Automation and Independent Work in a Digital Economy

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Digitalisation is reducing demand for routine and manual tasks while increasing demand for low- and high-skilled tasks and for problem-solving and interpersonal skills.

Digitalisation raises questions on technology's potential to substitute work. Estimates based on the Survey of Adult Skills (PIAAC) show that on average across countries, 9% of jobs are at high risk of being automated, while for another 25% more jobs, 50% of the tasks will change significantly because of automation.

Digitalisation has opened the ground for new forms of work organisation. Though the 'platform economy' may bring efficiency in matching workers to jobs and tasks, it also raises questions about wages, labour rights and access to social protection for the workers involved

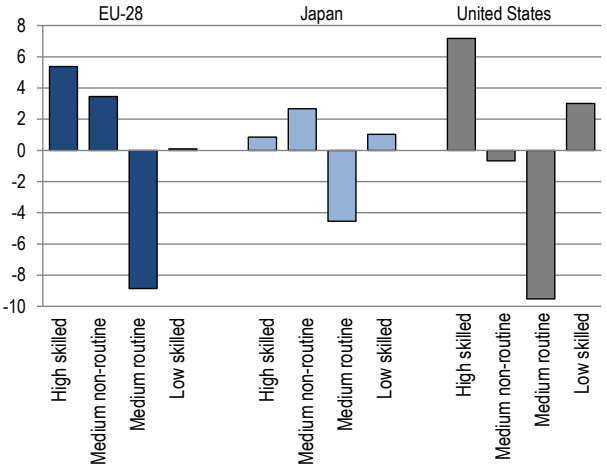
Digitalisation will provide new opportunities to many but will raise challenges for others, with the risk of growing inequalities in access to jobs and their quality and career potential. We need more rather than less policy to allow workers to grasp the new opportunities and respond to the challenges.

Digitalisation is changing the world of work

Demographic shifts, globalisation and new technologies are changing the nature of work and careers. Digitalisation is seen as a key influence on the future of work over the next decades. Ever-increasing computing power, Big Data, the penetration of the Internet, Artificial Intelligence (AI), the Internet-of-Things and online platforms are among developments radically changing prospects for the type of jobs that will be needed in the future and how, where and by whom they will be done. This has sparked a debate about the risk of greater job insecurity, growing inequality and even mass "technological" unemployment.

Figure 1. Job polarisation in the European Union, Japan and the United States

Percentage-point change in employment shares by occupation category, 2002-2014



Source: OECD calculations based on EU-LFS, Japanese Labour Force Survey and BLS Current Population Survey.

Economic history suggests that major innovations such as the steam engine, electricity and the assembly line can be disruptive. They can result in substantial job losses in the short-term, even if this is more than offset in the long-term by the creation of more productive and rewarding jobs with substantial improvements in living standards (Mokyr, Vickers and Ziebarth, 2015; OECD, 2015a). But the lessons of the past may not always apply to the future.

While technological innovation is positively associated with employment in all groups of occupations (OECD, 2015b), artificial intelligence (AI) and digitalisation challenge high-routine jobs (Marcolin et al. 2016). The rapid progress in AI is also raising the prospect that a much broader range of tasks than previously could be carried out by machines. There has already been a hollowing out of jobs involving mid-level skills (Figure 1). Automation has led to the substitution of machines for a substantial part of routine jobs, irrespective of the skill level (OECD, 2013). At the same time, the demand for workers in high-skilled, non-routine jobs has increased considerably in most advanced economies. These jobs often involve tasks such as working with new information, interpersonal skills and solving unstructured problems. Some increase has also occurred in the demand for workers in low-skilled non-routine jobs in activities such as caring and personal services that are hard to automate.

The end result has been a pattern of job polarisation by skill level in many but not all OECD countries (Autor, 2015; Berger and Frey, 2016). It is not clear how these trends will play out in the future, particularly because other structural changes are taking place simultaneously (e.g. globalisation, demographic change, etc.) but there will continue to be a high premium placed on having the cognitive skills to solve non-standard problems.

How many jobs could be replaced?

The idea of 'technological unemployment' was already highlighted by Keynes (1931). Some experts (e.g. Brynjolfsson and McAfee, 2014), suggest that the technological change we are experiencing in this 'second machine age' not only risks displacing some specific types of jobs, but could lead to a decline in overall employment. Not only will routine tasks continue to be automated but cognitive tasks that until recently were considered non-automatable are now at risk, for example, writing standard reports on stock-market changes (OECD, 2015c). Some estimates based on the characteristic tasks of each occupation suggest that almost half of all jobs in the United States and other advanced countries are at risk of being substituted by computers or algorithms within the next 10 to 20 years (e.g. Frey and Osborne, 2013).

Critics of these alarming estimates argue that occupations as a whole are unlikely to be automated as there is great variability in the tasks within each occupation (Autor and Handel, 2013). Two workers holding jobs in the same occupation may not perform the same tasks because their work may be organised differently, one requiring more face-to-face interaction or autonomy, for example. At the same time, within most if not all occupations, tasks have been evolving already for a long time.

A better approach to analysing the number of jobs at risk of automation is to analyse the task content of individual *jobs* instead of the average task content of all jobs in each *occupation*. This results in much lower figures for the share of jobs potentially at risk of automation. On a study commissioned by the OECD and using workers' reports of the tasks involved in their job from the OECD's Survey of Adult Skills (PIAAC), Arntz, Gregory and Zierahn (2016) estimate that just 9% of jobs are at a high risk of being automated on average, ranging from around 12% of jobs in Austria, Germany and Spain to around 6% or less in Finland and Estonia (Figure 2, grey bar). These are jobs for which at least 70% of the tasks are automatable.

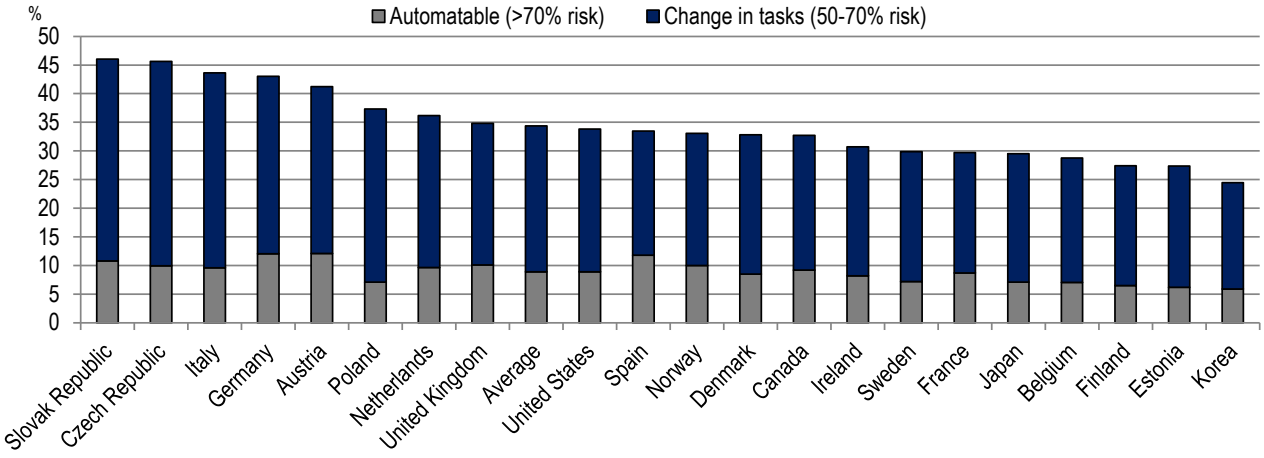
Cross-country differences in the share of workers at high risk of substitution reflect to some extent differences in how work is organised. Countries where jobs rely less on face-to-face interaction are at higher risks of automation. Country differences also reflect the extent to which technology already plays a big role in the economy. Denmark, Japan and Sweden spend a comparatively large percentage of their GDP on ICT investment, signalling that they may well have already automated several tasks or jobs (Arntz, Gregory and Zierahn, 2016).

A larger share of jobs has low risk of complete automation, but an important share (between 50% and 70%) of automatable tasks. These jobs will not be substituted entirely, but a large share of tasks may, radically transforming how these jobs are carried out. These jobs will be significantly retooled and workers will need to adapt (Figure 2, blue bar).

Across all countries, workers with a lower level of education are at the highest risk of displacement. While 40% of workers with a lower secondary degree are in jobs with a high risk of job automation, less than 5% of workers with a tertiary degree are. Thus, automation could reinforce existing disadvantages faced by some workers (Berger and Frey, 2016; Arntz, Gregory and Zierahn, 2016).

Figure 2. The risk of job loss because of automation is less substantial than sometimes claimed but many jobs will see radical change

Percentage of workers in jobs at high and medium risk of automation



Note: Data for the United Kingdom corresponds to England and Northern Ireland. Data for Belgium corresponds to the Flemish Community.

Source: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012) and Arntz, M. T. Gregory and U. Zierahn (2016), "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", *OECD Social, Employment and Migration Working Papers*, No. 189, OECD Publishing, Paris.

Technological unemployment?

The risk of extensive technological unemployment can be discounted for several reasons. First, while the number of new jobs directly created by the ICT sector may not fully compensate for jobs displaced elsewhere (Berger and Frey, 2016; OECD, 2015a), new jobs are likely to appear as technological applications develop and other sectors expand as costs fall and income and wealth increase, even if the latter may take some time to materialise. Indeed, some estimates suggest that for each job created by the high-tech industry, around five additional, complementary jobs are created (Moretti, 2010; Goos, Konings and Vandemeyer, 2015).

Second, estimates of job automation typically rely on the theoretical possibility of technology displacing existing jobs, but ignore whether these technologies are actually adopted, which may lead to overestimating the overall impact of technology on the number of jobs in the economy. Indeed the introduction of new technologies is a slow process due to economic, legal and societal hurdles, so that technological substitution often does not take place as expected.

Finally, even if there is less need for labour in a particular country, this may translate into a reduction in the number of hours worked and not necessarily a reduction in the number of jobs. This has been the experience of many European countries over past decades (Spiezia and Vivarelli, 2000).

Even if the risk of technological unemployment can be discounted, job displacement and changes to occupational structure will take place in addition to many jobs being retooled. The magnitude of these changes will vary from country to country, reflecting differences in industry structure, work organisation and the skill mix of the work force. These changes can have an adverse impact on those workers who are not able to make the transition to new jobs. If the labour market polarises even further, some workers may end up stuck in low-skill, low-paying jobs with little possibility of crossing the growing divide into jobs that provide sufficient income and well-being.

Greater work-life flexibility or greater job insecurity?

The Internet facilitates for a more efficient matching between the demand and supply of labour, products and tasks. This creates greater opportunities for workers to enjoy the flexibility and benefits of freelancing, and to top-up their income with additional work in other jobs. Service providers can divide otherwise complex tasks into a set of cheap, routine mini-tasks allocated to workers around the world. This trend has led to the flourishing of the "gig-", "on-demand-", "sharing-" or, more generally, the "platform economy" (AirBnB, Uber, Lyft, Blabla Car, Nubelo, Amazon Mechanical Turk, Task Rabbit, YoupiJob, Frizbiz, etc.) (Spiezia and Gierten, 2016).

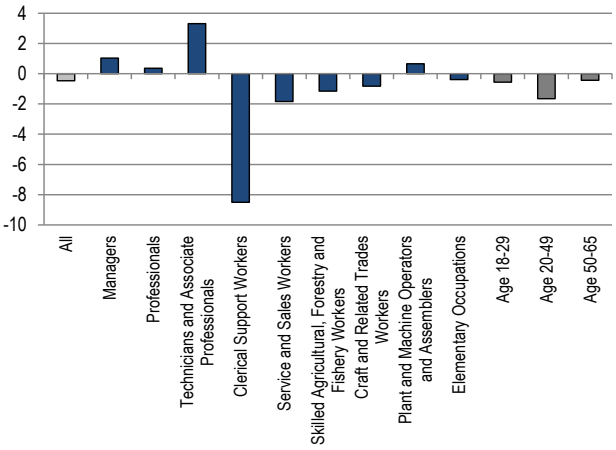
Though still relatively small in scale, the 'platform economy' is largely based on non-standard work arrangements and independent work in particular. Relative to standard wage and salary employment, workers in non-standard jobs tend to have fewer rights to social protection, receive less training, often have weaker career progression, lack access to mortgage and other forms of credit, and face greater insecurity.

It is too early to tell whether this reflects the inherent insecurity of jobs in the platform economy or whether workers who in general are likely to wind up in more precarious jobs tend to be over-represented in these new forms of work. Unfortunately, the employment data that is currently available is not suitable for examining in detail the growth in new forms of work and the extent to which they are associated with greater insecurity.

Available data suggest that between 2011 and 2013 in the EU-28 area, the share of the self-employed among those in employment aged 18 to 64 fell by 0.5% (Figure 3). However, this partly reflects the declining importance of the agriculture sector where the self-employed account for a high share of employment. By occupation, self-employment accounted for a growing share of all jobs among technicians and associate professionals. There are also some differences across countries, with a long-term rise in self-employment as a share of total employment in Germany, the Netherlands and the United Kingdom (France Stratégie, 2015).

Figure 3. Change in the share of self-employment by age and occupation in Europe

Percentage change between 2011 and 2013 in the EU-28 area



Source: OECD calculations based on the EU-LFS.

The most common sources of data on self-employment do not differentiate between independent workers who do independent work as their primary or only activity (freelance business owners, independent contractors), from those that consider themselves freelancers although they are also employees (diversified workers) or from those that had an employer and did some freelance work on the side of a regular or temporary job (moonlighters or temporary workers). Between 2014 and 2015, the share of diversified workers in total employment increased from 6% to 9% in the United States, while other forms of independent work declined during this period in the United States (Mishel, 2015).

As workers in the "platform economy" are more likely to have multiple jobs and income sources, the role and meaning of traditional labour market institutions are being challenged. Statutory working hours, minimum wages, unemployment insurance, taxes and benefits are still modelled on the notion of a traditional and unique employer-employee relationship. In addition, as independent work becomes more common, an increasing number of workers may not be covered by collective agreements. They may also not be eligible for unemployment insurance and pension and health schemes available to employees and face difficulties in obtaining credit. Currently, in 19 out of 34 OECD countries, self-employed workers are not eligible for unemployment benefits and in 10 they are not eligible for work injury benefits. Even if eligible, the self-employed in many countries receive less generous benefits or enrolment is optional, as is commonly the case for insurance benefits, sickness/maternity, unemployment and old-age/disability/survivor benefits (OECD, 2015d).

Is there a risk of growing inequality?

The polarisation of the occupational structure into high-skilled and low-skilled jobs and between open-ended and various atypical forms of employment may entail further polarisation of the wage structure into high-paying and low-paying jobs. In some countries, the reduction in the demand for workers with middle-level skills has reinforced competition for lower-paid jobs which has held down wages in the bottom half of the earnings distribution. At the same time wages at the top of the distribution have risen because of the high demand for workers with high-level skills. These developments could increase the risk of experiencing in-work poverty and the persistence of low income from work (OECD, 2015d, 2015e).

The shift to capital-intensive modes of production could also spur further declines in the labour share of GDP and further increases in inequality. The changes in the occupational structure may create regional inequalities, as new jobs are created in cities with a high concentration of highly-skilled workers, which are usually different cities than those experiencing displacement or job losses (Berger and Frey, 2016).

In the face of these developments, labour market and skill policies as well as tax and benefit schemes will need to be adapted to promote skills adaptation as well as labour mobility while at the same time ensuring that work, even low-paying work, provides a sufficient income to escape poverty.

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