

Who is at risk?

Work and automation,
in the time of Covid-19

Fabian Wallace-Stephens
and Emma Morgante

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Fabian Wallace-Stephens and Emma Morgante, 2020.

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REALISING



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The RSA Future Work Programme aims to secure good work for all in an age of technological upheaval. The pandemic and economic crisis that has followed only adds urgency to this mission. Covid-19 not only looks likely to create ‘a tsunami of job losses’ in industries that are unable to turn a profit but, alongside this bleak economic outlook, there are also signs the pandemic could rapidly accelerate the pace of technological change. This report explores how these forces could interact to fundamentally reshape the labour market.

To do this, we develop a risk register that combines an analysis of the impacts of the pandemic on different sectors, with measures of automation risk and their growth or decline over the last decade.

The need for this analysis is clear: unemployment is set to rise considerably. With every day that passes, the V-shaped recovery several economists initially expected looks more unlikely, hindered by the endemic nature of the virus. Some of the hardest hit industries have barely recovered at all: 4.5 million workers were still furloughed on the government’s Coronavirus Job Retention Scheme (CJRS) at the end of July.¹

Meanwhile, the government’s new Winter Economy Plan has introduced the concept of whether jobs are ‘viable’ as a key factor in determining policy support.² This requires an analysis of both the short-term effects of the pandemic and longer-run trends in the future of work. For example,

if some workers are best supported by retraining policies, then we need to know both which workers are most in need of that support and what future jobs are most resilient to technological disruption.

To assist policymakers wrestling with this challenge, we develop a risk register that combines an analysis of the impacts of the pandemic on different sectors, with measures of automation risk and their growth or decline over the last decade. We also assess the evidence base that the pandemic will accelerate the pace of technological change and further reduce the number of jobs available, identifying three broad arguments. These arguments relate, respectively, to public health considerations, consumer preferences and the relatively high cost of labour in a pandemic (see Table 1).

Table 1: Key arguments that the pandemic will accelerate the pace of technological change

Argument	Summary	Examples
Public health considerations	Businesses could increase automation in order to minimise interaction between workers and consumers and reduce the risk of contagion.	Amazon opening its first cashierless store in the UK; mobile robots delivering room service to guests in hotels across Hong Kong.
Consumer preferences	While new technologies may have initially been introduced for health and safety reasons, some will stick around because they offer consumers more convenient, enjoyable or affordable experiences.	Exercise classes held over Zoom; the rise of e-commerce and food delivery platforms.
The cost of labour in a pandemic	Social distancing and other protective measures increase the cost of human labour relative to machines that can still work in close proximity, don’t need to self-isolate and don’t require sick pay.	Robots in manufacturing and fast food restaurants; modular construction.

¹ RSA analysis of CJRS statistics (see Chapter 1).

² HM Treasury (2020) Chancellor outlines Winter Economy Plan. [online] GOV.UK. Available at: www.gov.uk/government/news/chancellor-outlines-winter-economy-plan

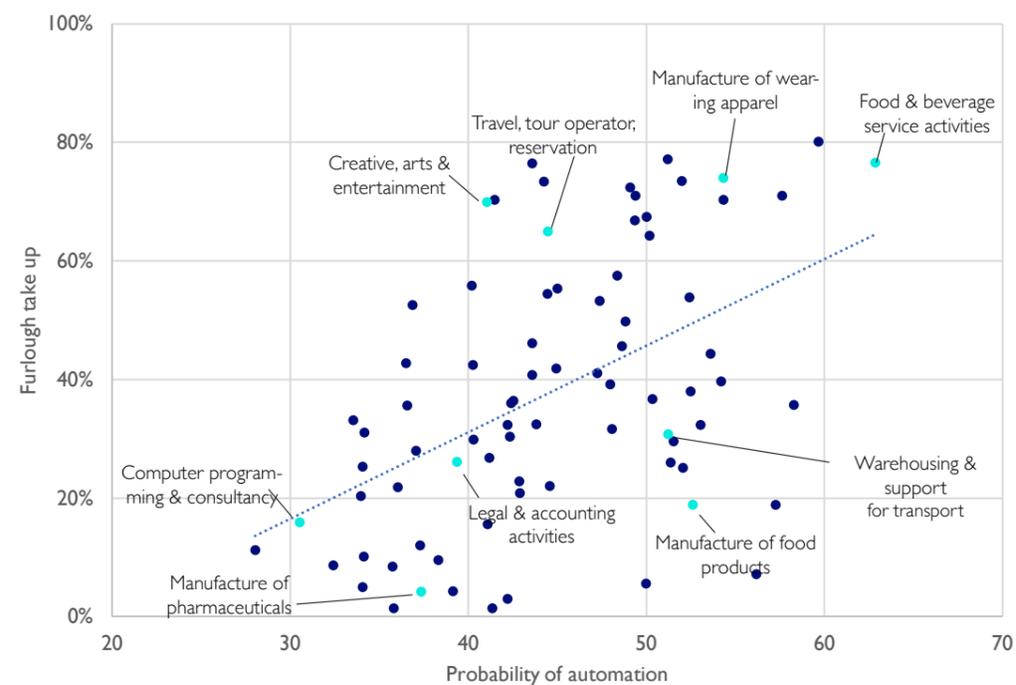
Our findings are of course caveated by the fact that so much remains uncertain. Forecasting future job losses is difficult in this context because of the interplay between several uncertain factors, including those that relate to the ongoing public health situation. If a breakthrough in the search for an effective treatment or vaccine is just around the corner, then 'the new normal' might yet look surprisingly like the old. Our hope is that this risk register can help decision makers through these uncertain times by identifying what groups of workers are most vulnerable or resilient to these different forces. And thus, what policy support is needed to make sure all workers can gain or retain access to good work, during the pandemic and beyond.

When developing this risk register we compiled a range of indicators that are both timely and granular, to provide an overview of the labour market at a detailed industrial classification level:

- To measure coronavirus risk, we use HMRC data on furlough take-up, alongside RSA estimates of changes in economic output relative to their pre-pandemic level (February to July 2020).
- To measure automation risk, we use data from a 2019 Office for National Statistics (ONS) analysis, which builds on inputs from the seminal 2013 Oxford University study by Frey and Osborne.
- We also use RSA analysis of the Annual Population Survey (APS) to flag whether industries have experienced growth or decline over the last decade.

We find that industries with the highest level of furlough take-up are considerably more likely to be at risk of automation. However, this relationship is far from straightforward.

Figure 1: Relationship between furlough take-up and automation risk (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and ONS, the probability of automation in England)



Not all industries that have been impacted by the pandemic are at a high risk of automation. Some of the most automatable industries have been shielded from the impacts of the pandemic and may have even benefitted from the Covid-19 economy.

We conduct a segmentation analysis to explore this relationship in more detail. We identify four broad clusters of industries along the axes of Covid-19 and automation risk. Our risk register also includes data on demographic characteristics, including age, gender, income and education levels, to illustrate how these forces could impact employment prospects for different demographic groups. In summary, we identify the following four clusters of industries:

- High Covid-19, high automation risk. Industries in this cluster tend to have high levels of young workers (under 30). Workers in these industries are slightly more likely to be men, tend to be lower paid and are less likely to have higher levels of education; 17 percent of employment. Includes

industries such as hospitality, sports and recreation and parts of manufacturing and construction.

- High Covid-19, low-medium automation risk. Workers in this cluster are also more likely to be men overall, but are relatively well paid and have higher levels of education; 30 percent of employment. Includes industries such as air travel and tourism, creative arts and entertainment, architecture, film production, museums and culture.
- Low-medium Covid-19, high automation risk. This cluster is relatively gender balanced, tend to be lower paid and are less likely to have higher levels of education; 17 percent of employment. Includes some key worker industries such as retail, food production, residential care and postal and courier activities.
- Low Covid-19, low automation risk. Overall workers in the most resilient cluster of industries are more likely to be women, tend to be well paid and have high levels of education; 35 percent of employment. Includes scientific research, healthcare and education as well as some male dominated industries such as computer programming.

Table 2: Demographic characteristics of at risk/resilient industries

	Average hourly earnings (£)	Percentage of workers who are women	Percentage of workers who are under 30	Percentage of workers with degree or equivalent	Percentage share of total employment
All workers	16	48	23	37	100
High Covid-19, high automation	12	40	30	17	17
High Covid-19, low-medium automation	18	31	22	42	9
Low-medium Covid-19, high automation	11	51	27	20	17
Low Covid-19, low automation	18	58	18	55	35

Our analysis not only highlights where the pandemic could accelerate the pace of automation, it also underlines how Covid-19 will create new winners and losers, with industries we previously thought to be more resilient now on the brink of collapse. Crucially this analysis allows us to move beyond 'a one size fits all' approach to developing policy recommendations. Different groups of workers will need very different kinds of support in the coming months. We put forward several policy recommendations that aim to support them:

1

Targeted support

to protect jobs at risk of Covid-19: The government should modify its Job Support Scheme (JSS) and introduce a two-track system based on the French 'partial activity' scheme. Alongside the existing national JSS scheme this would see an alternative pathway for businesses in the most at-risk sectors, with reduced employer contributions. As a condition for long-term support, this pathway should also require any firm with more than 20 workers to introduce a works council.

2

Transition services

for workers at risk of Covid-19 and automation: The government should introduce an end-to-end transition service that redeploys the most at-risk workers into sectors that are more resilient, modelled on Swedish Job Security Councils (JSC). These workers could then be provided with a transitional basic income to support them financially as they retrain.

3

Upskilling workers

at risk of automation: The government should introduce personal learning accounts to futureproof roles in sectors at high risk of automation, particularly those that have experienced good growth since the pandemic.

Some of these policies aim to protect those from the unemployment risks associated with the pandemic. Others focus on helping them to transition into roles that are more resilient. But together we hope they provide the basis for a system that could allow the economy to evolve – both in the short and medium-term - without leaving any workers behind.

INTRODUCTION

Automation anxiety is back.

Introduction

On 23 March 2020, the UK went into lockdown. Almost overnight, the government forced vast swathes of the economy – including hospitality, leisure, entertainment and non-essential retail businesses – to close temporarily in order to prevent the spread of the Covid-19 virus. Other businesses, in sectors such as manufacturing or construction, found themselves having to close voluntarily due to a lack of demand, disruptions to supply chains or difficulties working under social distancing guidelines.³ These public health restrictions, alongside the reduction in consumption that accompanied peoples' individual actions to reduce the risk of catching the virus, led the economy to contract by 25 percent between February and April.⁴ Meanwhile more than eight million employees were temporarily laid off – or furloughed – under the government's Coronavirus Job Retention Scheme.⁵

The International Monetary Fund (IMF) now expects that the fall in global economic output this year will represent the worst downturn since the Great Depression.⁶ But alongside this bleak economic outlook, there are signals that Covid-19 could rapidly accelerate the pace of technological change. When discussing

the rise of remote working back in April, Microsoft CEO Satya Nadella suggested that “we've [already] seen two years' worth of digital transformation in two months”.⁷ The share of online retail sales has increased from 20 percent to 29 percent, which is comparable to the five years of transformation the industry saw between 2015-2020.⁸ While Cambridge University has announced that all lectures will now be online-only until summer 2021.⁹

Over the last decade, debates about the future of work have been dominated by the prospects for this long-heralded tech transformation and, in particular, by attempts to predict the numbers of jobs that might disappear as a result. We would argue, a little too dominated – the RSA has long maintained that a focus only on how technology affects the quantity of work misses the more profound and impactful way it also changes the quality of work. In the UK, this debate also struck an especially discordant note when juxtaposed with a period of consistently high employment in recent years. It was as if, to adapt the economist Robert Solow's famous quip about productivity and the computer age, you could see automation everywhere but in the employment statistics.¹⁰

However, automation anxiety is now justifiably back. It is not just that the pandemic has led to huge demand shocks that could mean the economy simply no longer retains a need for the labour of some workers. It also that our behaviour might now adapt in a way that accelerates the roll out of labour-saving technology. For business leaders, a reliance on human labour might now look like a systemic business risk, whereas consumers may start to prefer less labour-intensive services. Indeed, as the futurist Martin Ford has pointed out “people usually say they want a human element to their interactions but Covid-19 has changed that”.¹¹ While economists such as Adair Turner have reminded us that “robots don't get sick”.¹²

This report sets out to explore how Covid-19 might interact with technology and how this could fundamentally reshape the labour market. To do this we develop a risk register that combines an analysis of the impacts of the pandemic on different sectors, with measures of automation risk and their growth or decline over the last decade. Our risk register does not aim to put a precise figure on the number of jobs that will be lost due to either robots or the pandemic. Rather, our aim is to help key decision makers – whether the Chancellor of the Exchequer or a careers advisor in an FE college – identify what jobs are vulnerable or resilient to these two different forces. And thus, what different types of policy support we need to make sure all workers gain or retain access to good work, during the pandemic and beyond.

In our view, securing good work for all has always been an urgent social objective (see Box 1, following page). But as we approach the end of the CRJS and the Office for Budget Responsibility predicts unemployment could surpass levels last seen in the 1980s, the cost of inaction has perhaps never seemed so stark.¹³ We set out our findings in the following five chapters.

In **Chapter 2** we examine the emerging evidence on the impacts of Covid-19. We draw on a range of indicators to illustrate in more detail how the pandemic has impacted the labour market and consider several economic forecasts and their implications for future unemployment.

In **Chapter 3** we explore the different ways in which the pandemic could interact with technology. We examine the key arguments from the literature that the pandemic will accelerate technological change and reduce the number of jobs available for workers.

3 BBC (2020) Coronavirus: Construction firms split as shutdown calls grow. BBC News, [online] 25 March. Available at: www.bbc.co.uk/news/business-52034586

4 Office for National Statistics. (2020) GDP monthly estimate, UK: April 2020. [online] ONS. Available at: www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpmonthlyestimateuk/april2020

5 RSA analysis of HMRC Coronavirus Job Retention Scheme Statistics suggests that furlough take-up peaked at 8.8 million in late April and early May.

6 Gopinath, G. (2020) The Great Lockdown: Worst Economic Downturn Since the Great Depression. IMF Blog, [blog] 14 April. Available at: <https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/>

7 Spataro, J. (2020) 2 years of digital transformation in 2 months. Microsoft, [blog] 30 April. Available at: www.microsoft.com/en-us/microsoft-365/blog/2020/04/30/2-years-digital-transformation-2-months/

8 RSA analysis of ONS Internet Sales Index.

9 BBC (2020) Cambridge University: All lectures to be online-only until summer of 2021. BBC News, [online] 19 May. Available at: www.bbc.co.uk/news/education-52732814

10 Krishnan, M., Mischke, J. and Remes, J. (2018) Is the Solow Paradox Back? [online] McKinsey. Available at: www.mckinsey.com/business-functions/mckinsey-digital/our-insights/is-the-solow-paradox-back

11 Thomas, Z. (2020) Coronavirus: Will Covid-19 speed up the use of robots to replace human workers? BBC, [online] 18 April. Available at: www.bbc.co.uk/news/technology-52340651

12 Turner, A. (2020) Robots don't get sick: accelerated automation in the post-Covid world, Montrose Journal Covid-19 Edition, [online]. Available at: www.montroseassociates.biz/article.asp?aid=135

13 Office for Budget Responsibility (2020) Fiscal sustainability report. [pdf] Office for Budget Responsibility. Available at: cdn.obr.uk/OBR_FSR_July_2020.pdf

In **Chapter 4** we outline our methodology and initial results. We find that industries with highest levels of furlough take-up generally tend to be more at risk of automation. However, this relationship is far from straightforward as some industries that have been impacted by the pandemic are at relatively low risk of automation. While some of the most automatable industries have been shielded from the impacts of the pandemic and may have even benefitted from the Covid-19 economy.

In **Chapter 5** we conduct a segmentation which explores this in more detail and highlights what industries are exposed to these different forces as well as the implications for different demographic groups.

In **Chapter 6** we put forward some policy recommendations to ensure that these workers are able to access good work, despite the changes that are afoot.

Box 1: What do we mean by good work?

The goal of the RSA Future Work Programme is to ensure that all workers, regardless of background, can pursue good work in an age of technological change. We have identified five principles that provide the foundations for this vision:

Security – all should enjoy work that provides enough economic security to participate equally in society.

Wellbeing – all should enjoy work that does not harm their physical and mental health.

Growth – all should enjoy work that grows and develops their capabilities.

Freedom – all should enjoy work that provides freedom to pursue a larger life.

Subjective nurture – all should enjoy work that nurtures their subjective working identity.

FORECASTING FUTURE JOB LOSSES

People looking for a new job will find the most inhospitable labour market in modern memory.

Forecasting future job losses

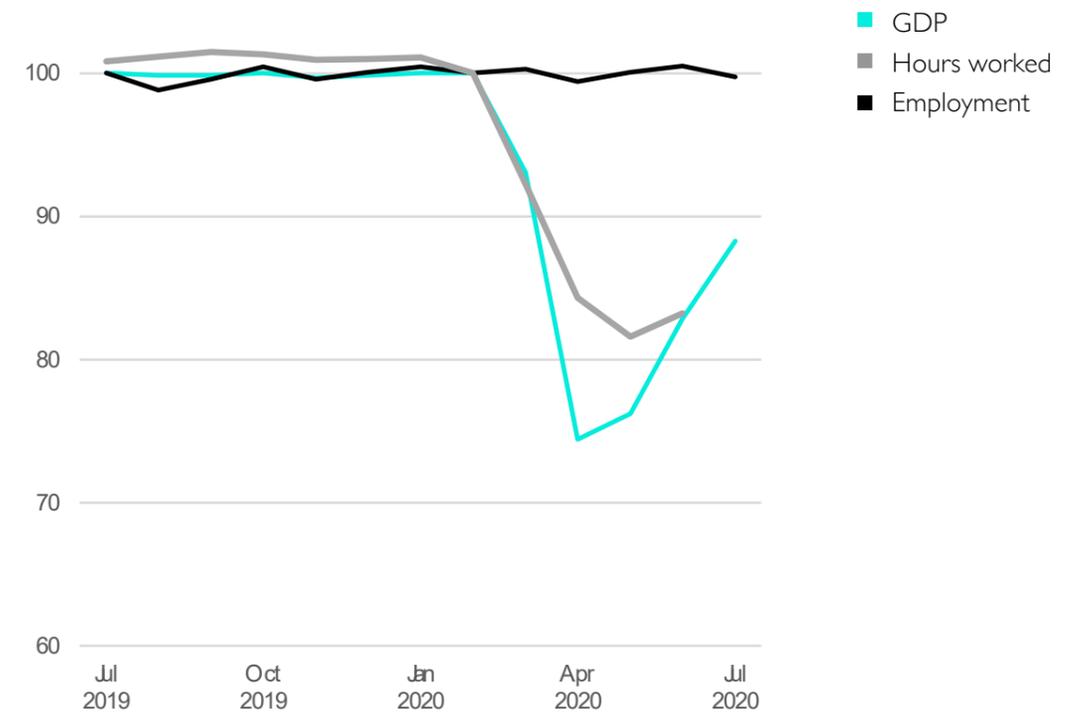
Not all recessions lead to widespread unemployment. During the 2008 financial crisis, for example, unemployment was comparatively light, given how deep the recession was in terms of lost output.¹⁴ The view amongst some labour market economists is that this time will be very different. According to Paul Gregg of the University of Bath, this is because many of the industries that have been hardest hit this time – hospitality, for example – are labour intensive.¹⁵ Another key variable is how threatened employers feel by bankruptcy. With social distancing regulations striking many firms at the level of business model viability, rather than just altering trading conditions, there are fears such worries could be more widespread than usual. Understanding exactly how the pandemic and its uniquely challenging economic forces will affect unemployment is clearly crucial to our goal of identifying which workers are most at risk. But to date, interpreting the impacts of Covid-19 on UK employment have been far from straightforward. It is now quite clear that April was not only the nadir of this recession, in terms of the fall in economic output. Yet despite this, data from the Labour Force Survey suggests that

employment has so far remained largely unaffected by the pandemic (see Figure 2, following page). In this chapter we draw on a range of indicators to unpack this mystery and illustrate in more detail precisely how Covid-19 has impacted the labour market. We then consider several economic forecasts and their implications for assessing the scale of future unemployment associated with the pandemic.

The headline employment rate has so far been a poor indicator of the impacts of the virus on the economy, not only because it suffers from significant time lag but because it was not designed to pick up the peculiarities of this recession. The nature and scale of this economic shock required that the government protect jobs and incomes through the furlough scheme. These workers are not technically classified as unemployed as they remain on their employer's payroll and in most cases are not actively seeking work (a requirement of the ILO definition of unemployment).¹⁶ But initially they were not permitted to work for their employers either, which explains why hours worked fell to a record low in May.

Economists David Bell and David Blanchflower have suggested that we should assume furloughed workers are unemployed.¹⁷ But this could overestimate the extent of potential job losses associated with the pandemic. It is far from obvious that all these workers would have been made redundant, as firms may have been much less reluctant to use the CJRS scheme than completely

Figure 2: Monthly changes in GDP, hours worked and employment (RSA analysis of ONS Monthly GDP estimates and Single-month Labour Force Survey estimates, 100 = February 2020)



sever ties with experienced staff. For example, in countries such as the US where no equivalent scheme is in place unemployment rose to around 15 percent in April, which is much lower than take-up of the furlough scheme in Britain.¹⁸

Administrative data from HMRC suggests that the number of jobs furloughed peaked at around 8.8m in late April and early May, before falling to 4.8m at the end of July.

Our analysis also suggests that many of the broad industry sectors (1-digit SICs) that have been hardest hit have shown signs of a partial recovery, with construction, retail, manufacturing seeing more than half of furloughed workers returning by late July. But hospitality and the arts, entertainment and recreation, have continued to struggle, with more than 40 percent of jobs in these sectors still dependent on the CJRS.

¹⁴ While GDP fell by 6 percent, employment fell by only 3 percentage points, with unemployment peaking at around 8 percent in 2011.

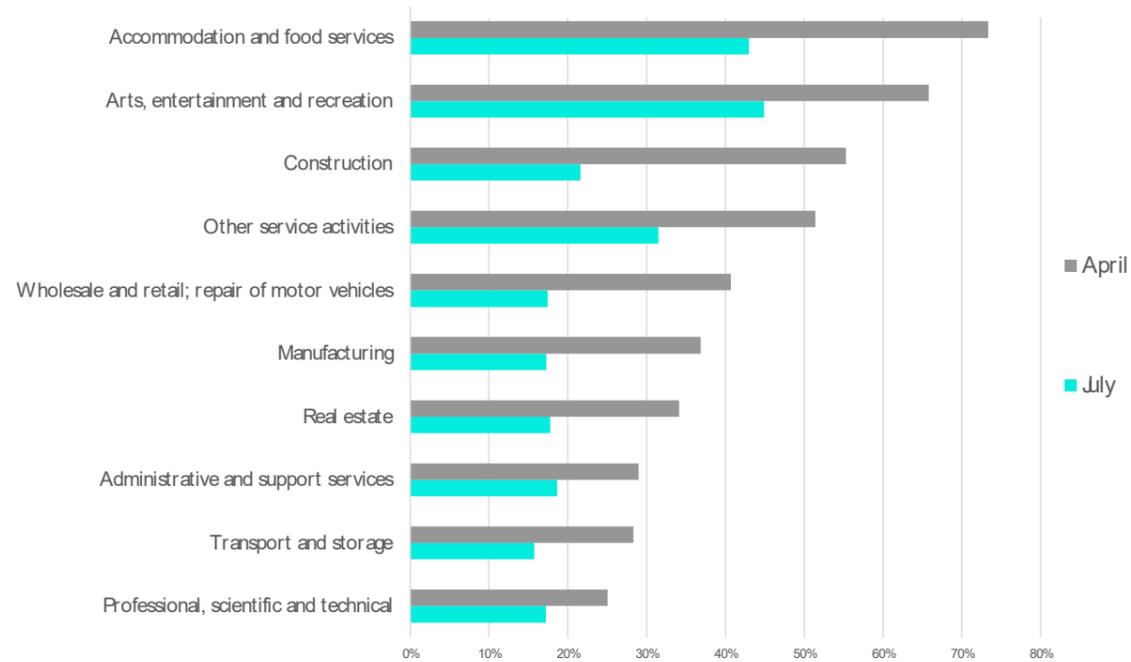
¹⁵ Gregg, P. (2020) Unemployment: The Coming Storm. UCL. [blog] 17 June. Available at: blogs.ucl.ac.uk/cepo/2020/06/17/unemployment-the-coming-storm/

¹⁶ Office for National Statistics. (2020). A guide to labour market statistics. [online] ONS. Available at: www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/aguidetolabourmarketstatistics

¹⁷ Bell, D. and Blanchflower, D. (2020) US and UK labour markets before and during the Covid-19 crash. National Institute Economic Review. [e-journal] Vol 252. Available at: www.cambridge.org/core/journals/national-institute-economic-review/article/us-and-uk-labour-markets-before-and-during-the-covid19-crash/5A8D5A27F1854AF5E6906330B214AFF0

¹⁸ OECD. (2020) Unemployment rate [online]. Available at: data.oecd.org/unemp/unemployment-rate.htm

Figure 3: Changes in furlough rates for industries with the highest levels of take up (RSA analysis of HMRC CJRS statistics)



Another important data point is the huge spike in the claimant count. This increased by 1.4 million or 114 percent from March to May 2020. However, whilst this cannot be straightforwardly interpreted as a rise in unemployment, it could speak to rising economic insecurity within the labour market. Enhancements to Universal Credit (UC) made as part of the government's response to coronavirus have meant more people are eligible for this support.¹⁹ But the decline in pay received by low paid employees who have been furloughed - and thus only receiving 80 percent of their salary - could also have contributed to increases in benefit claims by bringing more people underneath the eligibility threshold.

Lastly because the Self-Employment Income Support Scheme (SEISS) grant

covering April and May was not paid until June many of the 2.6 million self-employed workers that were eligible may have applied for UC in April to help with their immediate cash flow.

HMRC estimates of people paid through the Pay As You Earn (PAYE) system may provide clearer insight into the scale of job losses so far. These experimental statistics indicate that the number of employees on payroll fell by over 730,000 (or 2.5 percent) between March and July.²⁰ The number of vacancies also fell to 337,000 between April and June, down 56 percent on the previous quarter. This means that people who are looking for a new job will find themselves in the most inhospitable labour market in modern memory.²¹

19 Office for National Statistics. (2020). Employment in the UK: June 2020. [online] ONS. Available at: www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/employmentintheuk/june2020

20 Office for National Statistics. (2020). Employment in the UK: August 2020. [online] ONS. Available at: www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/august2020

21 Ibid.

Redundancies as a result of the pandemic have so far remained relatively low, almost certainly because of the furlough scheme. But it remains uncertain just how much unemployment will rise in the coming months. Much will depend on the shape of the recovery (see Box 2), which in turn will depend on the public health situation, including the availability of a vaccine and the stringency of ongoing social distancing measures as the pandemic infection rate rises and, hopefully, falls.

“So far, so V” said Andy Haldane, chief economist at the Bank of England, in a June speech about the likely recovery pathway. Haldane was citing indicators that suggested consumer spending was rising faster than the Bank's May forecasts expected.²² However, the Bank's analysis showed that only 'delayable spending' on items such as clothes, cars and household goods had returned to its pre-pandemic levels. At this time, social spending in pubs restaurants and entertainment venues remained almost 60 percent below pre-pandemic levels.

Box 2: Some possible economic trajectories

- The Bank of England expected a V-shaped recovery back in May. On this trajectory economic output recovers by the end of the year and unemployment peaks at just 9 percent.²²
- The OBR released three different economic scenarios in July.²³
 - The more sombre downside scenario (which looks a bit like a Nike swoosh) suggests unemployment would peak at 13 percent by Q1 2021 and that economic output does not return to its pre-pandemic level until 2024.
 - The upside scenario is an optimistic V-shaped recovery.
 - The central scenario still suggests that unemployment will surpass levels seen in the 1980s by reaching 12 percent.
- The OECD have made forecasts for two scenarios, including a W-shaped recovery where a second wave of the virus brings additional lockdowns. Under this 'double hit' scenario economic unemployment would rise to almost 15 percent by the end of the year.²⁴

22 Bank of England (2020) Monetary Policy Report – May 2020. [pdf] Bank of England. Available at: www.bankofengland.co.uk/-/media/boe/files/monetary-policy-report/2020/may/monetary-policy-report-may-2020.pdf

23 Office for Budget Responsibility. (2020) Fiscal sustainability report – July 2020. Op cit.

24 OECD (2020), OECD Economic Outlook, Volume 2020 Issue 1, [online] OECD Publishing. Available at doi.org/10.1787/0d1d1e2e-en

As our analysis of economic output data for detailed industry divisions (2-digit SICs) from the ONS Index of Services (IoS) and Index of Production (IoP) shows, the recovery of some of the hardest hit industries looks more like an I or a U than a V. Table 3 highlights the sustained impact the virus has had on air travel, tourism, hospitality and other personal services (which includes hairdressing, massage therapy and the beauty industry).²⁶ Similarly, the ONS Index of Production highlights how manufacturing sub-sectors, such as those involved in the production of cars and clothes, had all but ground to a halt in April and are yet to fully recover.

To add to this more uneven picture, the spectre of further lockdowns now also looms large. Tough lockdown measures have already been reintroduced across Europe and in parts of Australia, whilst several parts of the UK, including parts of both Birmingham and Greater Manchester, have endured local lockdowns. Indeed, in August Prime Minister Boris Johnson had told UK businesses that they may even need to be prepared for a second national lockdown²⁷ and by September Prime Minister Boris Johnson admitted that “the UK is now seeing a second wave” as cases started to dramatically rise.²⁸ The OECD highlight the impacts of this scenario, which could see unemployment rise to 15 percent in the UK by the end of the year.²⁹

Moreover, it is possible that some form of social distancing could be maintained indefinitely if we are unable to develop a vaccine or effective treatment – a scenario that is arguably more likely than the public debate seems able to countenance. Back in April, the Economist warned of “the 90 percent economy that lockdowns will leave behind”.³⁰ As ongoing social distancing measures will likely be associated with a permanent reduction in output. We may now be at this point. The economy had recovered to 88 percent of its pre-pandemic level in July. But as economist Thomas Pugh points out “now that most sectors in the economy are open again there is little scope for further large rises in monthly GDP”.³¹

However, the hoped-for V-shaped recovery now seems increasingly unlikely; many industries have barely recovered at all. This means we can probably expect unemployment to rise considerably, surpassing levels not seen since the 1980s. Meanwhile, as we illustrate in the next chapter, there are also strong signals that the pandemic will accelerate the pace of technological change, which could also have an impact on job availability in both the short and medium-term.

In summary, forecasting future job losses is difficult in this context because of the interplay between several uncertain factors, including those that relate to the ongoing public health situation. To a large extent this explains why, when attempting to identify which workers are most in need of support, we have developed a risk register, rather than more predictive approach (see Chapters 4 and 5 for further details).

Table 3: Changes in output since the pandemic for industry divisions that saw the largest decline between February and April and are yet to recover (RSA analysis of Index of Services and Index of Production)

Industry division (2-digit SIC)	Percentage change in output (Feb-Apr 2020)	Percentage change in output (Feb-Apr 2020)
51 Air transport	-96	-92
79 Travel, tour operator, reservation	-95	-88
29 Manufacture vehicles and trailers	-94	-27
55 Accommodation	-92	-63
56 Food and beverage service activities	-90	-59
96 Other personal service activities	-72	-37
31 Manufacture of furniture	-68	-14
14 Manufacture of wearing apparel	-66	-24
93 Sports, amusement, and recreation	-58	-30
49 Land transport including via pipelines	-52	-24

25 Bank of England (2020) The second quarter – Speech given by Andrew G Haldane [pdf]. Available at: www.bankofengland.co.uk/-/media/boe/files/speech/2020/the-second-quarter-speech-by-andy-haldane.pdf?la=en&hash=3B82F9C046B7BCDA160AE8BE558B1EB58CFF21EB

26 Table 3 shows data for the ten industries with the largest fall in output between April and February, which had not recovered to 95 percent or more of their pre-pandemic levels by July.

27 Thomas, D. and Pickard, J. Johnson warns UK business to prepare for second wave. Financial Times. [online] 27 July. Available at: www.ft.com/content/38177be2-c782-478a-87ca-c9f113f093a4

28 BBC News. (2020) Covid: UK seeing second wave, says Boris Johnson. BBC. [online] 18 September. Available at: www.bbc.co.uk/news/uk-54212654

29 OECD. (2020) OECD Economic Outlook, Volume 2020 Issue 1. Op cit.

30 The Economist. (2020) The 90 percent economy that lockdowns will leave behind. The Economist. [online] 30 April. Available at: www.economist.com/briefing/2020/04/30/the-90-economy-that-lockdowns-will-leave-behind

31 Jordan, D. (2020) UK economy continues recovery in July. BBC. [online] 11 September. Available at: www.bbc.co.uk/news/business-54113948

References on following page

ROBOTS INA PANDEMIC

**What might have taken three or four years...
has happened in less than six weeks.**

3 Robots in a pandemic

Robots in a pandemic

Over the last decade, debates about the future of work have been dominated by attempts to predict the number of jobs that will be replaced by robots. Automation anxiety looks set to witness a revival now that reliance on human labour looks like a systemic business risk. Indeed, some commentators have suggested that the pandemic is “a crisis that robots were built for”.³²

The impacts of technology on jobs has been the RSA Future Work Programme's primary research question in recent years. But across our enquiries we have consistently found that these impacts are both more subtle and significant than the narrow debate about automation sometimes allows. This is true for the pandemic context also; even on the narrower question of the quantity of work, technology is not only impacting jobs through automation or the completion of tasks that would otherwise have been undertaken by workers. Rather we are also beginning to see a rapid transformation at the level of business models, through a shift to online and digital services, including telemedicine and e-commerce.

In this chapter we outline three key arguments about how the pandemic will accelerate the pace of technological change: reacting to public health considerations; changing consumer preferences; and the cost of labour in a pandemic. For each we give examples of how businesses are already adopting new technologies and illustrate how this could impact job availability.

Public health considerations

The absence of a vaccine has meant that minimising human contact has been at the heart of attempts to manage the pandemic. The obvious reason this could increase automation is, as Adair Turner has pointed out, that “robots don't get sick”.³³ Robots and algorithms can't catch coronavirus and so are less likely to spread it. The pandemic could therefore lead businesses to adopt these technologies in order to reduce the risk of contagion and protect both workers and consumers. As futurist Blake Morgan has suggested, “customers now care more about their safety and the safety and health of workers ... moves towards automation can keep them all healthier and customers will reward companies that do this”.³⁴

Cashierless stores in retail are a prime example of this. Amazon is due to open its first Amazon Go convenience store in the UK by the end of the year, with around 30 more planned to follow.³⁵ These stores employ cameras and sensors, along with machine learning algorithms to automatically detect when products are taken from, or returned to, shelves. Customers are then charged automatically when they leave, eliminating the need for cashiers or self-service checkout assistants. Sainsbury's is offering a similar service through its SmartShop system, which allows customers to scan their groceries as they go around the store and pay via an app. Sales from this service have reportedly increased from 15 percent to 30 percent. Mike Coupe, Sainsbury's CEO until May of this year (now testing director for NHS Track and Trace), has suggested this “might have taken three or four years to get to, and it happened in the space of less than six weeks”.³⁶

32 Simon, M. (2020) The Covid-19 Pandemic Is a Crisis That Robots Were Built For. Wired. [online] 25 April. Available at: www.wired.com/story/covid-19-pandemic-robots/

33 Turner, A. (2020). Op cit.

34 Ibid.

35 Barr, S. (2020) Amazon 'plans to open at least 30 physical shops in the UK'. Independent. [online] 3 August. Available at: www.independent.co.uk/life-style/amazon-uk-shops-go-open-launch-jeff-bezos-a9651231.html

36 WARC (2020) Sainsbury's embraces technology to boost sales during lockdown. [online] WARC. Available at: www.warc.com/newsandopinion/news/sainsburys-embraces-technology-to-boost-sales-during-lockdown/43619

Similar technology is being deployed across hotels in Asia in what has been described as a shift towards “touchless hospitality”. According to Korean tech company Yanolja, demand for their self-service check-in kiosks has more than doubled since the Covid-19 outbreak. Customers can use these systems to collect their room keys by scanning a QR code provided when they make a reservation. Meanwhile the L’hotel Group, which operates seven hotels across Hong Kong, has introduced a team of robots to serve food and drinks to guests under quarantine.³⁷

Robots are also being used to meet increased health and safety demands without endangering workers. Technology company Fetch is best known for its mobile robots that help with picking and packing in warehouses. However, as a response to the pandemic, it has recently developed a disinfecting spray robot, which can decontaminate a 100,000 square foot space in 1.5 hours. The robot, Breezy One, was co-developed with the City of Albuquerque’s Aviation Department and has been sanitising airport facilities every night since the pandemic.³⁸ Elsewhere Singapore park-goers have been reminded of their social distancing obligations by Boston Dynamics’ yellow ‘dog’. This robot hound is equipped with numerous cameras and sensors, which it can use to detect transgressors and broadcast pre-recorded warnings.³⁹

Furthermore, a report by Bain & Company argues that consumer-orientated companies will either have to “reduce the risks of human proximity by reconfiguring physical spaces and setting up tailored safety protocols, or bypass the risks of proximity by adapting products or experience for use in the home”.⁴⁰ In many sectors there has been a huge shift to online services. According to the ONS Business Impact of Coronavirus Survey (BICS), almost one in three businesses have increased their use of online services to help communicate with customers since the pandemic. Businesses in education (64 percent), health (56 percent), real estate (46 percent) and the arts, entertainment and recreation (46 percent) were the most likely to do so.

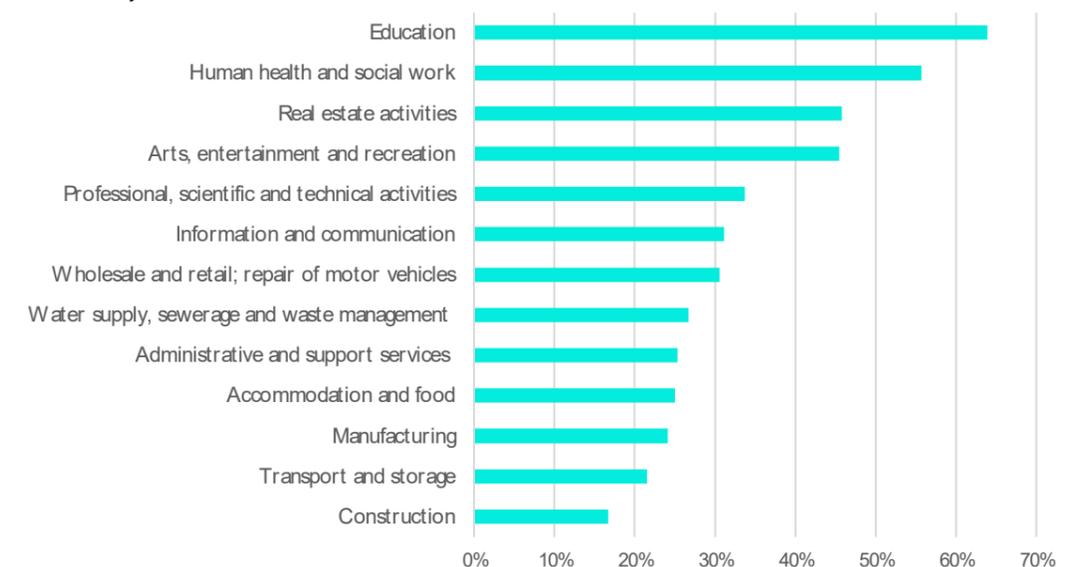
To take one particularly visible example, Cambridge University has stated that all lectures will take place online until the summer of 2021.⁴¹ Lockdown also saw a rise in online workouts, with many gyms holding yoga and HIIT classes over Zoom - Joe Wicks’ exercise series broke a record on YouTube after being viewed by millions.⁴² Telemedicine platform eConsult

is now being used by more than 2,500 NHS practices. Strategic director Mark Harmon, has suggested that “before the crisis, GPs were seeing 90 percent of their patients face to face” while “now, 90 percent of practices are using remote consultations”.⁴³

This shift to online services is an example of digitisation, where technologies turn physical goods, knowledge and experiences into data that can be easily replicated, shared and stored.⁴⁴ Like automation, this can have an impact on the number of jobs available. As Adair Turner explains, “in a world where the cost of computing and communication hardware keeps falling, and where software is infinitely

replicable at zero marginal cost, very small numbers of highly skilled people can create products and services which deliver high consumer value with trivial employment.”⁴⁵ Cambridge University could now replicate its world-leading lectures at very little cost, to a virtually infinite audience. This could offer more students access to a top-tier education but also potentially reduce the number of professors needed at other institutions.

Figure 4: Percentage of businesses reporting increased use of online services during the pandemic (ONS Business Impact of Coronavirus Survey, Wave 8)



37 Liang-Pholsena, X. (2020) Asia’s Hotels Warming Up to Automation Thanks to Growing Social Distancing Norms. [online] Skift. Available at: skift.com/2020/04/22/asias-hotels-warming-up-to-automation-thanks-to-growing-social-distancing-norms/

38 Fetch Robotics (2020) Build With Robots, Fetch Robotics and the City of Albuquerque Launch the Breezy One, Autonomous Disinfecting Robot at Albuquerque International Sunport [online]. Available at: fetchrobotics.com/fetch-robotics-blog/build-with-robots-fetch-robotics-and-the-city-of-albuquerque-launch-the-breezy-one-autonomous-disinfecting-robot-at-albuquerque-international-sunport/

39 Tucker, I. (2020) The five: robots helping to tackle coronavirus. The Guardian. [online] 31 May. Available at: www.theguardian.com/technology/2020/may/31/the-five-robots-helping-to-tackle-coronavirus

40 Darnell, D., Faelli, F., Almquist, E. and Bhardwaj, S. (2020) The Great Reluctance. [online] Bain & Company. Available at: www.bain.com/insights/the-great-reluctance/

41 BBC (2020) Cambridge University. Op cit.

42 Yeates, C. (2020) Joe Wicks bags Guinness World Record for most-watched YouTube workout live stream Metro. [online] 14 April. Available at: metro.co.uk/2020/04/14/joe-wicks-bags-guinness-world-record-1million-tune-online-fitness-class-12557302/

43 Ford, P. (2020) Digital Triage changes the game for UK GP practices in the age of COVID-19. Mobihealth news. [online] 5 May. Available at: www.mobihealthnews.com/news/europe/digital-triage-changes-game-uk-gp-practices-age-covid-19

44 Dellot, B., Mason, R. and Wallace-Stephens, F. (2019) The Four Futures of Work. London: RSA.

45 Turner, A. (2020) Op cit.

46 Autor, D. and Reynolds, E. (2020) The Nature of Work after the COVID Crisis: Too Few Low-Wage Jobs. [pdf] The Hamilton Project. Available at: www.hamiltonproject.org/assets/files/AutorReynolds_LO_FINAL.pdf

47 BBC News (2020) Pret A Manger to cut 3,000 jobs in the UK. BBC. [online] 27 August. Available at: www.bbc.co.uk/news/business-53939526

48 BBC News (2020) Warnings of ‘ghost towns’ if staff do not return to the office. BBC. [online] Available at: www.bbc.co.uk/news/business-53925917

Indeed, the economists David Autor and Elisabeth Reynolds have recently suggested that ‘telepresence’ – where technology enables people to accomplish tasks remotely – is a form of automation. This shift to online services and consumption patterns, not to mention remote working more generally, could reduce the need for cleaning, security and building maintenance staff, along with a “myriad other workers who feed, transport, clothe, entertain, and shelter people when they are not in their own homes”.⁴⁶ Already we have seen something of a ‘doughnut effect’ playing out in UK cities. Commuter favourite Pret has announced it will be cutting almost a third of its workforce, with sales down 60 percent from last year due to a lack of footfall⁴⁷ while the CBI has warned of “ghost towns” if people do not return to the office.⁴⁸

Consumer preferences

Futurist Martin Ford has suggested that during the pandemic “people will prefer to go to a place that has fewer workers and more machines because they feel they can lower overall risk”.⁴⁹ But while the pandemic has resulted in new technologies being introduced for health and safety reasons, whether or not these changes stick in the long-term may depend on whether they offer consumers more convenient or enjoyable experiences. Some will, some will not. For example, there is evidence to suggest that telemedicine can improve patient satisfaction.⁵⁰ University students, on the other hand, may not be overly enthused at the prospect of entirely virtual campuses.⁵¹

However, sometimes people may opt for virtual experiences even if they are inferior to those ‘in real life’. Consumers tend to ‘trade down’ during economic downturns, by opting for cheaper, lower quality goods and services. These products tend to be less labour intensive, than their high-quality counterparts. A recent study by Jaimovich, Rebelo and Wong found that this dynamic accounted for a substantial share of the decline in US employment during recession that followed the 2008 financial crash.⁵² Since online services are often considerably cheaper to provide, this could be an important way in which consumers will trade down in this recession. As Guardian columnist Gaby Hinsliff reminds us “online yoga at home can’t match the conviviality of a live class, but if it’s cheaper and safer than going to the gym, people might settle for it”.⁵³

Past health crises suggest that Covid-19 could also lead to lasting changes in the way we shop. Duncan Clark, author of *Alibaba: the house that Jack Ma built*, has argued that SARS epidemic was significant in the growth of the e-commerce giant in the early 2000s. Clark suggests that this epidemic “came to represent the turning point when the Internet emerged as a truly mass medium in China”.⁵⁴ Similarly many people, particularly older generations, who were previously reluctant to shop online will have been forced to during lockdown and may have been converted into online shoppers for the long-term. Between February and May, the share of online retail sales increased from 20 percent to 33 percent, before falling slightly to 29 percent in July. To give some context to the scale of this change, the last five months is roughly comparable to the previous five years of digital transformation.⁵⁵

49 Thomas, Z. (2020) Op cit.

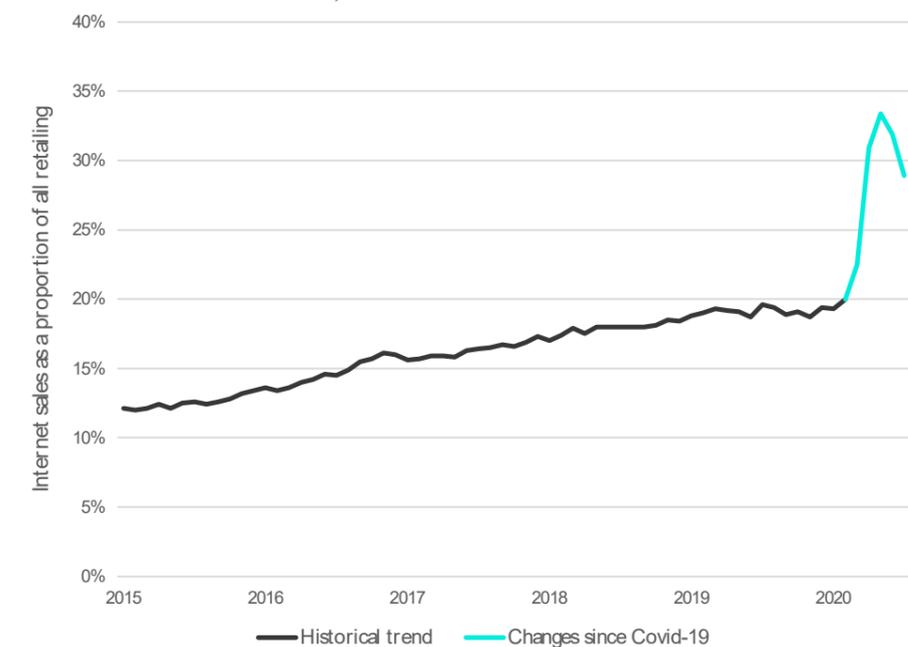
50 Scott Kruse, C. et al. (2017) Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Journals*. Vol 7, Issue 8.

51 Turner, C. (2020) University students campaign for refund as they say remote learning should not cost £9,250-per-year. *The Telegraph*. [online] 25 March. Available at: www.telegraph.co.uk/news/2020/03/25/university-students-campaign-refund-say-remote-learning-should/

52 Jaimovich, N., Rebelo, S. and Wong, A. (2015) Trading Down and the Business Cycle. NBER Working Paper No. w21539. [online]. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=2656941

53 Hinsliff, G. (2020) The next wave of coronavirus disruption? Automation. *The Guardian*. [online], 30 April. Available at: www.theguardian.com/commentisfree/2020/apr/30/coronavirus-disruption-automation

Figure 5: Changes in share of online retail sales since 2011 (RSA analysis of ONS Internet Sales Index)



Then there are the negative indicators. Marks & Spencer are reportedly going to axe 7,000 jobs.⁵⁶ Boots are making 4,000 workers redundant.⁵⁷ Even Halfords has earmarked 60 of its stores for closure, despite a significant surge in bicycle sales over lockdown.⁵⁸ Previous RSA research has demonstrated that the rise of e-commerce has changed the sector’s occupational profile dramatically, with a shift away from customer service roles and towards logistics and distribution jobs.

This in turn has tilted the gender profile of jobs more towards male employment, thus further entrenching gender inequality.⁵⁹

There are signs that a similar trend could be starting to play out in hospitality, given the reported surge in restaurants signing up to food delivery platforms like Uber Eats and Deliveroo during lockdown.⁶⁰ This could further increase demand for male-dominated roles such as delivery workers while reducing the need for waiting staff who are more likely to be women.⁶¹

54 Huddleston, T. (2020) The SARS epidemic threatened Alibaba’s survival in 2003 – here’s how it made it through to become a \$470 billion company. *CNBC*. [online] 26 March. Available at: www.cnbc.com/2020/03/26/chinas-2002-2003-sars-outbreak-helped-alibaba-become-e-commerce-giant.html

55 Between 2015 and 2020, online sales increased from 12 percent to 20 percent. The slight fall in online sales is due to growth in non-online retail sales. The total volume of online sales remains 50 percent higher than pre-pandemic levels, which is also comparable to the growth the industry saw over the last five years.

56 Wearden, G. (2020) Marks & Spencer to cut 7,000 jobs; S&P 500 hits record high – as it happened. *The Guardian*. [online] 18 August. Available at: www.theguardian.com/business/live/2020/aug/18/marks-spencer-to-cut-7000-jobs-covid-19-economy-retail-business-live

57 Butler, S. (2020) Boots to cut 4,000 jobs and close stores after dramatic fall in shopper numbers. *The Guardian*. [online]. Available at: www.theguardian.com/business/2020/jul/09/boots-to-cut-4000-jobs-and-close-stores-after-dramatic-fall-in-shopper-numbers

58 Butler, S. (2020) Halfords to close up to 60 sites despite rise in bike sales in lockdown. *The Guardian*. [online] 13 July. Available at: www.theguardian.com/business/2020/jul/13/halfords-to-close-60-sites-despite-rise-in-bike-sales-in-lockdown

59 Wallace-Stephens, F. and Lockey, A. (2019). *Retail therapy: Towards a future of good work in retail*. London: RSA.

60 Financial Times (2020). Why food delivery apps are struggling even under UK lockdown. *Financial Times*. [online] 27 March. Available at: www.ft.com/content/1c296d9e-e654-486a-9e40-f8f39ea191e0

61 74 percent of waiters and waitresses are women according to RSA analysis of the Annual Population Survey

The cost of labour in a pandemic

The imposition of social distancing and other protective measures will also have increased the cost of human labour relative to machines that can still work in close proximity to each other. On top of this, automated solutions are particularly cost effective in a pandemic because they don't require sick pay and don't need to self-isolate if they suspect they may have been exposed to the virus. It may sound callous, but these considerations will become increasingly important in an economic downturn. Indeed, Mark Muro, a senior fellow at Brookings, has argued that there is evidence from the US that suggests "automation happens in bursts, concentrated especially in bad times such as in the wake of economic shocks".⁶⁶

This argument feels particularly salient in sectors such as manufacturing where businesses may need to restructure to achieve the same productive capacity with fewer employees. Economist Carl Frey has suggested that we might even see "brief productivity revival due to social distancing".⁶⁷ As Andrea Paoli, an expert on food manufacturing, robots and automation at the University of Lincoln explains "many factories have had to shut down because of workers refusing to work in production lines where they stand less than 50cm apart on 12-hour shifts".⁶⁸ These businesses may have had to reopen with reduced capacity and further adaptations to processes could be required to ensure they are viable going forward.

Box 3: Will Covid-19 lead to more concentrated markets?

As the RSA's previous research has documented, the rise of the technology giants could lead to a 'winner takes most' dynamic where sectors are dominated by a handful of platforms.⁶² This could be accelerated by the pandemic - recent data suggests that Amazon's sales have increased by 42 percent between April and June.⁶³ Streaming services such as Netflix are also benefitting from the pandemic, having reported a record 15.8 million additional subscribers globally in the first quarter of 2020.⁶⁴ Digitisation can lead to increased market concentration because once a service becomes digital, firms with the greatest number of customers can collect the largest troves of data, which in turn enables them to provide a better service, attract more customers and harvest even more data.

Legal scholar Lina Khan has illustrated how digitisation can also facilitate new instances of vertical integration. Vertical integration occurs when a company controls multiple stages of its supply chain. Amazon has a huge advantage over the other businesses that use its marketplace. Since this process also allows Amazon to collect data on the products they sell, this can then be used to develop and market its own AmazonBasics range more effectively. Amazon can then nudge consumers towards its own products by selling them at a marginally more favourable price point.⁶⁵

It's possible that we will start to see these dynamics play out more frequently in other industries, including food, education and leisure, which have seen an accelerated shift to online services during the pandemic.

62 Dellot, B., Mason, R. and Wallace-Stephens, F. (2019) Op cit.

63 Chapman, B. (2020) Amazon to create 7,000 new UK jobs after sales surge during pandemic. Independent [online] 3 September. Available at: www.independent.co.uk/news/business/news/amazon-new-uk-jobs-coronavirus-sales-a9702446.html

64 Shapiro, A. (2020) Netflix Adds 15.8 Million Subscribers in First Quarter. Forbes [online], 21 April. Available at: www.forbes.com/sites/arielshapiro/2020/04/21/netflix-stock-up-5-after-hours-reports-158-million-additional-subscribers/#4d1e1d773d18

A similar argument could be made for parts of the hospitality industry. Fast-food chain McDonald's has reportedly been testing AI-enabled voice activated drive-through restaurants in Chicago.⁶⁹ Miso Robotics has developed a robot called Flippy that can flip burgers all day long for the equivalent of \$3 per hour.⁷⁰ Meanwhile in construction, the pandemic seems to be accelerating a trend towards modular construction, which is manufactured offsite and more easily automated. According to the managing director of Connex Offsite this is "being embraced by the industry because of the restrictions on the level of labour on site".⁷¹

However, cost considerations could also limit the development and adoption of new technologies. For example, Uber recently announced that it would wind down its AI research lab in a bid to cut costs.⁷² While ONS data shows that 38 percent of businesses that are continuing to trade have reduced or stopped capital expenditure because of the pandemic. This is even higher for industries that

have been hit hard, such as the arts, entertainment and recreation (56 percent) and accommodation and food services (54 percent).⁷³

Firms might also exhibit risk averse behaviour concerning investment in new technologies, particularly as the hype around artificial intelligence appears to be dwindling. According to Paul Renno and Velu Sinha, partners and Bain & Company, many business leaders have expressed "uncertainty about their investments in machine learning, and dissatisfaction with the ways their organisations were adopting it".⁷⁴

This could mean that businesses opt for relatively cheap, retrofit solutions that are easier to deploy. Another solution could be increased reliance on robotics as a service (RaaS), which does not require the same level of upfront investment but is sustained through transaction fees and can be easily scaled up or down in line with business needs.⁷⁵

65 Khan, L.M (2017) Amazon's Antitrust Paradox. Yale Law Journal, Vol. 126, 2017.

66 Muro, M., Maxim, R. and Whiton, J. (2020) The robots are ready as the COVID-19 recession spreads. Brookings [blog]. Available at: www.brookings.edu/blog/the-avenue/2020/03/24/the-robots-are-ready-as-the-covid-19-recession-spreads/

67 Easen, N. (2020) Will COVID-19 solve the UK productivity puzzle? Raconteur. [online] May 26. Available at: www.raconteur.net/technology/connected-business-2020-may/covid-increase-productivity

68 Paoli, A. (2020) Food manufacture 4.0 – automation and robotics at the service of food manufacturing. New Food Magazine. [online] 10 June. Available at: www.newfoodmagazine.com/article/111886/food-manufacture-4-0-automation-and-robotics-at-the-service-of-food-manufacturing/

69 Lucas, A. (2019) McDonald's acquires A.I. company to help automate the drive-thru, its third tech deal this year. CNBC. [online] 10 September. Available at: www.cnbc.com/2019/09/10/mcdonalds-acquires-ai-company-trying-to-automate-the-drive-thru.html

70 Dean, S. (2020) The new burger chef makes \$3 an hour and never goes home. (It's a robot). Los Angeles Times. [online] 27 February. Available at: www.latimes.com/business/technology/story/2020-02-27/flippy-fast-food-restaurant-robot-arm

71 Construction Manager (2020) Covid-19 'catalyst for shift to modular', claims manufacturer. Construction Manager Magazine. [online] 24 June. Available at: www.constructionmanagermagazine.com/covid-19-catalyst-for-shift-to-modular-claims-manufacturer/

72 BBC (2020) Coronavirus: Uber announces drastic cuts to secure its future. BBC. [online] 18 May. Available at: www.bbc.co.uk/news/business-52711649

73 Office for National Statistics. (2020) Coronavirus and the economic impacts on the UK: 30 July 2020. [online] ONS. Available at: www.ons.gov.uk/businessindustryandtrade/business/businessservices/bulletins/coronavirusandtheeconomicimpactsontheuk/30july2020

74 Renno, P. and Sinha, V. (2020) Will the Pandemic Accelerate Adoption of Artificial Intelligence? [online] Bain & Company. Available at: www.bain.com/insights/will-the-pandemic-accelerate-adoption-of-artificial-intelligence/

75 Marr, B. (2019) Robots As A Service: A Technology Trend Every Business Must Consider. Forbes, [online] August 5. Available at: www.forbes.com/sites/bernardmarr/2019/08/05/robots-as-a-service-a-technology-trend-every-business-must-consider/#463a42a724ea

Good work in an age of technological change

There are strong signals that the pandemic will accelerate the pace of technological change, whether it is through robots automating specific tasks, or software changing the labour inputs needed to provide services online via Zoom. However, as illustrated in the previous chapter, the next few months look increasingly uncertain. The pace of technological change will also depend on the interplay of several uncertain factors, including those that relate to the public health situation. The second wave we are now living through could provide further impetus for automation. But if a vaccine is just around the corner, then the new normal could look surprisingly like the old.

Either way, the prospect of increased automation should not engender fatalism as the impacts of technology on jobs will ultimately depend on how businesses decide to adopt them. When specific tasks are automated, workloads could be restructured so that a smaller number of employees are needed to achieve the same productive capacity. This could benefit some workers, who could see improved pay and working conditions as a result but could also lead to rising unemployment. On the other hand, technology could also liberate workers from tasks that are 'dirty, dull and dangerous' by freeing up their time to focus on tasks that require creativity, emotional intelligence or other skills that have been characterised as 'engineering bottlenecks' because they cannot be performed by robots or algorithms.

For example, previous RSA research on the future of retail has highlighted how increased automation could give some workers a break from the humdrum of solving problems related to an 'unexpected item in bagging area'. This could allow

them to focus on 'hi-touch' customer experiences – providing services more akin to a personal concierge, or 'in-store influencer'.⁷⁶ Of course, the viability of these in-store influencers and other redesigned roles will be constrained by factors such as consumer demand. But this example shows that within reason, the future is ours to create.

Lastly, technology in this context could also create new roles, from robot maintenance engineers to virtual Zoom hosts, which may offer workers improved pay, scope for progression and sense of purpose, if they are able and supported to reinvent themselves. Indeed, we believe that with the right policy support technology can help usher in a future where good work is enjoyed for all. But this is something we must work towards rather than blindly hope for. Such talk will remain panglossian, until we have the systems in place to support workers who are at risk, adapt to a changing labour market. We return to this task in Chapter 6 of this report after outlining the results of our risk register.

DEVELOPING A RISK REGISTER

Industries previously thought resilient to technology are now on the brink of collapse

⁷⁶ Wallace-Stephens, F. and Lockey, A. (2019). Op cit.

⁷⁷ HMRC Coronavirus Job Retention Scheme statistics.

⁷⁸ Our analysis here calculates the percentage change in employment for different industries based on three-year averages for the years 2011-13 to 2017-19.

Developing a risk register

In the previous chapter we highlighted the different ways in which technology could interact with the pandemic and how this could impact job availability. In this chapter we outline the methodology and initial results of our risk register, which aims to identify what groups of workers are most exposed to these forces. This risk register combines analysis of the impacts of Covid-19 on different sectors, with measures of automation risk and their relative growth or decline over the last decade.

Our analysis is not without caveats, but we have tried to use measures that are both timely and granular, to provide this picture at a detailed industrial (SIC) classification level. As highlighted in Chapter 2, analysing only broad industry groupings can mask some of the most acute shocks associated with the pandemic. For example, transport and storage includes one of the hardest hit industries, air transport, alongside postal and courier activities, a sector which seems to have experienced modest growth. Overall a total of 32 percent of employee jobs in transport and storage were furloughed during the pandemic but this figure was as high as 70 percent for air transport.⁷⁷

To measure coronavirus risk, we use HMRC data on furlough take-up. This allows us to clearly pinpoint what industry divisions (2-digit SICs) have been hardest hit by the pandemic. Alongside this we provide data on changes in economic output relative to their pre-pandemic level (February to July 2020) from RSA analysis of the ONS Index of Services and Index of Production. Furlough take-up rates provide a better indicator of how exposed different industries are to the unemployment risks associated with the pandemic. However,

since at this more granular level these figures are cumulative, they don't tell us anything about how these industries have recovered. Changes in economic output therefore provide helpful balancing insight, as well as highlighting some of the industries that have experienced growth during the pandemic.

To measure automation risk, we use data from a 2019 ONS study, which estimates the probability of automation for different occupations in England. This builds on the seminal 2013 Oxford University study by Frey and Osborne and the 2016 OECD study by Arntz, Gregory and Zierahn. The purpose here is not to wade into the debate about the number of jobs that will be replaced by robots in this report. As illustrated in Chapter 3, there are other factors that will affect the pace and breadth of technological adoption, which should influence how the results of this exercise are interpreted. However, we would argue that this data still provides a helpful insight into the relative automation potential of different industries and occupations, (see Box 4) and thus serves as a good indicator of automation risk, with which to guide decision makers in these highly uncertain times.

As a further sense check, we also use RSA analysis of the Annual Population Survey to benchmark how industries have changed over the last decade.⁷⁸ It is of course difficult here to untangle the impacts of technology from other forces such as changing demographics or austerity. But by highlighting the relative growth or decline of industries, this measure helps provide an additional sense check to counterbalance against other data that may feel more speculative. For example, occupations that have seen high levels of growth may provide hope that demand will return to its pre-pandemic levels, eventually. But it may be harder to say the same for those industries that were already in decline.

Box 4: Automation predictions⁷⁹

The 2013 Frey and Osborne study used the O*NET, an online database of US job descriptions, to develop a machine learning algorithm that estimates the 'probability of computerisation' for different occupations. The algorithm was fed with 70 occupations, which were labelled in the following ways:

1. Technology experts assigned 1 to those which they agreed were fully automatable, else 0. This was aided by answering: "can the tasks of this job be sufficiently specified, conditional on the availability of big data, to be performed by state-of-the-art computer-controlled equipment".
2. Frey and Osborne assigned scores corresponding to levels of manual dexterity, creativity and social intelligence that are all characterised as 'engineering bottlenecks' because they are resilient to automation.

The 'probability of computerisation' then, indicates the likelihood of an occupation being automated, based on these inputs. Frey and Osborne estimate that 47 percent of jobs in the US are at high risk of being automated within 10 to 20 years. Transferring this methodology to UK data generates an equally daunting 35 percent of jobs.

A 2016 OECD study by Arntz, Gregory and Zierahn argued that since automation aims at certain tasks, rather than whole occupations, Frey and Osborne don't account for the fact that different jobs within an occupation vary considerably in their task make-up. For example, a retail assistant at a designer clothes store may spend much more time persuading customers than one working at a supermarket. But since both are technically the same occupation, with the same O*NET descriptions, they are given identical risk ratings by Frey and Osborne.

Arntz, Gregory and Zierahn's task-based approach uses the OECD's Survey of Adult Skills (PIAAC), which allows them to transfer Frey and Osborne's finding to individual-level data on the task composition of different jobs. The results are much less daunting: across 21 OECD countries, only 9 percent of jobs are at risk of automation. This because most jobs include 'bundles of tasks' that involve some form of social interaction and so are difficult to automate.

Arntz, Gregory and Zierahn predict that more jobs are likely to experience radical change than be automated. In the UK, this is 25 percent and 10 percent respectively. Radical change is likely when 50-70 percent of tasks are automatable; automation when >70 percent. So, under both estimations, 35 percent of the UK workforce will have to adapt significantly. Since the same expert input is used in both studies, the actual disagreement here is over the extent of technological unemployment, rather than the types of jobs that could be 'disrupted' by technology.

The ONS study that we use for our 'relative automation risk' indicator builds on both of these approaches as it applies a variation of the OECD methodology to the Annual Population Survey, which allows for a more robust demographic analysis because it contains a larger sample of UK workers.⁸⁰

79 Wallace-Stephens, F. (2017) How many jobs will robots replace? And why does everyone disagree? RSA [blog]. Available at: www.thersa.org/discover/publications-and-articles/rsa-blogs/2017/08/how-many-jobs-will-robots-replace-and-why-does-everyone-disagree

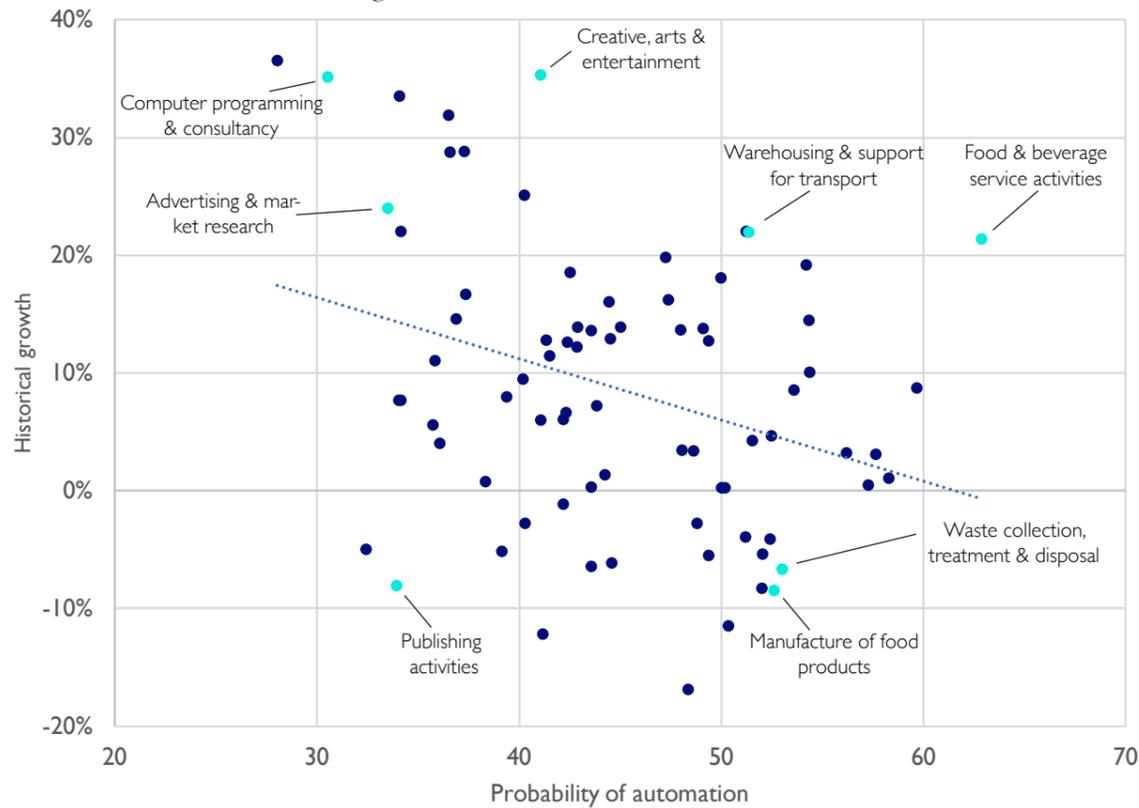
80 ONS. (2019) The probability of automation in England: 2011 and 2017 [online] ONS. Available at: www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/theprobabilityofautomationinengland/2011and2017

Risk associations

When we examine the relationship between our two non-pandemic measures of risk, we find a weak, slightly negative association for different industry divisions (2-digit SICs), meaning that those industries with a relatively low automation risk tend to have experienced higher levels of growth in the last decade. This is certainly true for industries such as computer programming, professional services and the creative arts. Meanwhile agriculture, waste

management and several manufacturing sub-sectors all experienced a decline and are at a relatively high risk of automation. There is a relatively clear explanation for this finding. Many of the roles that have experienced growth require skills such as creativity or social intelligence that are characterised by Frey and Osborne as engineering bottlenecks because they are resilient to automation.⁸¹

Figure 6: Relationship between automation risk and relative growth or decline, (RSA analysis of Annual Population Survey and ONS, the probability of automation in England)



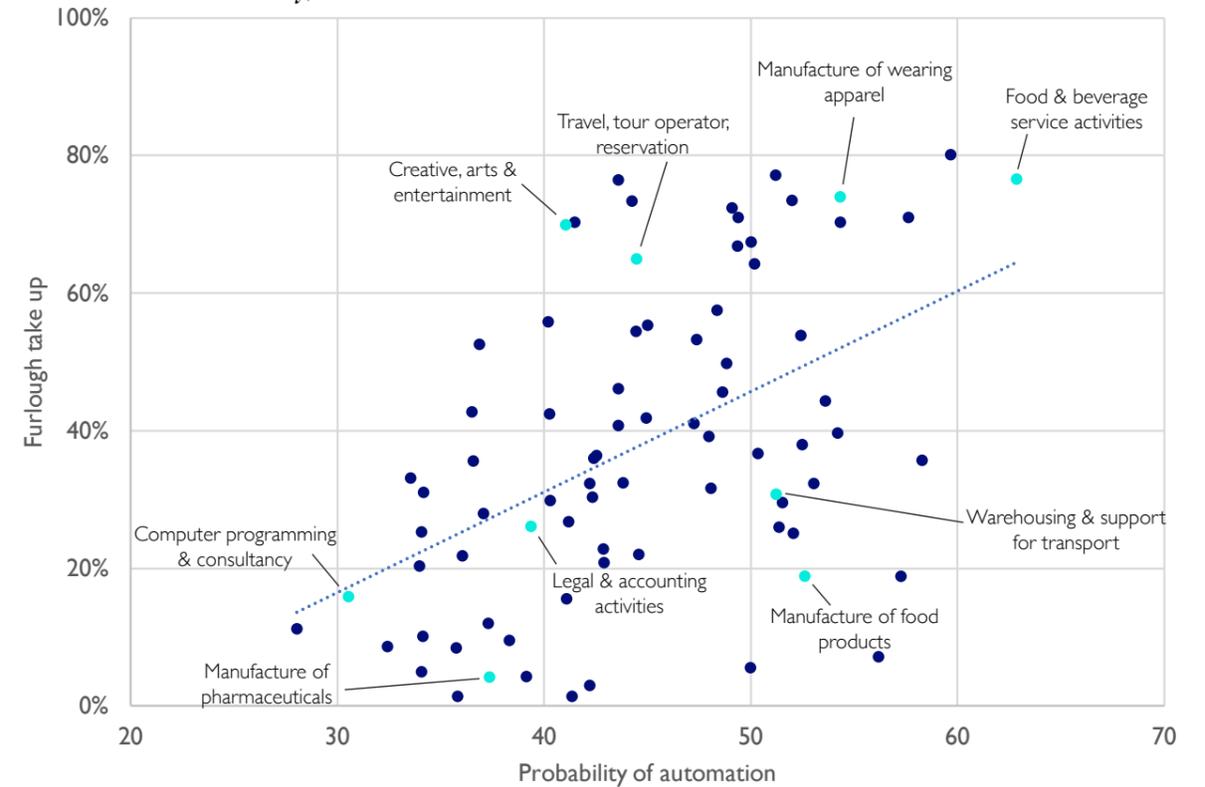
81 Frey, C.B. and Osborne, M. (2013) The Future of Employment: How susceptible are jobs to computerisation? [pdf] University of Oxford. Available at: www.oxfordmartin.ox.ac.uk/publications/the-future-of-employment/

82 RSA analysis.

However, the relationship here is far from clear cut - there are several notable exceptions to the trend. Food and beverage service activities has one of the highest automation probabilities but grew by 21 percent over the last decade. Warehousing and logistics experienced similar growth despite also being at high risk of automation. Some of this variation could be explained by changes in consumer behaviour which, as illustrated in the previous chapter, can play a significant role in reshaping the structure of the economy.

We find an even stronger positive association between furlough take-up and relative automation risk (see Figure 7). This means that many of the industries that have had high levels of furlough take-up are also at a high risk of automation. Conversely, many jobs that are more resilient to Covid-19 also have a lower automation risk. However, as we illustrate later in this report, not all industries that have been impacted by the pandemic are also at a high risk of automation. Some industries

Figure 7: Relationship between furlough take-up and automation risk (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and ONS, the probability of automation in England) (duplicate of Figure 1 in Executive summary)



that we had previously thought were more resilient to technological change - such as entertainment, culture and tourism - now appear to be on the brink of collapse due to Covid-19. Meanwhile other industries that are at high risk of automation seem to have been shielded from the impacts of the pandemic and may even have benefitted from the Covid-19 economy.

Indeed, the pandemic has not discriminated between industries that were previously thriving or in long-term decline. That is, there is no discernible association between furlough take-up and changes in employment over the last decade (see Appendices). For example, some industries, such as those involved in the production of food and other essential goods, have experienced decline over the last decade but have proven to be essential in the last few months.

Demographic impacts

Our risk register includes data on demographic characteristics, including age, gender, income and education levels, as we also aim to illustrate how the pandemic could impact employment prospects for these groups of workers. The 2019 ONS study which we draw on finds that young people, women, low earners and the less well educated are all more at risk of automation. We find that all of these groups, except for women, are more likely to be employed in industries with high levels of furlough take-up (see Appendices). As we illustrate later in this report, workers in the industries most resilient to the pandemic are more likely to be women.

THE RISK REGISTER

Which groups of workers do policymakers need to pay particular attention towards

The risk register

As the previous chapter underlined, while industries with higher furlough take-up rates do tend to be more at risk of automation, this relationship is far from straightforward. Therefore, it is helpful to look beyond general trends. In this chapter we examine the results of our risk register in more detail. This exercise is not intended to be an exhaustive segmentation of the labour market, but rather a way to highlight the groups of workers that policymakers will need to pay particular attention towards. Moreover, since different groups of workers will clearly need very different kinds of support in the coming months this analysis allows us to move beyond 'a one size fits all' approach to developing policy recommendations.

We identify four broad clusters of industries of particular interest, plotted along the axes of Covid-19 and automation risk.

- **High Covid-19, high automation risk.** Industries in this cluster tend to have high levels of young workers (under 30). Workers in these industries are slightly more likely to be men, tend to be lower paid and are less likely to have higher levels of education; 17 percent of employment. Includes industries such as hospitality, sports and recreation and parts of manufacturing and construction.
- **High Covid-19, low-medium automation risk.** Workers in this cluster are also more likely to be men overall, but are relatively well paid and have higher levels of education;⁸² 10 percent of employment. Includes industries such as air travel and tourism, creative arts and entertainment, architecture, film production, museums and culture.

- **Low-medium Covid-19, high automation risk.** This cluster is relatively gender balanced, tend to be lower paid and are less likely to have higher levels of education; 17 percent of employment. Includes some key worker industries such as retail, food production, residential care and postal and courier activities.
- **Low Covid-19, low automation risk.** Overall workers in the most resilient cluster of industries are more likely to be women, tend to be well paid and have high levels of education; 35 percent of employment. Includes scientific research, healthcare and education as well as some male dominated industries such as computer programming.

82 We include industries that are in the bottom 35 percent of the distribution for changes in economic output but exclude industries with the lowest levels of furlough take-up (bottom 35 percent). We use the same approach to identify industries at high risk of Covid-19 but low-medium risk of automation.

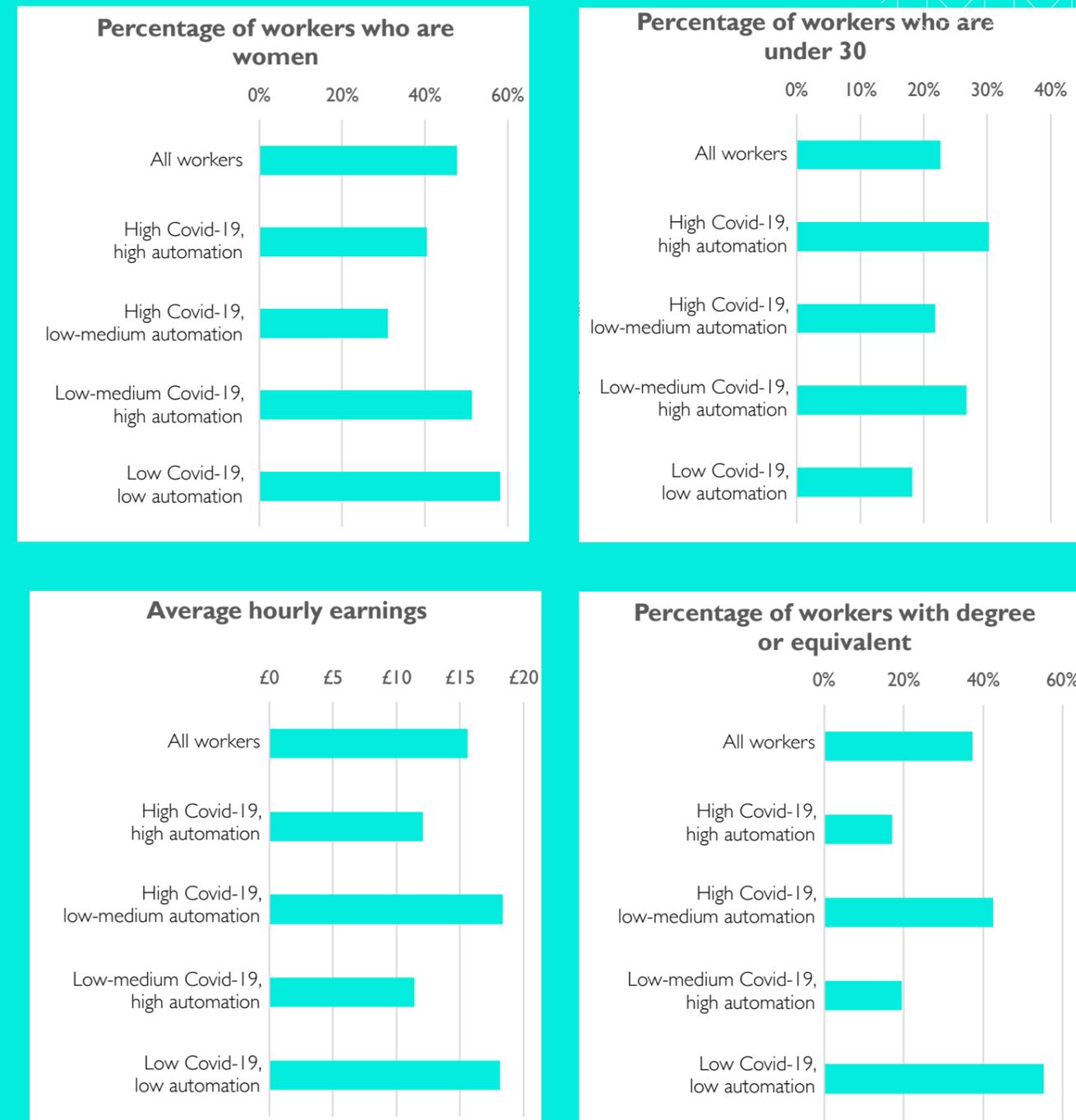


Figure 8: Demographic characteristics of at risk/resilient industries (RSA Covid-19 and automation risk register)

Industries at highest risk of Covid-19 and high risk of automation

In this grouping we include all industries with the highest levels of furlough take-up and highest automation probabilities (in the top 35 percent of the distribution). However, we exclude industries with a high level of furlough take-up that appear to have shown signs of a strong recovery in terms of output (in the top 35 percent of the distribution for changes in economic output). We also include some industries that now appear to be more at risk given their level of economic output relative to pre-pandemic levels.⁸³

Industries related to manufacturing may be the poster boys for automation, but their Covid-19 risk is also often high. Many manufacturers have not only found themselves unable to operate under normal conditions because of social distancing, they may also have experienced a significant fall in consumer demand and disruptions to their supply chains, all of which could have forced them to halt production. Between February and April, manufacturing output fell by 28 percent.⁸⁵ That said, as our analysis shows, there is significant variation between sub-sectors. Demand for cars plummeted during lockdown, as the automotive industry experienced a decline of 94 percent.

Figure 9: High Covid-19, high automation risk industries (RSA Covid-19 and automation risk register)⁸⁴

Industry division (2-digit SIC)	Percentage of employee jobs furloughed	Percentage change in output (Feb - Apr 2020)	Percentage change in output (Feb - Jul 2020)	Probability of automation	Percentage change in employment (2011 - 2019)
Accommodation	80	-92	-63	60	9
Food and beverage service activities	77	-90	-59	63	21
Other personal service activities	70	-72	-37	54	15
Sports activities and amusement and recreation activities	71	-58	-30	49	13
Manufacture of motor vehicles	72	-94	-27	49	14
Land transport and transport via pipelines	38	-52	-24	52	5
Manufacture of wearing apparel	74	-66	-24	54	10
Services to buildings and landscape activities	40	-27	-19	54	19
Printing and reproduction of recorded media	58	-39	-18	48	-17
Manufacture of furniture	77	-68	-14	51	-4
Specialised construction activities	67	-44	-12	50	0

84 Data on changes in economic output for specialised construction activities (see Figure 9) and construction of buildings (see Figure 10) are based on changes in output for the whole construction industry and so could over or underestimate how exposed the industry is to the pandemic. See Appendix for further details of our methodology.

85 Office for National Statistics. (2020) GDP monthly estimate, UK: April 2020. Op cit.

Meanwhile, industries involved in the production of fashion have not only been hit hard by the pandemic, they have also come under fire for poor adherence to social distancing rules, with poor working conditions in 'sweatshop' factories being blamed for the local lockdown in Leicester.⁸⁶

The government was quick to tell manufacturing firms to get back to work in early May.⁸⁷ And the industry has experienced a partial recovery since recommencing business with social distancing protocols in place. As illustrated in Chapter 3, there are strong arguments that the pandemic could lead to increased automation in these industries, particularly where factories will have had to reopen with reduced capacity and further adaptations to processes may be required to ensure their business is viable going forward.

The high automation risk of some service industries may come as a surprise to some. Jobs in hospitality, sports and leisure (which includes personal trainers) and other personal services (which includes hairdressers and beauticians) are all those that we might previously have struggled to imagine ever being replaced by robots. This could be because they are usually thought of as services where the human touch represents a value add that people are willing to pay for even if the robot could perform the tasks at a lower cost. Indeed, the employment growth they have experienced over the last decade would appear to strengthen this case.

Sometimes humans want to be served by other humans for reasons of status. This is why door attendants still exist in 2020. But sometimes interacting with an automated system is just downright strange. The 'uncanny valley' effect is a term to describe the uncomfortable emotional response we have when we encounter human-like robots. At least this is true of Westerners. Japan, with its long history of androids in popular culture and aging population, are much less wary.⁸⁸ However, all of this may now be under question. It is important to emphasise automation predictions are firmly in the realm of what is technically possible. But as we have illustrated in the Chapter 2, the pandemic may have created a business case for more automation in these industries.

Businesses in these industries were directly impacted by lockdown measures, as the government forced them to temporarily close in order to prevent the spread of the virus. Some have since experienced a partial recovery. However, they are all particularly exposed to public health restrictions to manage the second wave. Epidemiologists have gone as far as warning that once secondary schools reopen the government may have to close venues such as pubs and restaurants in order to keep transmission rates low.⁸⁹

86 Bland, A. and Campbell, D. (2020) Some Leicester factories stayed open and forced staff to come in, report warns. The Guardian. [online] 30 June. Available at: www.theguardian.com/uk-news/2020/jun/30/some-leicester-factories-stayed-open-and-forced-staff-to-come-in

87 Tovey, A. (2020) Manufacturers welcome Government's call to return to work. The Telegraph. [online] 9 April. Available at: www.telegraph.co.uk/business/2020/04/09/manufacturers-welcome-governments-call-return-work/

88 Wallace-Stephens, F. (2017) The human factor: what will really determine the pace of automation? RSA [blog]. Available at: www.thersa.org/blog/2017/08/the-human-factor-what-will-really-determine-the-pace-of-automation

89 Busby, M. (2020) Pubs in England may have to close to control coronavirus, says Sage adviser. The Guardian. [online] 1 August. Available at: www.theguardian.com/world/2020/aug/01/pubs-england-close-control-coronavirus-adviser-graham-medley

Industries at high risk of Covid-19 but low-medium risk of automation

Not all industries that have a high coronavirus risk are also at high risk of automation. Some that we had previously thought were more resilient to technological change, such as entertainment, culture and tourism, now appear to be on the brink of collapse due to Covid-19. And this is despite them having experienced some of the strongest growth over the last decade. Some of these industries were also hit hard by public health restrictions and have struggled to adapt.

Restrictions on movement have had a pronounced effect on aviation and tourism. The Foreign & Commonwealth Office (FCO) advised against all non-essential international travel in March and, by May, health secretary Matt Hancock told the nation to cancel their summer holidays.⁹⁰ Quarantine measures were lifted for arrivals from some countries in July only to soon be reintroduced where cases have surged. Air travel has already seen large numbers of redundancies with Flybe going bust and British Airways set to cut 12,000 staff (more than a quarter of its workforce).⁹¹ According to Boeing's CEO Dave Calhoun demand for air travel is not expected to pick back up to its previous level for two or three years.⁹²

Figure 10: High Covid-19, low-medium automation risk industries (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Percentage of employee jobs furloughed	Percentage change in output (Feb - Apr 2020)	Percentage change in output (Feb - Jul 2020)	Probability of automation	Percentage change in employment (2011 - 2019)
Air transport	70	-96	-92	41	11
Travel agency, tour operator and other reservation services	65	-95	-88	44	13
Creative, arts and entertainment activities	70	-51	-58	41	35
Advertising and market research	33	-37	-30	34	24
Libraries, archives, museums and other cultural activities	56	-49	-29	40	9
Motion picture, video and television programme production	53	-52	-25	37	15
Manufacture of other transport equipment	30	-22	-23	42	7
Rental and leasing activities	53	-40	-20	47	16
Other professional, scientific and technical activities	43	-23	-18	36	32
Architectural and engineering activities	31	-29	-17	34	22
Construction of buildings	55	-44	-12	45	14

90 Merrick, R. and Calder, S. (2020) 'That's a reality': Prepare to cancel summer holidays, Matt Hancock says. Independent. [online] 12 May. Available at: www.independent.co.uk/news/uk/politics/coronavirus-summer-holiday-travel-matt-hancock-a9509921.html

91 BBC News (2020) British Airways to cut up to 12,000 jobs as air travel collapses. BBC. [online] 28 April. Available at: www.bbc.co.uk/news/business-52462660

92 Josephs, L. (2020). Boeing CEO says air travel recovery could take two to three years; board wins approval. CNBC. [online] 27 April. Available at: www.cnbc.com/2020/04/27/coronavirus-boeing-ceo-says-air-travel-rebound-could-take-2-or-3-years-board-approved.html

While there are signs of a trend towards staycations, which could represent a boon to domestic tourism, this has not stopped London's beloved Beefeaters from being told they may be made redundant.⁹³

Arts and entertainment have so far shown an I-shaped recovery (that is, no recovery at all). The closure of theatres, cinemas and other venues saw output shrink by 51 percent by April, and 58 percent below its pre-pandemic level by July. The entertainment industry is particularly at risk because of the difficulty operating profitable business models under social distancing. Playwright James Graham has argued that the average theatre capacity would be just 20 percent with these measures in place, despite theatres needing to sell about 80 percent of seats to sustain themselves economically.⁹⁴ Some have turned to streaming performances online but there is little certainty about this providing a sustainable business model. Theatre and film director Sam Mendes called for streaming services like Netflix and Amazon Prime to share their windfall gains from Covid-19, pointing out that these companies have made millions during lockdown "from our finest acting, producing, writing and directing talent, while the very arts culture that nurtured that talent pool is [being] allowed to die".⁹⁵

In some ways these industries may face greater challenges in the short-medium term than those that are more automatable since it is less obvious how they might turn to technology to transform their business models. But many provide jobs that are relatively well-paid, in aspirational, creative professions. Moreover,

some of the industries have strong employment growth in the last decade. It is likely then that these are things that there will be demand for in the future. Rather than being 'zombie jobs' that are not viable in the long-term. All this means there may be a case for providing additional support to protect jobs in these industries as we brace ourselves for further lockdown measures.

Industries at low-medium risk of Covid-19 but high risk of automation

Meanwhile some industries that are at high risk of automation seem to have been shielded and may have even benefitted from the impacts of Covid-19. Some of these include roles have been identified by the government as key workers. Notably many are involved in the production of food or other essential goods, as well as retail and residential care activities. However, unlike teachers and nurses, these roles don't always require professional qualifications, which is why they are sometimes described as 'low skilled'. Many have also experienced decline (or relatively weak employment growth) over the decade.

93 Jolly, J. (2020) Beefeaters at Tower of London face job cuts amid coronavirus crisis. The Guardian. [online] 20 July. Available at: www.theguardian.com/business/2020/jul/20/beefeaters-tower-of-london-job-cuts-coronavirus

94 Thompson, J. (2020) Theatre needs an investment, not a bailout, says playwright James Graham on Question Time. Evening Standard. [online] 22 May. Available at: www.standard.co.uk/go/london/theatre/james-graham-question-time-theatre-investment-bailout-coronavirus-a4448256.html

95 Wiegand, C. (2020) Sam Mendes calls on Netflix and Amazon to share 'Covid-19 windfall' with theatre. The Guardian. [online] 5 June. Available at: www.theguardian.com/stage/2020/jun/05/sam-mendes-calls-on-netflix-and-amazon-to-share-covid-19-windfall-with-theatre

Figure 11: Low-medium Covid-19, high automation risk industries (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Percentage of employee jobs furloughed	Percentage change in output (Feb - Apr 2020)	Percentage change in output (Feb - Jul 2020)	Probability of automation	Percentage change in employment (2011 - 2019)
Retail trade, except of motor vehicles and motorcycles	36	-22	3	58	1
Crop and animal production, hunting and related service activities	19	-6	-2	57	0
Postal and courier activities	7	-8	11	56	3
Waste collection, treatment and disposal activities	32	-18	3	53	-7
Manufacture of food products	19	-2	6	53	-8
Manufacture of paper and paper products	25	5	14	52	-5
Security and investigation activities	30	-16	-10	52	4
Warehousing and support activities for transportation	31	-23	-12	51	22
Manufacture of basic metals	37	-12	-7	50	-11
Residential care activities	6	-3	-1	50	18
Manufacture of chemicals and chemical products	22	-2	7	45	-6

The retail sector appears not to have been hit quite as hard by the pandemic as the sectors highlighted earlier in the chapter. It is also showing stronger signs of a V-shaped recovery than other service industries. Sales had increased 2.7 percent on their pre-pandemic level by June. But it's possible that demand for food and other essential goods may have cushioned the blow to overall economic activity. Clothing sales, for example, remained 30 percent below their pre-pandemic level in June.⁹⁶ But the industry has also seen higher levels of furlough take-up. A possible explanation here is that the shift to e-commerce has reduced the labour inputs needed to meet consumer demand. Indeed, if this is the case, then jobs in the industry may be at greater risk than our analysis suggests.

Postal and courier activities is another sector affiliated with e-commerce. However, there are signals that these businesses are adopting new technologies in response to the pandemic. Starship Technologies, an autonomous delivery start-up has expanded their use of robots for grocery and takeaway food deliveries in Milton Keynes.⁹⁷ Meanwhile in agriculture, Dogtooth Technologies, a Cambridge based robotics company is prototyping a strawberry harvester in a bid to counter farm labour shortages.⁹⁸ This could limit the number of new jobs created in these sectors. For once firms invest in automation, they may never rehire for those roles. While integrating robots into a business can require a hefty initial outlay, once they are up and running they are often cheaper to deploy than human workers.

References on following page

One of the reasons that workers in the residential care sector have a relatively high automation risk could be because their jobs have been designed in this way. That is, they may spend too much of their time on tasks that are potentially automatable, and less on those that might be more difficult to automate such as providing emotional support. This is not to say that their jobs are at risk here. On the contrary, care workers may need to one day work alongside robots to meet the ever-growing demands of an aging population. RIKEN's Robear robot has been engineered to lift and carry patients, a task which can be a major cause of lower back pain for care workers.⁹⁹

From redundant to resilient?

On a more positive note, a large share of total employment (35 percent) is in industries with low coronavirus and automation risk. Many of the roles in these industries have also been identified by the government as key workers. Workers in these industries tend to have much higher levels of education and be better paid than other clusters of industries identified in this chapter. They have also experienced strong growth over the last decade. We discuss these industries in more detail in the next chapter where we look to put forward some policy ideas to support at risk workers.

96 Office for National Statistics. (2020) Retail sales, Great Britain: June 2020. [online] ONS. Available at: www.ons.gov.uk/businessindustryandtrade/retailindustry/bulletins/retailsales/june2020

97 Hern, A. (2020) Robots deliver food in Milton Keynes under coronavirus lockdown. The Guardian. [online] 12 April. Available at: www.theguardian.com/uk-news/2020/apr/12/robots-deliver-food-milton-keynes-coronavirus-lockdown-starship-technologies

98 Hodge, K. (2020) Coronavirus accelerates the rise of the robot harvester. Financial Times. [online] 1 July. Available at: www.ft.com/content/eaaf12e8-907a-11ea-bc44-dbf6756c871a

99 Riken. The strong robot with the gentle touch. [online] Riken. Available at: www.riken.jp/en/news_pubs/research_news/pr/2015/20150223_2/

SUPPORTING AT RISK WORKERS

A strategy to protect, support and upskill workers at risk of coronavirus and automation.

6 Supporting at risk workers

Supporting at risk workers

The goal of the RSA Future Work Programme is to ensure that everyone, regardless of background, can pursue good work in an age of technological change. As we have illustrated throughout this report, the pandemic has added urgency to this challenge. For not only is it set to accelerate the pace of technological change in sectors that were previously more at risk of automation, it also looks likely to create new winners and losers. Some industries we previously thought to be more resilient may now find themselves on the brink of collapse, due to the pandemic. In this chapter we put forward three-tiered strategy to protect, support and upskill workers at risk of coronavirus and automation.

- 1.** Targeted support to protect jobs at risk of Covid-19: The government should modify its Job Support Scheme and introduce a two-track system based on the French partial activity scheme. Alongside the existing national JSS scheme this would see an alternative pathway for businesses in the most at-risk sectors, with reduced employer contributions. As a condition for long-term support, this pathway should also require any firm with more than 20 workers to introduce a works council.
- 2.** Transition services for workers at risk of Covid-19 and automation: The government should introduce an end-to-end transition service that redeploys the most at-risk workers into sectors that are more resilient, modelled on Swedish Job Security Councils.

These workers could then be provided with a transitional basic income to support them financially as they retrain.

- 3.** Upskilling workers at risk of automation: The government should introduce personal learning accounts to futureproof roles in sectors at high risk of automation, particularly those that have experienced good growth since the pandemic.

Together these policies provide the basis for a systemic response that could allow the economy to evolve without leaving any workers behind. Given that new jobs could be scarce in this context, transition services should be targeted towards workers that are at-risk of both Covid-19 and automation. There are two reasons why this support should be targeted in this way. Firstly, jobs in industries that are more automatable are less likely to be viable in the long-term, even if they are slightly more viable in the pandemic context. Secondly, workers in this group tend to be less well paid. Therefore, transitioning into a new, better paid or more secure role in a growth industry could represent an opportunity to close gaps in good work. To the extent that the economy may or may not be able to deliver on mass job creation, we also see a modified version of the Job Support Scheme as a backstop to prevent rising unemployment. Not only that, there is also a strong case for protecting good jobs in industries that are likely to be 'viable' in the long-term because they are resilient to automation and technological upheaval more broadly. For such resilient jobs – often good work, higher paying roles - it seems too early to move towards a transition approach merely because they are less viable in the short-term due to public health restrictions. The government should therefore not, whilst so much uncertainty abounds about the possibility of mass testing or a vaccine in the next six months, rule out this type of approach.

Targeted support to protect jobs at risk of Covid-19

Unlike some previous recessions, the economic pain associated with the pandemic was largely self-initiated by governments around the world.¹⁰⁰ The pandemic required that we sacrifice people's livelihoods in order to save the lives of those who are most vulnerable. This is part of the reason why the government's response has been unprecedented, with business support measures such as the CJRS introduced to protect people's incomes, strengthen business resilience and prevent rising unemployment. To date, the furlough scheme has cost over £26bn and has undergone gradual iterations to become more flexible. Employees are now able to work part-time, with the remainder of their wages being topped up by the government. But as we draw closer to CJRS' October end date, there is a risk it will be a job half done, leaving a hefty bill and limited benefit in terms of preventing mass unemployment.

Germany is planning on extending its equivalent furlough policy, a modified version of its Kurzarbeit (literally 'short-time work') scheme, which was introduced to stabilise the economy following the 2008 financial crisis. It is the success of this approach which has arguably set the precedent for similar schemes around the world to support workers during the pandemic.¹⁰¹ There may therefore be good arguments for making a version of the furlough scheme a semi-permanent feature of our labour market. Indeed, there

is evidence that suggests such schemes are important because they protect "the firm specific human capital of workers", the destruction of which has been shown to derail careers, keep wages low and further dampen demand, thereby prolonging the effects of a recession.¹⁰²

On the other hand, leading economists have warned against the prospect of extending the furlough scheme. In September Andy Haldane, chief economist at the Bank of England, suggested that "keeping all those jobs on life support is in some ways prolonging the inevitable in a way that probably doesn't help either the individual or the business".¹⁰³ The OECD has also called for job retention schemes to ensure that they are not artificially supporting "zombie" jobs that are unviable in the long term. This, it argues, could hinder the recovery by slowing the reallocation of employment to more productive parts of the economy. Instead it suggests active labour market policies should be geared towards protecting jobs that are only temporarily unviable.¹⁰⁴

In September the chancellor Rishi Sunak announced his plans for the latest iteration of the furlough scheme, now called the Job Support Scheme, which was reportedly inspired by both the German scheme and its French equivalent, the partial activity scheme (see below). The JSS is a six-month scheme starting from November that will allow employers to cut employees working hours rather than make them redundant.

To be eligible employees must work at least 33 percent of their usual hours, with the government and employers each picking up 33 percent of the costs for the hours they do not work. An employee working the minimum 33 percent of their usual hours should expect to receive 77 percent of their pay (full pay for hours worked plus 66 percent of their pay for hours not worked).¹⁰⁵

However, the design of the JSS could also create incentives for employers to lay off some employees, rather than cutting hours across the board. For example, if a pub employing 10 full-time staff, each earning £400 a week needed to cut working hours from 35 to 18 during the pandemic, the weekly cost of keeping on all staff at these reduced hours would be £2,698. Alternatively, they could make half their workforce redundant and keep half working 35 hours a week at the cost of just £2,000.¹⁰⁶

This may of course be intentional. The JSS may not be designed to protect all workers, with firms perhaps instead only incentivised to pay these extra costs to hold onto employees that would be difficult to replace. In other words, the scheme's purpose could be to explicitly focus on 'viable jobs', following the warnings of the OECD, Andy Haldane and others.¹⁰⁷ However, the problem here is that it may not be generous enough to support jobs in the hardest hit industries that may be more viable in the long-term, despite being less viable in the short-term because of public health restrictions. As our risk register shows some of the hardest hit sectors, such as entertainment, are more resilient to technological change and have experienced good jobs growth in the last decade.

The evolution of the French partial activity scheme seems particularly influential here. From October, French businesses that use

this scheme will be asked to pay for 40 percent of the wage replacement for the next 6 months. Employees now receive 60 percent of their pay for the hours they do not work, down from 70 percent earlier in the pandemic. However, crucially in France, as distinct from the UK approach, the sectors hit hardest by public health restrictions such as sport, tourism and culture are exempt from these changes, meaning that businesses in those sectors still only contribute 15 percent in employer contributions rather than the increased 40 percent.

The French scheme is now also a two-track system. Businesses facing longer term difficulties can apply for a separate support package that will remain in place until 2022. Businesses accessing this track of support in France are only allowed to reduce workers' hours by a maximum of 40 percent but workers will still receive 70 percent of their salary for this time off with employers only needing to contribute 15 percent (as per earlier iterations of the partial activity scheme). Yet eligibility for this 'track' requires an agreement between employers and unions, meaning employers cannot unilaterally take decisions to furlough employees. The scheme will also require employers to commit to a no-firing policy to prevent layoffs while employees are registered.¹⁰⁸

We recommend that the Treasury modify its JSS scheme along these lines. In the short-term this means reducing the employer contribution for businesses that have been hardest hit by the pandemic, particularly those that have been subject to public health restrictions. But the government should also explore introducing a long-term version of the Job Support Scheme for these businesses, modelled on the second-track of the French partial activity scheme, with similar conditional asks on firms seeking support.

100 The OBR have suggested that lockdown measures are responsible for around 90 percent of the hit to UK the economy. Office for Budget Responsibility. (2020) Fiscal sustainability report – July 2020. Op cit.

101 IMF. (2020). Kurzarbeit: Germany's Short-Time Work Benefit. [online] IMF. Available at: www.imf.org/en/News/Articles/2020/06/11/na061120-kurzarbeit-germanys-short-time-work-benefit

102 Dias, M.C. et al. (2020) The Challenges for Labour Market Policy during the COVID-19 Pandemic, Fiscal Studies, volume 41 issue 2, June. [online]. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-5890.12233>

103 Carrick, A. (2020) BoE's chief economist Andy Haldane warns against furlough extension. City AM, [online] 7 September. Available at: www.cityam.com/exclusive-boes-chief-economist-andy-haldane-warns-against-furlough-extension/

104 OECD. (2020) Job retention schemes during the COVID-19 lockdown and beyond. [online] OECD. Available at: www.oecd.org/coronavirus/policy-responses/job-retention-schemes-during-the-covid-19-lockdown-and-beyond-0853bald/

105 HM Treasury (2020) Chancellor outlines Winter Economy Plan. Op cit.

106 RSA calculations based on examples from HM Treasury.

107 HM Treasury (2020) Chancellor outlines Winter Economy Plan. Op cit.

108 OECD. (2020) Job retention schemes during the COVID-19 lockdown and beyond. Op cit.

For example, the RSA has previously recommended that the government should require any business with more than 20 workers which requires a bailout as part of the pandemic sets up a works council.¹⁰⁹

In a similar vein this could be made a pre-requisite for businesses looking to access enhanced support on a more long-term basis. This would give workers and unions more say over how business models will adapt in response to Covid-19 (as well as, in the long-term, starting to build a British model of co-determination).

Clearly, there is also a need to provide tailored support for businesses and workers affected by more stringent local lockdown regulations – for example, hospitality firms who are forced to close to manage local outbreaks of the virus. The government’s announcement last week to reintroduce furlough-type support for such workers is a welcome first step. However, we believe that this need would be best met if it were also underpinned by these modifications to the JSS at a national level, irrespective of what ‘level’ of lockdown an area faces at a given time.

Box 5: Works councils

The co-determination approach taken by many northern European countries – most famously, Germany – seeks to give workers democratic decision-making power over their companies through structures like works councils, which enjoy wide-ranging consultation and decision-making powers. In Germany this even includes the right to veto company decisions following (if agreement is not possible) a verdict from an internal conciliation committee, which often contains an independent legal referee from the German labour courts.

The possibility of developing a British version of co-determinism has often been treated with suspicion by the British labour movement. The worry is that works councils provide an alternative worker voice structure that can diminish or displace the need for trade unions. This, however, does not seem to be borne out by the European experience. In practice, many German works councils are dominated by the trade unions anyway, which are effective at ensuring their representatives win the work council elections. As Christos Katsioulis, Director of Friedrich-Ebert-Stiftung’s London arm explains, works councils actually give unions outreach, both in the companies and throughout the economy:

“There is a very close relationship between work councils and unions. This is also because it gives them outreach in the companies and a sense of reality of what is actually happening in the parts of the economy where they are represented. It [the works council] is perceived as something at the core of the labour movement, it’s the place where you shape the day of your co-workers, it’s something where you have immediate influence.”

There is a sense that greater workplace democracy can equate to greater economic resilience in times of crisis. As Christos Katsioulis describes it, “the whole scheme of Kurzarbeit was devised together with unions. So, the reaction to this crisis was something they already had in the drawer.” This is a crucial point when considering the power dynamics within the government’s current JSS approach. In more co-determinist systems, incentives that might, encourage employers to take decisions that might lead to job losses or a reduction in terms and conditions are mitigated by strong worker voice institutions. That is not currently the case in Britain.

Transition services for displaced workers

If the OBR’s central forecast is close to the mark, unemployment will rise to levels not seen since the 1980s. These workers will need to be supported by active labour market policies to transition into the jobs of the future. Similarly, young people now entering the labour market, perhaps into roles supported by the government’s kick starter scheme, may want to find work that is more secure. Our risk register provides some insight into what jobs are most resilient to coronavirus and automation.

This list includes roles in health, education, financial services, telecoms and utilities, and government, as well as scientific research and pharmaceutical manufacturing that are leading the search for a vaccine. Workers in these industries tend to have much higher levels of education and be better paid than other clusters of industries identified in this chapter. They have also experienced strong growth over the last decade. While some of the best paid hi-tech roles in this cluster are dominated by men, overall we find that workers in these industries are more likely to be women. This is because hi-touch industries such as health and education account for a large share of employment and are female-dominated industries.

Figure 12: Resilient industries (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Percentage of employee jobs furloughed	Percentage change in output (Feb - Apr 2020)	Percentage change in output (Feb - Jul 2020)	Probability of automation	Percentage change in employment (2011 - 2019)
Water collection, treatment and supply	1	7	12	41	13
Public administration and defence	2	0	1	36	11
Manufacture of basic pharmaceutical products and pharmaceutical preparations	4	16	17	37	17
Financial service activities, except insurance and pension funding	4	-6	-1	39	-5
Human health activities	5	-40	-35	34	8
Telecommunications	9	-7	-4	36	6
Programming and broadcasting activities	9	-4	-2	32	-5
Manufacture of coke and refined petroleum products	10	-25	-11	38	1
Education	10	-42	-22	34	8
Scientific research and development	11	-4	-9	28	37
Activities auxiliary to financial services and insurance activities	12	-8	-2	37	29
Electricity, gas, steam and air conditioning supply	16	-25	-32	41	6
Computer programming, consultancy and related activities	16	-8	-2	31	35
Information service activities	22	-11	-7	36	4
Legal and accounting activities	26	-17	-10	39	8
Manufacture of computer, electronic and optical products	27	-14	3	41	-12

¹⁰⁹ Lockett, A. and Wallace-Stephens, F. (2019). A blueprint for good work: Eight ideas for a new social contract. London: RSA

Previous RSA research has stressed the importance of ensuring these roles are open to all, particularly those who are most at risk from technological change. This is a particular challenge given that the economy does not seem to be creating many jobs at the moment. The TUC have estimated that the government could create 600,000 public sector jobs in sectors such as health, social care, education and national and local government.¹¹⁰ Meanwhile, the government has suggested its job creation policies will create up to 130,000 'green' jobs, through retro-fitting homes and upgrading public buildings.¹¹¹ To complement these job creation schemes, we recommend that the government introduce a transition service modelled on a 'job security centre' to help workers at risk of both Covid-19 and automation find work in sectors that are more resilient. These workers are in the greatest need of support because their jobs are less likely to be viable in the long-term than those with a lower automation risk. Giving priority to this group could also represent an opportunity to close historical gaps in good work.

A job security centre, as set out in previous RSA research, is a reimagining of Jobcentre Plus into a universal, end-to-end transition service influenced by Swedish Job Security Councils.¹¹² Job Security Councils were first developed in Sweden in the 1970s, in response to massive job losses among white-collar workers in the wake of an oil crisis. These non-profit organisations are set up through collective agreements between employers and trade unions. Following redundancies, they provide an end-to-end transition service that includes

information about labour markets, as well as career coaching and access to training opportunities or business start-up support to help workers find new jobs. JSCs make Sweden's economy more dynamic. Businesses can more easily shed labour as unions feel more comfortable supporting job cuts due to structural changes, as they know workers will be protected by the JSC and wider Swedish welfare safety net.¹¹³

The RSA has previously recommended that the DWP, BEIS and DfE work with the Jobcentre Plus to pilot a range of new transition services under the banner of a job security centre.¹¹⁴ With the devolution of skills funding and the divergence of local labour markets, this list of stakeholders should also include key local actors, such as local authorities, local enterprise partnerships and key social innovators operating in a given place. Any pilot should also include the use of new technologies, such as platforms that leverage AI and labour market data to offer personalised coaching to displaced workers. Bob, by Bayes Impact, is an example of exactly this kind of platform, deploying a chatbot interface and live labour market information to offer free tailored support for jobseekers in France and Belgium.

The job security centre would represent a more universal service than the Jobcentre Plus. As one DWP representative we spoke to last year explained "most of the people who walk through our doors are on Universal Credit". But they also suggested: "we have that current customer base – but we're at a moment of full employment and that won't always be the case".¹¹⁵ Suffice to say, recent events have

rendered that prediction somewhat prophetic – the demands of the Covid-19 pandemic necessitate a rapid scale-up of a universal active labour market service. Already, the National Careers Service and regional LEPs operating across Berkshire, Buckinghamshire, Oxfordshire and the South West have come together to create a Regional Redeployment Service focused on redeploying recently redundant workers into sectors where jobs demand is surging.¹¹⁶

In the long-term, we envision a job security centre being supported by a safety net that includes a Universal Basic Income (UBI). While individuals will be expected to periodically adapt to a changing labour market, one of the largest barriers to reinventing themselves will be the loss of earnings from taking time off work to retrain.¹¹⁷ Yet this might present significant barriers to the short-term too – some workers, even in volatile or hard hit industries, might cling-on to unviable jobs when enrolment in a transition service might prove the better long-term bet. Therefore, there is also a case for providing a transitional basic income alongside any retraining incentives, so that workers who enrol at the job security centre are compensated more generously than existing out-of-work benefits. For example, in our previous research we have suggested that a transitional basic income of £2,500 could operate alongside existing Universal Credit entitlements. This approach could be similarly targeted to workers who enrol at a job security centre transition service, ie the workers most in need of redeployment during the pandemic. The OECD argue that this can strengthen incentives for workers in sectors that are less likely to be viable in the long-term to look for new jobs¹¹⁸

Upskilling for workers at risk of automation

However, some of the low-Covid, high automation risk industries in our risk register may also provide job opportunities for displaced workers. Particularly those in sectors such as postal and courier activities, food retail and residential social care that have experienced growth in economic output. The pandemic has highlighted the importance of roles like and the key workers who provide these essential services. But too often they remain poorly paid and offer little scope for progression.

To ensure that they are resilient going forward we will need to upgrade these occupations by giving workers more opportunities to develop their skills at work. This might mean that workers in social care need to be given opportunities to upskill in order to work alongside robots and meet the ever-growing demands of an aging population. Or that more automation in retail allows workers to focus on becoming in-store influencers that demonstrate a deeper level of brand knowledge and marketing know-how. In either case, the more highly skilled these workers become, the better chance that technology will complement their capabilities, rather than compete against them.

We recommend that the government explore how personal learning accounts could help futureproof these roles. Both France and Singapore now give all workers annual training credits that they can spend on courses accredited by the government.

110 TUC (2020) Cut unemployment rate now by unlocking 600,000 public service vacancies and staff gaps, says TUC. 13 September. Available at: www.tuc.org.uk/news/cut-unemployment-rate-now-unlocking-600000-public-service-vacancies-and-staff-gaps-says-tuc

111 HM Treasury (2020) A Plan for Jobs Speech. [online] GOV.UK Available at: www.gov.uk/government/speeches/a-plan-for-jobs-speech

112 Lockey, A. and Wallace-Stephens, F. (2019). Op cit.

113 OECD. (2018) Back to work: Lessons from nine country case studies of policies to assist displaced workers. OECD [online]. Available at: www.oecd-ilibrary.org/employment/oecd-employment-outlook-2018/back-to-work-lessons-from-nine-country-case-studies-of-policies-to-assist-displaced-workers_empl_outlook-2018-8-en

114 Lockey, A. and Wallace-Stephens, F. (2019). Op cit.

115 Ibid.

116 Adviza. (2020) Regional Redeployment Service. [online] Adviza. Available at: www.adviza.org.uk/services/national-careers-service/%20regional-redeployment-service

117 Lockey, A. and Wallace-Stephens, F. (2019). Op cit.

118 OECD. (2020) Job retention schemes during the COVID-19 lockdown and beyond. Op cit.

For every year a person works full-time in France, they now received €500 worth of training credits, up to a maximum allowance of €5,000.¹¹⁹ While as part of Singapore's SkillsFuture program, all adults over 25 now receive S\$500 (£280) in training credits each year.¹²⁰ As in France, these credits can be stockpiled and drawn down across a person's working life. Once accrued by workers they are retained if they move jobs or become unemployed.

In both countries, personal learning accounts are provided by the government but funded by a levy on employers. In France, employers contribute via a levy of 0.55-1 percent of their total payroll cost. In Singapore, SkillsFuture is funded through a similar levy of 0.25 percent. The Singaporean government has also pledged to invest S\$5bn in a lifelong learning endowment fund, with returns from this being used to fund training programs. In the UK, we have a similar levy. Businesses with an annual wage bill over £3m contribute 0.5 percent of their payroll cost into a fund, which can be drawn down to pay for apprenticeships. However, there is a growing consensus among businesses that there is a need for more flexibility in how this fund can be used. This could be reconfigured to finance personal learning accounts.

We recommend that BEIS and DfE introduce personal learning accounts in the high automation, medium-low Covid sectors identified in our risk register. The retail sector previously made a similar ask of government in its initial proposal for an industrial strategy sector deal.¹²¹ In the medium-term, personal learning accounts could be introduced across the economy through a series of sector deals – or similar horizontal partnerships with industry, unions and learning providers. In hindsight, having this kind of system in place could have benefitted furloughed workers across the economy by allowing them to make more productive use of their time off. BEIS and DfE should also explore the scope to use new technologies such as digital badges, which provide learners with a new way to recognise and validate skills, including those developed through on-the-job learning.

CONCLUSION

An opportunity to reimagine the social contract.

¹¹⁹ Lockey, A. and Wallace-Stephens, F. (2019). Op cit.

¹²⁰ Ibid.

¹²¹ BEIS Select Committee. (2019) Industrial Strategy: Sector Deals. London: House of Commons.

Conclusion

Preparing for the future is no easy task, especially when the pace of change is so fast that the next few years seem almost as uncertain as the next 15. This report intends to complement an emerging body of research from the RSA Future Work Programme that aims to provide those in positions of responsibility with practical tools to help prepare today's workers for tomorrow's workplaces.

In March 2019 we published *The Four Futures of Work*, a report that used scenario planning to explore the different ways that future work trends could play out and model how the labour market, a complex system, might evolve over time. This piece of research has a different but complementary aim. Rather than building possible worlds of what the future could look like in 2035, it aims to provide more specific insights about who is at risk in the short-medium-term. This is crucial because getting the short-term response to the pandemic right is paramount for good work: we need to allow the economy to evolve without leaving any workers behind. But also because many of the solutions and responses we urgently need now will become ever more critical as technology begins to transform the economy. For example, a transition service is needed now for the pandemic, but should become a permanent feature of our labour market institutions.

However, the pandemic also represents an opportunity to reimagine the social contract for work – at a deeper level.

Earlier this year, we set out in detail our vision of how this might work, with our report, *A blueprint for good work: Eight ideas for a new social contract*. Central to our argument is the belief that we need a more 'corporatist' model of capitalism, grounded in stronger stakeholder

relationships between workers, employers, local authorities, civil society and trade unions, particularly the latter. This is a long-term goal and, in part, reflects a view that the absence of strong trade unions and the low unionisation rates within the UK are a systemic brake on good work. However, as the pandemic perhaps underlines, this shift towards a more 'stakeholder' model it is not just about amplifying worker voice. Such relations also allow for different types of intervention by the state in terms of economic management (particularly at the sectoral level), but perhaps most importantly of all, also help to maintain social cohesion in times of crisis. The Kurzarbeit scheme in Germany works – or at least has done historically – because it is founded on institutions such as works councils which bind in workers, employers and unions.

All of the policy recommendations we make in this report see an enhanced role for worker voice and would work best where that is an explicit objective. Indeed, at a deeper level, our hope is that the pandemic might shock our institutions in this direction. Perhaps you can see this happening already, with the CJRS furlough scheme – which was drawn up in partnership with the Trade Union Congress – and the ongoing practical need to provide workplace guidance on social distancing across widely varying sectoral dynamics. This should encourage a move towards social partnerships and a stakeholder economy – for too long in the UK we have seen good work as essentially something the state, and the state alone, must secure in situations where employers deliver poor outcomes. Certainly, that approach will not serve us well in the volatile, complicated and highly uncertain world of the pandemic labour market.

Notes on risk register methodology

Data sources

Covid-19 risk

We use administrative data from HMRC on total furlough take-up rates as our primary measure of Covid-19 risk. This data is published at industry group level (3-digit SIC) which allows to calculate take up at industry division level (2-digit SIC). This data was published in August but is cumulative and so has not changed despite new data being published in September. According to our correspondence with the statistics team at HMRC, future data releases may include more timely estimates of furlough take-up at this granular level. Data for mining and quarrying is only available at industry sector level (1-digit SIC) due to it being a relatively small industry in terms of employment. For this industry, we provide all data for this industry at this broad level.

We use data from the Index of Services and Index of Production to calculate changes in economic output. While furlough take-up rates provide a better indicator of the potential unemployment risks than changes in economic output, they don't tell us anything about how these industries have recovered. Data for some sectors is not available at industry division level (2-digit SIC) due to the way these statistics are produced. This is an issue for agriculture and construction. In light of this, we use data at the industry sector level (1-digit SIC) as a proxy where we are confident this provides a reliable estimation of the extent to which they

have recovered. Otherwise we exclude some of the sub-sectors from our segmentation analysis on the basis of a lack of available data. However, we include data for other indicators for these industries in the accompanying data tables.

- We exclude both forestry and fishing, which together only account for 12 percent of the agriculture industry (around 0.13 percent of all employment) but have higher levels of furlough take-up than farming, or crop and animal production so may not be quite as resilient.
- We exclude civil engineering which has had lower levels of furlough take-up other parts of the construction industry and accounts for a much smaller share of employment. We expect this industry may not be as high risk of Covid-19.

Automation risk

We use data from the 2019 ONS study as our primary measure of automation risk (see Chapter 3 for more details). We also use RSA analysis of the Annual Population Survey to benchmark how industries have changed over the last decade. Our analysis here calculates the percentage change in employment for different industries based on three-year averages for the years 2011-13 to 2017-19.

Demographic data

We use data from the Quarterly Labour Force Survey (Jan-Mar 2020) to provide demographic breakdowns for different industries, looking at age, gender, income and education.

Segmentation

We define industries at high risk of Covid-19 as the following:

- Industries with the highest total furlough take-up (65th percentile and above) and the largest decline in economic output (35th percentile and below).
- Industries with a medium levels of furlough take-up (35th to 65th percentile) and the largest decline in economic output (35th percentile and below).

We define industries at low risk of Covid-19 as the following:

- Industries with the lowest total furlough take-up (35th percentile and below) but not the largest decline in economic output (35th percentile and below).
- However, we include in this grouping essential public services such as health and education and utilities that have seen large declines in economic output. These industries have very low levels of furlough take-up and this discrepancy can largely be explained by differences in the way that economic output is measured in the public sector.¹²²

We define industries at high risk of automation as the following:

- Industries that with the highest automation probability (65th percentile and above).
- Industries with medium automation probability (35th to 65th percentile) that have experienced a decline of more than 5 percent over the last decade.

Otherwise industries are defined as low (35th percentile and below) or medium (35th to 65th percentile) risk of automation

There is one group of industries identified from our segmentation that we have not explored in detail in this report: industries that appear to have been impacted by the pandemic but have since experienced a strong recovery. These industries account for 7 percent of employment. As outlined in Chapter 5, this analysis is not intended to be an exhaustive segmentation of the labour market, but rather a way to highlight the industries that policymakers will need to pay particular attention to because they are most at risk or resilient. In some cases, these industries may have successfully adapted to the pandemic context and so are no longer at risk. But it is unclear how resilient are, especially given the prospect of a second wave.

Table 4: Industries that could no longer be high Covid-19 risk (RSA Covid-19 and automation risk register)

SIC code	Industry division
92	Gambling and betting activities
25	Manufacture of fabricated metal products, except machinery and equipment
15	Manufacture of leather and related products
23	Manufacture of other non-metallic mineral products
22	Manufacture of rubber and plastic products
13	Manufacture of textiles
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
32	Other manufacturing
39	Remediation activities and other waste management services
95	Repair of computers and personal and household goods
45	Wholesale and retail trade and repair of motor vehicles and motorcycles
46	Wholesale trade, except of motor vehicles and motorcycles

¹²² Office for National Statistics. (2020) Coronavirus and the effects on GDP. [online] ONS. Available at: www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/coronavirusandtheeffectsonukgdp/2020-05-06#the-treatment-of-non-market-output-in-gdp

Additional data

Table 5: Changes in furlough take-up rates for all industries (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics)

	Percentage of furlough take-up (30 Apr 2020)	Percentage of furlough take-up (31 Jul 2020)	Percentage of estimated returns from furlough
Accommodation and food services	73	43	41
Arts, entertainment and recreation	66	45	32
Construction	55	22	61
Other service activities	51	32	39
Wholesale and retail; repair of motor vehicles	41	17	57
Manufacturing	37	17	53
Real estate	34	18	48
Administrative and support services	29	19	36
Transportation and storage	28	16	44
Mining and quarrying	28	11	59
Professional, scientific and technical	25	17	31
Water supply, sewerage and waste	22	10	53
Agriculture, forestry and fishing	18	8	53
Information and communication	15	12	25
Energy production and supply	13	4	71
Health and social work	9	6	37
Education	9	6	30
Households	7	3	56
Finance and insurance	6	4	34
Public administration and defence; social security	1	1	54

Figure 13: Relationship between furlough take-up and historical employment growth (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and Annual Population Survey)

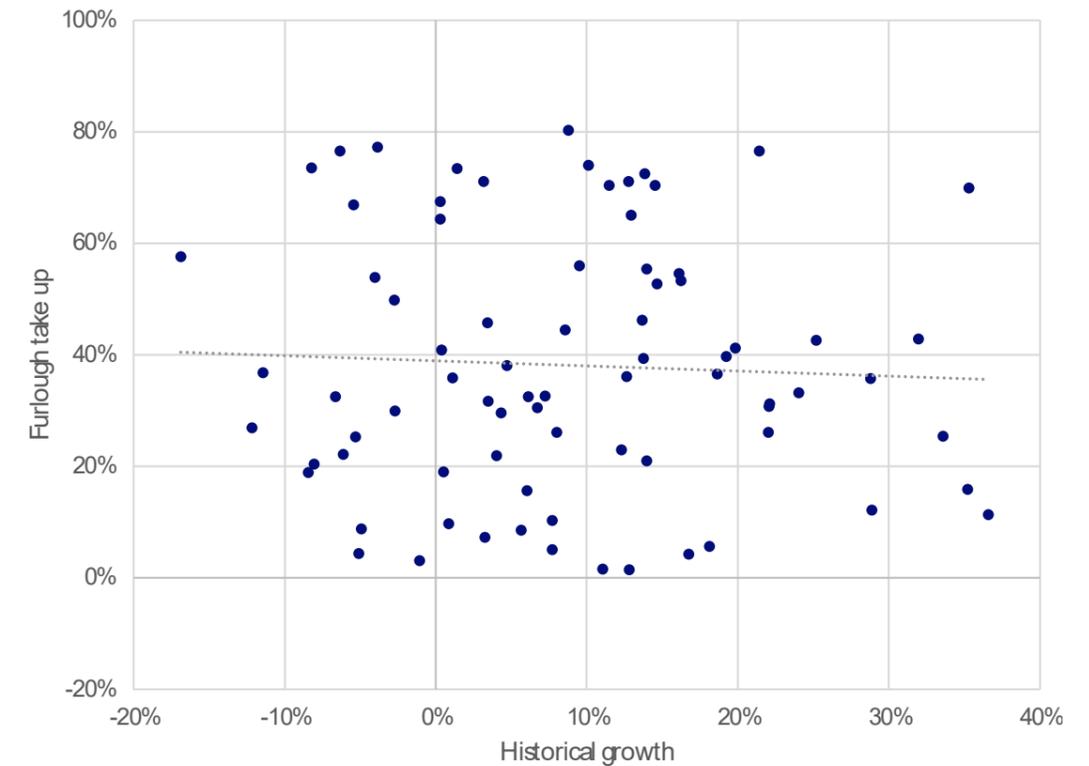


Figure 14: Relationship between furlough take-up and income (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and Labour Force Survey, Jan-Mar 2020)

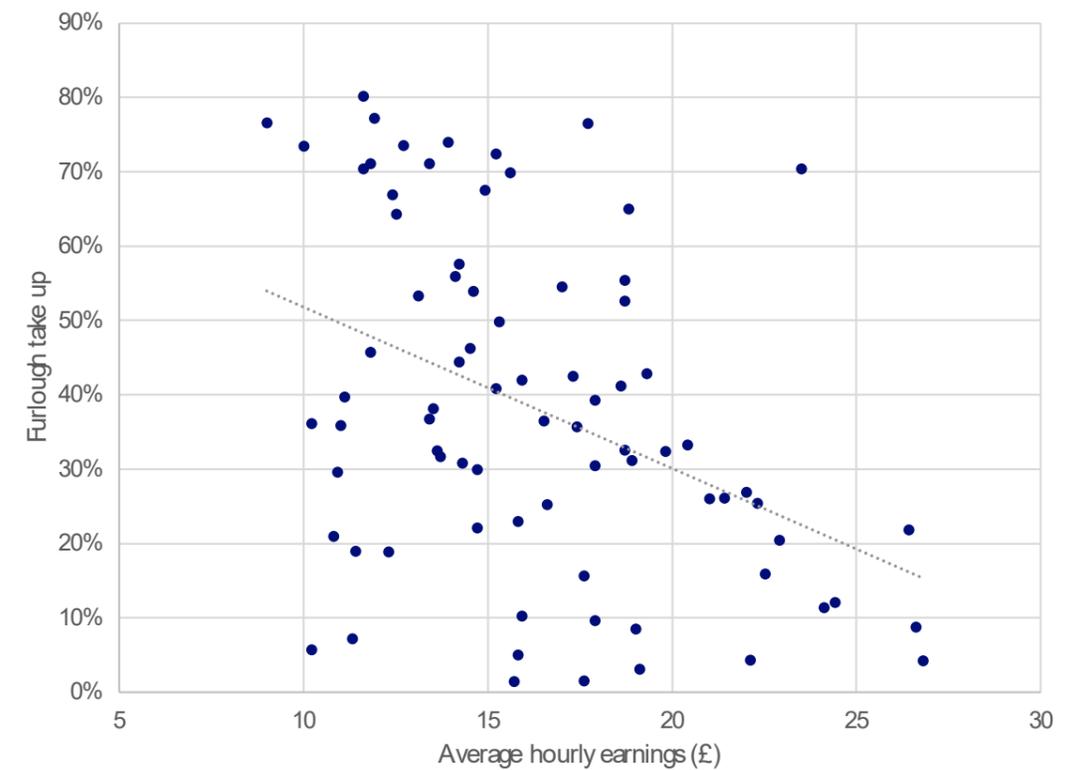


Figure 15: Relationship between furlough take-up and gender (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and Labour Force Survey, Jan-Mar 2020)

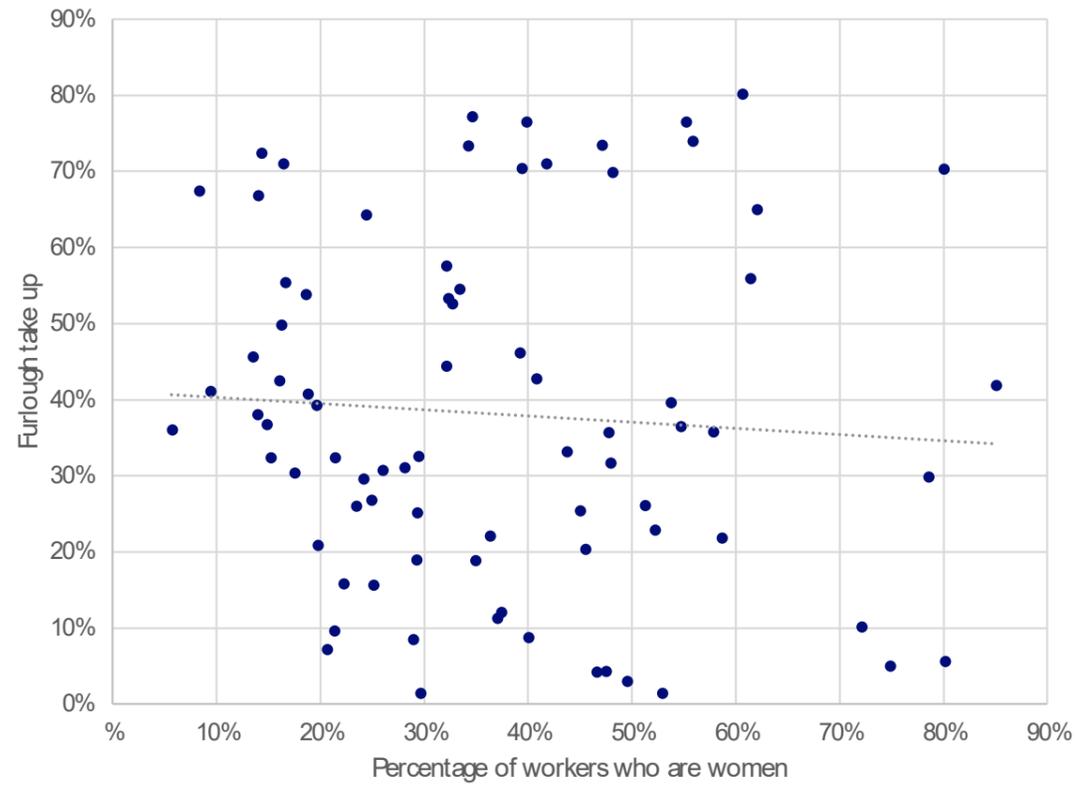


Figure 17: Relationship between furlough take-up and education (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and Labour Force Survey, Jan-Mar 2020)

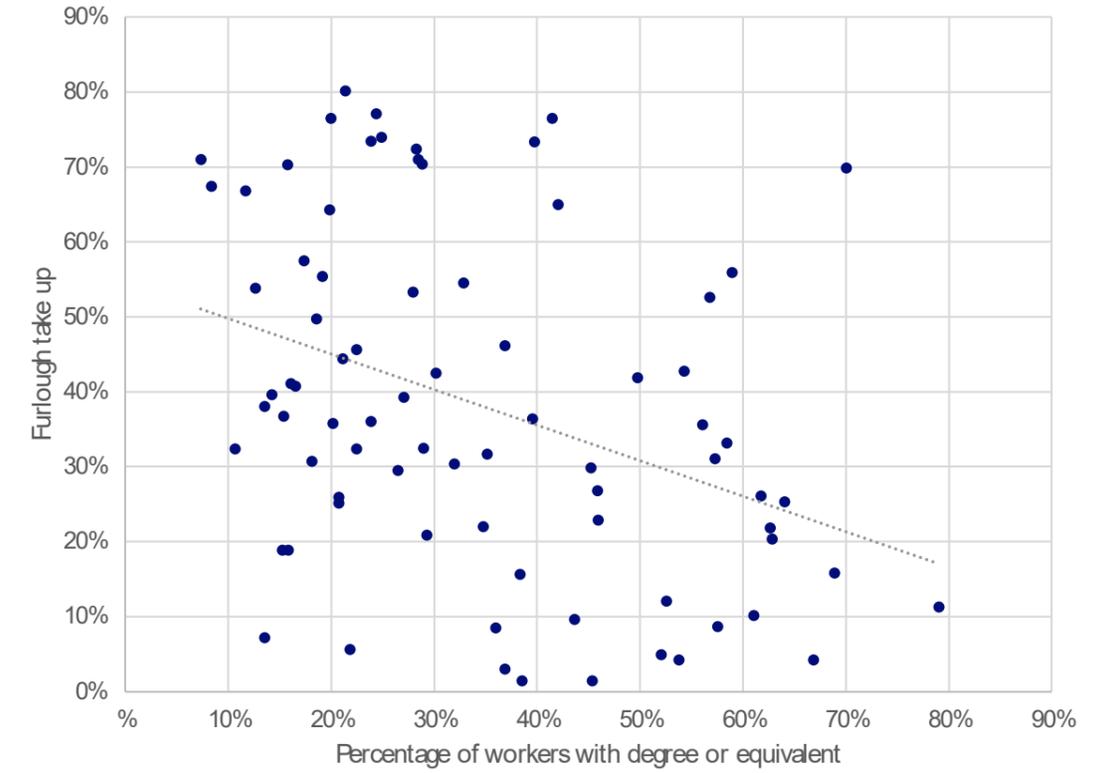
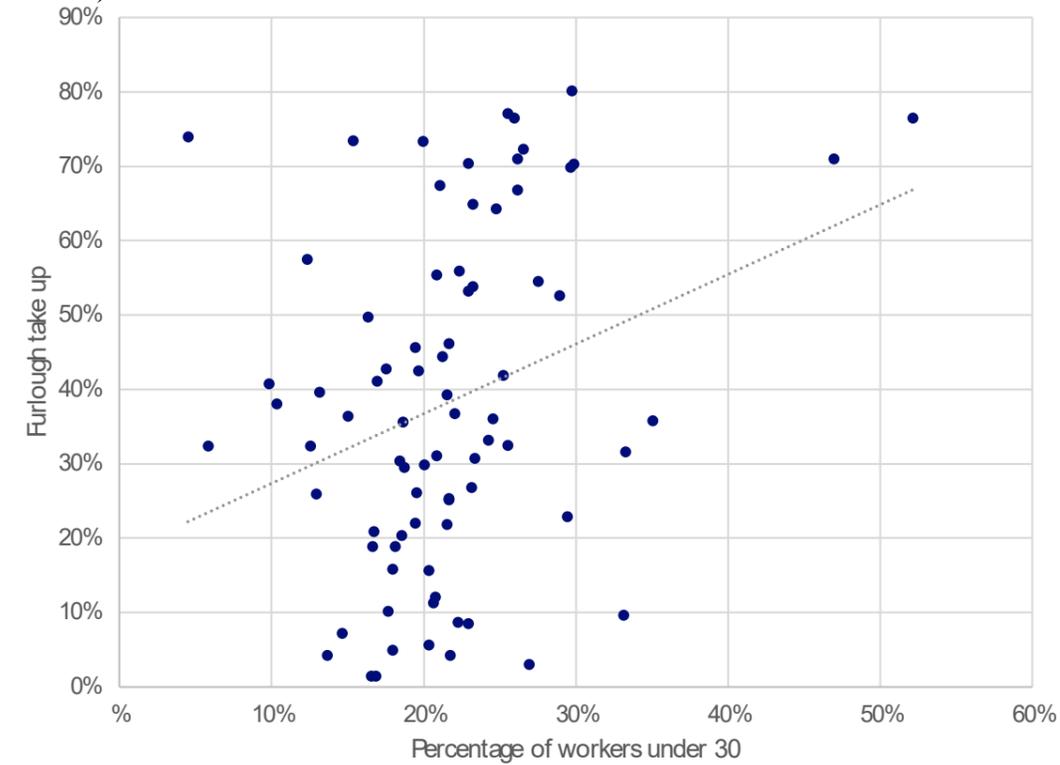


Figure 16: Relationship between furlough take-up and age (RSA analysis of HMRC Coronavirus Job Retention Scheme statistics and Labour Force Survey, Jan-Mar 2020)



Who is at risk?

Table 6: Demographic breakdown of industries at high risk of Covid-19 and high risk of automation (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Average hourly earnings £	Percentage of workers who are women	Percentage of workers who are under 30	Percentage of workers with degree or equivalent
Accommodation	11.6	60.6	29.7	21.3
Food and beverage service activities	9	55.2	52.1	19.9
Other personal service activities	11.6	80	29.8	15.7
Sports activities and amusement and recreation activities	13.4	41.7	46.9	28.4
Manufacture of motor vehicles, trailers and semi-trailers	15.2	14.3	26.5	28.2
Land transport and transport via pipelines	13.5	13.9	10.3	13.5
Manufacture of wearing apparel	13.9	55.8	4.5	24.8
Services to buildings and landscape activities	11.1	53.7	13.1	14.2
Printing and reproduction of recorded media	14.2	32.1	12.3	17.3
Manufacture of furniture	11.9	34.6	25.5	24.3
Specialised construction activities	14.9	8.3	21	8.3

Table 7: Demographic breakdown of industries at high risk of Covid-19 and low risk of automation (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Average hourly earnings £	Percentage of workers who are women	Percentage of workers who are under 30	Percentage of workers with degree or equivalent
Air transport	23.5	39.4	22.9	28.8
Travel agency, tour operator and other reservation service and related activities	18.8	62	23.2	42
Creative, arts and entertainment activities	15.6	48.1	29.6	70
Advertising and market research	20.4	43.7	24.2	58.4
Libraries, archives, museums and other cultural activities	14.1	61.4	22.3	58.9
Motion picture, video and television programme production, sound recording and music publishing activities	18.7	32.7	28.9	56.7
Manufacture of other transport equipment	17.9	17.5	18.4	31.9
Rental and leasing activities	13.1	32.3	22.9	27.9
Other professional, scientific and technical activities	19.3	40.8	17.5	54.2
Architectural and engineering activities; technical testing and analysis	18.9	28.1	20.8	57.2
Construction of buildings	18.7	16.6	20.8	19.1

Table 8: Demographic breakdown of industries at low-medium risk of Covid-19 but high risk of automation (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Average hourly earnings £	Percentage of workers who are women	Percentage of workers who are under 30	Percentage of workers with degree or equivalent
Retail trade, except of motor vehicles and motorcycles	11	57.8	35	20.1
Crop and animal production, hunting and related service activities	11.4	29.2	16.6	15.2
Postal and courier activities	11.3	20.6	14.6	13.5
Waste collection, treatment and disposal activities; materials recovery	13.6	15.2	12.5	10.6
Manufacture of food products	12.3	34.9	18.1	15.8
Manufacture of paper and paper products	16.6	29.3	21.6	20.7
Security and investigation activities	10.9	24.1	18.7	26.4
Warehousing and support activities for transportation	14.3	26	23.3	18.1
Manufacture of basic metals	13.4	14.8	22	15.3
Residential care activities	10.2	80.1	20.3	21.8
Manufacture of chemicals and chemical products	14.7	36.3	19.4	34.7

Table 9: Demographic breakdown of industries at low risk of Covid-19 and low risk of automation (RSA Covid-19 and automation risk register)

Industry division (2-digit SIC)	Average hourly earnings £	Percentage of workers who are women	Percentage of workers who are under 30	Percentage of workers with degree or equivalent
Water collection, treatment and supply	15.7	29.6	16.8	38.5
Public administration and defence; compulsory social security	17.6	52.9	16.5	45.3
Manufacture of basic pharmaceutical products and pharmaceutical preparations	26.8	46.6	13.6	66.8
Financial service activities, except insurance and pension funding	22.1	47.5	21.7	53.7
Human health activities	15.8	74.8	17.9	52
Telecommunications	19	28.9	22.9	35.9
Programming and broadcasting activities	26.6	40	22.2	57.5
Manufacture of coke and refined petroleum products	17.9	21.3	33.1	43.6
Education	15.9	72.1	17.6	61
Scientific research and development	24.1	37	20.6	79
Activities auxiliary to financial services and insurance activities	24.4	37.4	20.7	52.5
Electricity, gas, steam and air conditioning supply	17.6	25.1	20.3	38.3
Computer programming, consultancy and related activities	22.5	22.2	17.9	68.8
Information service activities	26.4	58.6	21.5	62.6
Legal and accounting activities	21.4	51.2	19.5	61.7
Manufacture of computer, electronic and optical products	22	24.9	23.1	45.8

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creation**



8 John Adam Street
London WC2N 6EZ
+44 (0)20 7930 5115

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