The changing nature of work and inequality

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Abstract

Labour markets and occupations have gone through profound changes as a result of technological progress, globalisation and changes to labour market institutions, among many other factors. A result is the reduction of labour's share in income, while inequality has increased across countries. This paper presents descriptive evidence on the labour share and inequality on both sides of the Atlantic, and offers a view of the main differences between the European Union and the United States. In some EU countries, the decline in the labour share has slowed and seems to have started to increase earlier than in the United States. Some trends in inequality were less pronounced in the EU than in the US. We then discuss the factors that might have contributed to these distributional outcomes, focusing on the role of technology and, in particular, automation, and the abrupt changes brought by the COVID-19 pandemic. We also offer some policy reflections that the US might take into account when tackling declining labour shares, issues of job quality and wage inequality.

1. Introduction

There is a burgeoning literature on the 'Future of Work' that examines the effects of technological change – particularly the latest wave of digital and non-digital (robot-related) automation – on unemployment and the reshuffling of occupations (see Ciarli *et al*, 2022 for a systematic literature review on the role of different technologies).

The changing composition of jobs over the last few decades has also resulted from a variety of interrelated phenomena, including globalisation and the emergence of global value chains (GVCs) (Bontadini *et al*, 2021), which have affected the international division of labour and countries' trade specialisations in particular sectors and jobs. Other drivers have been deep changes in migration flows and profound changes in the structural composition of economies. The role of skills, in the form of technological upgrading of skills, the trends of deskilling and the hollowing out of medium-level skills, is a connected phenomenon and is perhaps the main determinant of changes in earnings across categories of workers. It has in some instances led to patterns of increasing income inequality, both within and across countries.

This paper focuses on the influence of technology, in particular digital automation, on these trends, both in the European Union and the United States. We present a novel descriptive picture of the transatlantic comparison of labour share, income and earnings inequality developments. We also survey selected relevant literature. Post-pandemic patterns of working from home (WFH) are also touched upon, with evidence that they have exacerbated some of the job and earning patterns.

We also highlight the main policy challenges that emerge from the changing nature of jobs and the issue of earning inequality and inclusion. It is important that prognosis follows diagnosis, particularly on in the realm of the Future of Work, and, most importantly, the Future of Inclusion.

2. Labour shares, income inequality and occupational earnings: A glance at EU/US trends

One of the profound changes in the world of work has been **the reduction of the share of labour in total income**, which has characterised labour markets on both sides of the Atlantic (Figure 1). Autor *et al* (2020) attributed this to what they call the *"rise in superstar firms"* which typically show lower labour shares of value added, operate in industries with higher market concentration and drive increases in firm and sector markups. It seems therefore that these changes are (and most likely will continue to be) responsible for a more polarised income distribution (Autor *et al*, 2020).

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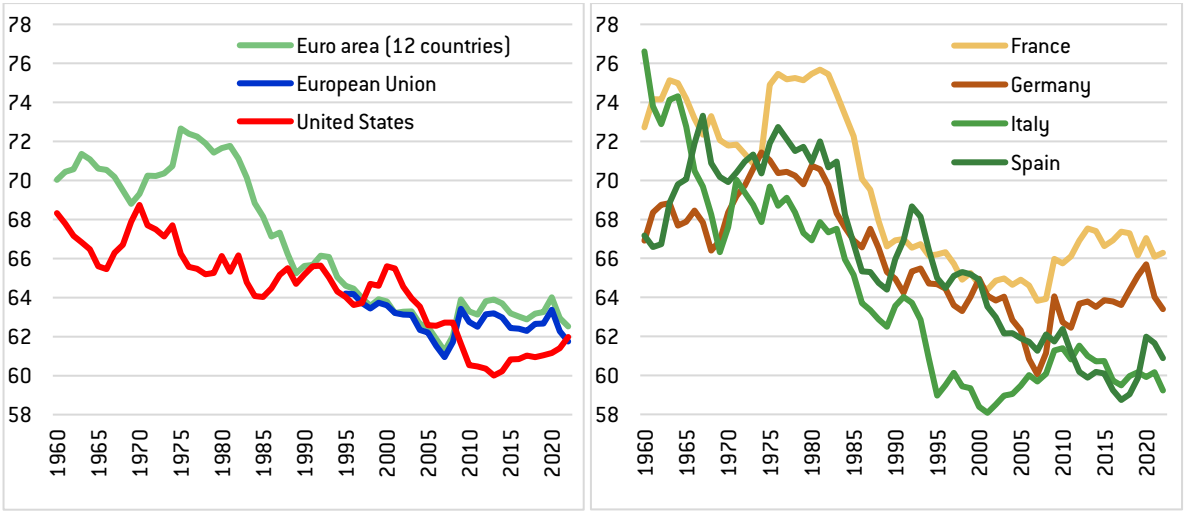
Notwithstanding the long-term declining trend, there are significant transatlantic differences, as well as differences between EU countries (Figure 1). For example, the labour share started to recover in France and Germany in the late 2000s, while in Italy the recovery started from a comparatively low level at the turn of the millennium. In France, Germany and Spain, one reason for the temporary spike in the labour share in 2020 was the much greater drop in GDP than labour income during the COVID-19 recession, which was corrected as GDP recovered. It is also notable that a gradual increase in the labour share started in the United States in the mid-2010s.

Figure 1: The adjusted labour income share (% GDP at factor prices), 1960-2022



Source: AMECO dataset May 2022. Note: The adjusted labour share corrects the unadjusted share (total labour compensation over GDP) with the impact of self-employed. We report ratios to GDP at factor costs and not at market prices, because the gap between the two, taxes on production and imports (minus subsidies), represent neither any kind of return to capital nor to labour, and therefore should not be counted, as argued by Guerriero (2019). Values for 2022 are European Commission forecasts.

Labour shares have fallen because of a complex set of determinants. It is beyond the scope of this paper to analyse all of the potential causes, so we aim to summarise the main ones based on the literature.

According to OECD (2015) and IMF (2017), factors underpinning the declining labour share include:

- Technological change (the role of capital accumulation and capital-augmenting technical change, a decline in the relative price of investment goods);
- Globalisation (the intensification of competition, the entry of labour-abundant countries into the global economy, offshoring production from advanced to emerging and developing countries);
- The above-mentioned *"rise of superstar firms"* (Autor *et al*, 2020);
- A compositional shift in employment from labour-intensive to more capital-intensive sectors, since the labour share in capital-intensive sectors tends to be lower;

- Financial deepening might increase pressures on businesses to maximise profits, increase shareholder value and pay dividends, rather than share with workers; it may also incentivise firms to focus on their core activities while subcontracting labour-intensive activities;
- Reduction of minimum wages relative to median wages was found to increase inequality, and to lead to the emergence of less-secure employment types, including part-time, casual and temporary employment;
- Declining union density and the bargaining power of labour, which reduces the influence of organised workers on policymakers to adopt more redistributive policies;
- The privatisation of state-owned enterprises in network industries has been found to contribute to the labour-share decline in these industries.

2.2 Income inequality

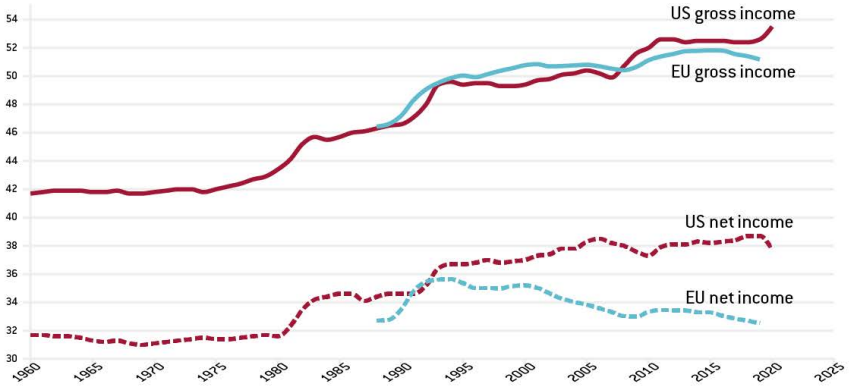
Another salient feature is the general **trend of increasing income inequality**, though with notable transatlantic differences. Gross income inequality (that is, the dispersion of income before taxes and redistribution) increased faster in the US than in the EU in the past three decades. Yet it is interesting to note that the level of gross income inequality is rather similar in the EU and the US, while there is a sizeable difference in net (after-tax and subsidies) inequality, which has been on a downward trend in the EU since the mid-1990s but has continued to grow in the United States (Figure 2, Panel A). Income inequality declined in some EU countries in the past decades (Figure 2, Panel B), but it increased in almost all US states (Figure 2, Panel C).

Explanations for growing income inequality within advanced countries often include the same factors as explanations for the labour income share decline, as surveyed by Fröster and Tóth (2015). Since the distribution of capital income is very unequal in society, **a rise in the capital share is bound to widen income inequality**. Moreover, within labour income, in some countries, the top earners have captured a bigger piece, while the middle class and the poorest segments of society have experienced little if any real income growth.

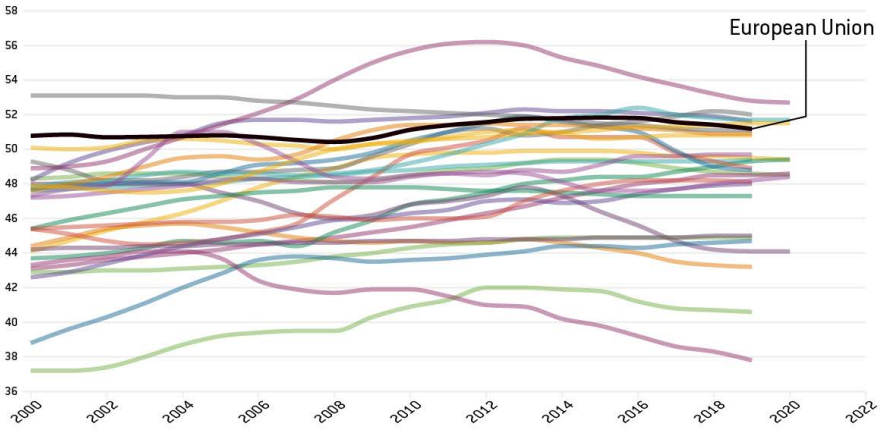
Similar levels of gross income inequality, and different levels of net income inequality, across the Atlantic suggest that redistributive policies in Europe are more effective in altering the income distribution resulting from market forces. Another conclusion based on this transatlantic comparison is that technological change, globalisation and the many other factors identified in the literature could increase inequality throughout advanced countries, but cannot explain the transatlantic differences in net inequality developments.

Figure 2: Gini coefficient of income inequality: EU and US

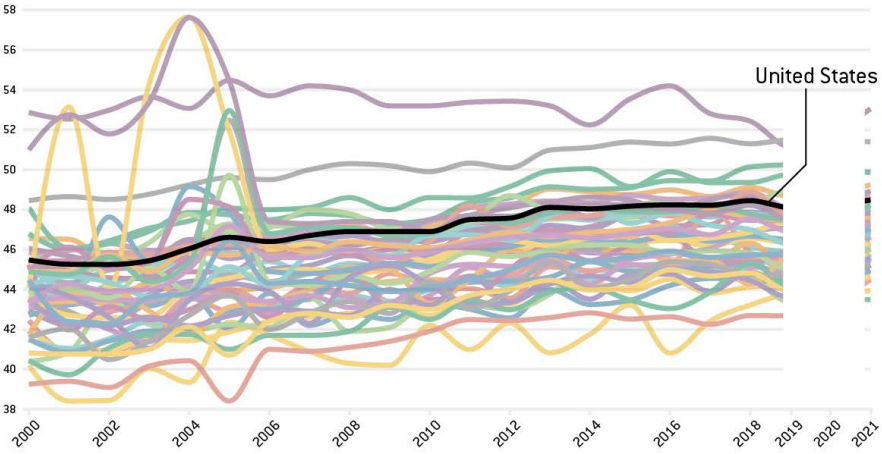
A) EU and US comparision: gross and net income Gini (comparable data based on SWIID)



B) EU countries: gross income Gini (SWIID data)



C) US states: gross income Gini (Census Bureau data)



Source: Bruegel based on Standardized World Income Inequality Database (SWIID; Solt, 2020, version 9.3) for US data on panel A and 27 EU member states' data on panel B; updated calculations by Darvas (2019) for the European Union on panels A and B, which are consistent with SWIID data; US Census Bureau data for US data on panel C (series: B19083, 1-year estimates).

Note: The Gini index is expressed on a 0-100 scale. SWIID data for the US is on average 4.3 Gini points higher than Census Bureau data; that is, a value of 36 in panel B roughly corresponds to a value of 32 in panel C. European Union data includes the current 27 members in the full sample period. The 2020 1-year Gini coefficient estimates are not available from the Census Bureau, due to the impacts of the COVID-19 pandemic on data collection. The three most equal countries (in terms of gross income inequality) in the EU in 2019 were Slovakia, Slovenia and Czechia, and the three least equal countries were Ireland, France and Italy. In the US, the three most equal states in 2021 were New Hampshire, Alaska and Utah, and the three least equal states were Washington DC, New York, and Louisiana.

2.3 From jobs to earnings: Differences between EU and US trends

The literature has demonstrated **growing earnings inequality in the United States**, where highly-qualified high-earners reaped most of the benefits of economic growth, while low-qualified (typically low-earner) workers did not benefit much, if at all, from real income growth over the past decades. Only a subset of European countries shares such developments. However, in a number of European countries, we **do not observe relative wage declines for workers with lower qualification levels** (Figure 3).

Eurostat publishes earnings data for twelve occupational categories, of which we selected six: managers and professionals are the highest earners (indicated with circles in Figure 3); technicians and clerical support workers typically have middle qualifications and are in the middle of the income distribution (denoted with solid lines without symbols in Figure 3); while workers in sales and elementary occupations usually have low-level qualifications and low earnings (indicated with triangles in Figure 3).

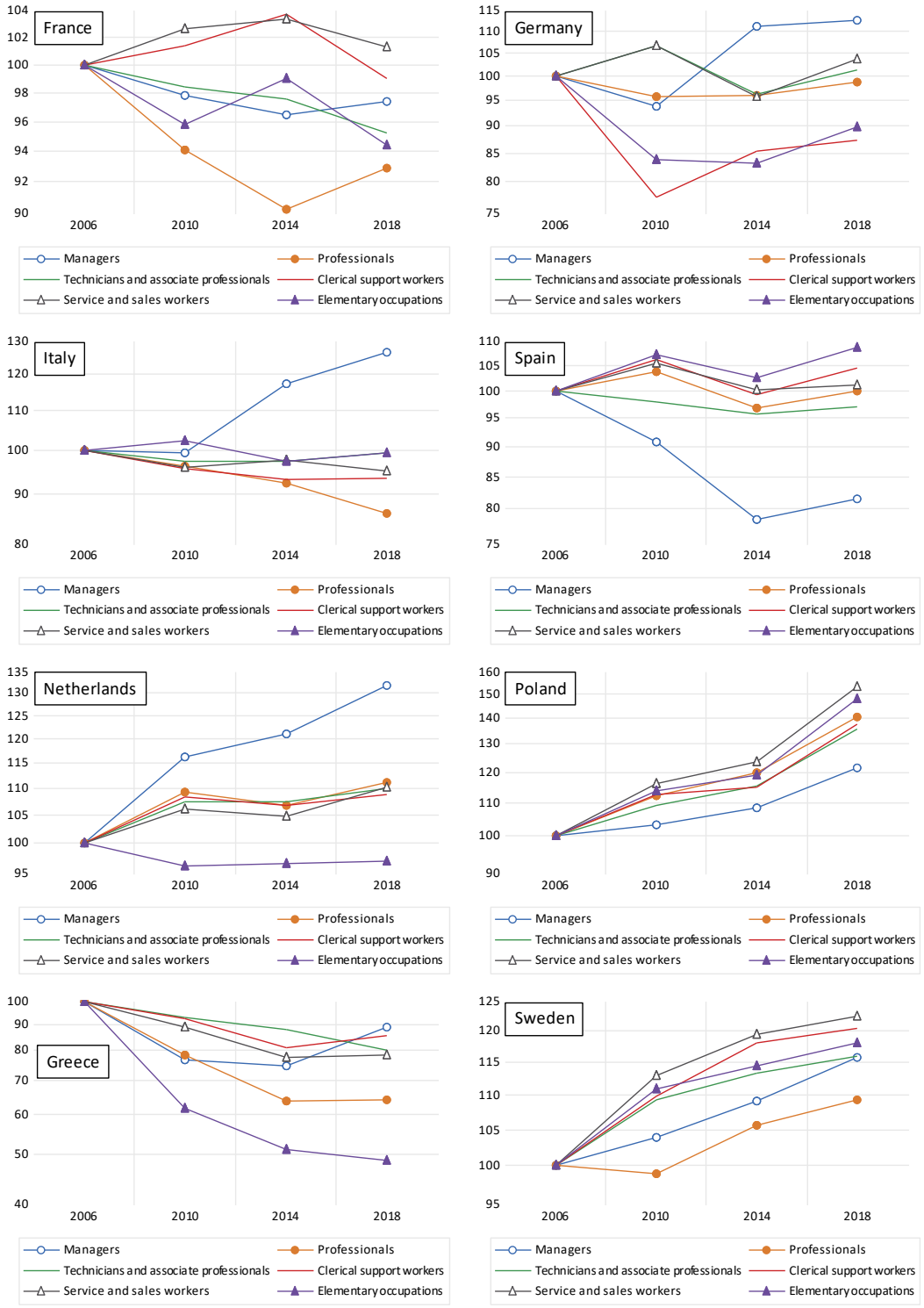
Among the eight countries reported in Figure 1, **earning developments in the Netherlands followed the US pattern**, with managers and professionals obtaining the fastest earning growth. In Germany, managers became even richer, yet the earnings growth of professionals was lower in the 2006-2018 period than for service and sales workers and technicians. In Italy, only managers benefited from positive real income growth; professionals, another well-paid group, suffered from a larger real income decline than all other occupations reported in Figure 3. Greece is a special case where real earnings of all occupation groups have declined, because of the harsh macroeconomic adjustment after 2009. The smallest decline in Greece from 2006-2018 is observed for managers.

The experiences of France, Poland, Spain and Sweden, meanwhile, are rather the contrary to US developments because both well-paid managers and professionals are typically at the lower scale of income growth among the various occupations.

To sum up, while earnings developments in some EU countries are also characterised by weaker growth for the less-qualified and lower-paid, compared to the US, there are several EU countries in which this was not the case from 2006-2018[3].

[3] To check nominal wage convergence in the EU, we estimated a simple regression for wage growth from 2006-2018 on the 2006 level of wages (all variables are measured in euros). We found strong wage convergence in all occupations when including all EU countries, a result likely driven by the income convergence of poorer central and eastern European countries. When restricting the sample to eight high-income euro-area countries (Austria, Belgium, Finland, France, Germany, Ireland, Luxembourg and the Netherlands) we did not find statistically significant impacts anymore, though the parameter estimates have a negative sign and the coefficient of determination (R2) is largest for (a) technicians and associate professionals, (b) craft and related trades workers, and (c) clerical support workers, suggesting some weak wage convergence in these occupations across countries. The R2 is the lowest for (a) plant and machine operators and assemblers, (b) service and sales workers, and (c) skilled manual workers, suggesting the lowest convergence of wages in these occupations across countries.

Figure 3: Real earnings by occupation in selected EU countries (2006=100)



Source: Bruegel using Eurostat's 'Structure of earnings survey: annual earnings [earn_ses_annual]', 'HICP - annual data (average index and rate of change) [prc_hicp_aind]' and 'Euro/ECU exchange rates - annual data [ert_bil_eur_a]' datasets.
Note: Nominal earnings are deflated with the harmonised index of consumer prices (HICP). Eurostat reports earnings data in euros. For non-euro area countries (Poland and Sweden), we first converted euro values to the national currency and then deflated that with the HICP.

3. Digital and non-digital automation and occupations: Selected evidence

The deep transformation of economies arising from technical change has been going on for a long time. Automation, which involves in general the decrease of the involvement of human labour in production processes, is as old as the industrial revolution. For instance, mechanisation led to **the decline in demand for routine manual tasks** performed by agricultural and industrial workers in the nineteenth and twentieth centuries (Nedelkoska and Quintini, 2018).

Information technology (IT) and artificial intelligence (AI) have brought a new form of automation over the past 40 years. The adoption of digital technologies at the end of the twentieth century extended the set of tasks that can be done by a machine. Over the past decade, technology has affected the replacement of humans in **routine cognitive tasks** (Autor *et al*, 2001) and will likely **replace humans in non-routine and manual cognitive tasks in the medium- to long-term** (Brynjolfsson and Mitchell, 2017). While it is hard to predict precisely which jobs will be automated (Frey and Osborne, 2017; Brynjolfsson *et al*, 2018), AI, robotics and automation are only a few possible technology disruptions with a potentially substantial impact. In sum, digital transformation has profoundly modified the structure of jobs and skills (see, among others, Goos and Manning, 2007; Mokyr *et al*, 2015).

Hence, automation (robotisation and digital automation) could be an important driver of the fall in the labour share of income and the increase in income inequality, depending on whether:

- Automation substitutes capital for labour or automation complements labour and creates new tasks,
- Automation changes the relative wages for different tasks,
- Automation changes the composition of employment,
- Automation in a particular sector creates jobs in other sectors.

A large body of recent research has concluded that the substitution effect dominates. For example, Lankisch *et al* (2019) developed a growth model with automation to explain the observed decline in the real wages of low-skilled workers and the increased *per-capita* output and wages of high-skilled workers in the US. The model of Prettner and Strulik (2020) assumed that high-skilled workers are complements to machines and low-skilled workers are substitutes for machines, leading to the finding that automation leads to an increasing share of college graduates, increasing income and wealth inequality, and causing a declining labour share.

Acemoglu and Restrepo (2020) showed that the impact of robots is distinct from other capital and technologies. They estimated that one more robot per thousand workers reduces the employment-to-population ratio by 0.2 percentage points and wages by 0.42 percent in the US. In turn, Acemoglu and Restrepo (2021) documented that between 50 percent and 70

percent of changes in the US wage structure over the last four decades is accounted for by the relative wage declines of worker groups specialised in routine tasks in industries experiencing rapid automation. They developed a conceptual framework to explain this development, in which automation technologies expand the set of tasks performed by capital, displacing certain worker groups from employment opportunities.

Focusing on inequality, Moll *et al* (2021) explored how technology affects wealth inequality and overall income inequality (not just wages). They concluded that automation not only **benefits high-skilled labour but also increases inequality via increased returns to wealth.** The flipside of such return movements is that automation is more likely to lead to stagnant wages and therefore stagnant incomes at the bottom of the distribution.

By considering age, Battisti and Gravina (2021) found evidence of greater complementarity between robots and older workers (aged 50 and over), and greater substitutability among robots and younger cohorts of the labour market, based on data from 13 advanced countries (including the US and 8 EU countries) from 1994-2005.

However, some works highlight that some technologies create more jobs than they destroy. Gregory *et al* (2021) concluded that routine-replacing technologies destroyed 9 million jobs in Europe in 1999-2010, but created about 14-19 million jobs over the same period, resulting from lower product prices, which improve regions' terms of trade, raising their tradable output and employment, as well as from growing local incomes and positive demand spillovers to the non-tradable sector. Furthermore, Gregory *et al* (2021) showed that employment would have grown substantially more had firm mark-ups not increased, in line with the argument and evidence put forward by Autor *et al* (2020).

Most recently, Ciarli *et al* (2022) emphasised that in many cases, deploying labour-saving devices results in the **reconfiguration rather than elimination of jobs** – with some net loss of employment and often an increase in output or productivity (which can then be reflected in lower prices that increase the size of a market or market share). In addition, digital automation might routinise and replace segments of tasks, rather than entire tasks within occupations, and might affect also the degree of use of codified versus tacit knowledge, which requires different skills from workers.

In line with the above, Baldwin (2019) argued that **artificial intelligence (reflecting automation) and remote intelligence (ie hiring people from other countries who can work from home for lower salaries – reflecting globalisation) will mostly affect people working in the service sector, who faced little displacement so far from globalisation and automation**. The sectors most exposed to such a risk are office and administration, retail, construction jobs, food preparation, transportation, medical jobs, pharmacies, journalism, legal work and finances. He expects that in the years to come, the number of jobs displaced by white-collar robots will be somewhere between one in ten (*"big"*) and six in ten (*"enormous"*). However, Baldwin (2019) also expects that new jobs will be created and in the long run, everyone will

benefit. But the transformation period is expected to be disruptive for many people. Nevertheless, Autor (2015) expressed a hopeful prediction: **a significant stratum of middle-skill jobs combining specific vocational skills with foundational middle-skill levels of literacy, numeracy, adaptability, problem-solving and common sense will persist in the coming decades**.

4. The shock of the pandemic: essential and digital workers

More recently, all these trends have been further affected by COVID-19. Bloom and Prettner (2020) argued that the COVID-19 pandemic, as well precautions against future pandemics, will likely accelerate automation and the displacement of certain workers exposed to close interactions, some of whom are low-wage earners. Remote work increased massively during the pandemic and will likely be more frequent after the pandemic than before (Marcus *et al*, 2022). Occupations that can be done remotely are typically for better-educated higher earners. These developments will likely widen inequalities.

Savona (2021) highlighted the role of 'essential' services: the opportunities for remote working are to a great degree specific to occupations and sectors (Dingel and Neiman, 2020; Del Rio-Chanona *et al*, 2020). Some anecdotal evidence seems to suggest that remote working is either for privileged, highly skilled and well-paid workers, or for precarious, self-employed gig workers. The global lockdowns have accelerated the pace of remote working and exacerbated these differences (Adams-Prassl *et al*, 2021; Haldane, 2020; Darvas, 2021; Marcus *et al*, 2022).

Stuck in the middle are all the 'essential services' that are unsuited to remote working. Wholesale and retail services, including delivery services, transport and services auxiliary to transport, personal care, social services and healthcare, are the essential services that have played a crucial role during the pandemic and are likely to do the same in the next ones. Essential service occupations cannot be carried out from home 'by design', and yet are indispensable if the economy is to retain a minimum level of functioning when most economic activities are shut down.

While some 50 percent of information and communication service workers, 45 percent of professional and scientific service workers, and 40 percent of finance and real-estate service workers could turn to home working during the pandemic in the United Kingdom, for instance (Haldane, 2020; Del Rio-Chanona *et al*, 2020), essential services are structurally unsuited to remote working.

More generally, the COVID-19 pandemic has had an impact on remote working and on the challenges of managing the effects of digital transformations on working conditions in two major ways. First is the long-term consequences of the global shift towards smart (remote) working, from which, as argued here, essential services are most likely to be excluded. The second aspect is the extent to which digital home working, in both its traditional and emerging

forms, are to become the 'new normal' (Alipour *et al*, 2021), and if they can be made more inclusive.

Haldane (2020) suggested two interesting potential long-term negative effects of home working. First, the lack of face-to-face interaction might lead to the loss of a fertile environment for the creative and novel ideas that are at the very core of innovation. Second, the loss of social networks and the opportunity to exchange ideas informally might lead to a loss of social capital as existing social capital is eroded and new social capital does not get formed: *"Whether it is creative sparks being dampened, existing social capital being depleted or new social capital being lost, these are real costs and costs which would be expected to grow, silently but steadily, over time. They weigh on the other side of the ledger when it comes to assessing the case for home working. They cast doubt on whether it will lead to the promised land of improved productivity and greater happiness"* (Haldane, 2020).

This is all very plausible and applies to non-essential but highly valued services. Services which are essential but for which a low value is set will most likely be immune to the risks of creative sparks being dampened or social capital lost, simply because they did not enjoy these things in the first place. Acknowledging the costs of home working is undoubtedly forward-looking, but recognising that the value of essential services is not reflected in their wages would be revolutionary.

5. Technology and labour markets: main policy challenges

The evidence we have set out above is crucial but is a moving target: transformational change due to the joint effects of technology, market structure, the skills gap and the impact of the pandemic is still ongoing and it is hard to pinpoint what the future holds.

Remote working and digital jobs are only a symptom of a much deeper and longer-standing transformation of occupations and working models, long pre-dating (but accelerated by) the COVID-19 pandemic and the restrictions imposed on some occupations by governments.
For the purpose of this work, it is important to raise a selected number of questions that require bold policies in order to address the challenges of the changing nature of jobs arising from automation and digitalisation, and the side effects that these phenomena have on workers.

- **What can explain the different labour share, inequality and earnings developments in the US and in some EU member states?**
- What are the possible effects of the changes brought about by *technology*, and the *COVID-19 pandemic* and the *fall in labour shares* by age, gender, race, ethnicity, geography and educational attainment?
- Which occupations or tasks are at greatest risk of being automated? What are the socio-economic characteristics of workers currently performing these tasks? Would this lead to the further polarisation of labour markets and income?

- **How can technical change be steered to ensure social mobility and to offer new opportunities to young people from disadvantaged backgrounds?**
- What policies are needed to ensure that automation does not just displace jobs, but creates new occupational opportunities that displaced workers can take?
- What is the role of the public sector in offering opportunities to experiment in novel inclusive trajectories of technical change that are facilitated by purported policies of training, education and learning on the job?

These questions require a substantial research effort, of which we have only scratched the surface in this paper. Solid evidence to underpin policy solutions is also needed. The High Level Group Report on the Impact of Digital Transformations on EU Labour Markets (European Commission, 2019) unpacked the effects of digitalisation trends on several occupations. While the literature dealing with the effects of digitalisation on occupations and tasks has produced robust findings, what is missing is a systematic effort to devise policies that tackle potential side effects. The policy recommendations offered in the report have proved to be somewhat prophetic in the context of the COVID-19 crisis. We summarise them below, and refer the interested reader to the full report (European Commission, 2019):

A skilled workforce
The abrupt shift to home working and the need to shield at-risk categories, including those with hidden disabilities, have shown that one of the most important requirements for workers to survive in current labour markets is the acquisition of digital literacy and updated digital skills. Workers might not be aware of the need or might not have the opportunities and access to invest in their digital skills. If so, policymakers can organise digital skills personal-learning accounts that belong to workers and are portable from job to job. Details such as contributions, the number of hours per year, top-ups, eligible expenses, withdrawal processes and taxation schemes are important, and not much is known yet about their effectiveness.

New labour relations and a new social contract
The combination of the abrupt shift mentioned above and the effects of lockdown have put a dramatic strain on workers' mental health. The European Commission (2019) recommendations emphasised the need to avert occupational safety and health risks like mental health and stress-related issues resulting from digitalisation and increased volatility in today's world of work. What is needed is to increase the focus on prevention in employee assistance programmes, and to improve uptake by increasing social acceptance of mental health issues through informed discourse. The COVID-19 crisis is an unprecedented opportunity to increase public expenditure in the health sector, and governments should plan a substantial expansion of mental health programmes.

Remote working has accelerated the pace of growth in platform working and alternative work arrangements, a trend which started before the COVID-19 crisis (Ciarli *et al*, 2020; Bell and Blanchflower, 2021). One of the most inclusive steps that governments could and should take in the wake of the crisis is to equalise the (administrative) treatment of standard and non-

standard work arrangements. This could be done, for example, by providing equal access to government services and credit lines and transferability of benefits regardless of employment status.

Along the same lines, it is important to ensure neutral social protection against unemployment, sickness and other life circumstances, independent of employment status. The increasing number of workers with non-standard employment should have access to social protection, eg through portable benefits attached to the worker rather than the job, or the establishment of an 'underemployment insurance' scheme to smooth out fluctuating incomes in the gig economy.

These structural, forward-looking actions could well be spillovers from government spending on furlough schemes to tackle the COVID-19 crisis. European Commission (2019) advocated a combination of context-specific and structural interventions that not only cover the emergency but ensure long-term inclusivity in labour markets.

Digitalisation, worker wellbeing and work-life balance
Workers, employers and policymakers play key roles in determining the trade-offs related to new workplace technologies for worker physical and mental health and overall wellbeing. Policies should help build worker wellbeing into the company culture. Examples are offering preventative medical check-ups (eg to prevent 'tech-neck injuries') and training staff to recognise and address stress in colleagues (due to 'organisation-change fatigue' and 'learned helplessness' from workplace digitalisation). A focus on mental health issues seems particularly important because, unlike many physical conditions, mental health conditions can be denied for a long time by the individual, both to themselves and to those around them.
These policies can be based on recent experiences with employee assistance programmes (EAPs) offered to help employees navigate challenges at work and in their personal lives. Many employees can access early support related to topics like personal relationship challenges, anxiety and stress – thus providing an early-stage prevention approach that has proven to be cost-effective for employers. As well as improving morale within firms, studies show that, through investments in EAPs, companies can increase worker productivity and reduce absenteeism costs.

In sum, occupational safety and health risks are rising in part because of digitalisation. Although more evidence **is needed to determine the emerging trade-offs for worker health and wellbeing from new workplace technologies, policies** should focus on prevention through EPA-type programmes and improve uptake by increasing social acceptance through informed discourse and the delivery of personalised, cost-effective solutions enabled by technology.

All these proposed policy measures help the most vulnerable segments of society and thus have the potential to lessen the adverse distributional impacts of digitalisation.

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