The Skills Imperative 2035: Occupational Outlook – Long-run employment prospects for the UK, Baseline Projections

Working Paper 2a

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Glossary

ABI	Annual Business Inquiry
ABS	Annual Business Survey
AES	Annual Employment Survey
BRES	Business Register and Employment Survey
CE	Cambridge Econometrics
CoP	Census of Population
CVM	Chained volume measure
DfES	Department for Education and Skills
DIUS	Department for Innovation, Universities and Skills
DTI	Department of Trade and Industry
ESA95	European System of (National) Accounts, 1995
Expansion demands	Net change in employment between two years (may be negative)
GDP	Gross Domestic Product
GDPO	Gross Domestic Product (output)
GORs	Government Office Regions
GVA	Gross Value Added
IER	Institute for Employment Research
IoP	Index of Production
LAD	Local authority district
LEC	Local Enterprise Council
LEFM	Local Economy Forecasting Model
LEP	Local Enterprise Partnership
LFS	Labour Force Survey
LLSC	Local Learning and Skills Council
LSC	Learning and Skills Council
MAFF	Ministry of Agriculture Food and Fisheries
MDM-E3	Multi-sectoral Dynamic Model
NES	New Earnings Survey
nes	not elsewhere specified
n.e.c.	not elsewhere classified
NOMIS	National On-line Manpower Information System
ONS	Office for National Statistics

OPCS	Office of Population Censuses and Surveys
QCF	Qualifications and Credit Framework
RAS	RAS is a widely used iterative technique, which ensures that elements in a two-dimensional data array match target row and column totals. Full details are given in the accompanying Technical report, Wilson et al (2022c).
Replacement demands	Job openings arising from the need to replace those leaving the workforce due to retirement, etc
RQF	Regulated Qualifications Framework
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
SSCs	Sector Skills Councils
SSAs	Sector Skills Agreement sectors
SSR	Standard Statistical Region
SUTS	Supply and Use Tables
Total requirements	The sum of expansion demands and replacement demands
TEC	Training and Enterprise Council
WF	Working Futures

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The responsibility for the views expressed and for any remaining errors lies with the authors.

The opinions expressed in this report are those of the authors and do not necessarily reflect the views of Nuffield.

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Executive Summary

Introduction and general approach

This report has been prepared for *The Skills Imperative 2035:* Essential skills for tomorrow's workforce research programme, funded by the Nuffield Foundation. This is being led by the National Foundation for Educational Research (NFER), who are working in collaboration with a number of partners, including The Institute for Employment Research (IER) at the University of Warwick and Cambridge Econometrics (CE).

In the first Working Paper from this research study, we presented a review of the key literature.[1] This identified a number of mega trends which may impact on the future labour market, including technological advancement (digitisation, automation, artificial intelligence (AI)), demographic and environmental change.

In the next stage of this study, we examine the long-run labour market and skills prospects for the UK to 2035. The findings are published in a suite of reports produced under the Working Paper 2 banner. This report, Working Paper 2a, describes a set of *Baseline projections*. These include an overview of macroeconomic and sectoral employment prospects as well as the implications for skills as measured by qualifications and occupation. The latter includes detailed projections to 2035 for 412 4-digit occupational categories (based on the latest Standard Occupational Classification 2020 (SOC2020) system for classifying occupations).

Working Paper 2b presents the results for some *Alternative scenarios* that have been considered. These are based on assumptions which explore a more rapid take up of certain technologies and faster moves in both policy and practice towards the greening of the economy, as well as considering how such technologies will afford the space to create value though human-centric jobs that are difficult to replace.[2] Together, the *Baseline projections* and *Alternative scenarios* provide a sound basis for discussions about skills provision in the future.

Working Paper 2c, the *Technical report*, presents details of the data sources and methods used to generate the results.[3]

Lastly, Working Paper 2, is a *Headline report* which summarises the main findings from the *Baseline projections* and *Alternative scenarios* and brings together the scenarios to consider overall implications for occupations and skills.[4]

Working Papers 2a to 2c are technical documents, aimed at an expert audience interested in the details of how economic changes are impacting upon the occupational structure of employment. The Working Paper 2 *Headline report* is aimed at a more general audience, which includes government, policymakers, employers, etc.

[1] https://www.nfer.ac.uk/media/4852/the_skills_imperative_2035_working_paper_1_essential_skills_literature_review.pdf
[2] Wilson *et al*., (2022b)
[3] Wilson *et al*., (2022c)
[4] Wilson *et al*., (2022)

Baseline projections and Alternative scenarios

Of course, nobody can predict the future with certainty or precision. Producing projections of the future labour market is even more challenging at present given uncertainties associated with Brexit, the abrupt labour market changes introduced by the Covid-19 pandemic and the social distancing measures introduced to deal with it. Paradoxically, these uncertainties highlight the need to quantify the range of possible outcomes.

This report, Working Paper 2a, presents *Baseline projections* for the macroeconomy, sectoral employment and the labour force, based on our assessment of the most likely path the economy will take over the next 15 years or so given what we know about changes to the future policy landscape.

These projections are based on the well-established methodology used in *Working Futures* (WF) which uses a multi-sectoral dynamic macroeconomic model and other quantitative models. These consider existing technological trends, the impact of Brexit and the pandemic, other labour market factors (such as population growth, migration and the current demographic structure of the workforce) as well as any changes to the policy landscape which have been made or announced to determine how the sectoral structure of the economy will change between 2020 and 2035.

The *Baseline projections* do not, however, take into account any policy changes which may happen in the future but where the detail is not yet known (for example, future new policies to help the UK meet its net zero carbon commitment by 2050). In this sense, the *Baseline projections* can be considered to be a set of projections based on a minimum disruption due to policy and other potentially disruptive changes.

The mega trends identified in Working Paper 1, which may impact on the future labour market including the adoption of new technologies and environmental change, could generate greater change than assumed in the *Baseline projections*. Given the inherent uncertainty in undertaking this type of exercise and the broader aim of the research programme to explore a range of possible futures, we have produced some *Alternative scenarios*. These build on our *Baseline projections* but consider other possible outcomes such as a more rapid adoption of technology, greater focus on green initiatives and the provision of better-quality education, health and care services.

Adoption of the new SOC2020 classification

The projections produced in this report drive the detailed occupational employment projections. Occupations summarise the main tasks required in a particular job and act as a proxy to understand the skills requirements in the labour market. We have adopted the recently introduced SOC2020 in this study. SOC2020 improves the classification of jobs associated with information technologies, allowing disaggregation into less heterogeneous Unit Groups. These results will drive the analysis in the next phase of the project, which will link these results to implications for skills as measured in the United States' O*NET database and other related information.

Macroeconomic prospects

The projections consider a number of key drivers of change in the economy, including:

- **Pandemic and social distancing measures:** The Covid-19 pandemic impacted on ways of living and working very abruptly. People were restricted from working as normal to avoid spreading the virus. Restrictions varied depending on the type of tasks and

nature of work in each occupation. Moreover, specific sectors and occupations such as those involved in hospitality faced relatively more restrictions since a considerable share of their activities were not compatible with teleworking.

- **Trade**: While the uncertainty about the possibility of a 'no-deal Brexit' has been lifted, the effect of the EU-UK Trade and Cooperation Agreement (such as restrictions on immigration) are expected to have a considerable impact on the UK economy.[5] We assume a long-term effect of a decline in UK exports to the world of around 13 per cent by 2035, allowing for the potential positive prospects from unilateral trade agreements with countries such as the US, Australia, Canada and New Zealand. This is broadly similar to the assumptions adopted in other studies, or modelling results based on scenarios similar to the deal adopted in December 2020, such as those in: OBR October 2021 Economic and fiscal outlook publication, Bank of England 2019 Report, or CEP 2019 modelling.[6, 7, 8]
- **Technological developments:** The introduction of new technologies (primarily related to automation) is displacing certain jobs, whilst incentivising the creation of new jobs.
- **Climate change and environmental issues:** The global transition for a greener economy (2015 Paris Agreement) is altering the occupational and skills composition of the UK labour market.
- **Demographic developments:** The demographic composition in the labour market is changing considerably. The main drivers of the demographic composition are the aging population and an increasing percentage of females in the labour market.

Given these main trends and drivers, the macroeconomic projections indicate:

- The UK economy is projected to see a substantial recovery in GDP following the sharp contraction due to the pandemic, with GDP forecast to grow by around 1.8 per cent per annum (pa) to 2035 (this also represents 1.8 per cent pa in GVA terms).[9]
- Following the decrease in 2020 due to the pandemic, employment is projected to rise by around 0.5 per cent pa between 2020 and 2035, which is equivalent to around 2.6 million additional jobs by 2035.
- UK population growth is forecast to slow in the next decade and a half, leading to a slower expansion of supply of labour to the UK economy.
- More than half the new jobs created between 2020 and 2035, many of which will be part-time, are expected to be taken by women.
- The unemployment rate doubled in 2020 to 4.5 per cent due to the pandemic but is projected to fall back to 3 per cent by 2035.

[5] See Section 2.2.2 for further detail.
[6] https://obr.uk/docs/dlm_uploads/CCS1021486854-001_OBR-EFO-October-2021_CS_Web-Accessible_v2.pdf
[7] https://www.bankofengland.co.uk/-/media/boe/files/monetary-policy-report/2019/november/monetary-policy-report-november-2019.pdf
[8] https://ukandeu.ac.uk/wp-content/uploads/2019/10/The-economic-impact-of-Boris-Johnsons-Brexit-proposals.pdf
[9] The results were prepared before the Russian invasion of Ukraine and subsequent economic fallout. Although a recession now appears likely in 2023, this is not expected to affect the long-run trends presented here.

- Nevertheless, population growth and higher female participation will expand UK labour supply. The female labour force is expected to increase fastest, reflecting increasing participation rates.

Due to these changes, by 2035, the structure of the economy and the labour market will have changed substantially from that observed in 2020, with significant implications for the pattern of occupational employment and the demand for skills.

The projections should be regarded as indicative of likely developments for the economy and the labour market, rather than precise forecasts of what will inevitably happen. Many of the trends presented are resilient and are not sensitive to modest unanticipated shocks. They present a view of medium to longer-term trends for the UK economy and labour market (10-15 years ahead) and incorporate policy changes where these have been announced. The results should be regarded as a robust benchmark for debate and further analysis.

Sectoral output and employment projections

At sectoral level, the broad profile of change is expected to develop in a similar fashion to that in previous projections, with further shifts towards a service orientation, especially in terms of employment.

In terms of output, the *Construction and Trade*, *accommodation and transport* sectors lead the way, mirroring the high growth seen prior to the pandemic. While the *Manufacturing* sector is projected to continue to grow – it is projected to be 25 per cent larger in term of output by 2035 – its share of output is expected to decline by 0.8 per cent pa by 2035. This is driven by increasing competition from overseas manufacturers and as the UK continues to move even further towards a services-oriented economy.

Employment will generally reflect the trends observed in output, with the strongest growth rates in *Business and other services* (accelerating with 657,000 net new jobs over the period 2025-35), and *Non-market services* (*Public administration, education and health*, 470,000 net new jobs over 2025-35). *Construction* is also projected to grow by 164,000 over the same period, while *Manufacturing* declines by 200,000 jobs.

Generally, the economy is expected to continue to develop in favour of service sector jobs, many of which will favour higher-skilled occupations and better-qualified people.

At a more detailed level, the sectors with largest absolute employment growth at the 2-digit level of the Standard Industrial Classification (SIC) are mainly services. They include *Health, Food and beverage services, Social work, Education, Residential care, Specialised construction, Employment activities, Computer programming, Accommodation* and *Services to buildings*. Each of these is projected to grow by at least 100,000 jobs between 2020 and 2035, with *Health* rising by almost 360,000.

In contrast, the 2-digit sectors with the largest projected employment declines are focussed mainly in *Manufacturing*: *Metal products, Repair and installation, Rubber and plastic, Other transport equipment, Machinery not elsewhere classified (n.e.c.), Printing and recording, Other manufacturing, Furniture, Textiles* and *Mining and quarrying*. These industries are projected to lose between 15,000 and 40,000 jobs over the same period.

Occupational projections

A reassertion of long-term trends in occupational employment is expected, following recovery from the effects of the pandemic, with continued growth in the number of jobs for

Professionals and Associate professionals. However, there will also some growth for lower skilled work where jobs are less easily automated.

Professional and Associate professional occupations are projected to see the fastest growth (+1.94 million and +0.94 million jobs from 2019 (pre-pandemic) to 2035, respectively), mainly due to a considerable rise for *Health and social care associate professionals*. But there will also be a significant employment increase for some less skilled groups such as *Customer service occupations*. It is expected that traditional manual/blue-collar occupations such as *Skilled metal, electrical and electronic trades, Skilled construction and building trades* (among others) will continue declining. Employment for both high and lower skilled occupations is therefore projected to grow, but with some hollowing out in the middle.

However, 'Replacement demands' arising due to the need to replace those leaving the workforce for retirement, etc., will outweigh any projected negative changes between 2020 (the base year for our projections) and 2035. This means there will still be significant job openings and skill requirements, even in occupations that are projected to decline the fastest. Replacement demands will dominate the picture for job openings and skill requirements.

Detailed occupational projections

In order to assess changing skill requirements, projections are needed at a very detailed level. We have therefore adapted the 4-digit level occupations (412 categories) of the new SOC2020 occupational classification to historical and projected employment data. These projections are based on historical patterns and trends as revealed in the latest Labour Force Survey (LFS) data. *Care workers and home carers, Programmers and software development professionals, Higher level teaching assistants and Nursing auxiliaries and assistants* will experience the largest growth in absolute terms by 2035. In contrast, *Receptionists, Personal assistants and other secretaries* and *Warehouse operatives* will experience the largest declines in absolute terms by 2035.

Qualification projections

Projections have also been made of the qualification profiles of the population and the employed workforce using the QCF/RQF Framework.[10] These present a picture of the population becoming increasingly well qualified with formally accredited qualifications. The proportion of the population obtaining degree level qualifications is projected to continue rising, reaching well over 50% by 2035. In contrast, the proportion of the labour force who are unqualified (i.e. those with no or very low formal qualifications, below RQF level 1) is expected to represent only a small minority by 2035 (less than 2½ per cent, compared with around 4 per cent in 2020). These patterns will be reflected in the employed workforce.

Alternative scenarios

We have developed some *Alternative scenarios* to complement the *Baseline projections*. These aim to explore the range of possible outcomes for occupational employment in the light of different but plausible assumptions. The *Alternative scenarios* are focused on transformations in the management of new technologies, the transition to a low-carbon

[10] QCF, the Qualifications and Credit Framework was superseded by RQF, the Regulated Qualifications Framework. They aim to help people understand regulated qualifications and how they relate to each other. For more details see https://qualifications.pearson.com/en/support/support-topics/understanding-our-qualifications/framework-rqf.html

economy, and the provision of better-quality education, health and care services. These scenarios consider more disruptive changes leading to greater job displacement by new technologies than those built into the *Baseline projections*. They consider the implications of a much faster take up of technologies related to AI and automation, as well as an acceleration in policies and practices associated the greening of the economy, including the 'net zero' target set out by the government. The *Human-centric scenario* also places greater emphasis on some non-cognitive skills (which are less vulnerable to such displacement), such as caring skills.

The different assumptions about the macroeconomy and sectoral prospects are combined with alternative assumptions about changing occupational patterns at the 4-digit level in order to provide an indication of the full range of possible outcomes. These results are presented in detail in a separate, accompanying report.[11]

Next steps

The next step of this research programme will be to explore the implications for demand for essential employment skills. This will involve the development of an up-to-date Mapping between the SOC2020 4-digit occupational categories and skill taxonomies and systems such as the US O*NET database. Using this Mapping, we will work out in more detail the future implications for essential employment skills of the occupational patterns projected here.

[11] Wilson *et al.*, (2022b).

1 Introduction

Key messages

This report is part of a suite of documents produced under the heading of Working Paper 2 for the Nuffield Foundation funded research programme *The Skills Imperative 2035: Essential Skills for tomorrow's workforce.*

The National Foundation for Educational Research (NFER) is leading this five-year research programme, projecting the demand for and supply of essential employment skills up until the year 2035.

This report describes a set of quantitative projections of the UK economy and labour market which have been prepared by the Institute for Employment Research (IER) at the University of Warwick, in collaboration with Cambridge Econometrics (CE). This team was responsible for producing the well-established *Working Futures* projections, previously funded by the Government, most recently by the Department for Education (DfE).

These projections will form a key input into thinking about how the UK economy and labour market may respond to major technological, environmental and demographic developments over the coming decades and what this will mean for essential employment skills.

A key aim is to provide government, policy makers, education and training providers as well as employers with practical insights about how the demand for essential employment skills is likely to evolve.

These new projections estimate the impact of the UK's exit from the European Union (EU), as well as the effects of the Covid-19 pandemic and the responses of governments around the world to it.

1.1 Background and context to the research programme

The global economy faces significant shifts in the coming decades. New technologies, coupled with major demographic and environmental change, are predicted to disrupt the economy and the labour market in various ways. This will have a significant impact in the next 10 to 15 years and beyond, both in terms of the *jobs* available and the *skills* needed to do them. Many commentators anticipate that skills such as creativity, critical thinking, teamwork, problem solving and resilience – skills which complement the new technologies and other changes taking place – will become increasingly important in the future.

In this research programme, we seek to investigate how the nature of jobs and the demand for skills will change over the next 15 years, and to identify which employment skills will be most needed in future. We will also assess the potential supply of these *essential employment skills*. *The Skills Imperative 2035* programme also aims to identify where the skills gaps are likely to arise, and which groups are most at risk of not having the essential employment skills needed. The programme as a whole will consider what actions are needed to support such groups of workers whose jobs are affected by these drivers of change to transition to other opportunities. Finally, the programme will investigate how the education system can support the development of the essential employment skills needed in future.

1.2 Occupational Outlook – development of detailed projections

This report describes the use of well-established techniques to develop *Baseline projections* to describe the size, composition and detailed estimates of the changing structure of employment in the UK labour market up to 2035, focussing on occupations.

While nobody can be certain about the future, detailed quantitative projections, linked to a coherent view of the prospects for the economy, provide a sound foundation for thinking about how the labour market may respond to both recent short-term shocks, as well as the longer-term drivers of changes in the patterns of demand and supply of skills.

This has been achieved by updating the labour market assessments produced by the IER and by CE in their *Working Futures* (WF) series of reports (see for example Wilson *et al*., (2020)). Such assessments have been conducted on a regular basis for many years. They include detailed quantitative assessments about the future size and composition of the labour market, focussing in particular on the patterns of employment by industry and occupation.

The most recent WF projections were published in January 2020, before the Covid-19 pandemic. They were also prepared prior to the UK's exit from the EU, which was formalised at the start of 2020. To provide a sound foundation for thinking about how existing trends are likely to unfold, and the implications of this for future skills needs, it is necessary to update this assessment. In particular, it is important to take into account, as far as it is possible, the impacts, both short and long term, of the Covid-19 pandemic, as well as the final outcome of the Brexit process. Furthermore, the previous WF projections extended only to 2027. The present research programme requires a longer time horizon than the ten years ahead which WF has typically adopted. The present analysis therefore extends the horizon to 2035, when the impact of longer-term technological developments such as AI and automation are anticipated to have really begun to take effect.

As noted in section 1.3, the projections were largely prepared before the Russian invasion of Ukraine and its subsequent economic effects. While these factors will undoubtedly have a significant impact on the short-term prospects for the British economy and labour market, they are not expected to affect the longer-term prospects for structural change. The focus of these projections is on long-term structural trends such as demographics, economic change and automation, rather than effects we currently consider will have shorter-term impacts on the labour market and future skills needs (e.g. the war in Ukraine). While events and issues like these may have a short-term impact on the economy and labour market, they are not expected to alter the longer-term prospects for employment structure by sector and occupation.

To assess the impact of these developments on the essential employment skills that will be needed over the coming decades, very detailed occupational employment projections have been developed. In the next phase of the research programme these projections will be linked to detailed information about skills needed in different occupations which are collated on theUS O*NET system. This will enable inferences about the kinds of skills that will be needed in 2035 to be made. These skills projections will be the subject of further working papers in future. This report focuses on the detailed occupational employment projections which drive that assessment.

In 2021, the UK Office for National Statistics (ONS) introduced a new version of the Standard Occupational Classification – SOC2020 to replace the old SOC2010 classification. SOC2020 will be the classification system used by Government and other stakeholders

during the next decade, when they will be most focused on this strategic challenge. The research study has undertaken work to reclassify the old WF database on to the new SOC2020 system, producing detailed projections down to the 4-digit level (412 categories). This provides the level of granularity needed to develop the detailed analysis of essential employment skills that will be the focus of the next stage of this study.

The *Baseline projections* presented in this report are based on the macroeconomic, multi-sectoral model, developed by CE. They include detailed sectoral employment forecasts and underlying labour market projections. These *Baseline projections* take account of existing technological trends (assuming that innovation, automation, as well as energy and environmental transitions, continue at a similar pace in the future). They also include the impact of other labour market factors, including demographic changes (such as population growth, migration and the current demographic structure of the workforce), as well as the impact of Brexit and the pandemic. In addition, they take account of any changes to the policy landscape which have been made or announced. The model focuses on how the sectoral structure of the economy will change. IER have then used this material to produce detailed skill demand and supply projections, including employment breakdowns by occupation and qualifications.

1.3 Caveats to the projections

Of course, the future cannot be predicted with precision or certainty. The rationale for producing quantitative forecasts is that a comprehensive, systematic, consistent and transparent set of projections can help to inform users about the world they are likely to face. The view presented here is not the only possible future. It represents a benchmark for debate and reflection about the future that can be used to inform policy development and other choices and decisions. The *Baseline projections* present a carefully considered view of what the future might look like, assuming that past patterns of behaviour and performance are continued over the longer term. They should be regarded as indicative of likely developments for the economy and the labour market, rather than precise forecasts of what will inevitably happen. If policies and patterns of behaviour are changed then alternative futures can result.

It is important to understand that although the 4-digit occupational projections, in particular, are presented in the form of detailed quantitative numbers, they should not be interpreted as precise and certain predictions. They should not be regarded as precise forecasts of what will necessarily happen.

These projections were developed based on published data and the macroeconomic outlook up to June 2021. They do not reflect various short-term factors such as the current cost of living and energy price crises and the impact of the events in Ukraine on the world economy. Given our focus on the long-term structural developments in the economy and the labour market, these factors are not expected to have a significant impact on the main findings.

As noted, if policies and patterns of behaviour are changed, then alternative futures might be achieved. Other possibilities may also arise if some of the exogenous assumptions turn out differently. These possibilities are considered in the *Alternative scenarios* which have also been developed for this project.

1.4 Suite of reports

The future labour market projections are published in a suite of reports produced under the Working Paper 2 banner. The full suite of reports comprises:

Working Paper 2 – henceforth referred to as the *Headline Report*[12]. This presents the main findings about the size and composition of the labour market in 2035. It draws on the *Baseline projections* and *Alternative Scenarios* reports to describe the likely range of potential outcomes for the future labour market and considers what the implications of these changes will be.

Working Paper 2a – This is the present document. It summarises the main findings for the UK in the *Baseline projections*[13]. It presents *Baseline projections* for the macroeconomy, sectoral employment and the labour force, based on our assessment of the most likely path the economy will take over the next 15 years or so, given what we know about changes to the future policy landscape. It includes tables of data for selected years, together with a written commentary explaining and interpreting the forecasts. It covers the whole of the UK and the constituent countries which make it up.

Working Paper 2b – This summarises the findings for the UK for some *Alternative scenarios* that we have considered[14]. These build on our *Baseline projections* but consider other possible outcomes such as a more rapid adoption of technology, greater focus on green initiatives and the provision of better-quality education, health and care services.

Working Paper 2c – A detailed *Technical report* which provides further information on the data sources and methodology used to generate the projections[15].

Working Papers 2a to 2c are technical documents, aimed at an expert audience interested in the details of how economic changes are impacting upon the occupational structure of employment. The Working Paper 2 *Headline report* is aimed at a more general audience, which includes government, policymakers, employers, etc.

1.5 Outline of this report

The remainder of this report is structured as follows. Section 2 sets out the Macroeconomic context. This is based on projections produced by CE using their detailed multisectoral macroeconomic model. CE have a long and distinguished track record of producing quantitative assessments of the UK and economy and labour market, including the well-established *Working Futures* series which has been produced regularly since the start of the millennium. This section also summarises the prospects for the UK labour force to 2035.

Section 3 provides more detail on the implications for employment by sector. Changes in the sectoral or industrial structure of employment is one of the key drivers of occupational employment patterns and hence the demand for skills.

Section 4 moves on to consider the implications for occupations at the broad level (distinguishing the 9 major and 26 sub-major groups of the 2020 revision of the Standard Occupation Classification (SOC2020)).

Section 5 presents a much more detailed picture of implications for the 412 4-digit level categories distinguished in SOC2020.

Section 6 discusses implications for qualifications.

[12] Wilson *et al.,* (2022)
[13] Wilson *et al.,* (2022a)
[14] Wilson *et al.,* (2022b)
[15] Wilson *et al.,* (2022c)

2 Macroeconomic and general labour market context

Key messages

Following exit from the EU and the outbreak of Covid-19 in 2020, the UK economy contracted sharply, with GDP falling by almost 9.2 per cent in 2020 (this represents -8.4 per cent in GVA terms). However, at the time the present forecast was developed (in Autumn 2021), recovery was expected to begin in 2021. GDP growth is expected to average around 1.8 per cent pa over the next 15 years (this also represents 1.8 per cent pa in GVA terms).

Overall, following a 1 per cent decrease in employment in 2020 due to the Covid-19 pandemic, the number of jobs in the UK is projected to rise by around 0.5 per cent pa over 2020-35 (a net increase of some 2.6 million jobs). More than half of the additional jobs are expected to be taken by women. By 2035 women will account for half the employed workforce.

Following a doubling of the unemployment rate in 2020, the rate is expected to fall over the forecast period, from 4.5 per cent in 2020 to 3 per cent in 2035.

UK population growth is forecast to slow over the next 15 years, leading to a slower expansion of the labour supply, despite the increasing participation of women in the labour market. The female labour force is expected to increase faster than the male labour force, reflecting a stronger drop in the activity rate for men (-4.2 percentage points) than for women (-1.6 percentage points) over 2020-35.

2.1 Introduction

The macroeconomic prospects for the UK provide the context for the detailed forecasts of employment and the labour market that are examined in more detail in subsequent sections of this report. This section provides an overview of the input assumptions and a summary of the consequences for UK macroeconomic aggregates. This summary provides the necessary context with which to present the detailed sector-level results presented in Section 3. These projections are produced using CE's detailed multi-sectoral dynamic macroeconomic model (MDM-E3).

Section 2.2 begins with a brief overview of the key exogenous assumptions underlying the projections in relation to EU exit and the Covid-19 pandemic. The resulting UK macroeconomic prospects and the general prospects for the labour market are then summarised in Sections 2.3 and 2.4.

2.2 UK modelling assumptions

In an ideal world, modelling would reflect the latest state of the economy. In practice, due to the time lag between current affairs and data collection and reporting cycles, disruptive events often need to be accounted for through exogenous assumptions as model inputs.

The most critical of these assumptions, based on the best available evidence at the time, which are continuously monitored and developed, relate to the impacts of Brexit and the pandemic. They are discussed in turn in this section.

In addition, the model inputs include exogenously determined assumptions about population growth and UK government spending plans, which are based on official projections and public announcements.[16]

Technological developments are dealt with in part by exogenous assumptions about input-output coefficients which encapsulate relationships between industries. For example, industries using robotics buy this equipment from those industries that manufacture robots. These purchases are represented in the input-output tables prepared by the Office for National Statistics. These tables are at the heart of the CE E3ME model. Other aspects, such as the relationship between output and employment (productivity) in each industry, are determined endogenously by the various econometric relationships embedded in the model. Industries which invest in new technologies such as robots will experience a shift in these relationships, which are reflected in the econometric parameters estimated. Full details are provided in the separate *Technical Report.*[17]

The econometric (data-driven) modelling approach means that future projections are determined within the model, subject to a combination of historical trends and these exogenous assumptions.

2.2.1 Covid-19

As a result of the Covid-19 pandemic, the UK government introduced public health measures in 2020 with a view of containing the outbreak and bringing it under control. The impact of these measures and the virus was a sudden and sharp reduction in economic activity in nearly all sectors in 2020Q2. Measures were relaxed in the summer months, allowing a partial recovery, before further tightening of measures (Lockdown 2.0) in November 2020, resulting in a 8.4% fall in GVA in 2020 as a whole.

In 2021Q1, in response to new, more virulent variants of Covid-19, a third round of lockdown measures was implemented, once again dampening economic activity.

In line with the government's envisaged 'road map', lockdown formally ended in late-March 2021, with social distancing progressively easing over the spring and the economy fully opening by mid/late summer (by which time all adults had been offered at least a first dose of the Covid-19 vaccine). The assumed 'post-lockdown' pick-up in activity implies an overall increase in GVA in 2021, though to a lesser extent than previously forecast, pre-pandemic, due to slower than expected economic recovery.

At the time the forecast was developed, despite the opening-up of the UK economy in 2021Q2, economic scarring and a muted economic recovery was expected in 2021-22. Unemployment, business closures and weak capital accumulation manifest in the longer-term as permanent productivity impacts (impacts on productivity from the pandemic are not expected to be reversed by the recovery following the pandemic). Moreover, UK trade prospects remain very weak due to a combination of slow global economic growth (exacerbated/perpetuated by inequalities in the global allocation of the vaccine) and Brexit trade disruptions (see EU exit section below). Given this, the central assumption of this

[16] These include ONS's principal population projections and the Office for Budget Responsibility's (OBR) macroeconomic forecast.
[17] See Wilson *et al.,* (2022c)

forecast is a 3.6 per cent increase in GDP in 2021 and a 3.1 per cent increase in GDP in 2022, which is above trend as the UK economy recovers.[18,19]

The post-pandemic economic recovery (i.e. short-term economic prospects) depends on the combined responses of households, businesses and government. We adopt the following assumptions:

1 **Households** – There are both upside and downside uncertainties with the recovery experience of households expected to be unequal. High levels of household saving have been recorded during the pandemic, although this was not universally observed across all income groups.[20, 21] Built-up savings could help fuel economic recovery if those savings are then spent (owing to pent-up demand). Conversely, considerable job losses have also been seen (especially among 16-24-year-olds). In the forecast, household spending is assumed to recover partially in the short term but experience permanent impacts from the pandemic (relative to a counterfactual in which there was no Covid-19 pandemic).[22]

2 **Businesses** – Solvency issues are expected to weigh down on business investment in the near/medium term, offset partially by government support (furlough, business tax relief, recovery loans, etc.) in the pandemic. Consequently, the forecast assumes 1.7 per cent growth in gross fixed capital formation (GFCF) in 2021, picking up to 3.1 per cent in 2022.[23]

3 **Government and the Bank of England** – The UK government and the Bank of England responded in several ways to support the economy and limit job losses and business insolvency. Many of these schemes were subsequently phased out and replaced by business 'Restart Grants' and 'Recovery Loans'. The forecast assumes that UK fiscal and monetary policy remains loose in the medium term as the economy recovers gradually. The UK government is expected to tolerate higher-than-normal debt levels in the medium term, delaying future ambitions to reduce public sector net debt.[24]

2.2.2 The UK's exit from the EU

Based on the general terms included in the EU-UK Trade and Cooperation Agreement signed on 30 December 2020, the following political assumptions were adopted in the forecast:

1 The agreed Free Trade Agreement with the EU avoids reversal to WTO terms, but still results in some barriers to trade which will gradually phase in from 2021-30.

[18] The baseline forecast was developed before the current cost of living and energy price crises, and therefore, does not account for a potential slowdown in economic recovery due to these factors.
[19] GDP is the model assumption, and GVA is the consequent model result.
[20] ONS 'Households' saving ratio', available at ONS (2022): https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/dgd8/ukea
[21] Bank of England 'How has Covid affected household savings?', available at: https://www.bankofengland.co.uk/bank-overground/2020/how-has-covid-affected-household-savings
[22] By 'partial' recovery, it is implied that household spending does recover, but not to the extent that the effects of Covid-19 are reversed. Household spending does not catch up to what it would have been forecast to, in the absence of the pandemic.
[23] Gross fixed capital formation is a similar concept to investment but relates specifically to acquisitions (less disposals) of 'fixed' assets, including buildings and machinery, but excluding investment in human capital). The term also implies that only acquisitions made by producers are considered (excluding investments made by households, unless otherwise imputed).
[24] Strictly, public sector net debt excluding the Bank of England, as a measure of underlying UK government debt.

2 The points-based migration system introduces restrictions on inward migration from the EU.

3 The uncertainty about the possibility of a 'no-deal Brexit' is lifted. However, some uncertainty remains over the speed of regulatory divergence.

4 Some uncertainty remains over the possibility of changes to the Free Trade Agreement in the future that could affect barriers to trade, such as equivalence rules in the financial sector.

5 The UK will continue to seek other trade agreements, which could reduce barriers to trade with non-EU countries in the future.

These political assumptions were converted into *economic* and *modelling* assumptions to explore the macroeconomic implications. For the forecast, we focussed primarily on the macroeconomic effects of Brexit on **exports**, **migration** and **investment**.

Export assumptions

We assume an overall 30.6 per cent decline in trade with the EU in the long term (by 2030) relative to a counterfactual (in which UK remains in EU), with the impact on services trade being roughly twice as high as for manufacturing (see Table 2.1).[25] We assume that a larger share of the total long-run impact happens in 2021 (following the end of the transition period on 31 December 2020) for goods exports, compared to services exports. This reflects the relatively greater significance of non-tariff barriers at the border for goods trade (such as customs declarations), compared to services trade.

In addition, we have incorporated into the assumptions the potential effect of future trade deals with non-EU countries, such as the US, Australia, Canada and New Zealand. We take a moderate view that is aligned with the potential impact of the UK-US free trade agreement modelled by the Department for International Trade.[26] We assume that UK exports to the US, Australia, Canada and New Zealand will increase by 4.3 per cent in the long run (relative to a counterfactual in which UK remains in EU). The implicit assumption on trade with the remaining parts of the world is that the UK will form trade arrangements similar to those achieved through EU membership. While assumptions for unilateral trade agreements were included and are seen to be generally positive for UK exports, they do not make up for the loss of trade with the EU. The resulting combined effect of these assumptions is a decline in UK exports to the rest of the world by 13.2 per cent in the long run (relative to a counterfactual in which UK remains in EU). This is broadly similar to the assumptions adopted in other studies, or modelling results based on scenarios similar to the deal adopted in December 2020, such as those in: OBR October 2021 Economic and fiscal outlook publication, Bank of England 2019 Report, or CEP 2019 modelling.[27, 28, 29]

[25] This was calculated by developing assumptions based on the economic literature on the effects of barriers to trade. The analysis accounted for how individual sectors could be affected, the share of trade within each sector which is attributed to EU, and the relative size of different UK export sectors.
[26] https://www.gov.uk/government/publications/the-uks-approach-to-trade-negotiations-with-the-us
[27] https://obr.uk/docs/dlm_uploads/CCS1021486854-001_OBR-EFO-October-2021_CS_Web-Accessible_v2.pdf
[28] https://www.bankofengland.co.uk/-/media/boe/files/monetary-policy-report/2019/november/monetary-policy-report-november-2019.pdf
[29] https://ukandeu.ac.uk/wp-content/uploads/2019/10/The-economic-impact-of-Boris-Johnsons-Brexit-proposals.pdf

Table 2.1 EU exit export assumptions by sector

	Change in trade (%)	Change in trade with EU (%)	Change in trade with AUS, CAN, NZL, USA (%)
Agriculture	-13.5	-20.0	4.5
Mining & quarrying	0.1	0.0	3.7
Low and medium-low tech manufacturing	-11.6	-20.0	3.8
High and medium-high tech manufacturing	-12.3	-30.0	3.7
Utilities	-6.0	-20.0	3.7
Construction	-8.1	-20.0	3.7
Low skill market services	-15.1	-40.0	4.9
High skill market services	-16.4	-45.0	4.9
Non-market services	-8.6	-20.0	4.9
Total trade	-13.2	-30.6	4.3

Source: CE

Migration assumptions

The forecast assumes that long-run net migration to the UK will decline as a result of new UK immigration policy. These assumptions are based on the 2018-based Office for National Statistics (ONS) principal population projections, which were adjusted to reflect the effect of Brexit on *total* net migration to the UK.[30]

This adjustment is aligned to the recommendation of the Migration Advisory Committee in 2018 and the likely effect of the points-based system that is now in place.[31] Our assumption is that total net annual migration across the whole population will decline to 150,000 in the long run. Effectively, this reduces net immigration of the working-age population by 40,000 annually, a change driven primarily by a decline in net migration from the EU. This assumption is comparable with other estimates in the literature on the impact of Brexit.

The estimated decline in annual net migration is distributed across UK sectors according to the proportion of EU nationals in each sector's workforce. Data on workforce by nationality come from the Annual Population Survey.[32]

Additional assumptions were developed to account for the likely impacts of Covid-19 on internal and international migration. These impacts are assumed to:

- reduce net international migration in 2020-21, with the impact distributed proportionally across UK sectors based on the presence of non-UK born population in the UK
- through the effect on internal migration, resulting in a small negative impact on the population size of London and a correspondingly small positive impact on the population size in other UK regions.

[30] ONS National population projections: 2018-based
[31] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/741926/Final_EEA_report.PDF
[32] ONS Number of UK nationals, EU nationals, and non-EU nationals in employment by industry and region, April 2018 to March 2019

Table 2.2 sets out the assumptions adopted about migration impacts by sector.

Table 2.2 Impact of migration by sector

	Share of the assumed Brexit migration impact
Agriculture, forestry and fishing	1%
Energy and water	1%
Manufacturing	13%
Construction	8%
Wholesale and retail trade	23%
Transport and communication	12%
Financial and business services	18%
Public administration, education and health	19%
Other services	5%
Total	100%

Source(s): CE

Investment assumptions

Post-referendum uncertainty about the future of the UK-EU relationship depressed investment. While the new agreement clarifies the current relationship, our expectation is that reductions in UK-EU trade will outweigh any gains made through other trade agreements (as above). Combined with continued uncertainty about the speed of any future regulatory divergence, we continue to assume that UK investment post-Brexit will be lower than it might otherwise have been.

It is assumed that the overall impact of the new agreement on investment in the UK will lead to a 5 per cent decline in the long run (relative to a counterfactual in which the UK remains in the EU).[33]

These long-run investment impacts have been distributed across broad sectors according to the following categories of impact:

- no change in investment levels
- investment would adjust (up or down depending on the sector) based on changes to public spending
- slower investment:
    - some businesses moving a proportion of their activity out of the UK – this would result in a decrease in investment, proportional to the lower level of activity in the UK
    - diminished growth prospects of a particular sector within the UK – this could further dampen investment intentions in the UK, as multi-national organisations in those sectors may choose to divert a disproportionate amount of their investment to countries with better growth prospects.

[33] This is based on CE's judgement, which is broadly aligned with the modelling results of the Government's proposal FTA variant from The Economic Effects of the Government's Proposed Brexit Deal (Hantzshe *et al.*, 2018).

In the last case, expectations of diminished growth prospects may stem from factors such as lack of access to the Single Market, or skills shortages that have been exacerbated by migration restrictions. Growth may also dampen in sectors that rely heavily on cooperation with EU Member States or funding.

2.3 UK macroeconomic prospects

In the decade prior to the Covid-19 pandemic (2010-19), UK GVA growth averaged 1.8 per cent pa, driven by strong household spending (see Table 2.3). However, in 2020 the UK's withdrawal from the EU dampened growth prospects, with the outbreak of the Covid-19 pandemic then pushing the country into recession. Despite an initial strong recovery, UK GVA fell by over 8.4 per cent in 2020. This decline is more than double the contraction in the 2008-09 'Great Recession', when GVA fell by 4.0 per cent.

Following a continued strong recovery in 2021 and a further year of above-trend GVA growth in 2022, we forecast average annual growth of 2.6 per cent pa for 2020-25. Longer-term growth returns to trend at 1.4 per cent pa over the period 2025-35.[34]

Household expenditure was growing in the last decade up to the Covid-19 pandemic, underpinned by growth in real incomes, mild inflation and falling unemployment. While household spending was hit substantially by Covid-19 in 2020 (a 12 per cent decrease on 2019), the high level of household savings during the pandemic is likely to support renewed spending as the economy recovers. As a result, household expenditure is forecast to grow faster than in the pre-COVID period (2.7 per cent pa over 2020-25 and 1.9 per cent pa over 2025-35, compared to 1.7 per cent pa over 2015-19).[35]

UK employment fell by 1.1 per cent (0.4 million jobs) in 2020 during the pandemic. At the same time, claimant count unemployment almost doubled in 2020, reversing the trend of falling unemployment since 2011. While this was the first fall in employment since 2010, it was partly cushioned by government support schemes, such as the Coronavirus Job Retention Scheme (the furlough scheme), which was introduced by the Government to protect jobs during the pandemic. The employment recovery is expected to be mild, but to lead to sustained jobs growth over the longer term (0.5 per cent pa over 2020-35).

[34] The short-term forecast was constructed on the basis of CE's judgement of recent economic trends and the general economic, fiscal and policy outlook. The forecast is not designed to match other official projections such as those by the OBR. There are various reasons why forecasts might differ across forecasters. For example, the BoE have recently become a lot more downbeat about growth prospects, because they are typically proportionately more concerned about capacity. OBR tend to be relatively upbeat when it comes to growth outlook and are more policy focussed.

[35] The baseline forecast was developed before the current cost of living and energy price crises, and therefore, does not account for an increase in household expenditure due to these factors.

Table 2.3 Macroeconomic indicators for the UK

	Historical trends			Projections	
	2010-15	**2015-19**	**2019-20**	**2020-25**	**2025-35**
GDP (% pa)	1.9	1.7	-9.2	2.1	1.6
GVA (% pa)	2.1	1.5	-8.4	2.6	1.4
GVA per job (% pa)	0.6	0.3	-7.4	2.0	1.0
Household expenditure (% pa)	1.9	1.7	-12.1	2.7	1.9
	2015	**2019**	**2020**	**2025**	**2035**
Employment (jobs, millions)	33.8	35.5	35.1	36.2	37.7
Unemployment (claimants, millions)	0.8	1.1	2.2	1.8	1.2

Source(s): CE, MDM revision 13547.

Note(s): GDP = Gross Domestic Product

GVA = Gross Value Added

Household expenditure estimates are based on average weekly household expenditure collected by the ONS Living Costs and Food Survey (LCF).

Employment is total workplace employment (jobs) and includes HM Forces.

Employment estimates are based on the ONS quarterly Workforce Jobs series, from which the June (Q2) count seasonally unadjusted data are used.

Unemployment estimates are based on annual averages of the seasonally adjusted Claimant Count.

At the time the forecast was developed, ONS data showed that the 12-month Consumer Price Index (CPI) rose above the Bank of England's 2 per cent inflation target rate in September 2021, to 2.9 per cent.[36, 37] This followed a fall in the CPI rate from 1.9 per cent in 2019 to 0.9 per cent in 2020, which was due to a decrease in consumer spending during the Covid-19 lockdowns. The recent surge in the CPI was driven by rising household expenditure as the economy started to recover from the pandemic. With household expenditure expected to continue to grow over the period 2020-35, there is potential for further inflationary pressure, which will be further exacerbated by continuing supply chain disruption in the short-term.

The Bank of England Interest Rate (Bank Rate) has been below 1 per cent since the global financial crisis up until May 2022. During the pandemic, the rate was cut to an all-time low of 0.1 per cent to reduce costs faced by businesses and households in the UK. However, with inflation soaring well over the 2 per cent target rate and household expenditure growing, the Bank of England was forced to increase the Bank Rate to above 1 per cent to respond to these pressures.

[36] The forecast was developed based on published data and the macroeconomic outlook available up to June 2021, and does not reflect the current cost of living, energy price crises and impacts of the war in Ukraine. While these may have a short-term impact on the economy and labour market, they are not expected to alter the longer-term prospects for employment structure by sector and occupation.

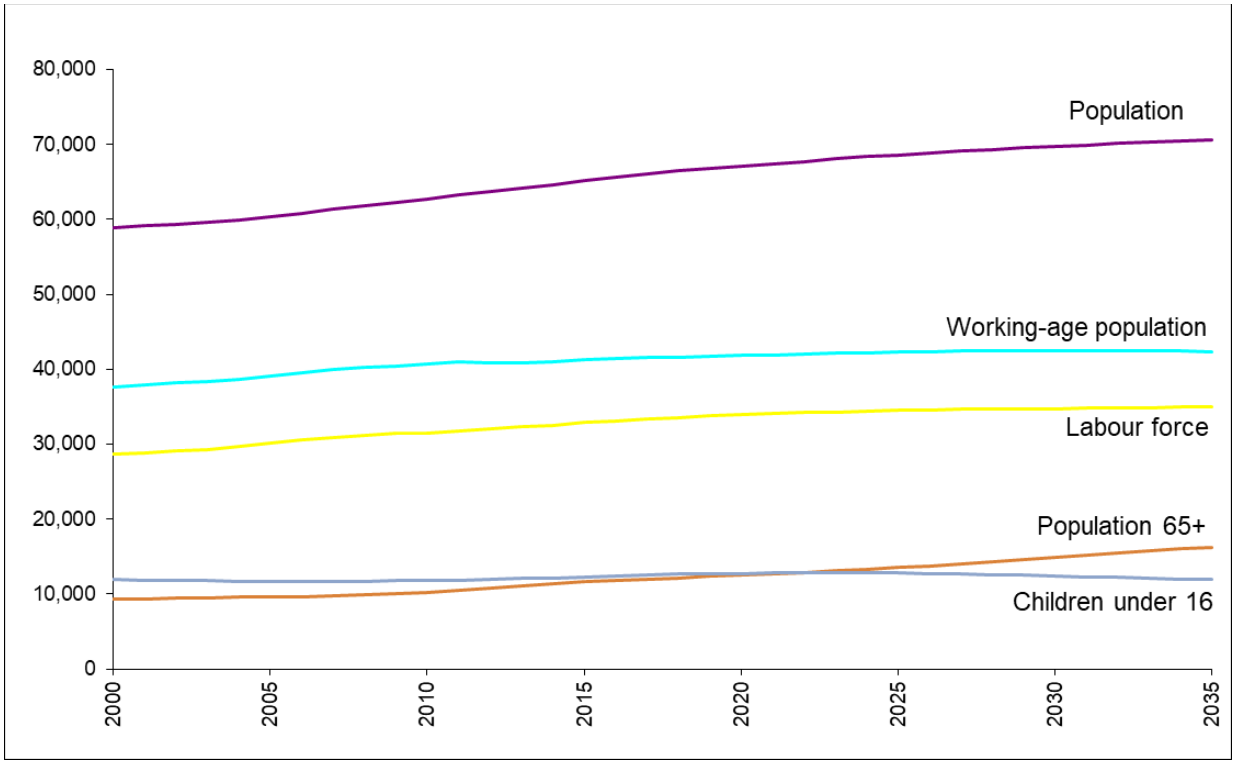
[37] Consumer price inflation, UK: September 2021. Available from: https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/september2021

2.4 UK labour market prospects

2.4.1 Population and the labour force

The composition of the population is an important driver of the labour market, influenced by changes in, for example, the aging population and female labour market participation. Over the period 2000-19, the UK total resident population increased by 7.9 million (13.4 per cent), from 59 million to 67 million (see Figure 2.1). This was reflected in a 17.8 per cent increase in the labour force, which rose by 5.1 million to 33.9 million by 2019 – i.e. a larger proportion of the population growth was in working-age adults. After a period of strong growth in the size of the labour market in the last decade (0.9 per cent pa over 2010-15 and 0.7 per cent pa over 2015-19), this slowed to 0.4 per cent pa during the period 2019-20 following the Covid-19 pandemic. Despite the slowdown in labour force growth in 2020, it is expected to pick up again by 2.9 per cent over 2020-35. This is forecast to be driven by stronger growth in the female labour force (4.3 per cent over 2020-35) than in the male labour force (1.6 per cent over 2020-35).

Figure 2.1 UK Population, labour force and unemployment profiles, 2000-35 (000s)



Source(s): CE, MDM revision 13547.

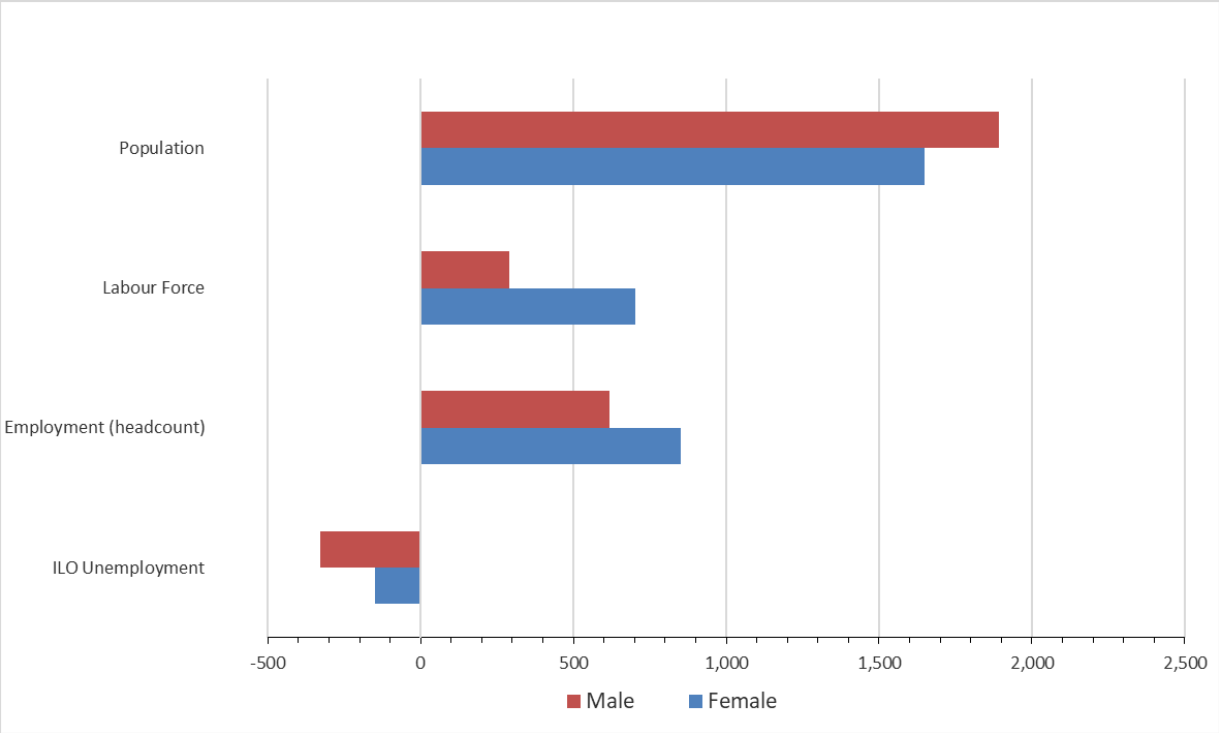
The UK population is expected to grow by 0.3 per cent pa over 2020-35, a slower increase compared to the decade to 2020, during which the population increased by 0.7 per cent pa. The population aged 16 and over is also expected to grow at a slower rate in the next five years (2020-25) than historically, before picking up again in the longer term, from 2025 onwards (see Table 2.4).[38] The short-term slowdown in growth of the adult population is partly driven by lagged effects of Brexit and the Covid-19 pandemic, which resulted in a large number of people (the majority of whom are of working age) leaving the UK, who are unlikely to return.

[38] The ONS projections are the starting point, but CE have made adjustments to this. See the 'Migration assumptions', Section 2.2.2, for more detail.

The number of children (aged less than 16 years) in the population rose over 2010-20, alongside a continuing steady rise in the number of people aged 65 and over. However, growth in the child population is expected to slow over 2020-35, with the total number of children starting to fall from 2024. By 2035, the number of children is projected to be around 5.9 per cent (around 748,000) lower than the 2020 level, while the number of those aged 65+ is expected to increase by 30 per cent (over 3.5 million) over the same period, reflecting the ageing population in the UK.

Overall, labour market participation (activity rates) increased slightly over the decade to 2020, this being driven by a rising activity rate for women (by 3 percentage points), offset slightly by a falling activity rate for men (by 1.5 percentage points). Despite that, the activity rate for women was still 9 percentage points lower than the activity rate for men in 2020. Overall participation rates, which are affected by the age and gender profile of the population, are expected to decrease over 2020-35 as there are more people aged 65 and over, and as the average age of the population rises. As a result, the overall rate in 2035 will be approximately 3 percentage points lower than the rate in 2020.

Figure 2.2: Changes in key labour market indicators for the UK, 2020-35 (000s)



Source: CE, MDM revision 13547.

Table 2.4 Population and labour force in the UK

							Total growth (%)				
	2010	**2015**	**2019**	**2020**	**2025**	**2035**	**2010-15**	**2015-19**	**2019-20**	**2020-25**	**2025-35**
Male											
Population (000s)	30,805	32,074	32,978	33,146	33,968	35,039	4.1	2.8	0.5	2.5	3.2
Population 16+ (000s)	24,756	25,797	26,469	26,619	27,403	28,900	4.2	2.6	0.6	2.9	5.5
Labour Force (000s)	16,950	17,559	17,883	17,815	17,911	18,105	3.6	1.8	-0.4	0.5	1.1
Activity Rate (%)	68.5	68.1	67.6	66.9	65.4	62.7	-0.4*	-0.5*	-0.6*	-1.6*	-2.7*
ILO Unemployment (000s)	1,446	945	729	857	608	530	-34.7	-22.8	17.5	-29.1	-12.7
Employment (000s)	15,504	16,614	17,154	16,957	17,304	17,575	7.2	3.3	-1.1	2.0	1.6
Female											
Population (000s)	31,954	33,036	33,819	33,936	34,641	35,583	3.4	2.4	0.3	2.1	2.7
Population 16+ (000s)	26,189	27,055	27,630	27,735	28,402	29,742	3.3	2.1	0.4	2.4	4.7
Labour Force (000s)	14,497	15,332	15,979	16,185	16,580	16,888	5.8	4.2	1.3	2.4	1.9
Activity Rate (%)	55.4	56.7	57.8	58.4	58.4	56.8	1.3*	1.2*	0.5*	0.0*	-1.6*
ILO Unemployment (000s)	954	783	581	661	649	513	-17.9	-25.8	13.9	-1.9	-21.0
Employment (000s)	13,544	14,549	15,398	15,523	15,930	16,375	7.4	5.8	0.8	2.6	2.8
Total											
Population (000s)	62,759	65,110	66,797	67,081	68,609	70,622	3.7	2.6	0.4	2.3	2.9
Population 16+ (000s)	50,946	52,852	54,099	54,354	55,805	58,642	3.7	2.4	0.5	2.7	5.1
Labour Force (000s)	31,447	32,890	33,862	33,999	34,491	34,993	4.6	3.0	0.4	1.4	1.5
Activity Rate (%)	61.7	62.2	62.6	62.6	61.8	59.7	0.5*	0.4*	0.0*	-0.7*	-2.1*
ILO Unemployment (000s)	2,400	1,728	1,310	1,519	1,257	1,043	-28.0	-24.2	15.9	-17.3	-17.0
Employment (000s)	29,048	31,163	32,552	32,480	33,234	33,950	7.3	4.5	-0.2	2.3	2.2

Source: CE, MDM revision 13547.
*Note: * indicates percentage points.*

Total population is forecast to rise faster for men than for women, but the labour force for women is expected to increase faster than for men (continuing recent trends). This is reflected in a stronger drop in the activity rate for men (-4.2 percentage points) than for women (-1.6 percentage points) over 2020-35.

Participation in the labour force varies considerably by age and gender. Women are still not as likely to take part in the formal economy as men, although trends in participation rates for women are rising, with many more women working in part-time jobs than is the case for men. This trend is projected to taper off in the short run, with the female activity rate remaining almost constant by 2025, before falling by 1.6 percentage points between 2025 and 2035. The male activity rate is expected to decrease by 4.2 percentage points over 2020-35, which is driven by an increase in people aged 65 and over, who will have lower activity rates.

2.4.2 Employment

Employment can be defined and measured in a variety of ways:

- numbers: of jobs, or people in employment (head count); and
- by area: workplace or residence.

Box 2.1 provides details of various definitions. In most of this study, the term employment is used to refer to the number of jobs located in a particular area (generally, where the workplace is located). Unless indicated otherwise, data on employment in tables and charts show the number of workplace jobs rather than numbers of people in employment or place of residence.

2.4.3 Employment by gender and employment status

In 2020, employment (workplace jobs) in the UK fell by 1.1 per cent due to the pandemic. In employment terms, the impact of the pandemic was more pronounced for men (with an overall 2 per cent decrease in employment) compared to women, for whom the net impact was broadly neutral. Among men, full-time employment fell by some 300,000 jobs (-2.3 per cent) but the job losses for self-employed men were almost as large, at 282,000 (representing a much larger percentage reduction, of 9.5 per cent). In contrast, male part-time employment grew, but this increase, of 203,000 jobs (+7.5 per cent), was not enough to offset the losses elsewhere. The overall impact was a decrease in jobs done by men of 378,000 (see Table 2.5 and Figure 2.3 – Figure 2.6).

The impacts on women were smaller, with a net reduction of around 8,000 jobs in 2020. Self-employed women saw the most job losses (a fall of 23,000 jobs, or 1.3 per cent of jobs), but full-time employment increased somewhat (by 17,000 jobs, or 0.2 per cent), offsetting a share of the decline. Reductions in female part-time employment were comparatively mild, at 2,300 jobs (less than 1 per cent). The experience of full-time and part-time men and women thus differed in the pandemic, while self-employed men and women both saw job losses.

Despite the fall in employment, the structure of that employment by type remained similar to before the pandemic. Almost 60 per cent (20.8 million) of all jobs in the UK in 2020 were full-time, and 28 per cent (10 million) were part-time. The remaining 12 per cent (4.4 million) were self-employed.

Box 2.1: Definitions of employment and related labour market indicators

Alternative definitions

There are various ways of looking at employment. For example, a distinction can be made between the number of people in employment (head count) and the number of jobs. These two concepts represent different things, as one person may hold more than one job. In addition, a further distinction can be made between area of residence and area of workplace.

Similarly, there are various different definitions of unemployment, the labour force, workforce and population. In this study, the following definitions are used:

Residence basis: measured at place of residence, as in the LFS.

Workplace basis: measured at place of work, as in the Business Register and Employment Survey (BRES).

Workplace employment (number of jobs): these are typically estimated using surveys of employers, such as BRES, focusing on the numbers of jobs in their establishments. In this report references to employment relate to the number of jobs unless otherwise stated.

Employed residents (head count): the number of people in employment. These estimates are based primarily on data collected in household surveys, e.g. the LFS. People are classified according to their main job. Some have more than one job.

ILO unemployment: The International Labour Organisation (ILO) definition covers people who are out of work, want a job, have actively sought work in the previous four weeks and are available to start work within the next fortnight (or out of work and have accepted a job that they are waiting to start in the next fortnight).

Claimant Unemployed: measures people claiming Job Seeker's Allowance benefits. This is also referred to as the 'claimant count'.

Workforce: the size of the workforce is obtained by summing workplace employment (employee jobs and self-employment jobs), HM Forces, government-supported trainees and claimant unemployment.

Labour Force: economically active (employed residents plus ILO unemployed) aged 16 and over.

Labour market participation or Economic activity rate: the number of people who are in employment or (ILO) unemployed as a percentage of the total population aged 16 and over.

Labour Market Accounts Residual: workplace employment minus Residence employment. The main cause of the residual at national level is 'double jobbing'. At a more disaggregated spatial level, net commuting across geographical boundaries is also very significant. The difference will also reflect data errors and other minor differences in data collection methods in the various sources.

Total Population: the total number of people resident in an area (residence basis).

Population 16+: the total number of people aged 16 and above (residence basis).

Working-age Population: the total number of people aged 16-64 (residence basis). The State Pension age of females was increased from 60 years in 2011 to 65 years in 2018. The State Pension age for all (both males and females) increased again to 66 years in October 2020. The definition of working-age population is fixed at 16-64 years old for all periods in this study.

Among men, full-time employment was most common, accounting for around 69 per cent (12.6 million) of all jobs held by men in 2020. Almost 3 million jobs held by men were part-time, representing about 16 per cent of all jobs held by men, while self-employment accounted for 15 per cent (2.7 million jobs). Full-time employment accounted for just 48 per cent of all jobs held by women in the UK in 2020, while around 42 per cent were part-time jobs.

At the time the forecast was developed, the recovery in employment was expected to begin in 2021, with employment projected to grow by 0.5 per cent pa over 2020-35 (amounting to a cumulative net increase of 2.6 million jobs over the period). This is forecast to be weaker than pre-pandemic employment growth, which averaged 0.9 per cent pa over 2005-19. The patterns of job growth by gender and employment status are principally driven by historical trends in the gender and tenure mix of employment industry sectors in which jobs are forecast to be created or lost, subject to labour supply constraints (see Section 3). For example, this means that if a sector that is currently female dominated is forecast to grow, it contributes more to female job growth.

More than half (56 per cent) of the new jobs are expected to be taken by female workers, driven by growth in female full-time employment (0.8 per cent pa over 2020-35). This compares to 0.3 per cent pa growth in male full-time employment over the same period. Although only 44 per cent of the expected increase in jobs is among male workers, growth in male part-time jobs is projected to be faster (0.7 per cent pa) than in female part-time jobs (0.2 per cent pa).

Self-employment is projected to grow at a slower rate over the forecast period (0.7 per cent pa over 2020-35) compared to the pre-COVID period (2.1 per cent pa over 2010-19). This will be driven by the concentration of self-employment jobs in sectors in which jobs are forecast to be lost rather than in those being created.

Table 2.5 Employment status, 2020-35

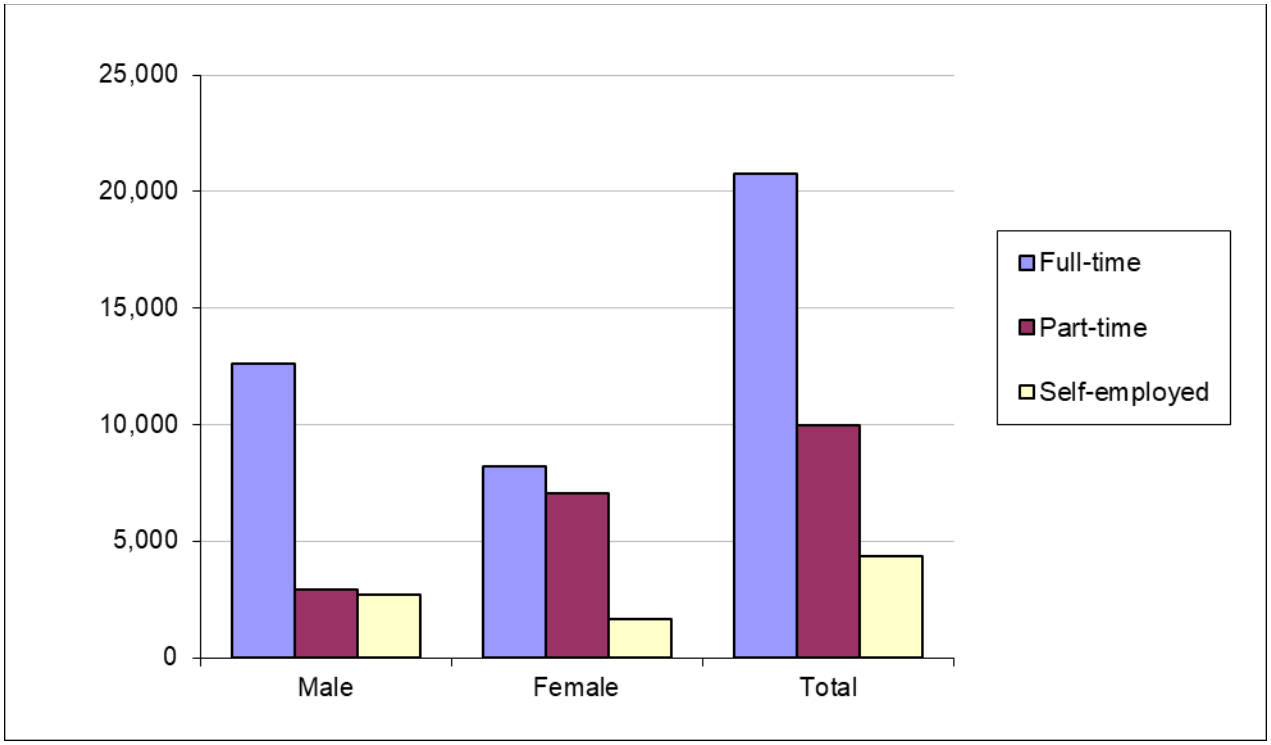
Level				**000s**
2019				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	12,907	2,722	2,963	18,592
Female	8,173	7,047	1,706	16,926
Total	21,080	9,769	4,668	35,517
2020				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	12,607	2,925	2,681	18,214
Female	8,190	7,044	1,683	16,918
Total	20,797	9,970	4,364	35,131
2025				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	12,873	3,034	2,785	18,692
Female	8,590	7,146	1,745	17,481
Total	21,463	10,180	4,530	36,173
2035				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	13,137	3,250	2,954	19,341
Female	9,237	7,258	1,874	18,368
Total	22,374	10,508	4,828	37,710
Share of total				**%**
2019				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	36.7	7.7	8.4	52.9
Female	23.3	20.1	4.9	48.2
Total	60.0	27.8	13.3	100.0
2020				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	35.9	8.3	7.6	51.8
Female	23.3	20.1	4.8	48.2
Total	59.2	28.4	12.4	100.0
2025				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	35.6	8.4	7.7	51.7
Female	23.7	19.8	4.8	48.3
Total	59.3	28.1	12.5	100.0
2035				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	34.8	8.6	7.8	51.3
Female	24.5	19.2	5.0	48.7
Total	59.3	27.9	12.8	100.0

Table 2.5 (continued): Employment status, 2020-35

Change				000s
2019-20				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	-299.6	203.0	-281.4	-378.0
Female	16.9	-2.3	-22.6	-8.0
Total	-282.7	200.7	-304.0	-386.0
2020-25				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	265.4	108.9	104.2	478.5
Female	399.7	101.2	62.2	563.1
Total	665.1	210.1	166.4	1041.6
2025-35				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	264.3	215.8	169.1	649.2
Female	646.9	112.1	128.8	887.8
Total	911.2	327.9	297.9	1537.0
2020-35				
Employment by Gender	Full-time	Part-time	Self-employed	Total
Male	529.7	324.7	273.3	1127.7
Female	1046.6	213.3	191.0	1450.9
Total	1576.3	538.0	464.3	2578.6

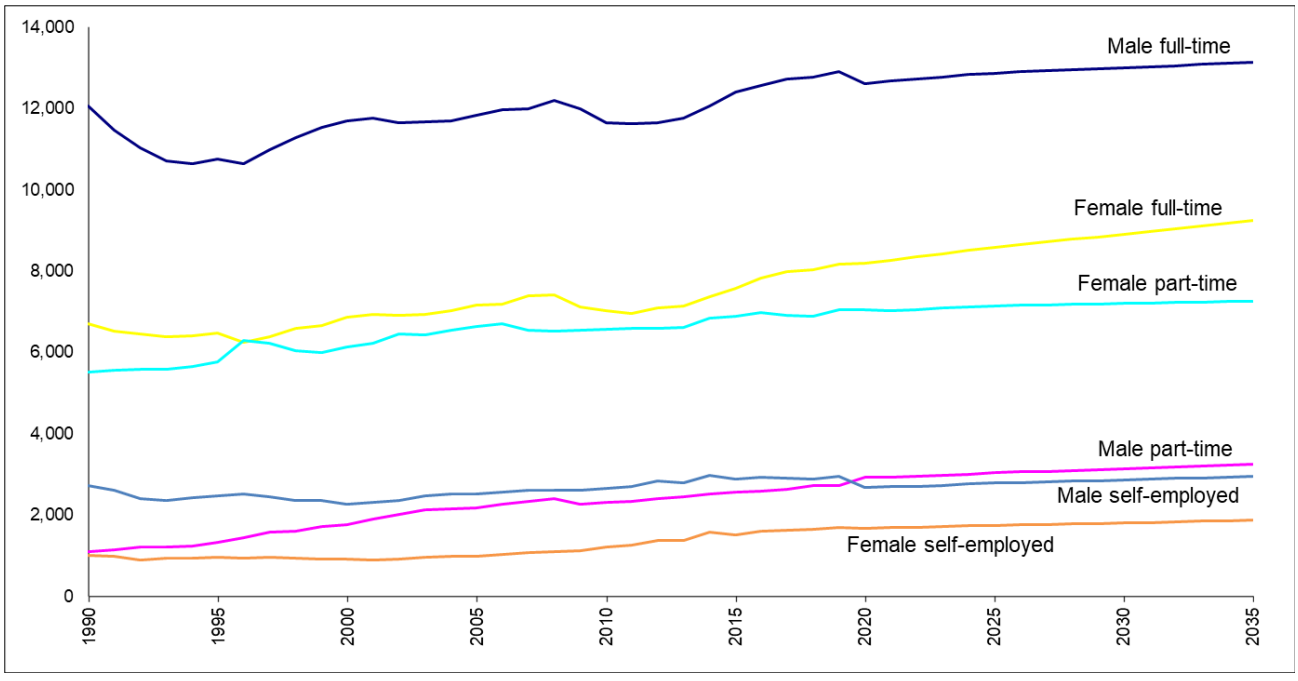
Source: CE, MDM revision 13547.
Note: Detailed results may not sum to totals due to rounding errors.

Figure 2.3 Employment status in the UK, 2020 (000s)



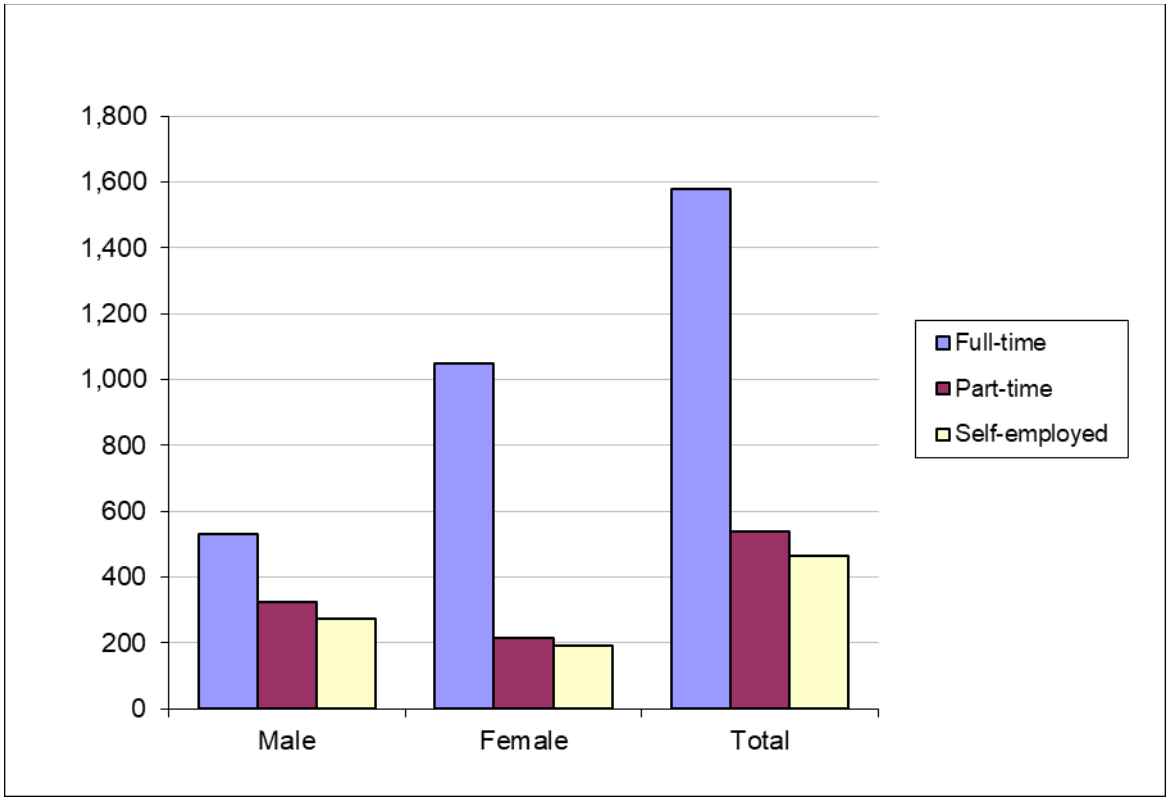
Source: CE, MDM revision 13547.

Figure 2.4 UK employment by gender and employment status 1990-2035 (000s)



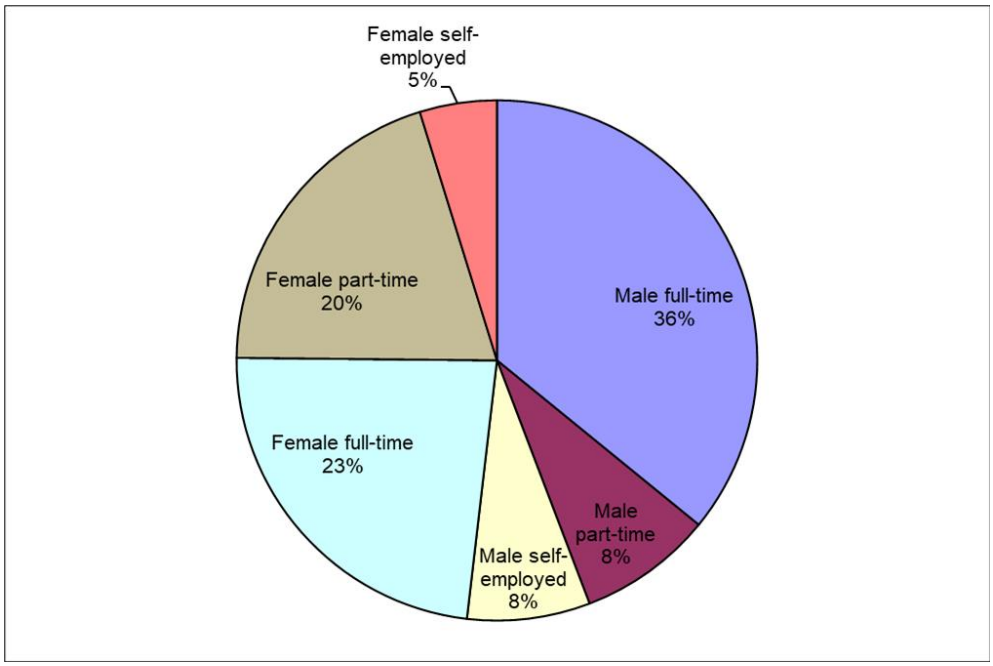
Source: CE, MDM revision 13547.

Figure 2.5 Changes in employment in the UK by employment status, 2020-35 (000s)



Source: CE, MDM revision 13547.

Figure 2.6 Composition of UK employment by status, 2020 (%)



Source: CE, MDM revision 13547.

2.4.4 Claimant count and ILO unemployment

There are two commonly used measures of unemployment: the claimant count and the ILO definition based on those actively searching for work (see Box 2.1).

The claimant count has recorded a trend of decreasing unemployment between 2010 and 2015, from 1.5 million to 0.8 million. This trend is also reflected in ILO unemployment. Since 2015, claimant unemployment has increased, reaching 1.1 million in 2019, before doubling to 2.2 million in 2020 when the Covid-19 pandemic began, its highest level since 1996.[39]

The LFS measure of unemployment, which is consistent with the ILO's definition, records the unemployment rate increasing from 3.8 per cent in 2019 to a high of 5.2 per cent in 2020Q4, the highest rate since 2015.

Despite the recent increase in unemployment, ILO unemployment is forecast to fall over the forecast period, from 1.5 million in 2020 to just over 1 million in 2035, as employment growth is expected to outpace the expansion of the labour force. This trend is driven by an especially large fall in male unemployment over 2020-35. As shown in Table 2.4 increases in male employment over 2020-25 are expected to exceed increases in the male labour force whereas the increases are more similar for women over the same period (future female labour demand only slightly outpaces female labour supply). Consequently, male unemployment is expected to fall by almost 30 per cent over that period, compared to a 1.9 per cent fall for women. However, in the longer term, female employment growth is expected to be strong and, alongside slower growth in the female labour force, female unemployment is forecast to fall at a faster rate (-21 per cent over 2025-35) than male unemployment (-12.7 per cent).

2.5 Alternative macroeconomic scenarios

2.5.1 Macroeconomic and related uncertainties

The *Baseline projections* described in Sections 2.1-2.4 is a realistic assessment of what is likely to happen, given actual policies and behaviour, rather than reflecting aspirations such as the 'net zero' target. It is subject to a range of uncertainties. The most significant relate to:

- automation, including the introduction of AI
- decarbonisation and the greening of the economy (the move to 'net zero'); and
- the potential for renewed investment in education, health and care.

The *Baseline projections* does not make any explicit assumptions about these matters. It reflects the implications of extrapolating historical trends and patterns of behaviour forward, subject to the constraints of the exogenous assumptions, such as, for example, the labour supply implied by population growth and government policy as reflected in planned expenditure, tax rates, etc.

The *Baseline projections* therefore assumes:

- automation continues to take place at the current pace, but it does not impose an evolutionary transformation above that experienced in recent trends (e.g. accelerated deployment of robots and AI systems across all economic sectors).
- environmental policies implemented to date are extended, and none are reversed, but it does not assume any new (and more ambitious) policies are added, including further

[39] Since June 2015, the measure of the claimant count has changed to include the number of people claiming Jobseeker's Allowance plus those who claim Universal Credit.

decarbonisation commitments (to achieve the ‘net zero' target such as large-scale deployment of renewables and low-carbon technologies, electric vehicles and heat pumps).

- no further renewed investment in education, health and social care (following the Covid-19 pandemic, the government temporarily increased spending on public services to help recover and balance the economy from the shock, but in the long-term expenditure in these areas largely reverts to pre-pandemic (austerity) plans).

Each of these assumptions are relaxed in the *Alternative scenarios*, which are presented in the accompanying separate report.[40] However, it is important to understand that there are no explicit assumptions about environmental policy in the scenarios, including recently announced policies such as the ‘net zero’ target. To model the possible impact of these, we make assumptions about new job opportunities which may be driven by accelerated decarbonisation activities, as outlined in Chapter 2 of the *Alternative scenarios* report. The impacts of environmental policies are therefore dealt with implicitly and embedded in the historical data which are used as a basis for the projections.

[40] Wilson *et al*., (2022b)

3 Sectoral output and employment prospects

Key messages

This section presents the projections for sectoral output and employment. The sectors are defined using the Standard Industrial Classification (SIC).

Output is forecast to grow modestly over 2020-35. Total UK Gross Value Added (GVA) is forecast to bounce back after the pandemic, raising average annual growth over 2020-25 to 2.6 per cent pa, before slowing to 1.4 per cent pa in the longer term, over 2025-35. With the exception of *Primary sectors & utilities*, all broad sectors are forecast to grow over the forecast period. *Construction* in particular is expected to see strong growth of almost 2 per cent pa over 2025-35. *Trade*, *accommodation & transport* (after having seen the largest fall in output in these sectors in 2020) are also expected to grow at a faster rate than the economy as a whole. In these sectors, average annual growth is expected to mirror the high-growth rates seen in the decade prior to the pandemic.

Consistent with current trends, the *Manufacturing* sector's share of UK output is expected to continue to decline (from 9.8 per cent of total GVA in 2019 to 9.4 per cent in 2035), driven by increasing competition from overseas manufacturers and as the UK continues to move towards a services-oriented economy. However, *Manufacturing* output is still forecast to grow (around 1.6 per cent pa over 2020-2035), albeit at a slightly slower pace than the economy as a whole.

Employment will mostly reflect the trends observed in output across the six broad sectors. A modest growth in total employment is forecast over the period 2020-35 (0.5 per cent pa, approximately 2.6 million jobs in total). As with output, the strongest employment growth rates are expected to be in *Construction*, *Business* and *other services* (657,000 net new jobs over 2025-35), and *Non-market services* (*Public administration, education and health* – 470,000 net new jobs over 2025-35). Conversely, employment growth in *Primary sectors and utilities* is expected to be slow, coupled with slowing productivity growth.

Detailed employment projections: results are also presented at a much more detailed level, including 75 2-digit industries based on SIC2007.

3.1 General prospects

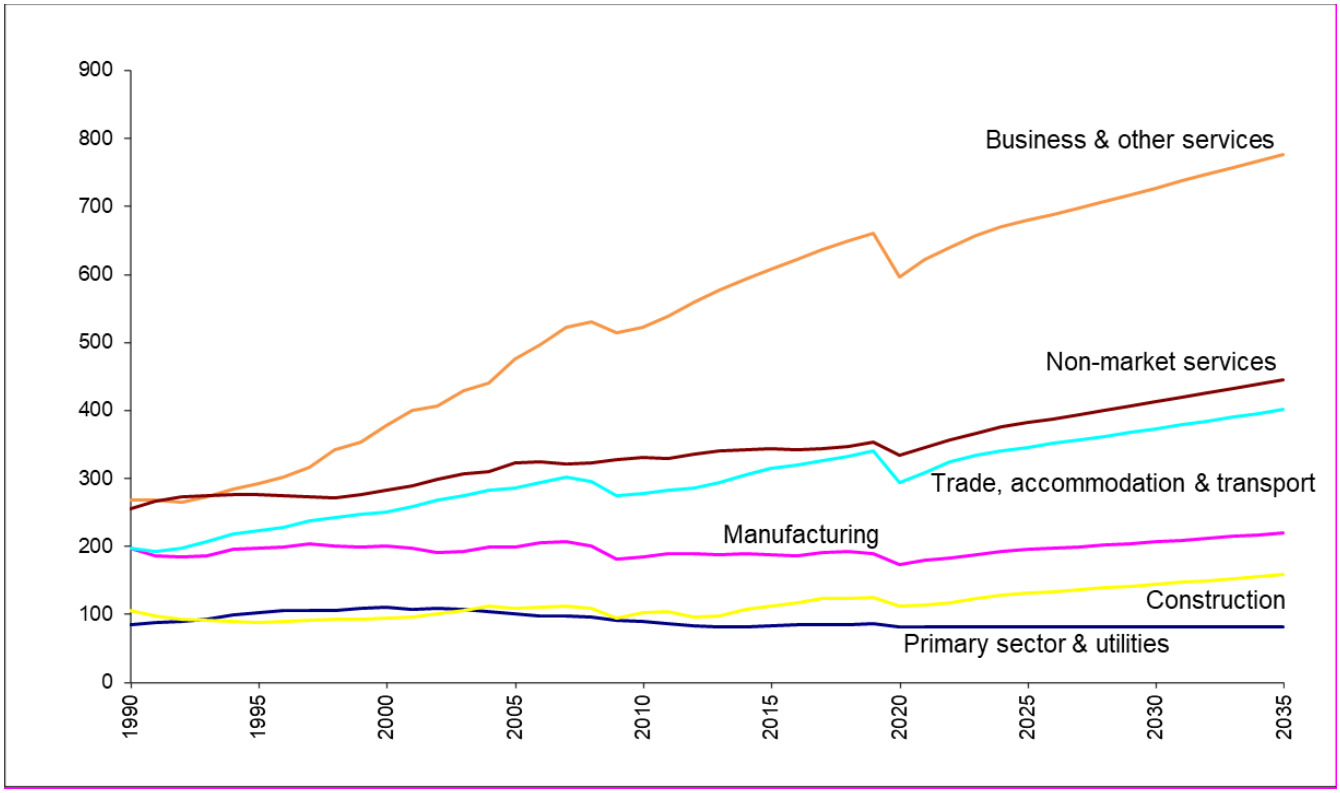
This section focuses on the output and employment prospects, focusing on six broad sectors: *Primary sector and utilities*; *Manufacturing*; *Construction*; *Trade, accommodation and transport*; *Business and other services*; and *Public administration, education and health* (collectively referred to as *Non-market services*).[41]

3.1.1 Output

An overview of GVA ('output') in the six broad sectors is presented in the figures below (see Figure 3.1 and Figure 3.2).[42]

[41] These services are predominantly provided by the public sector and other non-market producers (i.e. non-profit institutions serving households (NPISH))
[42] Output is measured by GVA – gross value added.

Figure 3.1 UK GVA by broad sector, 1990-2035 (£2018 billions)

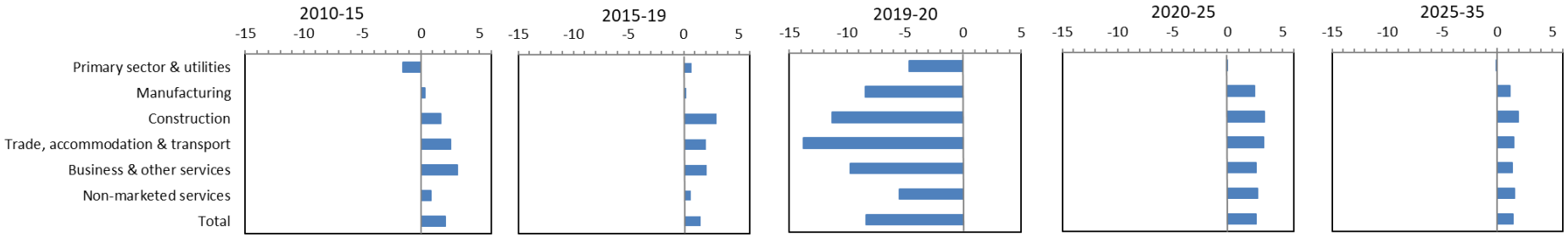


Source: CE, MDM revision 13547.

Notes: The 6 sectors are defined as the Standard Industrial Classification [divisions] as follows:

- *Primary sector and utilities [01-09, 35-39]*
- *Manufacturing [10-33]*
- *Construction [41-43]*
- *Trade, accommodation and transport [45-56]*
- *Business and other services [58-82, 90-99]*
- *Public administration, education and health (or non-market services) [84-88]*

Figure 3.2 Average UK GVA growth by broad sector, 2010-35 (% pa)



Source: CE, MDM revision 13547.

Table 3.1 GVA by broad sector, 2010-35

GVA levels (£2018 billions)						
	2010	**2015**	**2019**	**2020**	**2025**	**2035**
Primary sector & utilities	90.2	83.4	85.9	81.8	81.5	81.4
Manufacturing	184.1	187.0	188.9	173.0	195.1	219.2
Construction	102.7	111.6	125.4	111.2	131.1	158.2
Trade, accommodation & transport	277.2	314.4	340.6	293.6	345.7	401.4
Business & other services	521.3	608.0	660.4	596.2	678.9	776.9
Non-market services	330.1	343.8	352.9	333.5	381.3	445.4
Total	1,645.8	1,822.6	1,936.8	1,774.9	2,016.3	2,327.7
GVA share (% of total)						
	2010	**2015**	**2019**	**2020**	**2025**	**2035**
Primary sector & utilities	5.5	4.6	4.4	4.6	4.0	3.5
Manufacturing	11.2	10.3	9.8	9.7	9.7	9.4
Construction	6.2	6.1	6.5	6.3	6.5	6.8
Trade, accommodation & transport	16.8	17.2	17.6	16.5	17.1	17.2
Business & other services	31.7	33.4	34.1	33.6	33.7	33.4
Non-market services	20.1	18.9	18.2	18.8	18.9	19.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
GVA growth (% pa)						
	2010-15	**2015-19**	**2019-20**	**2020-25**	**2025-35**	**2020-35**
Primary sector & utilities	-1.6	0.7	-4.7	-0.1	0.0	0.0
Manufacturing	0.3	0.3	-8.4	2.4	1.2	1.6
Construction	1.7	3.0	-11.3	3.3	1.9	2.4
Trade, accommodation & transport	2.6	2.0	-13.8	3.3	1.5	2.1
Business & other services	3.1	2.1	-9.7	2.6	1.4	1.8
Non-market services	0.8	0.7	-5.5	2.7	1.6	1.9
Total	2.1	1.5	-8.4	2.6	1.4	1.8
GVA growth (%)						
	2010-15	**2015-19**	**2019-20**	**2020-25**	**2025-35**	**2020-35**
Primary sector & utilities	-7.6	3.0	-4.7	-0.4	-0.1	-0.6
Manufacturing	1.5	1.0	-8.4	12.8	12.3	26.7
Construction	8.6	12.4	-11.3	17.9	20.7	42.3
Trade, accommodation & transport	13.4	8.3	-13.8	17.7	16.1	36.7
Business & other services	16.6	8.6	-9.7	13.9	14.4	30.3
Non-market services	4.2	2.6	-5.5	14.3	16.8	33.5
Total	10.7	6.3	-8.4	13.6	15.4	31.1

Source: CE, MDM revision 13547.
Note: The sum of GVA of the six broad sectors differs from the UK total because the latter also includes the value added attributed to ownership of dwellings.

Table 3.1 shows the past and forecast patterns of output by broad sector. The top two panels show how the structure of the economy changes in terms of the distribution of economic activity: the top panel shows the levels of output; and the second panel shows the (output) shares of each sector in the overall economy. The bottom two panels show historical and forecast patterns of growth: the third panel presents average annual growth rates, while the last panel shows the total percentage change between the start and end of each period.

While the UK saw sustained output growth over the decade to 2019, average growth slowed somewhat over this period, from 2.1 per cent pa over 2010-15 to 1.5 per cent pa over 2015-19, driven by slower growth in *Trade, accommodation and transport*, and *Business and other services*. In 2020, as a result of the Covid-19 pandemic, total output fell by 8.4 per cent. Construction and *Trade, accommodation and transport* were affected the most, with output in those sectors falling by over 10 per cent. This was followed by *Business and other services* (the largest sector in the UK in terms of output), in which the fall was almost as severe: just shy of 10 per cent in 2020.

Total UK GVA is forecast to bounce back after the pandemic, raising average annual growth over 2020-25 to 2.6 per cent pa, before slowing to 1.4 per cent pa in the longer term, over 2025-35. With the exception of *Primary sector and utilities*, all sectors are forecast to grow after the pandemic. *Construction* in particular is expected to see strong growth of almost 2 per cent pa over 2025-35. While GVA growth in *Primary sectors and utilities* is muted following the pandemic, it is worth noting that the growth prospects for this sector were weak before the pandemic too.

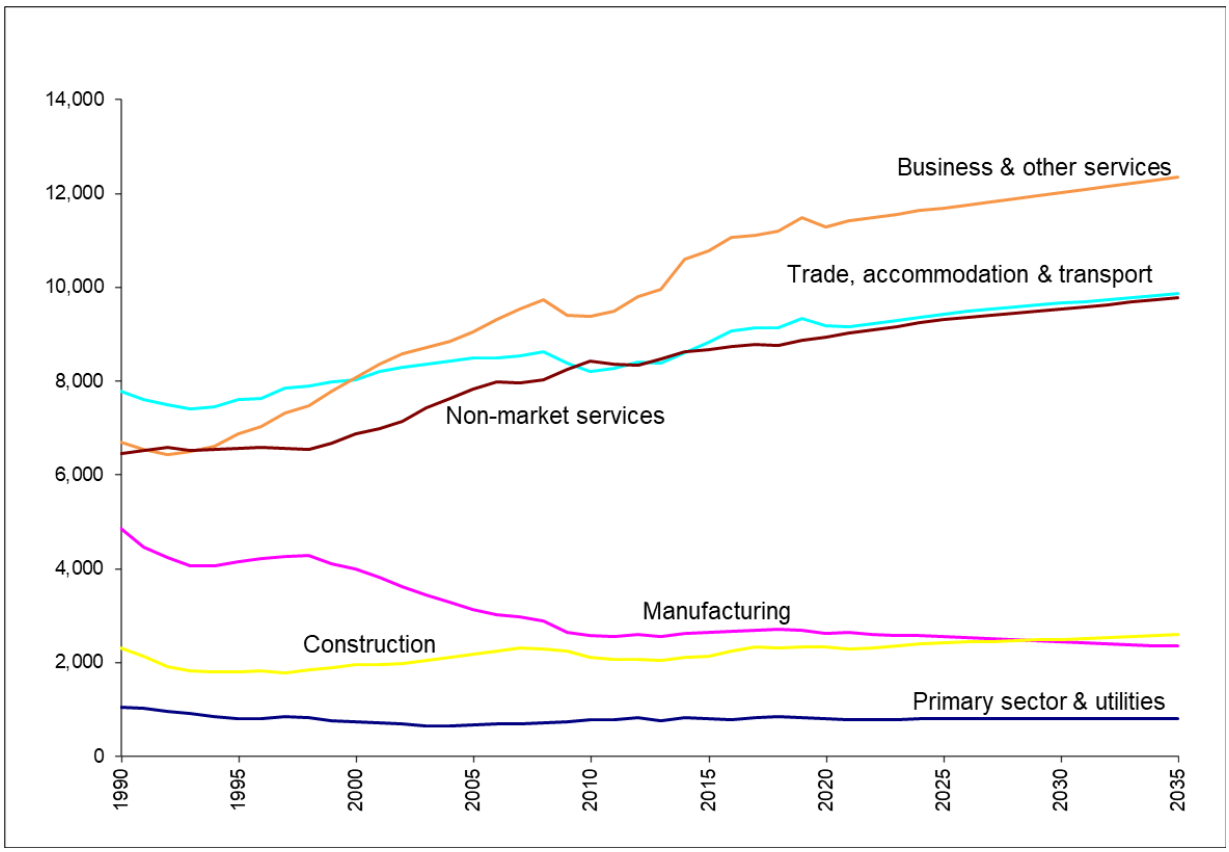
3.1.2 Employment

As noted above, employment by sector is driven by output and assumptions about productivity growth. The latter are built into the detailed econometric relationships that CE have estimated using historical time series data. Assumptions about AI, automation, etc., are therefore implicit rather than explicit. These are captured by the historical data on trends in productivity (output/employment).

The scenarios we developed in the next phase of the work have more explicit assumptions about automation, etc. The improvement in productivity is driven by automation and investment that has already happened to date, which will have an effect on future performances (whereas the automation reported in our accompanying *Alternative Scenarios* report considers what happens if automation accelerates above historical trends to reach its full potential).

An overview of the main results for employment across the six broad sectors is presented in Figure 3.3 – Figure 3.5.

Figure 3.3 UK employment profiles by broad sector, 1990-2035 (000s)

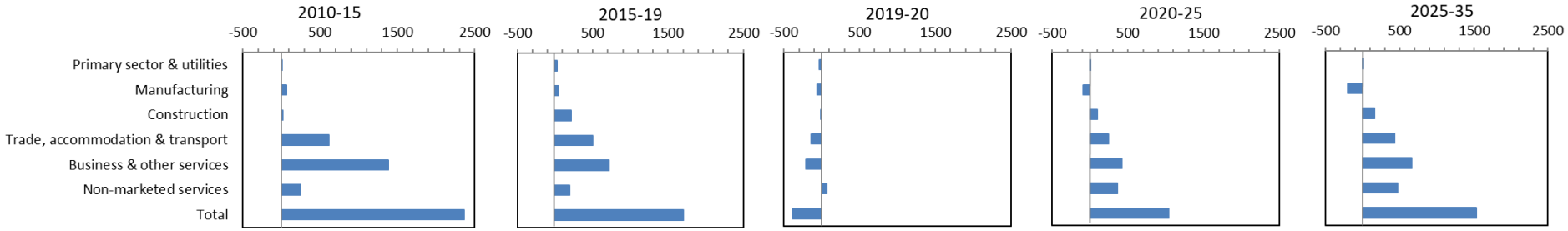


Source: CE, MDM revision 13547.

Figure 3.4 UK employment growth by broad sector, 2010-35 (% pa)

Source: CE, MDM revision 13547.

Figure 3.5 UK employment growth by broad sector, 2010-35 (000s)



Source: CE, MDM revision 13547.

Table 3.2 shows the past and forecast patterns of employment by broad sector. The top two panels show how the structure of the economy changes: the top panel shows the levels of employment; and the second panel shows the employment shares of each sector in the overall economy. The bottom two panels show historical and forecast patterns of growth: the third panel presents annual growth rates, while the last panel shows the change in the numbers of jobs over the period covered.

As is typical in a downturn, the impact of Covid-19 on employment was not as strong as on output. While there was a sharp decline in output, a large part of the policy response, such as the Coronavirus Job Retention Scheme, was intended to avoid large job/income losses. Total UK employment fell by 1.1 per cent in 2020 (while output fell by 8.4 per cent), with the largest fall seen in *Primary sector and utilities* (-4.1 per cent), followed by *Manufacturing* (-2.2 per cent). *Non-market services* (i.e. *Public administration, education and health*) was the only sector to see positive growth during the pandemic, mainly driven by increased employment in *Public administration and defence* and *Health* to support the pandemic response.

As with output, employment is forecast to recover in 2021 and grow steadily, if modestly, by 0.5 per cent pa (2.6 million jobs in total) over the forecast period to 2035. However, total employment growth is expected to be lower than historical averages and, most notably, employment in *Manufacturing* is expected to decrease by 0.8 per cent pa to 2035, despite recent employment growth in the sector before the pandemic (0.6 per cent pa over 2010-19). At the same time, GVA in *Manufacturing* is expected to increase by 1.6% pa over 2020-35, reflecting an expected increase in productivity in the sector.[43] Longer-term employment growth is expected to be driven by *Business and other services* (657,000 net new jobs over 2025-35) and *Non-market services* (470,000 net new jobs over 2025-35), which are both forecast to grow by 0.5 per cent pa over 2025-35.

3.1.3 Employment in more detail

This section presents the results on sectoral employment in greater detail. An overview of the main results for employment across 22 industries is presented in Table 3.3, Table 3.4 and Figure 3.6. The full set of results which drive the occupational results goes down to the 2-digit level of SIC (75 industrial categories), but these are not reported in full here. Tables 3.5-3.9 report selected results, for example the top ten industries (in terms of 2-digit SIC) with the largest projected employment increases and decreases in terms of jobs.

Primary sector and utilities: Within this broad category, the *Agriculture sector* currently has the highest share of employment. According to Table 3.4, this sector was the most negatively affected by the combined effect of Covid-19 and Brexit, with the employment rate falling by 6 per cent between 2019 and 2020. Also, the *Water and sewerage* sector exhibited a considerable contraction in the employment level between 2019 and 2020 (-5.8 per cent). However, *Agriculture* and *Water and sewerage* sectors are expected to return to historical trends in the following periods given that their role in the economy is not expected to change in the *Baseline projections*.

Agriculture is projected to recover in the medium term before stabilising, while *Water and sewerage* is expected to grow after having bounced back in 2021 from the initial impact of the pandemic. In contrast, the employment levels in the *Mining and quarrying* and *Electricity*

[43] The improvement in productivity is driven by automation and investment that has already happened to date, which is implicitly captured in the historical data.

and *Gas* sectors show a growth rate of 1.6 per cent and 1.4 per cent between 2019 and 2020, respectively. The employment level in mining and quarrying, however, is expected to decrease in the following periods, as a result of demand for coal, oil and gas continuing to decline, given the phase-out of coal from power generation and a long-term reduction in oil and gas extraction as reserves deplete and costs increase.[44, 45]

On the basis of current/known policies, the *Baseline projections* do not incorporate any explicit shift to a low-carbon economy (e.g. to achieve 'net zero'). Nevertheless, technological change is assumed to continue in the electricity and gas sector. The shift towards cleaner forms of energy tends to change the mix of technologies, in favour of more capital-intensive forms of generation. While sectoral output continues to increase (to supply energy), employment declines slightly.

Manufacturing: All subsectors within the *Manufacturing* sector experienced negative employment variation between 2019 and 2020, especially the engineering sector (around -4.6 per cent). Moreover, the employment level in these sectors is not expected to grow in the coming years, given that production processes have been closed or relocated outside of the UK (due to historic comparative advantage, and Brexit to some extent). In particular, employment in metal products is expected to decline by over 40,000 jobs over 2020-35.

Construction: The employment level in the *Construction* sector was modestly and negatively affected in 2020. Compared to 2020, the employment level is expected to increase by 0.7 per cent pa in 2035. This is particularly driven by specialised construction, such as electric and plumbing installation activities and demolition, which is expected to grow by 135,000 jobs over 2020-35. *Construction* plays an important role in providing critical infrastructure and housing, which are expected to continue growing in demand in the future to support economic growth.

Trade, accommodation and transport: Within this category, the accommodation and food sector was the most negatively impacted in 2020. As is well-known, the lockdown measures had a considerable negative effect on this sector since people could not travel and many activities required in this sector were not compatible with teleworking/working from home. Nevertheless, *Accommodation* and *Food* activities are expected to return to their pre-pandemic employment levels by 2025. An increase of 133,000 jobs in computing services over 2020-35 is the main area of employment growth. Employment growth in both these sectors is expected to be particularly strong, with employment in *Food and beverage services* expected to increase by almost 334,000 jobs over 2020-35 (the second fastest growing sector in terms of the number of jobs), and employment in *Accommodation* expected to increase by almost 110,000 new jobs. The pandemic and the government's reaction to it have obviously had a devastating effect short-term, but the longer-term trends favouring eating out, etc., are projected to soon re-establish themselves. *Retail*, historically the largest employer among all sectors, is projected to see growth slowing in the long term after recovering from the shock of the pandemic, due to a continued decline of high street stores and a younger generation of consumers shifting to online platforms and second-hand consumption. Among transport activities, *Land transport* is the only sector not projected to recover to its pre-COVID trajectory by 2035, as hybrid and home working is expected to remain popular, even after lockdown measures have been lifted.

[44] https://www.carbonbrief.org/countdown-to-2025-tracking-the-uk-coal-phase-out
[45] https://www.gov.uk/government/publications/extractive-industries-transparency-initiative-payments-report-2017/extractive-industries-in-the-uk-background-information-on-oil-and-gas

Table 3.2 Employment by broad sector, 2010-35

Employment levels (000s)						
	2010	**2015**	**2019**	**2020**	**2025**	**2035**
Primary sector & utilities	784	794	824	790	796	808
Manufacturing	2,567	2,638	2,687	2,627	2,541	2,341
Construction	2,098	2,122	2,334	2,319	2,419	2,583
Trade, accom. & trans.	8,211	8,824	9,328	9,184	9,425	9,859
Business & other serv's.	9,380	10,766	11,479	11,274	11,690	12,347
Non-market services	8,418	8,672	8,866	8,937	9,302	9,772
Total	31,458	33,815	35,517	35,131	36,173	37,710
Employment share (% of total)						
	2010	**2015**	**2019**	**2020**	**2025**	**2035**
Primary sector & utilities	2.5	2.3	2.3	2.2	2.2	2.1
Manufacturing	8.2	7.8	7.6	7.5	7.0	6.2
Construction	6.7	6.3	6.6	6.6	6.7	6.8
Trade, accom. & trans.	26.1	26.1	26.3	26.1	26.1	26.1
Business & other serv's.	29.8	31.8	32.3	32.1	32.3	32.7
Non-market services	26.8	25.6	25.0	25.4	25.7	25.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Employment growth (% pa)						
	2010-15	**2015-19**	**2019-20**	**2020-25**	**2025-35**	**2020-35**
Primary sector & utilities	0.2	0.9	-4.1	0.1	0.2	0.2
Manufacturing	0.5	0.5	-2.2	-0.7	-0.8	-0.8
Construction	0.2	2.4	-0.6	0.8	0.7	0.7
Trade, accom. & trans.	1.5	1.4	-1.5	0.5	0.5	0.5
Business & other serv's.	2.8	1.6	-1.8	0.7	0.5	0.6
Non-market services	0.6	0.6	0.8	0.8	0.5	0.6
Total	1.5	1.2	-1.1	0.6	0.4	0.5
Employment change (000s)						
	2010-15	**2015-19**	**2019-20**	**2020-25**	**2025-35**	**2020-35**
Primary sector & utilities	10	30	-34	6	12	18
Manufacturing	71	49	-60	-86	-200	-286
Construction	24	212	-15	100	164	264
Trade, accom. & trans.	613	505	-144	241	434	675
Business & other serv's.	1,386	712	-205	416	657	1,073
Non-market services	253	195	71	365	470	835
Total	2,357	1,702	-386	1,042	1,537	2,579

Source(s): CE, MDM revision 13547.

Note(s): Total employment and employment in public administration, education and health includes HM Forces.

Sums of figures may not match totals due to rounding.

Business and other services: The largest employment losses in 2020 came from the *Support services* sector (loss of around 175,000 jobs). However, the employment level in this sector is expected to return to the pre-pandemic level by 2025, with employment activities and services to buildings expecting to have the largest job increases of 133,000 and 107,000 job respectively over 2020-35. Also, the *Professional services* and *Arts and entertainment, Media* and *Information technology* sectors experienced a decrease in the employment level in 2020, but the employment level in these sectors is also expected to return to the pandemic level by 2025, due to these sectors being part of the supply chain for most other sectors. In contrast, the *Real estate* and *Finance and insurance* sectors experienced an employment growth in 2020 of 9 per cent and 1.3 per cent, respectively. However, future prospects for these are markedly different: as the housing market is anticipated to continue flourishing, *Real estate* is expected to experience modest employment growth between 2020 and 2035, whereas *Finance and insurance* is expected to see some bounce-back in the short term, before returning to pre-pandemic downward trends (driven by Brexit, continued digitisation and changes in consumer tastes). The pandemic has accelerated a number of already existing trends. For example, a reduction in commercial property business due to the pandemic as some businesses are downsizing their premises as more people are homeworking. However, there is no explicit assumption specifically related to this in the projections. They assume a continuation of historical trends, with slowing investment in commercial properties. That said, because the vast majority of market values is made up of residential properties for which demand is still expected to grow, this does not have an overbearing effect on the real estate sector as a whole.

Non-marketed services: All sectors within this group experienced employment growth in 2020, and they are expected to continue growing in the following periods. Of particular note, the *Health and social work* sector is expected to experience a considerable increase in employment between 2020 and 2025 of around 1.4 per cent per annum. Employment in education is also expected to increase by over 144,000 jobs over 2020-35. This largely reflects anticipated future demand to serve a growing (and ageing) population, and current trajectories for government spending plans (the main source of funding for the majority of provision in these sectors).

It is also important to note that, even in sectors where we are expecting employment levels to decline, there will still be significant numbers of job openings and skill requirements because of the need to replace those leaving the workforce for reasons of retirement, etc. These so called ‘replacement demands’ are discussed in more detail in the following section.

Table 3.3 Employment by detailed industry (levels and change), 2015-35 (000s)

	Levels						Change				
	2015	2019	2020	2025	2035		2015-2019	2019-2020	2020-2025	2025-2035	2020-2035
Primary sector and utilities	*794*	*824*	*790*	*796*	*808*		*30*	*-34*	*6*	*12*	*18*
Agriculture	387	396	372	381	385		9	*-24*	9	4	*13*
Mining and quarrying	74	61	62	54	47		-13	*1*	-8	-7	*-15*
Electricity and gas	133	144	146	140	139		11	*2*	-6	-1	*-7*
Water and sewerage	200	223	210	221	237		23	*-13*	11	17	*27*
Manufacturing	*2,638*	*2,687*	*2,627*	*2,541*	*2,341*		*49*	*-60*	*-86*	*-199*	*-286*
Food drink and tobacco	427	453	452	459	449		26	*0*	7	-10	*-3*
Engineering	395	403	384	393	349		8	*-18*	9	-44	*-35*
Rest of manufacturing	1,816	1,831	1,791	1,688	1,543		15	*-41*	-103	-145	*-248*
								0			
Construction	*2,122*	*2,334*	*2,319*	*2,419*	*2,583*		*212*	*-15*	*100*	*164*	*264*
Trade, accommodation and transport	*8,823*	*9,328*	*9,184*	*9,425*	*9,859*		*505*	*-144*	*241*	*434*	*675*
Wholesale and retail trade	4,971	4,992	4,980	5,007	5,059		21	*-12*	27	52	*79*
Transport and storage	1,609	1,812	1,788	1,904	1,941		203	*-24*	116	36	*153*
Accommodation and food	2,244	2,525	2,416	2,514	2,859		281	*-109*	98	346	*443*
Business and other services	*10,766*	*11,479*	*11,274*	*11,690*	*12,347*		*712*	*-205*	*416*	*657*	*1,073*
Media	365	380	378	381	386		15	*-2*	4	4	*8*
Information technology	1,025	1,117	1,114	1,198	1,296		92	*-3*	84	97	*181*

	Levels						Change				
	2015	**2019**	**2020**	**2025**	**2035**		**2015-2019**	**2019-2020**	**2020-2025**	**2025-2035**	**2020-2035**
Finance and insurance	1,113	1,135	1,150	1,157	1,136		22	*15*	7	-21	*-14*
Real estate	568	590	643	619	672		22	*53*	-24	53	*29*
Professional services	2,906	3,212	3,152	3,312	3,532		306	*-60*	160	220	*380*
Support services	2,846	3,012	2,837	3,005	3,214		166	*-175*	168	209	*377*
Arts and entertainment	982	1,029	1,000	1,031	1,119		47	*-29*	31	88	*119*
Other services	962	1,005	1,000	987	992		43	*-5*	-13	5	*-8*
Non-marketed services	*8,512*	*8,714*	*8,781*	*9,152*	*9,630*		*202*	*67*	*371*	*478*	*849*
Public admin. and defence	1,331	1,359	1,403	1,426	1,451		28	*44*	23	25	*48*
Education	2,956	2,946	2,956	2,997	3,100		-10	*10*	41	104	*144*
Health and social work	4,226	4,410	4,422	4,729	5,078		184	*12*	307	349	*656*
All industries	33,656	35,365	34,975	36,022	37,568		1,709	-390	1,047	1,546	*2,593*

Source: CE, MDM revision 13547.

Note: Total employment and employment in public administration, education and health includes HM Forces. Sums of figures may not match totals due to rounding.

Table 3.4 Employment by detailed industry (growth and shares), 2015-35

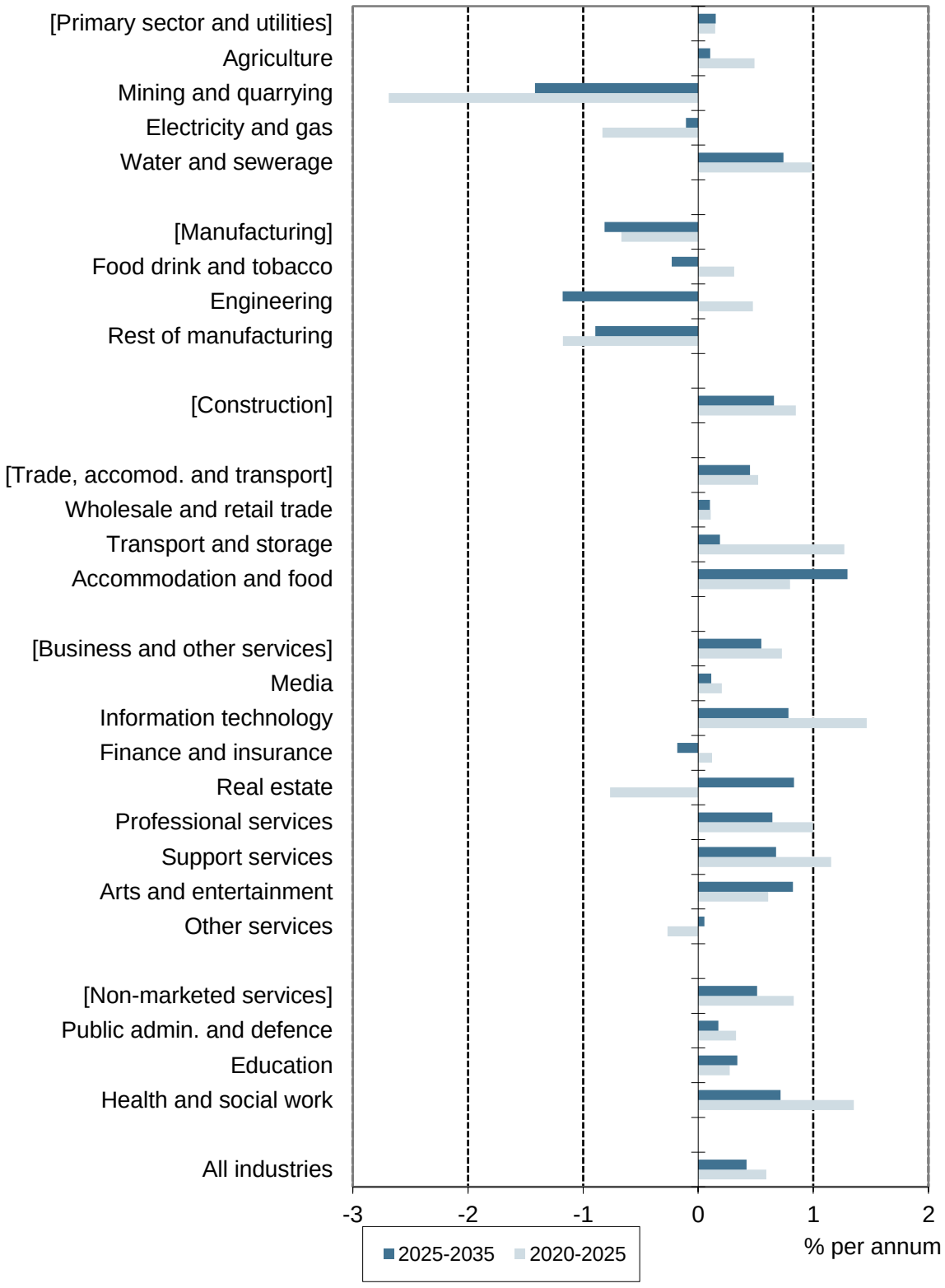
	Growth (% per annum)						Shares (%)				
	2015-2019	2019-2020	2020-2025	2025-2035	2020-2035		2015	2019	2020	2025	2035
Primary sector and utilities	*0.9*	*-4.1*	*0.1*	*0.2*	*0.2*		*2.4*	*2.3*	*2.3*	*2.2*	*2.2*
Agriculture	0.6	*-6.0*	0.5	0.1	*0.2*		48.7	48.1	47.1	47.9	47.7
Mining and quarrying	-4.7	*1.6*	-2.7	-1.4	*-1.8*		9.3	7.4	7.8	6.8	5.8
Electricity and gas	2.0	*1.4*	-0.8	-0.1	*-0.3*		16.8	17.5	18.5	17.6	17.1
Water and sewerage	2.8	*-5.8*	1.0	0.7	*0.8*		25.2	27.1	26.6	27.7	29.4
Manufacturing	*0.5*	*-2.2*	*-0.7*	*-0.8*	*-0.8*		*7.8*	*7.6*	*7.5*	*7.1*	*6.2*
Food drink and tobacco	1.5	*-0.1*	0.3	-0.2	*0.0*		16.2	16.8	17.2	18.1	19.2
Engineering	0.5	*-4.6*	0.5	-1.2	*-0.6*		15.0	15.0	14.6	15.5	14.9
Rest of manufacturing	0.2	*-2.2*	-1.2	-0.9	*-1.0*		68.9	68.2	68.2	66.4	65.9
Construction	*2.4*	*-0.6*	*0.8*	*0.7*	*0.7*		*6.3*	*6.6*	*6.6*	*6.7*	*6.9*
Trade, accommodation and transport	*1.4*	*-1.5*	*0.5*	*0.5*	*0.5*		*26.2*	*26.4*	*26.3*	*26.2*	*26.2*
Wholesale and retail trade	0.1	*-0.2*	0.1	0.1	*0.1*		56.3	53.5	54.2	53.1	51.3
Transport and storage	3.0	*-1.3*	1.3	0.2	*0.5*		18.2	19.4	19.5	20.2	19.7
Accommodation and food	3.0	*-4.3*	0.8	1.3	*1.1*		25.4	27.1	26.3	26.7	29.0
Business and other services	*1.6*	*-1.8*	*0.7*	*0.5*	*0.6*		*32.0*	*32.5*	*32.2*	*32.5*	*32.9*
Media	1.0	*-0.5*	0.2	0.1	*0.1*		3.4	3.3	3.3	3.3	3.1

	Growth (% per annum)						Shares (%)				
	2015-2019	**2019-2020**	**2020-2025**	**2025-2035**	**2020-2035**		**2015**	**2019**	**2020**	**2025**	**2035**
Information technology	2.2	*-0.2*	1.5	0.8	*1.0*		9.5	9.7	9.9	10.3	10.5
Finance and insurance	0.5	*1.3*	0.1	-0.2	*-0.1*		10.3	9.9	10.2	9.9	9.2
Real estate	1.0	*9.0*	-0.8	0.8	*0.3*		5.3	5.1	5.7	5.3	5.4
Professional services	2.5	*-1.9*	1.0	0.6	*0.8*		27.0	28.0	28.0	28.3	28.6
Support services	1.4	*-5.8*	1.2	0.7	*0.8*		26.4	26.2	25.2	25.7	26.0
Arts and entertainment	1.2	*-2.8*	0.6	0.8	*0.8*		9.1	9.0	8.9	8.8	9.1
Other services	1.1	*-0.5*	-0.3	0.1	*-0.1*		8.9	8.8	8.9	8.4	8.0
Non-marketed services	*0.6*	*0.8*	*0.8*	*0.5*	*0.6*		*25.3*	*24.6*	*25.1*	*25.4*	*25.6*
Public admin. and defence	0.5	*3.2*	0.3	0.2	*0.2*		15.6	15.6	16.0	15.6	15.1
Education	-0.1	*0.3*	0.3	0.3	*0.3*		34.7	33.8	33.7	32.7	32.2
Health and social work	1.1	*0.3*	1.4	0.7	*0.9*		49.6	50.6	50.4	51.7	52.7
All industries	1.2	*-1.1*	0.6	0.4	*0.5*		100.0	100.0	100.0	100.0	100.0

Source: CE, MDM revision 13547.

Note: Total employment and employment in public administration, education and health includes HM Forces. Sums of figures may not match totals due to rounding.

Figure 3.6 UK employment growth by detailed industry, 2020-35 (000s)



Source: CE, MDM revision 13547.
Note: Total employment and employment in public administration, education and health includes HM Forces. Sums of figures may not match totals due to rounding.

Tables 3.5-3.9 show a selection of 2-digit SIC categories based on the largest absolute projected employment growth and decline from 2020 to 2035. Overall, these results suggest that some services (such as 66. *Health*, 40. *Food and beverage services* and 68. *Social work*), as well as areas such as 30. *Specialised construction* and 45. *Computer programming*, etc., will experience considerable increases in employment by 2035. In sharp contrast, many parts of *Manufacturing* (such as 15. *Metal products*, 12. *Rubber and plastic* and 23. *Repair and installation*), as well as industries such as 02. *Coal, oil and gas*; *Mining and related* are expected to experience significant job losses between 2020 and 2035.

Table 3.5 Top 10 2-digit industry (75) in terms of employment levels in 2020

Industry (75) code and name	2020 (000s)	Rank	2035 (000s)	Rank
33. Retail trade	3,104	1	3,122	1
65. Education	2,956	2	3,100	2
66. Health	2,661	3	3,030	3
40. Food & beverage services	1,902	4	2,235	4
64. Public admin. & defence	1,403	5	1,451	5
32. Wholesale trade	1,256	6	1,277	7
30. Specialised construction	1,252	7	1,387	6
68. Social work	996	8	1,147	8
59. Employment activities	977	9	1,110	9
52. Head offices, etc.	882	10	946	11

Source: CE/IER estimates

Table 3.6 Top 10 2-digit industry (75) in terms of projected employment change between 2020 and 2035

	Employment				Change 2020-2035			
Industry (75) code and name	2020 (000s)	Rank	2035 (000s)	Rank	Change (000s)	Rank	Change (%)	Rank
66. Health	2,661	3	3,030	3	369	1	13.9	15
40. Food & beverage services	1,902	4	2,235	4	334	2	17.6	10
68. Social work	996	8	1,147	8	151	3	15.2	13
65. Education	2,956	2	3,100	2	144	4	4.9	34
67. Residential care	765	15	901	14	136	5	17.8	8
30. Specialised construction	1,252	7	1,387	6	135	6	10.8	25
59. Employment activities	977	9	1,110	9	133	7	13.6	17
45. Computer programming, etc.	805	13	936	12	131	8	16.3	11
39. Accommodation	514	22	624	20	110	9	21.3	5
62. Services to buildings	850	11	957	10	107	10	12.6	24

Source: CE/IER estimates

Table 3.7 Top 10 2-digit industry (75) in terms of employment change 2020-2035 (largest declines in absolute terms)

	Employment				Change 2020-2035			
Industry (75) code and name	2020 (000s)	Rank	2035 (000s)	Rank	Change (000s)	Rank	Change (%)	Rank
02. Coal, oil & gas; Mining & related	62	66	47	72	-15	66	-24.3	74
05. Textiles	68	65	52	67	-17	67	-24.4	75
21. Furniture	98	58	81	62	-17	68	-17.3	69
22. Other manufacturing	104	54	86	58	-18	69	-17.6	70
09. Printing & recording	92	60	73	63	-19	70	-20.6	71
18. Machinery, etc.	183	40	163	42	-20	71	-10.8	61
20. Other trans. equipment	144	48	122	51	-22	72	-15.4	67
12. Rubber & plastic	186	39	163	43	-23	73	-12.6	63
23. Repair & installation	149	46	124	50	-25	74	-16.5	68
15. Metal products	281	32	241	35	-41	75	-14.4	66

Source: CE/IER estimates

Table 3.8 Top 10 2-digit industry (75) in terms of employment change 2020-2035 (per cent change)

	Employment				Change 2020-2035			
Industry (75) code and name	2020 (000s)	Rank	2035 (000s)	Rank	Change (000s)	Rank	Change (%)	Rank
57. Veterinary	113	52	149	46	35	23	31.2	1
54. Scientific research	168	42	213	37	45	20	26.9	2
56. Other professional	260	33	328	32	68	16	26.2	3
55. Advertising, etc.	234	34	294	33	60	18	25.6	4
39. Accommodation	514	22	624	20	110	9	21.3	5
46. Information services	99	56	118	53	18	34	18.3	6
71. Gambling	100	55	118	52	18	35	18.1	7
67. Residential care	765	15	901	14	136	5	17.8	8
72. Sport & recreation	505	26	594	23	89	12	17.6	9
40. Food & beverage services	1,902	4	2,235	4	334	2	17.6	10

Source: CE/IER estimates

Table 3.9 Top 10 2-digit industry (75) in terms of employment change 2020-2035 (largest per cent declines)

	Employment				Change 2020-2035			
Industry (75) code and name	2020 (000s)	Rank	2035 (000s)	Rank	Change (000s)	Rank	Change (%)	Rank
15. Metal products	281	32	241	35	-41	75	-14.4	66
20. Other trans. equipment	144	48	122	51	-22	72	-15.4	67
23. Repair & installation	149	46	124	50	-25	74	-16.5	68
21. Furniture	98	58	81	62	-17	68	-17.3	69
22. Other manufacturing	104	54	86	58	-18	69	-17.6	70
09. Printing & recording	92	60	73	63	-19	70	-20.6	71
35. Water transport	19	75	15	75	-4	53	-20.6	72
06. Wearing apparel; Leather, etc.	55	68	42	73	-13	64	-23.7	73
02. Coal, oil & gas; Mining & related	62	66	47	72	-15	66	-24.3	74
05. Textiles	68	65	52	67	-17	67	-24.4	75

Source: CE/IER estimates

4 Occupational employment prospects

Key messages

This section focuses upon the implications for occupations, which are classified using the new SOC2020 system for this study. This section highlights developments at the broad 1-digit level of SOC (the 9 major groups).

Occupational employment patterns are to a large extent driven by the changing industrial structure of employment.

It is difficult to discern changes in occupational trends at the 1-digit level. Due to the level of aggregation, these groups tend to change slowly.

The main trends for SOC Major Groups to 2035 are expected to continue to favour highly-skilled, white collar, non-manual jobs. Comparing pre-pandemic (2019) to the future (2035) projected employment level, *Professional occupations* are expected to show an increase of around 1.94 million people, followed by *Associate professionals* (+0.94 million), *Managers and directors* (+0.24 million) and *Caring and leisure* occupations (+0.24 million).

There is, however, some weak evidence of continued polarisation of employment, with modest increases in employment in some lower skilled occupations (such as *Elementary trades and related occupations* and *Customer service occupations*).

Net changes in employment levels by occupation are referred to as expansion demands (although these can be negative as well as positive). Over 2020 to 2035, there is expected to be a net change of around 2½ million job openings. *Professional and Associate professionals* will experience the highest net change increases (around +1.5 and +0.7 million respectively). On the other hand, *Administrative and secretarial* and *Skilled trades occupations* are expected to experience a negative net change (about -0.15 million and -0.06 million job losses).

Replacement demands recognise the need to replace people who leave the workforce for reasons of retirement, etc. Replacement demands are typically much larger than expansion demands and generally easily offset any negative changes.

Replacement demands mean that there will continue to be significant job openings even for occupations which are projected to decline. *Professional and Associate professional occupations* are the categories with the highest increases in replacement demand (+4.2 and +2.4 million respectively) between 2020 and 2035, whilst *Process, plant and machine operatives* shows the smallest increase (0.9 million).

There are some minor variations by gender and status, but these patterns apply across the board. It is expected that female employment will increase by around 1.4 million between 2020 and 2035, whilst male employment will increase by 1.1 million over the same period.

4.1 Introduction

This section focuses upon the implications of the projections for patterns of employment by occupation. Occupation is one of the key ways in which skills are classified. Other aspects are covered by the implications for qualifications, which is covered in Section 6 of the report, and various ways of measuring skills, which will be the subject of subsequent analysis in *The Skills Imperative 2035* research programme.

Previous projections in the *Working Futures* series were based on classifying jobs using 2010 version of the Standard Occupational Classification (SOC2010). The UK Office for National Statistics (ONS) has recently updated this to SOC2020 (see Box 4.1 for more details).

A revised historical database has been developed for this study, reclassifying jobs using this new system for the classification of occupations. This was done using a detail mapping between SOC2010 and SOC2020 categories developed by ONS.

As noted above, the occupational projections are driven by the changing sectoral structure of employment as outlined in Section 3. Occupational patterns of employment are of course also changing within sectors and industries in response to technological change and other developments. This is taken into account by a detailed analysis of how such patterns are evolving over time based on LFS data. Full details of the methodology for producing the projections are provided in the accompanying *Technical Report*.

Section 4.2 provides a brief summary of the results at the 1-digit level of SOC2020 (SOC major and sub-major groups), including an analysis of how these patterns vary by gender and employment status. The implications for replacement demands (which reflect the need to replace those leaving the workforce for reasons for retirement, etc.) are also considered.

Section 4.3 continues with a discussion of variations in these patterns by gender and employment status.

A more detailed analysis at the 2 and 4-digit levels of SOC is presented in Section 5.

Box 4.1 Moving to SOC2020

The UK Standard Occupational Classification is a framework used to group jobs based on the tasks and duties undertaken in the job. This classification is a critical input for conducting standardised statistical labour market analysis in the UK since it allows study of the labour supply and demand by the task complexity required to carry out a particular job. With the introduction of new technologies and changes in knowledge and expertise requirements, SOC2010 has increasingly become an outdated tool for classifying a wide range of occupations in the UK labour market. In 2020, the ONS, as the agency responsible for maintaining the occupational classification, introduced SOC2020 to replace the old SOC2010 system.[46]

SOC2020 introduced three main improvements:[47]

- a review of the classification of *Professional* or *Associate professional* roles
- the reclassification of occupations associated with information technologies
- disaggregation into less heterogeneous Unit Groups.

As pointed out by ONS, 2021b, these changes affected the employment distribution by major occupational groups. The increase in the share of *Professional occupations* is the most notable change. This increase was due to the redefinition of occupational categories from major group 3 (*Associate professional occupations*) to major group 2 (*Professional occupations*). From 2021, the ONS has implemented these changes by replacing the SOC2010 variable in the LFS data with the SOC2020.

As SOC2020 will be the principal classification in use in the next decade, the current projections have therefore adopted this renewed classification. This involved:

1. using the ONS mapping of SOC2010 to SOC2020 at 4-digit level to convert the historical *Working Futures* database from SOC2010 to SOC2020
2. applying this mapping to the entire *Working Futures* database at 2-digit SOC to convert the previous round of projections on to a SOC2020 basis
3. LFS data from 2001 to 2020 were converted to SOC2020 using the ONS mapping and then used to constrain the occupational shares
4. using the revised database, new projections on a SOC2020 basis were developed.

The SOC update has some impact on occupational trends. It is clear that the share of occupations such as *Professional occupations* increases compared with the projections made in 2017 using SOC2010. For instance, at the 1-digit level, using SOC2010 the employment level of *Professional occupations* was around 6,500,000 people in 2015. This figure rises to 6,885,000 when reclassified using SOC2020. These differences are relatively small for most of the other major occupational groups. Differences at more disaggregated levels (e.g. at the 2-digit level) also arise due to the classification update.

[46]ONS (2020a)
https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/standardoccupationalclassificationsocextensionproject
[47] ONS (2020b)
https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2020/soc2020volume1structureanddescriptionsofunitgroups

4.2 New projections for SOC2020 Major Groups

4.2.1 Changes in occupational employment structure

The introduction of new technologies (especially related to automation of tasks and green transition) and Brexit and the Covid-19 pandemic outbreak can be considered the key drivers of occupational changes in the UK labour market during the last two decades. On the one hand, it has been widely documented that the introduction of new technologies related to automation of tasks and other technological changes has resulted in job polarisation.[48] Also, the global transition for a greener economy (2015 Paris Agreement) has altered the occupational and skills composition of the UK labour market. For instance, a recent report for Engineering UK (Bosworth *et al*., 2021) found that the demand for green skills has increased rapidly during the last two years for manufacturing and engineer-related occupations.

On the other hand, UK's exit from the European Union and the global Covid-19 pandemic considerably influenced labour and skill demand in the UK. Brexit has brought new trade barriers with the EU. These barriers may have differentiated effects across occupational groups. According to Davenport and Levell (2022), the occupations that are more exposed to these changes are machine operative (blue-collar workers), technical, and skilled trade roles since they tend to work in export related work.

As previously discussed, the unexpected pandemic in 2020 hit the UK economy very hard. Covid-19 brought a crisis without precedent in the modern era. People were restricted from working as normal to avoid spreading the virus. Restrictions varied depending on the type of tasks and nature of work in each occupation. Critical workers such as doctors, nurses, midwives, paramedics, social workers, care workers, and other frontline health and social care staff, including volunteers, experienced a significant increase in demand. People whose jobs/activities were compatible with teleworking could continue working from home. However, many non-critical and non-teleworking compatible occupations (such as waiters and waitresses, hairdressers, etc.) were negatively affected by Covid-19. As Adrjan and Lydon (2020) reported, occupations closely related to hospitality, tourism, personal services, and some retail activities experienced the largest declines in online job postings. Although the immediate impact of Covid-19 and the associated social distancing measures have now been lifted, the effects of this phenomenon may continue to echo during the following decades.

[48] Where the share of high and low-skilled employment increased substantially, whilst middle-skilled (automatable) occupations tend to decrease.

Box 4.2: The new SOC2020 occupational categories[49]

Managers, directors and senior officials – this group comprises Corporate managers and directors as well as Managers and proprietors of small businesses.

Professional occupations include 4 categories which all typically require a degree. These include Science, research, engineering and technology professionals.

Associate professional occupations include Health and social care associate professionals, and other sub-categories such as Protective service occupations (e.g. police, fire services, security) and Culture, media and sports occupations.

Administrative and secretarial occupations include Administrative and Secretarial and related occupations.

Skilled trades occupations encompass Skilled agricultural, construction, building, metal, electrical, electronic, textiles, printing trades and Other skilled trades workers.

Caring, leisure and other service occupations include Caring personal service, Leisure, travel and related personal service and Community and civil enforcement occupations.

Sales and customer service occupations cover Customer service and Sales occupations.

Process, plant and machine operatives include Process, plant and machine operatives, and Transport and mobile machine drivers and operatives.

Elementary occupations comprise Elementary administration and service, and Elementary trades and related occupations.

Table 4.1, Figure 4.1, Figure 4.2 and Figure 4.3 present employment projections for the 9 major occupational groups. These cover the period up to 2035. Data from 2015 to 2021 are consistent with trends in the LFS historical data.[50] Occupational changes are shown for different periods. These compare labour market trends:

- before the impact of the pandemic and implementation of Brexit (2010-2019)
- developments since the first wave of Covid-19 and the stricter lockdown measures imposed to deal with it (2020)
- projected 'short-term' changes after the end of the stricter lockdown measures (2020-2025) and 'long-term' projections after the end of the immediate impacts of Covid-19 (2025-2035).

Table 4.1 and Figure 4.1 portray historical trends before the pandemic and Brexit (2010-2019) as well as the projections. These historical trends show a deceleration in employment growth in the major occupational groups 4 to 9 prior to the pandemic.[51] Conversely, *Professional occupations* and *Managers, directors and senior official occupations* have experienced relatively high employment growth.

It is difficult to disentangle the effects of Brexit and Covid-19 since they almost occur simultaneously. However, it is evident that the combined impact resulted in a considerable immediate decrease in employment for all occupational groups in 2020 (Figure 4.1), with

[49] ONS (2020c).Full details of SOC2020 occupational categories can be found at https://www.ons.gov.uk/methodology

[50] Figures for 2021 include the three first quarters of this year due to data availability when the forecast was developed.

[51] The historical data (2010-2020) have been re-coded to SOC2020 in order to provide a consistent analysis with the most recent LFS data available. See Box 4.1.

particularly significant reductions in the number of people employed in middle and low-skilled (and low-paid) occupations such as *Skilled trade and Elementary occupations*.[52]

After this immediate impact, the combination of continuing changes in sectoral employment structure in the UK and skill-biased technical change to 2035 is expected to favour more highly skilled occupations (*Managers, directors, senior officials, Professionals and Associate professional occupations*), with growth in less skilled employment in areas that are currently difficult to automate (some *Caring, leisure and Elementary occupations*). The results also indicate a reduction in the numbers of clerical (*Administrative and secretarial occupations*) and skilled and semi-skilled manual jobs (*Process, plant and machine operatives*) (see Figure 4.2).

Managers, directors and senior officials – employment levels are projected to fall in the short term (2020-2025), driven by a decrease in *Corporate managers and directors*. It is expected that by 2035 the employment level in this major occupation group will recover and show a modest increase (+0.24 million) compared to the pre-pandemic period (2019).

Professional occupations are all expected to show significant increases in employment by 2035. In fact, comparing pre-pandemic (2019) to the future (2035), this occupational group will experience the largest employment increase (+1.94 million). Within this group, *Science, research, engineering and technology professionals* will experience a relatively higher employment increase.

Associate professional occupations will see increases in employment, mainly due to a considerable rise for *Health and social care associate professionals***.** Other sub-categories such as *Protective service occupations* and *Culture, media and sports occupations* are not projected to experience such significant changes to 2035. From 2019 to 2035, this group will experience a large increase in employment as a whole (+0.94 million)**.**

Administrative and secretarial occupations are expected to experience modest job losses to 2035. As has been widely documented, these occupations have been one of the groups hardest hit by technological changes such as the introduction of IT systems to replace human routinary tasks. This trend is projected to continue over the next period reducing the level of employment for these occupations from around 3.8 million people in 2021 to 3.5 million people in 2035.

Skilled trade occupations and Process, plant and machine operatives are expected to experience modest job losses as a whole, continuing the pattern of long-term decline. It is expected that by 2035 the employment level in this major occupation group will decrease by 0.47 million compared to the pre-pandemic period (2019). For many of these traditionally manual/blue-collar occupations, this is largely driven by the continuing decline in manufacturing activities (e.g. *Process, plant and machine* operatives and *Skilled metal, electrical and electronic trades*). The combination of Brexit and Covid-19 seems to have accelerated the decline of the employment level in these occupations.

Some modest employment growth is expected for some parts of the ***Caring, leisure and other service occupations*** group. This is driven primarily by the growth for caring personal service occupations. It is important to note that Covid-19 did not appear to affect employment levels amongst leisure, travel, and related personal service occupations very significantly. This result suggests that the employment schemes developed by the

[52] De Lyon, J. and Dhingra, S. (2021).

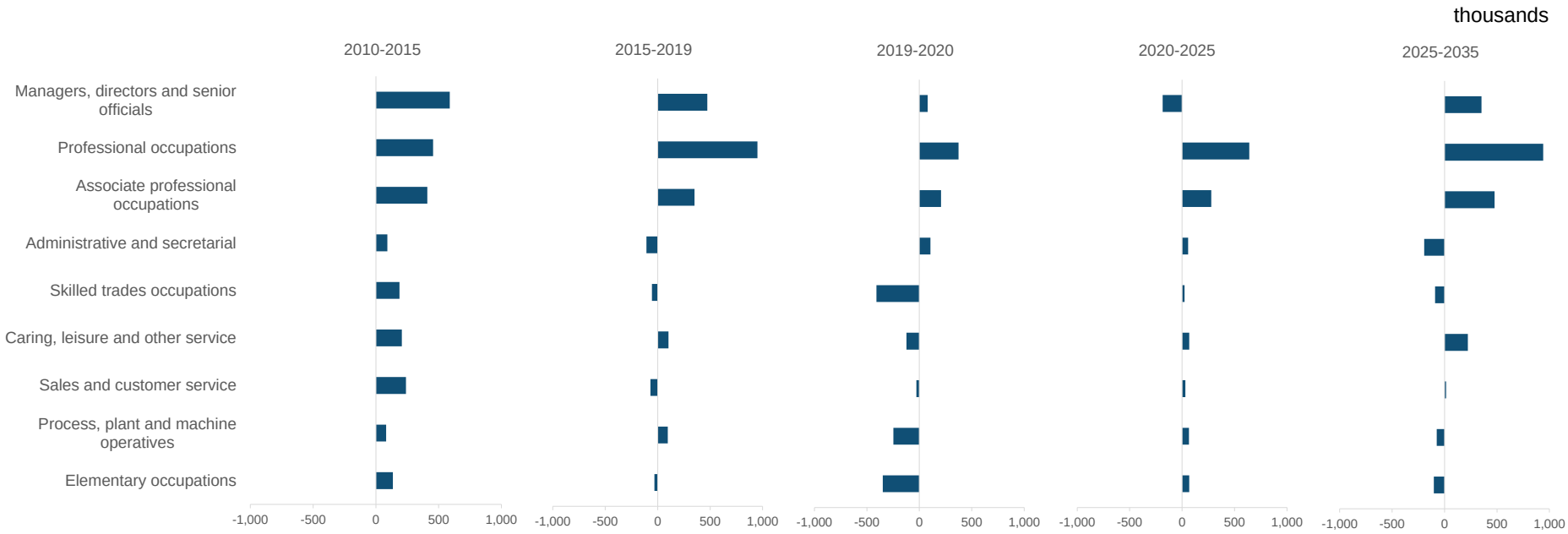
Government at least partially protected some of the most vulnerable activities in the economy.

Sales and customer service occupations are not expected to show much change to 2035 as a whole. However, some sub-categories are projected to experience some positive employment prospects. This is the case for *Customer service occupations*. In contrast, modest job losses are projected for the *Sales occupations* sub-category.

The pandemic and Brexit had an immediate and negative effect on ***Elementary occupations*** overall.[53] However, at a more disaggregated level, results are mixed. On the one hand, the sub-category *Elementary administration and service occupations* were hard hit by the conjunction of these two effects. On the other hand, the jobs in *Elementary trades and related occupations* were positively impacted. By 2035 the level of employment will be lower than in the pre-pandemic/Brexit period (see Section 5 for more details).

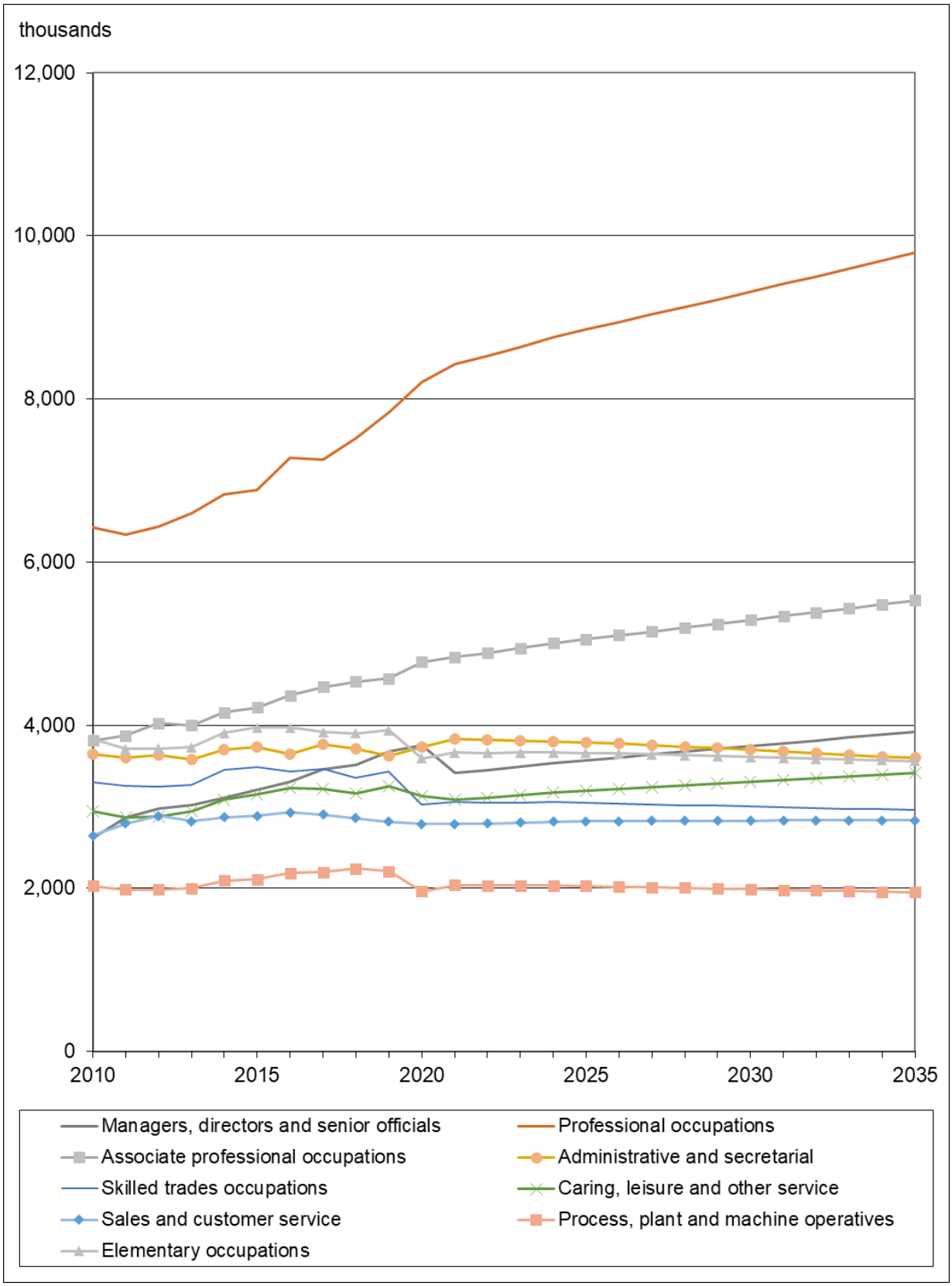
[53] These are both manual and non-manual jobs that require minimal amounts of training in order to undertake them.

Figure 4.1 Changes in occupational employment structure (000s), 2015-2035



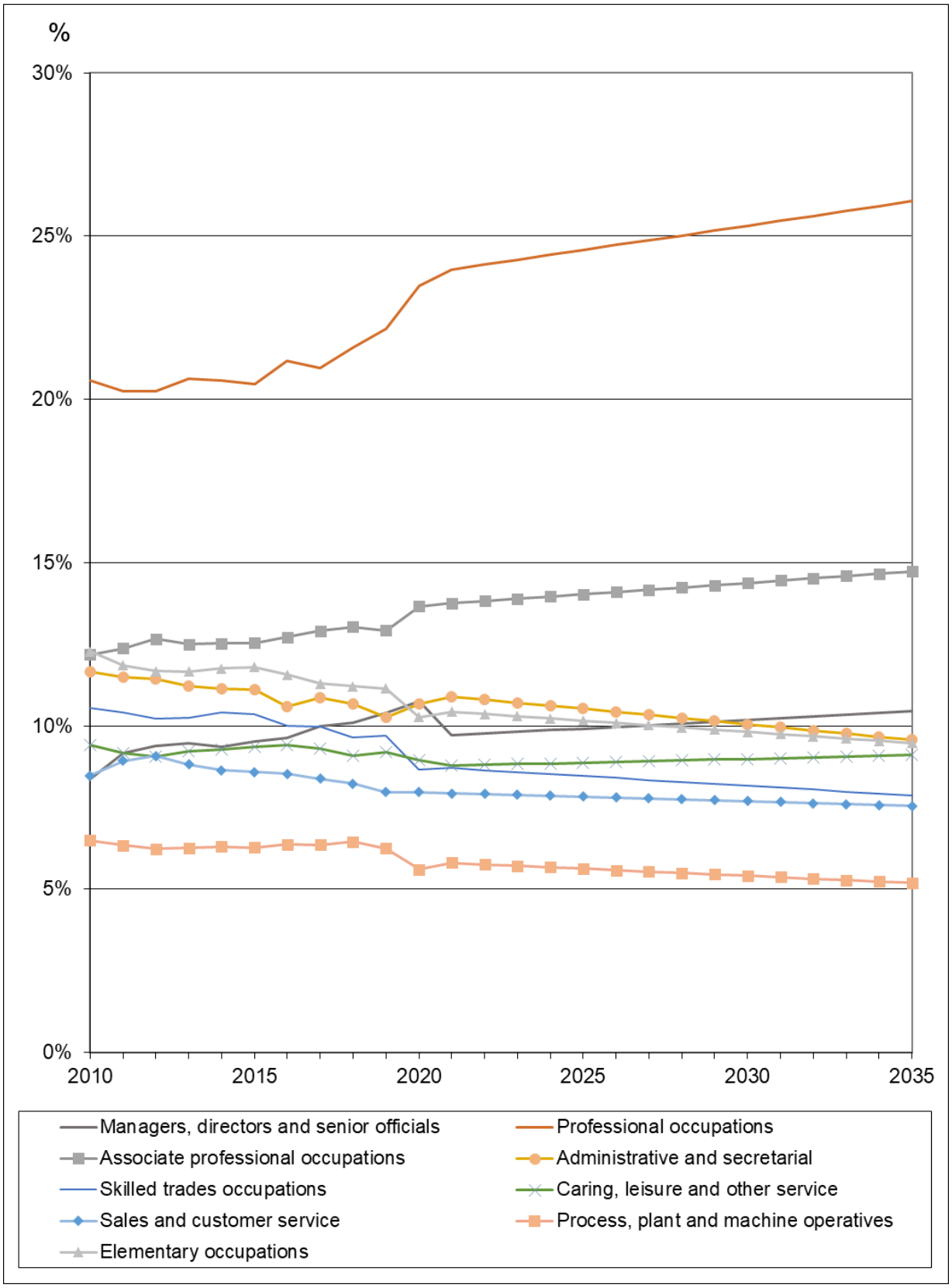
Source: IER estimates

Figure 4.2 Occupational trends (000s), 2015-2035



Source: IER estimates

Figure 4.3 Occupational trends (% shares) 2015-2035



Source: IER estimates

Table 4.1 Employment in SOC2020 occupational categories – Major Groups

Levels (000s)	2010	2015	2019	2020	2025	2035
Managers, directors and senior officials	2,617	3,205	3,678	3,758	3,572	3,924
Professional occupations	6,430	6,885	7,836	8,211	8,851	9,792
Associate professional occupations	3,810	4,219	4,571	4,777	5,055	5,533
Administrative and secretarial	3,644	3,736	3,628	3,733	3,791	3,597
Skilled trades occupations	3,302	3,489	3,434	3,025	3,049	2,958
Caring, leisure and other service	2,942	3,149	3,251	3,128	3,196	3,419
Sales and customer service	2,648	2,887	2,817	2,789	2,820	2,835
Process, plant and machine operatives	2,031	2,113	2,209	1,962	2,026	1,952
Elementary occupations	3,837	3,972	3,941	3,592	3,660	3,558
All occupations	**31,261**	**33,656**	**35,365**	**34,975**	**36,022**	**37,568**
Shares (%)	**2010**	**2015**	**2019**	**2020**	**2025**	**2035**
Managers, directors and senior officials	8%	10%	10%	11%	10%	10%
Professional occupations	21%	20%	22%	23%	25%	26%
Associate professional occupations	12%	13%	13%	14%	14%	15%
Administrative and secretarial	12%	11%	10%	11%	11%	10%
Skilled trades occupations	11%	10%	10%	9%	8%	8%
Caring, leisure and other service	9%	9%	9%	9%	9%	9%
Sales and customer service	8%	9%	8%	8%	8%	8%
Process, plant and machine operatives	6%	6%	6%	6%	6%	5%
Elementary occupations	12%	12%	11%	10%	10%	9%
All occupations	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Change (000s)	**2010-2015**	**2015-2019**	**2019-2020**	**2020-2025**	**2025-2035**	**2020-2035**
Managers, directors and senior officials	588	472	80	-185	352	167
Professional occupations	455	951	374	641	941	1,582
Associate professional occupations	409	351	207	278	477	755
Administrative and secretarial	92	-108	106	58	-194	-136
Skilled trades occupations	188	-55	-409	23	-90	-67
Caring, leisure and other service	206	103	-123	68	222	291
Sales and customer service	239	-70	-28	31	15	46
Process, plant and machine operatives	82	96	-247	65	-75	-10
Elementary occupations	135	-31	-349	68	-102	-34
All occupations	**2,395**	**1,709**	**-390**	**1,047**	**1,546**	**2,593**

Source: IER estimates

4.2.2 Measuring replacement demands

Replacement demands cannot be measured directly but are inferred from information on labour market flows from one state to another. Details are given in Box 4.3. Essentially, they indicate the number of job openings that arise due to permanent and semi-permanent withdrawals from the workforce for reasons such as retirement, family formation and care, as well as mortality.

Box 4.3: Replacement demands and net employment requirement: definitions

Net employment requirements refer to the total number of job openings required in an economy for its functionality. It is important to note that net requirements is composed of two different elements: structural demand (or net change, sometimes called 'expansion demands') and replacement demands. The former indicates the number of jobs created as a consequence of economic growth or decline. The structural demand is the net change in employment between two points in time. These figures are typically used to indicate the expansion or decline of certain occupational groups. Nevertheless, net requirements only provide a partial picture of labour market opportunities and training requirements. Apart from those jobs which are created/destroyed by the economic growth/decline, the economy also needs to 'replace' the labour who leave the labour market for various reasons such as:

- retirement from the workforce due to ageing, health, family decisions, etc.
- mortality
- people's mobility between sectors and occupations
- net geographical mobility.

The sum of these four is referred to as replacement demand. Replacement demand comprises different labour market flows. The estimates presented are net flows. The analysis of the replacement demand and structural demand provides a better picture of the expected total net requirements for each occupation and, thus, the number of people needed to be trained to fulfil the job market requirements for each occupational group.

The data used to estimate both the age structure of the workforce and the various flows are based upon very limited information, mostly taken from the LFS. The replacement demand estimates should, therefore, be regarded as indicative rather than precise.

Data on net migration by occupation are not readily available, so this is set equal to zero by assumption in all the tables. Net occupational mobility measures based on turnover of those who change occupations within a 12-month period are available from the LFS. These exclude those who remain in the same occupation and those who may change jobs more than once in a 12-month period. They are therefore a lower bound estimate of total turnover. However, it has proved impossible to develop a consistent set of such estimates for all the detailed specific sectors and geographical areas in the *Working Futures* database using data from the LFS due to sample size limitations. The estimates shown here and in the more detailed tables are therefore based just on estimated losses from retirements and mortality. They therefore represent a lower bound.

The methods for preparing estimates of replacement demands are described in more detail in the separate *Technical report*.[54]

[54] Wilson *et al.,* (2022c).

4.2.3 Estimates of replacement demands

Table 4.2 presents estimates of replacement demands and total requirements as well as showing a summary of the changing composition of employment by the major occupational groups (net change 2020-2035).[55]

The total requirement for workers is the sum of the net change in employment over a given period plus replacement demands. This is positive for all occupational groups between 2020 and 2035. Over this period, there is expected to be a net requirement of around 20 million new job openings. Replacement demand accounts for around 17.5 million of these. Replacing retirements from the workforce due to old age is the principal component of this result.

The rates of replacement demand range from 42 per cent (*Skilled trades occupations*) to 58 per cent (*Caring, leisure and other service occupations*) over 2020-2035 across occupational groups (Table 4.2). This considerable increase in replacement demand easily offsets any negative structural (expansion) demand expected in some occupations (Table 4.2). On average, the replacement demand over the period 2020-2035 is almost 7 times larger than expansion demand.

Four out of nine occupational groups exhibit a contraction in employment levels, where the net change or structural change is negative. These occupational categories include *Administrative and secretarial occupations*; *Skilled trades*; *Sales and customer service occupations*; and *Process, plant and machine operatives*. Although there is negative structural demand in these occupations, there will still be a number of new job opportunities arising due to replacement demand. Expansion demand is expected to be positive in all the other major occupational groups.

Replacement demands outweigh any negative changes resulting from any projected employment decline across all the occupation sub-groups. It is expected that *Health and social care associate professionals* will have the highest replacement demand rates, whilst *Protective service occupations* the lowest one. Similar results can be observed at the more detailed 2-digit level (see Table 5.1 and Figure 5.2 below).

Professional and *Associate professional* occupations are categories with the highest increases in the number of new job openings, whilst *Process, plant and machine operatives* shows the smallest increase. In the case of the former, replacement demands reinforce the number of new job openings. For the latter, they offset the job losses projected because of projected declining employment levels.

Results for *Skilled trades occupations* are mixed. On the one hand, the number employed in *Skilled metal, electrical and electronic trades* and *Skilled construction and building trades* is expected to decrease (net change) between 2020-2035. On the other hand, *Skilled agricultural and related trades* and *Textiles, printing and other skilled trade occupations* are expected to see a modest increase in employment numbers. In both cases replacement demands add significantly to the number of job openings for these occupations.

[55] More detailed figures on the 26 occupational sub-major groups (two-digit level) are shown in Figure 5.1 below.

Table 4.2 Changing Composition of Employment by Occupation 2010-2035 and Replacement Demands, 2020-2035

Levels (000s)							2020-2035		
	2010	2015	2019	2020	2025	2035	Net Change	Replacement Demand	Total Requirement
Managers, directors and senior officials	2,617	3,205	3,678	3,758	3,572	3,924	167	1,973	2,139
Professional occupations	6,430	6,885	7,836	8,211	8,851	9,792	1,582	4,216	5,798
Associate professional occupations	3,810	4,219	4,571	4,777	5,055	5,533	755	2,460	3,215
Administrative and secretarial	3,644	3,736	3,628	3,733	3,791	3,597	-136	1,886	1,749
Skilled trades occupations	3,302	3,489	3,434	3,025	3,049	2,958	-67	1,290	1,223
Caring, leisure and other service	2,942	3,149	3,251	3,128	3,196	3,419	291	1,786	2,077
Sales and customer service	2,648	2,887	2,817	2,789	2,820	2,835	46	1,307	1,353
Process, plant and machine operatives	2,031	2,113	2,209	1,962	2,026	1,952	-10	957	947
Elementary occupations	3,837	3,972	3,941	3,592	3,660	3,558	-34	1,750	1,716
All occupations	**31,261**	**33,656**	**35,365**	**34,975**	**36,022**	**37,568**	**2,593**	**17,625**	**20,217**

Shares (%)							2020-2035		
	2010	2015	2019	2020	2025	2035	Net Change	Replacement Demand	Total Requirement
Managers, directors and senior officials	8%	10%	10%	11%	10%	10%	4.4	52.5	56.9
Professional occupations	21%	20%	22%	23%	25%	26%	19.3	51.4	70.6
Associate professional occupations	12%	13%	13%	14%	14%	15%	15.8	51.5	67.3
Administrative and secretarial	12%	11%	10%	11%	11%	10%	-3.6	50.5	46.9
Skilled trades occupations	11%	10%	10%	9%	8%	8%	-2.2	42.6	40.4
Caring, leisure and other service	9%	9%	9%	9%	9%	9%	9.3	57.1	66.4
Sales and customer service	8%	9%	8%	8%	8%	8%	1.6	46.9	48.5
Process, plant and machine operatives	6%	6%	6%	6%	6%	5%	-0.5	48.8	48.3
Elementary occupations	12%	12%	11%	10%	10%	9%	-0.9	48.7	47.8
All occupations	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**7.4**	**50.4**	**57.8**

Source: IER estimates

The results for *Caring, leisure and other service occupations* suggest that this group as a whole will see employment increase, and this is reinforced by replacement needs. At a more disaggregated level, it is projected that *Caring personal service occupations* will lead to this increase. In line with findings reported in *Working Paper 1* from this study[56], this subcategory is one of the fastest-growing groups in terms of growth rate over the period 2020-2035, with a replacement demand rate of 3.2 per cent. In contrast, *Leisure, travel and related personal service* and *Community and civil enforcement occupations* will experience a decline in employment (net change) but this will be offset by replacement demands.

Sales and customer service occupations represent the group with the highest number of people employed in 2020. However, this subcategory is projected to decline by 2035. The replacement demand rate for this sub-category is 2.4 per cent which results in a significant number of job openings despite the projected overall decline in employment. In contrast, *Customer service occupations* (such as *Call centre advisor/agent*, *Telephone clerks, etc*.) are projected to experience a significant increase in employment by 2035, which is reinforced by replacement demands.

The report by ONS (2019c) has highlighted *Process, plant and machine operatives* as one of the most vulnerable to automation. Most recent projections seem to support this hypothesis since both *Process, plant and machine operatives* and *Transport and mobile machine drivers and operatives* are expected to decline. However, the replacement demand rate for *Transport and mobile machine drivers and operatives* is relatively high (around 2.9 per cent) which serves to offset the negative expansion demands.

The *Elementary occupations* category is composed of those occupations that require little or no prior training to carry out their tasks. *Elementary trades and related occupations* (such as *Building labourer/assistant*, and *Farmworkers*, among others) are expected to increase considerably by 2035. This subgroup also has one of the largest replacement demand growth rates for 2020-2035 (around 4.1 per cent). In contrast, *Elementary administration and service occupations* are expected to see employment decline by 2035. Indeed, this subcategory will experience the largest drop in net requirements (in absolute terms).

These occupational trends reflect the expected trends across the six broad sectors (see Section 3). The strong growth rates after the pandemic that are projected in *Construction, Business and other services*, and *Public administration, education and health* will increase employment levels for elementary trades and related occupations (such as *Building labourer/assistants*), *Caring personal service occupations*, *Health and social care associate professionals*, *Teaching and other educational professionals*, among other occupations. Meanwhile the decline of the *Manufacturing* sector's share of employment will negatively affect the employment levels for *Process, plant and machine operatives*, and *Skilled metal, electrical and electronic trades occupations*, among others.

Generally, these results are in line with the conclusion from the literature review, reported in *Working Paper 1*. This presented a review of international research on employment prospects by sector and by occupation. Health, social and personal care roles are the most frequently mentioned in the literature as areas of future employment growth. Education; professional services; sales/business development; creative, digital and design; green economy; information and communication; and natural and applied sciences are also widely predicted to grow. These areas cover both sectors and occupations.

[56] Taylor, A. *et al.,* (2022)

In contrast, the areas where there is a general expectation of job losses are focussed upon *Administrative/secretarial* and *Retail/cashier* work, as well as many jobs within *Manufacturing/production*, especially those which are vulnerable to automation. Jobs within some parts of the *Agricultural sector*, as well as certain parts of *Business administration/finance sectors*, are also widely predicted to see employment decline.

The occupational areas identified in the literature review as potential growth areas are grouped around: data and AI; engineering and cloud computing; people and culture; product development; sales, marketing and content; the care economy (which includes health); and the green economy. Growth is being driven by demand for both digital and human factors. There are also many new jobs that are likely to develop, or adaptations of existing jobs, which are very difficult to predict.

Differing outlooks are forecast for roles in food preparation/service and in transport which seem to reflect the pre- and post-pandemic scenarios. For example, post-pandemic forecasts tend to foresee a less optimistic prospect in areas such as *Accommodation/ hospitality* roles, which were previously expected to be growing rapidly. *Transportation* is by contrast regarded as having greater potential for employment growth post-pandemic, due to increased e-commerce, in contrast to earlier trends, although this may be offset by factors such as AI which is making driverless vehicles a real prospect.

4.3 Occupational trends by gender/employment status

Gender

Table 4.3, Table 4.4 and Figure 4.4 to Figure 4.7 show occupational employment prospects for males and females to 2035. Overall, it is expected that female employment will increase by around 1½ million between 2020 and 2035, whilst male employment will increase by 1.1 million over the same period. Despite this larger increase in female employment, the occupational structure of employment will remain strongly segregated. By 2035 *Caring, leisure and other service occupations* and *Administrative and secretarial occupations* will still mainly be represented by women, whilst *Process, plant and machine operatives*, *Skilled trades occupations* and *Managers, directors and senior* officials will still be composed primarily of male workers (see Table 4.3 and Table 4.4).

The largest employment increases for men are projected in *Professional occupations*, (858,000 extra jobs between 2020 and 2035). There will be also some male employment growth in *Administrative and secretarial* and *Caring, leisure and other service occupations*, accompanied by a more modest increase in *Elementary*, *Sales and customer service* and *Associate professional occupations*. Male job losses are expected for *Process, plant and machine operatives* and *Skilled trades occupations*.

The largest employment increase for women is expected in *Associate professional* and *Professional occupations* (729,000 and 707,000 extra jobs between 2020 and 2035, respectively). There will be also some female employment growth amongst *Managers, directors and senior officials* and *Caring, leisure and other service occupations*, with a modest increase in *Process, plant and machine operatives*, *Skilled trades* and *Elementary occupations*. The job losses projected for women are amongst *Administrative and secretarial* and *Sales and customer service occupations*.

Employment status

Figure 4.4 to Figure 4.7 depict the employment projections by employment status (i.e. full-time and part-time employees or self-employment).[57] In 2020, the total number of people in full-time jobs was around 20 million. This number represents 59 per cent of total employment in the UK. By 2035, it is projected that full-time jobs will represent the same share of UK employment (around 22 million jobs). Part-time and self-employed jobs will account for 28 per cent and 13 per cent of all jobs, respectively. There are some considerable different variations in the employment projections for occupations by employment status.

These results are driven by the structural differences in the needs from different sectors and gender trends and employment status mix within sectors. As previously mentioned, occupational (and sectoral) employment structure is still considerably segregated by gender. Males and females are impacted differently by economic changes. For instance, males in full time and self-employed jobs are relatively more affected by the changing prospects in jobs such as *Process, plant and machine operatives* and *Skilled trades* (where employment is declining). In contrast, female employment outcomes in full-time jobs are more sensitive to trends in *Caring, leisure and other service occupations* (where employment is expected to increase).

Full-time and part-time jobs in *Professional* and *Associate professional occupations* are expected to significantly increase between 2020 and 2035. A modest increase in self-employment is also expected for these occupational groups. The faster growth amongst professionals for part-time working is probably related to the rising concentration of women in this occupational group and a preference for more flexible working patterns.[58, 59] The *Managers, directors and senior officials* group exhibit a smaller increase in all forms of employment status.

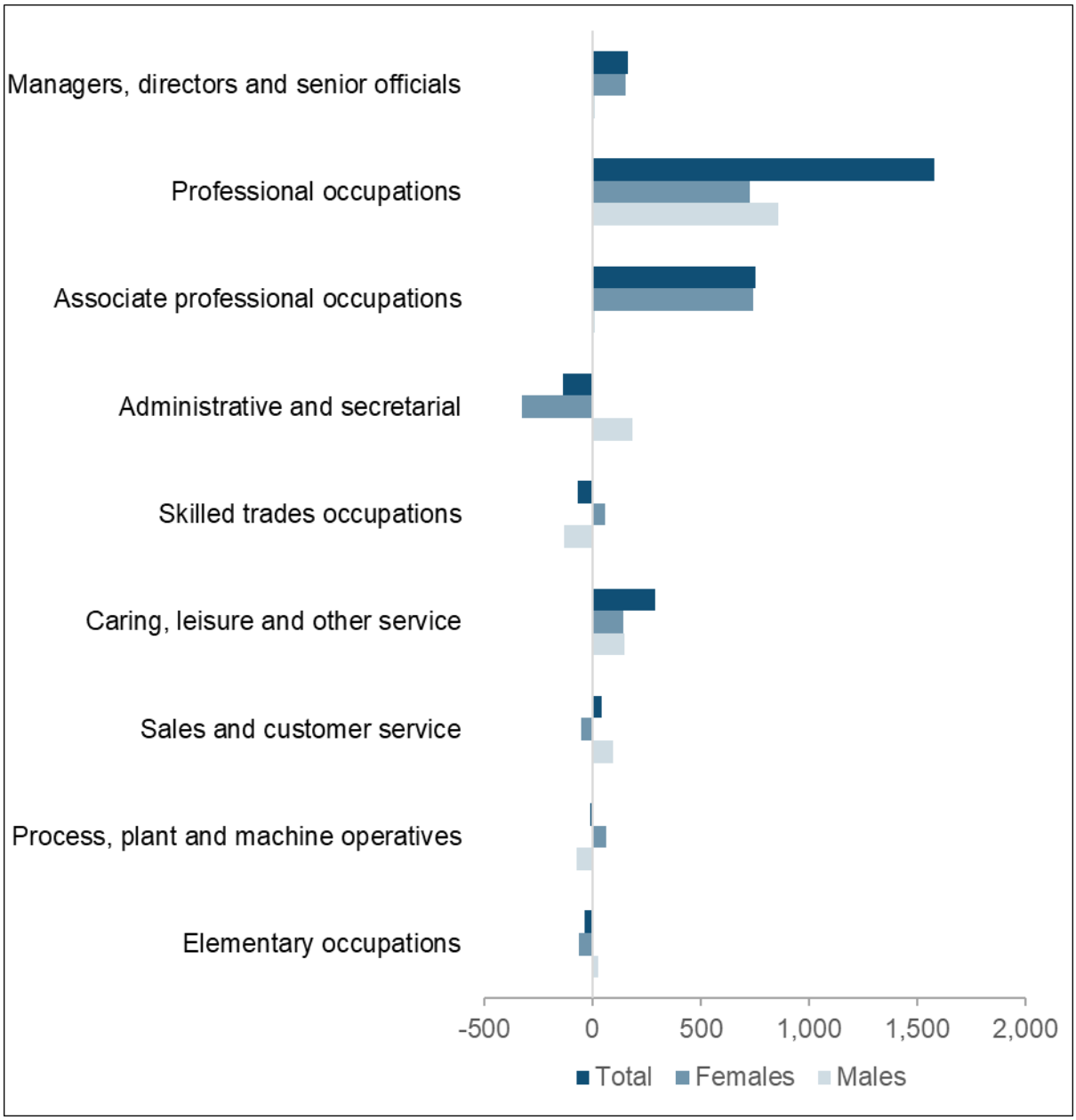
There are declines expected in both part and full-time jobs among *Administrative and secretarial occupations.* Small job losses are expected in all the employment status categories for *Sales and customer service occupations.*

For *Skilled trades occupations* and for *Process, plant and machine operatives*, job losses are expected amongst full-time jobs, especially for men. Female employment is projected to experience a small increase, especially in part-time jobs. Amongst *Caring, leisure and other service occupations*, there is considerable growth expected, primarily focused on females in full-time jobs. Male employment is projected to increase modestly in all the employment status categories.

Part-time jobs for both males and females are expected to decline in *Elementary occupations*. In contrast, self-employment and full-time jobs are projected to increase for both genders. Overall, self-employment is projected to see modest growth (around 464,000 extra jobs between 2020 and 2035). This employment status is expected to increase in all occupational groups, except for *Sales and customer service occupations*, where this type of job is expected to decrease slightly.

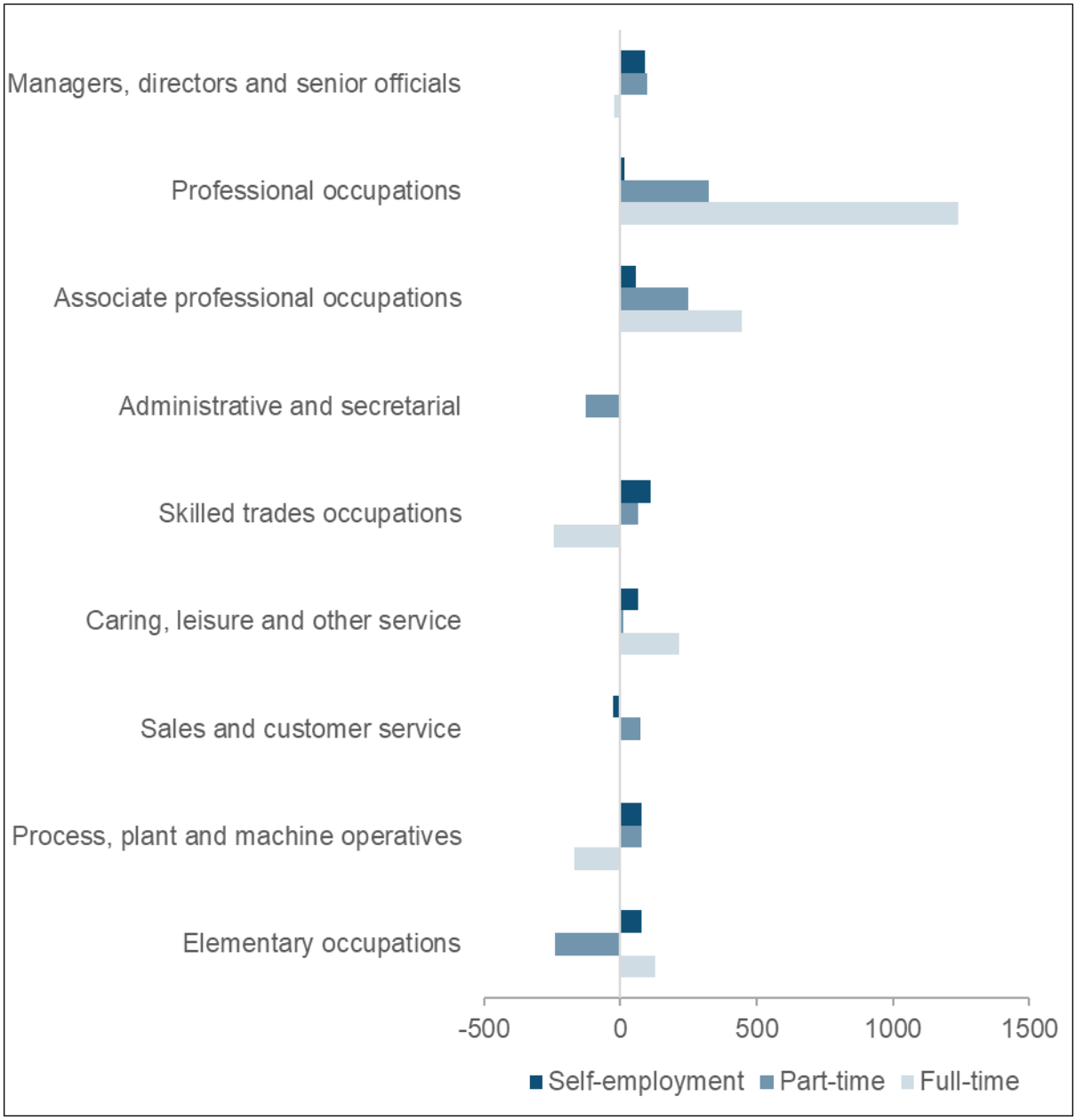
[57] These categories are defined as in the LFS (self- reporting). Part-time working is defined as those typically working fewer than 30 hours per week.
[58] Lund, S. *et al.,* (2021).
[59] Chung *et al.,* (2020); Chung *et al.,* (2021).

Figure 4.4 Occupational change by gender, 2020-2035: Total Employment (000s)



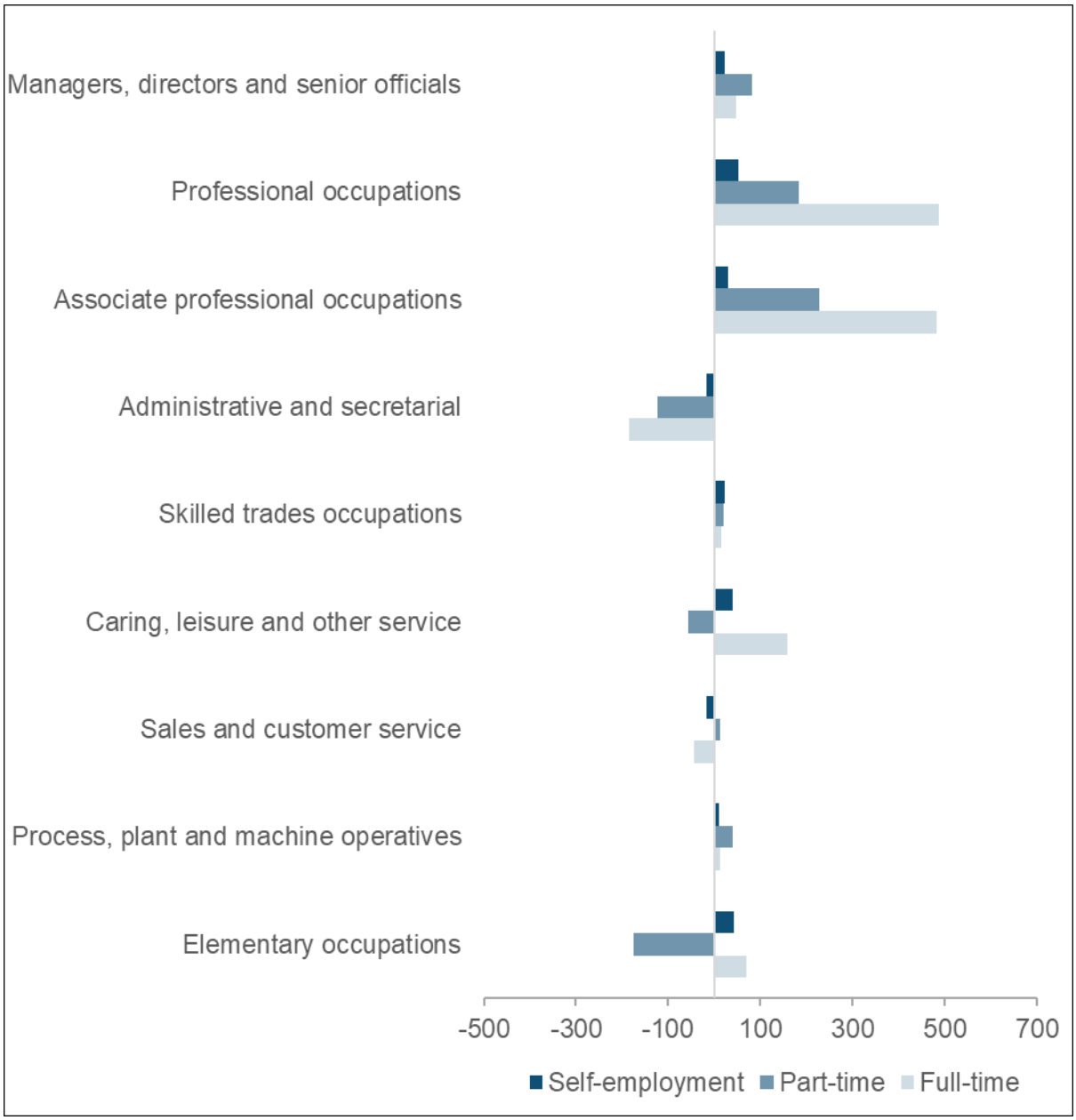
Source: IER estimates

Figure 4.5 Occupational change by employment status, 2020-2035: Males and Females (000s)



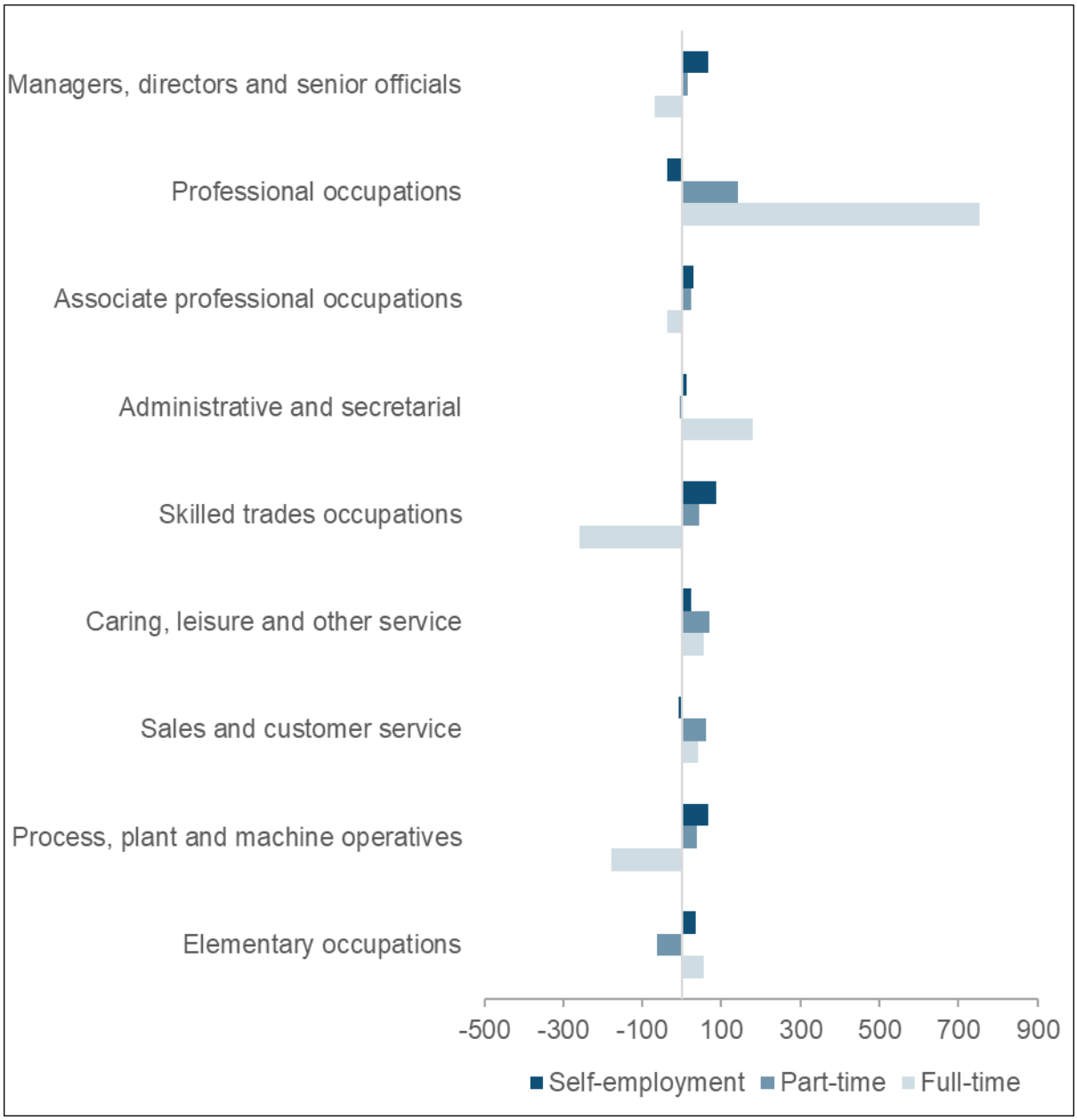
Source: IER estimates

Figure 4.6 Occupational change by employment status: Females, 2020-2035 (000s)



Source: IER estimates

Figure 4.7 Occupational change by employment status: Males, 2020-2035 (000s)



Source: IER estimates

Table 4.3 Females, Occupational categories, SOC2020 – Major Groups

Levels (000s)	2010	2015	2019	2020	2025	2035
Managers, directors and senior officials	931	1,076	1,304	1,372	1,326	1,525
Professional occupations	3,019	3,378	3,888	4,109	4,315	4,833
Associate professional occupations	1,671	1,941	2,144	2,261	2,623	3,001
Administrative and secretarial	2,864	2,785	2,729	2,688	2,677	2,365
Skilled trades occupations	299	368	366	383	408	444
Caring, leisure and other service	2,363	2,530	2,602	2,490	2,503	2,632
Sales and customer service	1,522	1,751	1,696	1,656	1,638	1,607
Process, plant and machine operatives	243	268	276	244	297	308
Elementary occupations	1,877	1,854	1,907	1,701	1,679	1,639
All occupations	**14,788**	**15,951**	**16,911**	**16,903**	**17,466**	**18,355**
Shares (%)	**2010**	**2015**	**2019**	**2020**	**2025**	**2035**
Managers, directors and senior officials	6%	7%	8%	8%	8%	8%
Professional occupations	20%	21%	23%	24%	25%	26%
Associate professional occupations	11%	12%	13%	13%	15%	16%
Administrative and secretarial	19%	17%	16%	16%	15%	13%
Skilled trades occupations	2%	2%	2%	2%	2%	2%
Caring, leisure and other service	16%	16%	15%	15%	14%	14%
Sales and customer service	10%	11%	10%	10%	9%	9%
Process, plant and machine operatives	2%	2%	2%	1%	2%	2%
Elementary occupations	13%	12%	11%	10%	10%	9%
All occupations	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Change (000s)	**2010-2015**	**2015-2019**	**2019-2020**	**2020-2025**	**2025-2035**	**2020-2035**
Managers, directors and senior officials	146	227	68	-45	198	153
Professional occupations	359	510	221	206	519	725
Associate professional occupations	271	203	116	362	379	741
Administrative and secretarial	-79	-56	-41	-11	-313	-323
Skilled trades occupations	69	-2	17	25	36	61
Caring, leisure and other service	167	72	-112	13	129	142
Sales and customer service	230	-56	-40	-18	-31	-49
Process, plant and machine operatives	25	7	-32	53	11	65
Elementary occupations	-23	54	-206	-22	-40	-62
All occupations	**1,163**	**960**	**-8**	**563**	**889**	**1,452**

Source: IER estimates

Table 4.4 Males, Occupational categories, SOC2020 – Major Groups

Levels (000s)	2010	2015	2019	2020	2025	2035
Managers, directors and senior officials	1,687	2,129	2,374	2,386	2,246	2,400
Professional occupations	3,411	3,507	3,948	4,102	4,537	4,959
Associate professional occupations	2,139	2,278	2,427	2,517	2,433	2,531
Administrative and secretarial	780	951	899	1,045	1,114	1,232
Skilled trades occupations	3,003	3,121	3,068	2,642	2,640	2,514
Caring, leisure and other service	580	619	649	638	693	786
Sales and customer service	1,126	1,136	1,122	1,133	1,182	1,228
Process, plant and machine operatives	1,788	1,845	1,933	1,718	1,730	1,644
Elementary occupations	1,960	2,118	2,033	1,891	1,981	1,919
All occupations	**16,473**	**17,705**	**18,454**	**18,072**	**18,556**	**19,213**
Shares (%)	**2010**	**2015**	**2019**	**2020**	**2025**	**2035**
Managers, directors and senior officials	10%	12%	13%	13%	12%	12%
Professional occupations	21%	20%	21%	23%	24%	26%
Associate professional occupations	13%	13%	13%	14%	13%	13%
Administrative and secretarial	5%	5%	5%	6%	6%	6%
Skilled trades occupations	18%	18%	17%	15%	14%	13%
Caring, leisure and other service	4%	3%	4%	4%	4%	4%
Sales and customer service	7%	6%	6%	6%	6%	6%
Process, plant and machine operatives	11%	10%	10%	10%	9%	9%
Elementary occupations	12%	12%	11%	10%	11%	10%
All occupations	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Change (000s)	**2010-2015**	**2015-2019**	**2019-2020**	**2020-2025**	**2025-2035**	**2020-2035**
Managers, directors and senior officials	442	245	12	-140	154	14
Professional occupations	97	441	154	435	422	857
Associate professional occupations	139	149	90	-84	98	14
Administrative and secretarial	171	-52	146	69	118	187
Skilled trades occupations	119	-53	-426	-2	-127	-129
Caring, leisure and other service	39	30	-11	55	93	148
Sales and customer service	10	-14	11	49	46	95
Process, plant and machine operatives	57	88	-215	12	-86	-74
Elementary occupations	158	-85	-143	91	-62	29
All occupations	**1232**	**749**	**-382**	**484**	**657**	**1141**

Source: IER estimates

5 More detailed occupational projections

Key messages

This section focuses upon the implications for occupations at the more detailed sub-major group level (2-digit SOC2020) and the 412 Unit Groups (4-digit SOC2020). The latter are a key component in the research programme as a whole. In the next phase of work, we will be examining changing patterns of skill demand within these detailed occupational categories.

As for the major groups, occupational trends at the 2-digit level generally tend to change quite slowly. The main 2-digit SOC2020 trends to 2035 are expected to favour high-skilled jobs such as *Science, research, engineering and technology professionals*, *Business, media and public service professionals* and *Health and social care associates*. Also, some medium and low-skilled jobs such as *Elementary trades and related occupations* and *Caring personal service occupations* are projected to experience substantial employment growth.

The number of jobs created due to economic growth (net change or expansion demand) to 2035 will be mainly concentrated in high-skilled jobs. Over 2020-2035, *Science, research, engineering and technology professionals* will experience the largest net increase (+0.88 million job openings), followed by *Health and social care associate professionals* (+0.63 million)

There will also be some new job openings for *Elementary trades and related occupations* (+0.45 million).

Replacement demands indicate the need to replace people who leave the workforce for different reasons. Replacement demands projections show that there will continue to be many job openings even for occupations that are projected to decline. This is the case for low-skilled occupations such as *Elementary administration and service occupations* (+ 1.38 million job openings), *Transport and mobile machine drivers* (+0.6 million) *and Operatives* and *Process, plant and machine operatives* (+0.29 million).

In order to work out implications for the demand for different kinds of employment skills, an even more detailed analysis is required. This section therefore presents a selection of detailed projections for the 412 4-digit level Unit Groups. These results will drive the analysis in the next phase of the project which links these results to implications for skills as measured in the US O*NET database and other related information.

5.1 Introduction

This section focuses upon the implications of the projections for patterns of employment by occupation at a more detailed level. The main focus is on the 26 sub-major groups in SOC2020. However, even this level of disaggregation is rather broad if one is interested in detailed implications for skills. One of the key objectives of this research programme is to explore implications at the more detailed 4-digit level of SOC. At this level, there are 412 Unit Groups.

As noted in the Introduction, it is important to understand that although these 4-digit occupational projections are presented in the form of detailed quantitative numbers, they should not be interpreted as precise and certain predictions. The results presented provide a

benchmark for debate and thinking about the future. They should not be regarded as precise forecasts of what will necessarily happen. Rather, the *Baseline projections* indicate a likely future, given a continuation of past patterns of behaviour and performance.

If policies and patterns of behaviour are changed, then alternative futures might be achieved. Other possibilities may also arise if some of the exogenous assumptions turn out differently. Some of these possibilities are considered in the *Alternative Scenarios* which have also been developed for this research programme and are discussed in the accompanying separate report.[60]

The *Baseline projections* presented in this report provide a consistent and systematic benchmark view across the whole economy and labour market. They are indicative of general trends and orders of magnitude, given the assumptions set out in detail in Sections 2-4 above.

5.2 Results for sub-major groups

Figure 5.1 and Figure 5.2 present a more detailed analysis for the 26 sub-major occupation groups (the 2-digit level of the SOC2020).

Managers, directors and senior officials: *Corporate managers* and directors represent a considerable number of workers in this category. However, the number of people working in this sub-category is expected to decrease by 2035. This pattern of decline may be in part due to classification changes introduced in the SOC2020, as well as the combined effect of Covid-19 and Brexit, which had a significant impact in 2021. The other category within this group is Other managers and proprietors. This sub-category includes the owners and managers of many small businesses, especially in the service sector. This group is projected to see employment grow substantially (by 200,000) over the coming decade as demand for these types of services continues to grow.

***Professional occupations*:** All the sub-categories included in this major group are projected to experience employment growth between 2020 and 2035. The sub-groups which will experience the most positive employment net change are *Science, research, engineering and technology professionals*, followed by *Business, media and public service professionals*, *Health professionals* and *Teaching and other educational professionals*. All these sub-groups have a similar replacement demand rate of growth for 2020-2035 (around 2.8 per cent pa).

***Associate professional and technical occupations*:** Substantial employment growth is projected for associate professional and technical occupations, especially for *Health and social care associate professionals*. This group is projected to experience the most rapid rates of increase of all sub-major groups between 2020 and 2035 and the highest replacement demand rate projected (around 4.6 per cent) by 2035. A high share of this increase is due to the rising demand for hospital services due to Covid-19. *Science, engineering and technology associate professionals* are also expected to see increases in employment, as well as *Business and public service associate professionals*. Total employment for *Protective service occupations* and *Culture, media and sports occupations* are projected to decrease between 2020 and 2035. It is important to note some changes introduced in the SOC2020 may have also affected the figures in these sub-categories (see Box 4.1).

[60] Wilson *et al*., (2022b)

***Administrative and secretarial occupations*:** The most recent data suggest that the number of people working in this occupational group will continue to decline in the following years. This phenomenon will be led by a considerable decline in *secretarial and related occupations* (such as *Secretaries, receptionists, typists*, among others). As pointed out by the ONS, a large share of these occupations is at risk of automation. Such occupations are amongst those most affected by the introduction of new technologies.[61] *Administrative occupations* are expecting to experience a modest positive employment net change.

Skilled trades occupations: Results within this group are mixed. On the one hand, the number employed in *Skilled metal, electrical and electronic trades* and *Skilled construction and building trades* is expected to decrease (net change) between 2020-2035. On the other hand, *Skilled agricultural and related trades* and *Textiles, printing and other skilled trade occupations* are projected to see a modest increase in employment numbers.

Caring, leisure and other service occupations: The results suggest that employment in this group will increase because of the increasing demand for health and related care from an ageing population. *Caring personal service occupations* will lead the way. In line with findings reported in *Working Paper 1* from this study, this subcategory is one of the fastest-growing groups in terms of growth rate over the period 2020-2035, with a replacement demand rate of 3.2 per cent per annum.[62] In contrast, *Leisure, travel and related personal service* and *Community and civil enforcement occupations* are projected to experience a decline in employment between 2020 and 2035.

Sales and customer service occupations: *Sales occupations* represent the group with the highest number of people employed. This subcategory is projected to decline by 2035. The replacement demand rate for this sub-category is 2.4 per cent pa. In contrast, *Customer service occupations* (such as *Call centre advisor/agent, telephone clerks,* etc.) are projected to experience a significant increase in employment by 2035.

Process, plant and machine operatives: In their report, the ONS has highlighted this group as one of the most vulnerable to automation.[63] The most recent projections seem to support this hypothesis since both *Process, plant and machine operatives* and *Transport and mobile machine drivers and operatives* are expected to decline. However, the replacement demand rate for *Transport and mobile machine drivers and operatives* is relatively high (around 2.9 per cent).

Elementary occupations: This category is composed of those occupations that require little or no prior training to carry out their tasks. *Elementary trades and related occupations* (such as *Building labourers/assistants, Farmworkers*, among others) are expected to increase by 2035 considerably. This subgroup also has one of the largest replacement demand growth rates for 2020-2035 (around 4.1 per cent). In contrast, *Elementary administration and service occupations* are expected to see employment decline by 2035. Indeed, this subcategory will experience the largest drop in net requirements (in absolute terms).

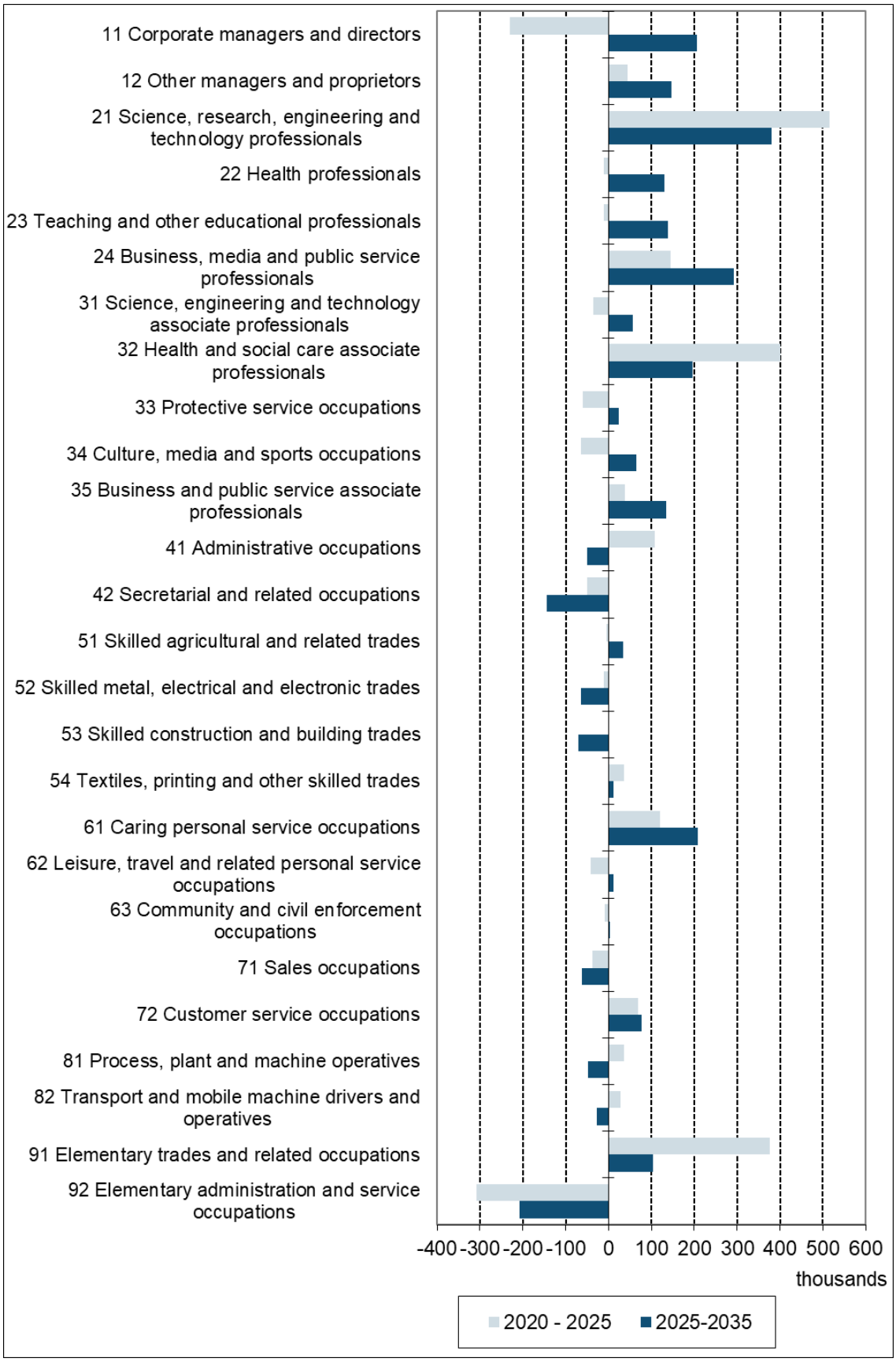
[61] ONS (2019c)
[62] (Taylor *et al*., (2022)
[63] ONS (2019c)

Table 5.1 Expansion and Replacement demand by occupation, 2020 – 2035

Levels (000s)	2020	2035	Net Change	Replacement Demand level	Total Requirement	Replacement Demand rate (pa)
11 Corporate managers and directors	2,611	2,586	-25	1,277	1,252	2.7%
12 Other managers and proprietors	1,146	1,338	192	696	888	3.2%
21 Science, research, engineering and technology professionals	2,167	3,065	898	1,043	1,941	2.7%
22 Health professionals	1,655	1,774	119	894	1,013	2.9%
23 Teaching and other educational professionals	1,818	1,947	129	940	1,069	2.8%
24 Business, media and public service professionals	2,570	3,006	436	1,338	1,774	2.8%
31 Science, engineering and technology associate professionals	690	711	21	279	299	2.3%
32 Health and social care associate professionals	682	1,279	597	643	1,240	4.5%
33 Protective service occupations	396	360	-36	120	84	1.8%
34 Culture, media and sports occupations	755	757	2	339	340	2.5%
35 Business and public service associate professionals	2,253	2,425	172	1,080	1,252	2.6%
41 Administrative occupations	3,058	3,117	59	1,575	1,635	2.8%
42 Secretarial and related occupations	675	480	-195	310	115	2.6%
51 Skilled agricultural and related trades	377	407	29	215	244	3.0%
52 Skilled metal, electrical and electronic trades	1,097	1,022	-74	409	335	2.1%
53 Skilled construction and building trades	905	835	-70	373	303	2.3%
54 Textiles, printing and other skilled trades	646	694	48	293	341	2.5%
61 Caring personal service occupations	2,359	2,688	329	1,416	1,744	3.2%
62 Leisure, travel and related personal service occupations	732	701	-31	356	325	2.7%
63 Community and civil enforcement occupations	38	30	-7	15	8	2.2%
71 Sales occupations	2,186	2,086	-100	994	893	2.5%
72 Customer service occupations	603	749	146	314	460	2.8%
81 Process, plant and machine operatives	768	757	-11	312	301	2.3%
82 Transport and mobile machine drivers and operatives	1,194	1,195	1	644	645	2.9%
91 Elementary trades and related occupations	462	944	482	391	872	4.2%
92 Elementary administration and service occupations	3,130	2,614	-515	1,359	844	2.4%
All occupations	**34,975**	**37,568**	**2,593**	**17,625**	**20,217**	**2.8%**

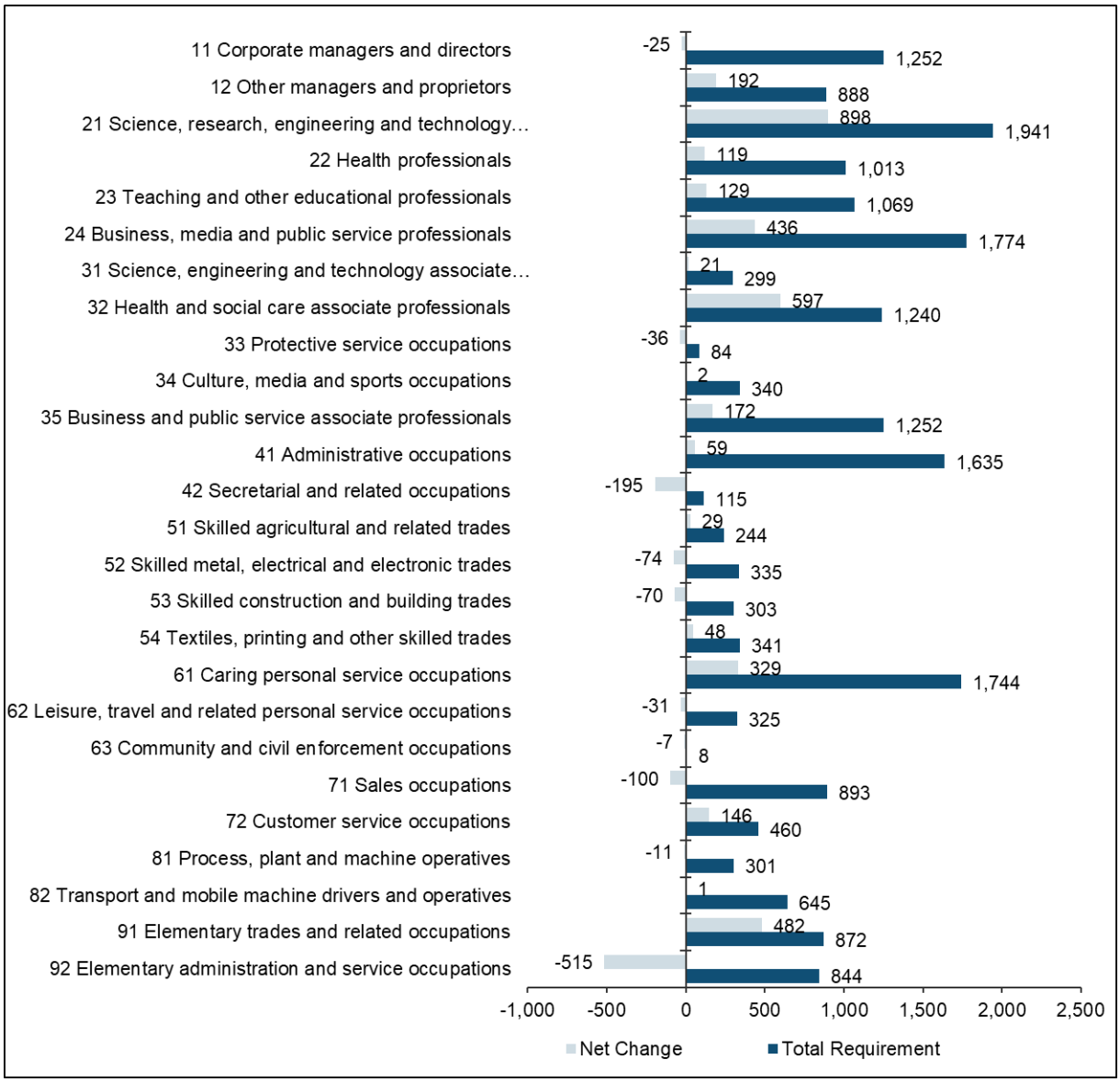
Source: IER estimates.

Figure 5.1 Detailed changes by occupation, 2020-2025, 2025-2035 (000s)



Source: IER estimates

Figure 5.2 Net Requirements by SOC2020 Sub-major Group, 2020-2035



Source: IER estimates

Box 5.1: Shift-share analysis of occupational change

Shift-share analysis is composed of three elements: ***scale, industrial and occupational effects.***

The **scale effect** indicates how much occupational employment growth/decline is due to the overall expansion/decline in the economy. This effect has the same rate for all occupations and industries.

The **industrial mix effect** refers to the share of occupational employment changes explained by changing patterns of employment by industry, assuming that occupational patterns of employment within industries remain fixed. This estimate is obtained by subtracting the total economy's national employment growth/decline rate (scale effect) from a particular industry's national employment growth/decline rate.

The **occupational effect** indicates how organisational and technological changes affect the occupational structure of employment within industries. It is measured as the difference between the total employment change in a specific occupation and the sum of the scale and industry effects.

It is important to note that the shift-share results depend on the level of industrial and occupational aggregation. Tables 5.2 and 5.3 present shift-share results (net employment changes) for the historical period 2015-2020 and for the projection period 2020-2035 for the 26 SOC2020 sub-major occupational groups and the 22 industry categories. The net changes are decomposed into each component.

5.3 Components of occupational change: Shift-share analysis

Shift-share analysis provides a detailed picture of the drivers of the historical and future occupational employment changes (see Box 5.1). Table 5.2 presents the results of the shift-share analysis which decomposes the observed changes into scale, industrial and occupational effects for the recent historical period 2015-2020.

The scale effect increased employment by approximately 4 per cent for all occupational groups over the period 2015-2020. This represented a slowdown compared with previous periods, where the scale effect accounted for a much more significant part of the occupational employment growth.[64] The present result reflects the combined effects of Covid-19 and Brexit which resulted in a significant decline in employment in 2020, thereby slowing the rate of employment growth in the UK over the period 2015-2020. The industrial mix effect had a relatively minor effect on employment growth/decline over this same period. For most occupations, the main driver of the historical occupational employment changes over this period was organisational and technological changes (the occupational effect).

Looking closely at the data, some heterogeneity between the occupational and industrial mix effects across occupational groups is observed. The industry mix effect was relatively and positively higher for *Skilled construction and building trades* and *Transport and mobile machine drivers and operatives*, whilst the occupational effects were negative for these occupational groups. The two effects do not necessarily always point in the same direction. Table 5.2 shows that employment levels in 13 out of 26 SOC2020 sub-major groups fell over the period 2015 to 2020. The negative impact of the first stages of the pandemic and Brexit contributed to this.

[64] Wilson *et al.,* (2020).

The occupational effect decreased employment for middle and low-skilled occupations (SOC2020 2-digit codes 41-92). *Elementary trades and related occupations* were the most affected group. In contrast, the occupational effect had a considerable and positive effect on employment growth for *Managers, directors and senior officials, Professional and Associate professional occupations* (SOC2020 2-digit codes 11-35). *Business, media and public service professionals* and *Science, engineering and technology associate professionals* had the most positive occupational effects.

The introduction of new technologies has tended to favour high-skilled jobs over middle and low-skilled jobs. Added to this effect, the pandemic and the Government's response to it impacted most on those occupational groups which were non-compatible with teleworking. These tend to be concentrated in the middle and low-skilled occupational groups.

Table 5.3 shows the components of occupational change between 2019 and 2021 to highlight the short-term impact of the pandemic and the immediate effects of Brexit. The weakening of the economy during this period (scale effect) caused a decrease in employment by approximately 0.6 per cent for all occupational groups. Employment levels in 17 out of 26 SOC2020 sub-major groups were negatively impacted by the pandemic and Brexit. The occupational effect had a considerable and negative impact on the level of employment in *Protective service*, *Skilled construction and building trades* and *Elementary administration and service occupations*. In general, the industry mix effect had only a minor effect on employment growth/decline over this period. However, for *Textiles, printing and other skilled trades* and *Elementary administration and service occupations,* the industry mix effect was relatively high (-3.6 per cent and -3.1 per cent, respectively).

Table 5.4 presents the shift-share analysis for the forecast period 2020-2035. The scale effect is projected to have a positive effect on employment growth compared to 2015-2020 (a 7½ per cent increase between 2020 and 2035).

The projections indicate that the occupation effect will be relatively high for *Health and social care associate professionals*, *Science, research, engineering and technology professionals* and *Elementary trades and related occupations*. The occupational effect will considerably reduce employment for *Secretarial and related occupations* and *Elementary administration and service occupations*. These results align with expectations about the impact of automation on some occupations and the higher demand for health services induced by the pandemic.

The industry mix effect is expected to continue to negatively impact the employment growth of *Process, plant and machine operatives*, *Skilled metal, electrical and electronic trades* and *Skilled agricultural and related trades*. These results reflect the effect of the ongoing deindustrialization process over UK occupational employment distribution.

Overall, these results suggest that non-manual and high-skilled occupations were the least affected by the short-term effects of the pandemic and the immediate impact of Brexit, and also are the occupations with better longer-term employment prospects.

Table 5.2 Total occupational employment, shift-share analysis, 2015-2020, UK: All industry sectors

							Components of change					
	Base year 2015		Target year 2020		Change 2015-2020		Scale effect		Occupation effect		Industry mix effect	
SOC2020 Sub-Major Groups	000s	% Share	000s	% Share	000s	%	000s	%	000s	%	000s	%
11 Corporate managers and directors	2,148	6.4	2,611	7.5	464	21.6	84	3.9	375	17.5	4	0.2
12 Other managers and proprietors	1,057	3.1	1,146	3.3	89	8.4	41	3.9	43	4.1	4	0.4
21 Science, research, engineering and technology professionals	1,804	5.4	2,167	6.2	363	20.1	71	3.9	267	14.8	26	1.4
22 Health professionals	1,432	4.3	1,655	4.7	224	15.6	56	3.9	155	10.8	12	0.9
23 Teaching and other educational professionals	1,647	4.9	1,818	5.2	171	10.4	65	3.9	158	9.6	-51	-3.1
24 Business, media and public service professionals	2,002	5.9	2,570	7.3	567	28.3	78	3.9	470	23.5	19	0.9
31 Science, engineering and technology associate professionals	543	1.6	690	2.0	147	27.1	21	3.9	121	22.2	5	1.0
32 Health and social care associate professionals	595	1.8	682	2.0	87	14.7	23	3.9	61	10.2	3	0.6
33 Protective service occupations	363	1.1	396	1.1	33	9.0	14	3.9	15	4.1	4	1.0
34 Culture, media and sports occupations	691	2.1	755	2.2	64	9.3	27	3.9	43	6.2	-6	-0.8
35 Business and public service associate professionals	2,027	6.0	2,253	6.4	226	11.2	79	3.9	142	7.0	5	0.3
41 Administrative occupations	2,983	8.9	3,058	8.7	75	2.5	117	3.9	-48	-1.6	6	0.2
42 Secretarial and related occupations	752	2.2	675	1.9	-77	-10.3	29	3.9	-112	-14.8	5	0.7
51 Skilled agricultural and related trades	405	1.2	377	1.1	-27	-6.8	16	3.9	-29	-7.3	-14	-3.4

							Components of change					
	Base year 2015		Target year 2020		Change 2015-2020		Scale effect		Occupation effect		Industry mix effect	
SOC2020 Sub-Major Groups	000s	% Share	000s	% Share	000s	%	000s	%	000s	%	000s	%
52 Skilled metal, electrical and electronic trades	1,243	3.7	1,097	3.1	-146	-11.8	49	3.9	-184	-14.8	-11	-0.9
53 Skilled construction and building trades	1,086	3.2	905	2.6	-181	-16.6	43	3.9	-262	-24.2	39	3.6
54 Textiles, printing and other skilled trades	756	2.2	646	1.8	-109	-14.5	30	3.9	-140	-18.5	1	0.1
61 Caring personal service occupations	2,378	7.1	2,359	6.7	-20	-0.8	93	3.9	-106	-4.5	-6	-0.3
62 Leisure, travel and related personal service occupations	735	2.2	732	2.1	-3	-0.5	29	3.9	-37	-5.1	5	0.7
63 Community and civil enforcement occupations	35	0.1	38	0.1	2	6.8	1	3.9	1	2.2	0	0.6
71 Sales occupations	2,342	7.0	2,186	6.3	-156	-6.7	92	3.9	-184	-7.9	-63	-2.7
72 Customer service occupations	545	1.6	603	1.7	57	10.5	21	3.9	40	7.4	-4	-0.8
81 Process, plant and machine operatives	905	2.7	768	2.2	-136	-15.1	35	3.9	-164	-18.1	-8	-0.9
82 Transport and mobile machine drivers and operatives	1,208	3.6	1,194	3.4	-15	-1.2	47	3.9	-82	-6.8	20	1.7
91 Elementary trades and related occupations	586	1.7	462	1.3	-124	-21.2	23	3.9	-148	-25.2	1	0.1
92 Elementary administration and service occupations	3,386	10.1	3,130	8.9	-256	-7.6	133	3.9	-392	-11.6	4	0.1
All occupations	**33,656**	**100.0**	**34,975**	**100.0**	**1,319**	**3.9**						

Source: IER estimates

Table 5.3 Total occupational employment, shift-share analysis, 2019-2021, UK: All industry sectors

SOC2020 Sub-Major Groups	Base year 2019		Target year 2021		Change 2019-2021		Components of change					
							Scale effect		Occupation effect		Industry mix effect	
	000s	% Share	000s	% Share	000s	%	000s	%	000s	%	000s	%
11 Corporate managers and directors	2,544	7.2	2,285	6.5	-259	-10.2	-16	-0.6	-262	-10.3	19	0.7
12 Other managers and proprietors	1,133	3.2	1,127	3.2	-6	-0.6	-7	-0.6	18	1.6	-17	-1.5
21 Science, research, engineering and technology professionals	2,079	5.9	2,519	7.2	441	21.2	-13	-0.6	441	21.2	13	0.6
22 Health professionals	1,646	4.7	1,582	4.5	-64	-3.9	-10	-0.6	-92	-5.6	39	2.3
23 Teaching and other educational professionals	1,741	4.9	1,740	5.0	0	0.0	-11	-0.6	-3	-0.2	14	0.8
24 Business, media and public service professionals	2,372	6.7	2,583	7.4	211	8.9	-15	-0.6	209	8.8	17	0.7
31 Science, engineering and technology associate professionals	640	1.8	628	1.8	-12	-1.8	-4	-0.6	-11	-1.7	3	0.5
32 Health and social care associate professionals	665	1.9	1,001	2.8	336	50.4	-4	-0.6	326	49.0	14	2.1
33 Protective service occupations	374	1.1	324	0.9	-51	-13.5	-2	-0.6	-56	-14.9	8	2.0
34 Culture, media and sports occupations	706	2.0	662	1.9	-44	-6.3	-5	-0.6	-36	-5.1	-4	-0.5
35 Business and public service associate professionals	2,185	6.2	2,222	6.3	37	1.7	-14	-0.6	35	1.6	16	0.7
41 Administrative occupations	2,936	8.3	3,155	9.0	219	7.5	-19	-0.6	215	7.3	23	0.8
42 Secretarial and related occupations	691	2.0	672	1.9	-19	-2.8	-4	-0.6	-17	-2.4	2	0.3
51 Skilled agricultural and related trades	408	1.2	357	1.0	-51	-12.5	-3	-0.6	-38	-9.3	-11	-2.6
52 Skilled metal, electrical and electronic trades	1,262	3.6	1,103	3.1	-159	-12.6	-8	-0.6	-121	-9.6	-31	-2.4
53 Skilled construction and building trades	1,074	3.0	924	2.6	-150	-14.0	-7	-0.6	-134	-12.5	-9	-0.9

SOC2020 Sub-Major Groups	Base year 2019		Target year 2021		Change 2019-2021		Components of change					
							Scale effect		Occupation effect		Industry mix effect	
	000s	% Share	000s	% Share	000s	%	000s	%	000s	%	000s	%
54 Textiles, printing and other skilled trades	689	1.9	674	1.9	-16	-2.3	-4	-0.6	14	2.0	-25	-3.6
61 Caring personal service occupations	2,426	6.9	2,381	6.8	-45	-1.9	-15	-0.6	-70	-2.9	40	1.6
62 Leisure, travel and related personal service occupations	795	2.2	679	1.9	-116	-14.6	-5	-0.6	-103	-13.0	-7	-0.9
63 Community and civil enforcement occupations	31	0.1	27	0.1	-4	-11.7	0	-0.6	-3	-11.0	0	0.0
71 Sales occupations	2,227	6.3	2,151	6.1	-77	-3.4	-14	-0.6	-77	-3.5	15	0.7
72 Customer service occupations	590	1.7	638	1.8	48	8.1	-4	-0.6	51	8.7	1	0.1
81 Process, plant and machine operatives	871	2.5	817	2.3	-54	-6.2	-6	-0.6	-40	-4.6	-8	-1.0
82 Transport and mobile machine drivers and operatives	1,338	3.8	1,222	3.5	-116	-8.6	-9	-0.6	-106	-7.9	-1	-0.1
91 Elementary trades and related occupations	523	1.5	793	2.3	270	51.5	-3	-0.6	273	52.2	0	-0.1
92 Elementary administration and service occupations	3,418	9.7	2,875	8.2	-543	-15.9	-22	-0.6	-414	-12.1	-108	-3.1
All occupations	**35,365**	**100.0**	**35,140**	**100.0**	**-225**	**-0.6**						

Source: IER estimates

Table 5.4 Total occupational employment, shift-share analysis, 2020-2035, UK: All industry sector

							Components of change					
	Base year 2020		Target year 2035		Change 2020-2035		Scale effect		Occupation effect		Industry mix effect	
SOC2010 Sub-Major Groups	000s	% Share	000s	% Share	000s	%	000s	%	000s	%	000s	%
11 Corporate managers and directors	2,611	7.5	2,586	6.9	-25	-1.0	194	7.4	-176	-6.8	-42	-1.6
12 Other managers and proprietors	1,146	3.3	1,338	3.6	192	16.7	85	7.4	93	8.2	13	1.2
21 Science, research, engineering and technology professionals	2,167	6.2	3,065	8.2	898	41.4	161	7.4	747	34.5	-10	-0.5
22 Health professionals	1,655	4.7	1,774	4.7	119	7.2	123	7.4	-77	-4.7	74	4.4
23 Teaching and other educational professionals	1,818	5.2	1,947	5.2	129	7.1	135	7.4	23	1.2	-29	-1.6
24 Business, media and public service professionals	2,570	7.3	3,006	8.0	436	17.0	191	7.4	247	9.6	-2	-0.1
31 Science, engineering and technology associate professionals	690	2.0	711	1.9	21	3.0	51	7.4	-21	-3.0	-10	-1.4
32 Health and social care associate professionals	682	2.0	1,279	3.4	597	87.5	51	7.4	516	75.6	30	4.4
33 Protective service occupations	396	1.1	360	1.0	-36	-9.1	29	7.4	-58	-14.8	-7	-1.8
34 Culture, media and sports occupations	755	2.2	757	2.0	2	0.2	56	7.4	-55	-7.3	1	0.1
35 Business and public service associate professionals	2,253	6.4	2,425	6.5	172	7.6	167	7.4	36	1.6	-32	-1.4
41 Administrative occupations	3,058	8.7	3,117	8.3	59	1.9	227	7.4	-138	-4.5	-29	-1.0
42 Secretarial and related occupations	675	1.9	480	1.3	-195	-29.0	50	7.4	-256	-37.9	10	1.5
51 Skilled agricultural and related trades	377	1.1	407	1.1	29	7.8	28	7.4	10	2.6	-8	-2.2
52 Skilled metal, electrical and electronic trades	1,097	3.1	1,022	2.7	-74	-6.8	81	7.4	-106	-9.6	-50	-4.6

							Components of change					
	Base year 2020		Target year 2035		Change 2020-2035		Scale effect		Occupation effect		Industry mix effect	
SOC2010 Sub-Major Groups	**000s**	**% Share**	**000s**	**% Share**	**000s**	**%**	**000s**	**%**	**000s**	**%**	**000s**	**%**
53 Skilled construction and building trades	905	2.6	835	2.2	-70	-7.7	67	7.4	-147	-16.2	10	1.1
54 Textiles, printing and other skilled trades	646	1.8	694	1.8	48	7.4	48	7.4	-9	-1.4	9	1.3
61 Caring personal service occupations	2,359	6.7	2,688	7.2	329	13.9	175	7.4	55	2.3	99	4.2
62 Leisure, travel and related personal service occupations	732	2.1	701	1.9	-31	-4.2	54	7.4	-81	-11.0	-4	-0.6
63 Community and civil enforcement occupations	38	0.1	30	0.1	-7	-19.1	3	7.4	-10	-27.7	0	1.2
71 Sales occupations	2,186	6.3	2,086	5.6	-100	-4.6	162	7.4	-185	-8.4	-78	-3.5
72 Customer service occupations	603	1.7	749	2.0	146	24.2	45	7.4	105	17.5	-4	-0.7
81 Process, plant and machine operatives	768	2.2	757	2.0	-11	-1.4	57	7.4	-12	-1.5	-56	-7.3
82 Transport and mobile machine drivers and operatives	1,194	3.4	1,195	3.2	1	0.1	88	7.4	-85	-7.1	-3	-0.2
91 Elementary trades and related occupations	462	1.3	944	2.5	482	104.2	34	7.4	459	99.3	-12	-2.5
92 Elementary administration and service occupations	3,130	8.9	2,614	7.0	-515	-16.5	232	7.4	-877	-28.0	130	4.1
All occupations	**34,975**	**100.0**	**37,568**	**100.0**	**2,593**	**7.4**						

Source: IER estimates

5.4 Results for Unit Groups – 4-digit projections to 2035

This section describes how the more detailed occupational projections for Unit Groups have been developed:

- the data are based on the LFS, which is a household survey rather than one of employers[65]
- the sample size is small when it to comes to establishing trends at a very detailed levels (if the data are cross classified by industry and occupation at the most detailed level many cells are empty)
- direct information on the latest SOC2020 system for classifying occupations is only available for 1 year (2021).

The information available at this most detailed level is therefore quite limited, and it is difficult to establish robust information on trends over time. Two sets of assumptions have been adopted for making the projections at this more detailed level:

(i) shares of unit groups within sub-major occupational groups remain fixed at their 2021 values

(ii) shares of unit groups are allowed to change:

- in line with trends based on converting data for SOC2010 categories over the period 2011-2020, to SOC2020 using a mapping developed with ONS
- combined with judgements based on a review of recent research on likely developments as a result of technological developments such as AI.

In the *Baseline projections*, the first option is used. The second option is adopted as part of the exploration of the Alternative macroeconomic scenarios, as described in the separate report.

This set of results at the 4-digit projections are therefore based on some very simple assumptions about occupational shares at the most detailed level (as summarised in Box 5.2).

In the *Baseline projections* presented here, we are assuming that more detailed 4-digit occupational patterns remain fixed at the 2021 levels. The results then show the impact of the sectoral and broader level occupational changes, given that assumption.

The *Alternative scenarios* consider some variation to that fixed-pattern assumption. This is based on an analysis of recent historical trends in the LFS data, as well as our review of the literature on recent trends and the impact of automation, AI and other factors.

[65] The LFS is a typical household survey which relies on individual self-assessment (in some cases by proxy if the individual is not present at the time of the survey). Surveys of employers, based on employment records, can provide more reliable information.

Box 5.2: Extension of the occupational database to 4-digit level of SOC2020

This box describes how the results are expanded from the 26 2-digit occupational level to the 412 4-digit Unit Groups. This involves translating information on the old SOC2010 classification to the latest SOC2020 one.

In principle, LFS data prior to 2021 can be converted to SOC2020 using the crosswalk between SOC2010-SOC2020 developed by the ONS. This enables the generation of historical time series, from which trends might be extrapolated.

For 2021 data classified using the new SIC2020 system are available. LFS data for 2021 were used to compute shares of 4-digit occupations within 2-digit groups for all industries. When compared with the estimates for 2010-2020 based on the use of the crosswalk it was apparent that there is a marked discontinuity between 2020 and 2021 at the 4-digit level. ONS has raised some concerns about this, but it remains unclear how much this represents real differences or some statistical discontinuity.

Around 220 occupations at 4-digit level in the SOC2010 (out of the full set of 369) have a one-to-one match with a SOC2020 Unit Group. Nevertheless, the use of this crosswalk at the more detailed 4-digit level, especially when cross-classified by industry of employment and other characteristics of interest (such as gender, status and region) is limited by the data available in the LFS. This is patchy, with many cells being empty.

It was therefore decided that for the *Baseline projections* employment shares of the 4-digit SOC2020 Unit Groups within 2-digit categories would be assumed to be fixed at their 2021 values (this was the first year that such information was published). The latest ONS data using SOC2020 at the time the projections were prepared relate to the 4th quarter of 2021.These shares were then applied to all industries and for all projected years (2022-2035). A RAS process was then used to generate results for separate industries, maintaining the same detailed results by industry, status and gender at the SIC 2-digit level.

Using the LFS data to compute shares of 4-digit occupations within 2-digit groups raises a number of methodological issues that need to be addressed. Primarily, these methodological problems have to do with the fact that some 4-digit occupations are industry-specific. Imputing the occupational shares across all industries may indicate that the largest share of some industry-specific occupations corresponds to an inappropriate sector (e.g. textile operatives appearing in food, drink, and tobacco, rather than in the textiles industry).

The final results guarantee that:

- The 75 industry employment totals from the macroeconomic model
- The 2-digit occupational totals

and within those

- the 75 industry x 2-digit occupational totals are maintained consistently throughout the projection period.

The following steps have been undertaken to address these issues:

Step 1 – using 2021 LFS data generate a set of shares of 4-digit within 2-digit categories for each of 75 industries (also covering other dimensions such as gender and status and region)

Step 2 – where there are gaps, use the nearest equivalent (more aggregate category)

Step 3 – apply the final shares to the existing employment database to generate a full data array of employment levels – 4-digit occupation by 75 industries for 2021-35.

Tables 5.5 to Table 5.9 show the projections for SOC2020 Unit groups (4-digit level) for the *Baseline projections.* Table 5.5 presents information on the top 20 occupations in 2021 in terms of employment levels. The occupation with the highest employment level was *Sales and retail assistants* (around 1,030,749 people employed), followed by *Care workers and home carers* (around 905,735 people) and *Other administrative occupations* (around 646,854 people).

By 2035, two patterns of change can be observed: First, it is expected that *Care workers and home carers* will become the occupation that holds the highest share of the people employed in the UK. This ranking change may be explained by the greater demand for health services, in part due to the pandemic.

Second, automatable occupations such as *Cleaners and domestics, Retail cashiers and check-out operators, Delivery drivers and couriers* will tend to lose their positions in the ranking of occupations with the highest number of people employed. Meanwhile, digital-related occupations such as *Programmers and software development professionals* will tend to move up in the ranking by 2035.

Table 5.6 and Table 5.7 display the top 20 occupations with the highest projected employment growth and declines in absolute terms, respectively. Following the previous results, these tables show that occupations in health services and digital-related occupations will increase considerably in the projection period[66]. In contrast, low-skilled and automatable (operative) occupations will tend to have the largest declines in absolute terms.

Specifically, *Care workers and home carers*, *Programmers and software development professionals*, *Higher level teaching assistants* and *Nursing auxiliaries and assistants* will experience the largest growth in absolute terms by 2035 (Table 5.6). In contrast, *Receptionists, Personal assistants and other secretaries* and *Warehouse operatives* will experience the largest declines in absolute terms (Table 5.7). These tables provide an indication of the occupations with the highest growth/declines in the number of people employed and point to where the largest labour market opportunities and training requirements will arise. The largest occupations in terms of employment level will also tend to have the largest variations in absolute terms.

In order to have a more complete picture, Table 5.8 and Table 5.9 shows the top 20 occupations with the highest projected employment growth and declines in *relative terms* (i.e. percentage rates of change), respectively in the UK labour market. The ranking in these tables is not affected by the fact that some occupations have higher numbers of people employed. Nevertheless, it can be observed that health services related occupations such as *Pharmaceutical technicians* and *Health associate professionals n.e.c.* are still expected to experience some of the highest positive growth rates by 2035. In the *Baseline projections* the shares with 2-digit categories are assumed to be fixed, so the percentage changes are common for 4-digit categories within a 2-digit category.

Table 5.8 also reflects a higher demand for green-related occupations such as *Conservation professionals*. *Higher level teaching assistants*, *Veterinary nurses* and Early *education and childcare practitioners* will also experience some of the highest percentage growth rates by 2035.

In contrast, Table 5.9 shows that Unit Groups within *Skilled trades* and *Administrative and secretarial occupations* will experience the highest percentage declines. Specifically, skilled trades such as *Floorers and wall tilers, Plumbers and heating and ventilating installers and*

[66] Wilson *et al.,* (2020)

repairers, Roofers, roof tilers and slaters, among others will experience a decrease of around 10 per cent in the number of people employed. *Administrative and secretarial occupations* such as *Legal secretaries, Company secretaries and administrators, Personal assistants and other secretaries*, among others will experience a larger reduction of around 29 per cent in the number of people employed.

Table 5.5 Top 20 4-digit occupations in terms of Employment levels in 2021

Occupation Code (412) and Name	Occ(26)	2021	rank	2035	rank
7111 Sales and retail assistants	71	1,030,749	1	999,820	2
6135 Care workers and home carers	61	905,735	2	1,022,476	1
4159 Other administrative occupations n.e.c.	41	646,854	3	639,121	3
6131 Nursing auxiliaries and assistants	61	530,606	4	598,996	5
2134 Programmers and software development professionals	21	505,332	5	614,881	4
4122 Book-keepers, payroll managers and wages clerks	41	502,749	6	496,738	7
9252 Warehouse operatives	92	488,565	7	444,309	9
1131 Financial managers and directors	11	444,425	8	503,005	6
9263 Kitchen and catering assistants	92	439,973	9	400,119	12
7219 Customer service occupations n.e.c.	72	391,610	10	459,640	8
2313 Secondary education teaching professionals	23	376,885	11	421,592	10
7112 Retail cashiers and check-out operators	71	362,870	12	351,982	17
2314 Primary education teaching professionals	23	361,992	13	404,932	11
9223 Cleaners and domestics	92	357,412	14	325,037	21
3556 Sales accounts and business development managers	35	355,203	15	387,787	13
2440 Business and financial project management professionals	24	325,553	16	378,884	15
9131 Industrial cleaning process occupations	91	311,714	17	371,202	16
8214 Delivery drivers and couriers	82	311,106	18	304,139	23
1150 Managers and directors in retail and wholesale	11	303,362	19	343,349	18
2319 Teaching professionals n.e.c.	23	299,487	20	335,013	19

Source: IER estimates

Table 5.6 Top 20 4-digit occupations in terms of employment growth in absolute terms, 2021-2035

	Employment					Change 2021-2035			
Occupation Code (412) and Name	**Occ(26)**	**2021**	**rank**	**2035**	**rank**		**rank**	**%**	**rank**
6135 Care workers and home carers	61	905,735	2	1,022,476	1	116,741	1	12.9	163
2134 Programmers and software development professionals	21	505,332	5	614,881	4	109,549	2	21.7	28
3231 Higher level teaching assistants	32	296,344	21	378,893	14	82,550	3	27.9	1
6131 Nursing auxiliaries and assistants	61	530,606	4	598,996	5	68,390	4	12.9	160
7219 Customer service occupations n.e.c.	72	391,610	10	459,640	8	68,030	5	17.4	72
9131 Industrial cleaning process occupations	91	311,714	17	371,202	16	59,488	6	19.1	49
1131 Financial managers and directors	11	444,425	8	503,005	6	58,580	7	13.2	139
2132 IT managers	21	267,829	23	325,891	20	58,062	8	21.7	25
2133 IT business analysts, architects and systems designers	21	261,700	25	318,433	22	56,733	9	21.7	27
3229 Welfare and housing associate professionals n.e.c.	32	197,485	40	252,497	30	55,012	10	27.9	6
2440 Business and financial project management professionals	24	325,553	16	378,884	15	53,331	11	16.4	95
2313 Secondary education teaching professionals	23	376,885	11	421,592	10	44,707	12	11.9	206
2314 Primary education teaching professionals	23	361,992	13	404,932	11	42,940	13	11.9	213
2422 Finance and investment analysts and advisers	24	257,402	28	299,569	24	42,166	14	16.4	104
1150 Managers and directors in retail and wholesale	11	303,362	19	343,349	18	39,987	15	13.2	145
2139 Information technology professionals n.e.c.	21	175,487	54	213,530	40	38,043	16	21.7	29
2129 Engineering professionals n.e.c.	21	165,134	60	200,933	45	35,799	17	21.7	38
2319 Teaching professionals n.e.c.	23	299,487	20	335,013	19	35,526	18	11.9	208
2421 Chartered and certified accountants	24	204,433	38	237,922	32	33,489	19	16.4	92
1251 Property, housing and estate managers	12	178,628	51	212,055	43	33,426	20	18.7	53

Source: IER estimates

Table 5.7 Top 20 4-digit occupations in terms of Employment Change 2021-2035 (largest declines in absolute terms)

	Employment					Change 2021-2035			
Occupation Code (412) and Name	**Occ(26)**	**2021**	**rank**	**2035**	**rank**		**rank**	**%**	**rank**
7112 Retail cashiers and check-out operators	71	362,870	12	351,982	17	-10,888	393	-3.0	308
5231 Vehicle technicians, mechanics and electricians	52	162,575	62	150,663	74	-11,913	394	-7.3	340
5223 Metal working production and maintenance fitters	52	177,063	53	164,088	65	-12,974	395	-7.3	333
4212 Legal secretaries	42	46,246	211	32,993	278	-13,253	396	-28.7	412
5315 Plumbers & heating and ventilating installers and repairers	53	142,205	72	128,540	86	-13,665	397	-9.6	395
9211 Postal workers, mail sorters and messengers	92	175,097	55	159,236	67	-15,861	398	-9.1	390
9265 Bar staff	92	190,461	43	173,209	57	-17,253	399	-9.1	386
5241 Electricians and electrical fitters	52	245,108	30	227,147	36	-17,960	400	-7.3	323
5316 Carpenters and joiners	53	189,873	44	171,627	59	-18,246	401	-9.6	401
5319 Construction and building trades n.e.c.	53	203,190	39	183,665	52	-19,526	402	-9.6	400
4211 Medical secretaries	42	80,058	125	57,116	188	-22,942	403	-28.7	407
9264 Waiters and waitresses	92	260,034	26	236,479	33	-23,555	404	-9.1	383
9231 Security guards and related occupations	92	261,783	24	238,070	31	-23,713	405	-9.1	371
4213 School secretaries	42	98,736	99	70,441	156	-28,295	406	-28.7	408
7111 Sales and retail assistants	71	1,030,749	1	999,820	2	-30,928	407	-3.0	310
9223 Cleaners and domestics	92	357,412	14	325,037	21	-32,376	408	-9.1	385
9263 Kitchen and catering assistants	92	439,973	9	400,119	12	-39,854	409	-9.1	387
9252 Warehouse operatives	92	488,565	7	444,309	9	-44,256	410	-9.1	381
4215 Personal assistants and other secretaries	42	181,531	49	129,510	85	-52,021	411	-28.7	410
4216 Receptionists	42	235,917	31	168,310	61	-67,607	412	-28.7	406

Source: IER estimates

Table 5.8 Top 20 4-digit occupations in terms of Employment Change 2021-2035 (per cent change)

		Employment				Change 2021-2035			
Occupation Code (412) and Name	**Occ(26)**	**2021**	**rank**	**2035**	**rank**		**rank**	**%**	**rank**
3231 Higher level teaching assistants	32	296,344	21	378,893	14	82,550	3	27.9	1
3240 Veterinary nurses	32	22,750	323	29,087	298	6,337	140	27.9	2
3232 Early education and childcare practitioners	32	85,597	116	109,442	102	23,844	33	27.9	3
3221 Youth and community workers	32	74,184	136	94,849	115	20,665	42	27.9	4
3222 Child and early years officers	32	65,109	154	83,246	129	18,137	49	27.9	5
3229 Welfare and housing associate professionals n.e.c.	32	197,485	40	252,497	30	55,012	10	27.9	6
3213 Medical and dental technicians	32	52,832	189	67,549	165	14,717	62	27.9	7
3219 Health associate professionals n.e.c.	32	25,808	301	32,997	277	7,189	128	27.9	8
3224 Counsellors	32	38,343	245	49,024	210	10,681	88	27.9	9
3214 Complementary health associate professionals	32	32,373	271	41,390	245	9,018	108	27.9	10
3212 Pharmaceutical technicians	32	37,779	247	48,302	213	10,524	92	27.9	11
3223 Housing officers	32	63,603	156	81,320	136	17,717	51	27.9	12
3211 Dispensing opticians	32	8,479	396	10,841	384	2,362	222	27.9	13
2162 Other researchers, unspecified discipline	21	67,629	152	82,290	131	14,661	63	21.7	14
2113 Biochemists and biomedical scientists	21	54,387	183	66,177	170	11,790	81	21.7	15
2115 Social and humanities scientists	21	38,535	241	46,889	219	8,354	117	21.7	16
2112 Biological scientists	21	48,663	201	59,213	183	10,550	91	21.7	17
2119 Natural and social science professionals n.e.c.	21	28,163	290	34,268	266	6,105	142	21.7	18
2114 Physical scientists	21	41,452	229	50,439	204	8,986	110	21.7	19
2151 Conservation professionals	21	24,917	307	30,319	293	5,402	160	21.7	20

Source: IER estimates

Table 5.9 Top 20 4-digit occupations in terms of Employment Losses, 2021-2035 (largest per cent declines)

	Employment					Change 2021-2035			
Occupation Code (412) and Name	**Occ(26)**	**2021**	**rank**	**2035**	**rank**		**rank**	**%**	**rank**
9233 Exam invigilators	92	26,110	300	23,745	320	-2,365	347	-9.1	393
5322 Floorers and wall tilers	53	34,546	260	31,226	289	-3,320	363	-9.6	394
5315 Plumbers & heating and ventilating installers and repairers	53	142,205	72	128,540	86	-13,665	397	-9.6	395
5314 Roofers, roof tilers and slaters	53	34,623	258	31,296	288	-3,327	364	-9.6	396
5321 Plasterers	53	52,186	192	47,171	217	-5,015	375	-9.6	397
5323 Painters and decorators	53	84,423	120	76,310	144	-8,113	391	-9.6	398
5312 Stonemasons and related trades	53	10,909	381	9,861	390	-1,048	308	-9.6	399
5319 Construction and building trades n.e.c.	53	203,190	39	183,665	52	-19,526	402	-9.6	400
5316 Carpenters and joiners	53	189,873	44	171,627	59	-18,246	401	-9.6	401
5313 Bricklayers	53	51,563	195	46,608	222	-4,955	373	-9.6	402
5317 Glaziers, window fabricators and fitters	53	62,014	162	56,055	190	-5,959	381	-9.6	403
5330 Construction and building trades supervisors	53	53,804	184	48,634	211	-5,170	376	-9.6	404
5311 Steel erectors	53	4,796	409	4,335	410	-461	282	-9.6	405
4216 Receptionists	42	235,917	31	168,310	61	-67,607	412	-28.7	406
4211 Medical secretaries	42	80,058	125	57,116	188	-22,942	403	-28.7	407
4213 School secretaries	42	98,736	99	70,441	156	-28,295	406	-28.7	408
4217 Typists and related keyboard occupations	42	5,498	406	3,923	411	-1,576	326	-28.7	409
4215 Personal assistants and other secretaries	42	181,531	49	129,510	85	-52,021	411	-28.7	410
4214 Company secretaries and administrators	42	24,233	311	17,288	348	-6,944	388	-28.7	411
4212 Legal secretaries	42	46,246	211	32,993	278	-13,253	396	-28.7	412

Source: IER estimates

Figures 5.3 to Figure 5.7 detail the shift-share analysis at 4-digit level for a sample of occupations. Figure 5.3 shows the shift-share analysis (2021-2035) for the Top 20 4-digit occupations in terms of employment levels in 2021. *Sales and retail assistants* (which is the occupation with the highest employment ranking in 2021) are projected to decrease, especially due to the occupational effect. A similar case can be found for *Retail cashiers and check-out operators*, *Warehouse operatives*, and *Delivery drivers and couriers*, among others. In contrast, occupations related to the development of technology such as *programmers* and *Software development professionals* will tend to increase, especially due to an occupational effect. Health care related occupations such as *Care workers and home carers* and *Nursing auxiliaries and assistants* are also expected to see employment increases. However, both occupational and industrial effects will have a similar positive effect on these occupations. For other occupations such as *Kitchen and catering assistants*, *Cleaners and domestics*, among others, the occupational and industrial effects point in opposite directions.

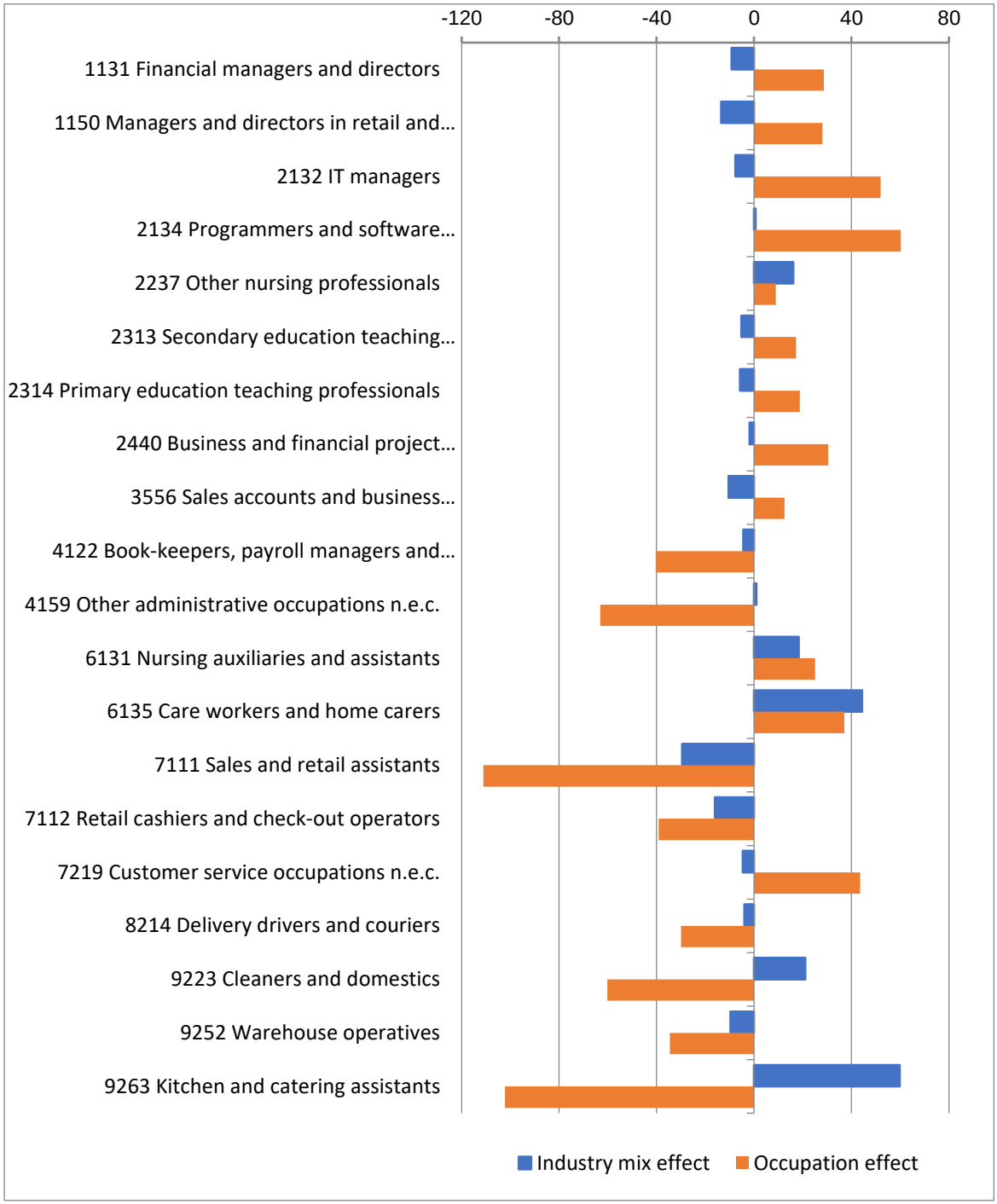
Figure 5.4 shows the shift-share for the top 20 4-digit occupations in terms of employment growth in absolute terms (2021-2035). In most cases, the occupational effect is expected to lead to this increase in employment. *Higher level teaching assistants and programmers*, and *Software development professionals* will be the most positively impacted by the occupational effects.

In contrast, Figure 5.5 shows the shift-share for the Top 20 4-digit occupations with the largest employment declines in absolute terms between 2021 and 2035. In most cases, the occupational effect will lead to this decrease in employment. *Local government administrative occupations* and *Customer service managers* will experience the highest drop in employment due to the occupational effect.

Figure 5.6 and Figure 5.7 show the occupations with the highest (positive/negative) employment variations in terms of per cent change. Teaching related occupations (such as *Higher level teaching assistants* and *Early education and childcare practitioners*) and *Welfare and housing associate professionals n.e.c*. will experience a considerable increase in employment due to both industrial and occupational effects (Figure 5.6). In contrast, *Metal working production and maintenance fitters* will experience a considerable decrease in employment due to industrial and occupational effects. *Sales supervisors – retail and wholesale and shopkeepers and owners – retail and wholesale* will experience a reduction in employment, mainly due to occupational effects. *Electricians and electrical fitters* and *Telecoms, and related network installers and repairers* will be significantly and negatively impacted by the occupation effect, whilst the industrial effect will have a small and positive impact on the employment projections for these occupations (Figure 5.7).

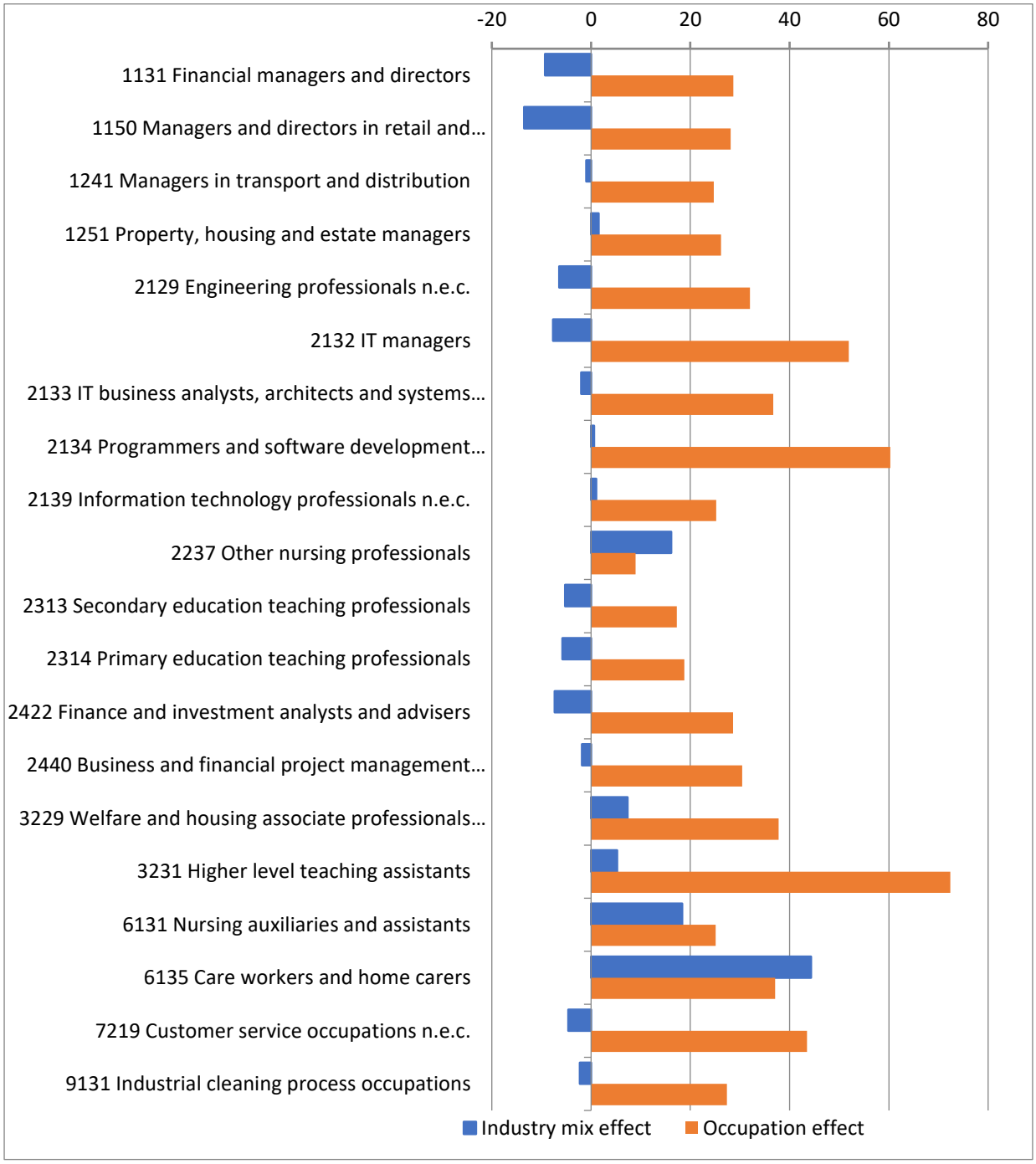
Finally, Table 5.10 shows the most significant occupations in terms of replacement demands. As noted earlier, replacement demands generally far outweigh the projected net changes in employment between 2020 and 2035. Replacement needs are the main component of the overall number of job openings or total requirements. They are included here to illustrate the biggest winners in terms of replacement demands at the 4-digit level. *Care workers and home carers, Sales and retail assistants, Nursing auxiliaries and assistants* and *Other administrative occupations n.e.c.,* are the 4 occupations with the largest replacement demands over the period 2020-2035. However, for many other occupations shown in the table, replacement needs mean that there will be significant numbers of job openings between 2020 and 2035.

Figure 5.3 Shift-share for the Top 20 4-digit occupations in terms of Employment levels in 2021 (000s, 2021-2035)



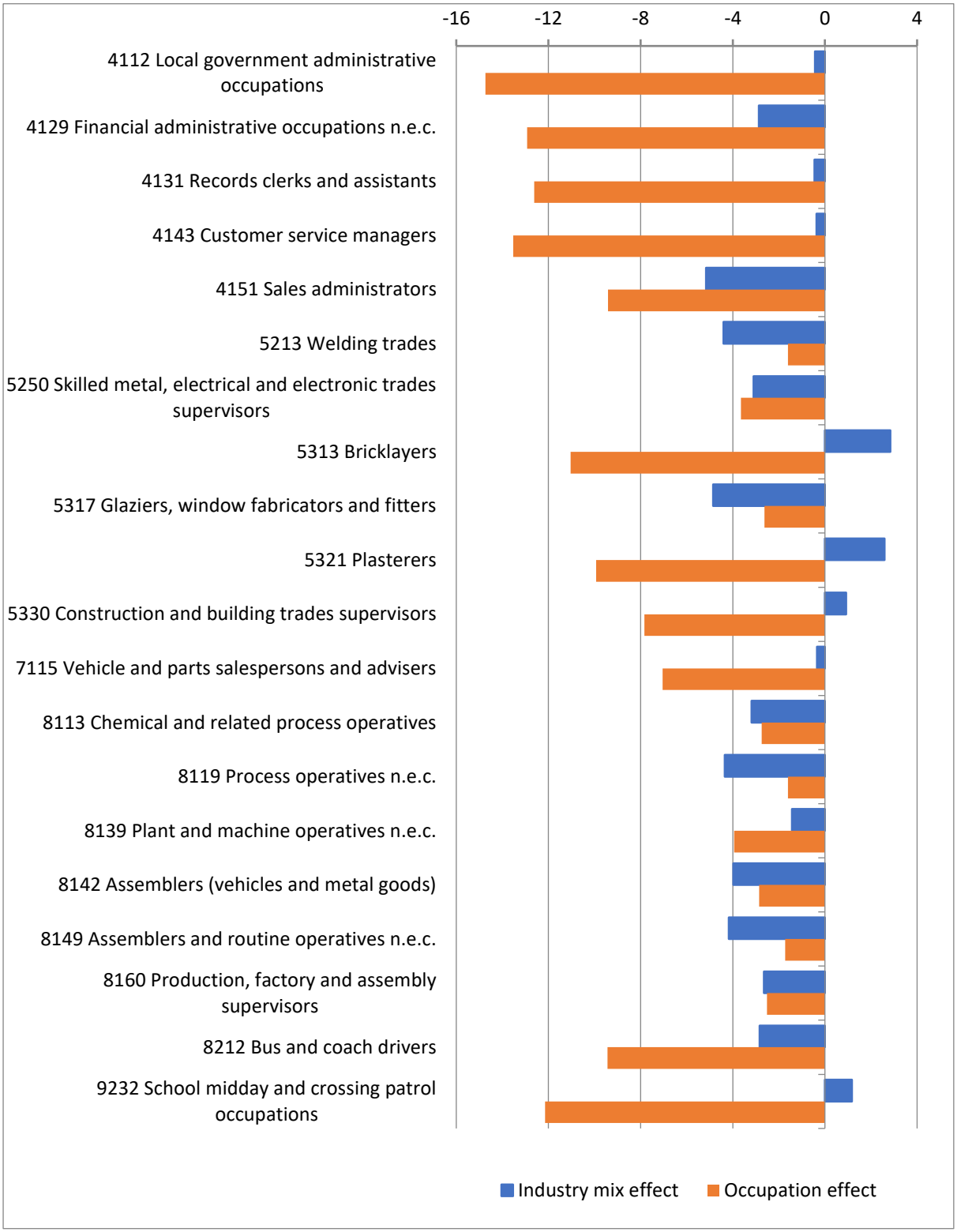
Source: IER estimates

Figure 5.4 Shift-share for the Top 20 4-digit occupations in terms of employment growth in absolute terms (000s, 2021-2035)



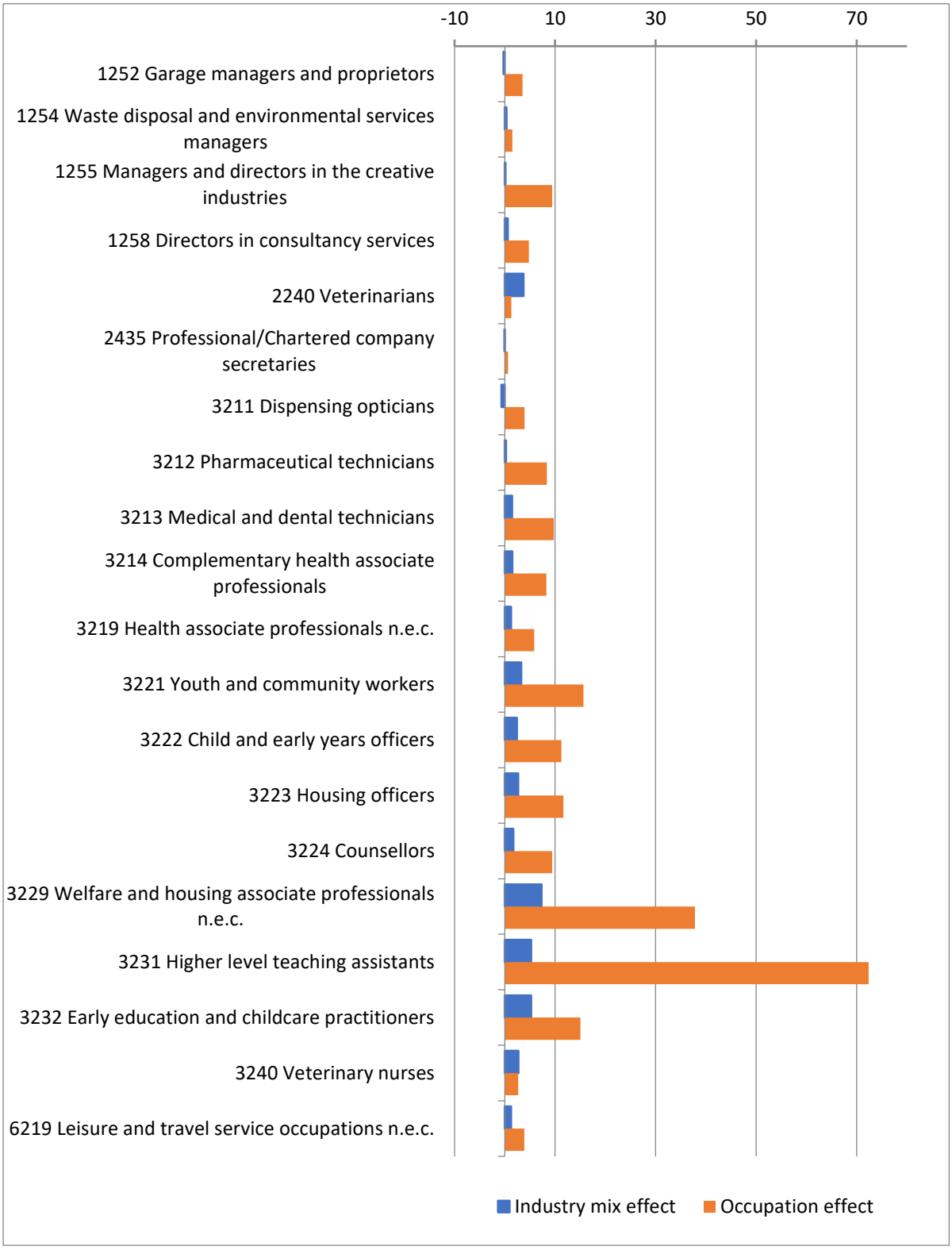
Source: IER estimates

Figure 5.5 Shift-share for the Top 20 4-digit occupations in terms of Employment Change 2021-2035 (largest declines in absolute terms, 000s)



Source: IER estimates

Figure 5.6 Shift-share the Top 20 4-digit occupations in terms of Employment Change 2021-2035 (per cent change)



Source: IER estimates

Figure 5.7 Shift-share for the Top 20 4-digit occupations in terms of Employment Change 2021-2035 (largest per cent declines)

Source: IER estimates

Table 5.10 Top 20 4-digit occupations in terms of Replacement Demand 2021-2035 (000s)

		Employment				Change 2021-2035				Replacement demand			
Occ(412) Name	**Occ(26)**	**2021**	**rank**	**2035**	**rank**	**000s**	**rank**	**%**	**rank**	**000s**	**rank**	**%**	**rank**
6135 Care workers and home carers	61	906	2	1,022	1	117	1	12.9	163	508	1	56.0	41
7111 Sales and retail assistants	71	1,031	1	1,000	2	-31	407	-3.0	310	447	2	43.4	272
4159 Other administrative occupations n.e.c.	41	647	3	639	3	-8	390	-1.2	277	304	3	47.0	197
6131 Nursing auxiliaries and assistants	61	531	4	599	5	68	4	12.9	160	297	4	56.0	50
4122 Book-keepers, payroll managers and wages clerks	41	503	6	497	7	-6	382	-1.2	281	236	5	47.0	197
1131 Financial managers and directors	11	444	8	503	6	59	7	13.2	139	232	6	52.2	83
9252 Warehouse operatives	92	489	7	444	9	-44	410	-9.1	381	215	7	44.1	268
2134 Programmers and software development professionals	21	505	5	615	4	110	2	21.7	28	199	8	39.4	320
9263 Kitchen and catering assistants	92	440	9	400	12	-40	409	-9.1	387	194	9	44.1	251
2313 Secondary education teaching professionals	23	377	11	422	10	45	12	11.9	206	191	10	50.7	103
2314 Primary education teaching professionals	23	362	13	405	11	43	13	11.9	213	184	11	50.7	103
3231 Higher level teaching assistants	32	296	21	379	14	83	3	27.9	1	183	12	61.9	1
7219 Customer service occupations n.e.c.	72	392	10	460	8	68	5	17.4	72	182	13	46.5	214
3556 Sales accounts and business development managers	35	355	15	388	13	33	21	9.2	235	162	14	45.7	223
2440 Business and financial project management professionals	24	326	16	379	15	53	11	16.4	95	159	15	48.8	148
1150 Managers and directors in retail and wholesale	11	303	19	343	18	40	15	13.2	145	158	16	52.2	83
9223 Cleaners and domestics	92	357	14	325	21	-32	408	-9.1	385	158	17	44.1	246
7112 Retail cashiers and check-out operators	71	363	12	352	17	-11	393	-3.0	308	157	18	43.4	272
8214 Delivery drivers and couriers	82	311	18	304	23	-7	389	-2.2	305	154	19	49.6	119
2319 Teaching professionals n.e.c.	23	299	20	335	19	36	18	11.9	208	152	20	50.7	113

Source: IER estimates.

6 Projections for qualifications

Key messages

The holding of formal qualifications is one of the key ways in which skills are defined and measured.

Skill supply (people economically active in the UK), as measured by the number of people categorised by the highest formal qualification they hold, is rising rapidly. More young people in particular stay in education longer and acquire more higher-level qualifications than their predecessors. In 2010, the number of economically active people with QCF 7-8 was around 2.7 million, while by 2020, this number had almost doubled (approximately 4.7 million). By 2035, it is projected that this number will continue increasing to about 8.3 million.

The proportion of the labour force who are unqualified was around 1.4 million (around 4.1% of the total workforce) in 2020. This population will be expected to represent only a small minority by 2035 (<2½ per cent, around 0.8 million).

The demand for skills, as measured by the numbers employed (satisfied demand) in higher level occupations, and the numbers employed holding higher level qualifications, is also projected to rise. Comparing pre-pandemic (2019) to the future (2035), the level of QCF 7-8 employment was around 4.4 million in 2019, while by 2035, this number is expected to double (approximately 8 million).

The average level of qualifications held is rising in all sectors. Business and other services sectors will experience the largest increase in the level of qualification. The share of QCF 7-8 employment in this sector, which was around 18.4 per cent (approximately 2 million) in 2020, is expected an increase of this share to around 30.7 per cent (about 3.7 million) in 2035.

How much this is due to increases in demand as opposed to the supply side changes remains a point of contention. There is a clear pattern of a rise in the number of high qualified people (economically active population with a high formal qualification), as well as increasing employment levels for the highest qualified workers.

6.1 Introduction

The model of qualifications supply is based on a time series extrapolative approach. The modelling has developed out of early work for the Treasury (as part of the Leitch Review) and subsequently evolved in exercises for the UK Commission for Employment and Skills and the Department for Education.

At various stages, the time series model for the UK has been evaluated against a stock-flow model. While conceptually superior, the stock-flow approach makes significantly greater data demands in its estimation – as these could not entirely be met, it resulted in a preference for the time series model. In particular, the stock-flow model underestimated the possibilities for qualification acquisition amongst older age groups which have become an increasingly important component of the population in recent years. However, the choice of model is kept under review as new data sources emerge.

The present work is based primarily on the National UK model.[67] On balance, the National model is viewed as giving the most robust results, as sample sizes are larger, which allow a more detailed and slightly more sophisticated modelling procedure to be adopted. This is based on a detailed analysis of data from the LFS.

The National model is disaggregated by age, gender and qualification level. Six qualification levels are explicitly incorporated in the modelling, including those designated as having no qualifications (in fact this group comprises individuals with only entry level qualifications 1-3 or no qualifications at all – these are designated level 0) or RQF/QCF 1-6.

The model explores how the proportions of qualification levels 0-6 for individuals of a given age change over time. In this way, it is possible to identify, for example, the increasing number of individuals of, say, age 23 holding first degree level qualifications (RQF 5) over time, reflecting the increase in uptake of university courses amongst those, say, aged 18. Similarly, such data can be used to examine the decrease in the proportion of older individuals with no qualifications, as younger, more qualified individuals, grow older.

These proportions are used to project what the qualification mix might look like in the future. Ten years of historical data are used in making the projections. While this period can be varied, it has become the norm in this work and allows comparisons to be made with earlier projections to provide an indication of any systematic changes in the forecasts over longer periods.

The National model produces separate results for men and women, as well as all individuals combined. While this implies a degree of duplication, it proves useful as a check on the consistency of the results, particularly where the cell sizes are small by gender. Given historical concerns over the effects of migration, immigration and emigration are also modelled separately. In earlier years, this was less satisfactory, but improved when ONS introduced a better classification of foreign qualifications, but, because of a lack of data, this part of the model still assumes that emigrants have the same mix of qualifications as the population as a whole.

All population figures sum to estimated totals provided by CE, which are, in turn, based on ONS population estimates and projections. All series used in the model and projections made by the model are checked and, where appropriate, adjusted to appropriate totals (e.g. population by age). Such adjustments are almost invariably limited to the predictions (as opposed to historical data) and are the result of rounding errors or limits imposed on the data (e.g. that predicted values cannot be negative, as is occasionally the case for levels 0 and 1, where there are small sample sizes – in this case a lower limit of 2.5 per cent has been applied).

Currently, estimated and predicted activity rates are applied to the population results. These are also estimated based on a time series extrapolative approach, although somewhat simplified. This modelling focuses on the supply of people with formal qualifications. The results are described in Section 6.2.

The supply-side results are compared with the demand side by analysing trends in employment patterns within occupations. Detailed patterns by occupation, cross classified by sector, are considered. The projections are based on extrapolating patterns of

[67] A Four nations model and a Regional model provide more detailed results for the individual countries within the UK and the English Regions (for more details see Bosworth and Wilson, 2019). The models are nested, in the sense that the UK model is the primary foundation for the other two sub-models.

qualification intensities by occupation for those employed within these various categories. The demand side is based on an analysis of trends for those in employment. Historical trends in these patterns are extrapolated forward to 2035 to produce an initial estimate of 'unconstrained demand'.

The occupational employment structure of each industry, and how this is changing over time, is one of the key drivers for the numbers of formally qualified people employed. The key source of information on qualification patterns is the LFS, although various other data are also exploited. The LFS, while large, does not provide a sufficiently large sample to enable the full database to be expanded to cover the qualification dimension using the original data. A full database has been created by assuming common patterns apply at more detailed levels and using RAS techniques to fill the gaps.[68]

These more detailed results are then constrained to provide a picture consistent with the overall supply results from the national model. The estimates of employment by RQF level are constrained using RAS iterative methods to:

- reconcile the aggregate sum of qualification requirements by qualification level with the numbers available as indicated by the national model and related analysis of economic activity rates
- reconcile the industry totals with the UK totals
- allocate unemployment across qualification categories in line with historical patterns (generally speaking unemployment rates are assumed to decline monotonically depending on the level of the formal qualification held).

This provides consistency across the full set of projections. These values are then used as control totals to constrain a detailed analysis of changing qualification patterns within occupations. The same qualification patterns for resident (heads) are assumed to apply to the workplace jobs employment estimates. More complete details of data sources and methods are given in the separate *Technical report*.

The results for employment (loosely interpreted as 'demand') are presented in Section 6.3.

6.2 Supply trends

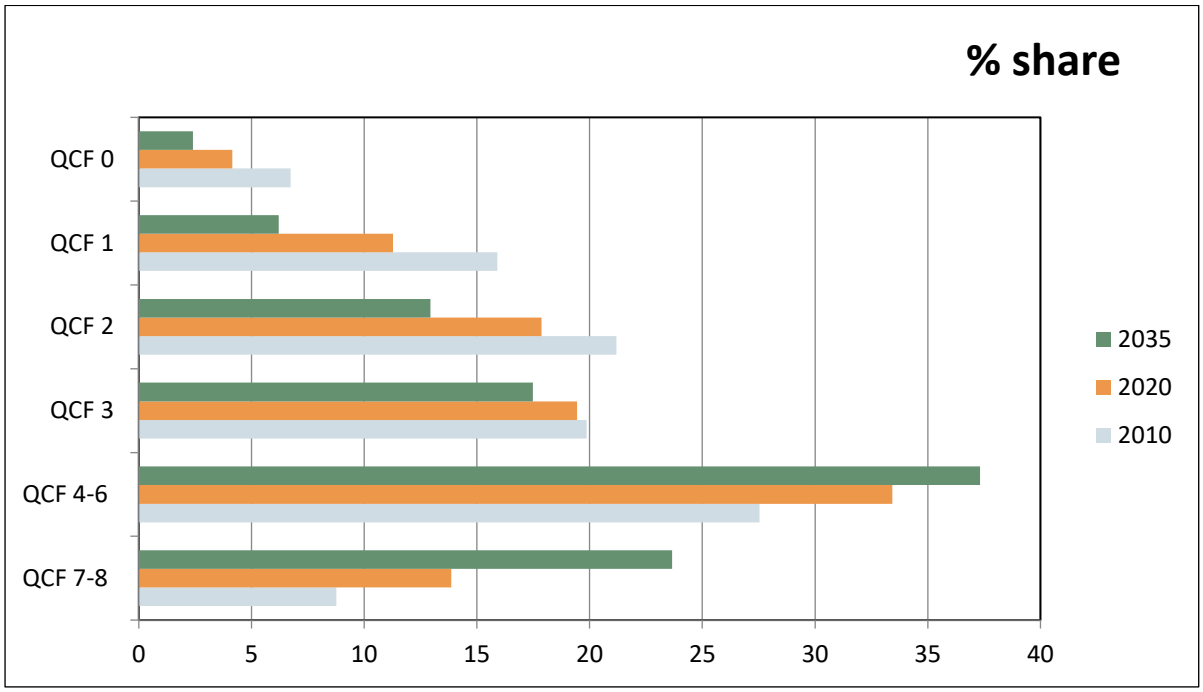
Figure 6.1 shows the share of people who are economically active in the UK by levels of qualifications (being QCF 0 the lowest level and QCF 7-8 the highest level of qualification) for different historical and projected periods. According to this Figure, the share of people within the labour force who held formal qualifications has increased considerably during the last decade, whilst the shares of those with no or relatively low level of qualifications have decreased. By 2035 the shares with formal qualifications will continue to increase, especially at the highest level (QCF 7-8).

A similar pattern can be found for those in employment (see Tables 6.6 and 6.7 below).

It is important to note that Brexit and the pandemic do not, so far, seem to have had an effect on the increasing trend in the number of people with formal qualifications.

[68] RAS is a widely used iterative technique, which ensures that elements in a two-dimensional data array match target row and column totals. Full details are given in the accompanying *Technical Report*, Wilson *et al.,* (2022c).

Figure 6.1 Changing patterns of qualification within the labour force (16+, % of total)



Source: IER estimates.
Notes: Qualifications are classified based upon the Regulated Qualifications Framework (RQF) which superseded the Qualifications and Credit Framework (QCF))[69].
QCF/RQF0 is the 'no qualification group', it comprises entry level qualifications below level 1
QCF/RQF1 comprises those with low level GCSE (grade 3 and under) and equivalent
QCF2/RQF2 comprises those with high grade GCSE (grade 4 and above)
QCF3/RQF3 comprises those with A level and equivalent
QCF4-6/RQF4-6 covers those with a degree at undergraduate level and equivalent
QCF 7-8/RQF 7-8 covers postgraduate degree level and equivalent
The word equivalent means that vocational qualifications are included alongside the academic at that level.

Table 6.1 shows the total number of people aged 16+ holding different levels of formal qualifications for 2010, 2020 and the projected numbers for 2035. As previously mentioned, the number of people within the labour force who hold higher qualification levels has increased considerably during the last decade. In 2010, the total number of people aged 16+ with QCF 7-8 was around 3.8 million, while by 2020, this number had almost doubled (approximately 6.7 million people). By 2035, it is projected that this number will continue increasing to about 13 million people.

Table 6.2 shows corresponding information for the economically active population. A similar pattern can be found for those in employment (see Tables 6.6 and 6.7 below). These results reflect the assumption that better qualified people will continue to have a higher probability of finding and retaining a job than those less well qualified. Generally speaking younger people will be better qualified than older generations.

[69] QCF was developed in parallel with the National Qualifications Framework (NQF) and withdrawn in 2015, for details see: https://www.gov.uk/government/consultations/withdrawing-qcf-regulatory-arrangements. For information on Regulations Qualifications Framework see: https://www.gov.uk/government/publications/regulated-qualifications-framework-a-postcard.

Table 6.1 Total numbers by qualification (total population 16+, 000s)

Supply	2010	2020	2035
QCF level			
QCF 0	5,472	3,800	2,960
QCF 1	8,500	6,650	5,018
QCF 2	10,924	10,282	8,668
QCF 3	9,846	10,473	10,586
QCF 4, 5 & 6	12,382	16,496	18,371
QCF 7 & 8	3,820	6,654	13,040
Total	50,944	54,356	58,643

Source: IER estimates.

Table 6.2 Economically active population by qualification level (16+, 000s)

Supply	2010	2020	2035
QCF level			
QCF 0	2,117	1,408	838
QCF 1	5,003	3,834	2,172
QCF 2	6,663	6,072	4,527
QCF 3	6,247	6,608	6,116
QCF 4, 5 & 6	8,661	11,365	13,059
QCF 7 & 8	2,755	4,710	8,280
Total	31,448	33,997	34,992

Source: IER estimates.

Table 6.3, presents the distribution of unemployment by level of qualification. Table 6.4 shows the shares of total unemployment taken by those qualified at different levels. During the first pandemic wave (2020), the share of unemployment at the highest and lowest qualification levels both decreased compared to 2010. However, it is expected that the unemployment share of those with the highest qualifications level will increase considerably by 2035, whilst the share of total unemployment of those with the lowest qualification levels will tend to decrease. The share of unemployment taken by the better qualified increases simply because they are increasing their share of employment and conversely for those least qualified.

In general, those with higher level qualifications tend to have lower unemployment rates. See Table 6.5 for details. Despite the effects of the pandemic and Brexit, unemployment rates decreased for almost all qualification levels between 2010 to 2020 (the exception being for those qualified at QCF 7 and 8 levels which rose very slightly).

Compared to 2020, it is expected that unemployment rates will decrease by 2035 for all qualification levels.

Table 6.3 Unemployed by qualification level (16+, 000s)

Supply	2010	2020	2035
QCF level			
QCF 0	318	117	50
QCF 1	559	257	107
QCF 2	626	354	196
QCF 3	423	307	214
QCF 4, 5 & 6	372	357	307
QCF 7 & 8	101	126	169
Total	2,399	1,518	1,043

Source: IER estimates.

Table 6.4 Share of total unemployment by qualification level (16+, %)

Supply	2010	2020	2035
QCF level			
QCF 0	13.3	7.7	4.8
QCF 1	23.3	16.9	10.2
QCF 2	26.1	23.4	18.8
QCF 3	17.6	20.2	20.5
QCF 4, 5 & 6	15.5	23.5	29.4
QCF 7 & 8	4.2	8.3	16.2
All qualifications	100.0	100.0	100.0

Source: IER estimates.

Table 6.5 Unemployment rates by qualification level (%)

Supply	2010	2020	2035
QCF level			
QCF 0	15.0	8.3	6.0
QCF 1	11.2	6.7	4.9
QCF 2	9.4	5.8	4.3
QCF 3	6.8	4.6	3.5
QCF 4, 5 & 6	4.3	3.1	2.3
QCF 7 & 8	3.7	2.7	2.0
All qualifications	7.6	4.5	3.0

Source: IER estimates.

6.3 Demand for formal qualifications

Observed employment levels by qualification reflect a combination of labour supply and labour demand factors. Given the available supply, employers can try to recruit the workers they think best meet their requirements. If the labour market is supplying greater numbers of well qualified people, this means that employers can raise the average qualification levels of their workforce even if this is not strictly necessary.

The resulting levels of employment by qualification (where these patterns are constrained to match the available supply) can be considered a measurement of (satisfied) labour demand. The observed employment patterns are influenced by both supply and demand factors (e.g. educational and training provision, type of job requirements, localisation of companies and employees, etc.).

It is difficult to determine precisely which factors have more influence over employment. Nevertheless, it is clear from the discussion above that labour supply changes have played a major role in the rise of employed people with formal qualifications. Table 6.6 presents estimates of employment based on the number of people in employment (a head count based on residence) for 2010, 2020 and the projected numbers for 2035. These results show the growing share of highly qualified employed people in the UK labour market.

Table 6.7 shows the corresponding estimates of employment by qualification level using the measure of workplace jobs (reflecting the fact that many people have more than one job). This is based on assuming that the patterns (shares of employment by RQF level) on the residence/heads basis can be applied to the workplace/jobs estimates that are used elsewhere in this report.[70]

These estimates are then used to constrain all of the other employment figures. In particular, the projections of changing qualification profiles within occupations, in aggregate, and separately by sector and by region, are all constrained to match these overall totals. The number of employed people with high qualifications is expected to increase by 2035 considerably, whilst low qualified workers will decrease sharply.

Table 6.6 Employment by qualification level (residence/heads, 16+, 000s)

	2010	2020	2035
QCF level			
QCF 0	1,799	1,291	788
QCF 1	4,444	3,577	2,065
QCF 2	6,038	5,717	4,331
QCF 3	5,825	6,301	5,902
QCF 4, 5 & 6	8,289	11,008	12,753
QCF 7 & 8	2,654	4,585	8,110
Total	29,049	32,479	33,949

Source: IER estimates.

[70] Analysis of the LFS suggest that double jobbing qualification patterns are not the exactly the same for heads and jobs, but the discrepancies would not make a huge difference here.

Table 6.7 Employment by qualification level (workplace/jobs, 000s)

	2010	2020	2035
QCF level			
QCF 0	1,947	1,395	875
QCF 1	4,811	3,865	2,284
QCF 2	6,540	6,183	4,803
QCF 3	6,302	6,813	6,556
QCF 4, 5 & 6	8,982	11,914	14,177
QCF 7 & 8	2,876	4,961	9,013
Total	31,458	35,131	37,709

Source: IER estimates.

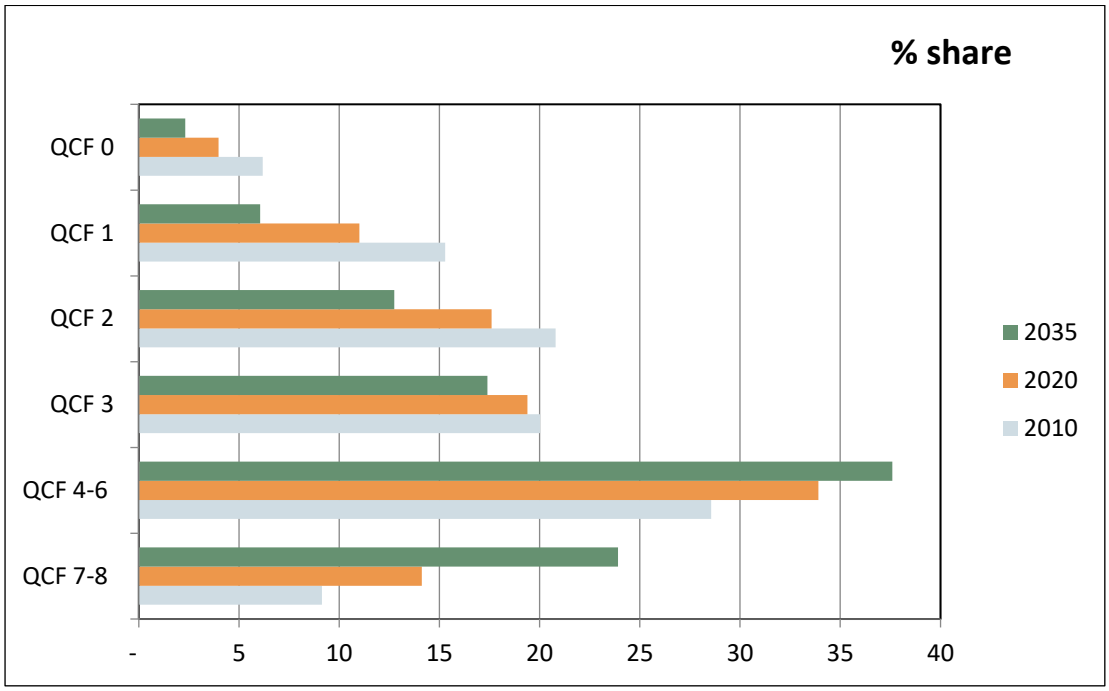
Table 6.8 and Figure 6.2 present the distribution of employment by level of qualification based on the workplace/jobs definition. The percentage share of employed people with high qualification levels (QCF 4 to 8) increased significantly between 2010 and 2020. This trend is expected to continue to 2035. In contrast, the shares of those with lower levels of qualifications (QCF 0 to 3) are expected to decrease by 2035.

Table 6.8 Changing qualification pattern of employment (workplace/jobs, % of total)

Supply	2010	2020	2035
QCF level			
QCF 0	6.2	4.0	2.3
QCF 1	15.3	11.0	6.1
QCF 2	20.8	17.6	12.7
QCF 3	20.0	19.4	17.4
QCF 4, 5 & 6	28.6	33.9	37.6
QCF 7 & 8	9.1	14.1	23.9
All qualifications	100.0	100.0	100.0

Source: IER estimates.

Figure 6.2 Changing qualification pattern of employment (workplace/jobs, % of total)

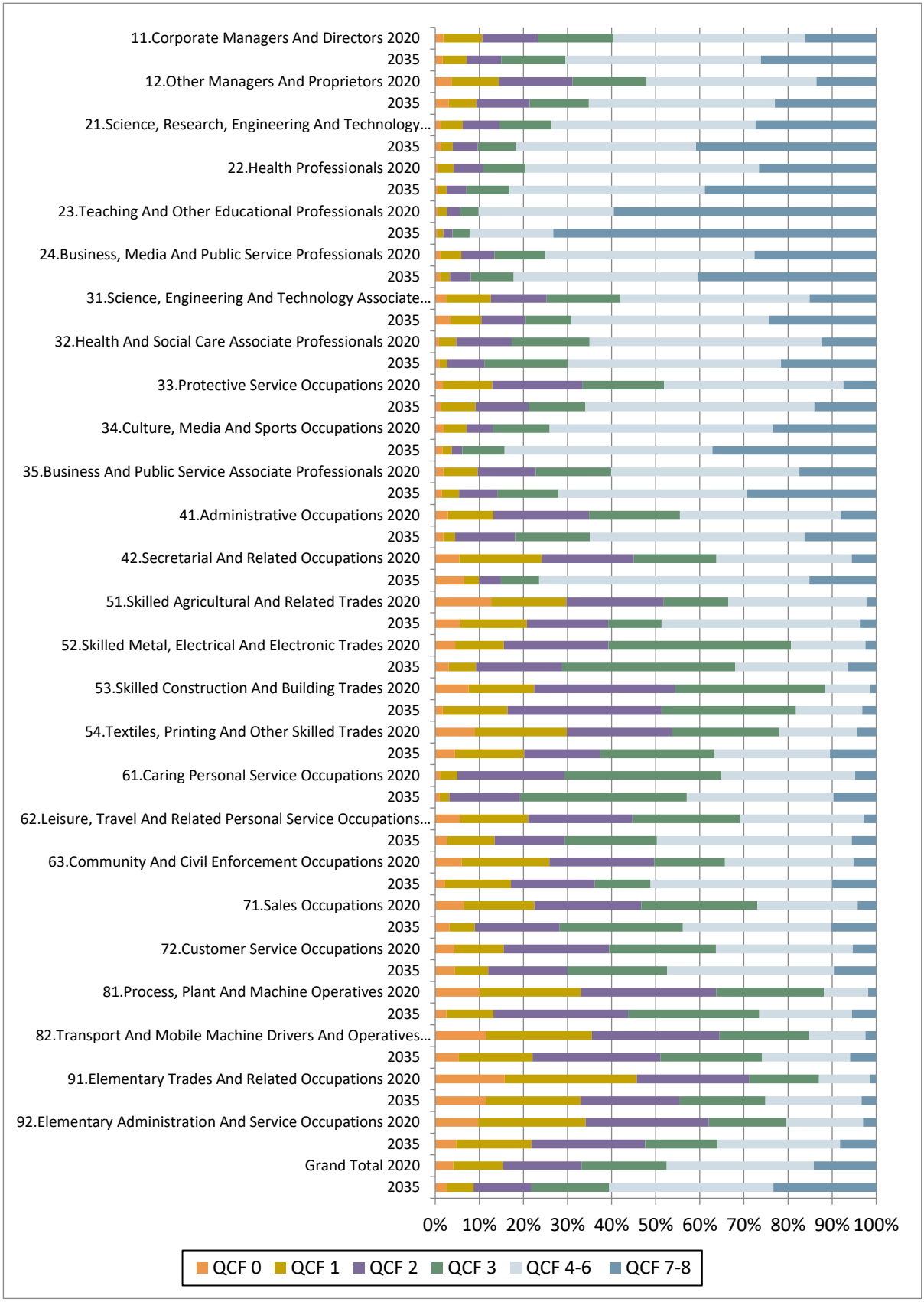


Source: IER estimates.

Figure 6.3 and Figure 6.4 show the qualification pattern of employment by occupations (sub-groups) and sectors, respectively. Generally, those in high-skilled occupations such as *Professionals and Associate professionals*, and (to a smaller extent) *Managers, directors and senior officials* tend to be more highly qualified than those in less-skilled occupations such as *Process, plant and machine operatives*, *Elementary occupations*, among others. Those employed as *Teaching and other educational professionals, Health professionals and Business, media and public service professionals* are mainly people with high qualifications (QCF 4-8). Conversely, those employed in *Elementary trades and related occupations, Transport and mobile machine drivers and operatives and Process, plant and machine operatives* are primarily people with low qualifications (QCF 0-2). Consequently, the increasing number of people with formal qualifications has facilitated the shift in the occupational employment structure towards high-skilled occupational groups (major groups 1 to 3).

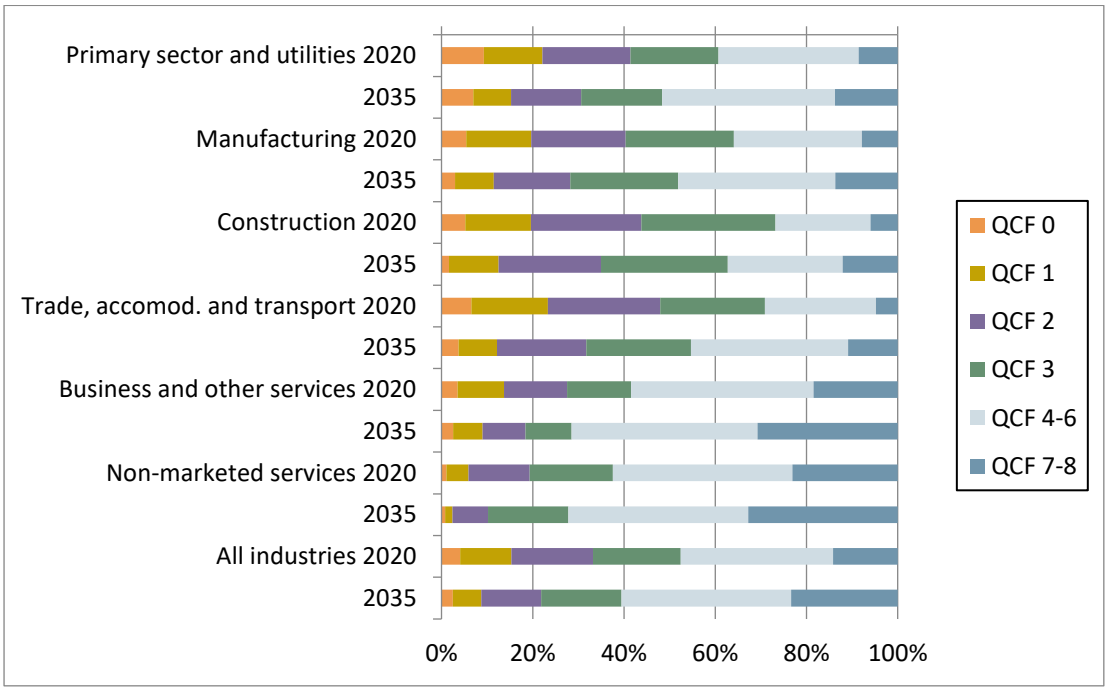
The patterns of employment by qualification also vary across sectors. Figure 6.4 shows that Non-market services and Business sectors tend to employ a higher share of people with high qualification levels (QCF 4-8). Conversely, sectors such as *Construction* and *Trade*, *accommodation* and *transport* tend to employ a higher share of people with low qualification levels (QCF 0-2). The occupational requirements of each sector mainly explain these results. For instance, it is natural that the *Construction* sector concentrates a higher share of occupations that typically require lower qualifications, such as bricklayers, construction operatives, etc. Conversely, the *Non-market services* sector (e.g., *Health, Education, Public administration*, among others) tends to need a higher a share of people with high qualification levels. Figure 6.4 also shows the expected changes in the qualification composition over time. One clear pattern that emerges from comparing the sectoral qualification composition of 2020 to the expected one in 2035 are projected sharp reductions in the employment shares of those less well qualified across all sectors.

Figure 6.3 Qualification patterns of employment by occupation, 2020 and 2035 (%)



Source: IER estimates.

Figure 6.4 Changing qualification patterns of employment by sector, 2020-2035 (%)



Source: IER estimates.

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Appendix A: Sources and methods

The results presented here are based on the use of a well-established multi-sectoral macroeconomic model together with other modules which have been used to produce projections for the UK economy and labour market for many years.

The macroeconomic model used has been developed by CE E3ME. MDM-E3 is a regional Multi-sectoral Dynamic Model of the UK economy. It has a Keynesian structure incorporating an input-output system and concentrates on the determination of changes in the real sector of the economy.

Other modules are based on those developed by IER as part of the *Working Futures* work programme which has been carried out on a regular basis since the start of the millennium. The most recent projections were published in 2019 (Wilson, R. A., S-A. Barnes, M. May-Gillings, H. Bui and S. Patel, (2019). *Working Futures* 2017-2027: Main report). Department for Education.

The results are based on various official data sources compiled by the UK ONS, including the National Accounts, their Labour Market Statistics series and the LFS.

Further details of the data sources, as well as the models and assumptions adopted are set out in the accompanying *Technical report*: Wilson *et al.,* (2022c).

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