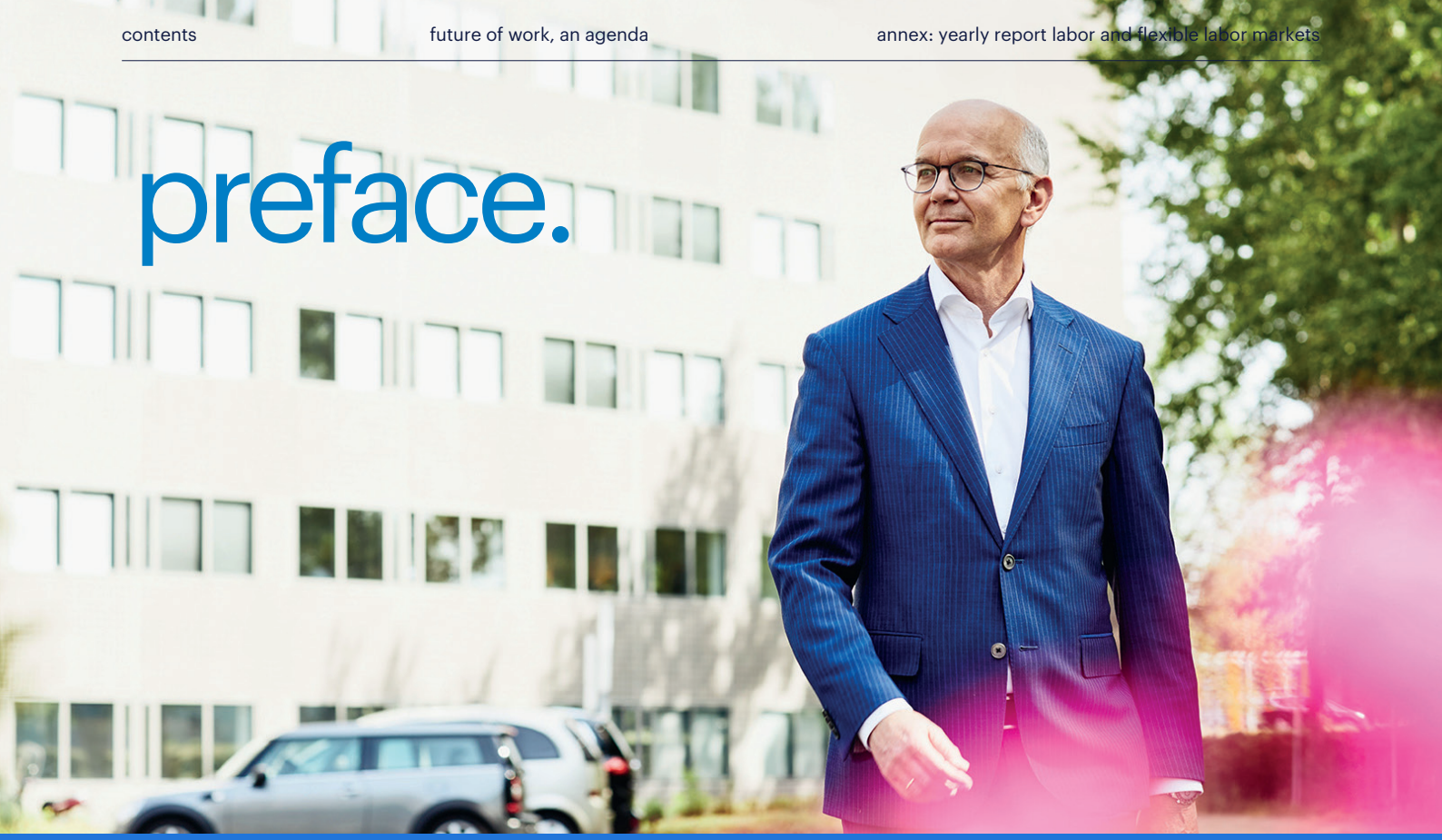

flexibility@work 2019
future of work
an agenda.
randstad

contents

preface.



Automation, globalization, and workforce ageing spark public debate and concern over the future of work. Society and its leaders are facing the challenge of how they can use these developments to foster economic growth, while at the same time ensuring decent work, fair pay and adequate social security.

The digital revolution has brought its own set of labour market impacts which, considering the speed of innovation in robotics, machine learning and Artificial Intelligence (AI), will continue into the future. These impacts are all getting a great deal of public attention as they propel fears of job losses – fears that, although understandable, are factually unfounded.

automation is job creation

As part of the Flexibility@Work series, in our 2019 publication "Future of Work, an agenda" the authors, Maarten Goos and Anna Salomons (Utrecht University & Boston University TPRI), explore the opportunities and challenges the future of work will bring and show that automation will actually have a positive net effect on jobs. Advancing technologies are likely to increase total employment by around 0.5% annually.

However, as the authors state in their paper, jobs in the future will not be the same as those of today. Despite an increase in total employment, on average 1 in 7 individual workers will be faced with job loss as a direct result of automation. The changing nature of jobs has been an enduring feature of past waves of technological progress and will ultimately lead to the emergence of three new work types: 'frontier work', 'wealth work' and 'last-mile work'. Frontier work concerns jobs in new technological fields, wealth work concerns jobs created thanks to increased productivity, and last-mile work concerns jobs that cannot yet be automated. Looking even further ahead, the OECD estimates that 65% of the children currently at nursery school will end up doing a job that does not yet exist, such as 'vertical urban gardener' or 'drone controller'.

new skills and work forms will include everyone

These new jobs will require new and different skills. While the rising demand for hard STEM skills and basic digital skills is well known, there is also ample evidence of a rise in the demand for soft social skills. Crucially, we will need to prepare our educational systems for these 21st-century jobs. In addition, we will need to create seamless public-private partnerships – connecting the world of work with that of education – enabling life-long learning opportunities to support workers in their careers and to help them transition securely to new jobs. Randstad is certainly playing its part in meeting this need for upskilling and reskilling. In 2018 alone, we trained some 300,000 flex workers worldwide.

Meanwhile, new attitudes to work give rise to new forms of work in many labor markets. In their paper, Goos and Salomons show how these new forms of work do not so much replace traditional full-time open-ended

contracts, but rather provide a pathway for the formerly inactive or informal labor force to find a decent job. Indeed, new work forms within the gig economy offer flexible and adaptable models to workers, such as working remotely, flexible hours, and a diversity of compensation arrangements and contracts. This has allowed people who never fitted into the traditional 40-hour, nine-to-five work-week format to enter the formal workforce.

However, we will need to reform our systems to adapt to this new work-life reality and provide workers with the security they need to successfully manage their careers. To this end, Randstad has developed a 'labor market value scan' to assess workers' work experience and skills, on the basis of which we can predict these workers' future value on the labor market. This scan is not only useful for assessing what skills need to be acquired, but also offers additional insights. For example, in the Netherlands, the tool can be used by banks to judge whether a flex worker can get a mortgage.

tech & touch: the human factor at the core

Inevitably, change and transitions come with insecurities which many people are currently experiencing. Although macro-level research shows that the future of work will create jobs and bring greater prosperity for societies as a whole, individuals who are facing job loss due to automation or robotization are not feeling this today. Young individuals who are struggling to enter the labor market may well be sceptical about what the future has to offer.

Our biggest challenge is to make the transition to a new reality beneficial to all. This means embracing technology, without losing sight of the human factor. Instead, technology should be used to augment the human factor. Technology should be used in an ethical and fair way to provide people with the jobs they love and employers with the workers they need. The human factor will always remain crucial. At Randstad, we call this Tech & Touch. Finding the optimal Tech & Touch combination will be vital for a successful future of work.

redefining work

Work needs to be redefined. We – business and policy-makers alike – need to rethink the way work is organized, and support workers in finding decent jobs and achieving a sustainable work-life balance. Current legislation is not always fit for the future of work, as new forms and ways of work require a new perspective. We need to set up a comprehensive programme of social innovation, which should lead to new, integrated solutions for working, learning and social protection for the benefit of workers, employers and society in general. We need to secure equal and full access to labor markets through diverse forms of work, while guaranteeing meaningful and decent working conditions, regardless of an individual's employment contract. And finally, we need to equip all workers with the skills they need to succeed in the labor market, and implement modernized social protection schemes. Only then will we be able to include everyone in our journey to the future.

As the 'Flexibility@Work 2019' paper shows, there will be no shortage of jobs in the future of work, but work will change fundamentally. While embracing the future, we also need to brace for change. Shaping a future of work that is more inclusive and rewarding for all calls for a transition agenda and a whole-of-government approach that includes all stakeholders, targeting interventions to those who need them most.

Best regards,

Jacques van den Broek

CEO Randstad N.V.

acknowledgements.

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Prof. Dr. Maarten Goos is a Professor of Economics and Institutions at the Faculty of Law, Economics and Governance at Utrecht University. His research focuses on labor markets including technological progress, labor market intermediation, inequality and institutions. His award-winning research is published in international peer-reviewed journals, books and magazines. He is a regular speaker at international conferences in the areas of innovation, productivity, economic growth, labour markets and the ethical, legal, socio-economic and political consequences of ongoing technological progress.

Maarten received his PhD from the London School of Economics (LSE) and held positions at Erasmus University Rotterdam, University College London and KU Leuven before joining Utrecht University. He also held visiting positions at Princeton University, the Centre for Economic Performance at LSE, Fudan University Shanghai, the Massachusetts Institute of Technology Sloan School, and Boston University. He is one of the founding directors of the Future of Work initiative at Utrecht University and is involved in various initiatives by the European Commission, national policy institutes and multinational corporations.

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future of work, an agenda.

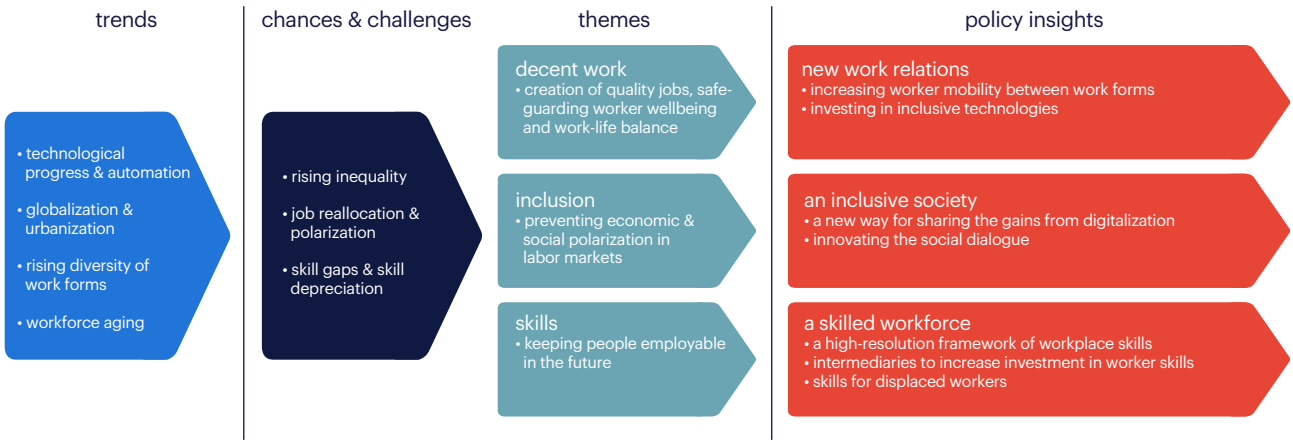
introduction.

The nature of work in modern economies is being transformed as a result of ongoing trends such as automation, urbanization and globalization, and workforce aging, sparking public debate and concern over the future of work. This report sketches an overview of these trends, their implications for work and workers, and the societal challenges they bring. Lastly, we outline some avenues for policy discussion.

Recent decades have witnessed important changes in our labor markets, influencing the nature, quality, and productivity of work. Entrepreneurs, policymakers, and other thought leaders face the challenge of making use of these developments to foster economic growth, while at the same time ensuring decent working conditions, social protection, and equal opportunities for all. To add to an understanding of and discussion about these ongoing changes, this report outlines the current debate. The structure of this report is shown in figure 1.

In chapter one, we draw on an active scientific literature to highlight key trends that are shaping the future of work. These include automation, a force which is at the center of the debate on the future of work, but also the shifting geography of work through globalization and urbanization, workforce ageing, and the rise of new work arrangements. Chapter two highlights the chances

figure 1. the future of work, an agenda



and challenges these forces raise for our labor markets today and in the future, such as rising inequality, job reallocation and polarization, and skill gaps. The third chapter then connects these to three broad societal themes along which thinking about the future of work can be organized: inclusion, decent work, and skills. Lastly, chapter four provides starting points for a policy discussion on how to address these challenges, aimed at safeguarding the three themes of labor market inclusion, decent work, and skill acquisition.

key trends affecting the future of work.

The future of work is shaped by many factors, from technological to institutional and cultural. Here, we outline three key driving forces that are impacting our labor markets today and into the future: technological progress and automation (chapter 1.1); globalization and urbanization (chapter 1.2); the rise of new work forms (chapter 1.3); and population ageing (chapter 1.4).

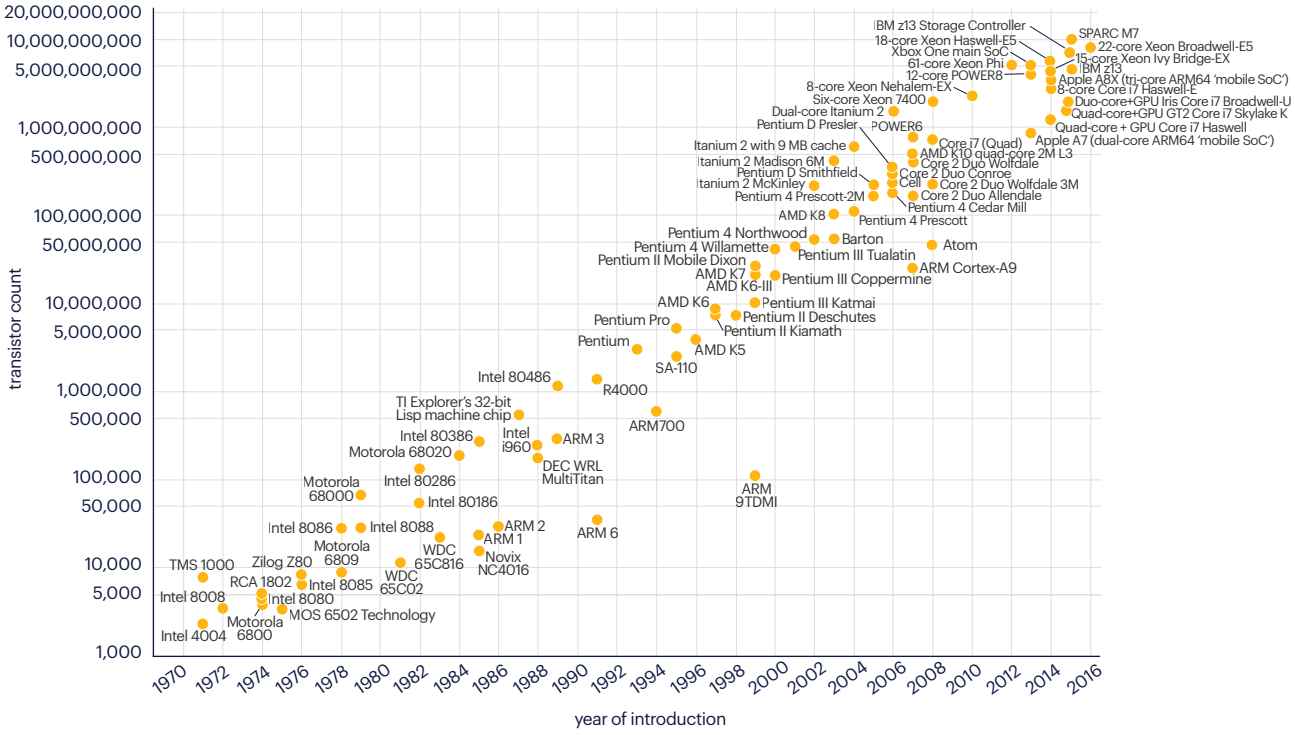
1.1 technological progress and automation

Chief among the trends impacting current and future labor markets is the progression of innovations that imbue machines with ever-increasing capabilities. While automation is by no means a new phenomenon, the digital revolution has brought its own set of labor market impacts through the introduction of desktop computing, the Internet, and other Information and Communication Technologies (ICT). These impacts are expected to continue into the future from further developments in robotics, as well as in machine learning and other Artificial Intelligence (AI) technologies.

It can be useful to classify these digital automation technologies in two broad types: firstly, rules-based technologies, and secondly, prediction-based technologies. The former are technologies which automate tasks by codifying them into a series of if-then statements, which are then embodied in software. As such, these technologies can be used to automate tasks that follow a set protocol, sometimes referred to as 'routine' tasks (Autor, Levy and Murnane 2003). Examples of such routine (or codifiable) tasks are performing calculations, and assembling products in an assembly line. Prediction-based technologies, on the other hand, use big data and machine learning techniques to predict likely outcomes (Agrawal, Gans, and Goldfarb 2018). These technologies belong to the class of so-called Artificial Intelligence. An example of AI is machine translation: algorithms trained on large databases of existing translated texts can learn to predict how a particular sentence would be translated into another language, without having encoded this translation in a set of explicit if-then rules. Similarly, machine vision can learn to recognize images of cats from a database of pictures previously tagged as containing cats or not: as such, AI can tell us whether a new picture contains a cat, without having been given explicit rules on what makes a cat cat-like.

Both types of technologies aim to automate tasks, as well as improve their speed, quality, and/or diversity relative to what human workers can produce unaided by technology. The main difference is that unlike rules-based technologies, prediction-based technologies do not require a precise description of the separate steps that need to be performed to complete the task. Rather, prediction-based technologies learn about how to automate a task by first observing how it has been performed previously (using what is called 'training data'), usually by humans, and then replicating the outcome using a statistical model. This is why prediction-based technologies can go beyond the automation abilities of rules-based technologies: given

figure 2. moore's law, 1971 - 2016



Source: wikipedia (//https://en.wikipedia.org/wiki/Transistor_count)

enough data and a clear determination on the outcome to predict, they can flexibly perform processes that are highly variable. Further, these technologies can learn over time (hence 'machine learning'), increasingly calibrating their decisions to the desired outcome.

For example, AI is being used to classify credit card charges as fraudulent. A machine learning algorithm uses a training database of existing credit card charges (both fraudulent and legitimate) and their characteristics (such as the expenditure amount, geolocation, time of the expense, as well as the previous expenditure history of the card), to predict in real-time whether charges should be flagged or not. Driverless cars are an example of an emerging AI technology: based on previous data from human drivers, online maps, and aided by machine vision, driverless cars analyze road situations and predict the best driving decision in real time.

In both cases, this is very different from an algorithm that would pre-program all possible credit card expenditures or road situations and what to do in each specific case. For one, there may simply be too many situations to program; and new ones may emerge which have not been preprogrammed and would therefore cause the automation to fail. Further, humans often make decisions without being able to summarize their reasoning in a set of explicit rules. This phenomenon is known as Polanyi's Paradox, also described as "we know more than we can tell". For example, a bank employee reviewing credit card charges may not be able to exactly explain their intuition on what makes a charge suspect – but such a rule-book is not needed for AI. Similarly, there is no way to explicitly encapsulate the task of driving into a finite set of pre-determined rules.

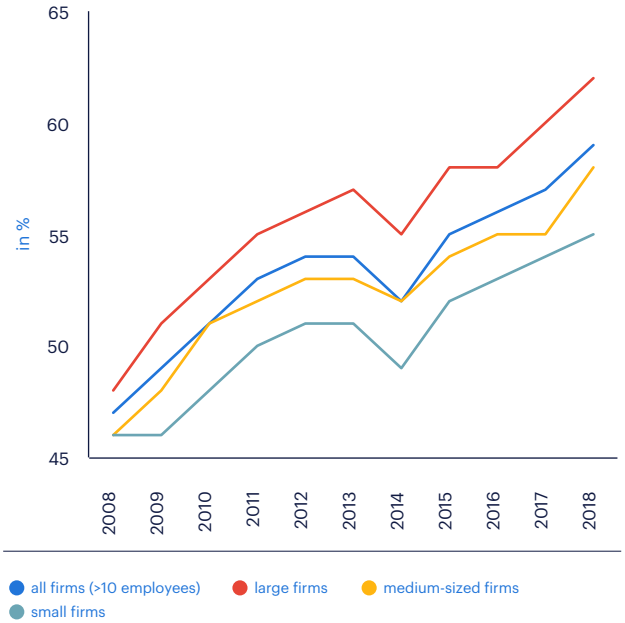
However, it would go too far to consider prediction technologies as equivalent to human intelligence. While they may be cheaper and better at predicting outcomes, the limits of these technologies lie in their inability to perform judgment the way humans do (Agrawal et al 2018). In particular, humans rely on causal reasoning to make decisions, but AI only observes patterns and

the computer revolution has transformed workplaces.

correlations in the data without separating cause from effect.

Evidence on the advances of these two types of technologies is not hard to find. Figure 2 illustrates how the number of transistors on integrated circuit chips has doubled roughly every two years, a phenomenon known as Moore's Law. This is seen as a marker of technological progress since Moore's law predicts concomitant changes in computing power and processing speed. These advances have allowed both rules-based algorithms as well as machine learning based prediction to perform tasks more quickly and cheaply.

figure 3. computer use at work



Note: large firms: >250 employees; medium-sized: 50 to 249 employees; small firms: 10-49 employees. Source: authors'calculation based on OECD Statline, ICT Access and Usage by Business.

This computer revolution has transformed workplaces. Firstly, digital technologies have replaced humans in some tasks and made them more productive in others – this is discussed in chapter 2. In the most direct sense, the prevalence of computer use at work increased from one-quarter of the workforce in 1984 to nearly one-half in 1993 (Autor, Katz, and Krueger 1998). More recent business surveys across the OECD report that around 59% of firms' employees regularly use a computer for work in 2018, compared to 47% in 2005: figure 3 depicts this upward trend, which is visible for firms of all different sizes, though most strongly for larger firms.

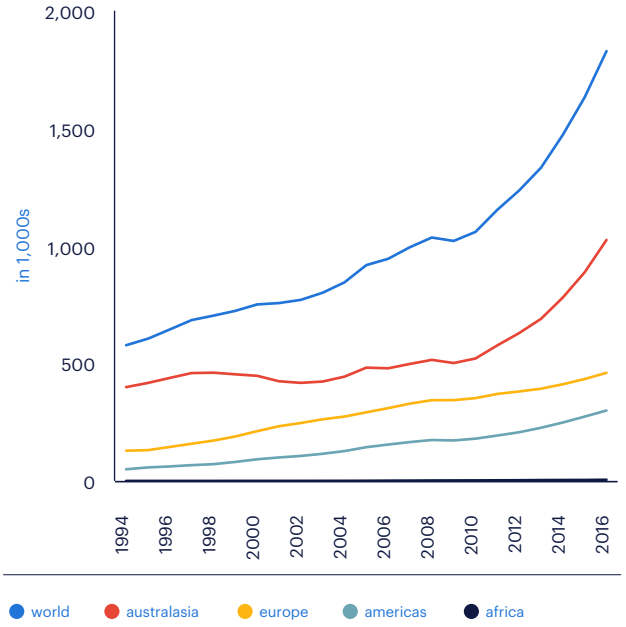
Among recent technologies impacting work, robotics has garnered a disproportionate amount of public attention, as it arguably represents the leading edge of workplace automation. While most countries as yet only have a relatively small number of robots per 10,000 workers, as shown in figure 4; figure 5 illustrates that workplace robot adoption has grown markedly in recent years. Specifically, the International Federation of Robotics documents that average growth in robot adoption has been 16% per year over the past decade and predicts the operational stock of industrial robots to increase from 2.1 million in 2017 to around 3.8 million in 2021. Service robots are much less prevalent, though their adoption is also growing, particularly in the logistics sector, followed by healthcare applications (International Federation of Robotics 2018).

A final important advancing technology is Artificial Intelligence (AI): as shown in figure 6, patenting in AI is on the rise in recent years, and AI patent growth has regularly exceeded other patent growth. This boom is to a large extent due to a fast increase in patenting in machine learning, a type of AI that is based on algorithms performing pattern recognition and prediction tasks using large datasets.

Advances in computing and AI have decreased the price of computation and prediction, leading firms to adopt smart algorithms across many domains of business practice, including enterprise resource planning and customer relationship management, as shown in figure 7. Enterprise resource planning has increased especially markedly over the past decade: some 35% of firms across OECD countries report using this in 2017, as opposed to 20% some 10 years ago.

While enterprise resources is a broad term that covers a large set of potential software applications, one that is of particular relevance is the use of algorithms in planning human resources. Digital technologies do not only change the nature of jobs and the skills they require, but also impact the functioning of labor markets directly. For example, online job search is the norm – in 2011, around three-quarters of the unemployed searched for jobs online, compared to only one-quarter in 2000 (Faberman and Kudlyak 2016). More recently, algorithms have been employed to screen résumés, match workers to jobs (including providing unemployed jobseekers with algorithmic search recommendations), aid firms in recruitment and hiring, provide input for job performance and promotion decisions, predict employee turnover, and nudge workers towards

figure 5. stock of industrial robots over time

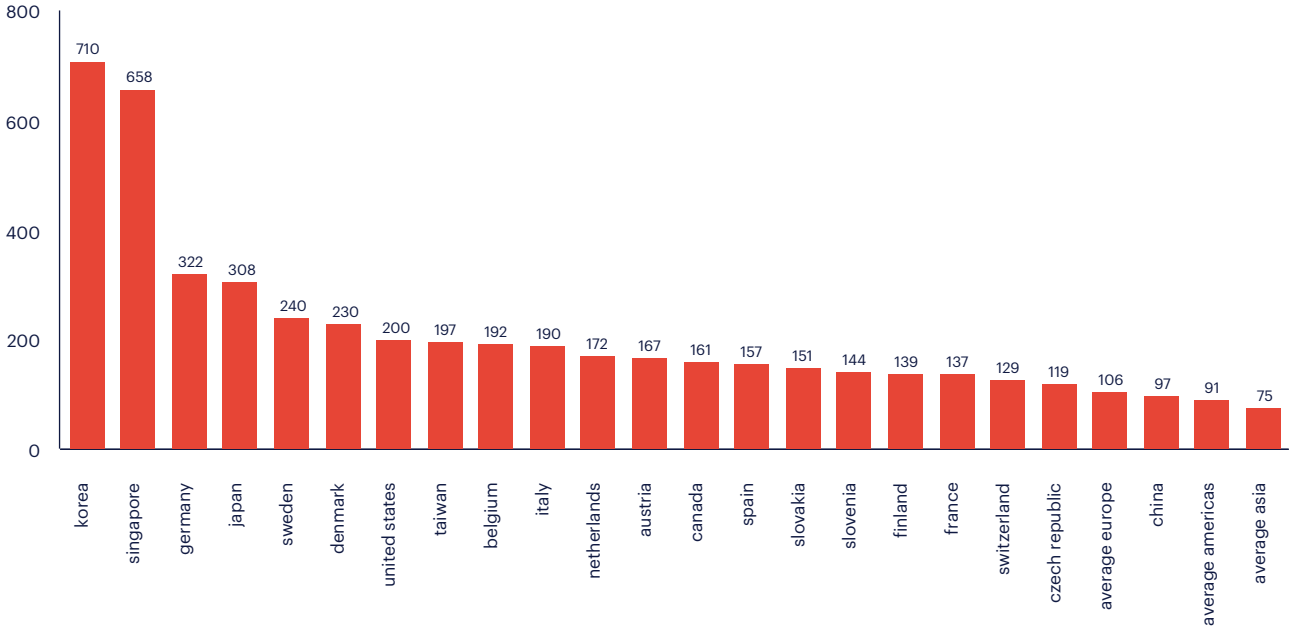


Source: International Federation of Robotics.

behaviors that are estimated to increase employee motivation and happiness (see inset). Such developments would not only increase employee welfare, but also have the potential to raise worker

figure 4. industrial robots per 10,000 manufacturing workers

data 2017



Source: International Federation of Robotics (2018).

chat-bots and physical robots have been developed that perform in-'person' HR interviews.

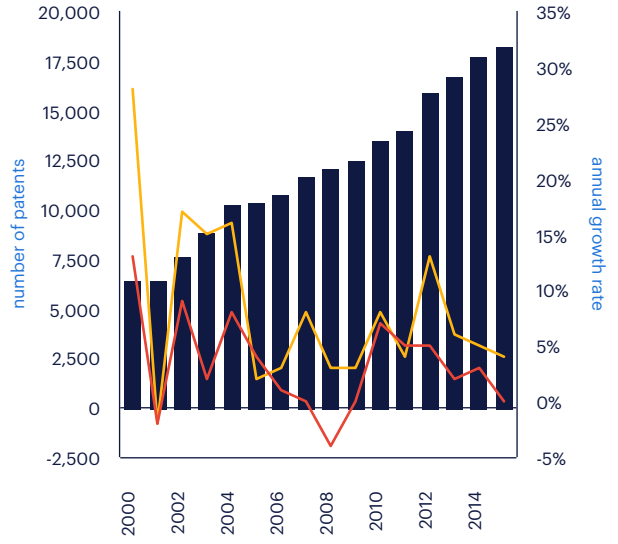
productivity – research has demonstrated a causal link between happiness and productivity (Oswald et al 2015).

For instance, automated résumé-screening is estimated to occur in over 90% of large companies (Wall Street Journal 2012). While this is in part a response to increases in application volumes which have occurred with the rise of online job boards (as many companies receive 100 or more applications for a single position), it also reflects HR cost-saving. Even at small companies, only 19% of hiring managers state they look at a majority of the résumés they receive, and 47% say they review just a few, according to a recent survey by Information Strategies Inc., publisher of Your HR Digest.

As with other AI-based technologies, applications are widening besides recommending CVs from an applicant pool for an interview, advanced HR software can suggest applicants by scraping online networks, as well as conduct initial interviews. Indeed, 96% of senior HR professionals believe AI has the potential to greatly enhance talent acquisition and retention (Randstad 2018b). For example, chat-bots and physical robots have been developed that perform in-'person' HR interviews (Randstad 2018c). These technologies aim to offer a human-like experience without the unconscious biases that humans are prone to. To that end, all questions are posed in an identical way, in the same tone, and typically, in the same order – and human recruiters or managers are then given text transcripts of each interview to help them decide which candidates should

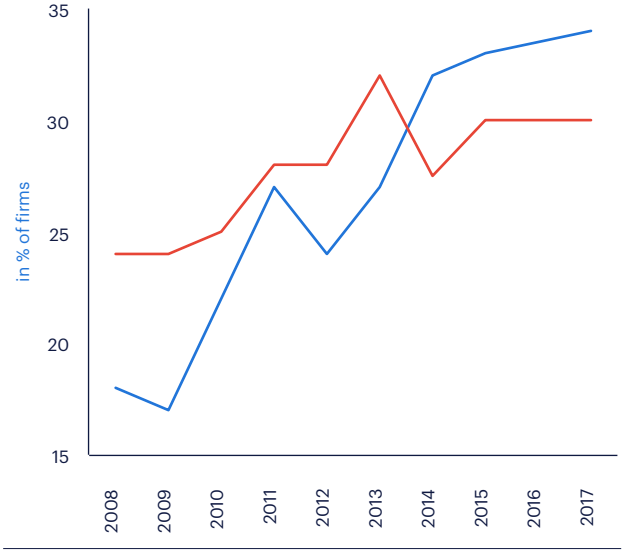
figure 6. patents in artificial intelligence technologies

2000-2015



Source: OECD (2017a).

figure 7. examples of firms' use of business software



Source: authors'calculation based on OECD Statline, ICT Access and Usage by Business.

artificial Intelligence in human resource planning

While HR planning software usage is already high, its range of applications is expanding through the use of AI. For instance, the New York Times (2018) reports how a tech start-up called Humu has developed a data-driven approach to increase employee happiness. It analyzes employee surveys to identify behavioral changes that are likely to make the biggest impact on elevating workforce happiness, and then uses emails and text messages to "nudge" individual employees into small actions that advance the larger goal. This nudging is based on economist Richard Thaler's Nobel-prize winning research on how to incite people to make better choices. Similarly, IBM has patented a "predictive attrition program" which was developed with its AI-based supercomputer Watson to predict employee flight risk and prescribe actions for managers to engage employees (CNBC 2019).

move to the next stage of the process, based on the answers alone. Other companies are going even further and are also using AI to recognize and categorize applicant emotions, a practice that has raised concern (The Guardian 2019).

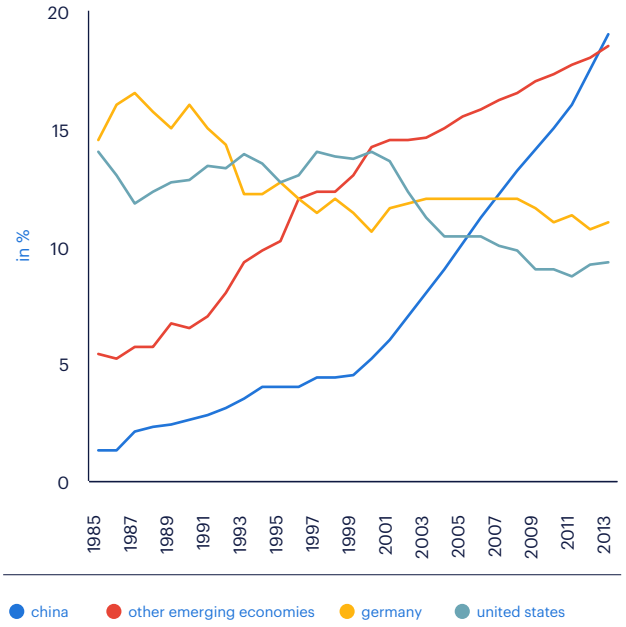
1.2 globalization and urbanization

Another key labor market trend is the changing geography of work, both internationally and within countries: here, we discuss these in turn.

Globalization causes international shifts in production, leading to a reallocation of work across borders: it is therefore an important force shaping the future of labor markets (Randstad 2017). Indeed, across the OECD, around 40% of business sector workers are estimated to be engaged in production to meet final demand originating in other countries (OECD 2017a, OECD 2019), including as supply chain (sub)contractors. While 40% is the average, this percentage is of course higher for small open economies than for larger countries which have sizable home markets.

Globalization in part results from advancing technologies allowing production processes to be unbundled and work product to be delivered electronically, and partly as from declining man-made barriers to trade. One of the most significant recent changes in the global economy that has been

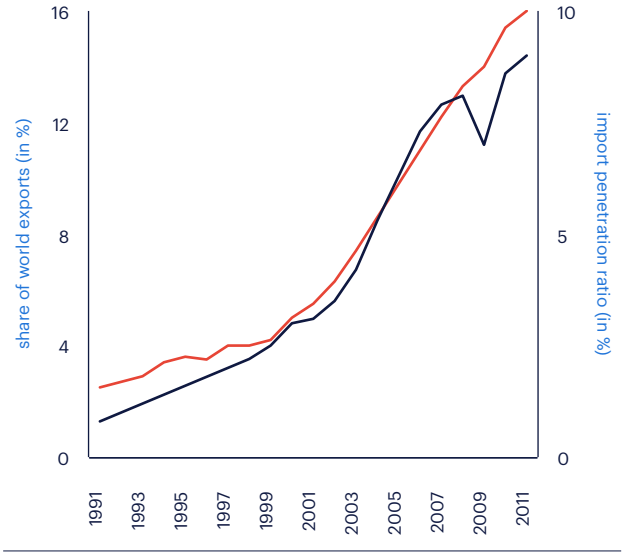
figure 8. share of world manufacturing exports



Source: Autor, Dorn, and Hanson (2016)

scientifically studied is the rapid emergence of China from a technologically backward and largely closed economy to the world's third largest manufacturing producer. This shift occurred over just two decades: as shown in figure 9, the share of world manufacturing

figure 9. rising trade with china



Source: Autor, Dorn, Hanson and Song (2014)

exports originating in China grew from 2% in 1991 to 16% in 2011 (Autor, Dorn, Hanson and Song 2014). While the resulting import competition from such trade integration produces large gains for consumers in the form of lower prices, it also leads to adjustments in home country labor markets.

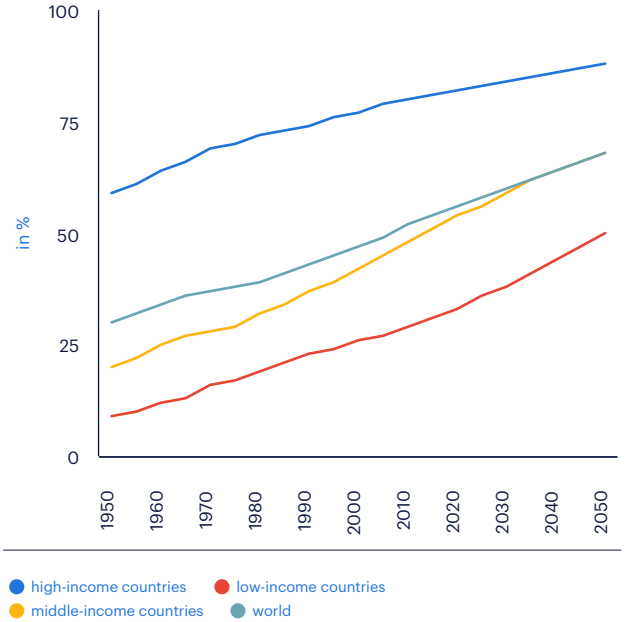
Some commentators have argued that certain types of emerging technologies may reduce the importance of global value chains in the future. For example, advances in robotics and artificial intelligence are seen as a way to re-shore labor-intensive production from low labor cost countries back to developed countries (McKinsey Global Institute 2019) – however, while actual data on this phenomenon is as yet very scarce and unrepresentative, current reports suggest re-shoring is only a small phenomenon compared to offshoring (De Backer et al 2016).

Besides international changes in the allocation of work, the regional distribution and nature of jobs have also shifted within countries' borders: a key trend here is urbanization (Randstad 2018a). This global trend is illustrated in figure 10: since 1950, the share of the world's population living in urban areas is steadily rising, and is predicted to continue doing so over the next decades. Figure 11 shows a world map with urbanization rates by country in 1950 and 2016: seen on this global scale, the shift is extremely striking.

A large body of research documents how particularly high-skilled workers have strongly moved to more densely populated (i.e., urban) areas over the last 35 years. Figure 12 illustrates the rising urban gradient in college degree holding that has been widely documented in the research literature. In 1970, working-age adults in the most densely populated regions were approximately 5 percentage points more likely to hold a college degree than those in the least densely populated regions. This gap rose to 15 percentage points between 1970 and 1990 and, by 2015, it had risen further to approximately 25 percentage points. No such urban-rural divergence is found in the location of the least-educated adults, high-school dropouts. As a result, the educational distribution in urban areas has become increasingly skewed towards higher educated workers. As shown in Autor (2019), this pattern is not driven by immigration patterns of foreign workers but is observed equally among natives.

figure 10. historical and predicted urbanization since 1950

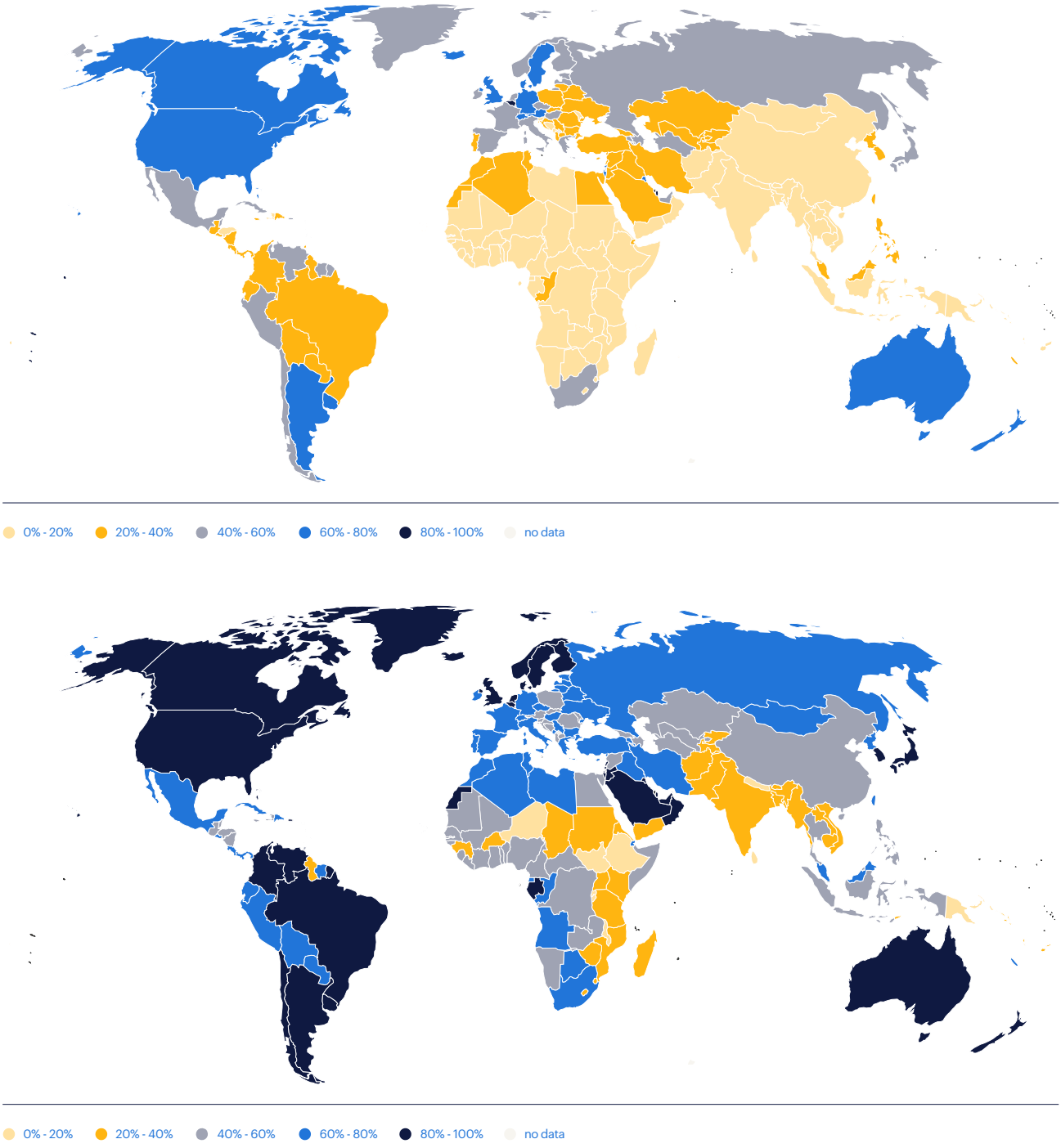
population living in urban area



Note: actual data until 2016, afterwards predictions. Definitions of urban area are country-specific, see data-source. Source: https//ourworldindata.org/urbanization.

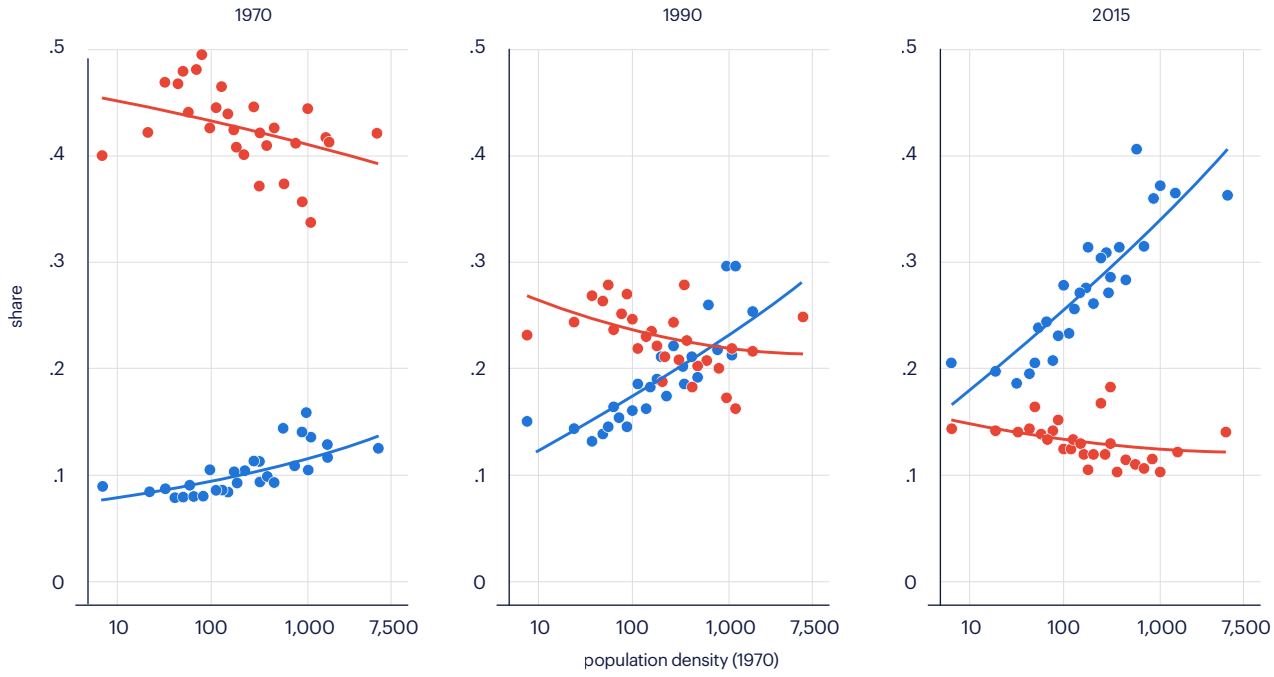
Indeed, Autor and Salomons (2019) show that this regional trend is further reinforced by the emergence of new jobs – those jobs which arise as the direct result of advancing technologies. Figure 13 documents how the set of high-paying new jobs which make use of novel technologies (so-called 'frontier work') has increasingly shifted towards urban centers over the past decades. Current examples of such jobs are robotics developers, artificial intelligence researchers, wind turbine technicians, and search engine optimization experts. Examples from previous decades are word-processing supervisors, and controllers of remotely-piloted vehicles (1980s); circuit layout designers, and robotic machine operators (1990s); and echocardiographers, molecular physicists, and programmer-analysts (2000s). The striking change is that these jobs were almost equally likely to be found in rural and urban areas in 1980, but by 2015 frontier jobs are strongly overrepresented in urban regions.

figure 11. urbanization on a global scale, 1950-2016



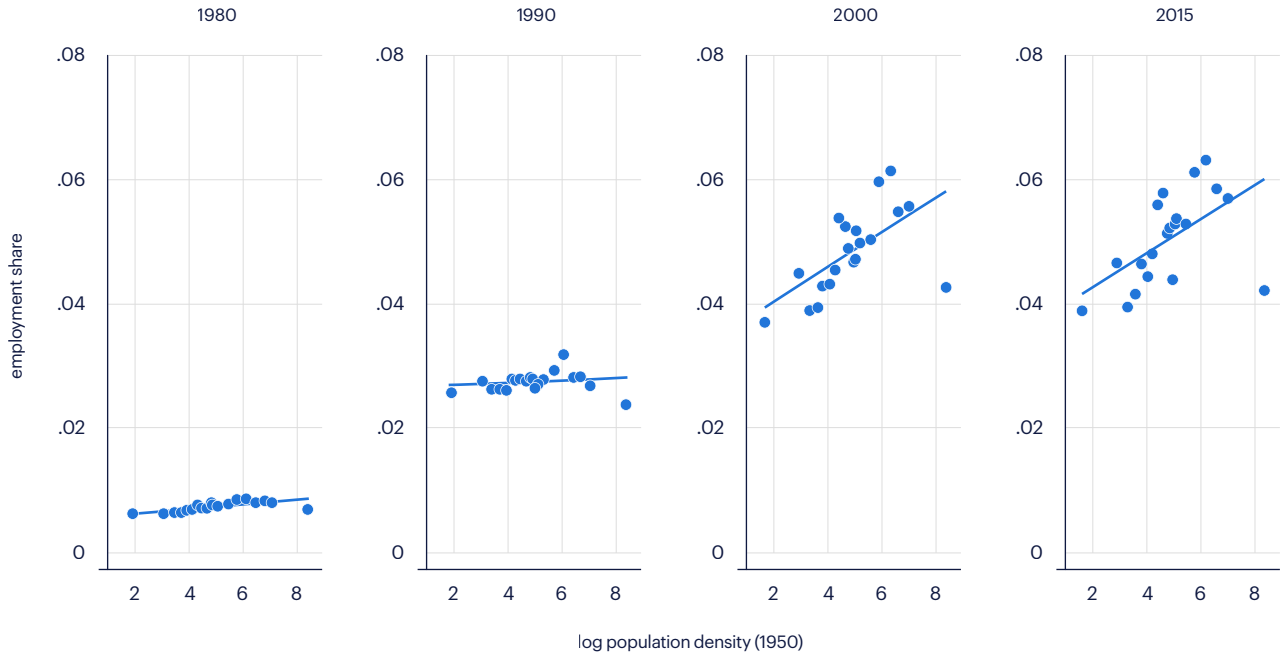
Notes: The graph shows the percentage of countries' population living in urban areas. Source: https://ourworldindata.org/urbanization. Definitions of urban areas are country-specific, see data source.

figure 12. the changing geography of work



Note: US share of working-age adult residents by region who have either four-plus years of college or less than a high school degree. Each plotted point represents approximately 5 percent of the working-age population in the relevant year. Source: Autor (2019).

figure 13. new high-tech jobs by population density and decade



Note: Cumulate employment shares in new jobs for US Census occupations, among working age adults. Source: Autor & Salomons (2019).

1.3 the rise of alternative work arrangements

Much evidence indicates that there is an increase in new forms of work that differ from the traditionally large group of full-time workers with permanent contracts. These new work forms include:

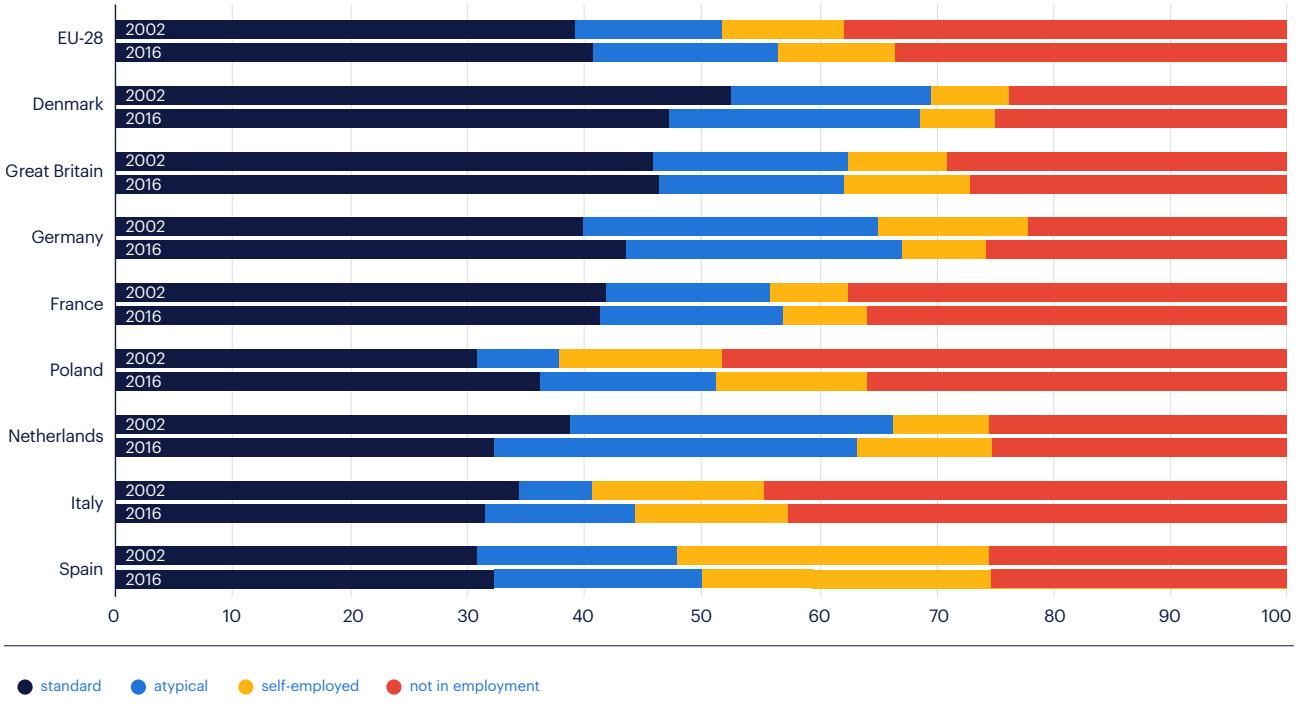
- Part-time workers are employed persons whose hours of work are fewer than those of comparable full-time workers. They can have a permanent or temporary contract with a company.
- Agency workers have a contract of employment with a temporary work agency with a view to being assigned to a company to work temporarily under its supervision and direction.
- Contract workers allow employers to hire staff with no guarantee of a regular work times or a set number of work hours. Contract work comes under different contractual forms. An example are on-call workers, who are expected to be available at any time, usually with short notice. Another example are zero-hours contracts for which the employer has no obligation to provide a set number of hours of work.
- Self-employed workers (here mostly own-account workers) or freelancers hold a self-employed job where the income is directly dependent upon the profits from the goods or services produced. They work as contractors for different companies at different times.

The gig economy is a labor market characterized by the prevalence of contract workers. It is often referred to in the context of two-sided digital platforms that bring together supply and demand for set tasks or projects (which can take place online or offline). In this case, it is called the 'online gig economy'.

New work forms have been on the rise in much of the developed world. In the US, new work forms rose from 10.7% in 2005 to around 15% in late 2015 (Katz and Krueger 2019). This documented increase is attributable to growth in contract work and in the self-employed, while agency work remained stable with a share of around 2% of the working-age population (World Employment Confederation 2018). For Europe, the changes are qualitatively similar: part-time and temporary employment have increased in the European Union since 2002 (Rhein and Walwei 2018), and self-employment grew significantly over the same period in

figure 14. new work forms in europe

Working-age population by labor force participation and type of main employment. Employees are defined as being in 'standard' employment when they are working full-time or nearly full-time (> 30 hours) and hold a permanent contract.



Source: Rhein and Walwei (2018).

new work forms have been on the rise in much of the developed world.

some EU member states such as the Netherlands and the UK (Chiarli et al 2018).

To illustrate this further, figure 14 shows the prevalence of 'standard' (employees working >30 hours holding a permanent contract) and new work forms ('self-employed' and the all other new forms of work captured by 'atypical') in the total population aged 15-64 for the EU as well as several individual countries. The figure illustrates the importance and pervasive rise of new work forms. At the same time, it can be seen that on average there has been no decline in the importance of the traditional employment relationship. Rather, its share is still close to 40% of the working-age population in the EU-28. As such, the increase in new work forms has not always come at the expense of traditional work, but sometimes also at the expense of non-work (i.e., unemployment and inactivity) and informal work.

A particularly salient new way of work has been reflected in the rise of online work platforms, which act as a clearing place for employers and workers to meet. In the online gig economy, there is a distinction between platforms acting merely as online intermediaries and platforms where work is performed remotely and delivered digitally, such that employers and workers need not meet in person. Examples of the former are online intermediaries such as Monster.com; as well as online platforms specializing in specific in-person services, including Uber, Lyft, Deliveroo, and Helpling. Examples of types of platforms where work is performed at a distance are Upwork, TaskRabbit, Toptal, and Catalant.

As yet, the importance of platform-mediated work in developed economies appears to be small: in the US, a 2017 Bureau of Labor Statistics survey suggests some 1% of jobs fall into this category (Appelbaum et al 2019, and see figure 15), and European Commission survey data

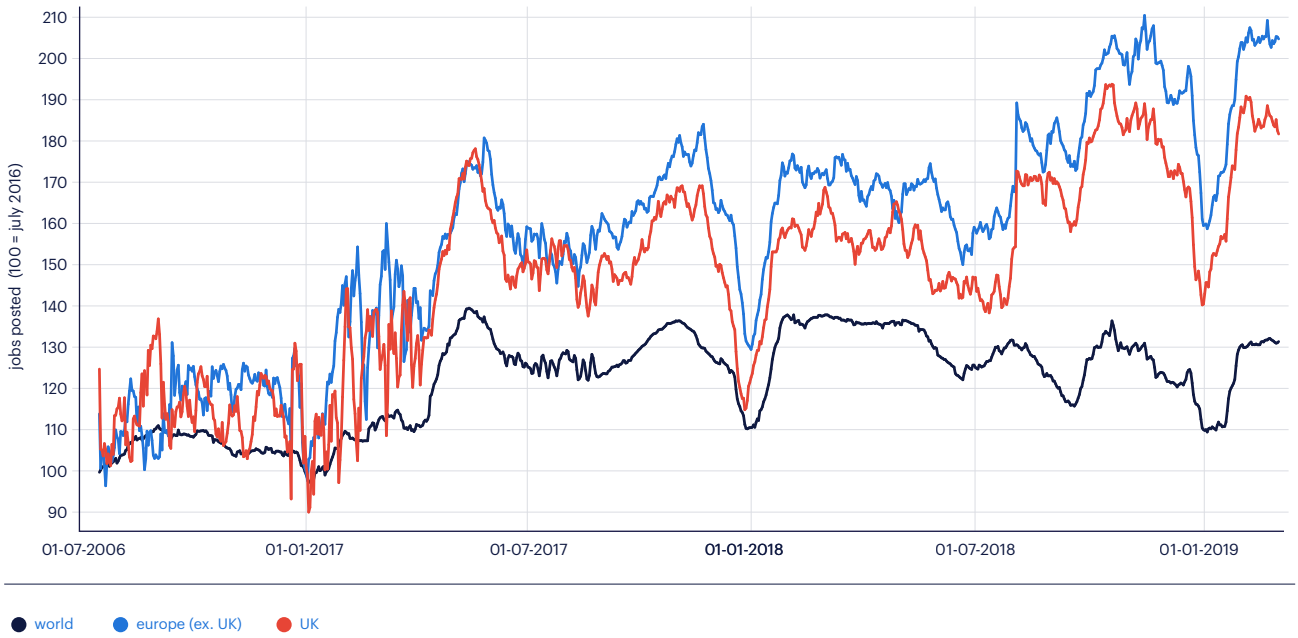
the online gig economy in europe

The online gig economy in Europe is increasing and is now the main source of income for as many as 2% of adults across 14 EU member states, according to European Commission survey data (Pesole et al. 2018). This includes transport, delivery, care, and other on-location work mediated by 'gig economy' apps, as well as software development, translation, data entry, and other knowledge work delivered remotely via the platform. Although in absolute terms European employers are not yet hiring very actively on online labor platforms, their use of such platforms is growing (Kässi and Lehdonvirta 2018).

estimates these jobs are the main source of income for around 2% of adults across 14 EU member states (Pesole et al 2018). However, as illustrated in figure 16, which presents an index of online platform job postings, the usage of such platforms has been rising sharply in recent years, and more so than other types of new work forms (Spreitzer et al 2017). Specifically, it shows these job postings have increased by about 30% worldwide from May 2016 to January 2019, and that this growth is driven by developed countries.

As documented by Kässi and Lehdonvirta (2018), not all jobs are equally represented on five major online platforms (Upwork.com, Freelancer.com, Peopleperhour.com, Mturk.com, and Guru.com). Indeed, the highest demand is for software development and technology skills, with roughly one third of online platform vacancies belonging to these categories. Other jobs frequently offered on these platforms are creative and multimedia work, as well as clerical and data entry work. Not coincidentally, these are jobs that are also typically subject to (domestic and international) outsourcing: they can be relatively easily described as stand-alone tasks, and require relatively

figure 16. employers' use of online platforms



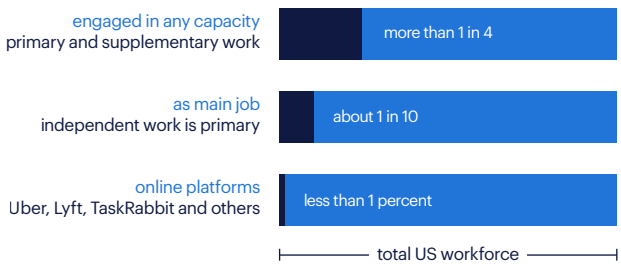
Source: Kässi and Lehdonvirta (2018)

little tacit communication and knowledge of the client's local institutional environment, which distant online service providers may not possess. As a result, professional services such as human resources, project management, consulting, and legal services are so far only rarely being contracted on online platforms (corresponding to only 2% of the total online platform market).

While the term 'new work forms' is used to describe a diverse set of alternatives to full-time employee work, many of these forms have been around for some time – for example, flexible staffing arrangements were used in 90% of firms in the 1980s already (Abraham 1988). In surveys, the large majority of firms indicate such arrangements are critical for absorbing workflow fluctuations.

A range of explanations have been posited for the rise of new work forms, including technological changes and globalization that have standardized work and reduced monitoring and supervisory costs; a demographic shift toward an older workforce with older workers more likely to be self-employed; and a weak labor market in the wake of the Great Recession of 2008 leaving workers with little bargaining power. As it turns out there is some truth to all of these: for example, the rise of online work platforms is a combination of advancing technologies for digitally delivering and monitoring work as well as business outsourcing practices driven in part by globalization. However, none of these factors appear able to explain a quantitatively significant portion of the rise of new work forms (Katz and Krueger 2017, 2019). Some have interpreted the secular rise in these forms as a response by companies to external market increases in skill differentials and

figure 15. how many workers are employed in new work forms?



Source: ILR School & Aspen Institute.

wage inequality that raise the costs of compensation compression within a single employer (Weil 2014).

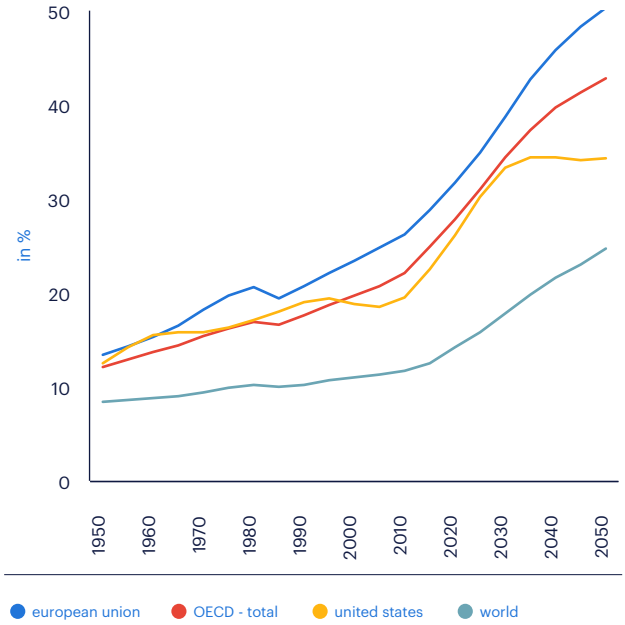
On the other hand, there is evidence that some workers prefer the flexibility and associated work-life balance (e.g., in terms of scheduling and working from home) offered by new work forms (Mas and Pallais 2017). It is likely that the demand for such flexibility has increased as women entered the labor force in growing numbers and families have increasingly relied on more than one earner, as this requires scheduling care of children and elderly parents. Further, a rising group of workers is pursuing (part-time) education or training while also working. These secular changes all inspire a need for more flexibility in the workplace, which is in part offered by new work forms (Council of Economic Advisors 2010).

1.4 workforce aging

A further trend that is important to consider from the perspective of the future of work are changes in the supply of workers. In recent history, some of the most important labor supply changes have been driven by increases in the average education level of workers and by the increase of female labor participation. These changes have been extensively documented and studied, and are shown to have had positive effects on productivity and economic growth. In the future,

figure 17. historical and projected old-age dependency ratios over time

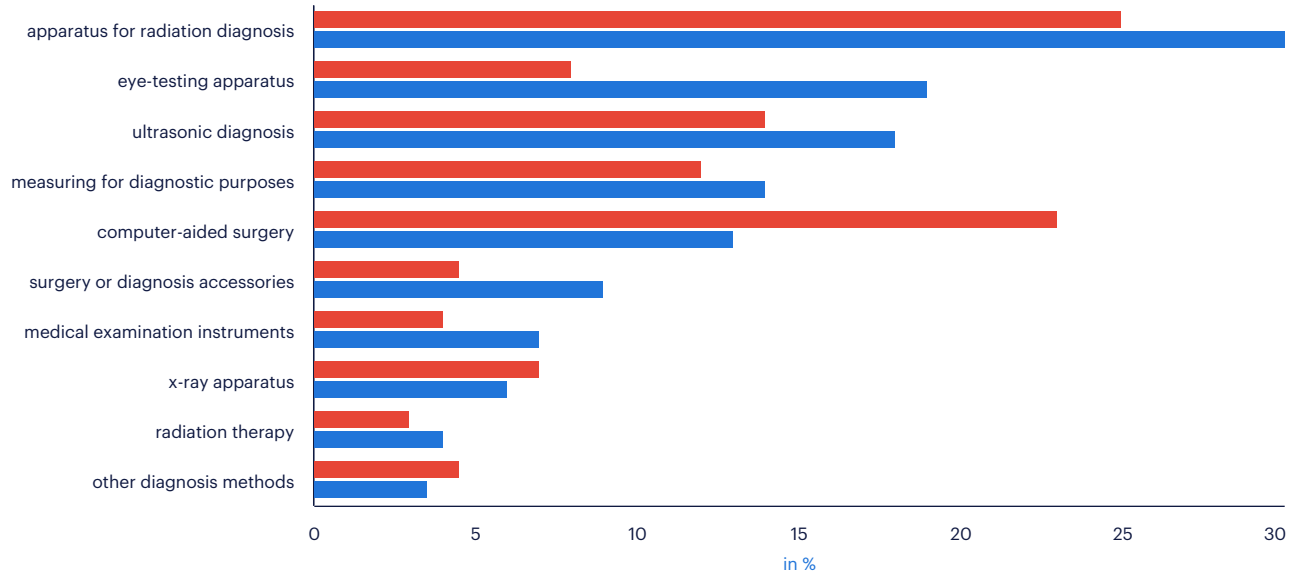
old-age dependency ratio is defined as (age 65+ / age 15-64 * 100%)



Source: OECD Statline, Historical population data and projections (1950-2050)

figure 18. top 10 artificial intelligence-based medical technologies

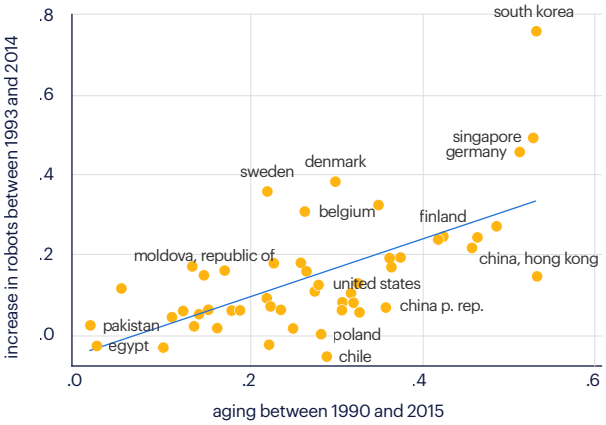
share of AI-related patents in IPS patent families related to medical technologies



Source: OECD (2017a).

there are more robots per 1,000 workers in countries with more rapidly aging populations.

figure 19. workforce aging and robot adoption



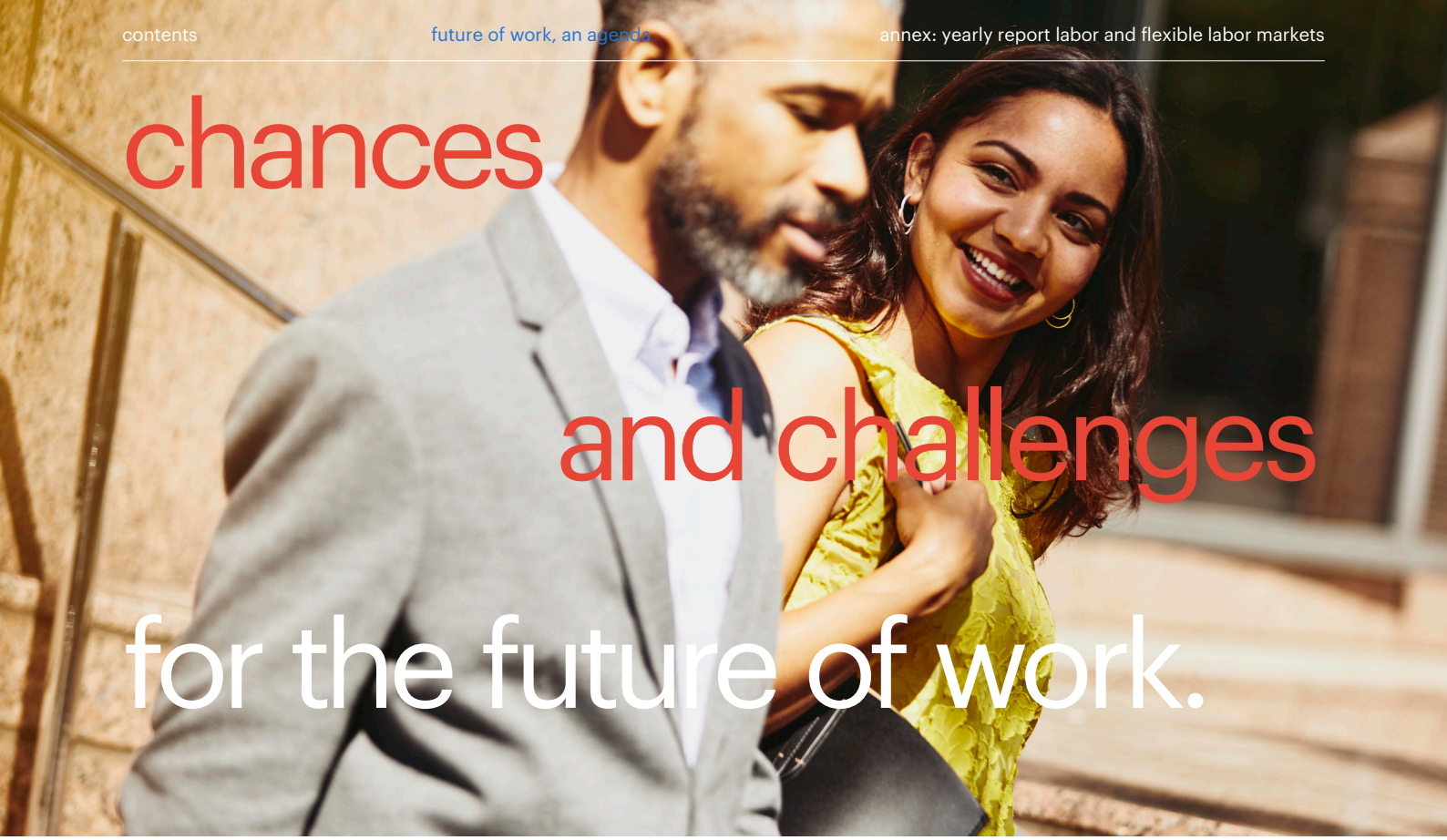
Source: Acemoglu and Restrepo (2019). The relationship plotted in the figure is based on a model controlling for other factors.

changes in terms of educational attainment and female participation are not expected to be as large as they have been in recent decades.

However, another pervasive and still ongoing change across the developed world is the changing age structure of our populations. Figure 17 shows OECD historical and projected old-age dependency ratios over 1950-2060, where this ratio is defined as the population aged over 65 years old as a percentage of the population aged between 15 and 64. The data illustrate that OECD countries have witnessed a marked increase in the size of older populations relative to working-age populations, and that this trend is even stronger in Europe than in the US.

An aging workforce may have unexpected interactions with other key trends highlighted above: in particular, countries with older workforces may be more rapid adopters of automation technologies. Advances in automation technologies are often viewed as the result of the inexorable march of technology, yet the development and adoption of these technologies is in part being boosted by demographic changes throughout the world (Acemoglu and Restrepo 2019). Figure 19 illustrates this point: there are typically more robots per 1,000 workers in countries with more rapidly aging populations, such as Germany, Japan, and South Korea. For example, 25% of the Germany-US difference in the adoption of robots is accounted for by these countries' different rate of workforce aging. Speculatively, population aging could also impact the direction of technological innovation through an increased demand for automation in healthcare services: figure 18 provides examples by documenting the top 10 medical areas where artificial intelligence innovations are being developed.

Another interaction occurs between demographics and urbanization: Autor and Fournier (2019) show that US urban regions are aging much more slowly than less densely populated areas. Indeed, since 1950, rural areas have aged 12 years on average whereas cities have only aged 2. This striking pattern is entirely accounted for by a dramatic change in migration patterns: younger workers are moving to the city, and no longer moving out.



chances and challenges for the future of work.

The key trends outlined in the previous section are technological progress and automation; globalization and urbanization, a rising diversity of work forms, and demographic change. To a large extent, these trends have fueled economic growth and brought unprecedented prosperity to our societies. As such, they do not pose a challenge to the future of our economies: rather, this future critically depends on our ability to continue innovating production processes and developing new goods and services, finding national and international markets for selling them, and reshaping and reallocating jobs to be at their most productive.

However, these trends do pose challenges for the future of work. These societal challenges are not related to a shortage of jobs, as we explain in chapter 2.2, but rather a matter of distribution: in particular, rising inequality (chapter 2.1); job reallocation and polarization (chapter 2.2); and skill gaps and skill depreciation (chapter 2.3).

2.1 rising inequality

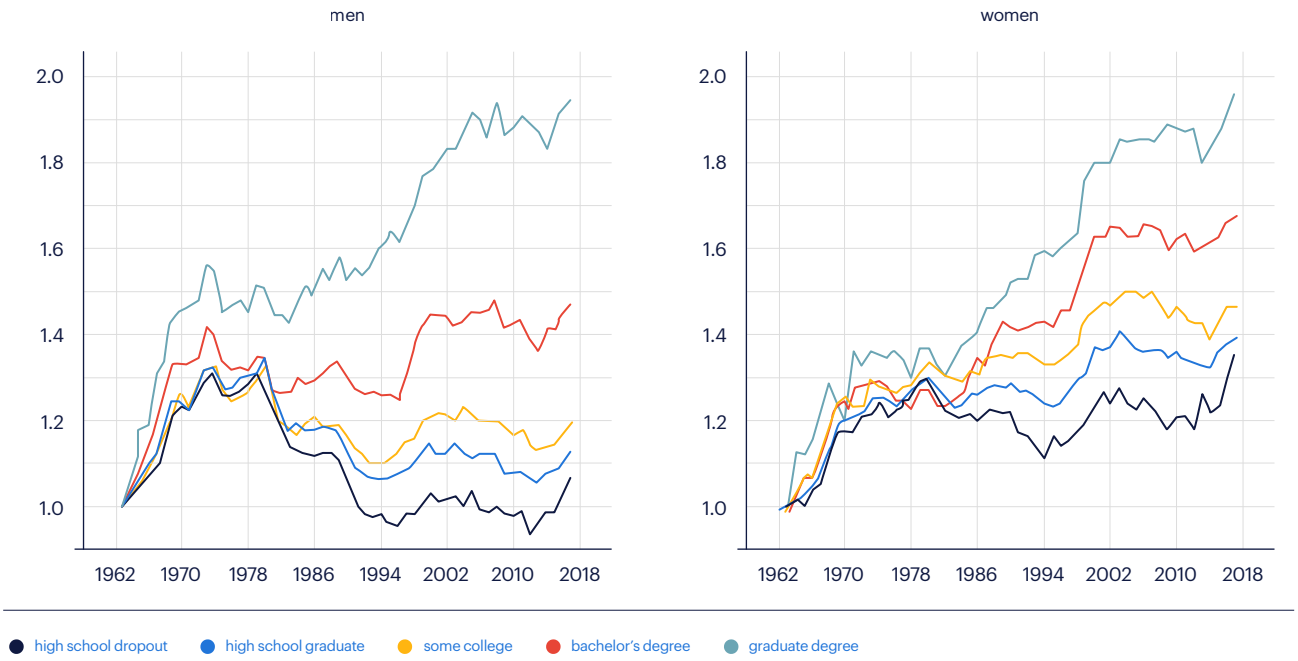
One of the key features of the digital age has been a tendency towards increasing labor market inequality in many OECD countries – albeit from different initial levels. Figure 20 shows how striking these patterns are for the US, a country which has one of the highest levels of inequality as well. For both men and women, real wage growth was broadly shared across different educational groups in the 1960s and early 70s. However, especially since 1980, wage growth for high-educated workers (those with a college degree) has raced ahead of that experienced by their lower-educated counterparts – as a result, inequality rose. For women, the lowest-educated groups still experienced positive wage growth even as they fell behind more educated workers; but for non-college educated men, there have been striking real wage declines since 1980. While these changes are not equally strong or striking in all OECD countries, there has been a tendency to more inequality on average, as shown in figure 21. Indeed, the top 90% earners have witnessed stronger wage growth than the bottom 40% or 10% earners, resulting in increasing wage inequality.

The main driver behind this increasing dispersion in wage earnings has been technological progress (along with globalization): new technologies have strongly increased the demand for high-skilled workers. This is because technologies are enabling skilled workers to be more productive and produce new goods and services. The skill premium has risen whenever the increase in the demand for skill has outstripped its increase in supply – this is known as Jan Tinbergen's famous race between education and technology.

So far, the focus has been on inequality in labor earnings. However, there have also been changes in the distribution of earnings between capital and labor: in particular, labor's share of national income has decreased in many countries. Figure 22 shows this pattern for the world's four largest economies: the US,

figure 20. rising US inequality, 1963 - 2017

cumulative change in real weekly earnings for adults aged 18-64

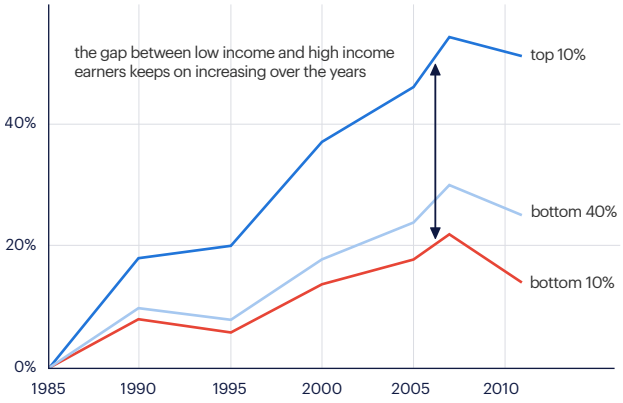


Source: Autor (2019).

China, Germany, and Japan. This trend appears to be partially driven by advancing technologies as well (Karabarbounis and Neiman 2014; Autor and Salomons 2018). It goes without saying that capital income is also owned by people, and therefore the declining labor share does not reflect a decrease in incomes – however, capital income is much more unevenly distributed than labor earnings, reinforcing the trend towards more income inequality.

figure 21. increasing inequality across OECD countries

change in real household income relative to 1985, OECD average



Source: OECD (2015).

2.2 job reallocation and polarization

A commonly heard public concern for the future of work is that jobs are being eliminated on net: that is, that we are heading for a future of mass technological unemployment. While such fears are by no means new (Mokyr et al 2015), they have found no empirical support despite widespread workplace automation.

To the contrary, the past decades of automation have led to net job creation (Autor and Salomons 2018). While direct replacement of labor by machines does reduce the demand for labor in industries where automation takes place, there are important countervailing mechanisms. Firstly, automation reduces prices, leading to additional demand for the goods produced by automating industries. This increased product demand leads to more labor in industries linked to the automating industry through the supply chain, as either suppliers or customers. For example, when the car manufacturing industry becomes more productive because of automation and therefore sells more cars,

figure 22. declining labor shares in the world's four biggest economies

share of national income

Source: Karabarbounis and Neiman (2014).

steel industries (which supply inputs to car manufacturers) see an increased demand as well, and thereby rising employment. And lastly, technological advances increase consumers' income, leading to increases in output and employment in all industries: this can be termed the final demand effect.

The sizes of these effects are illustrated in figure 23: while automation has a negative direct effect on employment, there is a positive net effect on jobs because of large positive countervailing mechanisms. Overall, estimates indicate that advancing technologies increase employment by around 0.5% annually across developed countries.

However, the absence of job destruction in aggregate does not preclude job displacement for individual workers who are facing direct automation or offshoring of their job tasks. Indeed, job reallocation has been an enduring feature of past waves of technological progress, also: a prime historical example of this is the transition from agriculture to manufacturing.

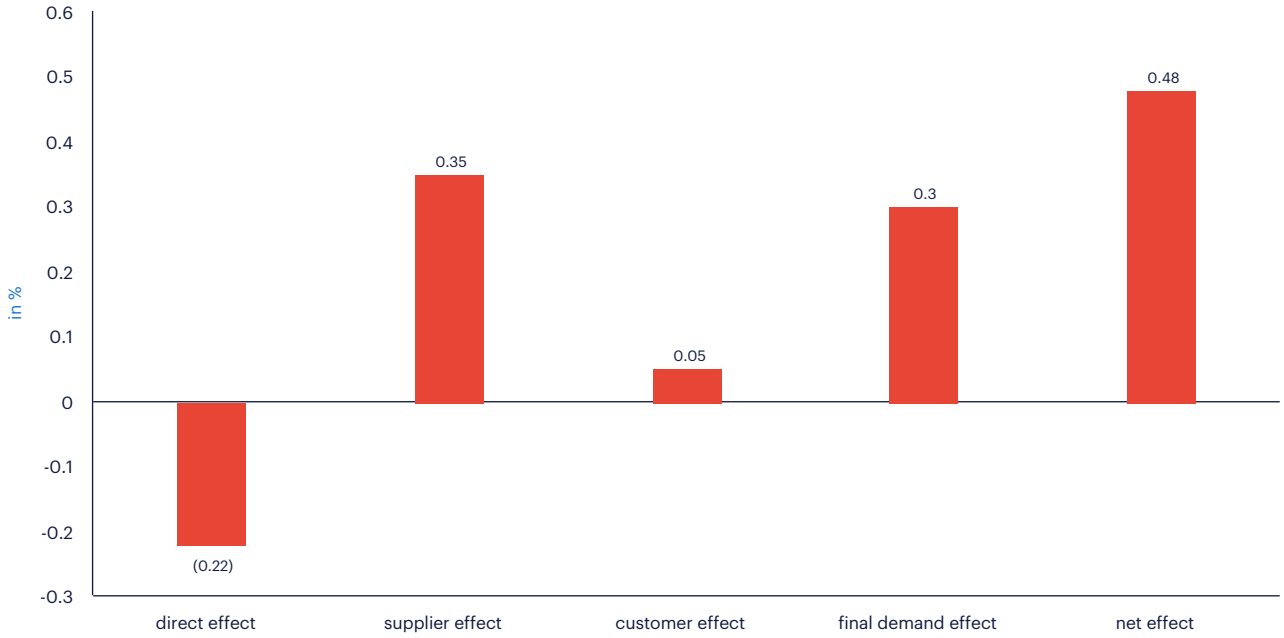
Such ongoing reallocation is clearly seen from changes in the job structure – that is, the changing employment shares of different job types. Over the last decades, many advanced countries have seen a process known as job polarization (Autor, Katz, and Kearney 2006; Goos, Manning, and Salomons 2009, 2014). This means that there has been a decline in employment shares of jobs in the middle of the wage distribution, such as clerical and production work, while employment shares of high-skilled professional jobs have increased. Employment shares of low-skilled jobs (such as construction laborers, childcare workers, waiters, and a range of personal care and service workers) have also risen, albeit to a lesser extent.

Job polarization arises because many of the tasks performed by medium-skilled workers can be automated using digital technologies. High-skilled

advancing technologies increase employment by around 0.5% annually.

figure 23. employment effects of advancing technology

predicted annual employment change from productivity growth on average across 17 developed economies



Source: Autor and Salomons (2018).

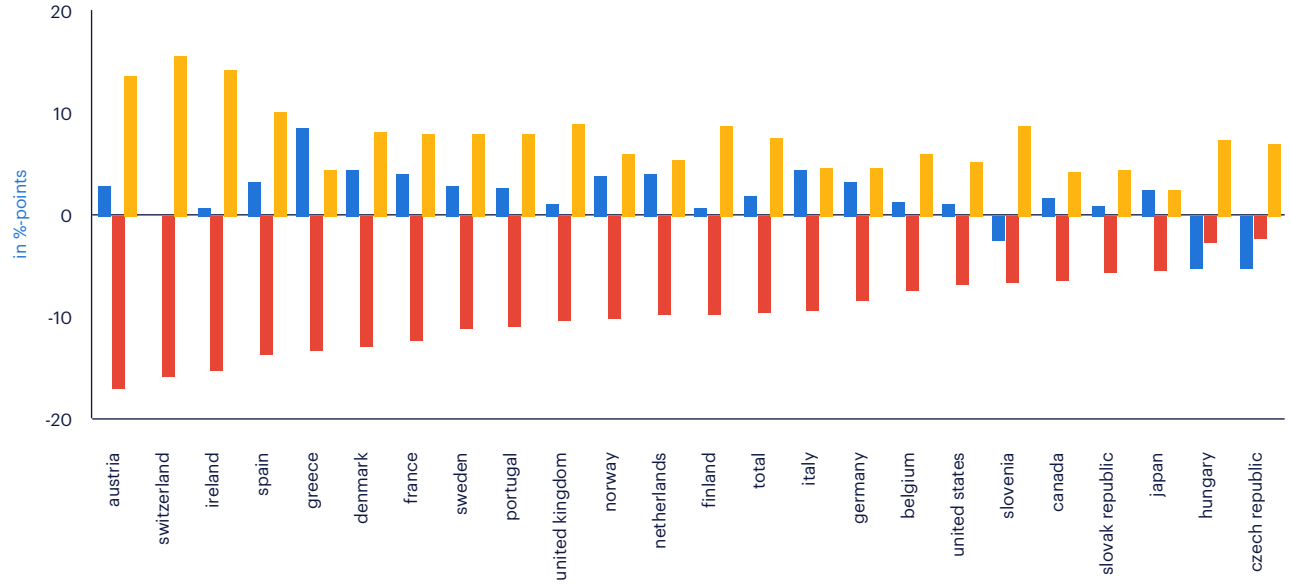
workers, on the other hand, have been made more productive by these technologies, but without being replaced: these technologies complement their tasks. At the same time, many tasks that do not require high levels of human skill (e.g. cleaning or hairdressing) are as yet very difficult to automate: this is why low-skilled work has not declined in the same way as middle-skilled work.

This pattern of polarization is reinforced by international trade, as it is mostly middle-skilled production work that is exposed to offshoring and import competition: low-skilled services need to be delivered in-person, and developed countries have a strong comparative advantage in high-skilled professional work. Job polarization is illustrated for OECD countries in figure 24: in all countries, employment shares of middle-skilled jobs have decreased, and for some, markedly so.

Polarization also has an important regional component. Figure 25 shows US employment shares for three broad occupation groups (low-paid service work; middling production and clerical work; and high-skilled professional work) across regions with different population densities over 1970-2015. This reveals that in the 1970s, denser (i.e. more urban) regions had far more middle-skill work than did suburban and rural regions. But this feature attenuated and subsequently reversed

figure 24. job polarization

change in share of total employment, OECD countries 1995-2015

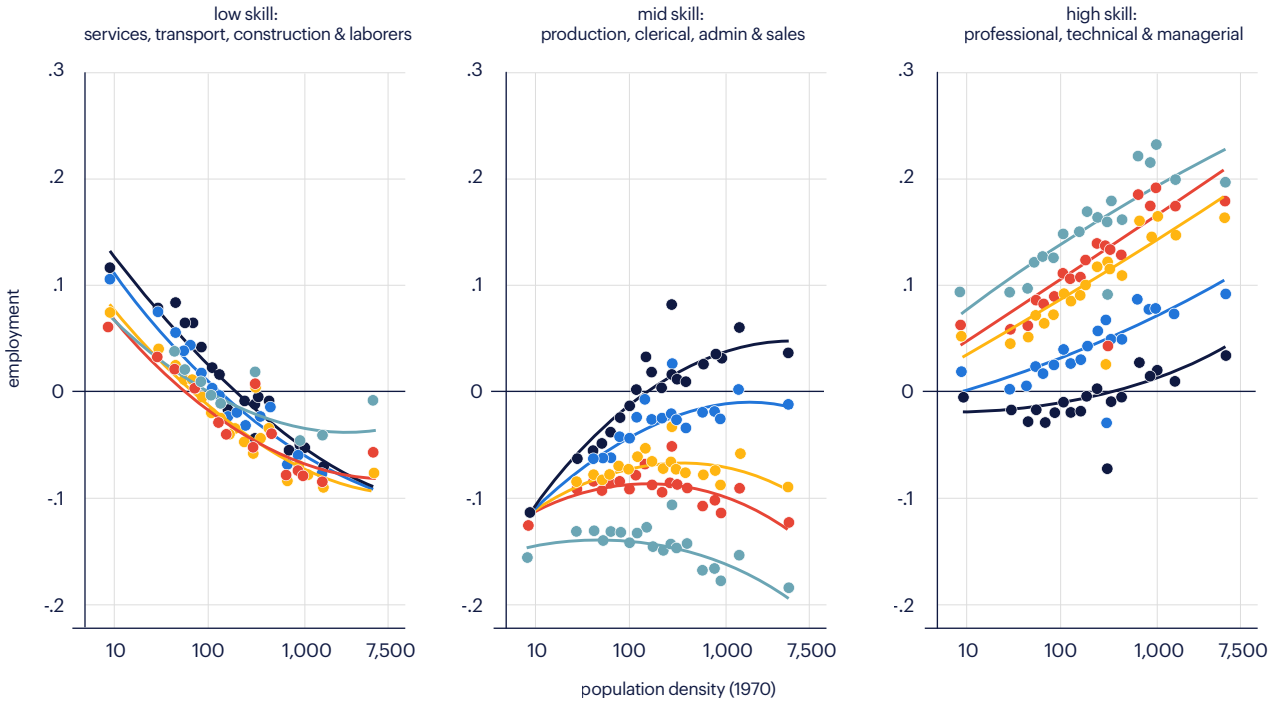


low skill middle skill high skill

Source: OECD (2017b).

figure 25. middling jobs are disappearing faster in urban areas

Occupational employment shares among working-age adults by commuting zone population density, 1970 - 2015: level relative to 1970 mean. Each plotted point represents approximately 5 percent of the working-age population in the relevant year.



1970 1980 1990 2000 2015

Source: Autor (2019).

advancing technologies lead to three classes of new jobs: frontier work, last-mile work, and wealth work. (Autor and Salomons 2019)

sign over the next four decades. That is, while middle-skill work was differentially present in urban areas in the 1970s, it was differentially absent from those same places 45 years later, in addition to less prevalent everywhere in absolute terms.

This trend of job polarization is to some extent reinforced by new job creation (Autor and Salomons 2019). This is because advancing technologies appear to lead to three broad classes of new jobs: frontier work, last-mile work, and wealth work.

- Frontier work involves directly producing, installing, maintaining, and deploying novel technologies. Recent examples are jobs in robot integration, search engine optimization, and radiological medicine – these are the jobs that have increasingly moved to cities, as documented in chapter 1.2. Frontier jobs are highly paid, and predominantly performed by college-educated men.
- Last-mile work, on the other hand, involves carrying out nearly-automated tasks that retain only a residual set of human components. Last-mile tasks typically do not require high levels of technology-specific expertise. Historical examples include call-center operators, order fulfillment workers, machine offbearers, and data entry clerks, whereas current examples include content taggers and facial recognition verifiers. These jobs are generally low-paid, can be performed with minimal training, and are geographically spread-out as they do not require in-person interaction.
- The final class of new jobs, wealth work, appears to arise as novel consumer luxuries driven by increased incomes. As such, wealth work occupations perform in-person services for affluent consumers: nail technicians, dog groomers, and many forms of personal training and counseling. Most wealth work is neither technologically novel nor broadly demanding of technical skills. It is also not highly paid. Women make up a disproportionate share of workers in wealth work occupations. These jobs have always been most prevalent in densely populated areas.

Examples of recent vacancies for these three types are shown in figure 26. While such newly emerging jobs make up only a small share of total employment, they do appear to reinforce the overall pattern of polarization. After all, in net, a disproportionate share of such `new work' is generated within dense urban labor markets. Moreover, the bifurcated structure of new work does not suggest that a technology-driven 'reinstatement' of middle-skill, non-college jobs is underway.

Recent work has quantified the adjustment costs from job reallocation for individual workers, finding a rise in the chance of firm separation for workers whose firm make major automation investments (Bessen, Goos, Salomons, and Vandenberge 2019). As shown in figure 27, workers affected by automation at their firm have up to 7 percentage point higher firm exit rates after 5 years. For workers with longer firm tenure (“incumbents”), these effects are sizable relative to their firm separation chance in the absence of automation. Indeed, because of automation, these workers are 24% more likely to leave their firm. Research shows that workers displaced by automation do find re-employment, but this takes some time: in total over 5 years, they lose around 10% of

figure 26. examples of new job types

examples of frontier jobs

Robotic Systems Integration Lead
Veo Robotics
Boston, MA
via Glassdoor
15 days ago full-time

Integration & Test Engineer
Veo Robotics
Boston, MA
via Glassdoor
22 days ago full-time

Solution Integration Engineer
RightHand Robotics
Sommerville, MA
via Glassdoor
6 days ago full-time

examples of last-mile jobs

Kids Content Tagger
Netflix
Remote, OR
via Career Square
over 1 month ago full-time

Data Entry/ Tagger assistant
Kallati
North Hempstead, NY
via ZipRecruiter
over 1 month ago 12-15 an hr.

Content Tagger
Axius Technologies Inc
New York, ny NY
via EmployZone
over 1 month ago full-time

examples of wealth jobs

Integrated Medicine Animal Rehabilitation Therapist
University of California, Davis
Los Angeles, CA
via Los Angeles CA Free Classified Ads
15 days ago full-time

Social Worker/Therapist-Animal Therapy
Princeton HealthCare System
Hamilton, MA
via CareerBuilder
13 days ago

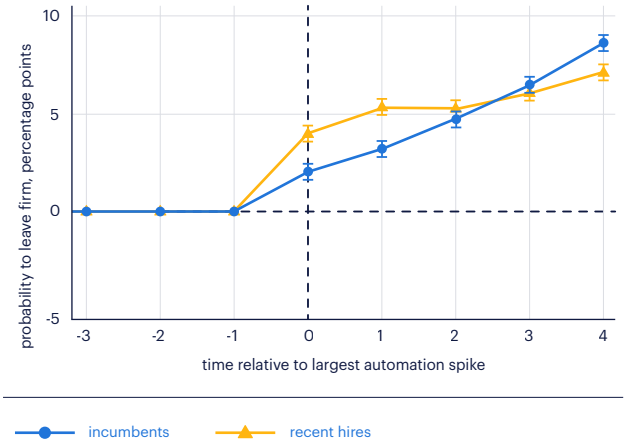
Social Worker/Therapist-Animal Therapy
Princeton HealthCare System
Princeton, NJ
via Glassdoor
13 days ago

Source: Autor and Salomons (2019)

one annual salary from the resulting unemployment spells (Bessen, Goos, Salomons, and Vandenberge 2019).

figure 27. job displacement increases after automation

Probability of workers whose firm automates (in t=0) separating from their job, compared to control group workers. Incumbents are workers who have been employed at the firm for at least 3 years prior to the automation event, recent hires have been hired less than 3 years prior to the automation event.



Source: Bessen, Goos, Salomons, and Vandenberge (2019).

Similar displacement effects have been documented for workers adversely affected by increased international trade. As an example, figure 28 shows how import competition from China has driven down US manufacturing employment.

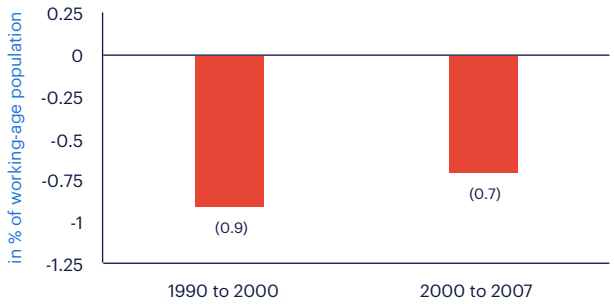
All in all, this points to job reallocation and displacement as a likely feature of the future of work: while this is not new, it does impose costs on individual workers who see their jobs automated or offshored. Further, the types of jobs and workers affected may change over time along with the nature of international competition and automation capabilities.

2.3 skill gaps and skill depreciation

Key trends such as automation and globalization lead to a change in the skills demanded in the labor market. This occurs through two broad channels: changes in the occupational structure, and changes in the task content of existing jobs. This first (between-occupational) effect occurs as jobs where routine tasks are performed decrease in importance in the economy: job polarization is one driver of such change. The creation of entirely new jobs also contributes to changes in the occupational structure. The second (within-occupational) effect arises when existing jobs change

figure 28. trade-driven job displacement

effect of a $1,000 dollar per worker increase in imports from China during 1990-2007 on the change in manufacturing employment



source: Autor, Dorn, and Hanson (2016).

their task content: for example, secretaries currently perform a very different set of tasks than before the advent of the computer. These within-occupational changes in task content are estimated to be an important source of labor market adaptation to change (Arntz, Gregory and Zierahn 2017). Together, these two sources of changing skill needs imply workers have to be able to acquire new skills for switching to other job types as well as adapt to changing task competence requirements in their existing work.

When skill needs in the economy are not met, skill gaps occur: these gaps are known to be especially large in the fields of Science, Technology, Engineering and Math (STEM). Figure 29 illustrates that many firms across the OECD report having ICT specialist vacancies that are difficult to fill, and that this difficulty has increased since the end of the crisis. Similarly, analysis of vacancy data shows that the median duration of advertising for a STEM vacancy is more than twice as long as for a non-STEM vacancy (Rothwell 2014). These indicators signal that there is a shortage of supply of STEM skills in the labor market, relative to demand.

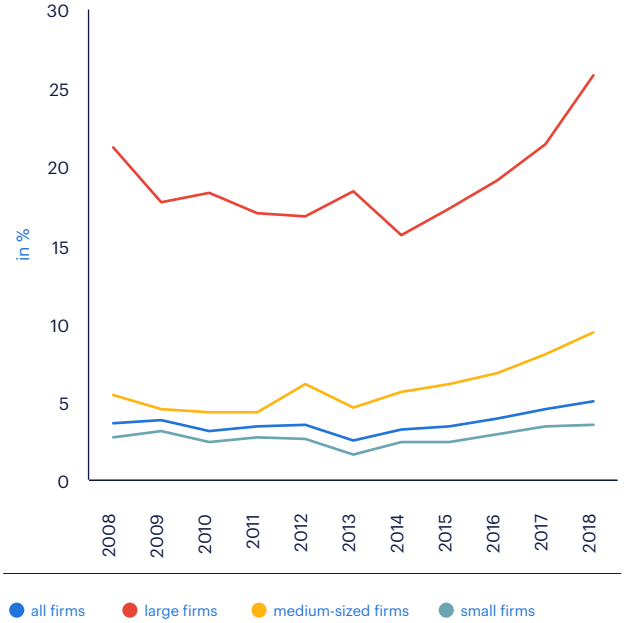
Along with the rising demand for STEM and other technical skills there has also been a lesser well-known rise in the demand for social skills, and even more so when combined with mathematical skills (Deming 2017). This is illustrated in figure 30 and figure 31, which respectively show the rising employment and wages of jobs involving a combination of social and math skills. Social skills are argued to matter because they help workers cooperate and work in teams, which is increasingly important in today's workplaces. These overall patterns are consistent with the OECD Skills for Jobs Database, which documents skill shortages in not only mathematical skills, but also judgment and decision-making as well as social perceptiveness.

women in science, technology, engineering, and math (STEM)

It is well-documented that women are underrepresented in STEM fields in terms of education and jobs. Only 30% of STEM graduates are women, and female representation in careers in these fields is even lower, as well as decreasing in job levels (OECD 2017a). Further, across the OECD, fewer than 10% of patents are filed by female innovators. Recent work shows that very little of these sizable differences can be attributed to differences in STEM ability or achievement between boys and girls at the time of course specialization choice (Delaney and Devereux 2019). This suggests these differences could be influenced by cultural factors including preferences, socialization, role model and peer effects, as well as expectations of future workplace discrimination. A fair representation of women as well as minorities in technology creation matters because the intersections of race, gender, and other identities and attributes shape people's experiences with technology and AI. (West et al 2019).

figure 29. ICT specialist vacancies are difficult to fill

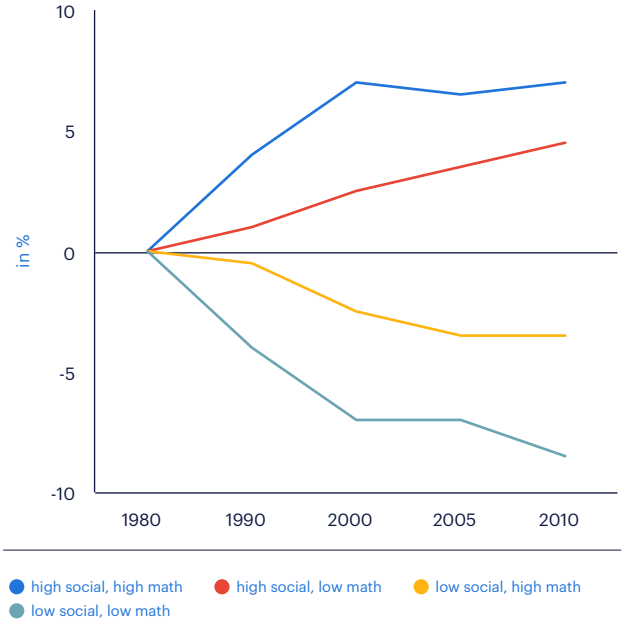
firms with ICT vacancies in past year that were difficult to fill



Note: large firms: >250 employees; medium-sized: 50 to 249 employees; small firms: 10-49 employees. source: authors'calculation based on OECD Statline, ICT Access and Usage by Business.

figure 30. rising employment for jobs with social skills

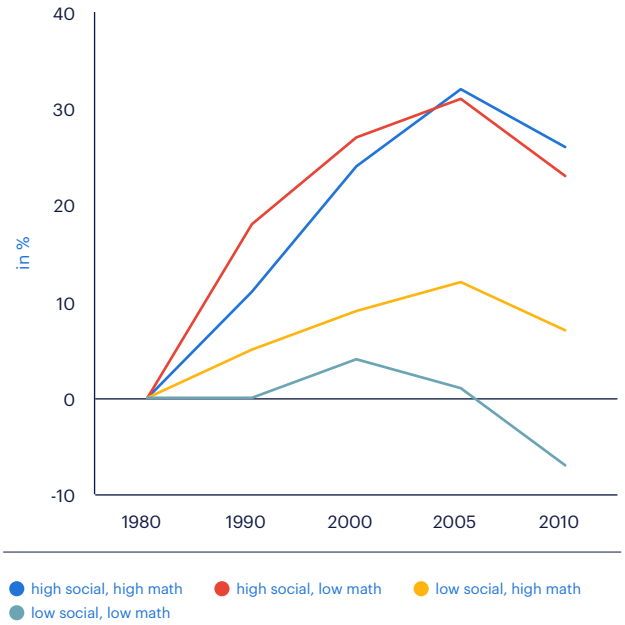
cumulative changes in employment share by occupation task intensity, 1980–2012



Note: occupational task intensities based on 1998 O'Net. Source: Deming (2017).

figure 31. rising wages for jobs with social skills

cumulative changes in real hourly wages by occupation task intensity, 1980–2012



Note: occupational task intensities based on 1998 O'Net. Source: Deming (2017)

For female workers, these changing skill demands have led to two contrasting patterns: while women are still strongly underrepresented in STEM occupations, high-skilled women overall have fared at least as well or even better than high-skilled men because there has been such a strong increase in the demand for social skills within high-skilled jobs (see insets).

women in high-skilled jobs

Since the 1980s, high-educated women have fared well relative to high-educated men. One key channel driving this seems to be the greater increase in the demand for female-oriented skills in cognitive/high-wage occupations relative to other occupations. Research shows that this relative increase in the demand for female workers is due to an increasing importance of social skills within such high-skilled occupations (Cortés et al 2018).

Lastly, skill depreciation is also a challenge whenever technology advances: this is especially relevant given the increasing average age of our workforces. An analysis of vacancy data shows that technology-intense STEM jobs have changed especially quickly over the last decade, leading to flatter age-earnings profiles as the skills of older cohorts become obsolete (Deming and Noray 2018). Further, older workers experience larger earnings losses following automation in their firm, since they have more trouble transitioning to new jobs (Bessen, Goos, Salomons and Vandenberge 2019). In some countries such as the US, entry to a different occupation may be further restricted because of occupational licensing. Strikingly, 5% of jobs required an occupational license in the 1950 versus nearly 25% today (Kleiner and Krueger 2013).

All in all, skill demands change both within and between jobs as work is partially automated or offshored, or as new types of production are enabled as a result of the key trends outlined in chapter 1. These trends therefore present ongoing skill-related challenges for the future of work.

themes for the future of work.

In this chapter we outline three themes for thinking about the future of work. Together, these themes represent a yardstick along which developments in the world of work can be measured: do they safeguard decent work; do they promote inclusion of various groups in the labor market; and do they foster skill investment and acquisition.

3.1 decent work

Several of the challenges outlined in the previous section touch on a key concern about the future of labor markets: the availability of decent work. The International Labour Organisation defines this as 'opportunities for work that are productive and deliver a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men'. Broadly considered, decent work therefore comprises job availability, job pay, as well as non-wage job characteristics.[1]

For a long time, advancing technologies were thought to only increase the prevalence of high-skilled, highly paid, work. However, the trend of job polarization, as well as the emergence of last-mile and new wealth work, shows that there is likely to be a substantial fraction jobs with relatively low human skill requirements which can nevertheless not (yet) be automated. Safeguarding the quality of these jobs in terms of wages and non-wage characteristics such as autonomy is a key societal challenge.

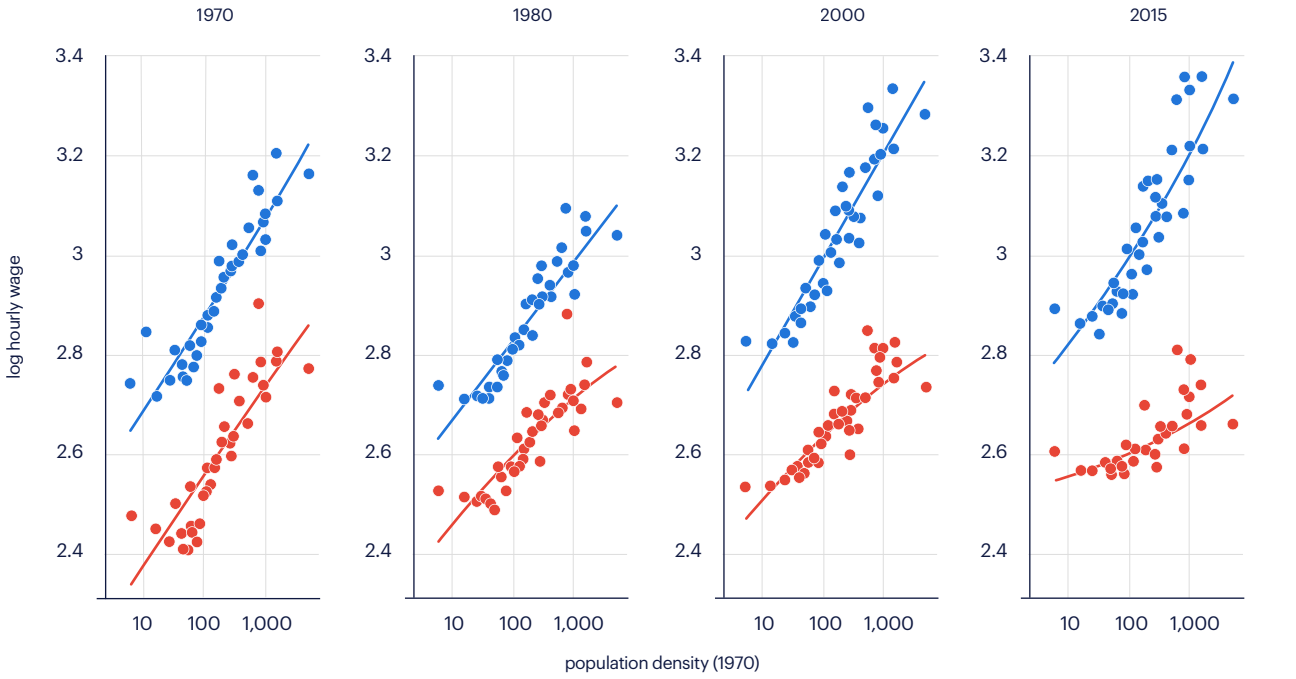
This is all the more important given how the trend of urbanization has impacted workers of different skill types, as urban areas have become more abundant in high-skilled jobs, while the availability of middle-skill work has declined. Although this skill-upgrading of the occupational structure is good news from a macro-economic perspective, workers without college degrees are shown to have much more limited access to these higher-paying jobs, and they are instead increasingly observed in low-skilled rather than medium-skilled occupations (Autor 2019). This shift is more pronounced in urban areas, highlighting the importance of regional disparities. Figure 32 depicts how the urban wage premium has declined for workers without a college degree. That is, while urbanization has benefited highly educated workers as their wages are higher in more densely populated regions, lower-educated workers have witnessed their urban wage premium erode over time. This implies opportunities for decent work are reduced for this group.

Non-wage job characteristics, such as autonomy, trust, and work stress, have been shown to matter greatly for work satisfaction, which in turn matters for job retention (Clark 2001; Helliwell and Huang 2011). These non-

[1] The equality aspects that the ILO partially classes under decent work are discussed separately, as inclusion, in section 3.2.

figure 32. declining urban wage premium among non-college workers

Real mean log hourly earnings among college and non-college workers in 1970, 1980, 2000, and 2015. Each plotted point represents approximately 2.5 percent of the working age population in the relevant year.



Source: Autor (2019)

monetary job aspects may also be affected by the trends outlined above. While research about these aspects is still in its infancy, some patterns emerge. For one, automation has eliminated the need for human intervention in many dangerous and tedious tasks, relieving workers of these workplace disamenities (OECD 2019). Indeed, there is recent survey evidence suggesting that the implementation of ICT and AI technologies increases job satisfaction in many jobs (Yamamoto 2019). However, workers interacting with these technologies also report higher levels of stress. This is arguably the case because as routine work is automated, there is more room for creative and problem-solving tasks – and these complex tasks typically bring higher mental loads. At the same time, many last-mile jobs which emerge as a result of partial automation processes are not stressful because of an abundance of challenging tasks – rather, they are anecdotally known to lack autonomy and may be emotionally stressful in some cases. For instance, warehouse order fillers have documented how their work pace is determined and monitored by technology, whereas human content taggers are being exposed to emotionally taxing material. More research is needed to determine how the introduction of new workplace technologies affects worker health and wellbeing: it seems highly likely that there are different outcomes across different job types, different technologies, and different institutional environments.

The emergence of new work forms, including online platform-based work, has also spurred some discussion about decent work. In part, this is because these contracts sometimes fall outside of standard regulatory frameworks, possibly providing less protection for workers – see insert. However, workers in new work forms earn similar hourly wages to comparably skilled workers in traditional contracts (Katz and Krueger 2019). Further, some 80% of workers who are independent contractors or freelancers value the flexibility and independence that comes with being their own boss and report they prefer working for themselves to being

80% of workers who are independent contractors or freelancers value the flexibility and independence.

an employee. Indeed, new work forms can provide a valuable option for workers. For example, recent studies on Uber drivers show that the option to work through the platform rather than buying a taxi medallion is highly valued (Angrist, Caldwell and Hall 2017; Chen et al 2019), illustrating the benefit of this work arrangement.

3.2 inclusion

Beyond decent jobs being available, challenges for the future of work can arise if certain groups of workers do not have equal access to such jobs: inclusion is therefore an important second labor market consideration.

Rising inequality and polarization threaten inclusion for a number of reasons. For one, polarized job opportunities imply the middle rungs of the job ladder are less commonly available: this matters since job mobility directly from the lowest to the highest rungs is much less likely. Further, increased inequality has been shown to impact intergenerational mobility: this reflects how likely parents are to transmit their wage income rank to their offspring. If this mobility is high, offspring of low-earning and high-earning parents have similar chances of becoming high-earning; whereas if it is low, offspring of high-earning parents have a strong advantage.

Figure 33 shows the so-called Great Gatsby curve, using cross-country evidence to show that intergenerational mobility is lower in countries with higher inequality. This may (for example) occur because a rise in the return to education leads to both a rise in income inequality at any one point in time and a decline in intergenerational mobility because educational attainment is positively correlated across generations. There is an active academic debate on whether intergenerational mobility has declined in recent decades: such long-run patterns are often hard to distinguish because of a lack of comparable data across multiple generations. Yet recent research using high-quality data for Norway has shown that intergenerational mobility has decreased, and especially for the very lowest-income workers (Markussen and Roed 2019). As the authors remark, "[we] may suspect that standard measures of intergenerational mobility [...] have failed to pick up trends toward lower rank mobility also in other countries" and that as Norway has "[a] large and ambitious welfare state explicitly designed to ensure equality of opportunities; this may not bode well for countries with less ambitious social and educational policies".

Beyond their tendency to raise labor market inequality, advancing digital technologies may also have direct impact on labor market inclusion. In particular, the

public concern about the gig economy

Some food delivery companies operating in multiple countries have been criticized in recent years for classifying its couriers as self-employed, circumventing worker rights such as minimum hourly wages and paid holiday leave (e.g. see Reuters 2018). A 2018 UK parliamentary inquiry found that this employment model fosters a polarized labor market that works well for some and poorly for others, including large earnings gaps between the platform's riders for identical work. Similar concerns have been brought up with respect to other gig economy companies, illustrating a growing societal concern to ensure those employed in new work forms have decent work.

polarized job opportunities imply the middle rungs of the job ladder are less commonly available.

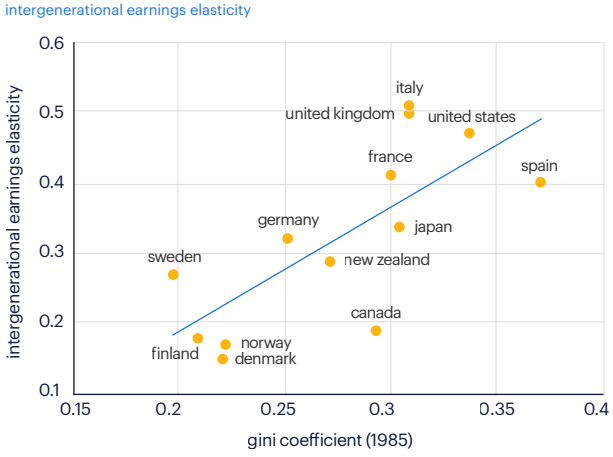
fairness consequences of the rising use of algorithmic prediction for screening and evaluation purposes is an area of active research. Standard machine learning has been shown to acquire stereotyped biases from textual data, propagating cultural stereotypes to artificial intelligence technologies that are already in widespread use (e.g., see Bolukbasi et al 2016; Caliskan, Bryson, and Narayanan 2017). While research efforts are being made to debias such algorithms, this is far from standard practice, and not all experts agree that current debiasing efforts are effective (Kleinberg et al 2018). Indeed, algorithmic bias has been shown in a number of labor market settings. One example documented how setting an otherwise identical worker's gender to female instead of male resulted in getting fewer instances of an ad related to high paying jobs (Datta et al 2015).

Further, bias may arise from other causes than biased training data, leading particular worker groups to be disadvantaged. For example, advertising STEM jobs on platforms such as Facebook can lead to the exclusion of women, purely because women are less likely to be shown these ads (Lambrecht and Tucker 2016). This lower exposure to STEM job ads was shown not to be due to women being less qualified or less likely to apply – rather, it is the algorithms of the advertising market that are biased. In particular, young women are a valuable demographic on Facebook, making it more expensive to show them ads: ad algorithms then automatically show ads to men, as this leads to higher ad exposure for the same advertising outlay. As such, even neutral ads may have discriminatory impacts. This suggests that algorithmic transparency is not sufficient to address all types of bias – one has to understand the underlying economic mechanisms leading to discriminatory outcomes.

On the other hand, such algorithmic applications should be judged relative to the counterfactual of human judgment, which itself is far from unbiased (see insert). For example, human recruitment often focuses on people already in one's network. But since these networks have been shown to be homogeneous in terms of gender and ethnicity, they can generate more male or white applicants in jobs that are already dominated by males or whites. Where they exist, comparisons between machine and human judgement suggest machines may be less biased than humans, even when trained on historical data (Kleinberg et al 2017; Cowgill 2018).

For example, research studying hiring for white-collar jobs found that the introduction of machine learning

figure 33. the great gatsby curve



Notes: The Gini coefficient is a measure of income inequality – the higher the Gini coefficient, the more inequality. The intergenerational earnings elasticity is a measure of mobility: the higher, the less mobile people are across generations (i.e. the more the current generation's income rank is determined by their parents' income rank). Source: Krueger (2012).

comparisons between machine and human judgment suggest machines may be less biased than humans.

> "A lot of people are saying this is showing that AI is prejudiced. No. This is showing we're prejudiced and that AI is learning it."
>
> Joanna Bryson, computer scientist at the University of Bath

technology yielded candidates that are substantially more likely to pass interviews and receive as well as accept a job offer, as well as more productive once hired as employees (Cowgill 2018). These results were driven by candidates who were evaluated in a biased way when humans had made job offer decisions. In particular, the candidates suggested by the artificial intelligence were broadly non-traditional: candidates who graduated from non-elite colleges, who lacked job referrals and prior experience, whose credentials are atypical and who had strong non-cognitive soft skills. In other words, the algorithm was better at picking excellent candidates from among those who would not normally be hired.

Other work on the introduction of job testing technologies in low-skilled service sectors has found that this raised productivity and the quality of job matches without harming minority hiring (Autor and Scarborough 2008; Hoffman et al 2018). When faced with similar applicant pools, managers who hire against machine-based recommendations end up with worse average hires. This emphasizes the potential of machine-based algorithms to mitigate errors and biases in human judgment across a variety of labor market domains.

Further, there is an emerging field aimed at auditing algorithms for bias (also known as 'AI neuroscience' because it aims to understand AI decisions). This is intended to deal with AI's weakness of being a black box in terms of decision-making: without such auditing there is no way to know what caused the bias. For example, the company Pymetrics, who is using AI to recruit job applicants, explicitly states that they regularly audit their algorithm. The aim of AI auditing is to increase transparency by highlighting which groups are (dis)advantaged by the algorithm. However, the case of STEM job ads shows that such audits aimed at algorithmic transparency may not always be sufficient.

All in all, there is reason to be optimistic about machine learning and other AI technologies to help identify and overcome human biases, and thereby improve decision-making and inclusion in labor markets.

The rise of new work forms is a double-edged sword in terms of inclusion. On the one hand, it increases inclusion in a multitude of ways. Although the literature is small, the best available evidence suggests that adoption of more flexible practices can boost productivity, improve morale and work-life balance, and benefit advanced economies (Council of Economic Advisors 2010). Workplace flexibility, such as part-time work or job sharing, can also facilitate a phased retirement that helps older workers transition slowly out of the workforce, allowing them to take care of health needs and maintain economic security while moving toward retirement. More generally, EU Collaborative Economy and Employment survey data show that workers cite a preference for flexibility as a reason for working in these forms (OECD 2019).

However, new work forms also raise inclusion concerns to the extent that they do not always offer the same

institutional protections such as parental leave, paid sick days, and skills training budgets as do full-time employee contracts. This differs within the group of new work forms, as illustrated in figure 34 for European countries.

In particular, for each category of employment relationship, this figure displays the average ratings of a range of employment rights. These ratings were done by experts in 12 European countries, scoring the degree of rights and protection workers have in various forms of employment relationships (McKay et al. 2012). Ratings range from 1 (no employment protection and lowest level of rights) to 5 (total protection and highest level of rights). A clear distinction emerges in these experts' perceptions between work that is full-time, part-time, fixed term, or agency, and other employment relationships. Workers in the informal economy and in zero-hours contracts are perceived as having some of the lowest access to all nine employment rights provisions.

A rise in those new work forms with lower worker rights is compounded because the rise of such work forms is disproportionately seen among women and minorities (Katz and Krueger 2019). While the platform economy can be a valuable way for older workers to continue earning money in semi-retirement (Chen et al 2019), there is evidence that these workers may not always reap the same return to experience as they would outside of the gig economy (Cook et al 2019).

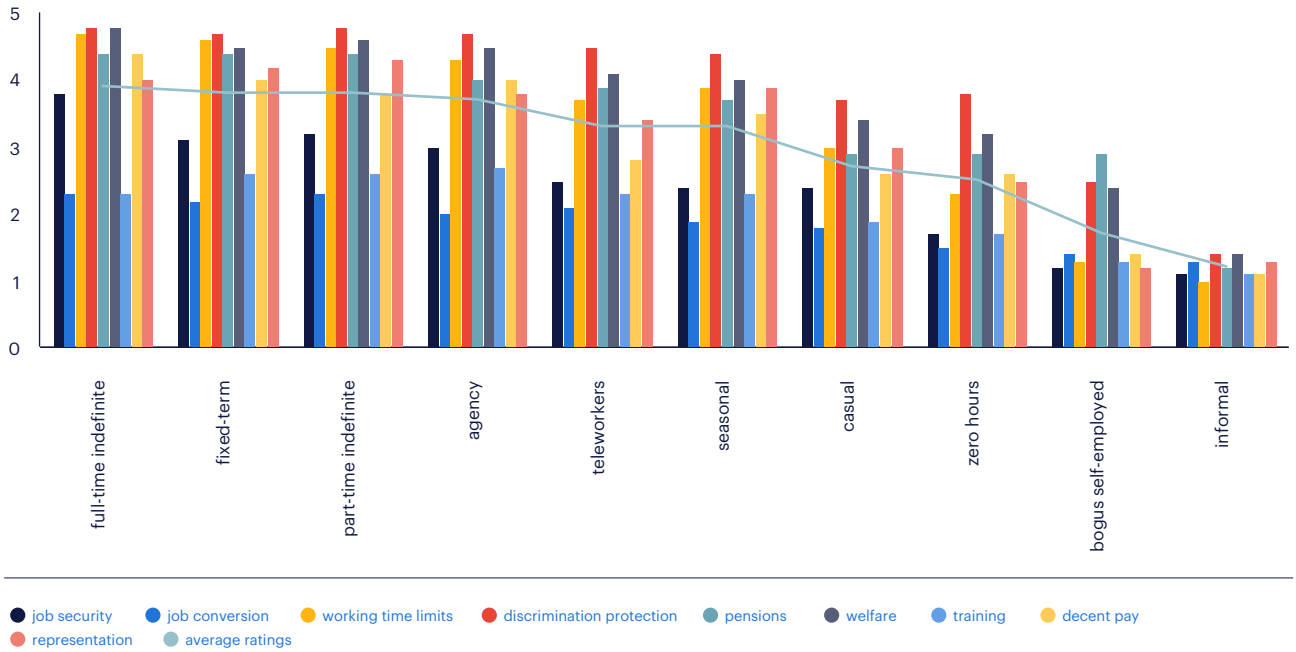
3.3 skills

Nobel Prize winner Wassily Leontief famously remarked that "Computers and robots replace humans in the exercise of mental functions in the same way as mechanical power replaced them in the performance of physical tasks. [...] This means that the role of humans as the most important factor of production is bound to diminish—in the same way that the role of horses in agricultural production was first diminished and then eliminated by the introduction of tractors." (Leontief 1983).

This humans-as-horses analogy is frequently cited as a concern for the future of work, sparking fears of a robotic apocalypse (or 'robocalypse') where humans have been made obsolete. In this context, it has also been remarked that 'the future of work requires the presence of work'. And horses have certainly been almost fully replaced by cars and tractors. However, as

figure 34. employment relationships and rights in 12 EU member states

average ratings are between 1 (no rights) and 5 (full rights)



Source: PWSR Ratings (2011)

'the future of work requires the presence of work'.

shown above, human employment is not declining as a result of automation.

A key reason for this is because there is an important difference between humans and horses: namely, that humans are not one-trick ponies. Whereas horse abilities have remained constant over time, human skills have adapted: if we could transport the labor force from 1900 to today, most workers would be utterly unable to perform in today's jobs. This is exactly because human skills have changed in line with what is demanded in the labor market. Therefore, a prime concern for providing access to work is measuring how the skills demanded from workers are changing, and investing in their acquisition.

As documented above, automation and other technological advances have been shown to increase as well as change skill demands in important ways. Further, skilled workers are known to be better able to adapt to changing skill demands over their working lives. As a result, more highly skilled workers suffer shorter unemployment spells and lower income losses from automation following displacement (Bessen et al 2019).

Further, research has documented substantial differences in skill requirements of jobs between firms, even within the same sector and occupation, and controlling for the job's formal educational and experience requirements (Kahn and Deming 2018). These skill differences are shown to correlate to differences in wages between regions and between firms. For example, computer programmers in Washington DC earn about 25% higher in Washington, DC, than in Manchester-Nashua, New Hampshire. At the same time, 35% of computer programmer vacancies in Washington, DC, require social skills, compared with only 21% in Manchester-Nashua, and firms with computer programmer vacancies in DC have about 10% higher revenue per worker than their New Hampshire counterparts. This is consistent with computer programmers in DC performing more complex functions, such as strategizing with clients or overseeing coworkers, raising their productivity.

As such, increasing and adapting the workforce's skill level is an important consideration for the future of work – and achieving this also matters for guaranteeing inclusive access to decent work.

starting points for policy discussions.

This section translates the challenges identified in the previous section into policy insights for businesses, governments, social partners, or other actors on labor markets. The objective is not to provide an exhaustive list of policy options or recommendations, but to focus on some of those that could fundamentally change current thought leadership and have a significant impact on the future of work. This implies that more traditional policy recommendations regarding educational investments and income redistribution are not reiterated here: while these remain of critical importance, we choose to focus attention on newer areas of thought to raise awareness of the possibilities. The policy insights discussed here are grouped into three main categories:

- New work relations - adapting relationships to today's realities (chapter 4.1);
- An inclusive society - upgrading the social fabric of our labor markets (chapter 4.2);
- A skilled workforce - ready to contribute to tomorrow's world of work (chapter 4.3).

4.1 new work relations – adapting relationships to today's realities

Digitalization and globalization, together with changes in labor market institutions, regulations and policies, are drastically changing work relations. This has resulted in a reduced need for static hierarchies, fixed desks, and long-term contracts. These are being replaced by flat management and temporary cross-functional teams, virtual workplaces, and shorter contracts (Baldwin 2019). These changes pose several important challenges to how workers, employers, intermediaries, and other actors on the labor market interact, and this section discusses two of these challenges: increasing worker mobility between types of work forms; and investing in inclusive technologies.

increasing worker mobility between work forms

New work forms are offering workers and firms flexibility in scheduling in many sectors: these new work forms are part of the future of work. However, it seems equally likely that more traditional work forms will persist. In some cases workers and employers might both prefer to be in a more permanent relationship for several reasons (Tirole 2017). First, the investment required to set up a business may be too large for a single worker, or even a group of workers. Even if the investments are affordable, some people prefer not to put up with the risk and stress of running a business, such as doctors or dentists who choose to be employees of a medical clinic rather than set up on their own. Second, from the perspective of a business owner, having someone work for other people may be undesirable too. If the worker has access to confidential information at work, an employer is likely to insist that people work for the one firm exclusively. When the work involves teams, and the productivity of each individual worker cannot be measured objectively (unlike that of a craftsman who works alone), the worker is not always free to organize work as he or she likes. In this case, having several employers could generate significant conflicts over the

diverse work forms will co-exist in future labor markets.

allocation and pace of work. Third, it may be the case that individual reputations based on ratings do not function well. For example, the quality of individual consultants may be hard to monitor, at least immediately, by their clients, whereas a traditional consultancy employing many consultants may be more efficient at 'guaranteeing' quality.

In short, new work forms are emerging rapidly but it is also unlikely that they will replace all traditional work relationships. That is, diverse work forms will co-exist in future labor markets. The challenge for business leaders, policy makers and social partners therefore is to ensure that a diversity of work relationships can exist and that workers can easily move between them.

This mobility of workers between forms of employment can be fostered in several ways, and we briefly discuss three examples. The first example suggests social security that is neutral to and transferrable between different work forms. The second example is to reduce the many institutional hurdles that workers face due to being in a new work arrangement or due to mobility between work forms. The third example is an illustration of how current regulations can reduce worker mobility between work forms, and it proposes one possible solution: It considers shifting the costs for employers of worker turnover from severance pay for workers to a contribution paid into the Unemployment Insurance (UI) system. It explains how this shift could reduce overall costs of job turnover for employers, thereby incentivizing them to create more jobs. At the same time, unemployment benefits ensure the income of dismissed workers despite an increase in labor market flexibility, thereby encouraging mobility of workers between work forms.

neutral and transferable social security

Social protection in case of unemployment, sickness, accident, old age, becoming a parent, and other life circumstances is a fundamental part of advanced economies' welfare systems. Protection is provided through means such as social insurance and social assistance, with the details of these schemes varying between countries. However, these schemes generally tend to assume that a person is either in traditional employment or unemployed. As a result, people engaged in new work forms are often left behind. For instance, self-employed workers are typically individually responsible for enrolling to and paying for sufficient unemployment insurance, disability insurance, and pensions.

on-board computers in trucks and driver-owner relationships

Although digitalization is likely to have contributed to the rise in new work arrangements, it can sometimes also have the opposite effect and favor more traditional employment. One example is the use of onboard computers in trucks (Baker and Hubbard 2003). Many truck drivers work for themselves, which causes some problems. The driver owns their own truck, which is a substantial investment. Drivers are investing their savings in the same sector as their labor, which is risky. In a recession, income from work and the resale value of the vehicle decrease at the same time. In addition, owner-drivers have to pay for repairs, during which time their only source of income is unavailable. If so, why aren't truckdrivers employees of a company that buys and maintains a fleet of trucks? One answer could be that, without the proper technology to monitor the behavior of truckdrivers, an employer needs to worry about the driver not being careful with the vehicle, whereas the independent trucker has every incentive to take good care of it. However, digitalization can alleviate this problem. The trucking company can monitor the driver's behavior using onboard computers, thereby favoring a more traditional employer-employee relationship.

To the extent possible, this suggests that social insurance should be neutral to the work arrangement. This could involve portable rights and benefits between different work forms, especially when combining more than one job, as current gaps in transferability may discourage individuals from moving between different work forms.

reducing institutional hurdles for people in new work forms

Even if social security were made neutral, several administrative hurdles for people engaged in new work forms remain. For instance, registering as a taxpayer, filing taxes, and getting an insurance is often much more complicated for workers in new work forms than it is for employees. Self-employed workers are sometimes treated as firms, even though they lack the dedicated administrative resources and know-how of a firm. People engaged in new work forms also face other hurdles such as obtaining a mortgage, as they are unable to present standard salary slips. Although validation of prior learning is a hurdle for all workers, it is particularly relevant for people in new work forms. Platform workers with significant work experience may struggle to prove their experience to a regular employer or educational institution, because they are unable to provide a conventional reference from a direct manager.

All this is likely to cause people in new work forms to face penalties consisting of costs and hurdles, reduced access to government services and credit, and reduced mobility to more traditional employment. These penalties should be addressed by ensuring that governments, financial institutions, and employers provide equally accessible services to all workers regardless of their form of employment. For example, temporary work agency Randstad is collaborating with financial institutions to help agency workers get access to mortgage loans. To do this, Randstad issues a statement on the future labor market perspective of the agency worker (based on an expected career trajectory and corresponding future earnings) on base of which financial institutions provide mortgages. This way, worker mobility between work forms will be increased.

shifting the costs of dismissal from severance pay for workers to an UI contribution

In many advanced economies, a company firing an employee has to pay the dismissed worker severance pay, but it does not directly pay anything for the dismissal to the UI system. Instead of requiring employers to pay dismissed workers severance pay, consider a scheme that would require them to pay a contribution to the Unemployment Insurance system for each worker they dismiss. Also assume that these dismissal payments to the Unemployment Insurance system are used to reduce social security contributions for employers, such that the change in social security is fiscally neutral for governments and for business as a whole.

Due to a shift away from expensive severance-pay regulation, companies face less costly rules and procedures for worker turnover. At the same time, unemployment benefits ensure the income of dismissed workers despite an increase in labor market flexibility, thereby encouraging mobility of workers between work forms.

Another way in which workers can benefit from this scheme is through increased training. Imagine that the costs of dismissal for a company is made proportional to the expected unemployment duration of a dismissed worker: a higher contribution to unemployment insurance has to be paid by companies for dismissing employees who will have a harder time finding new jobs. This gives companies an incentive to invest in on-the-job training to limit the length of time that workers who most need skills will be out of work in the event that they are dismissed. Similarly, it provides an incentive for management and labor in the same sector to improve the quality of ongoing vocational training, because they are incentivized to limit the typical length of time workers in their sector will remain unemployed. Consequently, job quality is expected to increase especially for the least skilled workers in the most precarious jobs.

Finally, the future of work extends beyond new work forms to new ways of finding work. For example, studies suggest that using the Internet to recruit and to search for jobs is cheaper than doing so by conventional means (Freeman 2002), has a small positive effect on wages (Bagues and Labini 2009), and may reduce structural unemployment (Kuhn and Skuterud 2004). Studies have also found Internet use to increase worker mobility (Bagues and Labini 2009) and employer-to-employer worker flows (Stevenson 2008). More recently, social media services such as LinkedIn have become means for

investing in AI technologies which are proven to raise inclusion would be good policy across many labor market domains.

workers in some occupations to market themselves to potential employers beyond their local markets. In a survey of European freelancers, almost a third said that they found work via social media platforms (EFIP & Malt 2019).

investing in inclusive technologies

As documented in chapter 3.2, emerging Artificial Intelligence technologies have the potential to raise labor market inclusion by reducing reliance on bias in human decision-making across a wide range of domains, including many areas of human resources. Further, as a general-purpose technology, AI has the potential to increase productivity, leading to economic growth and rising prosperity.

Investing in AI technologies which are proven to raise inclusion would therefore be good policy across many labor market domains. Examples are educational choice, recruitment and hiring, job search recommendations, job retention prediction, and skill (re)training. At the same time, such investments should be accompanied by careful evaluation, research, and algorithm auditing, to ensure their roll-outs do not have unintended adverse consequences for workers or firms. Here, the role of human judgment is likely to be pivotal: in a world where prediction becomes ever cheaper and more accurate, making the right choices and targeting the right outcomes becomes even more critical.

4.2 an inclusive society – upgrading the social fabric of our labor markets

Though digitalization, globalization, and the rising diversity of work forms have generally been sources of economic growth, they also pose challenges for making sure these gains are fairly shared among all citizens in society. This section discusses two pathways for building a prosperous and inclusive society.

a new way for sharing the gains from digitalization

Imagine an individual who wants to save money but has no safe to save the money in. To find the best cash safe, the individual can search for free online. This online search also produces valuable information for the company that owns the search engine: an online search for cash safes reveals the individual's intention to save money in the near future. And this intention is valuable information for sellers of cash safes who might want to advertise their products on the search engine. Or, many searches for cash safes might be an early predictor of an economy-wide recession which is valuable information to financial investors, central bankers, and policy makers. The same is true for data that workers generate for their employers that own their data: workers gain because new technologies increase their productivity. Employers gain because individual worker data are becoming increasingly valuable to firms with the increased use of Big Data, Machine Learning (ML) and Artificial Intelligence (AI).

However, the current model of free services for free data is also flawed. The most important problem is that free data are generally of low quality because they are free. For example, Facebook receives a constant flow of hundreds of millions of new photos posted each day by users. These photos are good training grounds for ML systems that Facebook is developing to automatically label and even explain photos. Yet at present, there is a mismatch between Facebook's needs and the reasons that users post photos. Users often provide little information accompanying a photo because they expect their friends to understand the context of it. The result is that the data that Facebook receives are low-quality. Facebook tries to nudge users to provide useful labels by inducing them to write comments explaining photos. But what Facebook really needs is the capacity

to ask users simple questions about the photos and receive answers from them.

Therefore, the current development and use of AI systems seem inefficient as they generally do not use high-quality data. One way to elicit users to share high-quality data is to reward those users that are best able to supply those data. Rewarding users for their private data can be done in several ways. One extreme way to do this would be to grant users of digital systems a digital property right for the data that they create – just like there exists an intellectual property right for the ideas of individuals. Another extreme example would be a digital dividend for workers related to the contribution of their work to the value of the company's intangible assets. But there are many other and, perhaps, more realistic ways in which the potential of digital technologies can be realized due to the use of higher-quality data while also sharing the gains from digitalization fairly. For example, several 'Living Labs' have emerged recently where people living in houses and neighborhoods are intensively monitored in exchange for cheaper, safer, and healthier living.

In short, the current governance of data largely neglects users' roles. Just as workers are incentivized by their weekly or monthly wage to share their time with employers – something we call 'labor' – data can also be seen as a form of labor by rewarding users for sharing their data with others who can make good use of them. This concept is generally known as 'data as labor'. Importantly, treating data (at least partially) as labor would incentivize users of digital technologies to increase the quantity and quality of data. In turn, this would improve the efficiency and further stimulate the development of new technologies, while sharing the gains from it fairly (Posner and Weyl 2018).

There are several other possible advantages of sharing the increased gains from digitalization by treating data as labor. First, rewarding individuals for their private data can be a source of self-esteem. For example, young people spend increasing amounts of time on digital interactions such as social media and video games. However, such activities are mostly framed as wasteful consumption, despite the considerable economic value that they create. This contributes to low self-esteem, resulting in some to become involved with antisocial activities such as cyberbullying and hate speech. This could potentially be mitigated by treating data as labor and directly compensating these young people for part of the economic value that they create (Ibarra et al 2018).

the smartest neighborhood in the world

In Helmond, the Netherlands, a Living Lab is currently being developed. The new 100 houses in this neighborhood will be equipped with new technologies to collect various data from their inhabitants. These new technologies provide a real-life test environment for companies to investigate how data can best be applied to improve people's lives. In return, inhabitants are allowed to take control over their own data and, depending on how much of their data they want to share, to live cheaper, safer and healthier.

Source: http://unsense.com/solution/100-houses-for-helmond/

innovating the social dialogue

In most advanced economies, labor unions were at their peaks in the 1950s, 1960s and 1970s. Union activity has generally declined since the 1980s. One reason for this decline is the process of employment de-industrialization, and the difficulties of trade unions to organize workers in new establishments in particular. The gig economy has also emerged as a small but mostly non-unionized sector, despite significant efforts and some successes by unions to organize gig economy workers. Structural changes in labor markets are thus challenging the social dialogue in many advanced economies. Social partners should (and in many cases have already started to) review and revise their organizational models and participatory processes in line with what is possible and necessary in today's environment.

For instance, some workers have self-organized into informal 'social worknets': social media groups in which they support each other and formulate collective responses to workplace issues (Wood et al 2018). These social worknets are more direct, real-time and provide a basis for a granular social digilogue at the company level, compared to the wider institutionalized social dialogue.

Thanks to its digital and informal nature, social digilogue can also cross regional and sectoral boundaries, facilitating collaboration between divisions within

structural changes in labor markets are challenging the social dialogue in many advanced economies.

multisectoral and multinational companies. Furthermore, to realize the gains from data as labor, data workers will need some organization to vet them, ensure they provide high-quality data, and help them navigate the complexities of digital systems without overburdening their time.

workers of the internet unite?

Coworker.org is a platform that allows people who work for a given company to form a 'network' together. Some networks have tens of thousands of members. Any member can start a campaign to advocate for changes in their workplace, and others can sign their petition. Workers use the platform to campaign on diverse issues, from corporation-wide pay policies to improvements to the local break room. The companies range from large multinational corporations to local firms and gig economy platforms, and participating workers range from standard employees to gig workers. Many campaigns have been successful in starting a dialogue with the employer.

4.3 a skilled workforce – ready to contribute to tomorrow's world of work

Digitalization and globalization are rapidly changing the demand for workers' skills and task competencies. In this way, they are contributing to skill mismatch and shortages that require investments in employee training. In light of these challenges, several actors, including the OECD, have focused on the question of how to achieve a better alignment of skill supply and demand, with a focus on: 1) understanding how countries collect and use information on skill needs; 2) investigating cost-effective training and labor market policies to tackle skill mismatch and shortages; 3) studying the incentives of training providers and participants to respond to changing skill needs; 4) setting up a database of skill needs (OECD 2016).

Despite these efforts, several important challenges remain. We briefly discuss three of those: Developing 'A high-resolution framework of workplace skills'; Incentivizing 'Intermediaries to increase investment in worker skills'; and 'Skills for displaced workers'.

a high-resolution framework of workplace skills

One possible definition of a worker's skills is the formal education that they received during formal schooling when young. One can then think of how digitalization and globalization have changed the demand for workers with more relative to less formal schooling (see for example Goldin and Katz 2009).

However, a more precise view would be that digitalization and globalization are changing the demand for tasks that workers do on-the-job because some tasks can be automated or offshored, but others cannot. Consequently, digitalization and globalization will change the demand for workers with different levels of formal schooling only indirectly through changes in on-the-job task requirements for workers.

This decoupling between workers' formal schooling levels and their task competencies poses the question of how to properly define skills. Consequently, several different classifications of skills (e.g., years of formal schooling, occupational or sector experience, tasks done in an occupation or soft skills such as personality traits) have been developed recently, and some studies have successfully used them to examine changes in skill usage in the labor market as a whole due to economy-wide digitalization, globalization, migration or aging.

Although these recent classifications go beyond formal schooling as a measure of skill, they are not always

informative for individual workers, each with their specific formal schooling, task experiences and other competencies, as well as for individual employers, each with their specific workplaces and related skill needs.

For example, Civil Engineers and Medical Doctors are both professions that fall into the same conventional labor categories: They both have high educational requirements, make high wages, and require cognitive non-routine labor. Yet, their skill sets are largely non-transferable. To explain why Civil Engineers are unlikely to become Medical Doctors — and to explain where skill sets might limit other workers' career mobility — a higher-resolution framework for specific workplace skills is needed.

An improved resolution of workplace skills and their complementarities can shed new light on where bottlenecks limit career mobility due to skill mismatch. Or, how workers can leverage their existing skills to grow their skill set and open up new career opportunities. A high-resolution framework for workplace skills also has the potential to inform worker re-training programs aimed at maintaining employment opportunities in an increasingly competitive economy due to digitalization and globalization.

constructing the 'skillscape'

An illustration of such a high-resolution framework for workplace skills is given by Alabdulkareem et al. (2018). They use high-resolution occupational skill surveys carried out by the US Department of Labor to construct a 'Skillscape'. By examining how pairs of detailed skills co-vary across occupations, they identify pairs of skills that tend to be bundled together. For example, spatial orientation and peripheral vision are both required in occupations such as bus drivers, light truck or delivery service drivers, taxi drivers, or parking lot attendants. On the other hand, mathematics and programming have high complementarity in a very different set of occupations. They then employ a data-driven approach to map how each detailed skill is required in combination with each other detailed skill in an occupation, workplace, sector or region.

intermediaries to increase investment in worker skills

A second challenge is to better understand why there is underinvestment in on-the-job training. Underinvestment in on-the-job training is most often explained by temporary misalignments between supply and demand, in large part driven by the business cycle. However, given the persistency of skill gaps across countries and over time, it is likely that there are other and more fundamental reasons why there is underinvestment in training.

Consider the rise of new work forms with more flexible contract durations, such as on-call workers, contract workers, and independent contractors or freelancers. For these types of contracts, it becomes riskier for workers and their employers (for whom these workers actually provide their labor, not the agency that matches these workers to employers) to credibly commit ex-anteto share in both the initial costs as well as the later benefits of training. For the worker the risk is that their current contract is not extended by their employer after they have invested in training but before they can earn a return on her investment. The same is true for the employer. Consequently, both the worker and the employer may be reluctant to invest in on-the-job training.

In other words, coordination problems between workers and firms lead to a market failure in skill acquisition, and policies involving third-party intermediaries that share in the costs and benefits of training are required to increase training and reduce skill gaps.

For example, there is evidence that temporary work agencies do invest in on-the-job training, because they can typically recoup their training costs from employers by charging a wage premium for trained workers. Employers are willing to pay this wage premium because they are no longer faced with the uncertainty about a worker's skills (given that they now exactly know what training these workers received from the temporary work agency). Finally, workers benefit because they do not have to invest in their own training, yet will receive part of their increased productivity in terms of higher wages.

There are several ways in which private or public intermediaries can provide training in practice. Examples include training provided by Public

policies involving third-party intermediaries that share in the costs and benefits of training are required to increase training and reduce skill gaps.

Employment Services (PES), outplacement offices that assist displaced workers in finding new jobs (and that are funded by companies that mass lay off workers), or temporary work agencies. Typically, these intermediaries focus on the re-employment of job seekers who are currently unemployed or without permanent jobs.

But intermediaries can also train workers who have a permanent contract with their employer, especially when the labor market is tight such that the costs for companies to search for new workers is high. Many companies may not have a clear view of their own employees' talents. Specialized intermediaries can help workers find logical, reasonable career paths within the organization, while also boosting worker productivity for employers. In doing this, intermediaries can use companies' underused repositories of data on a person's skills, internal reputation, learning capacity, ambitions and interests. For some of the training, intermediaries could partner with institutions specialized in formal schooling to hand out short-term badges, nanodegrees of less than a year, one-year master's degrees, or even a 'skill passport'.

skills for displaced workers

Changes in the job structure and in the task content of existing work lead to job reallocation and displacement. For some time, the academic consensus was that job training programs were not very effective at mediating these problems. However, a meta-analysis of 97 job training program evaluations from 1995 to 2007 that more frequently employ experimental variation and higher quality data has led to the opposite conclusion: training programs are associated with positive medium-term impact, although in the short term they often appear ineffective (Card et al 2010).

Recent work has studied the impact of Trade Adjustment Assistance (TAA)—a large social insurance program that couples retraining incentives with extended unemployment insurance (UI) for workers displaced by trade shocks (Hyman 2018). This program is found to be effective: TAA-recipients have $50,000 greater cumulative earnings ten years after displacement. These effects are driven by both higher incomes and greater labor force participation immediately after training. This suggests that training can play an important role in overcoming adjustment for displaced workers. Further, returns are concentrated in the most adversely affected regions, where workers are more likely to switch industries and move in response to TAA training.

This work also indicates that training policies are potentially underused: a higher availability of such programs and awareness among workers of their eligibility may help alleviate some of the transition costs associated with structural labor market change, and reduce labor market mismatch across skills as well as regions in the process.

concluding remarks.

Several key trends, including automation, globalization, urbanization, a rising diversity of work forms and demographic change are generating significant uncertainty and anxiety about the future of work. Here, we have outlined current scientific thinking on these changes and the chances and challenges they pose for our societies, with the aim of channeling the sense of collective concern into a discussion about how to harness these changes for social benefit.

key take-aways

chapter 1 – key trends impacting the future of work

- We consider four key trends that impact the future of work: 1) technological progress and automation; 2) international trade and urbanization; 3) a rising diversity of work forms; and 4) population ageing.
- Rules-based and prediction-based technologies are replacing workers in some tasks, while complementing them in others.
- Prediction-based technologies such as machine learning and other forms of Artificial Intelligence are seeing increasing applications across labor markets, including in human resource management.
- High-skilled workers have increasingly moved to cities.
- New work forms are increasingly important in our economies, including rises in part-time and temporary work, contractor work and freelancing, and working through online platforms.
- Aging workforces are a mediating factor for other key trends: countries with older workforces adopt more robotic technologies, and the workforce of rural regions is ageing more rapidly than in cities.

chapter 2 – chances and challenges for the future of work

- Technological progress, international trade, and diverse work forms have increased productivity, economic wealth and opportunity.
- However, these forces are also accompanied by several challenges related to the future of work: rising inequality, job reallocation, and skill gaps.
- While technological advances have not decreased total employment, they have led to increased wage inequality, displaced individual workers from their jobs and hollowed out the skill distribution, leading to job polarization.
- International trade and resulting import competition have had similar distributional impacts on workers, as well as affected regions unevenly.
- Economic opportunity has been increasingly concentrated in cities, and in favor of skilled workers.
- Science, Math, Engineering and Technology (STEM) skills as well as social skills are in high demand in our labor markets.

chapter 3 – themes for the future of work

- We use three themes to think about the future of work: 1) decent work, 2) inclusion, and 3) skills.
- Automation has bolstered the availability of decent work by raising average wages and reducing exposure to dangerous and physically onerous tasks.
- Inclusion in labor markets can be enhanced by a more diverse range of available work forms and the (careful) introduction of algorithmic recommendations in hiring and other HR decision-making.
- However, inclusion may be reduced by rising inequality; lower non-wage benefits for certain types of new work forms; and by reduced medium-skilled work opportunities for non-college workers, particularly in urban areas.
- Increases in the skill level of the labor force have been an essential component for generating increasing productivity and economic growth from advancing technologies.

chapter 4 – starting points for policy discussions

new labor relations – adapting structures to today's realities

- Increasing worker mobility between types of work forms by making social security neutral to different types of work forms; by reducing institutional hurdles for people in new types of work; and changing labor market regulation that reduces mobility between work forms.
- Investing in inclusive technologies that reduce reliance on bias in human decision-making across a wide range of domains, including many areas of human resources.

a new social contract – upgrading the social fabric of our labor markets

- A new way to share the gains from digitalization such that high-quality workers' and consumers' data can be used to improve new technologies.

concluding remarks.

- Reinvigorating the social dialogue through an intensified and better organized dialogue of workers and social partners especially in the online gig economy.

a skilled workforce – ready to contribute to tomorrow's world of work

- An improved resolution of workplace skills and their complementarities to shed new light on where bottlenecks limit career mobility due to skill mismatch.
- Supporting labor market intermediaries to reduce structural skill gaps especially for women and minorities in STEM and workers at risk of displacement.

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annex: yearly report labor and flexible labor relations.

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list of figures.

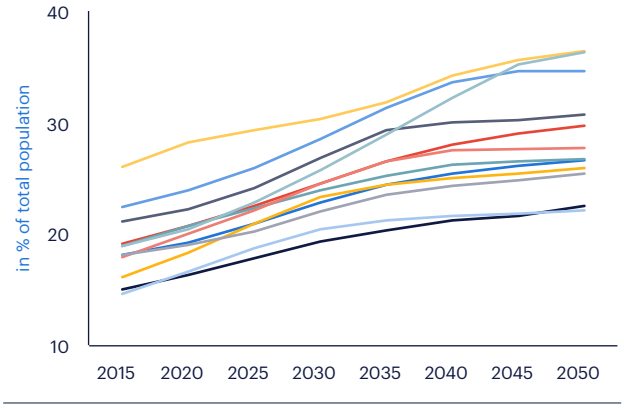
annex.

demographic shifts

Demographic shifts will significantly lower economic growth. The number of "super-aged" countries – where more than one in five of the population is 65 or older – will reach 27 in 2030. Only Germany, Italy and Japan meet that definition today. Thanks to the aging of today's middle-aged demographic swell and ongoing improvements in life expectancy, the population of seniors is projected to surge to 1.5 billion in 2050.

figure 2.1 aging populations

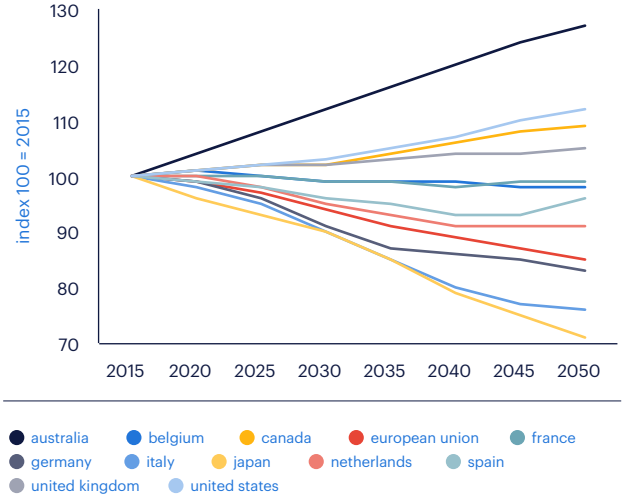
population age 65+



Source: UN population division (World Population Prospects: The 2017 Revision)

figure 2.2 working-age population

population age 15 to 64



Source: UN population division (World Population Prospects: The 2017 Revision)

The result will be a much older world, a future in which roughly one-in-six people is expected to be 65 and older by 2050, double the proportion today. In the coming decades, aging and slower rates of growth are expected to characterize the populations of all major regions in the world. Ranked by median age, Europe is currently the oldest region in the world and will remain so in 2050.

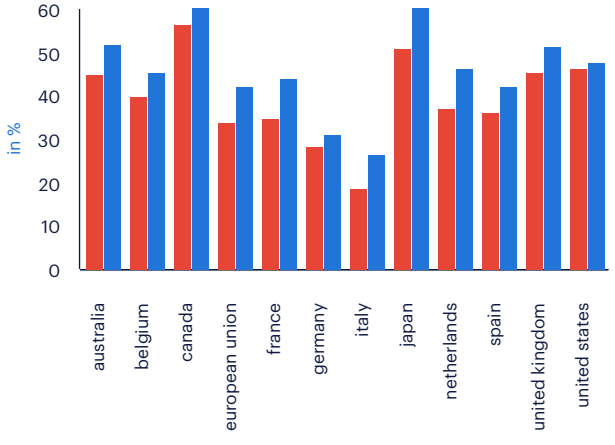
skills

Being skilled has always been an advantage – if not a necessity – for individual workers. Today, having a skilled workforce is just as much a necessity for countries competing in an advanced economy. Promoting education and training is an important facet of developing a skilled workforce. Skilled people generate knowledge that can be used to create and implement innovations and educated workers have a better start for acquisition of further skills. On the other hand, a concern is that in the future of work, only the highly skilled will have access to rewarding professional careers, and that this trend will increase inequality on the labor market.

Even at the height of the crisis employers reported having difficulties in finding workers with the appropriate skills. Employers say they cannot fill vacancies because even highly-qualified candidates have the wrong skills. The education systems 'educate graduates of tomorrow in the skills needed in the industry yesterday' as they claim. Many employers are concerned that applicants lack 'soft skills', such as

figure 2.3 share of labor force with tertiairy education

2017

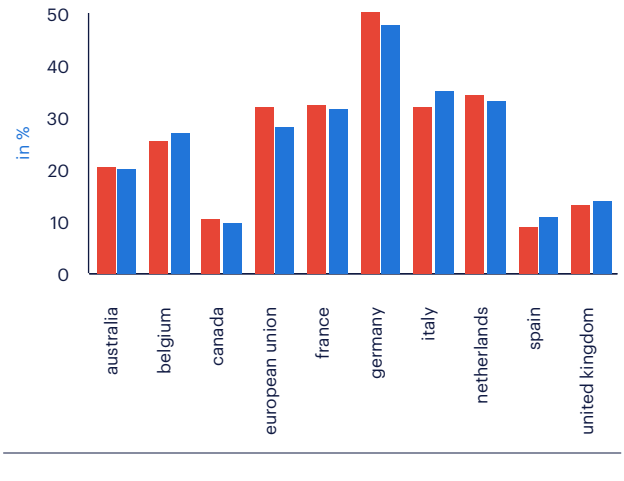


Source: OECD.stats (Education and Training)

interpersonal, communication and analytical problem-solving abilities. This clearly indicates that jobs in growing sectors such as health, education and other services require a different set of skills than those acquired by unemployed people who worked in declining sectors, such as agriculture and manufacturing. Youth often lack certain social and emotional skills such as those involved in working in teams, which can undermine the use of their cognitive skills.

figure 2.4 share of labor force with vocational training

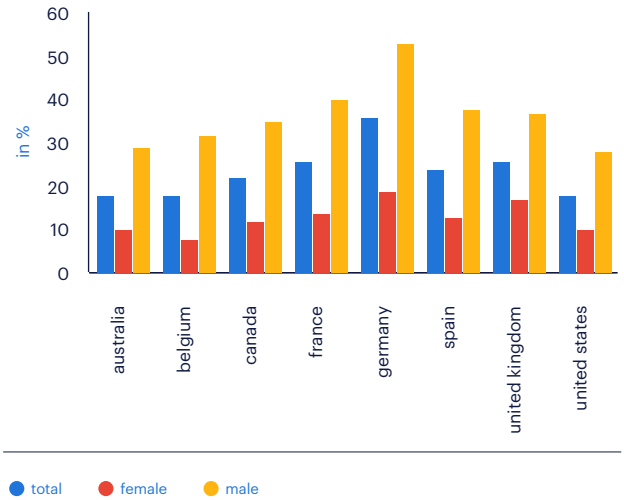
2017



Source: OECD.stats (Education and Training)

figure 2.5 share of STEM studies in tertiairy graduates

2016



Source: OECD.stats (Education and Training)

labor participation

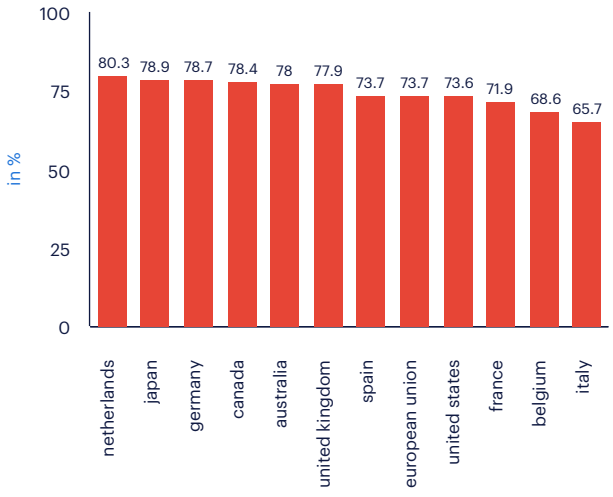
Globally, there are over 2 billion working-age people who are not participating in the labor market. The share of the population over the age of 15 that is active in the labor market varies tremendously. Variation in participation rates are due to both cyclical and structural factors. When jobs are scarce due to recession or slow recovery in the economic cycle, some jobseekers become discouraged and drop out of the labor market.

In terms of structural factors, population ageing and increasing years spent in education in many countries result in shrinking or slower growth in the working-age population. These two effects need to be differentiated to provide a clearer understanding of the future path of labor force participation and to design and implement an effective set of policy interventions.

As for women, their participation has been rising in all countries for several decades. Each new generation of women has had a stronger attachment to the labor market than the previous one. There are probably important cultural reasons for this, but the increase has also been enabled by technical progress, allowing housework to be done more easily, while higher educational attainment has also played a role in luring women into the job market. Policies have also affected this trend and appear to play an important role in explaining cross-country differences in female participation.

figure 2.6 labor participation

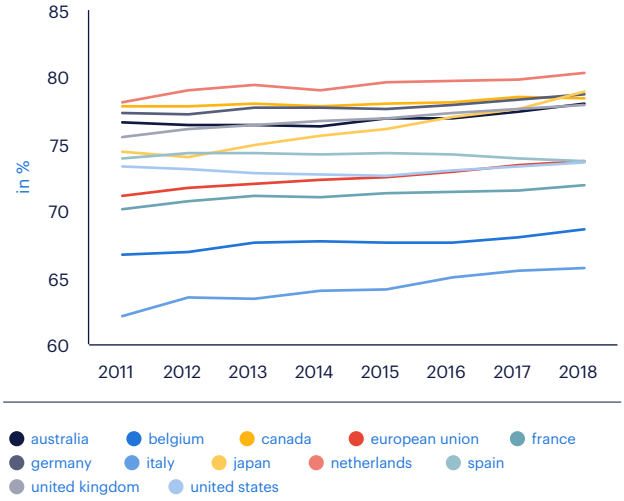
age 15 to 64, 2018



Source: OECD.stats (Labour force survey)

figure 2.7 labor participation 2011-2018

age 15 to 64

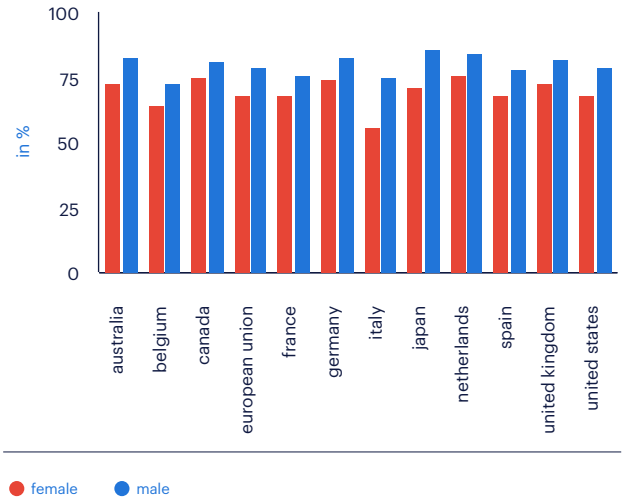


Source: OECD.stats (Labour force survey)

There is a strong presumption that those countries which achieved high labor force participation also had the best policy framework. The time has come to implement a new set of policies conducive to stronger growth, higher employment and sounder pension systems. To cope with mounting financial pressures due to the ageing of society, governments have to make hard choices. In particular, to avoid increasing the tax burden or impoverishing pensioners, they are now looking at ways of inducing more people to enter or stay in work.

figure 2.8 labor participation by gender

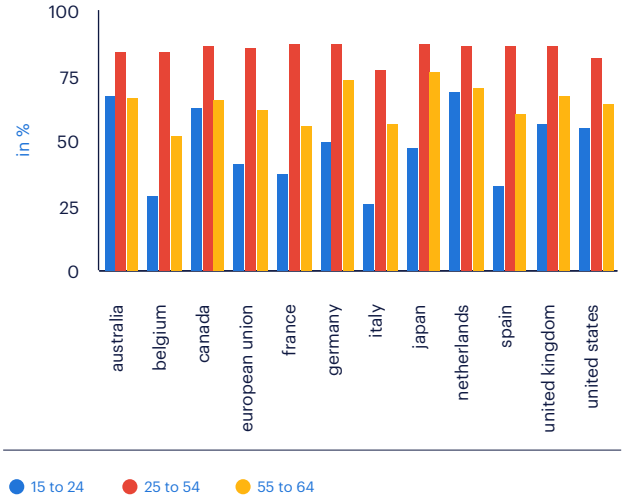
age 15 to 64, 2018



Source: OECD.stats (Labour force survey)

figure 2.9 labor participation by age group

2018



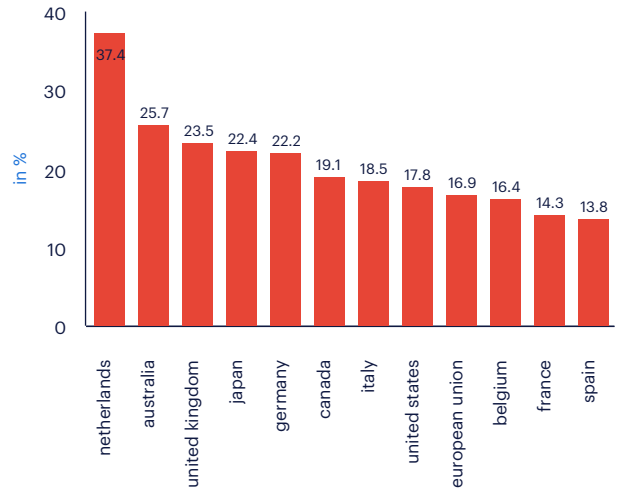
Source: OECD.stats (Labour force survey)

part-time employment

The rise in labor participation in the 90's of last century owes to a large extent to the possibility of part-time jobs, which stimulated many households to participate with both members. In that period some countries faced a transition from the standard 'breadwinner household' to the more modern '1.5 jobs per family' households, gaining popularity among young families with children.

figure 2.10 part-time employment

age 15 to 64, 2017

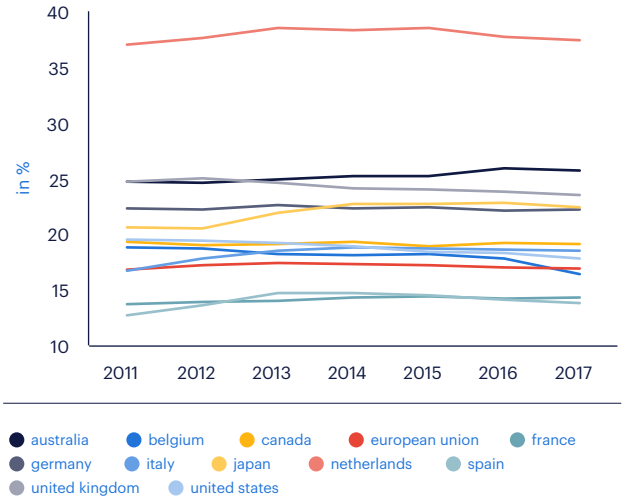


Source: OECD.stats (PT employment by common definition (US by national definition))

Part-time work is still a female and young phenomenon. Most of the increased female participation during the nineties, was through women entering the labor market in part-time jobs. When looking at the incidence of part-time work we see that the Netherlands take a special position. Nearly 40% of all employed Dutch persons are working in a part-time job of less than 30 hours/week, mostly women.

figure 2.11 part-time employment 2011-2017

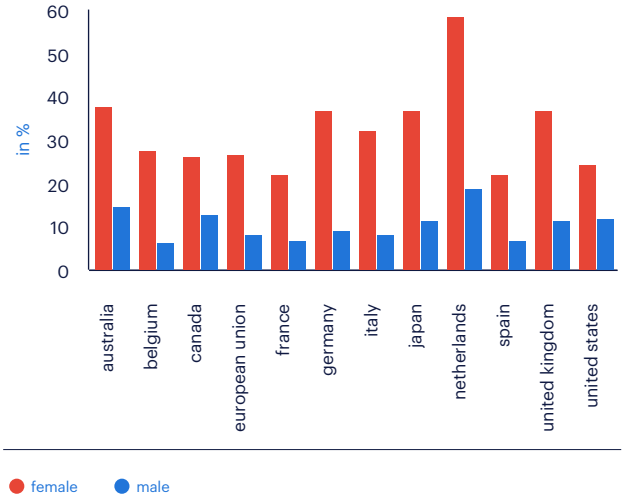
age 15 to 64



Source: OECD.stats (PT employment by common definition (US by national definition))

figure 2.12 part-time employment by gender

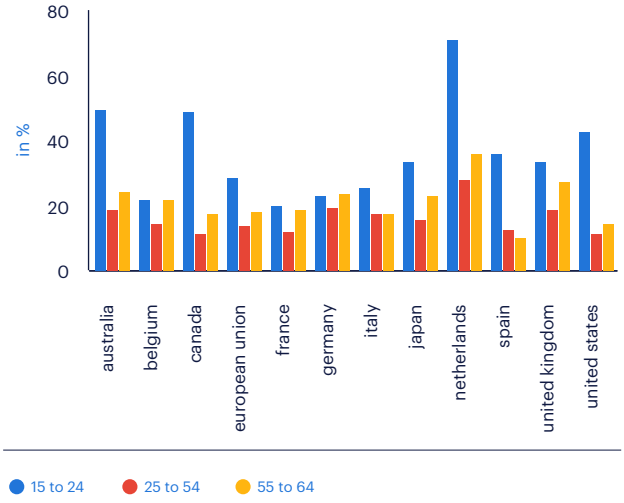
age 15 to 64, 2017



Source: OECD.stats (PT employment by common definition (US by national definition))

figure 2.13 part-time employment by age group

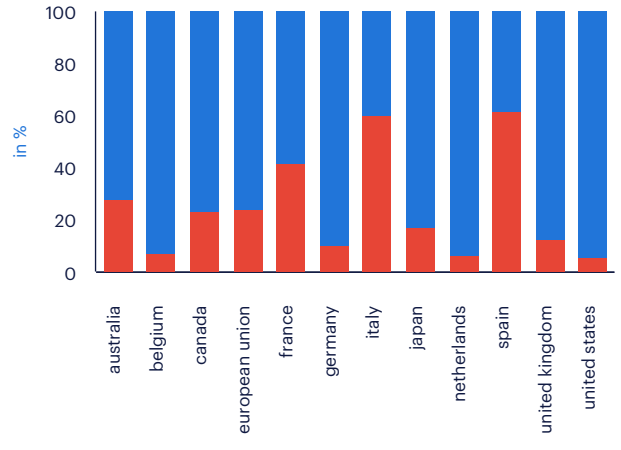
2017



Source: OECD.stats (PT employment by common definition (US by national definition))

figure 2.14 (in)voluntary part-time employment

age 15 to 64, 2017



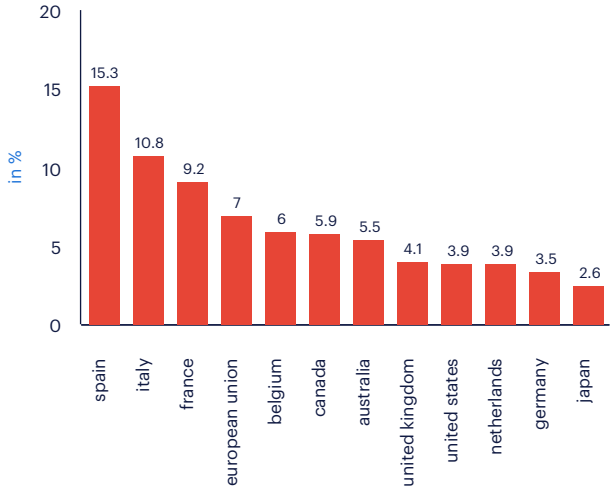
Source: OECD.stats (PT employment by common definition (US by national definition))

unemployment

After a long period of high unemployment and underemployment labor market conditions are finally improving even in those countries hit hardest by the global financial and economic crisis. In many countries there has been a drop in unemployment numbers since the global financial crisis, but there is some evidence that this is not only due to jobs growth but also because long-term unemployed are giving up on trying to find a

figure 2.15 unemployment

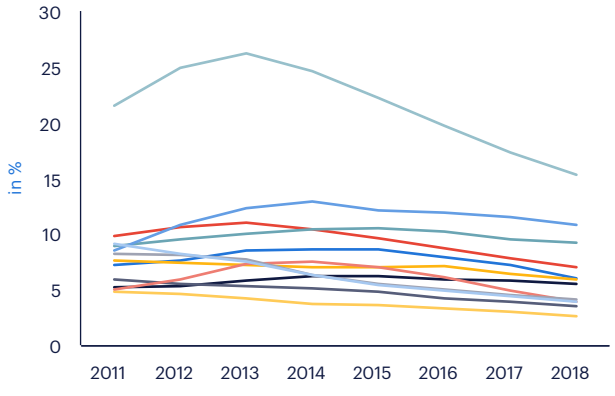
age 15 to 64, 2018



Source: OECD.stats (Labour force survey)

figure 2.16 unemployment 2011-2018

age 15 to 64

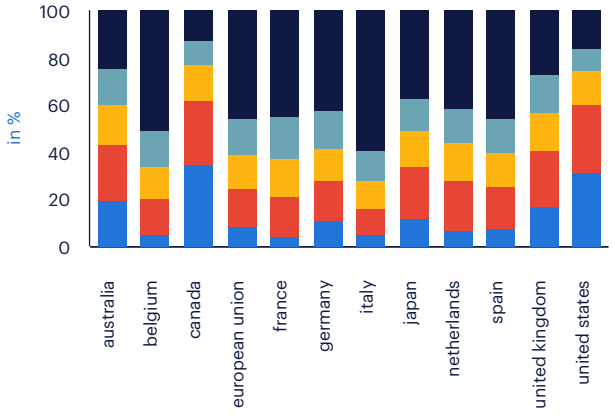


australia belgium canada european union france
germany italy japan netherlands spain
united kingdom united states

Source: OECD.stats (Labour force survey)

figure 2.17 unemployment by duration

share of total unemployment, 2017

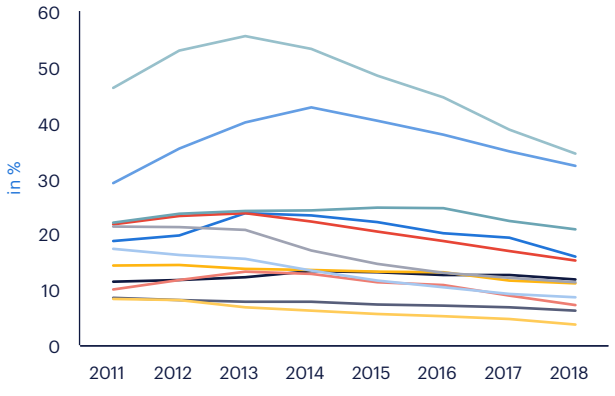


< 1 month > 1 month and < 3 months > 3 month and < 6 months
> 6 month and < 1 year 1 year and over

Source: OECD.stats (Labour force survey)

figure 2.18 youth unemployment 2011-2018

age 15 to 24



australia belgium canada european union france
germany italy japan netherlands spain
united kingdom united states

Source: OECD.stats (Labour force survey)

job. In Southern Europe labor market conditions are slowly improving and are expected to continue to do so in the short term.

Long-term unemployment has likely peaked but remains a major concern. In countries hardest hit, notably in Southern Europe, this has led to a rise in structural unemployment which will not be automatically reversed by a pick-up in economic growth. Long-term unemployment reveals an important problem of labor market. Because the longer one stays unemployed, the smaller becomes the chance of getting back into employment. Workers unemployed for long periods risk losing their skills, face reduced employability and are at greater risk of poverty. This means that unemployment on itself is not necessarily the problem, but the persistence of unemployment is. As long as mobility is high, people won't stay unemployed for too long.

Young people have suffered a disproportionate share of job losses during the global economic crisis. Coping with unemployment is difficult for everyone. But for low-

skilled youth, and especially those who have left school without qualifications, failure to find a first job or keep it for long can have negative long-term consequences on career prospects – a phenomenon often referred to as "scarring". The risks posed by a scarred generation have motivated many governments to take vigorous action, notably by scaling up funds for youth labor market programs.

flexible labor relations

Although the traditional open-ended labor contract is still the standard labor relation, many other forms of more flexible labor relations have developed over the last decades. These other forms of labor relations vary in the type of flexibility: flexibility in the duration of the contract (fixed-term contracts), flexibility in the company people work for (e.g. triangular labor relations such as agency work) and flexibility in the labor relation (e.g. self-employed workers). All these other types of contracts can be interpreted as flexible labor contracts as opposed to the traditional open-ended labor contract with a direct employer.

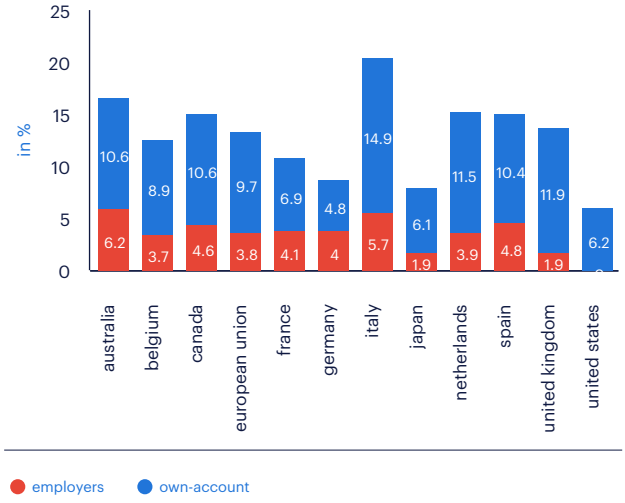
Flexible labor relations enable companies to quickly adjust the size and composition of their workforce when innovations change their product lines and production methods. These flexible labor relations also enable companies to screen workers with respect to their productivity and creativity before adding them to their more permanent workforce. Through this way of matching, long-term labor relations become more efficient to the employer. If flexible labor relations are used to support innovation processes and optimize the quality of the workforce, it enables further economic growth.

self-employment

Self-employment includes both owners of businesses, who can be considered employers rather than employees, and own-account workers. Many self-employed workers can be found in the agricultural sector and small retail. Therefor, countries with a large share of employment in these sectors have a high rate of self-employment. This is especially so in the developing and emerging regions of the world like Southern and Southeastern Asia and Latin-America where by far the highest rates of self-employment can be found. Self-employment rates here easily exceed 25% and reach up to over 80% in India. Often distinction

figure 2.19 self-employment

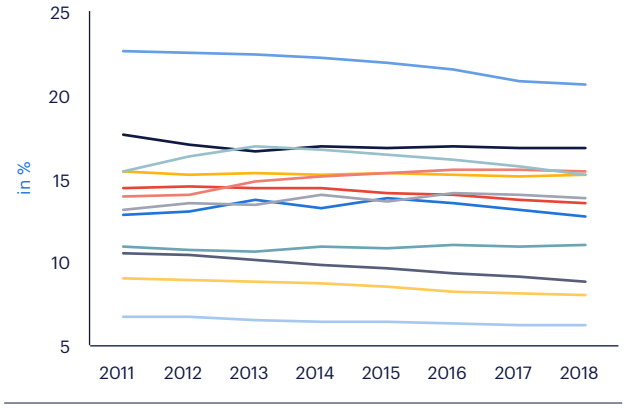
share of total employment, age 15 to 64, 2018



Source: Eurostat, ILOstat (Labour force survey)

figure 2.20 self-employment 2011-2018

share of total employment, age 15 to 64



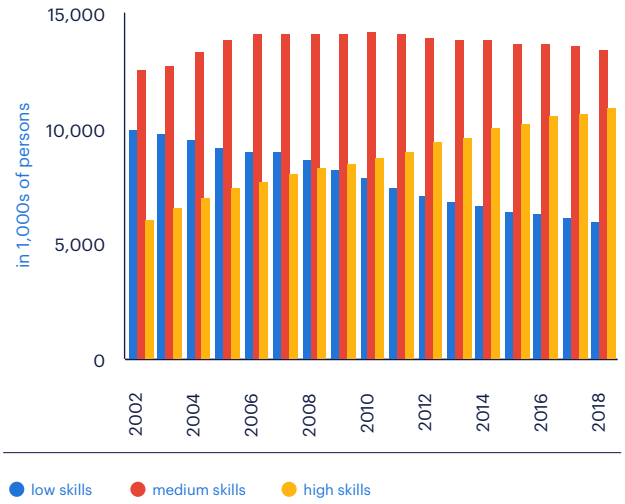
Source: Eurostat, ILOstat (Labour force survey)

between self-employment and informal work is difficult to make in these regions.

In the western world however self-employment rates are more moderate. About half of all flexible labor relations consist of self-employment. The highest shares of self-employment can be found in Southern- and Eastern-European countries where – again – agricultural businesses and small retail still hold a large part of total employment. These stable self-employment rates hide a strong variety. Variety between countries, sectors and

figure 2.21 self-employment by level of education in the european union

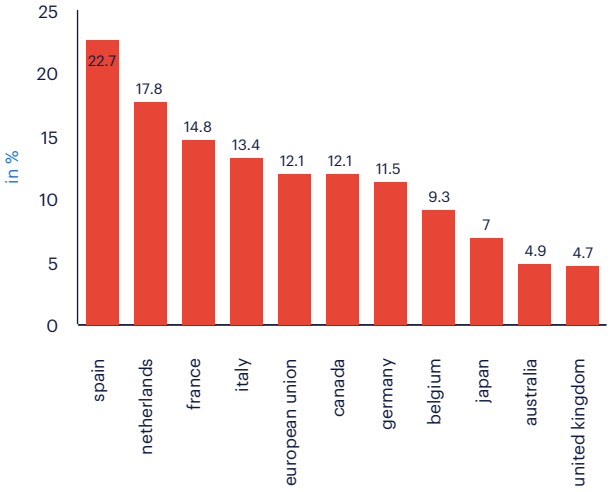
age 15 to 64



Source: Eurostat, ILOstat (Labour force survey)

figure 2.22 temporary employment

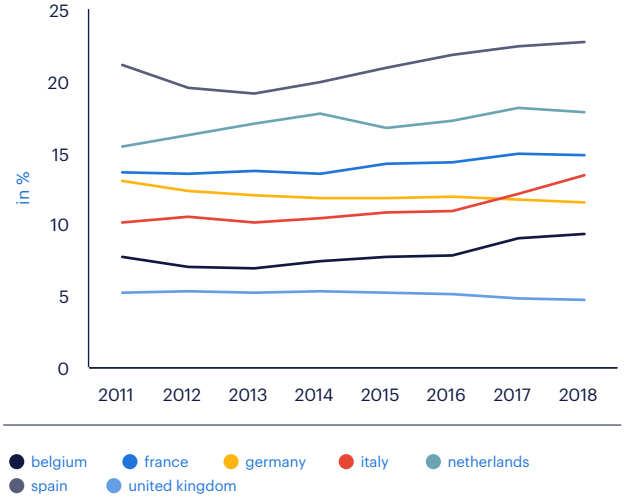
share of total employment, age 15 to 64, 2018 (Australia, Canada, Japan 2017)



Source: Eurostat, OECD.stats (Labour force survey)

figure 2.23 temporary employment 2011-2018

share of total employment, age 15 to 64



Source: Eurostat (Labour force survey)

educational attainment. When we look closer at the figures for Europe it is clear there has been a decline of self-employment in Southern- and Eastern Europe. On the other hand, self-employment in France, the UK and especially the Netherlands self-employment has been rising in the past decade.

temporary employment

In many countries temporary work has been an important component of employment growth in the last one or two decades. Temporary contracts may facilitate job matching, by providing an initial work experience especially for youths (either during their educational period, for starters or for drop-outs) while also allowing employers to screen suitable candidates. For employers temporary jobs also offer the opportunity to adapt the size of their workforce to the economic conditions.

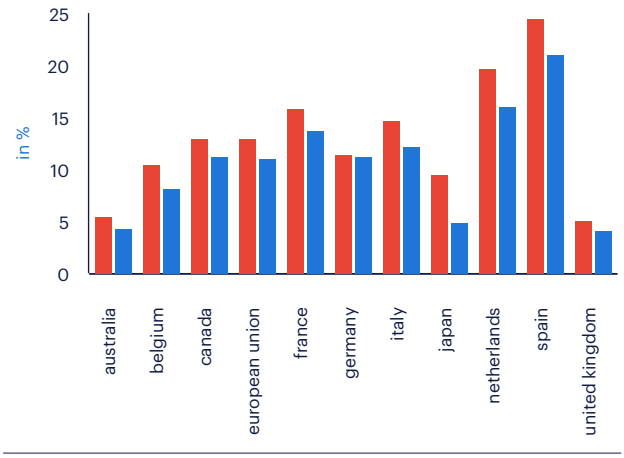
Currently, about half of all flexible labor consists of fixed-term contracts (the other half being self-employment). Most western countries between 5 and 20 percent of all workers have fixed-term contracts. The United States, Australia and the United Kingdom show traditionally the lowest figures due to the less stringent employment protection. Temporary work is more common among youth. Part of this effect is caused by the fact that many young people are still in education, and therefore not available for a fulltime job. The relations in temporary employment rates between the age-groups has been very constant over the years which indicates most youth who are in temporary employment do step into open-ended employment by the time they reach their thirties or before.

agency work

Agency work accounts for a relatively small but important part of total employment. It has a long tradition in the United States, with a long-term share in total employment of around two percent. In Europe, agency work has the highest employment share in the

figure 2.24 temporary employment by gender

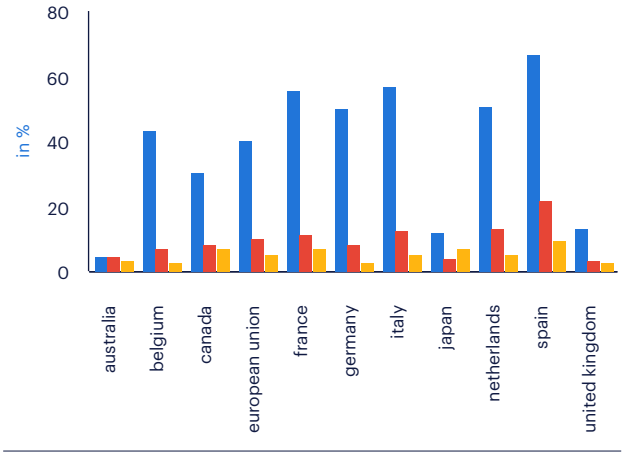
share of total employment, age 15 to 64, 2018 (Australia, Canada, Japan 2017)



Source: Eurostat, OECD.stats (Labour force survey)

figure 2.25 temporay employment by age group

share of total employment, 2018 (Australia, Canada, Japan 2017)



Source: Eurostat, OECD.stats (Labour force survey)

United Kingdom with over four percent, followed traditionally by the Benelux countries and France, where agency work has been well-established for four to five decades now. With agency work, the employer does not hire an employee directly on a fixed-term contract, but through a private employment agency.

Agency work give employers the opportunity to adapt the size of their workforce to economic conditions and at the same time facilitate job matching by providing initial work experience. This is particularly true for younger people, either during their educational period or when starting on the labor market, but also for the unemployed to find their way back to the labor market. Although there are significant differences between the countries, each show that agency work is a stepping stone out of unemployment into work. Clearly, people use the experience and skills they obtain while working as an agency worker to make a next move on the labor market.

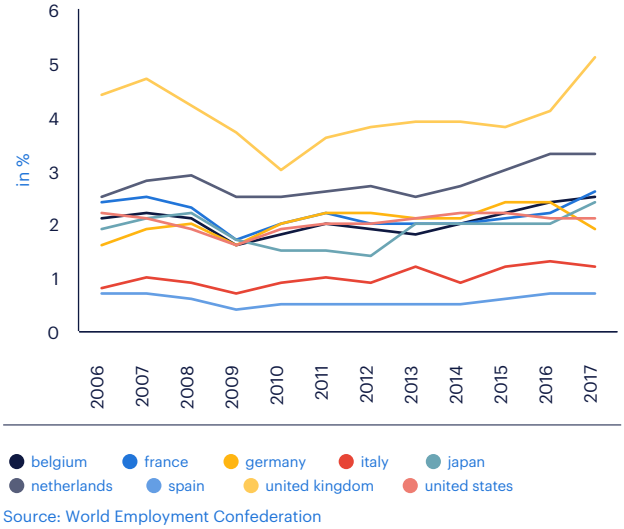
figure 2.26 agency work

share of total employment, age 15 to 64, 2017

Source: World Employment Confederation

figure 2.27 agency work 2011-2017

share of total employment, age 15 to 64, 2017



Source: World Employment Confederation

data tables.

unemployment

age 15 to 64, unemployment rates in %

	year								gender		age		
	2011	2012	2013	2014	2015	2016	2017	2018	female	male	15 to 24	25 to 54	55 to 64
argentina	7.1	7.3	6.6	7.0	6.9	8.4	8.7	..	10.9	7.3	24.7	6.3	..
australia	5.2	5.3	5.8	6.2	6.2	5.9	5.8	5.5	5.5	5.5	11.8	4.1	4.3
austria	4.6	4.9	5.4	5.7	5.8	6.1	5.6	4.9	4.7	5.1	9.4	4.4	3.8
belgium	7.2	7.6	8.5	8.6	8.6	7.9	7.2	6.0	5.6	6.4	15.9	5.4	4.4
brazil	6.7	7.2	7.0	6.7	8.4	11.6	12.9	..	15.1	11.2	30.5	9.0	..
canada	7.6	7.4	7.2	7.0	7.0	7.1	6.4	5.9	5.6	6.2	11.1	4.9	5.4
chile	7.4	6.7	6.2	6.6	6.5	6.8	7.0	7.3	8.0	6.8	17.6	6.6	4.2
czech republic	6.8	7.1	7.0	6.2	5.1	4.0	2.9	2.3	2.9	1.8	6.7	2.0	2.0
denmark	7.7	7.7	7.2	6.8	6.3	6.4	5.9	5.1	5.2	5.0	9.4	4.5	3.6
estonia	12.6	10.3	8.9	7.6	6.3	7.0	5.9	5.5	5.5	5.4	11.9	4.7	5.5
european union	9.8	10.6	11.0	10.4	9.6	8.7	7.8	7.0	7.2	6.7	15.2	6.3	5.3
finland	7.9	7.8	8.3	8.8	9.6	9.0	8.8	7.5	7.4	7.6	16.8	6.1	6.9
france	8.9	9.5	10.0	10.4	10.5	10.2	9.5	9.2	9.2	9.1	20.8	8.1	6.9
germany	5.9	5.5	5.3	5.1	4.8	4.2	3.9	3.5	3.0	3.9	6.2	3.2	2.9
greece	18.1	24.7	27.7	26.7	25.1	23.7	21.7	19.5	24.4	15.5	39.9	18.9	15.3
hungary	11.1	11.1	10.3	7.8	6.9	5.2	4.2	3.8	4.0	3.5	10.2	3.4	2.6
iceland	7.1	6.1	5.5	5.1	4.2	3.1	2.9	2.8	2.6	3.0	6.0	2.1	..
ireland	15.7	15.8	14.0	12.1	10.2	8.6	6.9	5.9	5.8	6.0	13.7	4.8	4.6
israel	5.7	7.0	6.3	6.0	5.3	4.9	4.3	4.1	4.1	4.1	7.1	3.6	3.0
italy	8.5	10.8	12.3	12.9	12.1	11.9	11.5	10.8	11.9	10.0	32.2	10.4	5.7
japan	4.8	4.6	4.2	3.7	3.6	3.3	3.0	2.6	2.4	2.7	3.7	2.5	2.3
korea	3.5	3.3	3.2	3.6	3.7	3.8	3.8	3.9	3.8	4.0	10.5	3.6	2.9
latvia	16.5	15.4	12.1	11.1	10.1	9.9	8.9	7.6	6.6	8.5	12.2	7.2	7.6
lithuania	15.7	13.7	12.0	10.9	9.3	8.1	7.3	6.4	5.6	7.1	11.2	5.6	7.2
luxembourg	5.0	5.2	5.9	5.9	6.7	6.3	5.5	5.6	5.9	5.4	14.1	5.1	3.6
mexico	5.4	5.1	5.1	5.0	4.5	4.0	3.6	3.4	3.6	3.3	6.9	2.8	1.7
netherlands	5.0	5.9	7.3	7.5	7.0	6.1	4.9	3.9	4.0	3.7	7.2	2.8	4.5
new zealand	6.3	6.7	6.0	5.6	5.6	5.4	4.9	4.5	4.6	4.3	11.5	3.2	2.4
norway	3.3	3.2	3.5	3.6	4.5	4.8	4.3	3.9	3.7	4.2	9.7	3.4	1.5
poland	9.8	10.2	10.5	9.1	7.6	6.3	5.0	3.9	3.9	3.9	11.8	3.4	2.8
portugal	13.4	16.3	17.0	14.5	13.0	11.5	9.2	7.3	7.6	6.9	20.3	6.1	6.6
slovak republic	13.7	14.0	14.3	13.2	11.5	9.7	8.2	6.6	7.1	6.2	14.9	6.1	5.3
slovenia	8.4	9.0	10.3	9.9	9.1	8.1	6.7	5.2	5.8	4.7	8.8	5.0	4.9
spain	21.5	24.9	26.2	24.6	22.2	19.7	17.3	15.3	17.1	13.8	34.4	14.1	13.8
sweden	8.0	8.2	8.2	8.2	7.6	7.2	6.9	6.5	6.4	6.6	16.7	5.3	4.5
switzerland	4.5	4.6	4.9	5.0	4.9	5.1	5.0	4.9	5.3	4.6	7.9	4.5	4.0
turkey	9.0	8.4	8.9	10.1	10.5	11.1	11.1	11.1	14.0	9.7	20.1	9.7	6.8
united kingdom	8.2	8.1	7.7	6.3	5.5	5.0	4.5	4.1	4.1	4.2	11.3	3.0	3.3
united states	9.1	8.2	7.5	6.3	5.4	4.9	4.4	3.9	3.9	4.0	8.6	3.3	2.9

Source: OECD.stats (Labour force survey)

data tables.

labor participation

age 15 to 64, activity rates in %

	year								gender		age		
	2011	2012	2013	2014	2015	2016	2017	2018	female	male	15 to 24	25 to 54	55 to 64
argentina	60.8	60.7	60.4	59.8	60.0	59.9	59.8	..	47.3	73.2	37.7	65.8	..
australia	76.6	76.4	76.4	76.3	76.9	76.9	77.4	78.0	73.2	82.9	67.9	84.4	66.7
austria	74.6	75.1	75.5	75.4	75.5	76.2	76.4	76.8	72.0	81.6	56.7	88.5	56.2
belgium	66.7	66.9	67.6	67.7	67.6	67.6	68.0	68.6	64.3	72.9	29.6	85.0	52.6
brazil	64.6	64.4	64.2	64.0	64.1	63.8	63.7	..	53.2	74.7	54.9	66.0	..
canada	77.8	77.8	78.0	77.8	78.0	78.1	78.5	78.4	75.1	81.7	63.3	87.0	66.5
chile	66.2	66.3	66.4	66.6	66.8	66.8	67.4	67.6	57.9	77.3	33.4	80.3	68.5
czech republic	70.5	71.6	72.9	73.5	74.1	75.0	75.9	76.6	69.6	83.3	30.4	89.3	66.5
denmark	79.3	78.7	78.1	78.1	78.5	80.0	78.9	79.4	76.6	82.1	63.2	86.6	73.3
estonia	74.8	74.8	75.1	75.3	76.7	77.5	78.8	79.1	75.6	82.6	47.3	88.3	72.9
european union	71.1	71.7	72.0	72.3	72.5	72.9	73.4	73.7	68.2	79.2	41.7	85.9	62.0
finland	75.0	75.2	75.2	75.4	75.8	75.9	76.8	77.9	76.3	79.6	53.1	87.8	70.3
france	70.1	70.7	71.1	71.0	71.3	71.4	71.5	71.9	68.2	75.8	37.7	87.7	56.0
germany	77.3	77.2	77.7	77.7	77.6	77.9	78.3	78.7	74.3	82.9	50.3	87.7	73.6
greece	67.3	67.5	67.5	67.4	67.8	68.2	68.3	68.2	59.9	76.6	23.3	85.0	48.5
hungary	62.4	63.7	64.7	67.0	68.7	70.1	71.2	72.0	64.9	79.1	32.3	87.0	55.9
iceland	84.5	84.9	85.8	87.4	88.4	89.4	88.7	87.5	84.6	90.2	80.3	91.0	82.5
ireland	71.2	71.1	71.8	71.8	72.1	72.7	72.7	73.0	67.2	78.9	46.7	83.2	63.3
israel	64.6	71.5	71.6	72.2	72.2	72.1	72.1	72.0	69.2	74.7	47.1	83.0	69.4
italy	62.1	63.5	63.4	64.0	64.1	65.0	65.5	65.7	56.2	75.1	26.1	77.9	57.0
japan	74.4	74.0	74.9	75.6	76.1	77.0	77.6	78.9	71.4	86.3	47.7	87.5	77.0
korea	66.2	66.5	66.8	68.0	68.4	68.7	69.2	69.3	59.4	79.1	29.2	79.3	68.8
latvia	72.8	74.4	74.0	74.6	75.8	76.3	77.0	77.7	75.1	80.4	37.7	89.0	70.8
lithuania	71.4	71.8	72.4	73.7	74.1	75.5	76.0	77.3	75.8	78.9	36.5	89.6	73.9
luxembourg	68.0	69.4	69.9	70.8	70.9	70.0	70.2	71.1	67.4	74.7	33.1	88.4	42.0
mexico	63.4	64.2	64.1	63.6	63.6	63.6	63.4	63.7	47.3	81.8	43.8	73.9	56.3
netherlands	78.1	79.0	79.4	79.0	79.6	79.7	79.8	80.3	75.8	84.7	68.9	87.0	70.8
new zealand	77.3	77.1	77.5	78.6	78.7	79.8	80.9	81.1	76.6	85.8	64.2	87.4	79.9
norway	77.8	78.3	78.2	78.0	78.2	78.1	77.3	77.9	75.4	80.2	54.4	86.3	73.2
poland	65.7	66.5	67.0	67.9	68.1	68.8	69.6	70.1	63.3	77.0	35.1	85.2	50.4
portugal	73.6	73.4	73.1	73.3	73.4	73.7	74.7	75.1	72.4	78.1	34.2	89.9	63.4
slovak republic	68.7	69.4	69.9	70.3	70.9	71.9	72.1	72.4	65.9	78.8	32.3	86.5	57.3
slovenia	70.3	70.4	70.5	70.9	71.8	71.7	74.2	75.1	71.7	78.2	38.5	92.1	49.5
spain	73.9	74.3	74.3	74.2	74.3	74.2	73.9	73.7	68.6	78.8	33.0	86.9	60.5
sweden	79.9	80.3	81.1	81.5	81.8	82.1	82.5	82.9	81.2	84.6	54.2	91.6	81.6
switzerland	82.1	82.3	82.4	82.9	83.3	83.9	84.0	84.2	79.9	88.5	68.0	90.8	75.6
turkey	53.2	53.4	54.4	55.1	56.0	57.0	58.0	58.5	38.3	78.6	43.8	68.0	37.9
united kingdom	75.5	76.1	76.4	76.7	76.9	77.3	77.6	77.9	73.3	82.6	57.1	86.8	67.5
united states	73.3	73.1	72.8	72.7	72.6	73.0	73.3	73.6	68.2	79.2	55.2	82.1	65.0

Source: OECD.stats (Labour force survey)

data tables.

part-time employment

age 15 to 64, in % of total employment

	year							gender		age		
	2011	2012	2013	2014	2015	2016	2017	female	male	15 to 24	25 to 54	55 to 64
australia	24.7	24.6	24.9	25.2	25.2	25.9	25.7	38.0	15.0	49.7	19.1	24.6
austria	19.0	19.4	19.9	20.9	21.0	20.9	20.9	34.8	8.6	22.3	19.6	21.6
belgium	18.8	18.7	18.2	18.1	18.2	17.8	16.4	27.8	6.5	22.1	14.7	21.9
canada	19.3	19.0	19.1	19.3	18.9	19.2	19.1	26.2	12.7	49.1	11.9	17.6
chile	17.2	16.7	16.5	17.0	16.8	17.4	17.6	24.9	12.5	28.2	14.3	17.7
czech republic	3.9	4.3	4.9	4.8	4.7	4.9	5.4	8.7	2.7	12.2	3.4	6.3
denmark	19.2	19.4	19.2	19.7	20.0	21.7	20.4	25.3	16.0	64.0	11.2	13.5
estonia	8.9	8.2	8.0	7.6	8.6	8.7	8.1	11.4	5.0	14.9	5.3	9.5
european union	16.8	17.2	17.4	17.3	17.2	17.0	16.9	27.0	8.2	29.1	14.1	18.7
finland	12.7	13.0	13.0	13.3	13.4	14.0	14.0	17.4	10.9	38.3	8.3	14.1
france	13.7	13.9	14.0	14.3	14.4	14.2	14.3	22.2	7.0	20.4	12.1	18.8
germany	22.3	22.2	22.6	22.3	22.4	22.1	22.2	36.8	9.4	23.1	19.9	23.9
greece	9.1	9.8	10.3	11.2	11.1	11.0	11.0	16.3	7.1	24.2	10.5	9.7
hungary	5.2	5.2	4.9	4.5	4.4	4.0	3.6	5.1	2.3	4.9	2.5	6.0
iceland	16.8	17.2	17.4	16.7	17.2	17.1	17.1	24.4	10.8	46.5	10.3	11.2
ireland	25.7	25.0	24.2	23.4	23.3	22.8	22.0	33.8	11.5	41.0	17.8	27.1
israel	14.9	16.1	15.9	16.0	15.9	15.5	15.3	22.4	9.0	20.5	11.9	16.1
italy	16.7	17.8	18.5	18.8	18.7	18.6	18.5	32.4	8.3	26.1	17.9	17.9
japan	20.6	20.5	21.9	22.7	22.7	22.8	22.4	36.7	11.5	33.9	16.3	23.4
korea	13.5	10.1	11.0	10.3	10.5	10.8	11.4	16.9	7.3	27.2	6.9	12.0
latvia	8.0	8.3	7.6	6.6	6.8	7.3	6.5	8.8	4.0	10.9	4.8	7.6
lithuania	7.6	7.9	7.3	7.2	6.8	6.9	7.0	9.3	4.6	12.6	5.2	8.3
luxembourg	16.0	15.5	15.3	15.5	14.9	13.6	14.2	25.9	4.1	17.4	13.1	20.3
mexico	18.4	18.9	18.4	18.2	18.1	17.7	17.2	26.4	11.5	21.3	14.5	20.6
netherlands	37.0	37.6	38.5	38.3	38.5	37.7	37.4	58.7	18.9	71.2	28.6	36.1
new zealand	22.1	22.3	21.6	21.5	21.3	21.2	21.1	31.7	11.6	39.1	15.0	19.4
norway	20.0	19.8	19.5	18.8	19.4	19.2	18.8	26.7	11.8	50.6	12.5	16.3
poland	8.3	8.0	7.7	7.1	6.4	6.0	6.1	9.5	3.4	11.0	4.6	8.1
portugal	11.7	12.5	12.0	11.0	10.5	9.1	8.5	11.0	6.1	16.8	5.6	11.2
slovak republic	4.0	3.8	4.3	4.9	5.7	5.8	5.8	7.9	4.1	10.0	4.7	7.5
slovenia	8.6	7.9	8.6	9.6	9.2	8.0	8.8	11.8	6.1	32.8	5.5	11.5
spain	12.7	13.6	14.7	14.7	14.5	14.1	13.8	22.1	6.7	36.5	12.9	10.7
sweden	14.3	14.3	14.3	14.2	14.1	13.8	13.8	17.5	10.4	38.1	8.3	11.2
switzerland	25.9	26.0	26.4	26.9	26.8	25.9	26.7	44.6	11.2	20.1	24.6	31.0
turkey	11.7	11.8	12.3	10.6	9.9	9.5	9.6	17.9	5.9	14.2	7.4	15.1
united kingdom	24.7	25.0	24.6	24.1	24.0	23.8	23.5	37.0	11.5	33.9	19.1	27.9
united states	19.5	19.4	19.2	18.9	18.4	18.3	17.8	24.4	12.0	43.3	11.6	15.0

source: OECD.stats (PT employment by common definition (united states by national definition))

data tables.

self-employment

age 15 to 64, in % of total employment

	year								type		gender	
	2011	2012	2013	2014	2015	2016	2017	2018	employers	own-account	female	male
australia	17.6	17.0	16.6	16.9	16.8	16.9	16.8	..	6.2	10.6	12.2	20.7
austria	10.9	10.8	11.0	10.9	11.0	10.8	10.6	10.4	4.5	5.9	7.9	12.6
belgium	12.8	13.0	13.7	13.2	13.8	13.5	13.1	12.7	3.7	8.9	9.1	15.8
canada	15.4	15.2	15.3	15.2	15.3	15.2	15.1	15.2	4.6	10.6	12.0	18.2
chile	25.0	23.8	24.1	24.5	24.5	25.3	26.4	26.0	4.3	21.7	23.9	27.2
czech republic	17.5	17.9	17.0	17.4	16.7	16.6	16.6	16.4	3.0	13.0	11.1	19.9
denmark	8.8	8.8	8.9	8.7	8.3	8.3	7.8	7.7	3.1	4.1	4.4	9.6
estonia	8.5	8.6	8.9	8.9	9.2	9.4	10.0	10.5	4.5	6.0	6.5	14.0
european union	14.4	14.5	14.4	14.4	14.1	14.0	13.7	13.5	3.8	9.7	9.6	16.9
finland	12.2	12.3	12.2	12.6	12.7	12.4	11.6	11.6	3.4	8.1	8.2	14.8
france	10.9	10.7	10.6	10.9	10.8	11.0	10.9	11.0	4.1	6.9	7.7	14.1
germany	10.5	10.4	10.1	9.8	9.6	9.3	9.1	8.8	4.0	4.8	6.3	10.9
greece	30.0	31.1	31.7	30.7	29.9	29.5	29.4	29.1	7.5	21.6	22.1	34.0
hungary	11.4	11.0	10.6	10.3	10.2	10.0	9.7	9.7	4.1	5.6	7.4	11.6
iceland	11.8	11.6	11.9	11.8	11.6	11.2	10.8	11.1	3.9	7.2	8.1	13.8
ireland	15.0	14.7	14.9	14.7	14.3	14.0	13.4	12.9	4.1	8.8	6.8	18.3
israel	12.5	12.6	12.5	12.4	12.5	12.7	12.4	..	..	12.4	9.0	15.4
italy	22.6	22.5	22.4	22.2	21.9	21.5	20.8	20.6	5.7	14.9	14.9	24.8
japan	9.0	8.9	8.8	8.7	8.5	8.2	8.1	8.0	1.9	6.1	4.7	10.8
korea	23.1	23.2	22.5	22.1	21.5	21.3	21.3	..	6.0	15.3	14.4	26.3
latvia	10.1	10.2	10.5	10.6	11.6	11.8	11.8	11.0	4.4	6.6	9.1	12.9
lithuania	9.0	9.6	10.5	10.6	10.8	11.1	10.9	10.8	2.4	8.4	8.3	13.4
luxembourg	7.7	8.0	7.9	7.8	8.6	9.0	8.9	7.5	2.9	4.6	6.4	8.4
mexico	27.5	26.9	27.2	26.7	26.7	26.7	26.8	27.1	4.8	22.3	25.1	28.4
netherlands	13.9	14.0	14.8	15.1	15.3	15.5	15.5	15.4	3.9	11.5	12.0	18.4
new zealand	15.7	15.5	14.3	14.3	13.9	17.0	17.8	..	6.2	11.6	14.0	21.1
norway	6.5	6.3	6.3	6.6	6.3	6.2	5.9	5.8	1.4	4.3	3.9	7.4
poland	18.7	18.4	18.1	17.9	17.9	17.7	17.4	17.4	3.9	13.5	12.3	21.6
portugal	16.8	17.0	17.1	15.5	14.5	13.9	13.4	13.1	4.5	8.6	9.8	16.2
slovakia	15.8	15.3	15.4	15.2	14.9	15.2	15.0	14.6	2.8	11.8	9.6	18.7
slovenia	11.9	11.6	11.6	12.1	12.1	11.5	11.4	12.1	3.7	8.4	8.3	15.4
spain	15.4	16.3	16.9	16.7	16.4	16.1	15.7	15.2	4.8	10.4	11.1	18.6
sweden	9.3	9.2	9.4	9.1	8.9	8.7	8.6	8.4	3.4	5.0	5.0	11.6
switzerland	12.2	12.2	12.1	12.0	11.7	11.8	11.6	11.6	5.4	6.2	9.3	13.6
turkey	23.3	22.7	22.1	20.6	20.0	20.0	20.3	20.3	4.4	15.8	10.7	24.7
united kingdom	13.1	13.5	13.4	14.0	13.6	14.1	14.0	13.8	1.9	11.9	9.8	17.4
united states	6.7	6.7	6.5	6.4	6.4	6.3	6.2	6.2	..	6.2	5.1	7.2

Source: Eurostat, ILOstat (Labour force survey)

data tables.

temporary employment

age 15 to 64, in % of total employment

	year								gender		age		
	2011	2012	2013	2014	2015	2016	2017	2018	female	male	15 to 24	25 to 54	55 to 64
australia	5.0	5.0	4.7	4.9	3.7	..	4.9	..	5.6	4.4	5.2	4.9	3.7
austria	8.4	8.2	8.1	8.1	8.0	7.9	8.1	8.1	8.6	7.7	32.4	5.4	2.8
belgium	7.7	7.0	6.9	7.4	7.7	7.8	9.0	9.3	10.5	8.2	44.0	7.5	2.8
canada	11.6	11.5	11.4	11.3	11.3	11.2	12.1	..	13.0	11.3	30.9	8.8	7.3
chile	20.8	21.4	20.9	20.4	20.5	20.0	21.8	..	20.0	23.1	38.9	20.7	13.0
czech republic	6.5	6.8	7.5	8.0	8.3	8.1	8.0	7.0	9.3	5.2	25.3	6.2	5.1
denmark	8.1	7.9	8.1	7.9	8.0	12.4	11.9	10.3	11.9	8.9	33.6	6.9	3.6
estonia	4.1	3.2	3.2	2.8	3.1	3.4	2.8	3.1	3.1	3.1	13.0	2.3	1.8
european union	11.8	11.5	11.5	11.7	12.0	12.1	12.2	12.1	13.1	11.2	40.9	10.4	5.3
finland	13.6	13.5	13.4	13.4	13.1	13.6	13.9	14.2	17.5	11.1	42.1	11.9	7.4
france	13.6	13.5	13.7	13.5	14.2	14.3	14.9	14.8	15.9	13.8	56.2	11.8	7.1
germany	13.0	12.3	12.0	11.8	11.8	11.9	11.7	11.5	11.5	11.4	50.6	8.5	2.9
greece	7.6	6.5	6.5	7.5	7.9	7.5	7.6	7.6	9.8	6.1	21.7	7.7	3.4
hungary	8.0	8.5	9.7	9.6	10.1	8.7	7.9	6.5	7.3	5.9	14.3	5.8	7.1
iceland	10.8	11.4	12.5	11.8	11.4	10.5	9.4	8.3	10.0	6.8	23.3	6.3	2.4
ireland	9.1	9.1	9.0	8.6	8.1	7.6	7.8	8.6	9.6	7.7	32.8	5.7	4.9
italy	10.1	10.5	10.1	10.4	10.8	10.9	12.1	13.4	14.8	12.4	57.1	12.8	5.3
japan	11.9	11.9	7.3	6.7	6.6	6.3	7.0	..	9.6	5.0	12.3	4.3	7.2
korea	17.2	16.6	16.3	15.9	16.6	16.4	16.8	..	23.5	14.9	22.3	12.0	18.6
latvia	5.9	4.2	3.8	2.9	3.3	3.2	2.6	2.4	2.2	2.6	5.7	2.2	2.2
lithuania	2.4	2.3	2.4	2.4	1.8	1.7	1.5	1.4	1.3	1.5	7.3	0.9	0.9
luxembourg	6.5	6.9	6.4	7.3	9.1	7.9	8.1	8.9	9.8	8.1	40.4	6.8	4.5
netherlands	15.4	16.2	17.0	17.7	16.7	17.2	18.1	17.8	19.9	16.1	50.9	13.3	5.7
norway	7.4	7.9	7.8	7.3	7.5	8.2	8.0	7.9	9.1	6.9	26.4	6.2	2.0
poland	20.9	20.9	21.1	22.4	22.2	21.9	20.9	19.5	21.2	18.0	56.5	17.6	12.0
portugal	18.2	16.9	17.6	18.0	18.7	19.1	19.0	19.0	19.8	18.3	61.1	18.1	8.1
slovak republic	5.5	5.7	5.8	7.4	8.9	8.4	8.0	6.9	7.9	6.1	18.7	6.1	6.1
slovenia	15.2	14.4	13.7	13.7	15.1	14.6	15.2	13.5	15.3	12.0	61.5	10.5	6.2
spain	21.1	19.5	19.1	19.9	20.9	21.8	22.4	22.7	24.6	21.1	67.0	22.4	9.9
sweden	14.9	14.4	14.7	15.2	15.1	14.7	14.7	14.3	16.4	12.3	51.2	10.9	6.0
switzerland	11.0	11.0	11.1	11.2	11.8	11.5	11.5	11.4	11.6	11.1	50.0	6.5	3.1
turkey	7.7	7.7	7.8	8.7	9.0	9.1	9.1	8.7	7.6	9.2	18.9	7.0	6.4
united kingdom	5.2	5.3	5.2	5.3	5.2	5.1	4.8	4.7	5.2	4.2	13.3	3.5	3.2

Source: Eurostat, OECD.stats (Labour force survey). Definition: temporary employment/all employment.

data tables.

agency work

age 15 to 64, in % of total employment

year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
argentina	..	..	..	..	..	..	..	..	..	..	..	0.5
australia	..	..	..	2.9	2.7	2.8	2.9	2.9	3.7	3.6	..	2.7
austria	1.5	1.7	1.7	1.4	1.6	1.8	1.9	1.8	1.6	1.8	..	1.8
belgium	2.1	2.2	2.1	1.6	1.8	2.0	1.9	1.8	2.0	2.2	2.4	2.5
brazil	..	..	..	..	..	..	..	..	..	..	..	0.6
canada	..	..	..	..	0.6	0.6	..	..	..	0.7	..	1.2
chile	..	..	..	0.4	0.5	0.3	..	..	..	0.5	..	..
czech republic	..	..	0.7	0.7	0.7	0.7	0.9	0.9	0.9	0.9	..	0.7
denmark	0.7	0.7	0.8	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.7	0.9
estonia	..	..	..	..	0.5	0.6	0.6	0.6	0.7	0.6	0.5	0.6
finland	0.7	1.1	1.3	0.8	0.9	1.3	1.2	1.1	1.2	1.5	..	1.6
france	2.4	2.5	2.3	1.7	2.0	2.2	2.0	2.0	2.0	2.1	2.2	2.6
germany	1.6	1.9	2.0	1.6	2.0	2.2	2.2	2.1	2.1	2.4	2.4	1.9
greece	..	0.2	..	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.3
hungary	1.4	1.4	1.4	0.6	1.8	..	..	2.3	..	2.6	..	..
ireland	1.5	1.7	1.7	0.9	1.9	2.5	1.4	..	1.4	..	..	..
italy	0.8	1.0	0.9	0.7	0.9	1.0	0.9	1.2	0.9	1.2	1.3	1.2
japan	1.9	2.1	2.2	1.7	1.5	1.5	1.4	2.0	2.0	2.0	2.0	2.4
latvia	..	..	..	..	0.3	0.4	..	..	..	..	0.2	..
luxembourg	2.6	2.5	2.0	1.8	1.9	..	2.4	2.5	2.6	2.8	3.0	..
mexico	..	..	..	0.1	0.1	0.3	0.3	0.3	0.3	0.9	..	..
netherlands	2.5	2.8	2.9	2.5	2.5	2.6	2.7	2.5	2.7	3.0	3.3	3.3
new zealand	..	..	..	..	..	..	..	..	..	3.3	..	..
norway	1.0	1.0	1.0	0.8	0.9	0.9	1.0	0.9	1.1	1.1	1.1	1.3
poland	0.2	0.4	0.6	0.5	0.7	1.0	1.0	1.2	1.3	1.3	1.2	1.0
portugal	0.9	0.9	1.6	1.6	1.8	1.7	..	..	..	1.8	..	..
slovak republic	..	..	0.6	0.6	0.8	..	..	..	..	..	..	..
slovenia	..	..	0.2	0.2	0.5	..	..	..	..	..	..	..
spain	0.7	0.7	0.6	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7
sweden	0.8	1.3	1.3	1.0	1.3	1.4	1.3	1.5	1.4	1.5	..	1.1
switzerland	1.5	1.7	1.6	1.3	1.5	1.7	1.7	1.7	1.7	1.8	2.0	1.9
united kingdom	4.4	4.7	4.2	3.7	3.0	3.6	3.8	3.9	3.9	3.8	4.1	5.1
united states	2.2	2.1	1.9	1.6	1.9	2.0	2.0	2.1	2.2	2.2	2.1	2.1

Source: World Employment Confederation

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