates partnerships between public employment services and private and third-sector providers of such services. In the United States, for example, the American Job Centers in each state are based on partnerships between various entities involved in workforce development, which are either based in the same physical

location (as a kind of one-stop shop) or are connected virtually. The Workforce Innovation and Opportunity Act requires states to report regularly to the federal Government on their provision of employment services. Many states are developing integrated information systems to coordinate the activities of different partners, including the American Job Centers, and to collect information for reporting purposes. Similarly, governments in other countries that have started outsourcing employment services to third-party providers use complex online systems to coordinate these services and monitor and follow up on the results achieved. Holistic approaches that link employment services and social welfare institutions through joined-up service provision with the help of digital technologies are increasingly being adopted to integrate hard-to-place young people, notably those with NEET status, and the long-term unemployed into the labour market.

3.2.8 The delivery of employment services through digital channels is expanding in all regions

The public employment service VDAB in Flanders, Belgium, is applying "deep learning" techniques to enhance job matching. Under this approach, an artificial neural network is used to look for similar patterns in vacancy texts and jobseekers' CVs. This is an important step in the development of more intelligent matching systems that can also help in identifying skill gaps among young jobseekers.

Another important area is the use of new technologies to interact with clients. Developed countries, such as the Netherlands, now provide a combination of online and offline services depending on the situation of individual jobseekers. Mobile apps developed and maintained by public employment services are also being used to reach young people. (ILO, 2017). The more advanced public employment services already combine traditional and digital channels to optimize their service delivery (Pieterson, 2017).

Many public employment services, however, are still developing their online platforms and new digital channels. India, for example, has launched a national programme, "Digital India", for improving service delivery and advancing social empowerment through the Internet and mobile devices. In line with this strategy, the country's public employment service has established a web-based portal to facilitate the registration of jobseekers, employers, training providers, careers advisers and private employment agencies. The portal enables jobseekers to obtain information and connect with service providers, linking "unorganized workers" (home-based workers, the self-employed and informal sector workers) to potential customers (Abraham and Sasikumar, 2017).

Morocco's public employment service, the National Agency for the Promotion of Employment and Competencies, has launched a multi-channel strategy to reach jobseekers, particularly young people (see box 3.2). In 2018, with the support of a Swiss company, Paraguay established an online system based on sophisticated algorithms that makes it possible to match skills to vacancies automatically. In Oman, the Public Authority of Manpower Register has developed an online system that matches job vacancies obtained from the Ministry of Labour and sends text messages to jobseekers on the register. In Namibia, the number of vacancies notified to the public employment service increased significantly after the establishment of the Namibia Integrated Employment Information System in 2014, which includes a platform for matching registered jobseekers to vacancies.

In francophone Africa, public employment services are increasingly offering digital services targeted at young people. Thus, Alix, Barbier and Ratsima Rasendra (2016) found that, out of the 14 countries they reviewed in 2015, three offered all six online services listed in table 3.1. The most common services were registration of jobseekers and vacancies (and their publication), pre-registration of jobseekers and the maintenance of a CV database. A review of the websites of these countries' public employment

> ▶ **Box 3.2**

Morocco's digital strategy for the promotion of youth employment

To increase the number of users (particularly young people) and improve the quality of services without incurring higher costs, Morocco's National Agency for the Promotion of Employment and Competencies (ANAPEC) has developed a digital strategy based on web-based, telephone and digital media tools.

A web-based portal offers various services related to labour market inter-mediation, including registration of jobseekers and vacancies, and personal-ized pages for employers and jobseekers. There are sites providing general labour market information and more specific information on self-employment and on opportunities for jobseekers to improve their employability. In addition to a text messaging service and call centres, ANAPEC uses various social media and mobile apps to disseminate information and e-learning materials.

Source: Presentation given by Nadia Benabid during the Academy on Employment held at the International Training Centre of the ILO in Turin in May 2019.

services in 2019 showed that they continue to provide online services and have im-proved their quality. Similarly, in anglophone Africa and the Maghreb, many countries are introducing e-services, targeted mostly at young people, as part of the modern-ization of their public employment services.[6]

Globally, public employment services are developing and testing innovative applications to provide jobseekers with career advice. A good example is the Occupation Outlook app developed in New Zealand, which helps both jobseekers and those seeking to develop their career to find out about the employment prospects and characteristics of various occupations (AfDB, ADB, EBRD and IDB, 2018).

Under the SkillsFuture programme, a credit fund has been available since January 2016 to all citizens of Singapore once they reach the age of 25; it provides financial support to help cover the fees of skill-related courses. The scope of the programme has recently been expanded to include various services for students and early- and mid-career employees. A one-stop online portal, MySkillsFuture, provides education, training and career guidance and can be used by pupils at secondary schools and students to gain a clearer idea of their interests, abilities and career ambitions.

Luxembourg's public employment service has launched various initiatives (e.g. "Start & Code" and "Fit4Coding") to provide young jobseekers with training in coding and other digital skills. It has also partnered with the French online platform OpenClassrooms to provide training in ICT management. Apart from improving the digital skills of jobseekers in general, these measures are designed to tackle the high level of unemployment among the most vulnerable groups and to respond to the high demand for labour in the ICT sector because of the difficulty in finding applicants with the right skills (EC, 2018a).

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[6] Examples include the Tanzania Employment Services Agency, the Employment Services of South Africa and Mozambique's online job portal. Botswana is currently developing a new online public employment service, while Zambia is combining its public employment service with a labour market information system.

Table 3.1

Online services offered by public employment services in francophone Africa

Online service	Benin	Burkina Faso	Cameroon	CAR	Côte d'Ivoire	DRC	Djibouti	Guinea	Mali	Niger	Senegal	Togo
Vacancy registration	•	•	•	•	•	•	•	•	•	•	•	•
Vacancy publication	•	•	•	•	•	•	•	•	•	•	•	•
Sending CVs to employers	•	–	•	•	–	•	–	–	–	•	–	–
Pre-registration of jobseekers	–	•	•	•	•	•	•	–	–	•	–	•
Individualized accounts	•	•	•	•	•	–	–	–	–	–	–	•
CV database	–	•	•	•	•	•	–	–	–	–	–	•

– = negligible.

Note: = operational; CAR = Central African Republic; DRC = Democratic Republic of the Congo. Alix, Barbier and Ratsima Rasendra (2016) included Chad and Mauritania in their survey, but the websites of these countries' public employment services were not accessible as at 6 November 2019.

Source: Adapted from Alix, Barbier and Ratsima Rasendra, 2016, p. 74, table 12.

The Danish Agency for Labour Market and Recruitment operates an all-inclusive job portal, Jobnet, since 2018. Designed as a "virtual job centre", Jobnet offers tailored services and advice to its users, including young jobseekers, employers and counsellors, through personalized dashboards (EC, 2018b).

The public employment services of several other EU countries are developing online tools and apps. For example, in Flanders, Belgium, online guidance is available to highly qualified young jobseekers, while in Slovenia, an e-counselling tool and a chatbot virtual assistant have been developed for this target group. In France, *"Emploi Store"*, a collection of free apps for jobseekers, provides assistance with integration into the labour market. One of these apps, called *"La Bonne Boîte"*, provides information to young jobseekers about firms that are actively recruiting new employees (Michel and Gaillard, 2018). Some public employment services have set up "innovation labs" (see box 3.3) to develop new digital applications, which are often aimed at younger people. One such lab at the Swedish public employment service is working on artificial intelligence applications (Pieterson, forthcoming).

An increasing number of Youth Guarantee initiatives in EU countries have a digital component. In Slovenia, for example, the Youth Council launched a communication campaign in 2013 to raise awareness of the Youth Guarantee in cooperation with other youth organizations and the governmental office responsible for youth affairs. The activities under this campaign included press conferences, high-level meetings, the launch of a website and Facebook page, and an art competition. In addition, since 2014, the country's public employment service has stepped up its activities to raise awareness

▶ **Box 3.3**

The innovation lab at France's public employment service

The French public employment service (*Pôle emploi*) seeks to foster innovation through its innovation lab (known simply as "Le LAB"):

(a) Any staff member of the service can submit an innovative idea for consideration by the lab. If the idea is accepted, the staff member has the opportunity to become an "Intrapreneur".

(b) Intrapreneurs can develop and test their ideas with help from the lab.

(c) If the idea is feasible, it can be developed further in an internal start-up and turned into a market-ready product with help from the service's incubator (known as *"La Fabrique"*).

(d) Successful ideas are implemented across the service. For example, new apps are released on the service's own digital services marketplace (*"Emploi Store"*), where customers can find various tools providing assistance with job searches and career development.

Trouvez tous les sites et applications dédiés à l'emploi

Parcourez les thèmes qui vous intéressent :

Qu'est-ce que l'Emploi Store ?

Choisir un métier
Les bonnes pratiques pour construire son projet professionnel

Se former
L'essentiel pour concrétiser son projet de formation

Préparer sa candidature
Les outils pour une candidature efficace

Trouver un emploi
Les clés pour postuler et réussir ses entretiens

Créer une entreprise
Les supports pour créer ou reprendre une entreprise

International
L'incontournable pour une recherche d'emploi à l'étranger

Source: EC, 2019.

among young people by publishing information on social media, setting up a new online platform and developing new apps for smartphones. Similarly, in Portugal, a media campaign about the Youth Guarantee included short adverts featured in YouTube videos (Santos-Brien, 2018).

As for more general initiatives, the Red Cross in Spain has pioneered an innovative approach to activation, based on encouraging young people with NEET status to engage with their self-image and think about how they come across to others, particularly potential employers. In view of the expansion of digital recruitment tools and the growing importance of social media and "influencers", this is a promising initiative (ESF, 2018). To facilitate the recruitment of young people, the Ministry of Labour in Peru created an online platform in 2011 for the authentication of educational qualifications, skills and credentials (see Chapter 5 for further details).

In recent years, public employment services and related organizations have been experimenting with new types of active labour market policy tailored to an increasingly digital world. In Argentina, for example, the Ministry of Labour, Employment and Social Security (now subsumed into the Ministry of Production and Labour) has promoted telework, which has the potential to create employment opportunities for young people, the disabled and older workers who find it harder to travel or move to another part of the country for work (Eurofound and ILO, 2017). Digital technologies can themselves help improve the design of labour market policies by providing access to high-quality and more up-to-date labour market information. For instance, in India, where official statistics are not regularly updated, data from an online job matching platform are used to improve labour market monitoring and assess the demand for specific skills (Nomura et al., 2017).

3.3 Certain challenges need to be tackled in the adoption of new technologies by public employment services

Despite the generally positive findings on the effects of digital technologies, there are obstacles to their adoption by public employment services as well as certain challenges related to their use – particularly the risk that the digitally illiterate may be excluded. The digitalization of public employment services requires comprehensive organizational reform, including measures to prepare both staff and clients to cope with the changes and switch to new ways of working. A recent study of trends in public employment services covering Belgium (Flanders), Germany and the United Kingdom indicates that these institutions have had to adopt change management strategies to help their staff migrate to the new "digital-first" systems (Finn and Peromingo, 2019). Moreover, recruitment policies were adjusted to attract digitally literate new staff. In all three countries, measures have been taken to ensure that jobseekers lacking digital skills either receive relevant training or are provided with non-digital channels ("channel blending") so that they can continue to benefit from employment services. The migration to the Universal Credit in the United Kingdom is a practical example of situations where concrete strategies have to be put in place to avoid unintended exclusion of clients and to support staff at the country's public employment service as they assume more responsibilities.

In Australia, where the provision of employment services has been completely outsourced to private providers and systems have been digitalized to a great extent, a recent evaluation found that the increasing use of online recruitment can disadvantage people who lack digital skills (Education and Employment References Committee, 2018). Ironically, while young people are usually assumed to have great affinity for new technologies, many of them lack the digital skills required to navigate the modern labour market.

In a study of the impact of digitalization on caseworkers at public employment services in France and Spain, Peña-Casas, Ghailani and Coster (2018) found that the new technologies led to an increased workload and pace of work, frustration over frequent technical problems, greater routinization of work and a loss of control over the content of tasks. Caseworkers also mentioned tensions within the team because of the different levels of digital skills and pointed out that not enough training was being provided.

Therefore, it is worth emphasizing that digital channels are not always the most effective way of reaching young jobseekers. Indeed, a case study in Finland has shown that, despite high levels of digitalization and use of online channels, young people still value traditional face-to-face contact with career advisers and caseworkers, confirming that personal trust is an important basis for effective employment support (ESF, 2018). Other studies have also noted how even young people still prefer to use traditional communication channels when interacting with governments (Pieterson and Ebbers, forthcoming).

3.4 Conclusions

Contrary to what one might expect, both the occupations and skill content in job vacancies posted online by private and public employment agencies in high- and middle-income countries have remained relatively stable in recent years. Nevertheless, the skill set sought by employers has expanded; basic computer literacy is expected for all occupations. This, however, does not mean that tasks have not changed – it may well be that the content of jobs has changed.

▶ The data show that employers are now seeking to fill more vacancies in health and social care than ICT; engineering roles have dropped out of the top 20 occupations sought by employers in the six developed countries analysed earlier in this chapter (see section 3.1).

▶ Jobseekers' preferences are influenced by changes in the occupations sought by employers; however, young people are not necessarily more responsive to these changes than other labour market participants.

▶ The new occupations in demand among employers do not overlap with jobseekers' preferences, which may be a sign of imbalance in the labour market.

Digitalization is important for public employment services if they wish to remain relevant and support workers throughout their various labour market transitions, especially young workers, who are among the most vulnerable groups of labour market participants.

▶ The adoption of digital technologies – such as online portals and more sophisticated systems based on artificial intelligence and deep learning – by public employment services in advanced economies and some emerging ones (e.g. Paraguay) has increased efficiency and transparency in the labour market.

▶ Public employment services in developing countries should be able to take advantage of the high levels of penetration of mobile devices to design employment services that reach young people (also in remote areas) without having to expand their administrative capacity.

▶ Digitalization, however, is not a panacea for all problems faced by young people as they try to gain a foothold in the labour market. It is preferable to offer a combination of digital services and traditional face-to-face contact with counsellors to take young people's needs and abilities properly into account.

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▶ Unequal distribution of the benefits of technological change among young people

Technological change is associated with increasing wage and income inequality due to falling demand for low- and middle-skilled workers. As shown in Chapter 2, the impact of technological change is particularly pronounced in youth labour markets. Yet, wage inequality among young workers has decreased significantly in many countries following the Great Recession of the late 2000s. This can be explained in terms of a post-crisis reduction in the benefits of post-secondary education, especially among youth, which points to imbalances in the demand for and supply of highly skilled young workers. While technological change has indeed increased demand for highly skilled workers, globally, growth in the supply of such workers has tended to outpace the growth in job opportunities, although specific country situations vary significantly.

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▶ # Chapter 4. Unequal distribution of the benefits of technological change among young people

4.1 Technological change can lead to greater inequality

Concerns have long been expressed over the impact of skill-biased and routine-biased technological change on inequality as both are associated with a hollowing out of middle-skilled jobs (ILO, 2017) and increased earnings at the top of the skills distribution. Such effects are felt more keenly in youth labour markets as "non-standard" and less secure forms of employment are beginning to dominate the entry-level jobs available to young labour market entrants.

Kuznets argued in a seminal paper (1955) that inequality would first increase with economic development as countries shifted from agriculture to manufacturing, but would again fall because of increased participation in education. This hypothesis was based on the observation of the development process in what are now high-income countries. However, it has been challenged by economists such as Tinbergen (1956 and 1975), who argued that a rising education level was not necessarily associated with falling inequality; any such effect would depend on the relative demand for, and supply of, high-skilled workers. More recently, Autor, Katz and Krueger (1998), among others, have drawn attention to skill-biased technological change as a driving force behind long-term increases in the demand for skilled labour, as well as to the acceleration of technological change since the 1980s, which generated a surge in the demand for skilled workers.

In an empirical analysis of the drivers of inequality, Roser and Crespo Cuaresma (2016) found that, when a single term to represent technological change[1] was included in a cross-country panel regression of the determinants of income inequality among households (as measured by the Gini coefficient), the coefficient was not statistically significant. Similarly, educational attainment was not found to have a statistically significant effect. However, when the interaction between technological change and educational attainment is included in the regression,[2] all three coefficients are highly statistically significant. Taken separately, both the level of educational attainment of the population and technological change have a negative impact on inequality (as measured by the Gini coefficient), that is, when either increases, income inequality is reduced. On the other hand, the interaction between the two is positively associated with (i.e. increases) inequality, implying that, when countries are at an early stage of development and their populations have relatively low levels of educational attainment, technological change tends to reduce inequality, but as they develop and educational attainment increases, the inequality-reducing effects of technological change are attenuated or even reversed.

ICT technologies have facilitated the emergence of platform-based business models that are essentially natural monopolies, that is, they have low or very low costs associated with expanding output (low marginal costs) but have very high set-up and other fixed costs (independent of the amount of the good produced or service delivered). If left to the private sector, natural monopolies lead to inefficient production; moreover, the high costs of entry limit competition, potentially leading to substantial excess profits or economic rents. Such technology-facilitated business models have contributed to rapid income growth at the top of the income distribution, thereby aggravating inequality. In addition, the fragmentation of production processes, a direct consequence of technological advancement, has led to more unstable employment and income, which in itself tends to increase inequality.

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[1] Namely the "Solow residual", a measure of total factor productivity.

[2] Specifically, the mean number of years of schooling for the population aged 15 and above.
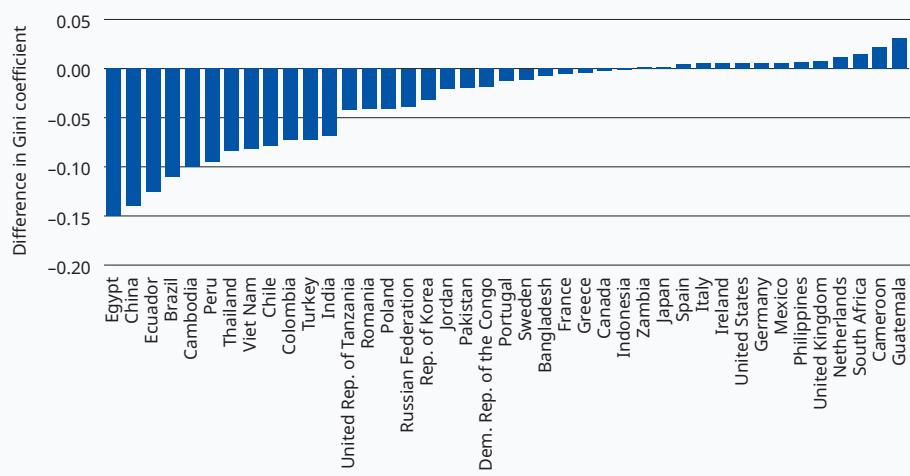
In this chapter, we consider the impact of technological change on inequalities among different groups of young people and, more generally, inequalities between young people and prime-age adults. As in the previous edition of this report (ILO, 2017), our analysis is based on a comparison between the first and second decades of the new millennium, before and after the global financial crisis of 2007–08. In the next section, we examine what has been happening to wage inequalities among young (aged 15–29) and prime-age adult workers (aged 30–49).[3]

4.2 Wage inequalities are particularly pronounced among the young

In most countries, wage inequality (as measured by the Gini coefficient of wages) is higher for young than for adult workers (figure 4.1).[4] This is in line with the notion that the types of jobs available to young people are more heterogeneous and unstable.

Figure 4.1

Difference between wage inequality (Gini coefficient) among prime-age workers (30–49 years) and wage inequality among young workers (15–29 years), selected countries, 2016

Note: The bars show the difference between the Gini coefficient of wages for mature adult workers (aged 30–49) and younger workers (aged 15–29) in 2016 or the closest year for which data are available. Positive values indicate that youth wages are more equally distributed than those of mature adults.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

Wage inequality has, however, decreased in most countries since the Great Recession of the late 2000s ...
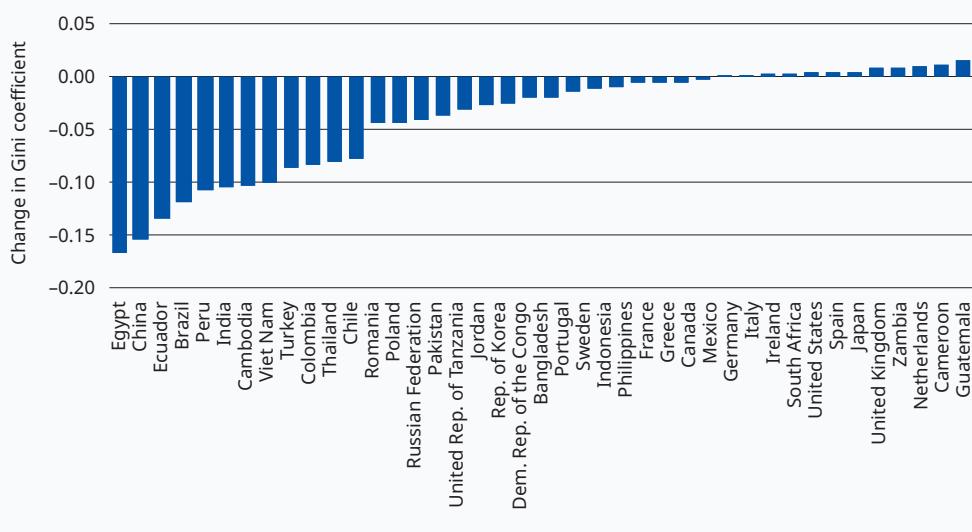
Income inequality within countries has been on an upward trend for several decades. This trend is associated with a decline in the labour share of income – a phenomenon linked to technological progress – and with the expansion of "natural monopoly"-type businesses facilitated by new technologies. Of course, the trend of rising income inequality does not

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[3] The underlying data have been standardized by country to facilitate cross-country comparison. Details of the methodology used are outlined in Appendix E.

[4] We focus here on wage inequality, comparing young people (aged 15–29) and prime-age adults (30–49). In line with previous chapters, the aim is to determine inequality between entry-level (or early-career) wages and the wages of established workers, hence the use of the broader youth group. Older workers (aged 50 and over) are excluded for the same reason, although inequalities among older workers are undoubtedly important drivers of overall wage and income inequalities as noted further on. In fact, although on average wage inequality has also fallen for the 15–64 age group as a whole over the same period, the pattern of change in wage inequalities among older workers follows a very different pattern to wage inequalities among young and prime-age adults.

Figure 4.2

Change in wage inequality (Gini coefficient) among workers aged 15–49 years before and after the global financial crisis of 2007–08, selected countries

Note: The figure shows the difference in the change in the Gini coefficient of wages between 2006 and 2016 or the closest years for which data are available for workers aged 15–49. Positive (negative) values indicate an increase (decrease) in inequality over the period.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

apply to all countries at all times. Nor does it necessarily apply to employee wages, on which we are focusing here.[5] Indeed, since the global economic and financial crisis of 2007–08, wage inequality has, in fact, decreased among 15–49-year-olds in most countries[6] – often markedly so, as in Egypt, China and several Latin American countries (figure 4.2).

… with some notable exceptions, especially among high-income countries

In contrast, wage inequality has increased in several high-income (mainly European) countries, including the United Kingdom, the United States, Italy, the Netherlands and Germany, along with a few African and Latin American countries. However, such increases have been relatively modest in comparison to the reductions in wage inequality observed in the majority of countries.

The reduction in wage inequality was greater for young people
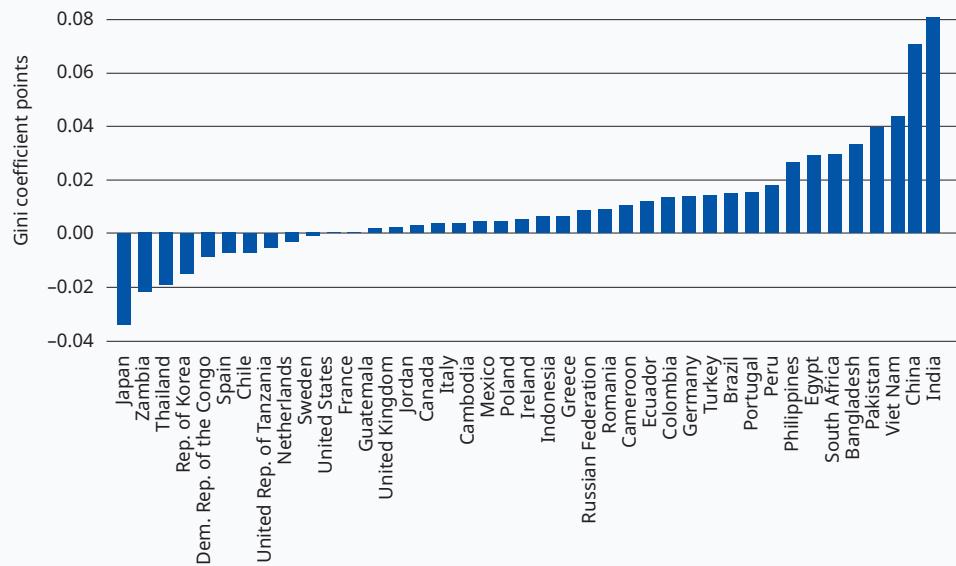
Although wage inequality typically decreased in both age groups over the past decade or so, the decrease was greater among younger workers. This implies that the degree of wage inequality among young workers is now closer to that of prime-age workers than it was a decade ago (figure 4.3).

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[5] There is a clear negative correlation between labour income share and wage inequality. For example, in the sample of 41 countries used here, the correlation between the wage rates of 15–49 year olds and the labour income share for the most recent data is –.58. On the other hand, the correlation between the change in labour income share and the change in wage rates is not significantly different from zero for either young people (15–29) or adults (30–49).

[6] This is true of both young (15–29) and prime-age (30–49) workers, although the decrease in wage inequality is more pronounced among the young.

Figure 4.3

Difference between the change in wage inequality (Gini coefficient) among prime-age workers (30–49 years) before and after the global financial crisis of 2007–08 and the change in wage inequality over the same period among young workers (15–29 years), selected countries

Note: The bars show the difference between the change in the Gini coefficient of wages for mature adult workers (aged 30–49) and for younger workers (aged 15–29) between 2006 and 2016 or the closest years for which data are available. Positive values indicate countries in which wage inequality has decreased more (or increased less) among younger workers than among mature adult workers.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

And this has also been accompanied by a closing of the youth–adult wage gap

Typically, wage rates tend to increase with age, such that, on average, young workers earn less than prime-age adults. Since the global economic and financial crisis, however, the youth–adult wage gap has also reduced. Indeed the two phenomena – age-based differences in changes in wage inequality and in median wages – are related. When wage inequality has decreased more for young people than adults, the gap between youth and adult wages has usually also narrowed (as measured by the ratio of youth-to-adult median hourly wage rates) and vice versa.[7]
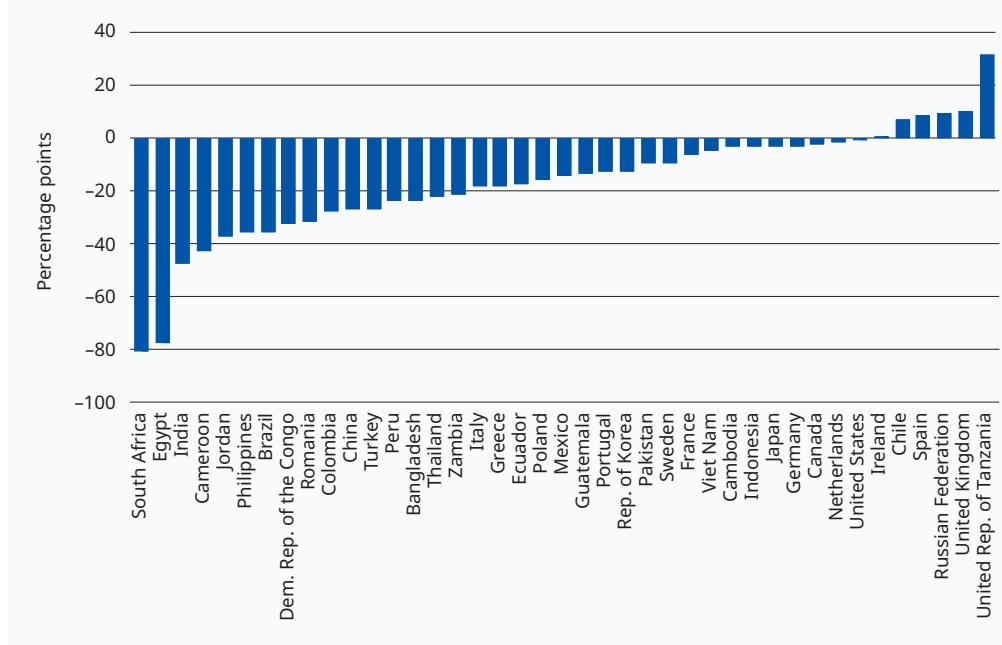
4.3 Returns to education have decreased in recent years

One important factor potentially influencing inequalities within age groups is the returns to education. The impact of variations in the returns to education on wage inequality depends on both the returns themselves and the distribution of educational attainment in the (youth) population. It is often argued that technological change raises the demand for more educated workers, thereby driving up the returns to higher education. However, as Tinbergen (1956 and 1975) pointed out, this ignores any supply-side response: higher

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[7] Indeed, there is a strong positive correlation between the two phenomena (0.43) due to composition effect. More young workers now possess a tertiary qualification, which increases wages above those of young secondary educated workers, even if the premium offered to tertiary educated workers has (as outlined in the following text) fallen since the global crisis.

Figure 4.4

Change in returns to tertiary education among workers aged 15–49 before and after
the global financial crisis of 2007–08, selected countries (percentage points)

Note: The figure shows the annualized change in the returns to tertiary education between 2006 (or nearest year) and 2016
(or nearest year). The returns to tertiary education are obtained using a hourly wage rate regression in which returns
to secondary (or lower) education are the default.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

(individual and social) returns to education are likely to make educational participation
more attractive for individuals and policy-makers alike. The increased supply of highly
skilled workers would, in turn, reduce the returns to education.

Until recently, returns to tertiary education have been rising …

A recent review of a large number of estimates of the returns to education between 1950
and 2014 (Psacharopoulos and Patrinos, 2018) suggests that over time the average
rate of return on an additional year's schooling has increased only slightly.[8] Perhaps of
more significance, the authors find that the returns to tertiary (higher) education
have increased over time despite the growing rate of enrolment in tertiary education.
This suggests a widening income gap between those with tertiary qualifications and
those with only secondary (or lower) qualifications. The authors conclude that the in-
crease in the supply of university graduates is not sufficient to meet the increased demand.
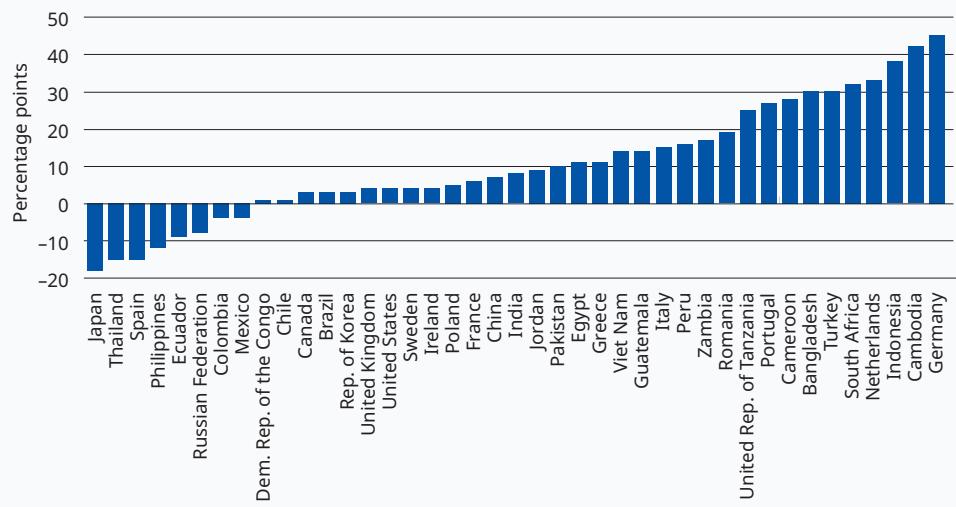
… but since the crisis this trend has been reversed

Over the last decade, the tendency towards increasing returns to tertiary education has
been reversed in the vast majority of countries (figure 4.4). In contrast to earlier periods,
returns to post-secondary education have been declining in most countries since the crisis.
The countries in which returns to education have increased or declined only slightly

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[8] Admittedly, the results are rather equivocal. The regression of returns to education on year produces a negative (albeit
not statistically significant) correlation coefficient, actually suggesting a decline in the rate of return over time.

Figure 4.5

Difference between the change in returns to tertiary education for mid-career workers (30–49 years) before and after the global financial crisis of 2007–08 and the change in returns to tertiary education for early-career workers (15–29 years) over the same period (percentage points)

Note: The figure shows the difference between the change in returns to tertiary education for prime-age workers (aged 30–49) and the corresponding change for young workers (aged 15–29) between 2006 and 2016 or the closest years for which data are available. Positive values indicate that the returns to tertiary education increase more (or decrease less) for prime-age workers than for young workers.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

are once again those high-income countries in which wage inequality has increased. It is reasonable to hypothesize that the general trends of decreasing wage inequality and falling returns to education (with exceptions occurring only in a few, mainly high-income countries) are being driven by technological change and its effects on the demand for and supply of highly skilled workers.

The decrease in returns to tertiary education has been greater for young people …
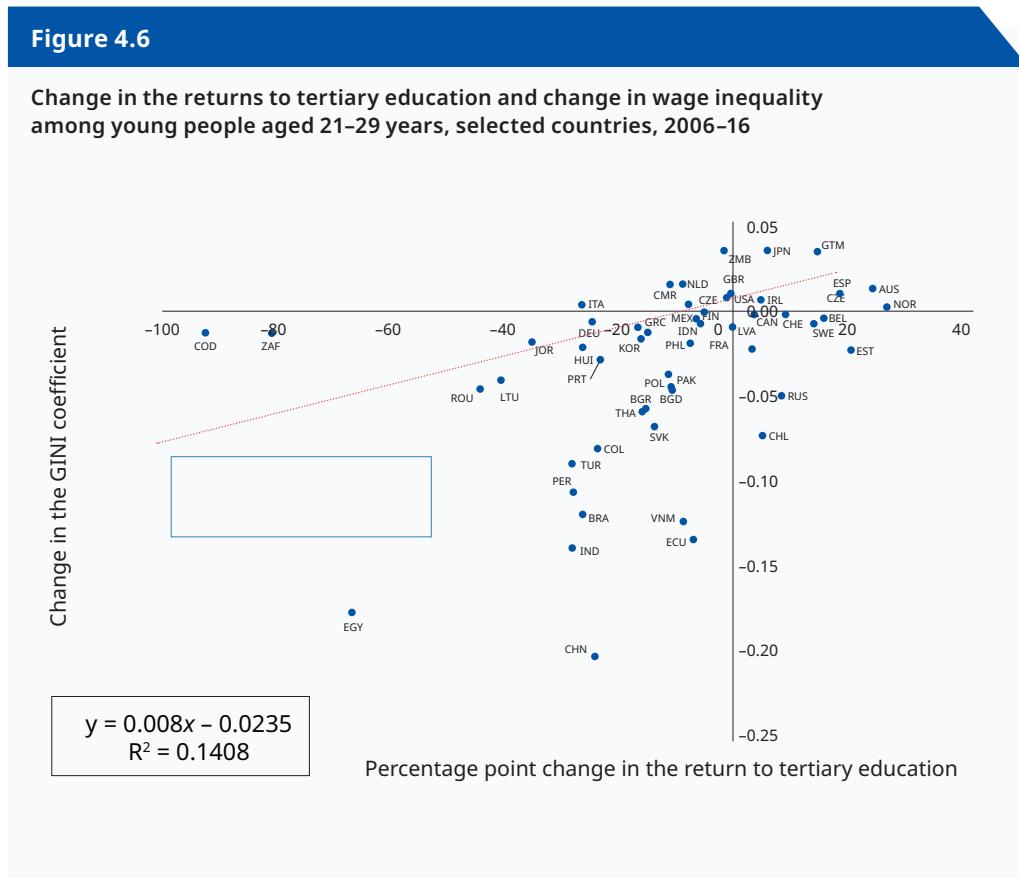
On comparing the change in the returns to tertiary education for young (or early-career) workers before and after the global financial crisis with the change in the returns to tertiary education for prime-age (or mid-career) workers between 2006 and 2016 (figure 4.5), it emerges that the decrease in the returns to tertiary education observed over the past decade is primarily due to decreasing returns in the early stages of workers' careers.

… and this underlies the decrease in youth wage inequality

A comparison of countries shows that there is a positive relationship between changes in the returns to tertiary education and changes in youth wage inequality (figure 4.6). Countries that have experienced a decrease in wage inequality tend to be those in which the returns to tertiary education have also declined.

Figure 4.6

Change in the returns to tertiary education and change in wage inequality
among young people aged 21–29 years, selected countries, 2006–16

$$y = 0.008x - 0.0235$$
$$R^2 = 0.1408$$

Note: The horizontal axis shows the change in the returns to tertiary education between 2006 and 2016 or the closest years for which data are available for those aged 21–29. The vertical axis shows the change in the Gini coefficient of wages over the same period for the same age group. The age group has been selected to include only those young people who are old enough to have been potentially able to obtain a post-secondary qualification, whether or not they did so, in order to provide a reasonable basis for comparison.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

Why have returns to education fallen and what, if anything, does this have to do with technological change?

Returns to education are driven by both technological change and the relative abundance of young graduates, as shown by a simple linear regression (table 4.1). The positive effects of technological change on returns to education are dampened by the rapid expansion of the graduate labour force. Over the past decade or so, the expansion in the supply of graduates has, in most countries, outpaced the growing demand for graduate labour associated with technological advances. The results of a fourth specification reported in the last column on the right include a term representing the interaction between technological change and graduate labour supply. These suggest that the labour supply effect (tending to reduce returns to tertiary education) is indeed interacting with technological change, thus moderating – and in the last decade overwhelming – the upward pressure of technological change on the returns to tertiary education arising from the increased demand for tertiary-educated workers.

Table 4.1

Effect of technological change and the relative supply of university graduates on the change in the returns to tertiary education, 2006–16

Explanatory variables	Dependent variable: Returns to tertiary education			
Global Innovation Index 2017	–	0.0064*** (0.00227)	0.0054** (0.00219)	0.0093*** (0.00289)
Change in the relative abundance of graduates	–0.0015*** (0.00038)	–	–0.0009** (0.00038)	0.0018 (0.00144)
Interaction term	–	–	–	–0.000073* (0.000036)

– = not included.

Note: The table shows estimates of linear regression coefficients from four specifications aimed at measuring the effect of the Global Innovation Index 2017 and the change in the abundance of university graduates on the change in the returns to tertiary education between 2006 and 2016 or the closest years for which data are available. The term in the last column is an interaction between the two explanatory variables. Statistical significance: *** 99 per cent, ** 95 per cent, * 90 per cent.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

4.4 The level of educational attainment has a strong influence on NEET rates in most but not all subregions

In this section, we consider the returns to education in terms of the expansion or contraction of jobs for young people with different levels of education. This reflects more directly the impact of technology, among other factors, on demand for young workers.[9] Not surprisingly, a better education brings advantages in terms of not only higher wages but also greater likelihood of being employed: NEET rates decline almost everywhere with rising level of education (figure 4.7).

One exception is sub-Saharan Africa, where the prevalence of NEET status is roughly constant across all levels of educational attainment, highlighting the danger of assuming that the challenge of youth employment can be tackled purely by promoting higher education. The patterns shown in figure 4.7 also serve to emphasize how misleading the picture obtained from analysis of rates of open unemployment can sometimes be. In some subregions – above all, the Arab States and Northern Africa, where unemployment rates rapidly increase with educational attainment – such an analysis would suggest that it is young people with higher education levels who face significant problems in entering the labour market. Consideration of NEET rates, however, tends to put the situation in a rather different light.
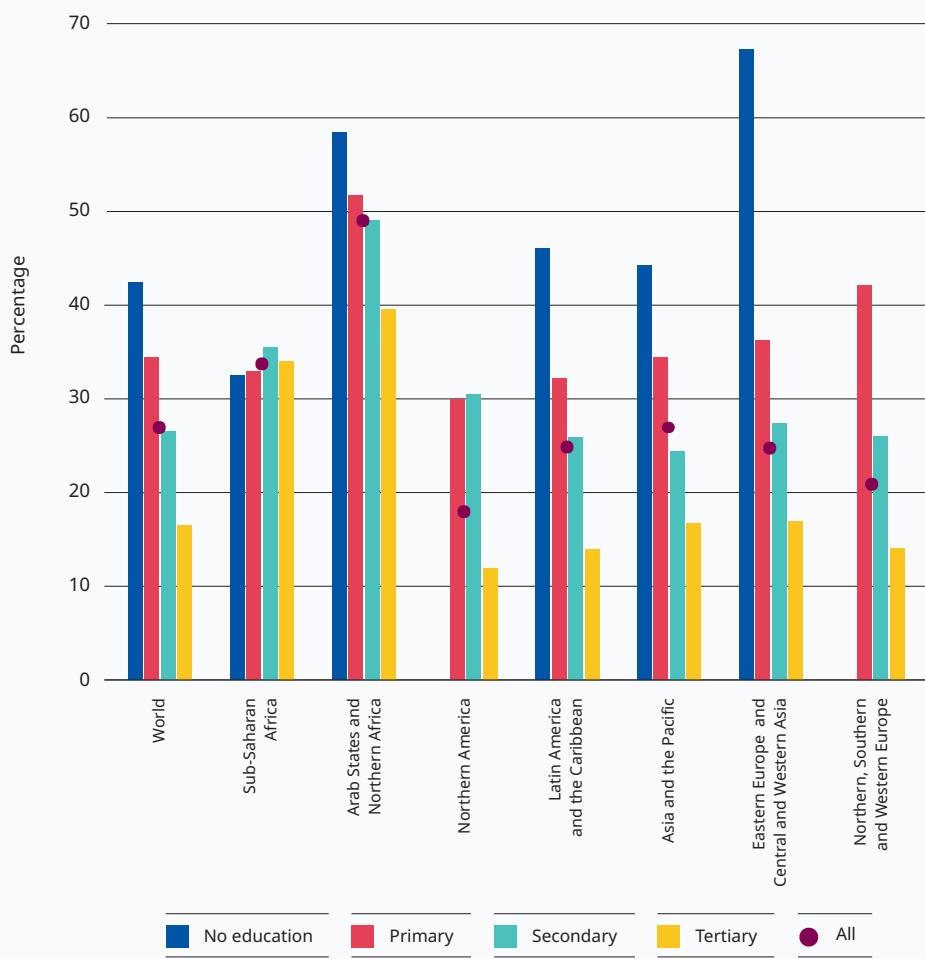
Although the NEET rate for tertiary graduates has generally fallen since the crisis …

Figure 4.8 shows the percentage point change in the NEET rate by level of educational attainment over the past decade or so. At the global level, the aggregate NEET rate for young adults has increased (in contrast with young people aged 15–24, among whom the NEET rate has fallen slightly). However, the NEET rate for young adults with a tertiary education has decreased.

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[9] To obtain a clearer picture of the impact of educational attainment on labour market status, we focus here on the NEET rate among young adults (aged 25–29).

Figure 4.7

NEET rate for young adults (aged 25–29) by level of educational attainment, global and by subregion, latest available year (percentages)

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).
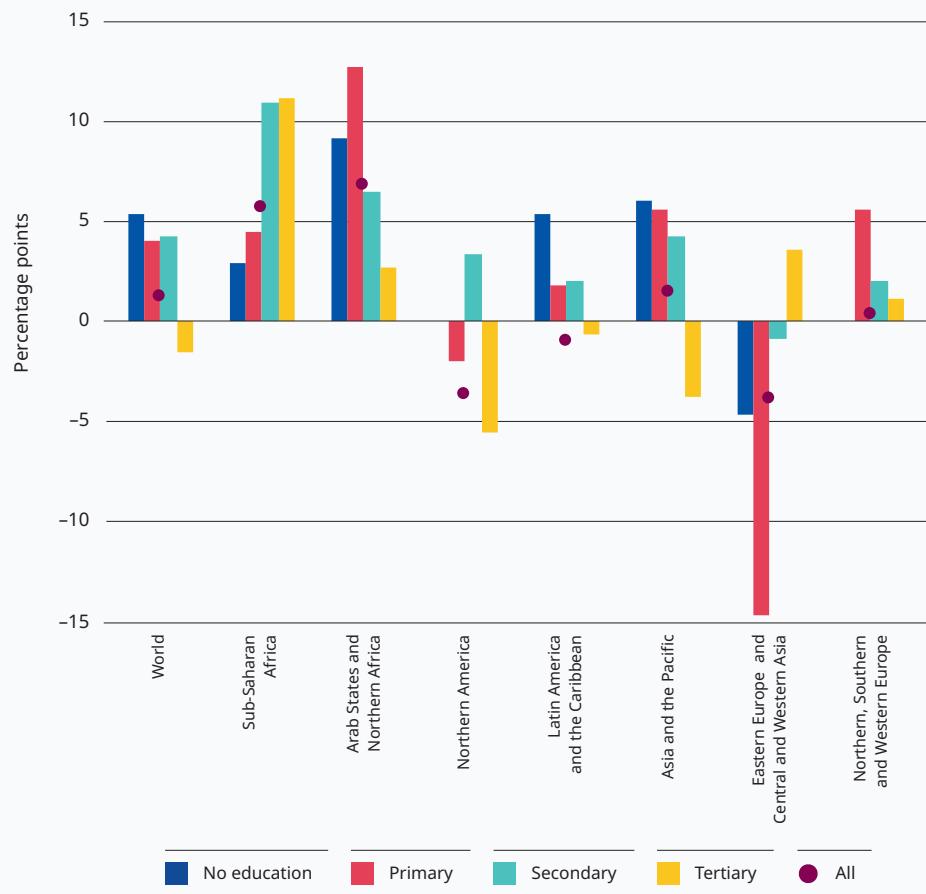
… in some regions the NEET rate for tertiary graduates has increased

In most parts of the world, the NEET rate for young people with tertiary qualification has either fallen or not increased as much as the NEET rate for those with lower levels of educational attainment. One notable exception is sub-Saharan Africa, where NEET rates increased to a greater extent among those with a tertiary education than among other educational attainment groups. In Eastern Europe and Central and Western Asia, the NEET rate fell across all educational attainment groups except for the tertiary-educated. Clearly, in sub-Saharan Africa and in Eastern Europe and Central Asia, there is a need to create more opportunities for young people with a tertiary education. In stark contrast to sub-Saharan Africa, the NEET rate among tertiary-educated young adults in Asia and the Pacific has declined despite an increase in the aggregate NEET rate in that region.

As noted in Chapter 1 and in the previous edition of this report (ILO, 2017), the NEET rates of young women, particularly in emerging countries, far exceed the NEET rates

Figure 4.8

Change in NEET rate for young adults (aged 25–29) by level of educational attainment, global and by subregion, 2006–16 (percentage points)
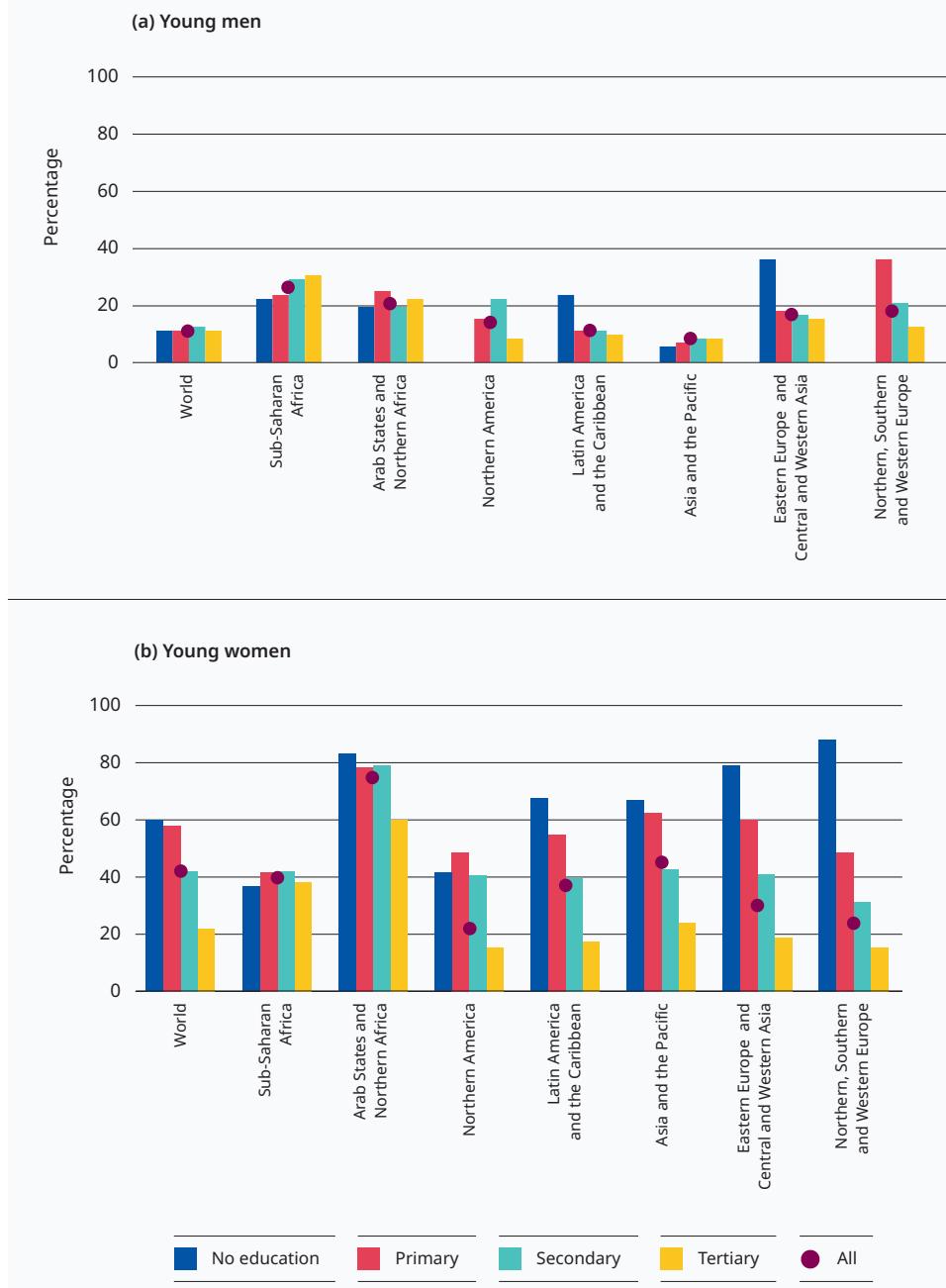
Note: The bars show the percentage point change in the NEET rate for the 25–29 age group between 2006 and 2016 or the closest years for which data are available.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

of young men. This may also be seen in the distribution of the NEET rate by level of educational attainment and sex (figure 4.9). Globally, the share of young adult women (aged 25–29) with NEET status is 42.1 per cent, compared with 11.8 per cent of young adult men. The gender divergence is even more pronounced among young adults than in the 15–24 age group. Young adult women are almost four times as likely as young adult men to be NEET, which ties in with the analysis of data from the ILO's School-to-Work Transition Survey presented in ILO and UNICEF (2018). Furthermore, the variation in NEET rates across education levels is much smaller among young adult men than among young adult women. NEET rates among young women clearly fall with rising education levels in all subregions with, again, the notable exception of sub-Saharan Africa. Among young men, the association between educational attainment and NEET rates is much less marked. Significantly, at 60.1 per cent, the NEET rate for uneducated young adult women worldwide is almost six times that for uneducated

Figure 4.9

NEET rate for young adults (aged 25–29) by level of educational attainment and sex, global and by subregion, 2006–16 (percentages)

(a) Young men

(b) Young women

Legend: ■ No education ■ Primary ■ Secondary ■ Tertiary ● All
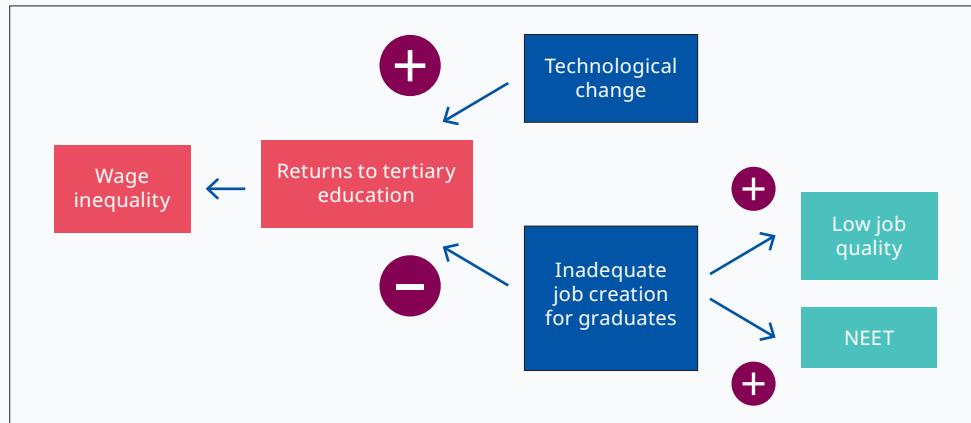
Note: The figures show the NEET rate for the 25–29 age group in 2016 or the closest year for which data are available, separately by gender.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

young adult men (10.7 per cent). As can be seen from figure 4.9, it is trends in the labour market status of young women that are driving the distribution of the NEET rate by education level for young people as a whole. This is not surprising, given the overwhelming numerical dominance of women among young people with NEET status.

Figure 4.10

Linkages between technological change, labour supply and demand and returns to education

To summarize, one would normally expect technological change to increase youth wage inequality – and to a lesser extent wage inequality as well among prime-age workers – by increasing the demand for highly skilled workers and thus increasing the returns to tertiary education (figure 4.10). Contrary to this expectation and to the long-run trend, youth wage inequality has actually been declining over the past decade or so because of decreasing returns to tertiary education. While technological change has indeed increased the demand for highly skilled workers, growth in the supply of such workers has tended to outpace the growth in job opportunities. It is plausible that the growth in supply is in itself partly due to the increased returns to higher education observed in earlier periods. This is discussed further in box 4.1.


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▶ **Box 4.1**

Demand for and supply of young workers with a tertiary education before and after the global financial crisis
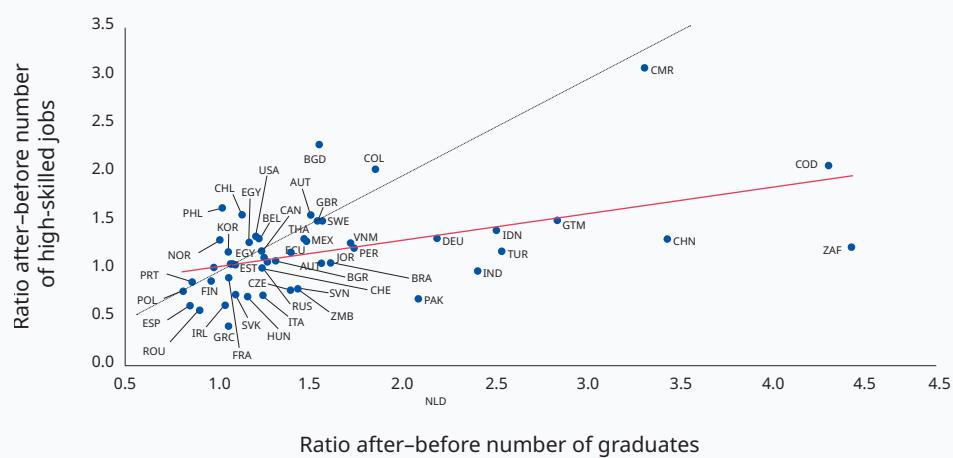
Rapid technological change increases the demand for tertiary-educated workers. This increases the returns to tertiary education, which may well, in turn, stimulate an increase in the supply of tertiary-educated workers. Over the past decade, in many countries, the expansion of the graduate labour supply has outpaced the rate of increase of the number of high-skilled jobs (figure 4.11). The regression line (red) diverges from the 45° line (black), which represents balanced growth in highly skilled labour demand and supply. Only high-income countries, such as the United States, the United Kingdom, the Republic of Korea, Chile and Austria, and a few middle-income countries, such as Bangladesh, Colombia and the Philippines, exhibit such balanced growth.

The excess supply of graduates in many countries has a number of other consequences. Not all graduates can obtain high-skilled jobs (figure 4.12, panel A), and the likelihood of not finding a job at all increases and is likely to be reflected in a rising NEET rate (figure 4.12, panel B). A unit increase in the ratio of the number of graduates to the number of high-skilled jobs is, on average, associated with a decrease of 7 percentage points in the share of properly placed graduates. Similarly, an increase of 3.5 percentage points in the NEET rate can be expected for every unit increase in the ratio of the number of graduates to the number of high-skilled jobs.

Failure to secure a high-skilled job despite having a tertiary education can lead to low job satisfaction and high job turnover, while not being able to find a job at all may lead to disappointment, increased anxiety and depression.

Figure 4.11

Growth of labour supply of graduates and high-skilled jobs, before and after the global financial crisis of 2007–08
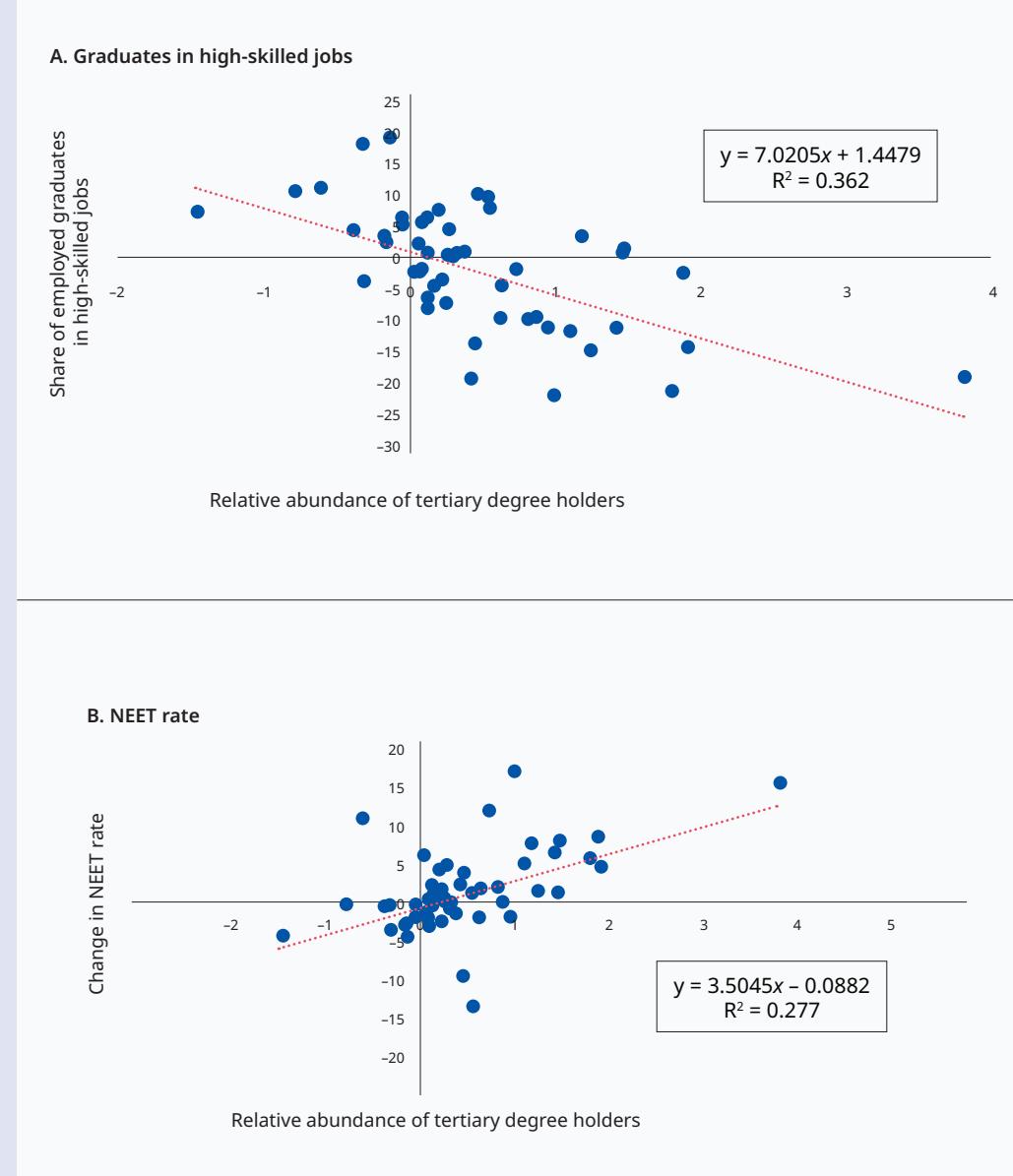
Note: The horizontal axis shows the ratio of the number of 21–29-year-olds with a tertiary degree in 2016 (or the closest year available) to the corresponding number in 2006 (or the closest year). The vertical axis shows the corresponding "after-before ratio" for the number of high-skilled jobs. High-skilled jobs include occupations from ISCO-08 major groups 1, 2 and 3. The black line drawn at 45° to both axes corresponds to balanced growth in graduate labour supply and skilled labour demand. The red line is the line of best fit obtained by linear regression analysis of the relationship between the two variables.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

Figure 4.12

Additional consequences of an excess supply of graduates aged 21–29

A. Graduates in high-skilled jobs

$y = 7.0205x + 1.4479$
$R^2 = 0.362$

Share of employed graduates in high-skilled jobs

Relative abundance of tertiary degree holders

B. NEET rate

$y = 3.5045x - 0.0882$
$R^2 = 0.277$

Change in NEET rate

Relative abundance of tertiary degree holders

Note: The horizontal axis shows the change in the ratio of the number of graduates to the number of high-skilled jobs between 2006 and 2016 or the closest years for which data are available. The vertical axis shows: (a) the change in the share of graduates employed in a high-skilled job; and (b) the difference in the age-specific NEET rate for graduates over the same period. The red dotted lines are the regression lines calculated in each case.

Source: ILO calculations based on the Labour Force Micro Database, version 1.5 (see Appendix E).

4.5 Policy messages

Though there has been a trend towards reducing wage inequalities since the Great Recession of the late 2000s, inequalities are still relatively high among young people in most countries. This ostensibly positive trend, however, is strongly driven by emerging imbalances between the supply of and demand for educated workers. Taken separately, the increase in the demand for skills caused by the emergence of new technologies and the rising levels of educational attainment among young people are both welcome. However, policy measures are necessary to promote the expansion of job opportunities for highly educated young people to balance the expanding supply of graduates. Evidently, markets alone will not do this.

Many studies have emphasized the negative impact of inequality on the economic growth of countries. However, this does not necessarily imply that adopting measures to reduce inequalities (e.g. through a more progressive tax schedule or by increasing social benefits for the less well-off) will necessarily improve growth. Indeed, the main justification given in the past for reducing such redistributive efforts was the negative effect which such policies were perceived to have on economic growth.

The findings in this chapter raise some fundamental questions about prioritizing and sequencing policies for youth employment. While developing education and skills of young workers is key to progress, unless such supply side measures are complemented or matched with demand-side measures for job creation, they risk fomenting discouragement among the young.

This also points to the need for better organization, representation and collective bargaining to ensure appropriate wages and working conditions for young workers.

In these circumstances, tailored redistributive policies are likely to be effective for promoting growth – for example, through large-scale active labour market programmes for disadvantaged young people which will have an expansionary effect on labour demand above and beyond the direct effects on participants. Such a tailored and, above all, deliberate approach is clearly preferable to the de facto – and unintended – reduction in wage inequality observed in many countries in recent years driven by imbalances in the supply of and demand for tertiary-educated young people.

Main conclusions

▶ Decreasing wage inequalities reflect an imbalance between the supply of and demand for highly skilled young people.

▶ There should be greater emphasis on balanced demand-side policies designed to foster the creation of jobs for young people along the entire skills spectrum.

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► Policy implications: Preparing a better future for young people

New technologies generate both opportunities and challenges for young women and men as they transition into or within the labour market. Policy-makers must ensure that there are enough decent jobs for young people and support them in preparing for the future.

5

▶ # Chapter 5. Policy implications: Preparing a better future for young people

The youth employment challenge is constantly evolving, as are the policy responses. This evolution is shaped by the global debate on the role of young people in society, changes in labour markets and the effect that public policies have on young people. It is crucial to design policies that harness new technologies to create decent jobs for young people while tackling the risks arising from technological change and new forms of employment. This requires innovation in policy action. In the words of young participants at the Global Youth Employment Forum in Abuja in 2019, "Trends on youth un- and under-employment have been going in the wrong direction. We need systemic change. Business as usual is not working".[1]

This chapter presents a policy framework and some examples of successful policies aimed at creating more and better jobs for young people at a time of rapid technological changes, and proposes a number of recommendations.

5.1 New technologies present both risks and opportunities in the creation of decent jobs for young people

Technological change is one of the most disruptive drivers of the future world of work. It generates new jobs, increases the productivity of firms and workers and enhances the ability of governments to implement policies. At the same time, it leads to the loss and/or transformation of jobs and can have an impact on inequality among different groups of workers and countries. As "digital natives", young people tend to be early adopters of new technologies. It is harder, though, for many youth in low- and middle-income countries to enjoy the benefits of these technologies. As shown in Chapter 2, young people are very often engaged in occupations with a heightened risk of automation, from which they are more likely to lapse into unemployment and inactivity. In addition, new technologies have given rise to new business models and forms of work: the "gig economy", "platform work", the "on-demand economy" and the "sharing economy" – terms that did not even exist only a few years ago but are now commonly used by young people.

5.1.1 Preparing a better future for young people

The ILO Centenary Declaration for the Future of Work, adopted by the International Labour Conference at its 108th Session in June 2019, emphasizes the need "to act with urgency to seize the opportunities and address the challenges to shape a fair, inclusive and secure future of work with full, productive and freely chosen employment and decent work for all."

One area that calls for urgent action is the macroeconomic policy framework, which needs to be reconsidered in the light of technological advances. The current discussion on inclusive growth, for example, accounts for the fact that growth tends to be uneven (Ray, 2010) and that a major source of productive inequalities is related to the unequal access to and spreading of technologies applied to production (Hart, 2012). In other words, new technologies can increase productivity and drive down the prices of goods and services, thus resulting in higher real incomes that can translate into greater aggregate demand and creation of new jobs. At the same time, these developments can

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[1] ILO: *Global Youth Employment Forum 2019, Activity report,* Annex 2, Youth Statement.

create further inequalities or dampen incomes. Therefore, the macroeconomic policy framework should ensure that there is sufficient aggregate demand to absorb (or to compensate) displaced workers and new entrants to the labour force.

In the case of young workers, if their potential is to be fully realized, it is vital to create new jobs in growing and dynamic sectors by combining an appropriate macroeconomic framework with specific industrial and sectoral policies. Investments in digital infrastructure are key to increasing connectivity and improving access to technologies that can boost job creation, such as big data, the Internet of Things and blockchains.

Technologies are also transforming macroeconomic policy instruments. With regard to fiscal policies, Abbott and Bogenschneider (2018), for example, argue that the tax system can inadvertently incentivize automation because payroll taxes are not paid on robots and accelerated tax depreciation on capital costs may occur. Moreover, automation can reduce tax revenue, which in developed economies is derived mostly from labour-related taxes (ibid.). Given the pressure on public services is likely to increase because of technological disruption, a reduction in tax revenue could have grave consequences. Clearly, tax systems and public expenditure will have to be reviewed carefully to ensure that there is sufficient funding to support innovation, productive employment, social protection and an environment conducive to lifelong learning. Of particular interest is the role of taxation in funding policies to compensate for the negative effects that new technologies may have.

Technology is also affecting monetary and financial policies. Cryptocurrencies provide an alternative means of payment, which may have consequences in demand for national currencies and the ability of central banks to conduct monetary policy effectively. On the other hand, technology-enabled financial inclusion, crowdfunding, peer-to-peer lending and similar mechanisms provide greater opportunities for young entrepreneurs and other players in the real economy to secure financing and attract investors.

Ensuring coherence between macroeconomic and demand-side policies that spur enterprise growth and productivity can promote inclusive structural transformation. Productive development policies and enterprise development policies would lead to an enabling environment for labour-intensive industries, thereby creating more jobs.

At the same time, there should be coherence with investments in education and skills development seeking to promote sustained economic growth and decent work. This includes updating education and training curricula at all levels to keep up with the rapid pace of technological change. In many low-and middle-income countries, young people are more educated than ever (see Chapter 4), yet the decreasing returns to post-secondary education arguably point to the imbalance between the supply and demand for this type of education. If young people are to benefit from the employment potential of new technologies, they must be equipped with skills that are relevant to the labour market from their early school years. Adapting education and skills development policies will ensure that young people achieve a successful school-to-work transition and can cope well with subsequent working-life transitions.

5.1.2 Tackling the risks associated with new technologies

Ensuring inclusive growth is necessary to help young people benefit from the opportunities of technological change but also to manage the risks associated with such change. Yet, that alone is not sufficient. Across countries and regions, young people face different labour market challenges that require specific policy interventions.

The immediate impact of technology and automation is arguably greater in high-income countries. Young people in these countries benefit from labour market institutions that help school-to-work transition and to find a job in case of unemployment. In addition, they benefit from social protection systems that support them throughout

unemployment, sickness or disability. In middle- and low-income countries, with high levels of informality and sometimes weaker labour market institutions, these countries provide insufficient support to unemployed youth or young people entering the labour market for the first time. Moreover, the impact of automation in high-income countries may spill over to the labour markets of middle- and low-income countries, as it potentially fuels "reshoring" by reducing the relative cost of domestic production in developed countries (Faber, 2018).

In all countries, low-qualified and low-skilled young people face a greater risk of being displaced by automation than those with higher qualifications and skills. However, higher education is no longer a guarantee of employment and stable livelihoods given the decreasing return on investment of post-secondary education. This is mainly due to the limited number of decent jobs, inefficiencies in job-matching mechanisms and discrepancies between jobseekers' skills and those required by employers. Consequently, many overqualified young people are pushed into occupations typically performed by those with lower levels of education. This places low-skilled young people in a particularly vulnerable situation because they face both upward pressure (the risk of automation) and downward pressure (displacement by young people with a higher level of education).

Policy interventions should focus on three main youth groups: (a) young people in education transitioning into the world of work; (b) young people already in the labour market; and (c) young people who have already been displaced by new technologies, including those neither in education nor in the labour market (NEET).

Education and training can help young people acquire skills that are relevant to the labour market, including technical, digital and core work (soft) skills. Research indicates that the impact of new technologies on occupations requiring core work skills, such as teamwork, creativity and critical thinking, will be lower than the impact on occupations based on performing repetitive tasks. Equipping young people with digital skills is essential not only because of their intrinsic value to a specific occupation but also because they can open door to acquiring additional knowledge, skills and qualifications. Although young people in general are more apt to learn, use and develop new technologies, inequalities in their uptake are caused by differences in the level of education, gender, geographical location (urban or rural) and access to the necessary infrastructure (Dasgupta, Chacaltana and Prieto, forthcoming). The adoption of digital technologies by public employment services can help young people because they are the primary users of these technologies (see Chapter 3).

National training systems should offer upskilling to help young workers at risk of being replaced by machines or automated processes. Combining training with on-the-job learning has proven to be successful in both developed and developing countries (Dema, Díaz and Chacaltana, 2015).

In high-income countries, the spread of non-standard forms of employment, such as the gig economy, has led to a rise in vulnerable employment. While the gig economy can promote labour market participation – in particular, "crowdwork" has the potential to create a "planetary labour market" (Graham and Anwar, 2019) – there are several major concerns. These include concerns not only about the employment relationship and working conditions but also about whether crowdwork can be used as work experience when applying for jobs in the "offline" labour market because it is not easy for such workers to demonstrate what they have been doing and to provide human references (Pinedo Caro et al., forthcoming). As the Global Commission on the Future of Work has argued, "[t]here is a need to review and where necessary clarify responsibilities and adapt the scope of laws and regulations to ensure effective protection for workers in an employment relationship. At the same time, all workers, regardless of their contractual arrangement or employment status, must equally enjoy adequate labour protection to ensure humane working conditions for everyone" (ILO, 2019, p. 38).

In low- and middle-income countries, the issue of job quality remains closely linked to that of informality. Therefore, an important challenge of the provision of lifelong learning in the informal economy exists. On the other hand, Chacaltana, Leung and Lee (2018) give several

examples of policies that have been adopted to tackle informality, including measures making it easier to register businesses and workers and modifications to the eligibility criteria for social protection for ensuring that vulnerable workers are covered. In both cases, the right to collective bargaining is also a key element of policy-making.[2]

Young people who have already lost their jobs, including as a result of automation, need specific and targeted support. This will help them to shorten their unemployment spells and prevent them from becoming NEET. Given that technology is automating specific tasks of occupations and not occupations themselves, young people could benefit from re-skilling and upskilling to be employable again.

5.2 New technologies have the potential to enhance the support provided to young people

New technologies are transforming youth employment policies, particularly in areas such as training, employment services and the promotion of entrepreneurship; they are even having an impact on policy coordination. In this section, we examine some relevant public sector interventions from recent years.

5.2.1 New technologies can be used to improve training

Equipping young people with technical skills that are in high demand, together with life skills (e.g. communication, teamwork) that enhance their general employability, is crucial. Even for non-technical roles such as customer services or sales, job applicants are increasingly expected to possess digital skills. Some examples of relevant initiatives are presented here:

▶ Up to 6,000 students and recent graduates from all disciplines are expected to benefit from the EU's "Digital Opportunity Traineeships" between 2018 and 2020. Participants can gain hands-on experience in fields that are in high demand among employers. The training programme is designed not only to improve young people's skills regarding cybersecurity, big data, quantum technology and machine learning but also to promote digital skills among the companies hosting the traineeships, especially in such areas as web design, digital marketing and software development. The trainees receive an allowance for between two and 12 months, in line with Erasmus+ rules and procedures. Companies willing to host trainees publish their vacancies on platforms such as ErasmusIntern and Drop'pin, or advertise them through university career services. A certificate is issued by the company to the trainee and the university within five weeks of the conclusion of the traineeship.

▶ The "One Million Arab Coders" initiative, launched in the United Arab Emirates in October 2017, seeks to provide free training in coding and web development to 1 million young Arabs. The aim is to jump-start the modern technology sector in the Arab world and ensure that it stays up to date. The programme consists of three phases lasting two years. The first phase involves registering on its official website as a student or tutor. Prospective students are asked about their motivations and aspirations so that the most appropriate courses for them can be identified. The second phase is a three-month online course covering various aspects of web development (e.g. mobile apps, front-end and full-stack web development, data analysis). The third stage consists of more specialized courses and vocational training. There are monetary incentives to encourage students to persevere with

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2 The very classification of gig workers as self-employed has begun to be called into question in high-income countries, including Spain, where the courts in July 2019 ruled that both Deliveroo and Glovo workers were in fact employees (High Court of Justice of Asturias, Social Chamber. Ruling No. 01818/2019 of 25 July 2019; and Madrid Social Affairs Court No. 19. Ruling No. 188/2019 of 22 July 2019).

the training and complete it, which is always a major problem in online education. Because all the training is provided online, the programme is attractive to young people who have study-, work- or family-related responsibilities. The main challenges are targeting and ensuring that participants complete all the courses they have signed up for.[3]

Various countries have adopted innovative mechanisms for training:

▶ The Bahamas is implementing a national system based on blockchain technology for verifying academic credentials and professional certifications. After a successful pilot project, developed by the Massachusetts Institute of Technology and funded by the Inter-American Development Bank, the National Training Agency issued its first "Bahamas Blockcerts" in June 2018. Bahamas Blockcerts provide individuals with a digital portfolio that can easily be viewed and verified by employers. The National Training Agency was the first institution to issue Blockcerts for all of its workforce readiness and skills training courses. It is expected that more national agencies and education and training providers will gradually be integrated into the system. A National Blockchain Strategy Committee has been established to roll out the new technology, which is expected to make lifelong learning easier for workers (*Nassau Guardian*, 2018).

▶ In Chile, the National Training and Employment Service (SENCE) has launched the "Elige Mejor" (Choose Better) programme,[4] based on a technology similar to that used in the Booking.com website. The programme's objective is to ensure that SENCE beneficiaries have more and better information to draw on when deciding which training courses they wish to sign up for. Both trainees and their companies have the opportunity to evaluate the training experience. It is expected that the results of these evaluations will eventually be published on the "Elige Mejor" website. Within a few weeks after its launch, users had evaluated over 7,000 courses and around 2,000 training providers.

▶ In the EU, the Directorate General for Education and Culture created the "Europass", an electronic credential that seeks to ensure that workers' skills and qualifications are clearly understood and recognized across EU countries, regardless of the differences in education systems. It has three objectives: help citizens communicate their skills and qualifications effectively when looking for a job or training; help employers understand the skills and qualifications of the workforce; and help education and training authorities define and communicate the content of curricula.[5] The Europass provides a learning credential describing the owners' skills and learning outcomes through formal, non-formal or informal learning. It has a digital signature called e-Seal that guarantees its origin and integrity to prevent fraud. There are Europass centres in all EU countries, with information available in 27 languages.

5.2.2 New technologies are transforming public employment services

Public employment services in countries at different levels of development are embracing new technologies to improve service delivery and outreach and promote efficiency. These technologies have been instrumental in expanding coverage, improving the range and quality of services and making the labour market more transparent at a relatively low cost. Technology is also facilitating the integration of unemployment benefit systems with employment services.

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[3] Cuautle Segovia and Costa Checa (2019) provide other similar examples, implemented by NGOs or social entrepreneurs, such as the Laboratoria programme in Latin America and the Simplon.co project in France.

[4] See: https://eligemejor.sence.cl

[5] See: https://europass.cedefop.europa.eu/about-europass

As discussed in Chapter 3, there are a number of innovative evolutions based on new technologies.

▶ Many high-income countries have set up systems for collecting big data by linking databases on jobseekers and registered vacancies, as well as by gathering data on elements such as job matching, unemployment insurance, training, wages, benefits and compensation for industrial accidents and occupational diseases. Chapter 3 discusses the cases of the Korea Employment Information Service or the Universal Credit system in the United Kingdom, based on the "digital first" principle, which has replaced separate unemployment benefits, resulting in greater integration. In the United States, the National Association of State Workforce Agencies has set up an Information Technology Support Center to assist states with the implementation of unemployment insurance programmes. New technologies have also been widely adopted by public employment services in developing and emerging countries, albeit at a lower level: mostly in job intermediation platforms. In some cases, new technologies are being used to look beyond qualifications in job matching. In Flanders (Belgium), artificial intelligence is used to match jobseekers with job offers on the basis of their skills, location and preferences, and they have an app called the "Digital Advisor" to help school-leavers improve their job interview skills through online teleconference sessions. Estonia is a notable example of the increasing use of new technologies in public employment services, as it is part of an "e-government" environment that relies on the secure Internet-based data exchange. A digital signature allows all citizens to log on to a common data platform where they can access most public services, including employment services.

▶ Middle- and low-income countries are also modernizing their public employment services with new technologies. In 2018, Paraguay launched a new job-matching engine called "ParaEmpleo" ("For Employment"), which uses semantic indexing and location mapping algorithms to recommend suitable vacancies to jobseekers. In India, in 2015, the Government decided to overhaul the system and established the National Career Service based on an online job portal that brings together all key players: employers, jobseekers, private employment providers, NGOs, training institutions, vocational guidance specialists, careers advisers and local artisans working in the informal economy.

Moreover, new technologies are being used to improve multi-agency coordination in the implementation of youth employment policies. In Peru, an online platform has been used since 2011 to coordinate the authentication of credentials. The Ministry of Labour provides young jobseekers aged between 18 and 29 with a free "Single Employment Certificate for Young People", which covers various types of credentials required by employers, including identity data, educational and judicial records and work experience. Employers can easily check the authenticity of these certificates because the relevant data are uploaded to the website of the Ministry of Labour. Employers in many developing countries would welcome such systems that can provide authenticated information on the background of job applicants.

All these innovations have the potential to improve access to public employment services and enhance their institutional capacities. At the same time, there is discussion on the effect of more automated solutions on key labour market variables, such as discrimination depending on the way algorithms are built to screen candidates (Ajunwa, forthcoming), which call for relevant government regulation. In addition, the processing of personal data of workers by employment services, whether provided by the public authority or private employment agencies or the third sector, should comply with national law and practice regarding protection of worker privacy. International labour standards on employment services foresee that information collected on jobseekers should be limited to matters

related to the qualifications and professional experience. Given that about half the world's population does not have Internet access (UNCTAD, n.d.[6]), public employment services have a key role to play in closing the digital gap for clients lacking digital skills or Internet access.

5.2.3 New technologies can be used to promote youth entrepreneurship and self-employment

Technology-based solutions can help young people realize their entrepreneurial aspirations by facilitating access to markets and market information, and by enabling them to acquire financial, entrepreneurial and digital literacy skills (e.g. through online courses and coaching, mobile learning apps and digital training materials). Access to finance for young entrepreneurs can be enhanced through mobile and crowdfunding channels, and electronic and mobile payment methods can be used to support the formalization of new businesses (Weidenkaff and Witte, forthcoming).

The initiatives discussed here illustrate the use of digital technologies to promote enterprise development and youth employment:

▶ In 2012, Peru's National Institute of Statistics and Informatics created, with assistance from the ILO, a Geographical Information System for Entrepreneurs, which is directed at people considering starting a business. Potential entrepreneurs (mainly those intending to set up small- and medium-sized enterprises) can obtain economic, demographic and social information on areas in which they are planning to operate. The system, for example, provides information on sales, profits, costs and the number of workers in similar businesses in the areas of interest.

▶ The Republic of Korea is supporting the creation of "smart factories", that is, fully automated, technology-based manufacturing systems. Aiming at a figure of 30,000 by 2022, the Government and firms share equally the costs of establishing smart factories, which are expected to promote innovation and efficiency, as well as to improve working conditions. Indeed, a recent evaluation by the Korea Labor Institute found positive impacts on the number of workers, productivity and product quality.

▶ The digital platform UjuziKilimo helps farmers in Kenya to plan their work better and reduce weather-related risks.[7] Drawing on real-time farm data from sensor devices, the platform uses machine learning and data analytics to provide farmers with timely and accurate information on fertilizers, seeds, weather, crop management and markets. This information is transmitted to farmers together with recommendations via text messages.

5.3 Involvement of young people in social dialogue is essential

New technologies are having an increasing impact on labour markets across the world, not least on youth employment. An integrated policy framework to support young people in securing decent jobs in such a context is critical for future socio-economic progress. Thus, policies are required to generate a sufficient number of decent jobs, equip young people with the skills required for those jobs, ensure that they enjoy social protection and have rights at work and encourage them to join workers' and employers' organizations so that they are represented in tripartite dialogue. Failure to take action would lead to growing numbers of discouraged young people in many countries and ultimately undermine their socio-economic development.

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[6] See: https://sdgpulse.unctad.org

[7] See: https://www.ujuzikilimo.com

In this chapter we have looked at several examples of labour market policies designed to support young people in rapidly evolving labour markets. These interventions have ranged from training on digital skills and the promotion of young digital entrepreneurs to the adoption of innovative mechanisms for delivering employment services. Although the evidence on their success or otherwise is still limited, it is important to monitor such interventions closely because there are many lessons to be learned for policy-makers. The use of new technologies can clearly improve the design and implementation of youth employment policies aimed at fostering inclusive growth and the creation of decent jobs.

There are, however, some key concerns over the use of new technologies, including inequalities in access; the need to provide social protection for young people working in the informal economy and platform economy and to uphold their right to collective bargaining and freedom of association; the presence (or absence) of labour market institutions and their capacity to adopt new technologies; and the protection of personal data to prevent discrimination. In the Global Youth Employment Forum, 2019, held in Abuja, young participants noted in their recommendations that "the right to disconnect is more than calling for a work–life balance: the rise of social media and individual data generation and collection is unjustly being used to control people even when they are not working".[8]

These concerns must be addressed through social dialogue with the active engagement of young people. Tripartite consultation remains the basis of sustainable progress and social justice. It is essential that young people should be included and represented in tripartite dialogue on the future of work, ideally as members of decision-making bodies. This is undoubtedly an ambitious goal, but it must be pursued if we are to secure a more inclusive and just future of work for young people. This can be ensured either by the social partners or through the direct representation of youth organizations in the policy consultation process.[9] There are some illustrative examples of formal or institutional spaces where the voices of youth are heard.[10] Apart from youth bodies within several workers' and employers' organizations, some tripartite schemes for young people exist in countries like Spain (Tripartite Commission on Youth Employment, created in 2006 as a consultative body attached to the Ministry of Labour and Social Affairs), Paraguay (National Roundtable for the Generation of Youth Employment, created in 2008) and Peru (Tripartite Social Dialogue Roundtable on Youth Employment, created in 2011 and formally included in the National Work Council structure) (Dasgupta, Chacaltana and Prieto, forthcoming).

Similarly, policy-makers must guarantee that the rights of young people are respected. This includes updating labour legislation to provide basic rights and social protection, especially in light of new forms of work and employment relations. Moreover, as occupations evolve and technology makes possible to work elsewhere than in the workplace (e.g. at home or in a coworking space), policy-makers should establish mechanisms to ensure that young people enjoy a work–life balance and that their personal data and privacy are protected. The rights of freedom of association and collective bargaining are of particular importance to that end, especially in new forms of on-demand work. For example, young people working in the gig economy could benefit from extended membership in trade unions.

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[8] ILO: *Global Youth Employment Forum 2019, Activity report,* Annex 2, Youth Statement.

[9] ILO: *The youth employment crisis: Time for action,* Report V, International Labour Conference, 101st Session, Geneva, 2012.

[10] ILO: *Social Dialogue: Recurrent discussion under the ILO Declaration on Social Justice for a Fair Globalization,* Report VI, International Labour Conference, 102nd Session, Geneva, 2013.

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▶ **Appendices**

▶ Appendix A. Regional, country and income groupings

Africa	Americas	Arab States	Asia and the Pacific	Europe and Central Asia
Northern Africa Algeria Egypt Libya Morocco Sudan Tunisia Western Sahara **Sub-Saharan Africa** Angola Benin Botswana Burkina Faso Burundi Cabo Verde Cameroon Central African Republic Chad Comoros Congo Congo, Democratic Republic of the Côte d'Ivoire Djibouti Equatorial Guinea Eritrea Eswatini Ethiopia Gabon The Gambia Ghana Guinea Guinea-Bissau Kenya Lesotho Liberia Madagascar Malawi Mali Mauritania Mauritius Mozambique Namibia Niger Nigeria Rwanda Sao Tome and Principe Senegal Sierra Leone Somalia South Africa South Sudan Tanzania, United Republic of Togo Uganda Zambia Zimbabwe	**Latin America and the Caribbean** Argentina Bahamas Barbados Belize Bolivia, Plurinational State of Brazil Chile Colombia Costa Rica Cuba Dominican Republic Ecuador El Salvador Guatemala Guyana Haiti Honduras Jamaica Mexico Nicaragua Panama Paraguay Peru Puerto Rico Saint Lucia Saint Vincent and the Grenadines Suriname Trinidad and Tobago United States Virgin Islands Uruguay Venezuela, Bolivarian Republic of **Northern America** Canada United States	Bahrain Iraq Jordan Kuwait Lebanon Occupied Palestinian Territory Oman Qatar Saudi Arabia Syrian Arab Republic United Arab Emirates Yemen	**Eastern Asia** China Hong Kong, China Japan Korea, Democratic People's Republic of Korea, Republic of Macau, China Mongolia Taiwan, China **South-Eastern Asia and the Pacific** Australia Brunei Darussalam Cambodia Fiji French Polynesia Guam Indonesia Lao People's Democratic Republic Malaysia Myanmar New Caledonia New Zealand Papua New Guinea Philippines Samoa Singapore Solomon Islands Thailand Timor-Leste Tonga Vanuatu Viet Nam **Southern Asia** Afghanistan Bangladesh Bhutan India Iran, Islamic Republic of Maldives Nepal Pakistan Sri Lanka	**Northern, Southern and Western Europe** Albania Austria Belgium Bosnia and Herzegovina Channel Islands Croatia Denmark Estonia Finland France Germany Greece Iceland Ireland Italy Latvia Lithuania Luxembourg Malta Montenegro Netherlands North Macedonia Norway Portugal Serbia Slovenia Spain Sweden Switzerland United Kingdom **Eastern Europe** Belarus Bulgaria Czechia Hungary Moldova, Republic of Poland Romania Russian Federation Slovakia Ukraine **Central and Western Asia** Armenia Azerbaijan Cyprus Georgia Israel Kazakhstan Kyrgyzstan Tajikistan Turkey Turkmenistan Uzbekistan

High-income countries	Upper-middle-income countries	Lower-middle-income countries	Low-income countries
Australia	Albania	Angola	Afghanistan
Austria	Algeria	Bangladesh	Benin
Bahamas	Argentina	Bhutan	Burkina Faso
Bahrain	Armenia	Bolivia, Plurinational	Burundi
Barbados	Azerbaijan	State of	Central African Republic
Belgium	Belarus	Cabo Verde	Chad
Brunei Darussalam	Belize	Cambodia	Congo, Democratic
Canada	Bosnia and Herzegovina	Cameroon	Republic of the
Channel Islands	Botswana	Comoros	Eritrea
Chile	Brazil	Congo	Ethiopia
Croatia	Bulgaria	Côte d'Ivoire	The Gambia
Cyprus	China	Djibouti	Guinea
Czechia	Colombia	Egypt	Guinea-Bissau
Denmark	Costa Rica	El Salvador	Haiti
Estonia	Cuba	Eswatini	Korea, Democratic
Finland	Dominican Republic	Ghana	People's Republic of
France	Ecuador	Honduras	Liberia
French Polynesia	Equatorial Guinea	India	Madagascar
Germany	Fiji	Indonesia	Malawi
Greece	Gabon	Kenya	Mali
Guam	Georgia	Kyrgyzstan	Mozambique
Hong Kong, China	Guatemala	Lao People's	Nepal
Hungary	Guyana	Democratic Republic	Niger
Iceland	Iran, Islamic Republic of	Lesotho	Rwanda
Ireland	Iraq	Mauritania	Sierra Leone
Israel	Jamaica	Moldova, Republic of	Somalia
Italy	Jordan	Mongolia	South Sudan
Japan	Kazakhstan	Morocco	Syrian Arab Republic
Korea, Republic of	Lebanon	Myanmar	Tajikistan
Kuwait	Libya	Nicaragua	Tanzania, United
Latvia	Malaysia	Nigeria	Republic of
Lithuania	Maldives	Occupied Palestinian	Togo
Luxembourg	Mauritius	Territory	Uganda
Macau, China	Mexico	Pakistan	Yemen
Malta	Montenegro	Papua New Guinea	Zimbabwe
Netherlands	Namibia	Philippines	
New Caledonia	North Macedonia	Sao Tome and Principe	
New Zealand	Paraguay	Senegal	
Norway	Peru	Solomon Islands	
Oman	Romania	Sudan	
Panama	Russian Federation	Timor-Leste	
Poland	Saint Lucia	Tunisia	
Portugal	Saint Vincent and	Ukraine	
Puerto Rico	the Grenadines	Uzbekistan	
Qatar	Samoa	Vanuatu	
Saudi Arabia	Serbia	Viet Nam	
Singapore	South Africa	Western Sahara	
Slovakia	Sri Lanka	Zambia	
Slovenia	Suriname		
Spain	Thailand		
Sweden	Tonga		
Switzerland	Turkey		
Taiwan, China	Turkmenistan		
Trinidad and Tobago	Venezuela, Bolivarian		
United Arab Emirates	Republic of		
United Kingdom			
United States			
United States			
Virgin Islands			
Uruguay			

Appendix B. ILO modelled estimates and projections

The source of all global and regional labour market estimates presented in this *Global Employment Trends for Youth* report is the ILO modelled estimates as of November 2019. The ILO has designed and actively maintains a series of econometric models that are used to generate estimates of labour market indicators in the countries and years for which country-reported data are unavailable. Labour market indicators are estimated for countries with missing data to obtain a balanced panel data set so that, every year, regional and global aggregates with consistent country coverage can be computed. These allow the ILO to analyse global and regional estimates of key labour market indicators and related trends. Moreover, the resulting country-level data, combining both reported and imputed observations, constitute a unique, internationally comparable data set on labour market indicators.

Data collection and evaluation

The ILO modelled estimates are generally derived for 189 countries, disaggregated by sex and age, as appropriate. Additionally, for selected indicators, an additional disaggregation by geographical area (urban and rural) is performed. Before running the models to obtain the estimates, labour market information specialists from the ILO Department of Statistics, in cooperation with the Research Department, evaluate existing country-reported data and select only those observations deemed sufficiently comparable across countries. The recent efforts by the ILO to produce harmonized indicators from country-reported micro-data have considerably increased the comparability of the observations. Nonetheless, it is still necessary to select data on the basis of the following four criteria: (a) type of data source; (b) geographical coverage; (c) age-group coverage; and (d) presence of methodological breaks or outliers.

With regard to the first criterion, for labour market data to be included in a particular model, they must be derived from a labour force survey, a household survey or, more rarely, a population census. National labour force surveys are generally similar across countries and present the highest data quality. Hence, the data derived from such surveys are more readily comparable than data obtained from other sources. Therefore, strict preference is given to labour force survey-based data in the selection process. However, many developing countries, which lack the resources to conduct a labour force survey, report labour market information on the basis of other types of household surveys or population censuses. Consequently, because of the need to balance the competing goals of data comparability and data coverage, some (non-labour force survey) household survey data and, more rarely, population census-based data are included in the models.

The second criterion is that only nationally representative (i.e. not geographically limited) labour market indicators are included. Observations corresponding to only urban or only rural areas are not included because large differences typically exist between rural and urban labour markets, and using only rural or urban data would not be consistent with benchmark data, such as gross domestic product (GDP).

The third criterion is that the age groups covered by the observed data must be sufficiently comparable across countries. Countries report labour market information for a variety of age groups, and the age group selected can influence the observed value of a given labour market indicator.

The last criterion for excluding data from a given model is whether a methodological break is present or if a particular data point is clearly an outlier. In both cases, a balance has to be

struck between using as much data as possible and including observations that are likely to distort the results. During this process, particular attention is paid to the existing metadata and the underlying methodology for obtaining the data point under consideration.

Historical estimates can be revised in cases where previously used input data are discarded because a source that is more accurate according to the preceding criteria has become available.

Methodology used to estimate labour market indicators

Labour market indicators are estimated using a series of models, which establish statistical relationships between observed labour market indicators and explanatory variables. These relationships are used to impute missing observations and make projections for the indicators.

There are many potential statistical relationships, also called "model specifications", that can be used to predict labour market indicators. The key to obtaining accurate and unbiased estimates is to select the best model specification in each case. The ILO modelled estimates generally rely on a procedure called cross-validation, which is used to identify models that minimize the expected error and variance of the estimation. This procedure involves repeat-edly computing a number of candidate model specifications using random subsets of the data: the missing observations are predicted and the prediction error is calculated for each iteration. Each candidate model is assessed on the basis of the pseudo-out-of-sample root-mean-squared error, although other metrics such as result stability are also assessed depending on the model. This makes it possible to identify the statistical relationship that provides the best estimate of a given labour market indicator. It is worth noting that the most appropriate statistical relationship for this purpose could differ depend-ing on the country.

The benchmark for the ILO modelled estimates is the 2019 Revision of the United Nations World Population Prospects, which provides estimates and projections of the total popu-lation broken down into five-year age groups. The working-age population comprises everyone who is at least 15 years of age. First, a model is used to estimate and project the labour force participation rates disaggregated by sex and five-year age groups. These estimated and projected rates are applied to the estimates for the working-age population to obtain the labour force. Second, another model is used to estimate the unemployment rate disaggregated by sex and for young people (15–24) and adults (25+). Combining the unemployment rate with the labour force estimates, the numbers of employed and unemployed are obtained. Third, yet another model is used to estimate the labour un-derutilization rates (LU2, LU3 and LU4 rates: see further down), from which the time-related underemployment and the potential labour force can be derived. Fourth, the distribution of employment as a function of four different indicators is estimated using four different models. These indicators include employment status, economic activity (sector), ccupation and economic class (working poverty). Fifth, a model is used to estimate the share of the youth population not in employment, education or training.

Although the same basic approach is followed in the models used to estimate all the indi-cators, there are differences between the various models because of specific features of the underlying data. Further details are provided here for each model.

Labour force estimates and projections

The ILO labour force estimates and projections (LFEP) are part of a broader international campaign to obtain demographic estimates and projections to which several United Nations agencies contribute. Estimates and projections are produced by the United Nations Population Division for the total population, and for its sex and age composition; by the ILO

for the employed, unemployed and related populations; by the Food and Agriculture Organization of the United Nations (FAO) for the agricultural population; and by the United Nations Educational, Scientific and Cultural Organization (UNESCO) for the school-attending population.

The basic data used as input for the relevant model are single-year labour force participation rates disaggregated by sex and age groups, of which ten groups are defined using five-year age intervals (15–19, 20–24, and so on until 60–64) and the last age group is defined as 65 years and above. The underlying methodology has been extensively assessed in terms of pseudo-out-of-sample performance. However, the LFEP model and the model used to estimate the labour income share are the only two models described in this appendix that do not automatically perform model specification searching.

The estimation is performed in two different steps, each of which is applied recursively. Linear interpolation is used to fill in the missing data for countries for which such a procedure is possible. The performance of this procedure has been found to be reasonable, which is not surprising, given that the labour force participation rate is a very persistent variable. In all other cases, weighted multivariate estimation is carried out. Countries are divided into nine estimation groups chosen on the combined basis of broad economic similarity and geographical proximity. In terms of model specification, after accounting for data structure and heterogeneity among various countries in the input data used, it was decided to use panel data techniques with country-fixed effects. The regressions are weighted by the non-response likelihood. The explanatory variables used include economic and demographic variables. The estimates are produced using the detailed five-year age intervals. The global figures are calculated using the benchmark population from the United Nations World Population Prospects and the detailed rates.

The projections are carried out following a different methodology than that used for the imputation of missing values over the historical period. A logistic trend model is used for data extrapolation. The main advantage of the logistic curve and other sigmoid or S-shaped curves is that they can capture growth processes that ultimately reach a steady state. These curves are frequently used to model populations and labour force participation rates. Furthermore, on the basis of past behaviour of observed labour force participation rates, upper and lower bounds on cumulative change are imposed to avoid extrapolating changes that would be excessive judging by historical experience.

Unemployment estimates

This model estimates a complete panel data set of unemployment rates disaggregated by sex and age (15–24, 25+). Real observations are more likely to exist for the total unemployment rate than for the rate disaggregated by sex and age. To maximize the use of real information, the model first estimates the total rate. Next, the rates for male and female employment, and for youth and adult employment, are estimated separately. These estimates are then rebalanced so that the implied total rate matches the total rate estimated in the first step. A similar procedure is used in the final step for the unemployment rates among male and female young people, as well as male and female adults.

The estimation of each indicator is performed in a two-step process. In the first step, a cross-country regression is carried out to identify the level of the unemployment rate in 2018 in countries with completely missing data. This step uses information on demography, per capita income, economic structure and an employment index from the Gallup World Poll. In the second step, the evolution of the unemployment rate is estimated, using information on the economic cycle as well as on economic structure and demographics. The two-step process has the advantage of treating two very different econometric problems using separate approaches.

Unemployment projections

These models project the future development of unemployment rates from 2019 onwards. In a first set of projection models, quarterly data are used. The use of such higher-frequency information increases the forecast accuracy. For 44 countries with available quarterly economic forecasts, a series of models are run to obtain estimates for 2019 and projections for 2020. These models are evaluated using the model search routines described earlier, specifically by splitting the data into training and evaluation samples. Because of the high serial correlation of quarterly unemployment rates, a block of observations around the evaluation sample needs to be excluded from the estimation to ensure the training sample's independence from the observation being evaluated. Models are combined using a "jackknife model-averaging" technique described in Hansen and Racine (2012), which essentially finds the linear combination of models that minimizes the variance of the prediction error. For countries for which quarterly labour market information is available but not quarterly macroeconomic forecasts, an Auto Regressive Integrated Moving Average (ARIMA) model is used to project the remaining quarters of the year, of which at least one quarter has been observed.

A second set of projection models is used to estimate the unemployment rate for countries without quarterly data and to project over longer horizons for all countries. These models use the full panel data set of unemployment rates up to the last year with reported information as the base; they also use projections of the cyclical component of GDP growth. A series of dynamic models are specified and evaluated using a slightly modified cross-validation procedure to identify the best-fitting projection models. For forecasting, a specified number of periods are dropped from the end of the sample, the parameters of the candidate model are re-estimated, and projections are then made for these periods to calculate the forecast error for different forecast horizons. By shifting the point at which periods are dropped, the forecast can be evaluated for different historical periods, and hence a root-mean-squared forecast error can be calculated for each candidate model and each projection horizon. The models in question are as follows:

▶ Country-level error correction models for countries that exhibit a cointegrated relationship between employment growth and labour force growth;

▶ A country-level model projecting the unemployment rate itself;

▶ A country-level model projecting the change in the unemployment rate;

▶ A panel regression model projecting the unemployment rate, where the panel dimensions are (a) geographical regions; (b) income groups; (c) oil exporters;

▶ A multi-level mixed model with random intercepts and coefficients projecting the unemployment rate;

▶ A multi-level mixed model with random intercepts and coefficients projecting the change in the unemployment rate.

Models are weighted on the basis of their forecasting performance over different horizons, implying that a model may receive a higher weighting in the short run, but a lower weighting in the long run. The forecast confidence interval is estimated using the weighted root-mean-squared forecast errors from the cross-validation, together with the weighted variance of forecasts obtained from the various forecasting models.

Estimates of labour underutilization (LU3 rates)

The target variables of the model are the measures of labour underutilization defined in the resolution concerning statistics of work, employment and labour underutilization adopted by the 19th International Conference of Labour Statisticians (ICLS) in October 2013. These measures include the combined rate of unemployment and the potential labour force (LU3). The measures are defined as:

$$LU3 = \frac{\text{Unemployed + Potential labour force}}{\text{Labour force + Potential labour force}}$$

The potential labour force consists of people of working age who were actively seeking employment, were not available to start work in the reference week, but would become available within a short subsequent period (unavailable jobseekers), or who were not actively seeking employment but wanted to work and were available in the reference week (available potential jobseekers).

The model uses the principles of cross-validation and uncertainty estimation to select the regression models with the best pseudo-out-of-sample performance, not unlike the unemployment rate model. The labour underutilization model, however, has two very specific features. First, all demographic groups are jointly estimated using the appropriate categorical variable as a control in the regression because the groups are interdependent (and data availability is roughly uniform across breakdown). Second, the model incorporates the information on unemployment and labour force into the regressions (used alongside other variables to reflect economic and demographic factors).

Estimates of the distribution of employment by status, occupation and economic activity

The distribution of employment by status, occupation and economic activity (sector) is estimated for the total and also disaggregated by sex. In the first step, a cross-country regression is performed to identify the share of each of the employment-related categories in countries with completely missing data. This step uses information on demography, per capita income, economic structure and a model-specific indicator with high predictive power for the estimated distribution. The indicators for each category are as follows:

▶ For status, an index of work for an employer from the Gallup World Poll;

▶ For occupation, the share of value added of a sector in which people with a given occupation are most likely to work;

▶ For sector, the share of value added of the sector.

The next step estimates the evolution of the shares of each category, using information on the economic cycle as well as economic structure and demographics. Lastly, the estimates are rebalanced to ensure that the individual shares add up to 100 per cent.

The estimated sectors are based on an ILO-specific classification that ensures maximum consistency between the third and fourth revision of the United Nations International Standard Industrial Classification of All Economic Activities (ISIC). The sectors A, B, C, F, G, I, K, O, P and Q correspond to the ISIC Rev.4 classification. Furthermore, the following composite sectors are defined:

- ▶ "Utilities" is composed of sectors D and E;

- ▶ "Transport, storage and communication" is composed of sectors H and J;

- ▶ "Real estate, business and administrative activities" is composed of sectors L, M and N;

- ▶ "Other services" is composed of sectors R, S, T and U.

In principle, the estimated occupations correspond to the major categories of the 1988 and 2008 iterations of the ILO International Standard Classification of Occupations (ISCO-88 and ISCO-08). However, subsistence farming occupations were classified inconsistently across countries, and sometimes even within one country across years. According to ISCO-08, subsistence farmers should be classified in ISCO category 6, namely, as skilled agricultural workers. However, a number of countries with a high incidence of subsistence farming reported a low share of workers in category 6, but a high share for category 9 (elementary occupations). This implies that the shares of occupational categories 6 and 9 can differ widely between countries that have a very similar economic structure. It is not feasible to determine the extent of misclassification between categories 6 and 9. Consequently, to obtain a consistent and internationally comparable classification, categories 6 and 9 are merged and estimated jointly.

Estimates of employment by economic class

The estimates of employment by economic class are produced for a subset of countries. The model uses the data derived from the unemployment, status and economic activity models as inputs in addition to other demographic, social and economic variables.

The methodology involves two steps. In the first step, the various economic classes of workers are estimated using the economic class of the overall population (among other explanatory variables). This procedure is based on the fact that the distribution of economic class in the overall population and in the working population are closely related. The economic class of the overall population is derived from the World Bank's PovcalNet database. In general, the economic class is defined in terms of consumption, but in particular cases for which no other data exist, income data are used instead.

Once the estimates from this first step have been obtained, a second step estimates the data for observations for which neither data on the economic class of the working population nor estimates from step 1 are available. This second step relies on cross-validation and subsequent selection of the best-performing model to ensure a satisfactory performance.

In the present edition of the model, employment is subdivided into five different economic classes: workers living on US$0–1.9 per day, US$1.9–3.2 per day, US$3.2–5.5 per day, US$5.5–13.0 per day and above US$13.0 per day, in purchasing power parity terms.

Estimates related to youth not in employment, education or training

The target variable of the model is the share of youth not in employment, education or training (NEET):

$$\text{NEET share} = \frac{\text{Youth not in employment, education or training}}{\text{Youth population}}$$

It is worth noting that, by definition, 1 minus the NEET share gives the share of young people who are either in employment or enrolled in some educational or training programme. The NEET share is included as one of the indicators used to measure progress towards the achievement of the Sustainable Development Goals, specifically Goal 8 ("Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all").

The model uses the principles of cross-validation and uncertainty estimation to select the regression models with the best pseudo-out-of-sample performance, not unlike the unemployment rate model. The NEET model estimates all demographic groups jointly using the appropriate categorical variable as a control in the regression because the groups are interdependent (and data availability is roughly uniform across breakdown). The model incorporates the information on unemployment, labour force and enrolment rates into the regressions (used alongside other variables to reflect economic and demographic factors). The resulting estimates include the NEET share and the number of NEET youth.

Appendix C. Additional tables

World

Indications	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	52.3	46.2	45.5	
Labour force participation rate	Male	per cent	61.3	54.7	54.0	
Labour force participation rate	Female	per cent	42.9	37.2	36.5	
Labour force	Total	millions	567.7	561.5	552.2	
Labour force	Male	millions	340.0	341.7	337.0	
Labour force	Female	millions	227.7	219.8	215.2	
Employment-to-population ratio	Total	per cent	45.8	40.1	39.4	
Employment-to-population ratio	Male	per cent	53.4	47.4	46.7	
Employment-to-population ratio	Female	per cent	37.8	32.4	31.8	
Employment	Total	millions	496.6	487.0	478.9	
Employment	Male	millions	296.1	295.7	291.3	
Employment	Female	millions	200.5	191.3	187.5	
Unemployment rate	Total	per cent	12.5	13.3	13.3	
Unemployment rate	Male	per cent	12.9	13.5	13.5	
Unemployment rate	Female	per cent	12.0	13.0	12.9	
Unemployment	Total	millions	71.1	74.5	73.3	
Unemployment	Male	millions	43.9	46.0	45.7	
Unemployment	Female	millions	27.3	28.5	27.7	
Combined rate of unemployment and potential labour force	Total	per cent		19.2	19.3	
Combined rate of unemployment and potential labour force	Male	per cent		18.3	18.5	
Combined rate of unemployment and potential labour force	Female	per cent		20.5	20.5	
Potential labour force	Total	millions		41.1	41.2	
Potential labour force	Male	millions		20.1	20.5	
Potential labour force	Female	millions		21.0	20.7	
Rate of NEET	Total	per cent		21.9	21.7	
Rate of NEET	Male	per cent		12.6	12.6	
Rate of NEET	Female	per cent		31.6	31.4	
NEET	Total	millions		265.8	263.9	
NEET	Male	millions		78.9	78.4	
NEET	Female	millions		186.9	185.6	
Extreme working poverty rate	Total	per cent	32.0	19.8	17.7	
Moderate working poverty rate	Total	per cent	24.3	21.0	20.6	
Extreme working poverty	Total	millions	159.1	96.4	84.9	
Moderate working poverty	Total	millions	120.9	102.1	98.6	

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	44.7	43.9	43.1	42.6	42.2	41.8	41.4	41.2	41.0	40.7
	53.2	52.3	51.5	50.8	50.3	49.8	49.3	49.1	48.8	48.5
	35.7	34.9	34.3	34.0	33.6	33.3	33.0	32.8	32.6	32.4
	541.2	529.1	518.4	511.1	505.6	501.5	497.6	496.5	495.6	495.1
	331.3	324.7	318.6	313.9	310.7	308.2	305.9	305.3	304.8	304.6
	209.9	204.4	199.8	197.2	194.9	193.4	191.7	191.2	190.8	190.5
	38.7	37.9	37.4	36.8	36.4	36.1	35.8	35.6	35.4	35.1
	45.9	45.0	44.4	43.7	43.2	42.8	42.5	42.2	41.9	41.7
	31.1	30.4	29.9	29.5	29.1	28.9	28.7	28.5	28.3	28.1
	468.5	457.3	449.2	441.5	435.7	432.6	430.3	428.9	427.7	426.9
	285.7	279.5	274.9	270.2	266.9	265.1	263.6	262.7	262.0	261.6
	182.8	177.8	174.2	171.3	168.8	167.6	166.7	166.2	165.7	165.3
	13.4	13.6	13.4	13.6	13.8	13.7	13.5	13.6	13.7	13.8
	13.8	13.9	13.7	13.9	14.1	14.0	13.8	14.0	14.0	14.1
	12.9	13.0	12.8	13.1	13.4	13.3	13.0	13.1	13.1	13.2
	72.7	71.8	69.3	69.6	69.9	68.9	67.2	67.6	67.9	68.2
	45.6	45.2	43.7	43.7	43.8	43.1	42.2	42.6	42.8	43.0
	27.1	26.6	25.6	25.9	26.2	25.8	25.0	25.0	25.1	25.2
	19.6	19.7	19.6	19.8	20.3	20.2	20.1	20.2	20.4	20.5
	18.8	19.0	18.9	19.1	19.5	19.5	19.4	19.6	19.7	19.8
	20.7	20.8	20.7	20.9	21.4	21.3	21.2	21.2	21.4	21.5
	41.2	40.4	40.2	39.7	40.7	40.6	41.1	41.3	41.5	41.8
	20.6	20.3	20.4	20.2	20.8	21.0	21.4	21.4	21.5	21.7
	20.6	20.1	19.9	19.5	19.9	19.6	19.8	19.8	20.0	20.1
	21.6	21.8	21.7	21.7	21.6	21.7	21.9	22.2	22.3	22.5
	12.5	12.8	12.8	12.9	13.0	13.2	13.5	13.8	14.0	14.2
	31.3	31.4	31.2	31.0	30.8	30.8	30.8	31.1	31.2	31.3
	261.8	263.3	260.7	260.0	259.0	260.3	263.2	267.0	269.7	273.0
	77.7	79.6	79.2	80.0	80.5	81.8	84.0	86.1	87.5	89.1
	184.1	183.7	181.5	180.0	178.5	178.5	179.2	180.9	182.3	183.9
	16.3	14.3	14.0	13.7	13.7	13.4	13.1	12.8	12.6	12.4
	20.1	19.4	18.8	18.1	17.7	17.3	16.8	16.6	16.3	16.0
	76.4	65.3	62.7	60.6	59.5	57.9	56.2	55.0	53.8	52.9
	94.2	88.6	84.2	79.8	77.0	74.7	72.5	71.1	69.7	68.5

Northern Africa

Indications	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	33.9	32.2	31.6	
Labour force participation rate	Male	per cent	48.5	46.8	46.1	
Labour force participation rate	Female	per cent	18.9	17.1	16.6	
Labour force	Total	millions	12.1	13.0	12.7	
Labour force	Male	millions	8.8	9.6	9.4	
Labour force	Female	millions	3.3	3.4	3.3	
Employment-to-population ratio	Total	per cent	23.6	24.4	22.8	
Employment-to-population ratio	Male	per cent	34.8	38.3	35.5	
Employment-to-population ratio	Female	per cent	12.1	10.1	9.7	
Employment	Total	millions	8.4	9.8	9.2	
Employment	Male	millions	6.3	7.8	7.2	
Employment	Female	millions	2.1	2.0	1.9	
Unemployment rate	Total	per cent	30.5	24.2	27.8	
Unemployment rate	Male	per cent	28.4	18.3	23.0	
Unemployment rate	Female	per cent	36.1	40.9	41.5	
Unemployment	Total	millions	3.7	3.1	3.5	
Unemployment	Male	millions	2.5	1.7	2.2	
Unemployment	Female	millions	1.2	1.4	1.4	
Combined rate of unemployment and potential labour force	Total	per cent		37.6	41.5	
Combined rate of unemployment and potential labour force	Male	per cent		27.4	33.0	
Combined rate of unemployment and potential labour force	Female	per cent		59.7	60.3	
Potential labour force	Total	millions		2.8	3.0	
Potential labour force	Male	millions		1.2	1.4	
Potential labour force	Female	millions		1.6	1.6	
Rate of NEET	Total	per cent		29.1	29.4	
Rate of NEET	Male	per cent		15.2	17.2	
Rate of NEET	Female	per cent		43.4	42.0	
NEET	Total	millions		11.7	11.8	
NEET	Male	millions		3.1	3.5	
NEET	Female	millions		8.6	8.3	
Extreme working poverty rate	Total	per cent	5.4	2.4	2.1	
Moderate working poverty rate	Total	per cent	19.9	15.5	13.5	
Extreme working poverty	**Total**	millions	0.5	0.2	0.2	
Moderate working poverty	**Total**	millions	1.7	1.5	1.2	

Northern Africa

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	31.6	31.9	30.9	29.8	29.3	27.8	27.6	27.5	27.3	27.1
	46.0	45.9	44.1	41.8	40.9	38.8	38.4	38.2	38.0	37.7
	16.8	17.4	17.2	17.4	17.2	16.4	16.4	16.3	16.1	16.0
	12.7	12.8	12.4	11.9	11.7	11.1	11.1	11.1	11.1	11.1
	9.4	9.3	9.0	8.5	8.3	7.9	7.9	7.9	7.9	7.9
	3.3	3.4	3.4	3.4	3.4	3.2	3.2	3.2	3.2	3.2
	21.9	22.2	21.7	20.4	20.2	19.2	19.0	19.2	19.2	19.1
	33.8	33.8	32.7	29.9	29.6	28.0	27.8	28.1	28.2	28.2
	9.5	10.1	10.3	10.6	10.4	9.9	9.9	9.8	9.7	9.5
	8.8	8.9	8.7	8.2	8.1	7.7	7.6	7.7	7.8	7.8
	6.9	6.9	6.7	6.1	6.0	5.7	5.7	5.8	5.9	5.9
	1.9	2.0	2.0	2.1	2.0	1.9	2.0	1.9	1.9	1.9
	30.9	30.4	29.8	31.5	31.0	31.2	31.1	30.2	29.8	29.6
	26.4	26.2	25.9	28.4	27.5	27.7	27.6	26.4	25.7	25.3
	43.6	41.9	40.1	39.1	39.6	39.6	39.5	39.6	39.8	40.3
	3.9	3.9	3.7	3.8	3.6	3.5	3.4	3.3	3.3	3.3
	2.5	2.4	2.3	2.4	2.3	2.2	2.2	2.1	2.0	2.0
	1.5	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	44.7	43.9	43.3	45.1	44.6	45.1	45.0	44.2	43.8	43.7
	36.6	36.5	36.5	39.6	38.6	39.2	39.1	37.7	37.0	36.6
	62.3	60.0	58.0	56.5	57.1	57.3	57.1	57.4	57.7	58.3
	3.2	3.1	2.9	3.0	2.9	2.8	2.8	2.8	2.8	2.8
	1.5	1.5	1.5	1.6	1.5	1.5	1.5	1.4	1.4	1.4
	1.7	1.6	1.4	1.4	1.4	1.3	1.3	1.3	1.4	1.4
	28.6	26.7	26.7	26.5	26.3	26.3	26.9	26.9	26.9	27.0
	17.0	15.7	16.3	17.2	17.2	17.4	18.2	18.1	18.0	18.0
	40.5	38.0	37.4	36.0	35.8	35.6	36.0	36.1	36.3	36.5
	11.5	10.7	10.7	10.6	10.5	10.5	10.8	10.9	10.9	11.1
	3.5	3.2	3.3	3.5	3.5	3.5	3.7	3.7	3.7	3.8
	8.0	7.5	7.3	7.1	7.0	7.0	7.1	7.1	7.2	7.3
	1.9	1.7	1.7	1.6	1.5	1.5	1.5	1.4	1.4	1.3
	11.2	10.5	10.4	9.3	9.0	8.4	8.2	8.2	8.1	7.8
	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6	0.6

Sub-Saharan Africa

Indications	Demographic group (Youth)	Unit	2000	2010	2011
Labour force participation rate	Total	per cent	53.0	50.7	50.5
Labour force participation rate	Male	per cent	55.3	53.0	52.8
Labour force participation rate	Female	per cent	50.8	48.4	48.2
Labour force	Total	millions	67.8	83.9	85.7
Labour force	Male	millions	35.4	44.0	44.9
Labour force	Female	millions	32.4	40.0	40.8
Employment-to-population ratio	Total	per cent	47.7	45.9	45.9
Employment-to-population ratio	Male	per cent	49.6	48.2	48.2
Employment-to-population ratio	Female	per cent	45.8	43.7	43.7
Employment	Total	millions	61.0	76.1	78.0
Employment	Male	millions	31.7	40.0	41.0
Employment	Female	millions	29.3	36.1	37.0
Unemployment rate	Total	per cent	10.1	9.3	9.0
Unemployment rate	Male	per cent	10.3	9.0	8.7
Unemployment rate	Female	per cent	9.7	9.7	9.3
Unemployment	Total	millions	6.8	7.8	7.7
Unemployment	Male	millions	3.7	4.0	3.9
Unemployment	Female	millions	3.2	3.9	3.8
Combined rate of unemployment and potential labour force	Total	per cent		16.8	16.4
Combined rate of unemployment and potential labour force	Male	per cent		14.8	14.6
Combined rate of unemployment and potential labour force	Female	per cent		18.9	18.4
Potential labour force	Total	millions		7.5	7.6
Potential labour force	Male	millions		3.0	3.1
Potential labour force	Female	millions		4.5	4.5
Rate of NEET	Total	per cent		18.5	18.3
Rate of NEET	Male	per cent		14.0	13.7
Rate of NEET	Female	per cent		23.1	23.0
NEET	Total	millions		30.7	31.1
NEET	Male	millions		11.6	11.6
NEET	Female	millions		19.1	19.5
Extreme working poverty rate	Total	per cent	59.8	49.3	48.0
Moderate working poverty rate	Total	per cent	20.8	26.0	26.5
Extreme working poverty	**Total**	millions	36.5	37.5	37.4
Moderate working poverty	**Total**	millions	12.7	19.8	20.6

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	49.5	48.7	48.7	48.9	49.1	48.8	48.3	48.2	48.1	48.0
	51.9	51.1	51.1	51.3	51.6	51.1	50.6	50.5	50.4	50.2
	47.1	46.3	46.2	46.5	46.7	46.5	46.1	46.0	45.9	45.7
	86.2	87.1	89.4	92.4	95.3	97.4	99.2	101.9	104.7	107.4
	45.3	45.8	47.1	48.7	50.3	51.3	52.2	53.6	55.1	56.6
	40.9	41.2	42.3	43.7	45.1	46.1	47.1	48.3	49.6	50.8
	45.1	44.5	44.6	44.8	44.8	44.5	44.2	44.1	44.0	43.8
	47.5	46.9	47.1	47.3	47.3	46.9	46.5	46.3	46.2	46.1
	42.8	42.1	42.1	42.3	42.2	42.0	41.8	41.8	41.7	41.6
	78.6	79.5	82.0	84.6	86.9	88.7	90.7	93.1	95.6	98.1
	41.5	42.0	43.4	44.8	46.1	47.0	48.0	49.2	50.6	51.9
	37.1	37.5	38.5	39.7	40.7	41.7	42.7	43.8	45.0	46.2
	8.8	8.6	8.3	8.4	8.9	8.9	8.7	8.7	8.7	8.7
	8.5	8.3	7.8	7.9	8.2	8.2	8.1	8.2	8.3	8.3
	9.2	9.1	8.8	9.0	9.6	9.6	9.3	9.2	9.2	9.1
	7.6	7.5	7.4	7.8	8.5	8.7	8.6	8.9	9.1	9.3
	3.9	3.8	3.7	3.9	4.1	4.2	4.2	4.4	4.5	4.7
	3.7	3.7	3.7	3.9	4.3	4.4	4.4	4.5	4.5	4.6
	16.3	16.1	15.7	15.7	16.2	16.2	16.1	16.1	16.1	16.1
	14.4	14.2	13.7	13.7	14.1	14.2	14.2	14.3	14.4	14.4
	18.3	18.2	17.8	17.9	18.4	18.3	18.2	18.1	18.0	17.9
	7.7	7.8	7.9	7.9	8.3	8.5	8.8	9.1	9.3	9.5
	3.1	3.2	3.2	3.3	3.4	3.6	3.7	3.9	4.0	4.1
	4.6	4.6	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.5
	18.4	18.6	18.7	18.6	18.7	18.6	18.8	19.0	19.0	19.1
	13.8	14.0	14.0	13.9	14.0	14.0	14.3	14.5	14.6	14.7
	23.0	23.2	23.4	23.3	23.3	23.2	23.3	23.5	23.5	23.6
	32.0	33.2	34.3	35.1	36.2	37.1	38.6	40.1	41.4	42.7
	12.0	12.5	12.9	13.2	13.7	14.1	14.7	15.4	16.0	16.5
	19.9	20.6	21.4	21.9	22.5	23.0	23.8	24.6	25.4	26.2
	46.5	45.8	45.1	44.5	44.1	43.3	42.3	41.5	40.6	39.7
	26.9	27.0	27.0	27.0	26.9	27.0	27.1	27.2	27.2	27.2
	36.6	36.4	37.0	37.6	38.3	38.4	38.4	38.6	38.8	38.9
	21.1	21.5	22.2	22.8	23.4	23.9	24.5	25.3	26.0	26.7

Northern America

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	62.8	52.2	51.9	
Labour force participation rate	Male	per cent	65.2	53.5	53.2	
Labour force participation rate	Female	per cent	60.3	51.0	50.6	
Labour force	Total	millions	27.1	25.4	25.4	
Labour force	Male	millions	14.4	13.3	13.3	
Labour force	Female	millions	12.7	12.1	12.1	
Employment-to-population ratio	Total	per cent	56.8	42.9	43.2	
Employment-to-population ratio	Male	per cent	58.7	42.6	43.4	
Employment-to-population ratio	Female	per cent	54.8	43.2	42.9	
Employment	Total	millions	24.5	20.8	21.1	
Employment	Male	millions	13.0	10.6	10.9	
Employment	Female	millions	11.5	10.2	10.2	
Unemployment rate	Total	per cent	9.6	17.9	16.8	
Unemployment rate	Male	per cent	10.0	20.2	18.3	
Unemployment rate	Female	per cent	9.1	15.3	15.2	
Unemployment	Total	millions	2.6	4.5	4.3	
Unemployment	Male	millions	1.4	2.7	2.4	
Unemployment	Female	millions	1.2	1.8	1.8	
Combined rate of unemployment and potential labour force	Total	per cent		20.8	19.6	
Combined rate of unemployment and potential labour force	Male	per cent		23.2	21.2	
Combined rate of unemployment and potential labour force	Female	per cent		18.1	17.9	
Potential labour force	Total	millions		0.9	0.9	
Potential labour force	Male	millions		0.5	0.5	
Potential labour force	Female	millions		0.4	0.4	
Rate of NEET	Total	per cent		19.3	18.4	
Rate of NEET	Male	per cent		19.1	17.6	
Rate of NEET	Female	per cent		19.6	19.2	
NEET	Total	millions		9.4	9.0	
NEET	Male	millions		4.8	4.4	
NEET	Female	millions		4.6	4.6	

Northern America

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	52.8	52.3	52.3	52.5	52.9	53.3	52.9	52.6	52.2	51.8
	54.3	53.5	53.5	53.5	53.9	54.2	53.4	53.0	52.6	52.2
	51.2	50.9	51.2	51.5	51.7	52.4	52.4	52.1	51.8	51.4
	25.9	25.8	25.8	25.8	25.9	26.0	25.6	25.3	25.0	24.8
	13.7	13.5	13.5	13.5	13.5	13.5	13.2	13.0	12.8	12.7
	12.3	12.3	12.3	12.4	12.4	12.5	12.4	12.3	12.1	12.1
	44.2	44.3	45.4	46.4	47.2	48.3	48.3	47.9	47.4	46.9
	44.7	44.6	45.7	46.6	47.6	48.5	48.2	47.8	47.3	46.8
	43.8	44.0	45.0	46.1	46.8	48.1	48.3	48.1	47.6	47.1
	21.8	21.8	22.4	22.8	23.2	23.5	23.4	23.1	22.7	22.4
	11.2	11.2	11.5	11.7	11.9	12.1	11.9	11.7	11.5	11.4
	10.5	10.6	10.8	11.1	11.2	11.5	11.5	11.4	11.2	11.0
	16.2	15.2	13.3	11.7	10.6	9.4	8.8	8.8	9.1	9.4
	17.7	16.7	14.5	12.9	11.7	10.5	9.7	9.9	10.1	10.4
	14.5	13.6	12.0	10.4	9.5	8.2	7.8	7.6	8.1	8.4
	4.2	3.9	3.4	3.0	2.8	2.4	2.3	2.2	2.3	2.3
	2.4	2.3	1.9	1.7	1.6	1.4	1.3	1.3	1.3	1.3
	1.8	1.7	1.5	1.3	1.2	1.0	1.0	0.9	1.0	1.0
	19.1	18.1	16.1	14.1	13.0	11.6	10.9	10.9	11.3	11.7
	20.3	19.6	17.3	15.3	14.2	12.8	12.0	12.1	12.4	12.8
	17.8	16.4	14.7	12.8	11.7	10.2	9.8	9.6	10.1	10.6
	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6
	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.4
	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	18.3	17.8	16.5	15.3	14.9	13.7	13.6	13.7	14.0	14.2
	17.5	17.0	15.6	14.7	14.3	13.0	13.0	13.4	13.6	13.9
	19.1	18.6	17.5	16.0	15.5	14.4	14.1	14.1	14.4	14.6
	9.0	8.8	8.1	7.5	7.3	6.7	6.6	6.6	6.7	6.8
	4.4	4.3	3.9	3.7	3.6	3.2	3.2	3.3	3.3	3.4
	4.6	4.5	4.2	3.8	3.7	3.4	3.4	3.3	3.4	3.4

Latin America and the Caribbean

Indicator	Demographic group (Youth)	Unit	2000	2010	2011
Labour force participation rate	Total	per cent	53.7	51.5	50.8
Labour force participation rate	Male	per cent	65.8	61.9	61.0
Labour force participation rate	Female	per cent	41.5	41.0	40.3
Labour force	Total	millions	53.7	55.4	54.8
Labour force	Male	millions	33.0	33.6	33.3
Labour force	Female	millions	20.7	21.8	21.5
Employment-to-population ratio	Total	per cent	44.7	44.2	43.8
Employment-to-population ratio	Male	per cent	56.6	54.6	54.0
Employment-to-population ratio	Female	per cent	32.8	33.6	33.3
Employment	Total	millions	44.7	47.5	47.3
Employment	Male	millions	28.3	29.6	29.5
Employment	Female	millions	16.4	17.8	17.8
Unemployment rate	Total	per cent	16.7	14.3	13.7
Unemployment rate	Male	per cent	14.1	11.8	11.4
Unemployment rate	Female	per cent	21.0	18.1	17.2
Unemployment	Total	millions	9.0	7.9	7.5
Unemployment	Male	millions	4.7	4.0	3.8
Unemployment	Female	millions	4.3	3.9	3.7
Combined rate of unemployment and potential labour force	Total	per cent		22.3	21.8
Combined rate of unemployment and potential labour force	Male	per cent		17.9	17.5
Combined rate of unemployment and potential labour force	Female	per cent		28.8	27.9
Potential labour force	Total	millions		5.8	5.7
Potential labour force	Male	millions		2.5	2.5
Potential labour force	Female	millions		3.3	3.2
Rate of NEET	Total	per cent		20.1	20.4
Rate of NEET	Male	per cent		12.3	12.5
Rate of NEET	Female	per cent		28.2	28.5
NEET	Total	millions		21.6	22.0
NEET	Male	millions		6.7	6.8
NEET	Female	millions		15.0	15.2
Extreme working poverty rate	Total	per cent		4.0	3.6
Moderate working poverty rate	Total	per cent		7.9	7.3
Extreme working poverty	Total	millions		1.9	1.7
Moderate working poverty	Total	millions		3.7	3.4

Latin America and the Caribbean

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	50.9	49.9	49.3	48.9	48.8	49.0	49.0	48.9	48.7	48.5
	61.1	59.9	59.3	58.9	58.2	58.3	58.1	57.9	57.7	57.5
	40.5	39.8	39.0	38.7	39.2	39.5	39.6	39.6	39.5	39.3
	55.2	54.3	53.7	53.4	53.2	53.3	53.1	52.7	52.3	51.9
	33.5	32.9	32.7	32.5	32.1	32.1	31.9	31.6	31.3	31.1
	21.7	21.3	21.0	20.8	21.1	21.2	21.2	21.1	20.9	20.8
	44.0	43.1	42.7	41.7	40.3	40.1	40.2	40.1	39.9	39.7
	54.2	53.0	52.6	51.6	49.6	49.4	49.2	49.1	48.9	48.7
	33.6	33.0	32.5	31.5	30.7	30.7	31.0	30.8	30.8	30.6
	47.7	46.9	46.5	45.4	43.9	43.6	43.5	43.2	42.9	42.5
	29.7	29.2	29.0	28.5	27.4	27.2	27.0	26.8	26.6	26.3
	18.0	17.7	17.5	16.9	16.5	16.5	16.6	16.4	16.3	16.1
	13.6	13.6	13.5	14.8	17.6	18.1	17.9	17.9	18.0	18.1
	11.3	11.5	11.4	12.4	14.9	15.3	15.3	15.2	15.2	15.4
	17.1	16.9	16.8	18.7	21.6	22.3	21.9	22.0	22.1	22.2
	7.5	7.4	7.3	7.9	9.3	9.6	9.5	9.4	9.4	9.4
	3.8	3.8	3.7	4.0	4.8	4.9	4.9	4.8	4.8	4.8
	3.7	3.6	3.5	3.9	4.6	4.7	4.6	4.6	4.6	4.6
	21.7	21.5	21.2	22.6	25.7	26.6	26.8	26.7	26.8	26.9
	17.4	17.5	17.4	18.3	21.3	22.1	22.4	22.3	22.3	22.5
	27.8	27.2	26.9	28.8	31.9	32.8	32.9	33.0	33.1	33.2
	5.7	5.4	5.2	5.3	5.8	6.2	6.4	6.3	6.3	6.2
	2.5	2.4	2.3	2.4	2.6	2.8	2.9	2.9	2.9	2.8
	3.2	3.0	2.9	3.0	3.2	3.3	3.5	3.4	3.4	3.4
	20.3	20.5	20.6	21.0	21.5	21.7	21.6	21.6	21.7	21.8
	12.5	12.8	12.9	13.3	14.1	14.4	14.4	14.5	14.6	14.7
	28.3	28.4	28.5	29.0	29.1	29.3	28.9	28.9	28.9	29.0
	22.0	22.3	22.4	22.9	23.4	23.6	23.4	23.3	23.2	23.3
	6.8	7.1	7.1	7.3	7.8	7.9	7.9	7.9	7.9	8.0
	15.1	15.2	15.3	15.6	15.6	15.7	15.5	15.4	15.3	15.3
	3.3	2.9	2.6	2.4	2.5	2.7	2.6	2.4	2.3	2.2
	7.1	6.3	6.2	6.1	6.0	5.9	5.7	5.4	5.2	5.0
	1.6	1.4	1.2	1.1	1.1	1.2	1.1	1.1	1.0	0.9
	3.4	3.0	2.9	2.8	2.7	2.6	2.5	2.3	2.2	2.1

Arab States

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	33.3	29.0	29.0	
Labour force participation rate	Male	per cent	52.8	46.7	46.8	
Labour force participation rate	Female	per cent	12.8	9.8	9.5	
Labour force	Total	millions	6.6	7.7	7.9	
Labour force	Male	millions	5.4	6.5	6.7	
Labour force	Female	millions	1.2	1.2	1.2	
Employment-to-population ratio	Total	per cent	27.3	23.3	23.3	
Employment-to-population ratio	Male	per cent	43.7	38.6	38.8	
Employment-to-population ratio	Female	per cent	9.8	6.7	6.5	
Employment	Total	millions	5.4	6.2	6.4	
Employment	Male	millions	4.4	5.4	5.5	
Employment	Female	millions	0.9	0.9	0.8	
Unemployment rate	Total	per cent	18.2	19.5	19.5	
Unemployment rate	Male	per cent	17.2	17.3	17.1	
Unemployment rate	Female	per cent	22.8	31.2	32.2	
Unemployment	Total	millions	1.2	1.5	1.5	
Unemployment	Male	millions	0.9	1.1	1.1	
Unemployment	Female	millions	0.3	0.4	0.4	
Combined rate of unemployment and potential labour force	Total	per cent		33.0	32.8	
Combined rate of unemployment and potential labour force	Male	per cent		26.3	25.9	
Combined rate of unemployment and potential labour force	Female	per cent		57.4	58.4	
Potential labour force	Total	millions		1.6	1.6	
Potential labour force	Male	millions		0.8	0.8	
Potential labour force	Female	millions		0.8	0.8	
Rate of NEET	Total	per cent		31.6	31.6	
Rate of NEET	Male	per cent		15.9	15.8	
Rate of NEET	Female	per cent		48.7	48.9	
NEET	Total	millions		8.4	8.6	
NEET	Male	millions		2.2	2.2	
NEET	Female	millions		6.2	6.4	
Extreme working poverty rate	Total	per cent		1.4	3.0	
Moderate working poverty rate	Total	per cent		11.8	12.7	
Extreme working poverty	Total	millions		0.1	0.2	
Moderate working poverty	Total	millions		0.7	0.8	

Arab States

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	28.7	28.5	28.3	28.0	28.1	27.9	28.0	27.7	27.4	27.2
	46.4	46.2	46.1	45.4	45.3	45.7	45.9	45.6	45.2	44.7
	9.3	9.2	9.0	9.2	9.5	8.5	8.4	8.3	8.2	8.1
	8.0	8.0	7.9	7.8	8.0	8.0	8.0	7.9	7.8	7.9
	6.7	6.8	6.7	6.6	6.7	6.8	6.9	6.8	6.7	6.8
	1.2	1.2	1.2	1.2	1.3	1.2	1.1	1.1	1.1	1.1
	23.1	22.7	22.3	21.9	22.0	21.6	21.6	21.4	21.1	21.0
	38.6	38.1	37.8	36.9	36.7	36.7	36.9	36.7	36.3	35.9
	6.1	5.9	5.6	5.7	6.1	5.0	4.8	4.8	4.7	4.7
	6.4	6.3	6.3	6.1	6.2	6.1	6.2	6.1	6.0	6.1
	5.6	5.6	5.5	5.4	5.4	5.5	5.5	5.5	5.4	5.4
	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
	19.5	20.5	21.1	21.7	21.7	22.8	22.8	22.9	23.0	22.9
	16.8	17.6	18.1	18.7	19.0	19.7	19.6	19.7	19.8	19.6
	34.4	36.2	38.1	37.6	35.9	40.8	42.4	42.2	42.1	42.5
	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8
	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3
	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	32.9	34.1	34.7	35.3	35.1	35.8	35.7	36.1	36.5	36.5
	25.3	25.9	26.2	27.0	27.4	28.3	28.3	28.6	29.0	28.9
	60.6	63.0	64.5	63.9	61.8	65.1	65.5	65.8	66.1	66.3
	1.6	1.6	1.6	1.7	1.6	1.6	1.6	1.6	1.7	1.7
	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9
	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
	31.0	32.7	33.1	33.3	33.3	33.8	34.0	34.2	34.3	34.5
	14.9	16.5	16.8	17.2	17.3	17.9	17.7	17.8	18.0	18.2
	48.6	50.4	50.8	50.7	50.6	51.2	51.8	51.9	51.9	52.2
	8.6	9.2	9.3	9.3	9.4	9.6	9.7	9.8	9.8	10.0
	2.2	2.4	2.5	2.5	2.6	2.7	2.6	2.7	2.7	2.7
	6.4	6.7	6.8	6.8	6.9	7.0	7.1	7.1	7.1	7.3
	3.8	5.4	5.7	9.3	11.5	12.7	12.9	13.3	13.2	13.1
	12.7	12.7	12.5	13.2	12.6	12.6	12.4	12.3	12.2	11.8
	0.2	0.3	0.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8
	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7

Eastern Asia

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	65.6	54.3	53.4	
Labour force participation rate	Male	per cent	66.0	56.2	55.3	
Labour force participation rate	Female	per cent	65.2	52.3	51.3	
Labour force	Total	millions	153.9	139.8	133.7	
Labour force	Male	millions	79.6	75.2	72.2	
Labour force	Female	millions	74.3	64.5	61.5	
Employment-to-population ratio	Total	per cent	61.0	49.0	48.1	
Employment-to-population ratio	Male	per cent	60.8	50.1	49.3	
Employment-to-population ratio	Female	per cent	61.1	47.7	46.8	
Employment	Total	millions	143.1	126.1	120.5	
Employment	Male	millions	73.3	67.1	64.4	
Employment	Female	millions	69.7	58.9	56.1	
Unemployment rate	Total	per cent	7.1	9.8	9.9	
Unemployment rate	Male	per cent	7.9	10.8	10.8	
Unemployment rate	Female	per cent	6.2	8.7	8.7	
Unemployment	Total	millions	10.9	13.7	13.2	
Unemployment	Male	millions	6.3	8.1	7.8	
Unemployment	Female	millions	4.6	5.6	5.4	
Combined rate of unemployment and potential labour force	Total	per cent		14.0	14.2	
Combined rate of unemployment and potential labour force	Male	per cent		15.1	15.3	
Combined rate of unemployment and potential labour force	Female	per cent		12.8	13.0	
Potential labour force	Total	millions		6.8	6.8	
Potential labour force	Male	millions		3.8	3.8	
Potential labour force	Female	millions		3.0	3.0	
Rate of NEET	Total	per cent		17.7	17.8	
Rate of NEET	Male	per cent		13.1	13.2	
Rate of NEET	Female	per cent		22.7	22.8	
NEET	Total	millions		45.7	44.6	
NEET	Male	millions		17.6	17.3	
NEET	Female	millions		28.1	27.3	
Extreme working poverty rate	Total	per cent		17.8	13.1	
Moderate working poverty rate	Total	per cent		16.4	15.4	
Extreme working poverty	Total	millions		22.4	15.8	
Moderate working poverty	Total	millions		20.7	18.6	

Eastern Asia

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	52.2	50.6	49.1	47.8	46.9	46.0	45.5	45.2	44.9	44.5
	54.0	52.3	50.7	49.3	48.3	47.4	46.8	46.5	46.1	45.7
	50.1	48.8	47.4	46.2	45.2	44.5	44.0	43.8	43.5	43.1
	125.9	117.0	108.8	102.2	97.1	93.3	90.7	89.1	87.3	85.7
	68.1	63.4	59.0	55.5	52.9	50.8	49.4	48.5	47.6	46.8
	57.7	53.6	49.8	46.6	44.2	42.5	41.3	40.5	39.7	38.9
	46.9	45.5	44.1	42.9	42.0	41.4	41.1	40.8	40.4	40.0
	48.1	46.5	45.0	43.7	42.9	42.2	41.8	41.5	41.1	40.6
	45.7	44.4	43.0	41.9	41.1	40.5	40.2	40.0	39.6	39.3
	113.2	105.1	97.6	91.5	87.1	83.8	81.9	80.3	78.6	77.0
	60.7	56.4	52.4	49.2	46.9	45.2	44.2	43.3	42.4	41.6
	52.6	48.8	45.2	42.3	40.2	38.6	37.7	37.0	36.2	35.4
	10.0	10.2	10.3	10.4	10.3	10.1	9.7	9.8	10.0	10.2
	11.0	11.1	11.3	11.4	11.2	11.0	10.6	10.8	11.0	11.1
	8.9	9.0	9.2	9.3	9.2	9.0	8.6	8.7	8.9	9.0
	12.6	11.9	11.2	10.7	10.0	9.4	8.8	8.7	8.8	8.7
	7.5	7.1	6.7	6.3	5.9	5.6	5.2	5.2	5.2	5.2
	5.1	4.8	4.6	4.3	4.1	3.8	3.6	3.5	3.5	3.5
	14.5	14.9	15.2	15.5	15.4	15.3	14.9	15.1	15.3	15.5
	15.5	15.9	16.3	16.6	16.5	16.3	15.9	16.1	16.4	16.6
	13.3	13.6	13.9	14.2	14.2	14.1	13.7	13.8	14.0	14.2
	6.6	6.4	6.3	6.1	5.9	5.7	5.6	5.5	5.5	5.4
	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.1	3.1
	2.9	2.8	2.8	2.7	2.6	2.5	2.4	2.4	2.4	2.3
	17.8	17.7	17.3	17.0	16.5	16.6	16.6	16.7	16.9	17.0
	13.2	13.2	12.8	12.6	12.1	12.1	12.1	12.2	12.3	12.5
	22.8	22.7	22.3	22.0	21.5	21.7	21.8	21.9	22.1	22.2
	42.9	40.9	38.4	36.3	34.3	33.7	33.2	33.0	32.9	32.8
	16.6	16.0	15.0	14.1	13.2	13.0	12.7	12.7	12.7	12.8
	26.2	25.0	23.4	22.2	21.0	20.7	20.5	20.3	20.2	20.1
	11.0	3.7	2.9	1.9	1.7	1.6	1.5	1.4	1.3	1.3
	14.0	11.8	9.6	7.8	7.1	6.5	6.0	5.6	5.2	4.9
	12.5	3.9	2.8	1.8	1.5	1.4	1.2	1.1	1.0	1.0
	15.8	12.4	9.4	7.2	6.2	5.5	4.9	4.5	4.1	3.8

South-Eastern Asia and the Pacific

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	56.3	51.3	51.3	
Labour force participation rate	Male	per cent	62.4	58.4	58.6	
Labour force participation rate	Female	per cent	50.0	44.1	43.8	
Labour force	Total	millions	61.0	58.1	58.3	
Labour force	Male	millions	34.2	33.5	33.8	
Labour force	Female	millions	26.7	24.6	24.5	
Employment-to-population ratio	Total	per cent	50.3	46.4	46.2	
Employment-to-population ratio	Male	per cent	55.7	52.9	52.9	
Employment-to-population ratio	Female	per cent	44.7	39.7	39.2	
Employment	Total	millions	54.5	52.5	52.5	
Employment	Male	millions	30.6	30.3	30.5	
Employment	Female	millions	23.9	22.2	22.0	
Unemployment rate	Total	per cent	10.6	9.6	10.0	
Unemployment rate	Male	per cent	10.8	9.4	9.7	
Unemployment rate	Female	per cent	10.5	9.9	10.5	
Unemployment	Total	millions	6.5	5.6	5.8	
Unemployment	Male	millions	3.7	3.1	3.3	
Unemployment	Female	millions	2.8	2.4	2.6	
Combined rate of unemployment and potential labour force	Total	per cent		16.7	17.1	
Combined rate of unemployment and potential labour force	Male	per cent		15.0	15.3	
Combined rate of unemployment and potential labour force	Female	per cent		18.9	19.5	
Potential labour force	Total	millions		5.0	5.0	
Potential labour force	Male	millions		2.2	2.2	
Potential labour force	Female	millions		2.7	2.8	
Rate of NEET	Total	per cent		19.6	19.2	
Rate of NEET	Male	per cent		13.9	13.5	
Rate of NEET	Female	per cent		25.4	25.1	
NEET	Total	millions		22.1	21.8	
NEET	Male	millions		8.0	7.8	
NEET	Female	millions		14.2	14.1	
Extreme working poverty rate	Total	per cent		12.2	11.1	
Moderate working poverty rate	Total	per cent		23.6	23.0	
Extreme working poverty	Total	millions		6.4	5.8	
Moderate working poverty	Total	millions		12.4	12.1	

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	51.1	50.6	50.0	49.3	48.4	48.1	47.6	47.4	47.2	47.0
	58.5	58.1	57.3	56.3	55.5	55.2	54.7	54.5	54.3	54.1
	43.5	42.7	42.4	41.9	40.9	40.6	40.2	39.9	39.7	39.5
	58.4	58.1	57.8	57.2	56.2	55.8	55.3	55.0	54.6	54.4
	34.0	34.0	33.8	33.3	33.0	32.8	32.5	32.4	32.2	32.1
	24.5	24.1	24.1	23.8	23.3	23.1	22.8	22.6	22.4	22.3
	46.4	45.8	45.2	44.3	43.7	43.3	42.8	42.4	42.1	41.8
	53.2	52.7	52.0	50.7	50.1	49.7	49.2	48.9	48.5	48.3
	39.3	38.6	38.3	37.7	36.9	36.5	36.0	35.6	35.2	35.0
	53.0	52.6	52.3	51.4	50.7	50.3	49.6	49.2	48.7	48.4
	30.9	30.9	30.6	30.0	29.8	29.5	29.2	29.0	28.8	28.7
	22.1	21.8	21.7	21.4	21.0	20.7	20.4	20.1	19.9	19.7
	9.2	9.4	9.5	10.1	9.8	10.0	10.2	10.5	10.9	11.0
	9.0	9.2	9.3	10.0	9.7	9.9	10.1	10.3	10.6	10.7
	9.6	9.8	9.8	10.1	9.9	10.1	10.4	10.8	11.2	11.5
	5.4	5.5	5.5	5.8	5.5	5.6	5.7	5.8	5.9	6.0
	3.1	3.1	3.1	3.3	3.2	3.2	3.3	3.3	3.4	3.4
	2.3	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.5	2.6
	16.2	16.6	16.7	17.1	17.4	17.1	17.4	17.8	18.2	18.5
	14.6	15.0	15.1	15.7	15.7	15.8	16.1	16.3	16.6	16.8
	18.4	18.8	18.8	19.1	19.6	18.9	19.3	19.9	20.4	20.8
	4.9	5.0	5.0	4.9	5.1	4.8	4.8	4.9	4.9	5.0
	2.2	2.3	2.3	2.2	2.3	2.3	2.3	2.3	2.3	2.3
	2.6	2.7	2.7	2.6	2.8	2.5	2.5	2.6	2.6	2.6
	18.5	18.8	18.4	18.5	18.3	18.0	17.9	18.2	18.4	18.5
	12.7	13.2	13.1	13.6	13.2	12.9	13.1	13.3	13.5	13.6
	24.5	24.6	24.0	23.7	23.7	23.2	22.9	23.3	23.6	23.7
	21.2	21.6	21.3	21.5	21.3	20.9	20.8	21.1	21.3	21.5
	7.4	7.7	7.7	8.0	7.8	7.7	7.8	7.9	8.0	8.1
	13.8	13.9	13.6	13.5	13.5	13.2	13.0	13.2	13.3	13.4
	9.8	8.7	7.7	6.8	6.0	5.2	4.5	3.9	3.5	3.0
	22.7	22.1	21.1	19.1	17.7	16.0	14.6	13.5	12.5	11.5
	5.2	4.6	4.0	3.5	3.0	2.6	2.2	1.9	1.7	1.5
	12.1	11.6	11.0	9.8	9.0	8.0	7.3	6.6	6.1	5.6

Southern Asia

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	44.6	37.9	36.6	
Labour force participation rate	Male	per cent	64.9	55.6	54.0	
Labour force participation rate	Female	per cent	22.7	18.7	17.7	
Labour force	Total	millions	128.4	125.8	122.3	
Labour force	Male	millions	97.0	96.2	94.1	
Labour force	Female	millions	31.4	29.6	28.3	
Employment-to-population ratio	Total	per cent	37.8	31.8	30.6	
Employment-to-population ratio	Male	per cent	55.0	46.6	45.0	
Employment-to-population ratio	Female	per cent	19.2	15.6	14.8	
Employment	Total	millions	108.7	105.4	102.1	
Employment	Male	millions	82.2	80.6	78.4	
Employment	Female	millions	26.6	24.8	23.7	
Unemployment rate	Total	per cent	15.4	16.2	16.5	
Unemployment rate	Male	per cent	15.3	16.2	16.6	
Unemployment rate	Female	per cent	15.5	16.3	16.2	
Unemployment	Total	millions	19.7	20.4	20.2	
Unemployment	Male	millions	14.8	15.6	15.6	
Unemployment	Female	millions	4.9	4.8	4.6	
Combined rate of unemployment and potential labour force	Total	per cent		19.9	20.5	
Combined rate of unemployment and potential labour force	Male	per cent		19.2	19.9	
Combined rate of unemployment and potential labour force	Female	per cent		22.1	22.2	
Potential labour force	Total	millions		5.7	6.1	
Potential labour force	Male	millions		3.5	3.9	
Potential labour force	Female	millions		2.2	2.2	
Rate of NEET	Total	per cent		28.9	28.6	
Rate of NEET	Male	per cent		9.5	9.4	
Rate of NEET	Female	per cent		50.1	49.6	
NEET	Total	millions		95.8	95.5	
NEET	Male	millions		16.4	16.3	
NEET	Female	millions		79.4	79.2	
Extreme working poverty rate	Total	per cent		25.4	22.2	
Moderate working poverty rate	Total	per cent		39.9	39.7	
Extreme working poverty	Total	millions		26.8	22.6	
Moderate working poverty	Total	millions		42.0	40.6	

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	35.5	34.8	34.0	33.4	32.8	32.4	31.8	31.6	31.4	31.2
	52.6	51.7	50.5	49.7	48.9	48.4	47.7	47.4	47.2	46.9
	16.9	16.3	15.8	15.5	15.1	14.8	14.3	14.2	14.1	13.9
	119.4	117.7	115.5	114.3	112.9	112.3	110.8	110.7	110.5	110.1
	92.3	91.4	89.9	88.9	88.2	87.8	87.0	87.0	86.9	86.7
	27.1	26.3	25.7	25.3	24.7	24.5	23.8	23.7	23.5	23.4
	29.5	28.7	28.0	27.4	26.8	26.5	26.0	25.7	25.5	25.3
	43.5	42.5	41.6	40.8	40.0	39.6	39.0	38.5	38.2	38.0
	14.1	13.5	13.1	12.7	12.3	12.1	11.7	11.6	11.5	11.4
	99.0	97.0	95.4	93.7	92.3	91.7	90.5	90.0	89.7	89.3
	76.3	75.1	74.0	73.0	72.1	71.8	71.1	70.7	70.5	70.3
	22.6	21.9	21.3	20.8	20.2	20.0	19.4	19.3	19.2	19.1
	17.1	17.6	17.5	18.0	18.2	18.3	18.3	18.7	18.8	18.9
	17.3	17.8	17.6	17.9	18.2	18.3	18.3	18.7	18.9	19.0
	16.5	17.0	17.0	18.0	18.3	18.5	18.3	18.4	18.5	18.6
	20.4	20.8	20.2	20.5	20.6	20.6	20.3	20.7	20.8	20.8
	16.0	16.3	15.8	15.9	16.0	16.1	16.0	16.3	16.4	16.5
	4.5	4.5	4.4	4.6	4.5	4.5	4.3	4.4	4.3	4.4
	21.0	21.4	21.5	21.9	22.4	22.7	23.0	23.4	23.5	23.6
	20.7	21.0	21.1	21.4	21.9	22.1	22.5	23.0	23.1	23.2
	22.3	22.6	22.8	23.4	24.0	24.6	24.7	24.8	24.9	25.0
	6.0	5.6	5.9	5.7	6.1	6.3	6.7	6.8	6.8	6.8
	3.9	3.7	4.0	4.0	4.2	4.4	4.7	4.8	4.8	4.8
	2.0	1.9	2.0	1.8	1.9	2.0	2.0	2.0	2.0	2.0
	28.5	29.2	29.0	29.3	29.2	29.6	30.1	30.5	30.7	30.9
	9.5	10.5	10.8	11.4	11.9	12.7	13.5	14.0	14.3	14.5
	49.4	49.6	49.0	48.9	48.2	48.3	48.4	48.8	48.8	48.9
	95.9	98.7	98.8	100.2	100.5	102.7	104.9	106.9	107.9	108.9
	16.6	18.6	19.2	20.4	21.4	23.0	24.6	25.7	26.3	26.8
	79.3	80.1	79.6	79.8	79.2	79.7	80.3	81.2	81.6	82.1
	19.4	18.2	17.2	16.1	15.1	13.9	12.9	12.0	11.1	10.3
	39.3	38.5	37.8	37.0	36.2	35.3	34.4	33.5	32.6	31.7
	19.2	17.7	16.4	15.1	14.0	12.8	11.7	10.8	9.9	9.2
	38.9	37.4	36.0	34.7	33.4	32.4	31.1	30.2	29.3	28.3

Northern, Southern and Western Europe

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	48.0	45.7	45.3	
Labour force participation rate	Male	per cent	51.6	48.6	48.0	
Labour force participation rate	Female	per cent	44.2	42.7	42.5	
Labour force	Total	millions	25.4	23.9	23.5	
Labour force	Male	millions	13.9	13.0	12.7	
Labour force	Female	millions	11.5	10.9	10.8	
Employment-to-population ratio	Total	per cent	39.9	36.1	35.6	
Employment-to-population ratio	Male	per cent	43.3	37.9	37.3	
Employment-to-population ratio	Female	per cent	36.3	34.2	33.9	
Employment	Total	millions	21.1	18.9	18.5	
Employment	Male	millions	11.7	10.1	9.9	
Employment	Female	millions	9.4	8.7	8.6	
Unemployment rate	Total	per cent	16.9	21.0	21.3	
Unemployment rate	Male	per cent	16.1	22.0	22.2	
Unemployment rate	Female	per cent	17.8	19.9	20.3	
Unemployment	Total	millions	4.3	5.0	5.0	
Unemployment	Male	millions	2.2	2.9	2.8	
Unemployment	Female	millions	2.0	2.2	2.2	
Combined rate of unemployment and potential labour force	Total	per cent		28.9	29.3	
Combined rate of unemployment and potential labour force	Male	per cent		29.3	29.7	
Combined rate of unemployment and potential labour force	Female	per cent		28.4	28.9	
Potential labour force	Total	millions		2.6	2.7	
Potential labour force	Male	millions		1.3	1.4	
Potential labour force	Female	millions		1.3	1.3	
Rate of NEET	Total	per cent		13.1	13.1	
Rate of NEET	Male	per cent		12.9	12.9	
Rate of NEET	Female	per cent		13.3	13.4	
NEET	Total	millions		6.8	6.8	
NEET	Male	millions		3.4	3.4	
NEET	Female	millions		3.4	3.4	

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	44.9	44.5	43.9	43.9	43.9	43.9	44.0	43.8	43.6	43.3
	47.6	46.8	46.2	46.1	46.0	45.9	46.3	46.1	45.8	45.5
	42.2	42.0	41.4	41.6	41.8	41.7	41.5	41.4	41.2	41.1
	23.1	22.7	22.2	22.1	22.0	21.8	21.8	21.6	21.4	21.3
	12.5	12.2	12.0	11.9	11.8	11.7	11.8	11.7	11.6	11.5
	10.6	10.5	10.3	10.2	10.2	10.1	10.0	9.9	9.9	9.8
	34.6	34.1	34.2	34.9	35.6	36.3	37.1	37.3	37.1	36.8
	36.2	35.5	35.5	36.2	36.8	37.6	38.7	38.8	38.7	38.2
	33.1	32.7	32.8	33.5	34.3	34.9	35.3	35.7	35.5	35.2
	17.8	17.4	17.3	17.6	17.8	18.1	18.4	18.4	18.3	18.0
	9.5	9.3	9.2	9.3	9.4	9.6	9.8	9.8	9.8	9.6
	8.3	8.2	8.1	8.2	8.4	8.5	8.5	8.6	8.5	8.4
	22.9	23.2	22.1	20.5	19.1	17.3	15.7	14.8	14.8	15.1
	24.0	24.2	23.1	21.5	20.1	18.2	16.5	15.8	15.6	15.9
	21.6	22.1	20.9	19.4	17.9	16.3	14.8	13.8	13.9	14.2
	5.3	5.3	4.9	4.5	4.2	3.8	3.4	3.2	3.2	3.2
	3.0	3.0	2.8	2.6	2.4	2.1	1.9	1.8	1.8	1.8
	2.3	2.3	2.1	2.0	1.8	1.6	1.5	1.4	1.4	1.4
	31.0	31.3	30.5	28.8	27.5	25.5	23.6	22.6	22.6	22.9
	31.6	31.9	31.1	29.4	28.3	26.2	24.1	23.2	23.1	23.4
	30.3	30.6	29.7	28.2	26.7	24.7	23.1	21.8	22.0	22.4
	2.7	2.7	2.7	2.6	2.6	2.4	2.2	2.2	2.1	2.2
	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.1
	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0
	13.3	13.0	12.6	12.2	11.7	11.2	10.8	10.5	10.6	10.8
	13.3	13.0	12.6	12.1	11.7	11.3	10.7	10.3	10.3	10.6
	13.4	13.1	12.6	12.2	11.7	11.1	10.8	10.7	10.8	11.0
	6.9	6.7	6.4	6.1	5.9	5.6	5.3	5.2	5.2	5.3
	3.5	3.4	3.3	3.1	3.0	2.9	2.7	2.6	2.6	2.7
	3.4	3.3	3.1	3.0	2.9	2.7	2.6	2.6	2.6	2.6

Eastern Europe

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	41.3	38.5	38.3	
Labour force participation rate	Male	per cent	44.9	42.9	42.8	
Labour force participation rate	Female	per cent	37.6	33.9	33.7	
Labour force	Total	millions	19.8	16.2	15.4	
Labour force	Male	millions	10.9	9.2	8.8	
Labour force	Female	millions	8.9	7.0	6.6	
Employment-to-population ratio	Total	per cent	32.1	31.4	31.5	
Employment-to-population ratio	Male	per cent	35.0	35.0	35.2	
Employment-to-population ratio	Female	per cent	29.0	27.6	27.6	
Employment	Total	millions	15.4	13.2	12.7	
Employment	Male	millions	8.5	7.5	7.2	
Employment	Female	millions	6.8	5.7	5.4	
Unemployment rate	Total	per cent	22.4	18.4	17.9	
Unemployment rate	Male	per cent	22.0	18.4	17.8	
Unemployment rate	Female	per cent	22.9	18.4	17.9	
Unemployment	Total	millions	4.4	3.0	2.8	
Unemployment	Male	millions	2.4	1.7	1.6	
Unemployment	Female	millions	2.0	1.3	1.2	
Combined rate of unemployment and potential labour force	Total	per cent		23.7	22.8	
Combined rate of unemployment and potential labour force	Male	per cent		23.2	22.4	
Combined rate of unemployment and potential labour force	Female	per cent		24.3	23.3	
Potential labour force	Total	millions		1.1	1.0	
Potential labour force	Male	millions		0.6	0.5	
Potential labour force	Female	millions		0.5	0.5	
Rate of NEET	Total	per cent		14.3	13.7	
Rate of NEET	Male	per cent		11.6	11.8	
Rate of NEET	Female	per cent		17.1	15.7	
NEET	Total	millions		6.0	5.5	
NEET	Male	millions		2.5	2.4	
NEET	Female	millions		3.5	3.1	

Eastern Europe

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	37.2	37.0	36.2	35.6	35.1	34.1	33.2	32.2	31.2	30.4
	41.7	41.4	40.8	39.9	39.5	38.2	37.0	35.9	34.8	33.9
	32.5	32.3	31.4	31.0	30.5	29.9	29.2	28.3	27.5	26.7
	14.2	13.3	12.3	11.5	10.8	10.1	9.6	9.1	8.7	8.5
	8.1	7.7	7.1	6.6	6.2	5.8	5.5	5.2	5.0	4.9
	6.1	5.7	5.2	4.9	4.6	4.3	4.1	3.9	3.8	3.7
	30.6	30.5	29.7	29.1	29.0	28.7	28.1	27.4	26.7	26.1
	34.3	34.2	33.6	32.8	32.7	32.2	31.5	30.6	29.9	29.2
	26.7	26.5	25.7	25.3	25.1	25.1	24.6	24.0	23.4	22.8
	11.7	11.0	10.1	9.4	8.9	8.5	8.1	7.7	7.5	7.3
	6.7	6.3	5.8	5.4	5.2	4.9	4.6	4.4	4.3	4.2
	5.0	4.7	4.3	4.0	3.8	3.6	3.5	3.3	3.2	3.1
	17.9	17.6	17.8	18.1	17.5	15.9	15.3	14.9	14.4	14.2
	17.7	17.4	17.7	17.8	17.3	15.8	14.8	14.6	14.1	13.9
	18.0	17.9	18.0	18.5	17.7	16.0	15.9	15.3	14.8	14.5
	2.5	2.3	2.2	2.1	1.9	1.6	1.5	1.4	1.3	1.2
	1.4	1.3	1.3	1.2	1.1	0.9	0.8	0.8	0.7	0.7
	1.1	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.5
	22.4	22.4	22.4	22.8	22.1	20.5	20.1	19.8	19.4	19.3
	22.0	21.8	22.0	22.2	21.6	20.0	19.2	19.1	18.7	18.6
	23.0	23.3	22.9	23.7	22.6	21.2	21.2	20.7	20.3	20.2
	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5
	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3
	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	13.3	13.5	13.9	13.4	13.4	13.0	13.6	14.2	14.8	15.4
	11.4	11.5	11.9	11.5	11.5	11.0	11.6	12.4	13.1	13.7
	15.3	15.6	16.0	15.3	15.4	15.2	15.7	16.0	16.5	17.0
	5.1	4.9	4.7	4.3	4.1	3.9	3.9	4.0	4.1	4.3
	2.2	2.1	2.1	1.9	1.8	1.7	1.7	1.8	1.9	2.0
	2.8	2.7	2.7	2.4	2.3	2.2	2.2	2.2	2.3	2.3

Central and Western Asia

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	44.1	40.9	41.2	
Labour force participation rate	Male	per cent	54.4	50.3	50.7	
Labour force participation rate	Female	per cent	33.7	31.2	31.4	
Labour force	Total	millions	11.9	12.4	12.4	
Labour force	Male	millions	7.4	7.7	7.7	
Labour force	Female	millions	4.5	4.7	4.7	
Employment-to-population ratio	Total	per cent	36.5	34.7	35.5	
Employment-to-population ratio	Male	per cent	45.2	42.7	43.9	
Employment-to-population ratio	Female	per cent	27.7	26.4	26.8	
Employment	Total	millions	9.8	10.5	10.7	
Employment	Male	millions	6.1	6.5	6.7	
Employment	Female	millions	3.7	4.0	4.0	
Unemployment rate	Total	per cent	17.3	15.3	13.9	
Unemployment rate	Male	per cent	16.9	15.1	13.3	
Unemployment rate	Female	per cent	17.8	15.5	14.7	
Unemployment	Total	millions	2.1	1.9	1.7	
Unemployment	Male	millions	1.3	1.2	1.0	
Unemployment	Female	millions	0.8	0.7	0.7	
Combined rate of unemployment and potential labour force	Total	per cent		22.9	21.0	
Combined rate of unemployment and potential labour force	Male	per cent		21.6	19.2	
Combined rate of unemployment and potential labour force	Female	per cent		25.0	23.9	
Potential labour force	Total	millions		1.2	1.1	
Potential labour force	Male	millions		0.6	0.6	
Potential labour force	Female	millions		0.6	0.6	
Rate of NEET	Total	per cent		24.5	23.4	
Rate of NEET	Male	per cent		17.4	16.2	
Rate of NEET	Female	per cent		31.8	30.7	
NEET	Total	millions		7.4	7.1	
NEET	Male	millions		2.7	2.5	
NEET	Female	millions		4.8	4.6	
Extreme working poverty rate	Total	per cent		10.5	9.6	
Moderate working poverty rate	Total	per cent		11.3	11.0	
Extreme working poverty	Total	millions		1.1	1.0	
Moderate working poverty	Total	millions		1.2	1.2	

Central and Western Asia

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	40.5	41.2	42.2	42.9	42.9	43.0	43.2	43.0	42.8	42.5
	49.9	50.7	52.1	52.3	52.2	52.5	52.8	52.6	52.4	52.0
	30.8	31.5	32.1	33.2	33.2	33.2	33.2	33.0	32.7	32.5
	12.2	12.3	12.5	12.6	12.5	12.4	12.4	12.2	12.1	12.0
	7.6	7.7	7.8	7.8	7.7	7.7	7.7	7.7	7.6	7.5
	4.6	4.6	4.7	4.8	4.7	4.7	4.6	4.6	4.5	4.5
	35.1	35.6	36.2	36.7	36.5	36.3	36.5	35.4	35.3	35.0
	43.6	44.0	44.9	45.2	44.9	45.0	45.3	43.9	43.6	43.2
	26.4	26.9	27.2	27.9	27.6	27.2	27.2	26.5	26.5	26.4
	10.5	10.6	10.7	10.8	10.6	10.5	10.4	10.1	10.0	9.9
	6.6	6.7	6.8	6.8	6.7	6.6	6.6	6.4	6.3	6.3
	3.9	3.9	4.0	4.0	3.9	3.8	3.8	3.7	3.7	3.6
	13.3	13.7	14.2	14.5	15.0	15.7	15.6	17.8	17.5	17.7
	12.7	13.1	13.7	13.5	13.9	14.3	14.2	16.6	16.6	17.0
	14.3	14.7	15.1	16.1	16.8	18.1	17.9	19.7	19.0	18.9
	1.6	1.7	1.8	1.8	1.9	1.9	1.9	2.2	2.1	2.1
	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.3	1.3	1.3
	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.8
	20.7	20.9	21.4	21.5	22.1	22.3	21.9	24.1	23.9	24.1
	19.0	19.0	19.3	19.1	19.7	19.5	19.1	21.5	21.6	22.0
	23.5	23.9	24.7	25.1	25.8	26.9	26.3	28.1	27.5	27.4
	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5
	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
	23.0	21.6	21.2	20.7	20.7	21.0	21.2	22.2	22.0	22.1
	16.2	15.2	14.8	14.5	14.6	14.7	15.3	16.7	16.4	16.5
	29.9	28.2	27.8	27.2	27.2	27.5	27.5	27.9	27.8	27.9
	6.9	6.4	6.3	6.1	6.0	6.0	6.1	6.3	6.2	6.3
	2.5	2.3	2.2	2.2	2.2	2.2	2.2	2.4	2.4	2.4
	4.4	4.1	4.0	3.9	3.9	3.9	3.8	3.9	3.8	3.9
	9.1	8.4	7.6	7.0	6.5	6.1	5.6	5.3	4.9	4.6
	10.5	10.3	9.5	9.2	8.7	8.2	7.8	7.6	7.1	6.7
	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5
	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7

Central and Western Asia

Indicator	Demographic group (Youth)	Unit	2000	2010	2011	
Labour force participation rate	Total	per cent	44.1	40.9	41.2	
Labour force participation rate	Male	per cent	54.4	50.3	50.7	
Labour force participation rate	Female	per cent	33.7	31.2	31.4	
Labour force	Total	millions	11.9	12.4	12.4	
Labour force	Male	millions	7.4	7.7	7.7	
Labour force	Female	millions	4.5	4.7	4.7	
Employment-to-population ratio	Total	per cent	36.5	34.7	35.5	
Employment-to-population ratio	Male	per cent	45.2	42.7	43.9	
Employment-to-population ratio	Female	per cent	27.7	26.4	26.8	
Employment	Total	millions	9.8	10.5	10.7	
Employment	Male	millions	6.1	6.5	6.7	
Employment	Female	millions	3.7	4.0	4.0	
Unemployment rate	Total	per cent	17.3	15.3	13.9	
Unemployment rate	Male	per cent	16.9	15.1	13.3	
Unemployment rate	Female	per cent	17.8	15.5	14.7	
Unemployment	Total	millions	2.1	1.9	1.7	
Unemployment	Male	millions	1.3	1.2	1.0	
Unemployment	Female	millions	0.8	0.7	0.7	
Combined rate of unemployment and potential labour force	Total	per cent		22.9	21.0	
Combined rate of unemployment and potential labour force	Male	per cent		21.6	19.2	
Combined rate of unemployment and potential labour force	Female	per cent		25.0	23.9	
Potential labour force	Total	millions		1.2	1.1	
Potential labour force	Male	millions		0.6	0.6	
Potential labour force	Female	millions		0.6	0.6	
Rate of NEET	Total	per cent		24.5	23.4	
Rate of NEET	Male	per cent		17.4	16.2	
Rate of NEET	Female	per cent		31.8	30.7	
NEET	Total	millions		7.4	7.1	
NEET	Male	millions		2.7	2.5	
NEET	Female	millions		4.8	4.6	
Extreme working poverty rate	Total	per cent		10.5	9.6	
Moderate working poverty rate	Total	per cent		11.3	11.0	
Extreme working poverty	Total	millions		1.1	1.0	
Moderate working poverty	Total	millions		1.2	1.2	

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	40.5	41.2	42.2	42.9	42.9	43.0	43.2	43.0	42.8	42.5
	49.9	50.7	52.1	52.3	52.2	52.5	52.8	52.6	52.4	52.0
	30.8	31.5	32.1	33.2	33.2	33.2	33.2	33.0	32.7	32.5
	12.2	12.3	12.5	12.6	12.5	12.4	12.4	12.2	12.1	12.0
	7.6	7.7	7.8	7.8	7.7	7.7	7.7	7.7	7.6	7.5
	4.6	4.6	4.7	4.8	4.7	4.7	4.6	4.6	4.5	4.5
	35.1	35.6	36.2	36.7	36.5	36.3	36.5	35.4	35.3	35.0
	43.6	44.0	44.9	45.2	44.9	45.0	45.3	43.9	43.6	43.2
	26.4	26.9	27.2	27.9	27.6	27.2	27.2	26.5	26.5	26.4
	10.5	10.6	10.7	10.8	10.6	10.5	10.4	10.1	10.0	9.9
	6.6	6.7	6.8	6.8	6.7	6.6	6.6	6.4	6.3	6.3
	3.9	3.9	4.0	4.0	3.9	3.8	3.8	3.7	3.7	3.6
	13.3	13.7	14.2	14.5	15.0	15.7	15.6	17.8	17.5	17.7
	12.7	13.1	13.7	13.5	13.9	14.3	14.2	16.6	16.6	17.0
	14.3	14.7	15.1	16.1	16.8	18.1	17.9	19.7	19.0	18.9
	1.6	1.7	1.8	1.8	1.9	1.9	1.9	2.2	2.1	2.1
	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.3	1.3	1.3
	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.8
	20.7	20.9	21.4	21.5	22.1	22.3	21.9	24.1	23.9	24.1
	19.0	19.0	19.3	19.1	19.7	19.5	19.1	21.5	21.6	22.0
	23.5	23.9	24.7	25.1	25.8	26.9	26.3	28.1	27.5	27.4
	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5
	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
	23.0	21.6	21.2	20.7	20.7	21.0	21.2	22.2	22.0	22.1
	16.2	15.2	14.8	14.5	14.6	14.7	15.3	16.7	16.4	16.5
	29.9	28.2	27.8	27.2	27.2	27.5	27.5	27.9	27.8	27.9
	6.9	6.4	6.3	6.1	6.0	6.0	6.1	6.3	6.2	6.3
	2.5	2.3	2.2	2.2	2.2	2.2	2.2	2.4	2.4	2.4
	4.4	4.1	4.0	3.9	3.9	3.9	3.8	3.9	3.8	3.9
	9.1	8.4	7.6	7.0	6.5	6.1	5.6	5.3	4.9	4.6
	10.5	10.3	9.5	9.2	8.7	8.2	7.8	7.6	7.1	6.7
	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5
	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7

▶ Appendix D. Methodology used to estimate the risk of automation of jobs

The methodology used in this report to measure the risk of automation of jobs has been borrowed from Nedelkoska and Quintini (2018)[1] who, in turn, closely follow the approach proposed by Frey and Osborne (2017).[2] Using data from the survey conducted by the OECD under the Programme for the International Assessment of Adult Competencies (PIAAC), Nedelkoska and Quintini (2018) model the risk of automation as a function of three types of "engineering bottleneck" (i.e. tasks that cannot be easily automated: social intelligence, creative intelligence, and perception and manipulation). These bottlenecks are captured by the PIAAC variables listed in table D1.

Table D1

Variables in PIAAC survey corresponding to engineering bottlenecks identified in Frey and Osborne (2017)

Engineering bottleneck	Variable in PIAAC survey	Variable code	Variable description
Tasks related to perception and manipulation	Fingers, hands (dexterity)	F_Q06C	How often do you carry out tasks requiring skill or accuracy with your hands or fingers?
Tasks related to creative intelligence	Problem-solving, simple	F_Q05A	How often do you have to tackle relatively simple problems that take no more than 5 minutes to find a good solution?
	Problem-solving, complex	F_Q05B	How often do you have to tackle relatively complex problems that take at least 30 minutes to find a good solution?
Tasks related to social intelligence	Teaching	F_Q02B	How often do you instruct, train or teach others (individually or in groups)?
	Advise	F_Q02E	How often do you advise others?
	Plan for others	F_Q03B	How often do you plan the activities of others?
	Communication	F_Q02A	How often do you share work-related information with co-workers?
	Negotiate	F_Q04B	How often do you negotiate with people either inside or outside your firm or organization?
	Influence	Q04A	How often do you have to try to persuade or influence others?
	Sell	F_Q02D	How often do you sell a product or a service?

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[1] Nedelkoska, L.; Quintini, G. 2018. *Automation, skills use and training*, OECD Social, Employment and Migration Working Papers No. 202 (Paris, OECD).

[2] Frey, C.B.; Osborne, M.A. 2017. "The future of employment: How susceptible are jobs to computerisation?", in *Technological Forecasting and Social Change*, Vol. 114, pp. 254–280.

To model the risk of automation as a function of these engineering bottlenecks, they fit a logistic function:

$$P_{auto} = \frac{1}{1 + e^{-(\alpha + \beta X)}},$$

where X is a matrix of the 10 variables listed earlier and their values. The subsample for Canada is used to fit the model, as it is the largest one in the PIAAC database. The model results in the following coefficient estimates (table D2).

Table D2

Modelling automatability as a function of engineering bottlenecks – coefficient estimates

	Beta	Standard error
Fingers, hands (dexterity)	0.105***	(0.0220)
Problem-solving, simple	0.0573*	(0.0309)
Problem-solving, complex	–0.0691**	(0.0297)
Teaching	– 0.0691***	(0.0255)
Plan for others	–0.308***	(0.0234)
Influence	– 0.235***	(0.0267)
Negotiate	0.0463*	(0.0255)
Sell	0.160***	(0.0206)
Advise	– 0.199***	(0.0270)
Communication	0.214***	(0.0260)
Constant	0.363**	(0.152)
Observations	4 656	
Pseudo R-squared	0.137	
Log likelihood	– 2 769	
Area under ROC curve	0.743	
AIC	1.194	
BIC	–33 693.5	

Note: Robust standard errors are given in brackets. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The sample includes only observations for 71 occupations in Canada.

Source: Nedelkoska and Quintini, 2018.

For this report, the PIAAC Public Use File is used, which differs from the PIAAC internal use file underlying the analysis in Nedelkoska and Quintini (2018).[3] The PIAAC Public Use File has more limited information on the occupational classification used in several countries; however, it offers comprehensive information on the responses to the skills- and job task-related questions in the survey. We used this information in combination with the logistic regression coefficients from table D2 to estimate the risk of automation at individual level in all 31 surveyed countries.

Assigning values for the risk of automation in the STEP data

Unlike the PIAAC Public Use File, the World Bank's STEP ("Skills Toward Employment and Productivity") Skills Measurement Household Survey[4] does not allow for a direct estimate of the job-specific probability of automation. Hence, the average probability of automation for each unique occupation–age–educational attainment combination in the PIAAC PUF are first calculated, and then these averages at the occupation–age–educational attainment level are matched to the STEP. The occupational groups used for calculating the averages are three-digit groups from the International Standard Classification of Occupations 2008 (ISCO-08), except for Ukraine, for which we have only two-digit ISCO codes. There are five age groups (15–24 years, 25–34 years, 35–44 years, 45–54 years and 55–64 years) and three educational attainment groups (low, medium and high).

As jobs in more developed economies typically involve more complex tasks within the same occupation–age–educational attainment groups (Nedelkoska and Quintini, 2018),[5] the highest-performing OECD economies are excluded when calculating the group averages for countries that participated in the STEP Skills Measurement Household Survey. Averages were thus obtained for the following countries: Chile, Cyprus, Czechia, Greece, Israel, Italy, Lithuania, Poland, Russian Federation, Slovakia, Slovenia, Spain and Turkey.

The PIAAC Public Use File data analysed were from the following 31 countries: Austria, Belgium, Canada, Chile, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Republic of Korea, Lithuania, Netherlands, New Zealand, Norway, Poland, Russian Federation, Singapore, Slovakia, Slovenia, Spain, Sweden, Turkey, United Kingdom and United States. The STEP data analysed were from the following 12 countries: Armenia, Plurinational State of Bolivia, China (Yunnan Province), Colombia, Georgia, Ghana, Kenya, Lao People's Democratic Republic, Sri Lanka, North Macedonia, Ukraine and Viet Nam. The PIAAC data were collected in 2012 and 2014, the STEP data in 2012 and 2013.

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[3] Nedelkoska and Quintini, op. cit.

[4] See Pierre, G.; Sanchez Puerta, M.L.; Valerio, A.; Rajadel, T. 2014. *STEP skills measurement surveys: Innovative tools for assessing skills* (English), Social Protection and Labor Discussion Paper No. 1421 (Washington, DC, World Bank).

[5] Nedelkoska and Quintini, op. cit.

▶ Appendix E. Labour Force Micro Database

Data sources

This database harmonizes a number of variables at two points in time using 130 micro data sets from the household and labour force surveys of 65 countries, covering approximately 85 per cent of the current world labour force. The idea behind having two points of data is to shed light on the employment-related changes that have occurred since the outset of the financial crisis. The selection of countries tried to achieve a balance between data availability, regional diversity and the size of the countries' labour force. The years chosen are 2006 and 2016, but sometimes, due to data availability constraints, years close to the preceding ones had to be used; details on the exact year and source are provided in table E1.

Table E1

Data sources and sample sizes

Country	Years	Source	Survey name	Sample
China	2002	China Institute for Income Distribution	Chinese Household Income Project (CHIP)	63,928
	2013			61.162
India	2005	ILO microdata repository	Employment and Unemployment -(NSSO 61)	602,837
	2018	Ministry of Statistics and Programme Implementation (MOSPI)	Periodic Labour Force Survey	433,339
United States	2006	US Bureau of Labor Statistics	Current Population Survey (CPS)	208,562
	2016			185,487
Indonesia	2005	ILO microdata repository	National Labour Force Survey (SAKERNAS)	202,633
	2015			133,916
Brazil	2005	Brazilian Institute of Geography and Statistics	National Household Sample Survey (PNAD)	408,148
	2015			356,904
Bangladesh	2005	ILO microdata repository	Labour Force Survey (LFS)	188, 487
	2016			493,886
Russian Federation*	2007	University of North Carolina at Chapel Hill	Russia Longitudinal Monitoring Survey (RLMS)	10,337
	2017			12,441
Japan*	2002	JGSS Research Center at Osaka University of Commerce	Japanese General Social Survey (JGSS)	2,953
	2012			4,667
Pakistan	2006	ILO microdata repository	Labour Force Survey (LFS)	661,321
	2015			74, 978
Nigeria	2007	IPUMS	General Household Survey (GHS)	83,700
	2016	World Bank		26,176

Country	Years	Source	Survey name	Sample
Viet Nam	2007	ILO microdata repository	Labour Force Survey (LFS)	661,321
	2014			74, 978
Mexico	2007	National Institute of Geography and Statistics	National Survey of Occupation and Employment (ENOE)	416,382
	2017			384,313
Ethiopia	2004	Central Statistical Agency of Ethiopia	Household Income, Consumption and Expenditure Survey (HICE)	99,229
	2016	World Bank	Ethiopia Socio-economic Survey (ESS)	23,160
Germany	2005	DIW-Berlin	German Socio-Economic Panel (SOEP)	27,233
	2015			41,575
Philippines	2007	ILO microdata repository	Labour Force Survey (LFS)	202,256
	2017			179,525
Thailand	2007	ILO microdata repository	Labour Force Survey (LFS)	22, 897
	2015			219,433
Egypt	2006	Economic Research Forum	Labour Market Panel Survey	37,140
	2016		Labour Force Survey (LMS)	347 604
Congo, Democratic Rep. of the	2004	ILO Microdata Repository	1-2-3 survey	72,685
	2012			111,679
Turkey	2007	Turkish Statistical Institute	Household Labour Force Survey (HIA)	490,040
	2017			495,664
Republic of Korea	2006	Korean Statistics Department	Economically Active Population Survey (EAPS)	70,552
	2016			59,681
Tanzania, United Republic of	2006	ILO microdata repository	Labour Force Survey (LFS)	72,441
	2014			47,199
Colombia	2005	National Administrative Department of Statistics	Continuous Household Survey (CHS)	50,142
	2015		Great Integrated Household Survey (GEIH)	64,785
Canada	2007	Statistics Canada	Labour Force Survey (LFS)	102,655
	2017			102,986
South Africa	2003	DataFirst	Labour For ce Survey (LFS)	98,748
	2017		Labour Market Dynamics (LMD)	27, 876
Uganda	2002	IPUMS	Census	17,525
	2014	World Bank	National Panel Survey	90,783
Peru	2006	ILO Microdata Repository	National Household Survey (ENAHO)	90,783
	2016			134,235
Ghana	2006	ILO Microdata Repository	Living Standard Survey	36,500
	2015		Labour Force Survey	19,367

Country	Years	Source	Survey name	Sample
Mozambique	2007	IPUMS	Socio-Economic Survey	59,852
	2015	ILO Microdata Repository		50,995
Cambodia	2004	National Institute of Statistics	Socio-Economic Survey	59,852
	2014	ILO Microdata Repository		50,995
Chile	2006	Ministry of Social Development	Chile National Socioeconomic Characterization Survey (CASEN)	268,873
	2015			266,968
Côte d'Ivoire	2002	ILO Microdata Repository	Enquête Niveau de Vie des Ménages	57,905
	2016		Enquête Nationale sur la Situation de l'Emploi et le Secteur Informel	44,003
Angola	2005	Angola Institute of National Statistics	Welfare Basic Indicators Survey (QUIBB)	48,270
	2014		Census	495,981
Cameroon	2007	ILO Microdata Repository	Enquête Camerounaise Auprès des Ménages	51,837
	2017			38,961
Zambia	2008	ILO Microdata Repository	Labour Force Survey (LFS)	156,680
	2014			58,985
Ecuador	2005	ILO Microdata Repository	National Survey of Employment and Unemployment (ENEMDU)	77,050
	2015			112,821
Tunisia	2005	Institut National de la Statistique	National Survey on Household Budget (EBCNV)	56,946
	2014	Economic Research Forum (ERF)	Tunisia Labour Market Survey (LMS)	16,430
Jordan	2006	Economic Research Forum (ERF)	Labour Force Survey	212,608
	2016			214,598
Armenia	2008	ILO Microdata Repository	Labour Force Survey	7,043
	2016			26,658
26 countries	2005	EUROSTAT	Statistics on Income and Living Conditions (SILC)	520,217
	2015			518,344
Total (sum)	2005			7,232,088
	2015			7,162,926

* The data for both the Russian Federation and Japan come from labour force modules of social surveys. Their small sample sizes limited the report's use of these data sets for the analyses.

Fifty-two of the microdata sets come from the European Union Statistics on Income and Living Conditions (EU-SILC); for the purposes of this publication, we took the years 2005 and 2015 for the following countries (in alphabetical order): Austria, Belgium, Bulgaria, Cyprus, Czechia, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom; the years 2007 and 2015 for Romania and Bulgaria; and the years 2008 and 2014 for Switzerland. The responsibility for all conclusions drawn from the data lies entirely with the authors of this report.

Chapter 4 shows a number of measures for educational attainment, high-skilled occupations, returns to education and wage inequality for selected countries. The countries included in each of the graphs are the following: Africa is represented by 14 countries (Angola, Cameroon, Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Côte d'Ivoire, Mozambique, Nigeria, South Africa, United Republic of Tanzania, Tunisia, Uganda and Zambia), totalling 64 per cent of the region's labour force. Asia and the Pacific is represented by 11 countries (Bangladesh, Cambodia, China, India, Indonesia, Japan, Pakistan, Philippines, Republic of Korea, Thailand and Viet Nam), totalling 93 per cent of the region's labour force. Latin America and the Caribbean is represented by Brazil, Chile, Colombia, Ecuador, Guatemala, Mexico and Peru, totalling 75 per cent of its labour force. Eastern Europe and Central and Western Asia[1] are represented by Armenia, Bulgaria, Cyprus, Czechia, Hungary, Poland, Romania, Russian Federation, Slovakia and Turkey, covering 68 per cent of their labour force. Northern, Southern and Western Europe is represented by Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland and United Kingdom, totalling 94 per cent of the sub-region's labour force. Finally, Northern America is represented by Canada and the United States, covering 100 per cent of the region's labour force.

Variable definitions and harmonization process

Here is a brief explanation of the definition and harmonization process use to derive the variables from the labour force micro database used in this report; each variable explanation starts with a comment about the population for which the variable is defined (e.g. all individuals, all workers, and so on).

Age: All individuals. As no differences in how age is measured exist, the harmonization is trivial.

Gender: All individuals. Same as with age; all surveys provide the gender of the people interviewed (or household members if they did not respond themselves) and they all distinguish between male and female. The harmonization is trivial.

Education: All individuals. The data used in the report distinguish between those with finished tertiary education and the rest. Tertiary education includes both graduate and post-graduate studies.

Labour force status: All individuals. Labour force status subdivides the population into three mutually exclusive categories: the employed, the unemployed and the inactive. This variable comes from labour modules within the surveys; these modules are normally age-restricted and thus usually the variable is only defined for those older than 10, 12 or 15, as the case may be. Following the ILO standard definitions,[2] a person is defined as employed if the person worked at least one hour during the reference period (typically one week).[3] Likewise, the person is defined as unemployed if he/she was without work, willing to work and actively looking for a job during the reference period. The inactive are defined as the remainder of the population who are neither employed nor unemployed.

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[1] This regional grouping makes reference to two of the three subregions of the Europe and Central Asia ILO region, namely Eastern Europe and Central and Western Asia; the third subregion – Northern, Southern and Western Europe – is shown separately.

[2] See *Resolution concerning statistics of the economically active population, employment, unemployment and under-employment,* adopted by the Thirteenth International Conference of Labour Statisticians (October 1982), available at http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/normativeinstrument/wcms_087481.pdf

[3] This requirement was sometimes relaxed and national classifications were used whenever the one-hour criterion was not feasible.

Employment status: All workers. The variable employment status is divided into five categories following the standard international classification (ICSE):[4] employee, own-account worker, employer, cooperative member and contributing family worker. For the purposes of this report, given their small numbers among young workers, employers and members of cooperatives were added to own-account workers. On some occasions (generally in countries with a high share of rural population), the surveys did not always assign an employment status but instead offered the number of hours worked by the person in a variety of tasks like helping in a family business, working as a dependent employee or as self-employed; in these cases, the work intensity (number of hours worked) was used to assign a primary employment status.

For the purposes of this report, an additional breakdown was added to employment status to distinguish amongst different contractual forms of dependent wage employment. These are:

(a) **Permanent employee:**
Defined as an employee with a written contract and hired without limit of time.

(b) **Temporary employee:**
Defined as an employee with a written contract hired for a limited period of time.

(c) **Employee without written contract:**[5]
Defined as an employee without a written contract independent of the specified duration of the job.

Economic activity: All workers. Two variables are created, one uses two digits of ISIC rev.4 codes and is only available for a limited number of countries and years. The second one uses 11 broad categories (derived from ISIC rev. 4),[6] as follows:

A: Agriculture, forestry and fishing
B, C, D and E: Mining and quarrying, manufacturing, electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation services
F: Construction
G, I: Wholesale and retail trade, repair of motor vehicles and motorcycles, accommodation and food service activities
H, J: Transportation and storage, information and communication
K: Financial and insurance activities
L, M, and N: Real estate activities, professionals, scientific and technical activities, administrative and support service activities
O: Public administration and defence; compulsory social security
P: Education
Q: Human health and social work activities
R, S, T and U: Arts, entertainment and recreation, other service activities, activities of households as employers; undifferentiated goods, activities of extraterritorial organizations and bodies

Some of the surveys included in the Labour Force Micro Database do not classify economic activities using ISIC rev.4 codes; these surveys sometimes use an older version of the international standard industrial classification (ISIC rev.3 or rev.2) or their own

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[4] *Resolution concerning the International Classification of Status in Employment (ICSE)*, adopted by the Fifteenth International Conference of Labour Statisticians (January 1993), http://www.ilo.org wcmsp5/groups/public/---dgreports/---stat/documents/normativeinstrument/wcms_087562.pdf

[5] Where contractual information was not available, the (non-)payment of, or enrolment in, social security was used in its place. Hence, as noted in the text, employees without a written contract broadly correspond to informal wage workers.

[6] Classification available at: http://unstats.un.org/unsd/cr/registry/isic-4.asp.

classifications (like NAICS or its version in Spanish, SCIAN). Whenever NAICS, ISIC rev.3 or ISIC rev.2 were found, official conversion tables were used to convert the codes to ISIC rev.4. In other instances (a minority), a case−by−case judgement, based on the names' similarity between the classification at hand and the ISIC rev.4 codes, was employed.

Occupation: All workers. A variable called "skill" is created based on the ISCO-08[7] occupational groups and their four related skills levels, 1–4. The correspondence between ISCO-08 and the skills level is as follows:

> Skills level 4 (Professional): Major group 2 and sub-major group 11, 12 and 13
> Skills level 3 (Skilled): Major groups 3 and sub-major group 14
> Skills level 2 (Semi-skilled): Majors groups 4–8
> Skills level 1 (Low-skilled): Major group 9

For the purposes of the report, in some figures, we further collapse skills levels 3 and 4 into a single "high-skilled" category giving the following threefold division of skills levels:

> Skills level 3/4 (High-skilled): Major groups 1, 2 and 3
> Skills level 2 (Semi-skilled): Majors groups 4–8
> Skills level 1 (Low-skilled): Major group 9

Wages: All employees. All the calculations that involve wages (Gini coefficients, returns to education) use hourly wages in purchasing power parity US dollars ($PPP). The original variable, monthly wage, is divided by the usual number of monthly[8] hours worked. In addition, for the calculation of Gini coefficients, the logarithm of hourly wages after it being trimmed above (2.5 per cent) and below (2.5 per cent) is used.

On weighting

All estimates produced in this report with the preceding micro-data are expanded to the actual population size. The expansion factors (or survey weights) are provided by the original sources with the exception of China (both years) and Thailand (2007). In the case of China we use the urban/rural population to impute a weight to each observation. For each area (rural or urban), the weight of the ith person is defined as:

$$weight_i = \frac{sample\ size}{population\ size}$$

For Thailand, we use the Censuses of 2000 and 2010 to estimate the population living in the rural/urban areas of each of the five regions of the country in 2007;[9] subsequently, we follow the same procedure used for China.

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[7] See ILO: *International Standard Classification of Occupations, ISCO-08: Vol. 1, Structure, group definitions and correspondence tables* (Geneva, 2012), and/or http://www.ilo.org/public/english/bureau/stat/isco/index.htm.

[8] Generally, surveys provide the usual number of weekly hours worked. This figure is converted to monthly terms.

[9] The population of 2007 is calculated by interpolation using the average population growth rate of each rural/urban area of the five regions of Thailand between 2000 and 2010. Source: web.nso.go.th.

Appendix F. Meta-information on Burning Glass Technologies data

Burning Glass Technologies (BGT) is an employment analytics and labour market information company that developed a database of employment vacancies posted online by employers in more than 40,000 sources. The analysis in Chapter 3 is restricted to data available for 2012 and 2018 and includes only job postings with information on minimum work experience and skill requirements. Our resulting data set includes nearly 16 million employment vacancies across six countries. The countries, sample sizes and reference periods are summarized in the following table.

Job postings were classified as entry level if requiring up to two years' minimum experience, while non-entry level job postings are defined as those requiring more than two years of previous work experience. The analysis uses national occupational classifications and skills clusters provided by BGT.[1]

Country	Sample size	Reference period
Australia	128,246 137,467	Jan.–Dec. 2012 Jan.–Aug. 2018
New Zealand	5,398 32,684	Jan.–Dec. 2012 Jan.–Aug. 2018
Canada	128,246 137,467	Jan.–Dec. 2012 Jan.–Aug. 2018
Singapore	5,398 32,684	Jan.–Dec. 2012 Jan.–Aug. 2018
United Kingdom	128,246 137,467	Jan.–Dec. 2012 Jan.–Aug. 2018
United States	5,398 32,684	Jan.–Dec. 2012 Jan.–Aug. 2018

[1] Note that computer literacy was classified as a software skill for the analysis in Chapter 3.