

Technological change, the future of work, and public policy

Manos MATSAGANIS

Social Policy Laboratory, Polytechnic University of Milan

Abstract

Technological change destroys some jobs as it creates others, with the net effect being difficult to predict in advance. Moreover, the distance separating the ‘creative’ from the ‘destructive’ aspect of disruptive technologies may be considerable, across time and space. This raises the question of how public policy might respond, in order to minimise costs, maximise benefits, and allocate both fairly. The paper addresses three interconnected themes: the nature of the current technological revolution, its effects on labour markets, and the implications of both for public policy. It brings together three strands of the literature. The first provides historical perspective to current concerns about ‘the end of work’. The second reviews recent contributions by economists on how automation and platforms might change the nature of work. The third assesses emerging policy responses to the challenges of ‘upskilling’ and of extending social and legal rights to workers in new employment forms.

Correspondence

emmanuel.matsaganis@polimi.it

Acknowledgements

Earlier versions of this paper were presented at conferences and seminars in Vilnius, Groningen, and Wellesley, MA, while an Italian translation was published as Social Cohesion Paper 4/2018 by the *Observatory on Social Cohesion*, Reggio Emilia. The author is grateful to Dimitris Ballas, Paolo Graziano, Takis Metaxas, Stefano Sacchi, Minna van Gerven, and other participants, for comments and suggestions. Research on the paper was undertaken during the author’s stay at the *Center for the Study of Europe*, Boston University (summer 2018).

Technological change, the future of work, and public policy

Technical change has always raised fears that human work could become obsolete. Up to now, these fears have proved largely unfounded: even though change has often been a disruptive experience for those who lived through it, workers displaced from one industry eventually found employment elsewhere. In fact, throughout the developed world, many more jobs were created in manufacture than were lost in agriculture in the 18th and 19th centuries, and many more jobs were created in services than were lost in manufacture in the 20th century.

Nevertheless, the past is never a fully reliable guide to the future: there is nothing inevitable about net job creation following technical change. Automation, the latest threat to employment as we know it, might reassuringly offer opportunities for more workers than it replaces, but it might not. Furthermore, welfare states in Europe and beyond were introduced when the economy and the labour market looked very different than they do today, and their resilience in their present form cannot be taken for granted.

This paper is an essay on three interconnected themes: the nature of the current technological revolution, its effects on labour markets, and the implications of both for the welfare state. It brings together three strands of the literature. The first reviews recent contributions, mostly by labour economists, on whether automation replaces workers. The second looks at how the platform economy might change the nature of work. The third and final strand of the literature assesses the emerging responses to the question of how to extend social protection to non-standard workers and new forms of work.

The structure of the papers is as follows. Section 1 places the current technological revolution in the context of previous ones. Section 2 revisits past fears that machines may make human work redundant. Section 3 discusses ‘creative destruction’, the creation of new jobs following the introduction of labour-saving technologies, and reviews the recent literature on the effects of technology-driven change on jobs. Section 4 presents evidence on the differential impact of technology on employment. Section 5 briefly analyses the rise of the platform economy and its effects on consumers and workers. Section 6 outlines possible policy responses in the areas of education and training, labour law, and social protection. Section 7 concludes.

1. Yet another technological revolution

The current period of rapid technical change can be traced back to the invention of the microprocessor in the early 1970s, which over the next decades led to the widespread adoption of digital technologies such as the personal computer, the internet, and the mobile phone (Eurofound 2018). Because of its general applicability, the microprocessor can be compared to earlier all-purpose innovations like the steam engine and electricity.

Numbering the current technological revolution can be as tricky as it is trivial. Erik Brynjolfsson and Andrew McAfee (2014) have titled their book ‘The Second Machine Age’, in the sense of being second only to the Industrial Revolution of the late 18th century. Jeremy Rifkin’s 2011 book was titled ‘The Third Industrial Revolution’, the previous two being the Fordist assembly line in the early 20th century and of course the original Industrial Revolution. Government agencies in Germany (*Industrie 4.0*) and Italy (*Impresa 4.0*) further distinguish between the wave of automation ushered in by the application of computers and electronic controls in the 1970s, and the digitalisation that has been taking place since the 1990s (see the collection of essays in Neufeind et al. 2018). Christopher Freeman and his colleagues have proposed a different timeline (see Freeman and Louçã 2002). In their view, the British Industrial Revolution (‘The Age of Cotton, Iron, and

Water Power’) was followed by three ‘Kondratiev waves’, i.e. long cycles of rapid growth leading to consolidation leading to an eventual downswing. These were ‘The Age of Iron Railways, Steam Power, and Mechanization’ (first half of the 19th century), ‘The Age of Steel, Heavy Engineering, and Electrification’ (last quarter of the 19th century), and ‘The Age of Oil, Automobiles, Motorization, and Mass Production’ (early 20th century). Our ‘Age of The Information and Communication Technology (ICT)’ is, according to this periodization, the Fifth Industrial Revolution.

The current wave of technical change can be usefully distinguished into three categories, each with different implications for work and social protection (Eurofound 2018): automation of work (artificial intelligence, robots), use of sensors and rendering devices (‘Internet of Things’, 3D printing, virtual and augmented reality), and coordination by platforms (the emblematic case being the ride-sharing app *Uber*). The next two sections focus on the first and third of these categories.

2. The ‘End of Work’ in history

The suggestion that the current technical change will eventually lead to the ‘End of Work’ was the theme of an earlier book by Jeremy Rifkin (1995). In their recent book, Brynjolfsson and McAfee warned that:

“Rapid and accelerating digitization is likely to bring economic rather than environmental disruption, stemming from the fact that as computers get more powerful, companies have less need for some kinds of workers. Technological progress is going to leave behind some people, perhaps even a lot of people, as it races ahead.”
(Brynjolfsson and McAfee 2014, p. 11)

At about the same time, Carl Frey and Michael Osborne (2013, 2017) found that 47% of all workers in the United States were in jobs facing a high risk of automation (defined as likely to be performed by computers and algorithms with a probability of over 70% within the next 10 to 20 years).

However apocalyptic such predictions may sound, they are hardly novel. As Luc Soete (2018, p. 31) has pointed out, in the 1970s and 1980s, ‘following the widespread adoption of microelectronics, similar references were made to the literature of the 1930s and 1940s about the fear of ‘permanent’ technological unemployment, that would be brought about by automation’ [1]. In fact, the fear that technical change will cause mass unemployment is something of a recurrent feature in economic history.

At times, concern with the adverse effects of technology on jobs fuelled outright opposition to innovation. In 1412, the municipal council of Cologne issued the following declaration:

“Let it be known that a Walter Kesenger came to us with a proposal to build a wheel for spinning silk threads. After deliberation and discussion with their friends, the council has found that many people in our city who spin silk for a living would be ruined. It has therefore been declared that no spinning wheel shall be built and installed, now or at any time hereafter.” (Quoted in Lenk and Maring 2001, p. 34)

Almost two centuries later, William Lee, a priest with a degree from University of Cambridge, heard that Queen Elizabeth I (1558–1603) had issued a ruling that her people should always wear a knitted cap, observed his mother and sister ‘sitting in the evening twilight plying their needles’, and became obsessed with making a machine that would free people from endless hand-knitting. In 1589, his ‘stocking frame’ knitting machine ready at last, he travelled to London to seek an audience with Elizabeth I, with the help of his local member of Parliament, who was sympathetic. But the Queen refused to grant him a patent, icily observing instead:

“Thou aimest high, Master Lee. Consider thou what the invention could do to my poor subjects. It would assuredly bring to them ruin by depriving them of employment, thus making them beggars.” (Cited in Acemoglu and Robinson 2012, pp. 182-183)

Eventually, of course, labour-saving technologies were introduced. In fact, it was their adoption and diffusion that launched the Industrial Revolution. The resulting growth in productivity was enormous: spinning machines allowed one worker to produce the amount of yarn previously produced by 200 workers. Obviously, the latter were not favourably inclined to the machines that displaced them, and on occasion they took matters into their own hands – quite literally in the case of the Luddites, who famously resorted to breaking spinning machines and intimidating their owners. Their rebellion (1811-1813) was so devastating that to suppress it the British Army deployed 12,000 troops, which ‘greatly exceeded in size the army which Wellington took into the [Iberian] Peninsula in 1808’ to fight Napoleon. As Eric Hobsbawm has explained, the phenomenon of machine-breaking (which he termed ‘collective bargaining by riot’) was significantly broader than Luddism, beginning ‘sometime in the 17th century’ and continuing ‘until roughly 1830’, involving both farms and factories. (See Hobsbawm 1952, pp. 58-59).

Writing in 1930, at the depth of the Great Depression, John Maynard Keynes ventured that:

“We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.” (Keynes 1931, p. 364)

Incidentally, Keynes was less worried by this prospect than one might suppose. He was actually trying to strike an optimistic note at decidedly bleak times, for he hypothesized that ‘mankind is solving its economic problem’, predicted that ‘the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is to-day’ – a prediction which, as pointed out by Summers (2013), has proved quite accurate. He also suggested that one way to deal with the problem might be ‘three-hour shifts or a fifteen-hour week’ (Keynes 1931, pp. 364-369).

While the historical record shows that in advanced economies the average number of hours worked has indeed been steadily declining over time [2], a fifteen-hour week has not materialised anywhere yet (although a three-day week was briefly introduced in a desperate, unsuccessful attempt to stem the chaos and strife of the ‘Winter of Discontent’ in Britain in the 1970s).

Naturally, Keynes was perfectly aware that ‘the needs of human beings may seem to be insatiable’. But he drew a distinction between ‘absolute needs’, and the rather less dignified relative ones (‘relative in the sense that we feel them only if their satisfaction lifts us above, makes us feel superior to, our fellows’). He thought that even though the latter may indeed prove insatiable, the former were bound to be met as living standards soared, so that ‘a point may soon be reached, much sooner perhaps than we are all of us aware of, when these needs are satisfied in the sense that we prefer to devote our further energies to non-economic purposes’. As he cheerfully concluded, we should not ‘overestimate the importance of the economic problem, or sacrifice to its supposed necessities other matters of greater and more permanent significance’. We should instead make ‘mild preparations for our destiny, in encouraging, and experimenting in, the arts of life as well as the activities of purpose’ (Keynes 1931, pp. 365-373).

3. Creative destruction

That economic progress creates new needs (whether real or perceived), and that technology creates jobs just as it destroys others, was a key insight of Joseph Schumpeter (1942), who argued that the defining feature of capitalism was ‘creative destruction’. At times of rapid change, those firms that for various reasons continue to use obsolete technologies can no longer compete and are pitilessly swept away. Nonetheless, this ‘destruction’ of unprofitable firms is ‘creative’, in the sense that it releases capital and labour that can be now more efficiently deployed by other firms that prosper precisely because they have adopted the superior technological innovations. The economic history

of the last two-and-a-half centuries shows that the jobs created by new technologies/firms have more than compensated for the jobs destroyed by them [3].

As David Autor has pointed out (2015), jobs hardly disappeared when agriculture was mechanised since the 18th and 19th centuries: the surplus workforce left the farms and eventually found employment in factories. The same process was subsequently repeated in the mid-20th century, as manufacture itself became increasingly mechanised: nowadays, in all advanced economies most workers are employed in services.

The ‘countervailing effects’ through which technology (even the disruptive technology of automation) creates jobs just as it destroys others have been spelled out by Daron Acemoglu and Pascual Restrepo (2018a, pp. 6-10). Innovative technologies raise productivity. This *productivity effect* ‘reduces the prices of the goods and services whose production processes are being automated, making households effectively richer, and increasing the demand for all goods and services’. *Capital accumulation* will raise the demand for labour in the firms and industries benefiting from technological innovation. The *deepening of automation* in tasks that have already been automated will clearly have no further direct adverse effects on labour demand, though its indirect effects (*via* productivity growth) will raise labour demand. Finally, ‘the emergence of new jobs, activities, industries and tasks’ that had not previously existed could be a significant source of net job creation. As estimated by the same authors, ‘about 60 percent of the 50 million or so jobs added [between 1980 and 2015] are associated with the additional employment growth in occupations with new job titles’ (Acemoglu and Restrepo 2018b, p. 1490).

As James Bessen (2015) has explained, these countervailing effects can be surprisingly powerful. After all, the introduction of automated teller machines (ATMs) and their widespread adoption by US banks replaced tasks previously performed by bank employees. However, after a modest fall, the number of jobs started to rise again, as efficiency savings enabled US banks to expand and open more branches, hiring more workers, whose job was to perform tasks ATMs had not automated (e.g. talk with customers). Bessen has also found that, of the 270 detailed occupations listed in the 1950 US Census, the number of those completely eliminated because of technical change amounted to exactly one: elevator operators.

Recent empirical studies have re-estimated the risk of automation for jobs, revising downwards earlier estimates. Arntz, Gregory and Zierahn (2016) applied a similar methodology to Frey and Osborne, except that instead of the *occupation-based* approach used by the latter they adopted the *task-based* approach developed by Autor, Levy and Murnane (2003), whose key insight was that what machines actually displace is not occupations but tasks. Since most occupations contain tasks that cannot be easily automated, and since tasks differ across countries and within occupations, Arntz and her colleagues assumed that occupations may well be less prone to automation than previously thought. They tested their assumption on data from the PIACC (*Programme for the International Assessment of Adult Competencies*) survey, which reports on the task structure of jobs across OECD countries. They found that the share of jobs at risk of automation in the US was significantly lower than estimated by Frey and Osborne (9% vs. 47%), while it varied inversely with education level and income (Arntz et al. 2016, p. 34).

The latest OECD study, by Nedelkoska and Quintini (2018), built on the approach of Arntz and her colleagues, used similar data, but estimated the risk of automation for a broader set of workers in more countries. Their estimate of the share of jobs at high risk of automation was quite similar: 10% of all jobs in the US [4]. The risk of automation was highest for workers on lower earnings, and declined with age (Nedelkoska and Quintini 2018, pp. 46-57).

On the evidence of the above, and given that automation creates jobs as it destroys others, it seems likely that predictions of ‘the end of work’ are greatly exaggerated. Even those authors whose work on the potentially massive adverse effects of technology on employment caused the greatest stir felt compelled to end on a more optimistic note:

“[The current technological revolution] will lead to sharp changes in the path of human development and history. The twists and disruptions will not always be easy to navigate. But we are confident that most of these changes will be beneficial ones, and that we and our world will prosper on the digital frontier.” (Brynjolfsson and McAfee 2012, p. 8)

“Despite technological change becoming more labour-saving and less job-creating, concerns over automation causing mass unemployment seem exaggerated, at least for now.” (Frey and Rahbari 2016)

4. The differential impact of technology on employment

All well then? Not quite. Drawing a parallel with the Industrial Revolution, which enabled humanity to escape the ‘Malthusian trap’ for the first time in history, and raised living standards to hitherto unimaginable levels, can only offer scant comfort. For those who lived through it, and especially for the former artisans or farm hands who found employment as factory workers in filthy cities, labouring for endless hours in dangerous conditions, living in overcrowded slums, that was the era of the ‘dark Satanic Mills’. Indeed, most historians agree that average living standards *fell* at the beginning of the Industrial Revolution, with real wages stagnating as productivity soared, until the mid-19th century when they started to improve (see Allen 2001, Broadberry et al. 2015, and, for an earlier discussion, Hobsbawm 1963). In other words, the ‘destructive’ and the ‘creative’ parts of technical change were separated by several decades.

Nor can the level of disruption brought about by automation be easily dismissed. As Nedelkoska and Quintini observed, commenting on the (otherwise reassuringly low) estimates produced by Arntz and her colleagues:

“While this figure [9% of US jobs at risk of automation] is only a fraction of the estimate provided by Frey and Osborne, it translates to approximately 13 million jobs across the United States, based on 2016 employment figures. As job losses are unlikely to be distributed equally across the country, this would amount to several times the disruption in local economies caused by the 1950s decline of the car industry in Detroit where changes in technology and increased automation, among other factors, caused massive job losses.” (Nedelkoska and Quintini 2018, p. 6)

Furthermore, a key feature of all technological revolutions is that their effects on workers, even though beneficial on average and in the long run, are typically asymmetric in the short run. More specifically, in the seminal paper by Autor, Levy and Murnane (2003), the impact of computerization on jobs depended on whether the underlying tasks were routine or non-routine, and manual or non-manual (‘analytic and interactive’) (p. 1286). Routine tasks, whether manual (‘picking or sorting, repetitive assembly’) or not (‘record-keeping, calculation, repetitive customer service’), faced a substantial risk of computerization. Non-manual non-routine tasks (‘forming/testing hypotheses, medical diagnosis, legal writing, persuading/selling, managing others’) had strong complementarities with computers, and hence were safe from substitution. Manual non-routine tasks (as those performed by janitors or truck drivers) were somewhere in between, as were considered to offer limited opportunities for either substitution or complementarity.

Technical progress since 2003, when Autor and his colleagues published their paper, makes the list of examples look slightly outdated. After all, *big data* technologies have made it possible to scan the entire corpus of the medical literature or legal precedents faster and more reliably than aspiring doctors or advocates can. As for truck driving, potentially threatened by self-driving cars, it would be no longer likely to make the list of occupations safe from automation.

Nevertheless, the basic intuition of Autor and his colleagues is still valid. At the one end of the spectrum of occupations that are least likely to be automated are abstract tasks that require

‘problem-solving capabilities, intuition, creativity, and persuasion’. These tasks are characteristic of professional, technical, and managerial occupations: ‘they employ workers with high levels of education and analytical capability, and they place a premium on inductive reasoning, communications ability, and expert mastery’. At the other end are tasks requiring ‘situational adaptability, visual and language recognition, and in-person interactions’, typical of personal services, ranging from hairdressing, cleaning and cooking, to health and social care. ‘While these activities are not highly skilled by the standards of the US labor market, they present daunting challenges for automation’ (Autor 2015, p. 12).

On the whole, there seems to be broad agreement that the current technical change is ‘routine-biased’ rather than ‘skill-biased’, with the risk of automation being lower for both high- and low-skilled workers than for middle-skilled ones, rather than monotonically declining as the level of skill rises. Moreover, empirical evidence on recent trends has largely borne out the hypothesis (Goos and Manning 2007).

Part of the explanation for job polarization (the hollowing out of jobs in the middle of the skills distribution, with both high- and low-skilled employment growing) is what Enrico Moretti has termed *local multipliers*. ‘Every time a local economy generates a new job by attracting a new business, additional jobs might also be created, mainly through increased demand for local goods and services’. These additional jobs are created in the non-tradeable sector, i.e. ‘in industries like restaurants, real estate, cleaning services, legal services, construction, medical services, retail, personal services, etc’. Using data from the 1980, 1990, and 2000 Census of Population in the US, Moretti estimated the local multiplier to be 1.6 for a manufacturing job, 2.5 for a skilled job, and as high as 4.9 for every new job in the high-tech sector (Moretti 2010; see also Goos et al. 2015).

The question of how technology might affect different types of workers was addressed by Nedelkoska and Quintini (2018, pp. 53-61, 116). They found that the risk of automation decreased with educational attainment, with the level of earnings, and with firm size. Its relation with age was U-shaped: younger workers faced the highest risk of their jobs being replaced by machines, followed by older workers, with prime-age workers likely to be less affected. Type of contract also played a role: ‘Employees on work-based VET programmes or in apprenticeships, as well as those hired through employment agencies on temporary contracts had the highest risk of automation, while those with indefinite and fixed term contracts had the lowest risk’.

5. The platform economy

The rise of the platform economy, best represented by the spread of the ride-sharing app *Uber*, is another important feature of the current technological revolution. As Christophe Degryse, writing for the European Trade Union Institute (ETUI) has commented:

“In April 2014, *Uber*, a start-up created barely five years earlier, inundated the European transport market using its shared transport app. Within a few months, as this decision shot like lightning through major European cities (Paris, London, Berlin, Brussels, etc.), it caused Europeans to become aware of the tremendous stakes concealed behind the technological progress largely underway in the United States and symbolised, *par excellence*, by *Uber*. With a simple mobile app and a few algorithms, anyone at all can now become a ‘cabbie’: without any training whatsoever, without the need to pay taxes or social security contributions, and without regulatory constraint (insurance, MOT, etc.), these self-appointed drivers can, from one day to the next, choose to compete with traditional taxi and minicab firms. An established and extensively regulated form of provision appears all of a sudden to have been overtaken by an American start-up that has not a single owned vehicle to its name.” (Degryse 2016, p. 6)

Is the hostility justified? From the point of view of most consumers, *Uber* and its competitors (*Lyft* in the US, *Didi* in China, *Ola* in India) offer a superior service at lower cost relative to traditional taxis. The same goes for *Airbnb*, and other accommodation rental platforms: their popularity suggests that many travellers, taking account of all relevant factors including cost, actually prefer to stay in other people's private apartments, rather than in hotel rooms.

There is no doubt that the disruption caused by the rise of the platform economy on traditional industries like taxis and hotels is considerable. In addition, traditional industries are challenged by information technology more broadly. Consumer rating of hotels can eliminate monopoly rents arising from imperfect information. Ready availability of Global Positioning System (GPS) technologies undermines the competitive advantage of professional taxi drivers relative to others. For instance, black cab drivers in London have quite rightly taken pride in 'The Knowledge', the examination for entry to their profession introduced in 1865, requiring drivers to memorise 320 standard routes through 25,000 streets within a six-mile radius from Charing Cross. Rather sadly, this is exactly the type of 'routine non-manual' operation at which information technology excels.

The question is whether the protection of established industries is a legitimate concern for public policy? There seems to be no compelling reason to think so, except of course in the sense of ensuring consumer protection and a level-playing field, preventing platform economy firms from exploiting regulation gaps to engage in unfair competition. It appears likely that, while the case for market regulation is strong, many platform economy firms will continue to be profitable (even though probably less so) in a more appropriately regulated environment. As for their competitors, in order to survive they will have to adapt by offering differentiated, reasonably priced services that appeal to consumers.

An analogy likely to cause discomfort to some readers might be with the teaching professions vis-à-vis massive open online courses (MOOCs). The case for regulation (e.g. to ensure quality) is again straightforward. Still, it would seem rather mean to deny smart kids in, say, Sub-Saharan Africa the opportunity to access courses offered by Harvard or MIT from the comfort of their local library, just because this might threaten the livelihood of teachers at the nearest university.

From the point of view of workers, the outlook may seem less bright. On the one hand, the rise of the platform economy is a positive-sum game: they expand markets, optimise the use of spare capacity (including time), make markets more efficient by eliminating frictions between buyers and sellers of employment and other services, and offer additional earning opportunities to a greater number of persons. On the other hand, platforms have rendered work more fluid, and labour markets more 'informal' (and often precarious), e.g. by further blurring the distinction between dependent employment and self-employment.

Exactly what is at stake was demonstrated by the decision of *Uber* in April 2016 to pay up to \$100 million and make several policy concessions to settle a pair of major class-action lawsuits in California and Massachusetts brought by drivers seeking 'a more secure status and more bargaining rights'. The settlement, which involved about 385,000 drivers in the two states, allowed *Uber* to preserve 'its thriving business model' that treats its drivers as independent contractors instead of employees. [5]

Recent empirical research has thrown some light on the preferences, work patterns, and earnings of drivers working for app-based companies. Alan Krueger and Jonathan Hall, in a study commissioned by *Uber*, analysed responses to a representative survey of 601 and 833 drivers in 2014 and in 2015 respectively in the US. Their main findings were: (i) 'many driver-partners valued the flexibility to choose their hours and days of work'; (ii) '*Uber*'s driver-partners are more similar in terms of age and education to the general workforce than to taxi drivers and chauffeurs'; and (iii) 'although it is difficult to compare the after-tax net hourly earnings of *Uber*'s driver-partners with that of taxi drivers, it appears that *Uber* driver-partners earn at least as much as taxi drivers and chauffeurs, and in many cases they earn more'. (Hall and Krueger 2018, pp. 729-730)

Another study, the most comprehensive and up-to-date at the time of writing, reached different results. The study was commissioned by the New York City Taxi and Limousine Commission, and was published in July 2018. The authors – Michael Reich and James Parrott – analysed earnings data for between one-half and two-thirds of the 80,000 drivers working for the four largest app-based for-hire vehicle companies (*Uber*, *Lyft*, *Via*, and *Gett/Juno*) in New York City, over four weeks between September 2016 and October 2017. They reported that a majority of the drivers worked full-time, and that 85% made less than \$17.22 per hour, the independent contractor equivalent of a \$15 hourly wage (which will soon be the statutory minimum wage in New York City for firms employing 11 workers or more, starting from 31 December 2018).

As it turned out, the report by Reich and Parrott (2018) had immediate policy impact. In August 2018, New York City Council introduced a one-year halt of new licences for ride-hailing apps and asked the city’s Taxi and Limousine Commission (TLC) to set minimum pay rules for drivers. A few months later, TLC voted on new rules “that will establish a per-minute and per-mile payment formula for *Uber*, *Lyft*, *Via* and *Gett*. The formula is supposed to result in drivers earning \$17.22 an hour. The move makes New York the first US city to set minimum pay standards for app-based drivers.”

A qualitative study of 102 earners on six platforms (*Airbnb*, *TaskRabbit*, *Postmates/Favor*, *Uber/Lyft*) by Juliet Schor and her co-authors (2017) revealed that about a quarter could be described as “wholly or primarily dependent on the platform for their livelihood; rely on earnings to pay for monthly expenses; roughly equivalent to full-time workers”). Another 41% were ‘partially-dependent’ (i.e. “rely somewhat on partially on platform earnings, but either work on multiple platforms or have part-time jobs, small businesses or other sources of income”). Among *Uber/Lyft* drivers, the share of those dependent on the platform rose to about four-fifths.

The number of workers in the platform economy is difficult to establish with precision. In the US, a survey by *Pew Research Center* (Smith 2016), found that 8% of the workforce were active in online job platforms, of which 44% were employed full-time, 26% considered themselves to be employees of the platform they used. In Europe, a survey of 32,400 internet users in 14 countries (Pesole et al. 2018) found that platform workers, defined as those earning more than half of their income *via* platforms, accounted for 2.3% of the workforce, and were more likely to be male, young, and well-educated than the general population. Less strict definitions yielded higher figures: 5.6% of respondents spent at least 10 hours a week on platform work, while 6.0% earned at least a quarter of their income this way. Another survey of 15,000 self-employed workers in Italy by *Fondazione Rodolfo Debenedetti*, cited in Boeri et al. (2018), found that about a quarter of those engaged in gig work considered it their main occupation, dedicating to it an average of 15 hours a week.

More broadly, data from the 2015 *European Working Conditions Survey* (EWCS) implied that 18% of all self-employed workers in Europe were ‘economically dependent’, defined as ‘self-employed without employees who have only one client and/or have no authority to hire staff and/or to make important strategic decisions’ (Eurofound 2017). Another report (Tomlinson and Corlett 2017) found that the number of self-employed workers has increased significantly in the UK, from just above three million in 2000 to almost five million in 2016. Agency work and zero-hour contracts involved almost one million workers each. Nearly 60% of all self-employment jobs created since 2009 were in high-skilled, high-earning occupations in sectors such as advertising, banking, and government. The remaining 40% were in relatively precarious sectors such as construction or cleaning. The authors of the report argued that one of the key drivers behind the growth in self-employment was the substantial tax advantages enjoyed by the self-employed and by the firms contracting them (i.e. in terms of employer National Insurance contributions).

6. Policy responses

As the preceding analysis has shown, automation and platforms have profound implications for the institutions regulating the interaction between work and social protection, collectively known as ‘the welfare state’. These institutions were conceived for a labour market characterised by nearly full (male) employment, and stable careers. The emerging labour market is more ‘liquid’, and work is less standard, more intermittent, more precarious, with longer non-employment spells. To deal with the implications of technical change, societies in Europe and beyond will need to rethink policies and institutions.

The question is how. Pesole et al. (2018) concluded their report with an interesting reflection on the policy implications of their survey’s findings:

“If platform work remains significant but small in the future, a two-pronged policy response is likely to suffice, focusing on [...] adjusting existing labour market institutions and welfare systems to the new reality and mitigating its potentially negative consequences for working careers and working conditions. However, [...] a scenario of general ‘platformisation’ of labour markets and working conditions would probably require a profound rethinking of labour market institutions and welfare systems. [...] In a labour market with more unstable working careers, a wider use of schemes based on personal accounts for workers’ entitlements might be required. From the social protection point of view, progress towards insurance models not based on employment status could be necessary.” (Pesole et al. 2018, p. 56)

Sketching out a detailed response to the issues raised by automation and platforms is not possible within the limits of this paper (and its author). Nevertheless, it seems clear that the main challenges concern three policy areas: education and training, labour law, and social protection.

The dislocations caused by disruptive change affecting sectors, industries, occupations, regions, and countries imply that millions of workers will have to acquire new skills in short time. The emphasis on ‘problem-solving capabilities, intuition, creativity, and persuasion’ implies that education systems, at least in some countries, will have to be radically overhauled, and that adult learning systems will have to be upgraded. Evidence from Germany, ‘where close to 40% of all employees have undergone at least one requalification in their careers’, and where vocational education and training (VET) has traditionally been more successful than elsewhere, illustrates the challenges involved. On the one hand, German workers in routine jobs displaced by automation were more likely to switch occupation than become unemployed. Moreover, those moving to occupations that required skill upgrades relative to their previous jobs did not experience long-term earnings losses. In contrast, US workers displaced by automation were more likely to move to unemployment or inactivity (in the latter case dropping out of the work force altogether). The difference can be at least partly attributed to the ‘absence of regional re-qualification opportunities’. On the other hand, in Germany, jobs requiring vocational training faced a significantly higher risk of automation relative to jobs requiring university education. The probability of participating in education and training (especially on-the-job training) is significantly lower in jobs at higher risk of automation. (Nedelkoska and Quintini 2018, pp. 36-37 and 99-115.) In other words, existing education and training systems tend to benefit less those who need them most. The intergenerational transmission of social disadvantage compounds difficulties (European Commission 2018, pp. 89-99).

The second challenge concerns the treatment of workers in the platform economy. In many ways, the issues raised are similar to those concerning existing precarious forms of employment such as those facing many self-employed workers in secondary labour markets throughout Europe. For instance, *Uber* drivers (ride sharing) or *Foodora* couriers (food delivery) are typical of the ‘dependent self-employed’ (i.e. those typically working for one employer, but without having employee status). In contrast, workers offering their services online or offline through platforms (such as *TaskRabbit*, ‘an online marketplace that matches freelance labour with local demand’) are typical of genuine, though often informal, self-employment. In many European countries, all self-employed workers, whether independent or dependent, are treated the same. But relative to

employees, the self-employed are often excluded from access to a range of benefits either *de jure* (e.g. protection against unfair dismissal, minimum wage, severance pay, sickness leave, maternity leave, unemployment insurance) or *de facto* (e.g. reduced eligibility for contributory pensions) (Spasova et al. 2017, Matsaganis et al. 2015).

Dealing with reduced coverage of self-employed workers is not straightforward. On the one hand, harmonizing social contribution rates across all categories would imply that the self-employed were liable for the sum of employer and employee contributions, which would be unrealistic expensive – and would probably reinforce perverse incentives (e.g. income under-reporting for tax and contribution evasion), or cause job losses, or both. On the other hand, subsidizing the contributions of self-employed workers, or retaining the current differentials in contribution rates relative to employees, would be unfair and strengthen the incentive of employers to treat employees as independent contractors, if they can get away with that.

In a few countries, such as Austria and Italy, the dependent self-employed are for the purposes of social insurance treated as a separate category: they are liable for higher social contributions than other ('independent') self-employed workers, and are eligible for a wider range of social benefits (OECD 2018, p.5). In Austria, their social contribution rate is now equal to that for employees; in Italy, it remains lower. In both countries, the social contribution rates for the dependent self-employed (defined as 'independent contractors' and 'exclusive collaborators' respectively) were raised considerably in recent years. The increase in the contribution rate was followed by a significant reduction in the number of workers covered, which suggests that the previous arrangement may have corresponded more to the demands of employers seeking to minimise their personnel costs, than to the needs of dependent self-employed workers themselves.

In Italy, recent estimates suggest that the dependent self-employed (known as 'exclusive collaborators') have a higher average level of education attainment, and significantly lower earnings, than employees [7]. In the context of a notional defined contributions pension system with few if any redistributive elements, as that of Italy, lower earnings at present translate directly into lower pensions in the future. This is especially the case for gig workers and others in informal employment. Protection gaps are keenly felt by the workers concerned. As reported by the *Fondazione Rodolfo De Benedetti* survey cited earlier, the demand for social protection on the part of gig workers is especially high in terms of retirement benefits, followed by unemployment compensation, (paid) sick leave, and work injury insurance (Boeri et al. 2018; see also Mingione 2017). In view of the combination of lower earnings and limited access to social benefits, gig workers reported lower levels of job satisfaction, and higher levels of financial insecurity, than other self-employed workers.

While no easy solutions to the protection gaps experienced by platform workers present themselves, it may be that the most promising course of action is to expand coverage where possible in piecemeal fashion. An interesting model might be the writers and artists' social insurance in Germany: workers are covered for health, pension, and long-term care (though not for unemployment) insurance, and are liable for the employee share of social contributions, while those buying their services pay 60% of employer contributions, with a public subsidy making up the remaining (OECD 2018, pp. 2-3). The Taylor Review's proposal to extend minimum wage legislation in the UK to workers in the gig economy [8] seems promising and deserves further examination in other countries too. The pros and cons of various other options, from offering non-standard workers the option of joining voluntary social insurance schemes to making platforms liable for collecting and paying social contributions, have also been put forward for discussion. (See OECD 2018, Boeri et al. 2018, The Taylor Review 2017)

The third challenge regards the future of the welfare state. If the goal is to ensure worker mobility between jobs while at the same time guaranteeing a high level of social protection to all citizens, irrespective of their employment status, there seems to be no alternative to abandoning occupational fragmentation in favour of making European welfare states more universal. The outlines of a

possible strategy readily follow from that: make health care, child care and other social services universal; introduce or strengthen basic income schemes for children (child allowances) and for the elderly (first-tier citizens' pensions); render contributory schemes (second-tier pensions) more actuarially fair; rethink means-tested income support (housing benefits, minimum incomes) in view of volatile earnings; step up efforts to obtain accurate information of earnings in the platform economy (and from other informal activities). The corollary of a shift from contributory to non-contributory social benefits would be a corresponding shift in funding, from social contributions to general taxation, and from taxing labour to taxing real estate, emissions, and value added. Recent efforts at EU level to limit the scope for tax arbitrage on the part of multinationals, including high-tech giants, are also steps in the right direction. While it may seem difficult to conceive of the wholesale adoption of an unconditional basic income, the current interest in the idea, and experimentation with basic income schemes in Finland and elsewhere, are both welcome. (See Atkinson 2015, Palier 2018, OECD 2018, Pulkka 2017)

7. Concluding remarks

To a considerable extent, the challenges of automation and platforms for work and social protection are more likely to be social and political than technical and economic in nature. Even under an extreme scenario of robots drastically reducing the amount of work required of human workers, the question would be how to share out the fruits of productivity growth in a socially (as well as environmentally) sustainable manner – that is, as Keynes speculated back in 1930, how to deal with the end of scarcity. Obviously, our capacity to invent and enforce benign political and social solutions cannot be taken for granted. Even when this turns out to be the case, history shows that corrections to the disruptions caused by technical progress, like Polanyi's counter-movement (1944), take time to develop. In the past, great upheavals ushered in new social and political actors, but not before a considerable time lapse. For instance, in Britain, the transition of organised labour from 'collective bargaining by riot' to craft unions to national unions unravelled over decades, while the election of the first Labour Representation Committee MPs to the House of Commons took place in 1900, a full 140 years after the onset of the Industrial Revolution. In our time, the first stirrings of labour mobilisation are already visible: the protests staged by cycle couriers working for *Foodora* in Turin in October 2016 attracted widespread interest and media attention, while the work accident of a young cycle courier working for *JustEat* in Milan in May 2018 led to a new series of protests and debates [9]. Older actors, such as mainstream trade unions, often struggle to respond to the demand for representation expressed by platform workers, but when they do their support can be decisive. In Switzerland, in 2017, couriers successfully negotiated improved terms and conditions with employers after *Unia* (the largest Swiss union) backed their protest (Vandaele 2017, p. 15). In the same year, in Germany, *IG Metall* created *FairCrowdWork Watch* (<http://faircrowd.work>), dedicated to digital workers, supporting efforts to improve working conditions in platforms. In the meantime, and if the history of ideas following the Industrial Revolution, from Count de Saint Simon to Karl Marx is anything to go by (Braudel 1995, pp. 389-398), the task of preparing the ground, thinking the unthinkable, imagining utopias, or even actually implementing partial solutions from positions of power, is likely to fall upon social theorists and reformers.

References

- Acemoglu D. and Restrepo P. (2018a) *Artificial Intelligence automation and work*. NBER working paper 24196. Cambridge MA: National Bureau of Economic Research.
- Acemoglu D. and Restrepo P. (2018b) The race between man and machine: Implications of technology for growth, factor shares, and employment. *American Economic Review* 108 (6) 1488–1542.
- Acemoglu D. and Robinson J. (2012) *Why nations fail: The origins of power, prosperity, and poverty*. New York: Random House.
- Akst D. (2013) Automation angst. *The Wilson Quarterly* 37 (3) 66-78.
- Allen R.C. (2001) The Great Divergence in European wages and prices from the Middle Ages to the First World War. *Explorations in Economic History* 38 (4) 411–447.
- Arntz M., Gregory T. and Zierahn U. (2016) *The risk of automation for jobs in OECD countries: A comparative analysis*. OECD Social, Employment and Migration working paper 189. Paris: Organisation for Economic Co-operation and Development.
- Atkinson A.B. (2015) *Inequality: What can be done?* Cambridge MA: Harvard University Press.
- Autor D.H. (2015) Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives* 29 (3) 3–30.
- Autor D.H., Levy F. and Murnane R.J. (2003) The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics* 118 (4) 1279-1333.
- Bessen J. (2015) *Learning by doing: The real connection between innovation, wages, and wealth*. Boston: Yale University Press.
- Boeri T., Giupponi G., Krueger A.B. and Machin S.J. (2018) *Social protection for independent workers in the Digital Age*. Presented at XX European Conference of the *Fondazione Rodolfo Debenedetti*. Pavia (26 May 2018).
- Braudel F. (1995) *A history of civilizations*. London: Penguin Books.
- Broadberry S., Campbell B., Klein A., Overton M. and van Leeuwen B. (2015) *British economic growth, 1270–1870*. Cambridge: Cambridge University Press.
- Brynjolfsson E. and McAfee A. (2012) *Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy*. MIT Sloan School of Management Research Brief. Massachusetts Institute of Technology.
- Brynjolfsson E. and McAfee A. (2014) *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. New York: W.W. Norton and Company.
- Degryse C. (2016) *Digitalisation of the economy and its impact on labour markets*. ETUI working paper 2016.2. Brussels: European Trade Union Institute.
- Eurofound (2017) *Non-standard forms of employment: Recent trends and future prospects*. Dublin: European Foundation for the Improvement of Living and Working Conditions.
- Eurofound (2018) *Automation, digitalisation and platforms: Implications for work and employment*. Luxembourg: Publications Office of the European Union.
- European Commission (2018) *Employment and Social Developments in Europe 2018*. Luxembourg: Publications Office of the European Union.

- Freeman C. and Louçã F. (2002) *As time goes by: From the industrial revolutions to the information revolution*. Oxford: Oxford University Press.
- Frey C. B. and Osborne M.A. (2013) *The future of employment: How susceptible are jobs to computerisation?* Oxford Martin School working paper. University of Oxford.
- Frey C. B. and Osborne M.A. (2017) The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change* 114 254-280.
- Frey C. B. and Rahbari E. (2016) *Technology at work: How the digital revolution is reshaping the global workforce* (<https://voxeu.org/article/how-digital-revolution-reshaping-global-workforce>).
- Goos M. and Manning A. (2007) Lousy and lovely jobs: The rising polarization of work in Britain. *The Review of Economics and Statistics* 89 (1) 118-133.
- Hall J.V. and Krueger A. (2018) An analysis of the labor market for *Uber's* driver partners in the United States. *Industrial and Labor Relations Review* 71 (3) 705-732.
- Hobsbawm E.J. (1952) The machine breakers. *Past and Present* 1 57-70.
- Hobsbawm E.J. (1963) The standard of living during the industrial revolution: A discussion. *The Economic History Review* 16 (1) 119-134.
- Keynes J.M. (1931) Economic possibilities for our grandchildren. In *Essays in persuasion*. London: Macmillan.
- Lenk H. and Maring M. (2001) *Advances and problems in the philosophy of technology*. Munster: Lit.
- Matsaganis M., Özdemir E., Ward T. and Zvakou A. (2015) *Non-standard employment and access to social security benefits*. Research Note 8/2015. Social Situation Monitor. Brussels: European Commission.
- Mingione E. (2017) Conclusioni. In Croce C. and Zucca A. (a cura di) *Altri lavori, altri lavoratori: Diario di bordo*. Milano: Fondazione Giangiacomo Feltrinelli.
- Moretti E. (2010) Local multipliers. *American Economic Review: Papers and Proceedings* 100 1–7.
- Nedelkoska L. and Quintini G. (2018) *Automation, skills use and training*. OECD Social, Employment and Migration working paper 202. Paris: Organisation for Economic Co-operation and Development.
- Neufeind M., O'Reilly J. and Ranft F. (2018) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution*. London: Rowman and Littlefield International.
- OECD (2018) *The future of social protection: What works for non-standard workers?* Policy Brief on the Future of Work. Paris: Organisation for Economic Co-operation and Development.
- Palier B. (2018) The politics of social risks and social protection in digitalised economies. In Neufeind M., O'Reilly J. and Ranft F. (eds) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution*. London: Rowman and Littlefield International.
- Parrott J.A. and Reich M. (2018) *An earnings standard for New York City's app-based drivers: Economic analysis and policy assessment*. Report for the New York City Taxi and Limousine Commission. Center for New York City Affairs. New York: The New School.
- Pesole A., Urzì Brancati M.C, Fernández-Macías E., Biagi F. and González Vázquez I. (2018) *Platform workers in Europe*. Luxembourg: Publications Office of the European Union.
- Polanyi K. (1944) *The Great Transformation*. New York: Farrar and Rinehart.
- Pulkka V.-V. (2017) A free lunch with robots: Can a basic income stabilise the digital economy? *Transfer* 23 (3) 295–311.

- Raitano M. (2018) Para-subordinate workers in Italy: The scale of the phenomenon, their characteristics and coverage by the welfare state. In OECD *The future of social protection: What works for non-standard workers?* Paris: Organisation for Economic Co-operation and Development.
- Rifkin J. (1995) *The end of work: The decline of the global labor force and the dawn of the post-market era*. New York: Putnam Publishing Group.
- Rifkin J. (2011) *The Third Industrial Revolution: How lateral power is transforming energy, the economy, and the world*. New York: Palgrave Macmillan.
- Schor J., Attwood-Charles W., Cansoy M., Ladegaard I. and Wengronowitz R. (2017) *Dependency and precarity in the sharing economy*. Boston College (mimeo).
- Schumpeter J.A. (1942) *Capitalism, Socialism and Democracy*. London: Allen and Unwin.
- Smith A. (2016) *Gig work, online selling and home sharing*. Pew Research Center (<http://www.pewinternet.org/2016/11/17/gig-work-online-selling-and-home-sharing/>).
- Soete L. (2018) Destructive creation: explaining the productivity paradox in the digital age. In Neufeind M., O'Reilly J. and Ranft F. (eds) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution*. London: Rowman and Littlefield International.
- Spasova S., Bouget D., Ghailani D. and Vanhercke B. (2017) *Access to social protection for people working on non-standard contracts and as self-employed in Europe*. Brussels: European Commission.
- Summers L. H. (2013) *Economic possibilities for our children*. The 2013 Martin Feldstein Lecture. NBER Reporter OnLine (<http://www.nber.org/reporter/2013number4/#report>).
- Tassinari A. and Maccarrone V. (2017) The mobilisation of gig economy couriers in Italy: Some lessons for the trade union movement. *Transfer* 23 (3) 353–357.
- The Taylor Review (2017) *Good work: the Taylor review of modern working practices* (<https://www.gov.uk/government/publications/good-work-the-taylor-review-of-modern-working-practices>).
- Tomlinson D. and Corlett A. (2017) *A tough gig? The nature of self-employment in 21st century Britain and policy implications*. London: Resolution Foundation.
- Vandaele K. (2018) *Will trade unions survive the platform economy? Emerging patterns of platform workers' collective voice and representation in Europe*. ETUI working paper 2018.5. Brussels: European Trade Union Institute.

Endnotes

[1] Soete (2018) notes that, at the time, this fear was much stronger in Europe, while in the US a more ‘positive vision’ prevailed.

[2] In the US, the average annual number of hours per worker fell from 1968 in 1950 to 1780 in 2017. In Germany, the average worker spent 1356 hours working per year in 2017 (down from 1554 in 1991). See OECD Statistics.

[3] Literally-minded readers may recall Leopold Bloom’s reflection from chapter 6 of James Joyce’s *Ulysses* (published 1922): “A pointsman’s back straightened itself upright suddenly against a tramway standard by Mr Bloom’s window. Couldn’t they invent something automatic so that the wheel itself much handier? Well but that fellow would lose his job then? Well but then another fellow would get a job making the new invention?” Quoted in Akst (2013), p. 67.

[4] Following Arntz et al. (2016) and Frey and Osborne (2013, 2017), Nedelkoska and Quintini (2018) define high risk as more than 70% probability of automation, and risk of significant change as between 50 and 70% probability of automation.

[5] See “Uber settles cases with concessions, but drivers stay freelancers” (The New York Times, 21 April 2016).

[6] See “NYC taxi regulators set minimum pay for rideshare drivers” (CBS New York, 4 December 2018).

[7] In 2013, 34% of ‘exclusive collaborators’ had university degrees, compared to 11% of private employees. In the same year, the median annual earnings of ‘exclusive collaborators’ were below €14,000, compared to over €20,000 for private employees. See Raitano (2018).

[8] “In re-defining ‘dependent contractor’ status, Government should adapt the piece rates legislation to ensure those working in the gig economy are still able to enjoy maximum flexibility whilst also being able to earn the [national minimum wage]”, as is already the case for some occupations where it is not possible for the employer to determine hours worked. See *The Taylor Review* (2017) pp. 37-38.

[9] On the October 2016 protests in Turin, see Tassinari and Maccarrone (2017). The May 2018 work accident in Milan involved a 28-year old cycle rider losing his leg after falling under a tram.