Department for Education

Working Futures 2017-2027: Long-run labour market and skills projections for the UK

Annexes

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This set of Annexes complements the main report providing more detailed results as well as information on sources and methods used.

The opinions expressed in this report are those of the authors and do not necessarily reflect the views of the Department. The projections should be regarded as indicative of likely developments for the economy and the labour market given a gradual recovery from recession and re-establishment of longer-term trends, rather than precise forecasts of what will inevitably happen. Many of the trends presented are very robust 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 (5-10 years ahead). The results should be regarded as providing a robust benchmark for debate. They should be used in conjunction with a variety of other sources of Labour Market Information.

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Introduction

Working Futures

Working Futures 2017-2027 is the latest in a series of quantitative assessments of the employment prospects in the labour market over a ten-year horizon. It presents historical trends and future prospects by sector for the UK and its constituent nations and the English regions. The prime focus of Working Futures is on the demand for skills as measured by employment by occupation and qualification, although the supply side is also considered. The results are intended to provide a sound statistical foundation for the deliberations of all those with an interest in the demand for and supply of skills, including education and training providers, as well as the various agencies and departments of government.

This document presents a set of Annexes, which provide additional detail on both the results and methods to complement those presented in Working Futures 2017-2027. The main report[1] summarises the key findings, including the main employment trends, and the implications for the next 10 years if they continue. It covers macroeconomic and detailed employment prospects by industry, occupation, qualification, gender and employment status (full-time part-time and self-employment), providing a commentary explaining and interpreting the forecasts. It covers the whole of the UK and its constituent countries. This set of Annexes comprises:

Annex A, which provides a brief technical description of the sources and methods used to generate the sets of employment projections by industry and occupation presented in Working Futures 2017-2027;

Annex B, which presents a comparison with previous projections in Working Futures 2014-2024[2], covering sectoral employment and productivity, comparison with previous forecasts for occupations and qualifications and comparison with previous results by devolved country and English region.

Annex C: presents new much more detailed results on occupation by the 369 4-digit Standard Occupational Classification (SOC) 2010 categories. The main report and

[1] See Wilson *et al*., (2019). *Working Futures 2017-2027: Main Report*. Department for Education.

[2] Wilson, R.A., N. Sofroniou, R. Beaven, M. May-Gillings, S. Perkins, M. Lee, P. Glover, H. Limmer and A. Leach (2016). *Working Futures 2014-2024: Main Report*. Wath upon Dearn: UK Commission for Employment and Skills.

Annexes are also supported by a separate Technical Report, which provides a much more detailed description of sources and methods used.[3]

Annex D provides detailed results by nation of the UK and region of England.

A comprehensive set of tabulations for the projections is provided in electronic format (supported by a detailed User Guide[4], etc.). All the detailed projections from Working Futures 2017-2027 are presented in the workbooks.

[3] Wilson *et al*., (2019). *Working Futures 2017-2027: Technical Report*. Department for Education

[4] Excel workbooks and the related User Guide and General Guidelines for using the workbooks.

A Sources and methods

A.1 Introduction

Working Futures is focused on developing quantitative projections of employment, concentrating on occupations and qualifications by industry and nation / region. Following best practice worldwide, these are based on the results from a detailed multi-sectoral macroeconomic model (for a recent review see the discussion in section 1 of the Main Report[5] and sections 2 and 3 of the Technical Report[6]). Projections of occupational employment are driven by an underlying view of sectoral prospects (both output and productivity) in the geographical area concerned.

The foundation for the present set of projections is results from the well-established regional Multi-sectoral Dynamic Model (MDM-E3)[7] of the UK economy developed by Cambridge Econometrics (CE) and detailed occupational and qualification forecasting modules developed by the Institute for Employment Research at the University of Warwick (IER). This approach has formed the basis for the previous Working Futures series of labour market projections.

A.2 Providing the sectoral and spatial detail required

As in the previous Working Futures projections, the Department for Education and its partners are interested in obtaining results at a detailed sectoral and geographical level. There are various technical and methodological issues that constrain what can be done. These include confidentiality and other related issues regarding the release of such detailed information into the public domain. The methods used here build on those developed in previous exercises.

In order to meet the remit specified for the previous Working Futures exercises, IER/CE have developed a detailed employment database covering all the main employment dimensions. This is based on the 46 (SIC 2007) based categories used in the CE multi-sectoral macroeconomic model known as MDM-E3. These are cross classified by the 25 sub-major occupational groups of SOC2010, and by the 12 nations and regions of the UK, plus gender and status. This database has been developed over many years to be as consistent as possible with all the official

[5] Wilson *et al*., (2019). *Working Futures 2017-2027: Main Report*. Department for Education.
[6] Wilson *et al*., (2019). *Working Futures 2017-2027: Technical Report*. Department for Education.
[7] The E3 stands for Economy-Energy-Environment.

published sources upon which it is based.[8,9] For Working Futures 2017-2027, this database covers 75 industries or sectors (roughly SIC 2-digit) categories based on SIC2007.

There are considerable technical problems and constraints in building a database to cover such a detailed breakdown of sectors and local areas. Taking all these dimensions in combination implies that the database required for Working Futures needs to cover over 135,000 separate time series on employment alone (ignoring the qualifications dimension).[10] This poses problems of validation and quality assurance as discussed below.

A.3 Using the latest SIC and SOC categories

It is important that models and results are structured around classifications which are both commonly used and appropriate in characterising the economy. It is also necessary that the models are founded on sound data, which in the context of economic models such as MDM-E3 means the availability of robust time-series data on which to estimate model parameters. These two factors are often in tension, especially when classifications change. This problem has been faced many times by the CE/IER team over the past 30 years and has been dealt with successfully.

Working Futures adopts the SOC2010 occupational classification. This classification system replaced SOC2000 in 2011 (and has been used to classify occupations for the 2011 Census and other official data since that date).[11]

The structure of UK-SOC2010 comprises 9 major groups, 25 sub-major groups, 90 minor groups and 369 unit groups. The major and sub-major groups, and associated skill level specialisations are presented in Table A.4. As can be seen, the skill specialisation criterion is used to distinguish groups of occupations within each skill level.

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[8] Complete consistency is not possible since the various official sources are themselves inconsistent, not least because some (but not all) are subsequently revised and updated by ONS.
[9] ONS have not, until very recently, published consistent time series information, cross-classified by region at the level of detail required for this exercise. However, it is possible to generate estimates by using the information ONS publish. While not strictly precise in a statistical sense, such estimates can provide useful information and intelligence to users about detailed employment trends. The current employment estimates reflect the latest ABI/BRES and LFS data available.
[10] That is: Sector (75) * occupation (25) * geographical area (12) * gender/status (6) = 135,000 separate time series.
[11] Full details on the UK SOC2010 can be obtained from the Office for National Stastics (ONS) at: https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2010

The reworking of the database on to a Standard Industrial Classification (SIC) 2007 and SOC2010 basis was a substantial task that involved translating all the historical data on output, productivity and employment. The process results in a set of data for 75 industries as set out in Tables A.1, A.2 and A.3 and 25 occupations as defined in Table A.5. These data are also cross classified by gender and status and for 12 spatial areas. Further disaggregation by 6 broad qualification levels is also made. This results in over 800,000 time series to be analysed and projected.[12] For the sub-regional analysis a more aggregate set of industries is used as described in Table A.5.

[12] That is 75 industries * 25 occupations * 6 gender /status categories * 6 qualification levels * 12 spatial areas.

Box A3.1: UK-SOC2010 Classification

Jobs are classified into groups according to the concept of 'skill level' and 'skill specialisation'. As in SOC2000 and its predecessor SOC90, skill level is defined with respect to the duration of training and/or work experience recognised in the field of employment concerned as being normally required in order to perform the activities related to a job in a competent and efficient manner.

Skill specialisation is defined as the field of knowledge required for competent, thorough and efficient conduct of the tasks. In some areas of the classification it refers also to the type of work performed (for example materials worked with, tools used).

Skill levels are approximated by the length of time deemed necessary for a person to become fully competent in the performance of the tasks associated with a job. This, in turn, is a function of the time taken to gain necessary formal qualifications or the required amount of work-based training. Apart from formal training and qualifications, some tasks require varying types of experience, possibly in other tasks, for competence to be acquired. Within the broad structure of the classification major groups and sub-major groups reference can be made to these four skill levels (see Table A.5):

The **first skill level** equates with the competence associated with a general education, usually acquired by the time a person completes his/her compulsory education and signalled via a satisfactory set of school-leaving examination grades. Competent performance of jobs classified at this level will also involve knowledge of appropriate health and safety regulations and may require short periods of work-related training. Examples of occupations defined at this skill level within the SOC2010 include postal workers, hotel porters, cleaners and catering assistants.

The **second skill level** covers a large group of occupations, all of which require the knowledge provided via a good general education as for occupations at the first skill level, but which typically have a longer period of work-related training or work experience. Occupations classified at this level include machine operation, driving, caring occupations, retailing, and clerical and secretarial occupations.

The **third skill level** applies to occupations that normally require a body of knowledge associated with a period of post-compulsory education but not normally to degree level. A number of technical occupations fall into this category, as do a variety of trades occupations and proprietors of small businesses. In the latter case, educational qualifications at sub-degree level or a lengthy period of

vocational training may not be a necessary prerequisite for competent performance of tasks, but a significant period of work experience is typical.

The **fourth skill level** relates to what are termed 'professional' occupations and high level managerial positions in corporate enterprises or national/local government. Occupations at this level normally require a degree or equivalent period of relevant work experience.

Source: http://www.ons.gov.uk/about-statistics/classifications/current/soc2010/soc2010-volume-1-structure-and-descriptions-of-unit-groups/index.html

A.4 Limitations of the database, statistical reliability and confidentiality

Having established a very detailed employment database it is important to appreciate its limitations.[13] Such detailed breakdowns can only ever be indicative, since they are based on survey estimates that were not designed to produce precise estimates at this level of detail. It is also important to recognise that without enormous resources it is not possible to monitor and quality assure every one of these series (over 135,000 in the core results for this latest update to Working Futures, and more than 800,000 if qualification is also included). Although IER/CE have carried out checks to ensure that the basic trends and structural features of the data are sound, it is impossible to check and validate every series.

Working Futures 2017-2027 also includes a more limited set of projections for some sub-regions (Local Enterprise Partnerships (LEP) areas in England and corresponding geographies in Wales). The aim in constructing the data series at this level is to provide a useful benchmark for consideration at a more disaggregated level rather than a fully thought out, local level forecast for each local area and detailed sector.[14]

[13] These concerns are even greater at a sub-regional level such as 'city regions' or LEP areas.

[14] Local users and commentators may be in a position to develop more customised projections, taking into account local circumstances and focusing on issues such as sustainable communities, local growth hot spots and major public sector interventions. It is possible to facilitate this by providing software packages that enable users to develop their own locally customised scenarios. Such software, based on the well-established *Local Economy Forecasting Model*, can be supplied at additional cost if required.

It is also important to recognise the difficulties in putting such detailed information into the public domain. These include confidentiality problems, as well as concerns about statistical reliability. The terms of the 1947 Statistics of Trade Act (and subsequent legislation) prohibits publicly collected data being disseminated in such a manner as to enable the identification of individual enterprises or individuals. Following detailed discussions with the ONS it was agreed that detailed data at the 75 industry level by region from Business Register and Employment Survey (BRES) could be placed by ONS in the public domain without being disclosive. This information, in combination with other data from the Labour Force Survey (LFS) can then be used to generate estimates of employment in various categories of interest (e.g. by occupation and by highest qualification held).

In addition to the issue of confidentiality, presenting detailed historical and projected data in a 'free access' fashion also raises a number of important additional issues for the UK Department for Education. The reliability of historical and projected data inevitably declines with greater sectoral and spatial disaggregation, and is certainly even less reliable in terms of levels for output data than for employment data.

This need not inhibit the presentation of the most detailed information, complete with the appropriate caveats, to the target group of users that the Department is concerned to inform. However, as in the previous Working Futures results, steps have to be taken to ensure confidentiality constraints are not breached and that users are aware of the limitations of the data.

A.5 The multi-sectoral macroeconomic model

The demand for labour is a derived demand. It depends critically on developments in the markets for goods and services and the technologies used to produce them. In order to assess the prospects for the changing pattern of demand for skills, it is essential to ground the analysis on a foundation and understanding of the key economic factors influencing the economy and its structure. This requires a multi-sectoral macroeconomic model.

The cornerstone of the projections is CE's regional model MDM-E3 of the UK economy. MDM-E3 is used to generate estimates of output, productivity and employment for all the main industrial sectors in the UK and its nations and regions (from here on, forecasts for the nations (Scotland, Wales, Northern Ireland) and regions (nine former Government Office Regions of England) of the UK will be denoted 'regional'). The sectoral output and employment forecasts are based on an integrated, one-model approach in which the detailed industry and regional analysis is consistent with the macro analysis.

To develop a model that embodies for all of the nations and regions an accounting structure (including input-output coefficients) to parallel that of the UK would inevitably entail a substantial exercise in data construction and imputation.[15] Instead, the approach taken in MDM-E3 is to make best use of the regional data available to support detailed modelling of the key variables of interest – output, labour demand and labour supply. The approach has been to build up a regional econometric model and database as an integral part of the MDM-E3 model. The model has a clear economic structure, uses incomplete and partial data, and applies econometric techniques to those variables for which the data is judged sufficiently robust to support econometric estimation. The forecasts and projections for the recent past are calibrated so as to reproduce the available data for employment and output. A sensible direction of economic causation for employment is an inherent feature of the model.

An important guiding principle is that that the regional variables and data are consistent with the UK variables and data. At the regional level, a less detailed industry classification has been adopted for the industry variables in the regionalised MDM-E3 (such as Gross Value Added (GVA) and employment) because the available regional data are not sufficient to disaggregate to the more detailed categories used in the UK level analysis. However this is extended to the same 75 industry level by some simple assumptions about fixed shares.

In the macroeconomic model, key drivers (investment, productivity, prices, technical change, competitiveness, imports and exports) are modelled separately for each industry at the UK level. Sectoral productivity is determined within the model by a set of employment functions based on best practice in time series analysis and econometric approaches, using co-integration.

The determination of output depends upon the demand for that sector's products and services from: consumers; other producers (for investment goods and intermediate inputs); government; and from abroad. This in turn depends on prices and costs. The approach explicitly incorporates projected changes in the input-output structure of the economy over the forecast period. This is one of the key ways technological change affects the real economy. Relative price and wage movements and international competition are also key drivers of changes in the structure of industry output.

Employment at the UK level is treated as a demand for labour, derived from the demand for goods and services. UK employment equations are estimated, relating

[15] Previous versions of MDM-E3 included a fuller accounting treatment for the regions, but the advantages that this provided were not considered sufficient to outweigh the limitations of the data and associated efforts to maintain that treatment.

industrial (headcount) employment in each industry to its gross output, wage rates and other drivers. Long-run cointegrating relationships are identified and estimated and dynamic error-correction equations estimated to allow for short-run effects. In general the equations are well determined and the parameters are of the expected sign and magnitude.

To determine employment by region, for each industry in the region, employment is set to grow at an assumed rate of productivity incorporated exogenously in the model. These productivity assumptions are derived from historical trends in regional productivity growth (by industry). Regional employment, by industry, is then scaled to match the UK employment.

MDM-E3 is built around an input-output model, which means that the relationships between different parts of the economy are taken into account. The present results provide a consistent and systematic benchmark view for on-going debate and policy deliberations and the planning of skills provision. They reflect, in a manner which more partial approaches cannot, how individual sector developments “fit together” into an economy-wide picture.

Working Futures sets out a carefully considered view of what the future might look like. It is not intended to be prescriptive. Aggregate demand is modelled in a Keynesian manner, with a consumption function and investment equations at the UK level. However, the model also includes equations for average earnings by industry. Other aspects of the supply side come in through the export and import equations, in which capacity utilisation affects trade performance at the UK level. The detailed set of industry employment equations allows relative wage rates and interest rates to affect employment and industry-level productivity growth.

The use of the macroeconomic model, which is built around a full input-output matrix, provides a sound foundation for assessing industrial employment prospects. In particular, it deals explicitly with such important issues as sub-contracting and technological change which have been features of much recent structural change. These phenomena are dealt with in the model by changes in the pattern of purchases by one industry from another, as reflected in the input-output matrix and by the technical relationship between sectoral employment and output.

In order to meet the needs of all users, the present analysis is at a very detailed level, exploiting the detailed industries used in MDM-E3, which are defined by reference to the availability of data on input-output flows. To meet the needs of sectoral users, the MDM-E3 regional results have also been disaggregated to the 75 industries listed in Table A.3.

Further information about data sources and methods is presented in the separate Working Futures Technical Report.[16]

A.6 Regional and Sub-regional/Sub- national Projections

The Government's policies of 'localism' in England mean there is increased emphasis on sub-regional geographies, encompassing both local neighbourhoods and 'natural economic geographies'. Development of LEPs highlights a preference for 'functional economic areas', rather than 'artificial' boundaries.

In recognition of the importance of provision of economic and labour market intelligence to the LEPs (and analogous geographical areas in the devolved nations) Working Futures projections for 2017-2027 have also been prepared for various sub-regional functional economic areas (see Table A.4), selected in agreement with the Department and its partners.

The main emphasis at the spatial level as far as reporting is concerned remains on the regions and devolved nations of the UK. Despite a renewed focus on sub-regional geographies there is recognition of a continuing need for overarching regional level information. Moreover, as stated above, regions still have a fundamental position in the sub-national statistical architecture. The sub-regional results will be published in due course.

A.7 Occupational Projections including replacement demands

Occupational projections

The occupational projections are developed using largely extrapolative methods, based primarily on data from the LFS releases up to 2017.

Estimates of occupational employment within industries are produced by linking the sectoral employment results to the IER's occupational and regional models. These models are based on research about the factors expected to influence occupational structure at sectoral level[17]. The IER database for Working Futures 2017-2027 has

[16] Wilson, R. A., M. May-Gillings, S. Patel and H Bui, (2019). *Working Futures 2017-2027: Technical report on sources and methods.* Department for Education.
[17] Briscoe, G, and R.A. Wilson, (2003). Modelling UK Occupational Trends, *International Journal of Manpower*. 24, 5, 568-589.

now been extended and updated on a SOC2010 basis, using detailed converters developed by IER in collaboration with ONS.[18]

The database provides breakdowns to the sector level used within the regional model (MDM-E3). This has been modified to cover the detailed 75 industry categories based on SIC2007 agreed with the Department and ONS. Using these data, it is feasible to generate industry by occupation employment matrices at a more detailed level (by the 75 industries, 25 SOC2010 sub major groups, gender, status and region / country). These estimates are constrained to match published totals using a complex RAS iterative procedure to ensure that everything still adds up to the target totals by sector, occupation, region, etc.[19]

Replacement demands

The occupational employment estimates also include replacement needs. These take into account the need to replace those who leave the employed workforce because of retirement or other reasons. Replacement demands (RD) need to be added to any structural change (or so called expansion demand or decline) that is projected, in order to obtain an estimate of the overall requirement. The Replacement Demand estimates are based on quite limited data on age structures and flow rates from the LFS. These have been updated using the latest information. They should be regarded as indicative rather than precise indications of the likely scale of replacement demands.

Estimates of replacement demands have been a key feature of IER occupational projections for many years. The projected net change in employment (expansion demand) tells only a part of the story in terms of future skill requirements. It is crucial to recognise that there will be job openings and important education and training requirements for many occupations where employment levels are expected to fall. These arise because of the need to 'replace' the existing skills that will be 'lost' as a result of retirements and other aspects of the normal process of labour turnover. The scale of replacement demand typically outstrips the scale of expansion demand by a considerable margin (in the current and previous Working Futures projections by an order of magnitude). This varies across occupations and sectors, but even where

[18] Professor Peter Elias of IER has played a leading role in the development of SOC2000 and SOC2010.

[19] RAS is an iterative technique designed to ensure that the row and column sums of a two-dimensional array match some target totals. It has been extended by IER to deal with multi-dimensional arrays. This is not a trivial problem. The present software used by IER to generate a consistent database runs to thousands of lines of complex computer code. This was substantially extended to meet the new requirements of *Working Futures* 3.

substantial job losses are projected, the replacement demand elements are usually more than sufficient to offset this. It is essential, therefore, for employers, education and training providers, and public agencies to recognise the different characteristics and requirements of these two different components of future skill needs.

The various elements of replacement demand depend upon the rates of flows from employment due to factors such as retirement and occupational and geographical mobility. The main source of information that has been used to generate replacement demand estimates is the LFS. This includes estimates of the various flows in and out of the labour market, as well as information on age structure. However, while this can provide useful information across all sectors and regions combined, its sample size is inadequate to provide specific data for particular sectors and regions at a detailed level. There are real problems in obtaining estimates differentiated by all the various dimensions that the Department for Education and its partners are interested in, notably sector and geographical area in tandem. It is obtaining consistent estimates, cross-classified by both dimensions simultaneously, which stretches the data beyond its limits.

Replacement demand estimates are sensitive to the precise assumptions made about the age structure of the workforce concerned and the rates of flows. These are likely to vary considerably across the various key dimensions, but in a manner that is not measured very robustly in the available statistics. In order to recognise this, as in the previous Working Futures, a set of benchmark projections are developed which recognise the importance of RD issues, and which set out clearly and transparently the assumptions upon which they are based.

Extension to 4-digit level of SOC2010

The projections at the 2-digit level are extended to the 4-digit level for use in the LMI for All project.[20] Historical data from the LFS are used to compute shares of 4-digit occupations within 2-digit groups for All Industries. These patterns are then applied to all industries and for all future years. More complete details are given in the accompanying Technical Report (section 8)[21].

[20] See http://www.lmiforall.org.uk/

[21] Wilson, R. A., M. May-Gillings, S. Patel and H Bui, (2019). *Working Futures 2017-2027: Technical report on sources and methods.* Department for Education.

A.8 Labour and Skill Supply Projections

There are many conceptual difficulties in modelling labour supply by level of skill. Most occupations are undertaken by people with a bewildering range of formal qualifications. This is partly a function of age, with older workers generally relying more upon experience than formal qualifications. Even allowing for the age factor, there are enormous differences. This makes defining the supply of people into an occupation almost impossible. It is possible to identify some key elements, focusing on the flows of people through the education and training system, but boundaries are too blurred and transitory to enable quantitative modelling. Much the same is true for the concept of supply of labour to a sector.

For these reasons, the development of supply estimates and projections by occupation and/or sector are not regarded as a practicable proposition. As in previous Working Futures exercises, the approach adopted is to focus on general projections of population and overall labour supply (those economically active) by gender for each geographical area, and to then disaggregate these by the highest levels of qualification held using various modelling techniques.

Labour supply projections are developed for the geographical areas detailed above (see section A.2 and A.6) and include:

- total population;
- population aged 16 and over;
- working age population;
- labour force;
- workforce;
- ILO unemployment;
- claimant unemployment;
- employed residents;
- workplace employment;
- labour market residual.

A set of stochastic equations is used to forecast economic activity rates for the UK by age-band/gender in MDM-E3. The remainder of the model required to construct the projections of labour supply indicators consists of a number of accounting equations to derive labour supply and unemployment from the existing labour market and demographic projections in MDM-E3.

The key stages to determine the labour supply indicators can be summarised as follows:

- UK activity rates (by age-band/gender) are modelled as a function of unemployment and lagged activity rates;
- regional activity rates are projected forward using the growth in the equivalent UK age-band/gender group;
- the regional labour force is determined by activity rates multiplied by the population (by age-band/gender) - this is then scaled to UK labour force and the final regional activity rates are calculated;
- workplace based employment jobs is determined using the existing MDM-E3 equations;
- the LFS measure of employment (employed residents) is determined from workforce employment minus a labour market residual (note that one element of the residual is net commuting);
- some adjustments to the labour market residual are made in the projections to account for trend changes;
- regional LFS employment is taken away from regional labour force to determine regional unemployment[22].

The difference between the LFS measure and the workforce measure of employment is accounted for in the labour market residual. This includes net commuting which results from people travelling from their place of residence, across regional boundaries to their place of work.

ONS projections of population by region, gender and age-band are taken as exogenous inputs to MDM-E3.

The analysis described above provides projections of labour supply, for each of the countries and regions of the UK, by gender. The modelling work is undertaken by detailed age-band[23] so also delivers projections disaggregated by age-band.

[22] Unemployment as defined by the International Labour Organization (ONS), see: http://www.ilo.org/ilostat-files/Documents/description_UR_EN.pdf
[23] The age-bands distinguished are 0-15, 16-24, 25-34, 35-44, 45-59, 60-64, 65+.

Qualifications

With regard to qualifications held by the workforce, the present approach is intentionally pragmatic and eclectic, making the most of the limited data available. It focuses on the highest level of qualification held.

The results are internally consistent at the different levels of aggregation, and the modelling of the supply side, in particular, is complementary to the qualifications modelling previously carried out for the UK Commission by Bosworth (2013a, b and c). It builds on the models developed in previous Working Futures exercises, covering both demand and supply.

The "supply of qualifications" focuses on the future flows of individuals in the population with different qualification levels (based upon the new Regulated Qualifications Framework (RQF) which recently replaced the old Qualifications Credit Framework).[24] It uses a revised **National time series model** as described in Bosworth and Wilson (2019). The results are then linked to the projections of the population and projections of the labour force by age and gender produced by RMDM, as set out above.

The present analysis also considers the "demand side". This generates estimates and projections of employment, unemployment and inactivity rates by level of qualification, as well as the distribution of employment by sector, occupation and region.

However, this distinction between supply and demand is somewhat artificial, as the observed outcomes are the result of a combination of both demand and supply influences. The flow of individuals through qualification levels depends upon perceptions of current and future employment opportunities and wage rates. Likewise, employment by qualification is the outcome of the interaction between supply and demand.

A **regional qualification model** produces equivalent regional results for employment (including results all for the individual countries and regions within the UK). This model focuses upon the shares of the employed population who are qualified to various levels. It uses an apportionment approach. This ensures that the estimates (and projected shares) sum to 100%. It covers the following main dimensions: country/region (12); gender (2); qualification level (6). The results are constrained to sum to the UK total from the national model.

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[24] Which in turn replaced the National Qualifications Framework see: www.qcda.gov.uk/resources/assets/qca-06-2298-nqf-web.pdf.

The **demand side** results are generated through the macro model, which gives benchmark information on future employment prospects by occupation. Occupation is one of the main drivers of changing patterns of employment by qualification, as different occupations tend to have very different requirements (e.g. most professional occupations require higher level qualifications as a matter of course, etc.). In addition there are often significant trends in these patterns within each occupational category which can be modelled and exploited to generate projections. The aggregate employment projections are then further disaggregated by a series of sub-models.

The **occupational/qualification shares model** (QUALSHARE), develops projections of qualification shares within occupations. In order to reconcile the supply and demand sides, a **sorting algorithm (SORT)** then sorts people into occupations such that the various results from the different parts of the modelling exercise are made consistent. In particular, this model is designed to reconcile the projections from the **National time series** model with those from QUALSHARE. The former can be regarded as essentially a view of supply side developments (the overall numbers of people acquiring qualifications), while the latter is more concerned with which occupations they end up in. The SORT model uses an iterative RAS procedure to reconcile the two sets of estimates, constraining the overall qualification shares from QUALSHARE to match those from STOCKFLOW, while maintaining the patterns of occupational deployment in QUALSHARE. The constraint is imposed at the 2- digit occupational level. The key dimensions are: occupations (25); gender (2); qualification levels (6). SORT operates at a UK level.

Finally, there is an extended **replacement demand module,** which generates estimates of qualification numbers for detailed industries and geographical areas. This final module provides the mechanism whereby the implications for individual sectors and regions are developed, focusing on replacement needs. The overall results from this module are calibrated to match the main results from the benchmark projections for the UK and its constituent countries and regions which emerge from SORT and REGQUAL (which generates the regional level results). Data and parameters are provided for individual sectors and regions which enable customised projections for these categories to be developed. These include aggregate qualification and age profiles for individual sectors and regions (but not cross-classified). While data limitations mean that it is not possible to ensure that these results are consistent in every respect with those from the national results, they provide reasonably robust and consistent implications at the more detailed regional and sectoral level. The key dimensions covered are: occupations (25); gender (2); qualification levels (6); country/regions (12); sectors (22).

A.9 Workbooks and access to detailed results

A set of detailed Workbooks have been prepared consistent with those produced for previous Working Futures exercises.

The detailed format of the Workbooks is broadly similar to that used previously. They include sheets providing an occupation by industry shift-share analysis in most workbooks.

A separate workbook presents the results at the 4-digit occupational level.

The workbooks will be published in due course.

Table A.1 Broad Sectors (SIC2007)

Broad Sector	SIC2007 Section	SIC2007 Division	Industry full name	Ind 22	Ind 75
1. Primary sector and utilities	A	01-03	Agriculture, forestry and fishing	1,2,6,7	1,2,24-27
	B	05-09	Mining and quarrying		
	D	35	Electricity, gas, steam and air conditioning		
	E	36-39	Water supply, sewerage, waste management		
2. Manufacturing	C	10-33	Manufacturing	3-5	3-23
3. Construction	F	41-43	Construction	8	28-30
4. Trade, accommod. & transport	G	45-47	Wholesale and retail trade; repair of motor vehicles	9-11	31-40
	H	49-53	Transport and storage		
	I	55-56	Accommodation and food activities		
5. Business & other services	J	58-63	Information and communication	12-17, 21-22	41-63,69-75
	K	64-66	Financial and insurance activities		
	L	68	Real estate activities		
	M	69-75	Professional, scientific and technical activities		
	N	77-82	Administrative and support service activities		
	R	90-93	Arts, entertainment and recreation; other services		
	S	94-96	Other service activities		
6. Non-marketed services	O	84	Public administration and defence etc.	18-20	64-68
	P	85	Education		
	Q	86-88	Human health and social work		

Table A.2 Industry Groups (SIC2007)

Ind 22	SIC2007 Section	SIC2007 Division	Industry full name	Ind 75
1. Agriculture	A	01-03	Agriculture, forestry and fishing	1
2. Mining & quarrying	B	05-09	Mining and quarrying	2
Manufacturing	C	10-33	Manufacturing	3-23
3. Food drink & tobacco		10-12	Food, drink and tobacco	3,4
4. Engineering		26-28	Engineering	16-18
5. Rest of manufacturing		13-25,29-33	Rest of manufacturing	5-15,19-23
6. Electricity & gas	D	35	Electricity, gas, steam and air conditioning	24
7. Water & sewerage	E	36-39	Water supply, sewerage, waste management	25-27
8. Construction	F	41-43	Construction	28-30
9 Whol. & retail trade	G	45-47	Wholesale and retail trade; repair of motor vehicles etc.	31-33
10. Transport & storage	H	49-53	Transport and storage	34-38
11. Accommod. & food	I	55-56	Accommodation and food activities	39-40
Information & comm.	J	58-63	Information and communication	41-46
12. Media		58-60, 63	Media and communication	41-43
13. IT		61,62	Information technology	44-46
14. Finance & insurance	K	64-66	Financial and insurance activities	47-49
15. Real estate	L	68	Real estate activities	50
16. Professional services	M	69-75	Professional, scientific and technical activities	51-57
17. Support services	N	77-82	Administrative and support service activities	58-63
18. Public admin. & defence	O	84	Public administration and defence etc.	64
19. Education	P	85	Education	65
20. Health & social work	Q	86-88	Human health and social work	66-68
21. Arts & entertainment	R	90-93	Arts, entertainment and recreation; other services	69-72
22. Other services	S	94-96	Other service activities	73-75

Table A.3 Detailed industries used in Working Futures (SIC2007)

Ind 75	SIC2007 Section	SIC2007 Division	Industry full name	Ind22	Ind 6
1. Agriculture etc.	A	01-03	Agriculture, forestry and fishing	1	1
2. Coal, oil & gas, mining & related	B	05-09	Coal, oil and gas, other mining and quarrying	2	1
3. Food products	C	10	Food products	3	2
4. Beverages & tobacco		11-12	Beverages and tobacco products	3	2
5. Textiles		13	Textiles	5	2
6. Wearing apparel; leather etc.		14-15	Wearing apparel, leather and related products	5	2
7. Wood etc.		16	Wood and cork products	5	2
8. Paper etc.		17	Paper and paper products	5	2
9. Printing & recording		18	Printing and reproduction of recorded media	5	2
10. Coke & petroleum; chemicals etc.		19-20	Coke and refined petroleum products, chemicals and chemical products	5	2
11. Pharmaceuticals		21	Pharmaceutical products	5	2
12. Rubber & plastic		22	Rubber and plastic products	5	2
13. Other non-metallic		23	Other non-metallic mineral products	5	2
14. Basic metals		24	Basic metals	5	2
15. Metal products		25	Metal products except machinery and equipment	5	2
16. Computers, etc.		26	Computer, electronic and optical products	4	2
17. Electrical equipment		27	Electrical equipment	4	2
18. Machinery etc.		28	Machinery and equipment n.e.c.	4	2
19. Motor vehicles, etc.		29	Motor vehicles, trailers and semi-trailers	5	2
20. Other trans. Equipment		30	Other transport equipment	5	2
21. Furniture		31	Furniture	5	2
22. Other manufacturing		32	Other manufacturing	5	2
23. Repair & installation		33	Repair and installation of machinery and equipment	5	2
24. Electricity, gas, etc.	D	35	Electricity, gas, steam and air conditioning supply	6	1

25. Water	E	36	Water collection, treatment and supply,	7	1
26. Sewerage		37	Sewerage	7	1
27. Waste management		38-39	Waste and waste management services	7	1
28. Construction	F	41	Construction of buildings	8	3
29. Civil engineering		42	Civil engineering	8	3
30. Specialised construction		43	Specialised construction activities	8	3
31. Motor vehicle trade	G	45	Wholesale and retail trade or motor vehicles and motorcycles	9	4
32. Wholesale trade		46	Wholesale trade	9	4
33. Retail trade		47	Retail trade	9	4
34. Land transport, etc.	H	49	Land transport and transport via pipelines	10	4
35. Water transport		50	Water transport	10	4
36. Air transport		51	Air transport	10	4
37. Warehousing, etc.		52	Warehousing and support activities for transportation	10	4
38. Postal & courier		53	Postal and courier services	10	4
39. Accommodation	I	55	Accommodation	11	4
40. Food & beverage services		56	Food and beverage service activities	11	4
41. Publishing activities	J	58	Publishing activities	12	5
42. Film & music		59	Motion picture, video and music publishing	12	5
43. Broadcasting		60	Programming and broadcasting activities	12	5
44. Telecommunications		61	Telecommunications	13	5
45. Computer programming etc.		62	Computer programming, consultancy and related activities	13	5
46. Information services		63	Information service activities	12	5
47. Financial services	K	64	Financial service activities	14	5
48. Insurance & pensions		65	Insurance and pension funding	14	5
49. Auxiliary financial services		66	Activities auxiliary to financial services and insurance	14	5
50. Real estate	L	68	Real estate activities	15	5
51. Legal & accounting	M	69	Legal and accounting activities	16	5
52. Head offices, etc.		70	Activities of head offices; management consultancy activities	16	5
53. Architectural & related		71	Architectural and engineering activities	16	5
54. Scientific research		72	Scientific research and development	16	5

55. Advertising, etc.		73	Advertising and market research	16	5
56. Other professional		74	Other professional, scientific and technical activities	16	5
57. Veterinary		75	Veterinary activities	16	5
58. Rental & leasing	N	77	Rental and leasing activities	17	5
59. Employment activities		78	Employment activities	17	5
60. Travel, etc.		79	Travel agency and tour operator activities	17	5
61. Security, etc.		80	Security and investigation activities	17	5
62. Services to buildings		81	Services to buildings and landscape activities	17	5
63. Office admin		82	Office administrative; office support activities	17	6
64. Public admin. & defence	O	84	Public administration and defence, compulsory social security	18	6
65. Education	P	85	Education	19	6
66. Health	Q	86	Human health activities	20	6
67. Residential care		87	Residential care activities	20	6
68. Social work		88	Social work activities without accommodation	20	6
69. Arts & entertainment	R	90	Creative, arts and entertainment activities	21	6
70. Libraries, etc.		91	Library, archives, museums and other cultural activities	21	6
71. Gambling		92	Gambling and betting activities	21	6
72. Sport & recreation		93	Sport activities, amusement and recreational activities	21	6
73. Membership organisations	S	94	Activities of membership organisations	22	6
74. Repair of goods		95	Repair of computers and personal household goods	22	6
75. Other personal service		96	Other personal services activities	22	6

Table A.4 Sub-regional Geographies in Working Futures 2017-2027

Working Futures 2017-2027 Sub-regional Geography	Local authorities included
England: Local Enterprise Partnerships (LEPS)	
Black Country	Dudley, Sandwell, Walsall, Wolverhampton
Buckinghamshire Thames Valley	Buckinghamshire
Cheshire and Warrington	Cheshire East (unitary), Cheshire West and Chester (unitary), Warrington (unitary)
Coast to Capital	Brighton and Hove (unitary), East Sussex: Lewes, Croydon, Epsom and Ewell, Mole Valley, Reigate and Banstead, Tandridge, West Sussex
Cornwall and Isles of Scilly	Cornwall (unitary), Isles of Scilly
Coventry and Warwickshire	Warwickshire, Coventry
Cumbria	Cumbria
Derby, Derbyshire, Nottingham and Nottinghamshire	Derby, Derbyshire, Nottingham (unitary), Nottinghamshire
Dorset	Bournemouth (unitary), Dorset, Poole (unitary)
Enterprise M3	Basingstoke and Deane, East Hampshire, Hart, New Forest, Rushmoor, Test Valley, Winchester, Elmbridge, Guildford, Runnymede, Spelthorne, Surrey Heath, Waverley, Woking
Gloucestershire	Gloucestershire
Greater Birmingham and Solihull	Cannock Chase, East Staffordshire, Lichfield, Tamworth, Birmingham, Solihull, Bromsgrove, Redditch, Wyre Forest
Greater Cambridge and Greater Peterborough	Cambridgeshire, Uttlesford, North Hertfordshire, King's Lynn and West Norfolk, Forest Heath, St Edmundsbury, Peterborough (unitary), Rutland (unitary)
Greater Lincolnshire	Lincolnshire, North Lincolnshire (unitary), North East Lincolnshire (unitary)

Greater Manchester	Greater Manchester
Heart of the South West	Devon, Somerset
Hertfordshire	Hertfordshire
Humber	East Riding of Yorkshire (unitary), Kingston upon Hull (unitary), North East Lincolnshire (unitary), North Lincolnshire (unitary)
Lancashire	Lancashire, Blackburn with Darwen (unitary), Blackpool (unitary)
Leeds City Region	Barnsley, Craven, Harrogate, Selby, West Yorkshire, York (unitary)
Leicester and Leicestershire	Leicester (unitary), Leicestershire
Liverpool City Region	Halton (unitary), Merseyside
London Enterprise Panel	Greater London
New Anglia	Norfolk, Suffolk
North Eastern	County Durham (unitary), Northumberland (unitary), Tyne and Wear
Northamptonshire	Northamptonshire
Oxfordshire	Oxfordshire
Sheffield City Region	Bolsover, Chesterfield, North East Derbyshire, Bassetlaw, South Yorkshire
Solent	East Hampshire, Eastleigh, Fareham, Gosport, Havant, New Forest, Test Valley, Winchester, Isle of Wight (unitary), Portsmouth (unitary), Southampton (unitary)
South East	East Sussex, Essex, Kent, Medway (unitary), Southend-on-Sea (unitary), Thurrock (unitary)
South East Midlands	Bedford (unitary), Aylesbury Vale, Central Bedfordshire (unitary), Luton (unitary), Milton Keynes (unitary), Corby, Daventry, Kettering, Northampton, South Northamptonshire, Cherwell
Stoke-on-Trent and Staffordshire	Staffordshire, Stoke-on-Trent (unitary)

Swindon and Wiltshire	Swindon (unitary), Wiltshire (unitary)
Tees Valley	Darlington (unitary), Hartlepool (unitary), Middlesbrough (unitary), Redcar and Cleveland (unitary), Stockton-on-Tees (unitary)
Thames Valley Berkshire	Bracknell Forest (unitary), Reading (unitary), Slough (unitary), West Berkshire (unitary), Windsor and Maidenhead (unitary), Wokingham (unitary)
The Marches	Herefordshire (unitary), Shropshire (unitary), Telford and Wrekin (unitary)
West of England	Bath and North East Somerset (unitary), Bristol (unitary), North Somerset (unitary), South Gloucestershire (unitary)
Worcestershire	Worcestershire
York North Yorkshire and East Riding	North Yorkshire, York (unitary), East Riding of Yorkshire (unitary)
Wales: Economic Areas	
North	Anglesey, Conwy, Denbighshire, Flintshire, Gwynedd, Wrexham
Mid	Ceredigion, Powys
South West	Carmarthenshire, Neath Port Talbot, Pembrokeshire, Swansea
South East	Bridgend, Blaenau Gwent, Caerphilly, Cardiff, Merthyr Tydfil, Monmouthshire, Newport, Rhondda, Cynon, Taff, Torfaen, Vale of Glamorgan

Table A.5 SOC2010 Major Groups and Sub-major Groups

Major group	Sub-Major Groups	Skill Level
1 Managers, directors and senior officials	11 Corporate managers and directors	4
	12 Other managers and proprietors	3
2 Professional Occupations	21 Science, research, engineering and technology professionals	4
	22 Health professionals	4
	23 Teaching and educational professionals	4
	24 Business, media and public service professionals	4
3 Associate professional and technical occupations	31 Science, engineering and technology associate professionals	3
	32 Health and social care associate professionals	3
	33 Protective service occupations	3
	34 Culture, media and sports occupations	3
	35 Business and public service associate professionals	3
4 Administrative and secretarial occupations	41 Administrative occupations	2
	42 Secretarial and related occupations	2
5 Skills trades occupations	51 Skilled agricultural and related trades	3
	52 Skilled metal, electrical and electronic trades	3
	53 Skilled construction and building trades	3
	54 Textiles, printing and other skilled trades	3
6 Caring, leisure and other service occupations	61 Caring personal service occupations	2
	62 Leisure, travel and related personal service occupations	2
7 Sales and customer service occupations	71 Sales occupations 72 Customer service occupations	2 2
8 Process, plant and machine operatives	81 Process, plant and machine operatives	2
	82 Transport and mobile machine drivers and operatives	2
9 Elementary occupations	91 Elementary trades and related occupations	1
	92 Elementary administration and service occupations	1

Source: SOC2010: Volume 1: Structure and Description of Unit Groups

B Comparison with previous projections

B.1 Comparison with previous results for Sectoral Employment and Productivity

It is informative to compare the current projections with those produced previously. The projections may change for three main reasons:

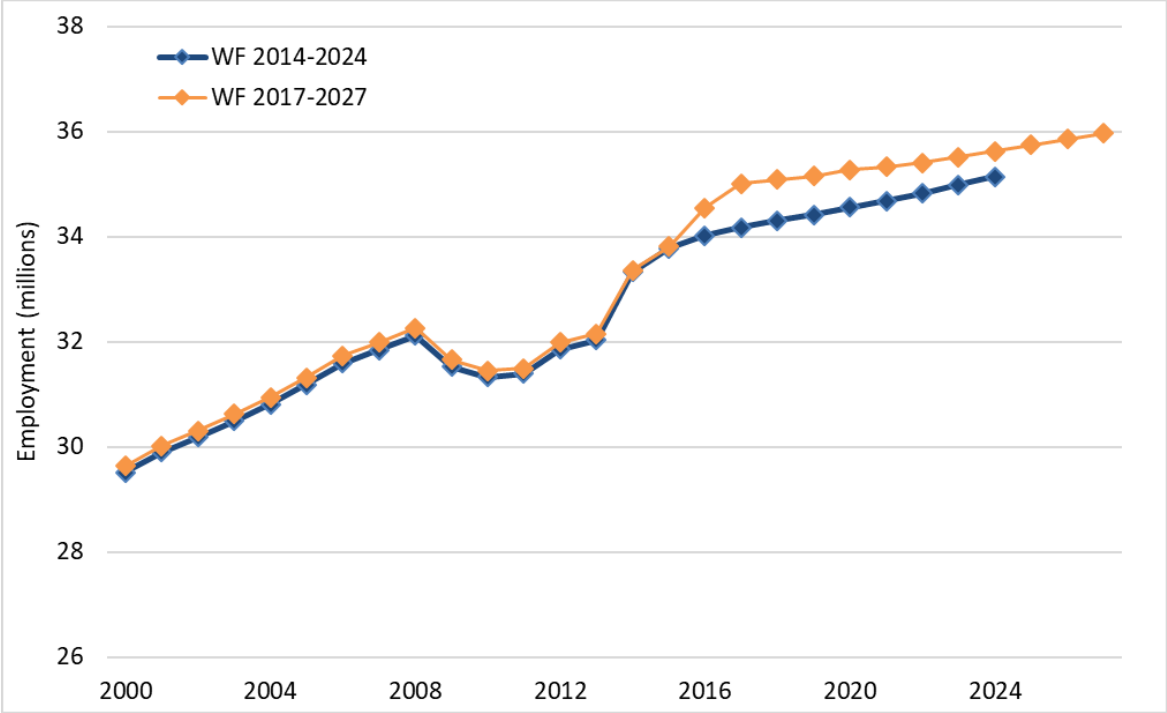
- revisions to historical data and perceptions of the current situation;
- amendments to exogenous assumptions about what might happen next;
- modifications and corrections to the underlying models used to produce the projections, including previous model error.

All three elements play a role.

Figure B.1 and Tables B.1 – B.3 compare the employment forecasts from Working Futures 2017-2027 with the forecasts from Working Futures 2014-2024. CE's forecasts underpinning the Working Futures 2014-2024 results were completed in Autumn 2015, and the last year of official UK employment data available at the time was for 2014 (CE uses June workforce jobs figures for each year, which were not available for 2015 when the forecast was being developed). Figure B.1 provides an overview of the difference in total UK employment (workforce jobs) in each forecast, and shows that there have been some revisions to the historical data since Working Futures 2014-2024, due to newly available data and changes in ONS methodology.[51] The chart shows that in 2014, the last year for which Working Futures 2014-2024 used official data, employment was recorded around 24,000 jobs lower than by the more recent data that was used for Working Futures 2017-2027.

[51] See https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/revisionstoworkforcejobsdecember2018 and previous versions

Figure B.1 UK Total Employment (millions)



For Working Futures 2014-2024, the first year of CE's forecast was 2015; for Working Futures 2017-2027 it is 2018. For the Working Futures 2017-2027 forecast, we have official data for UK workforce jobs for 2017 (and quarterly data up to March 2018, which were used to make an estimate for June 2018). The data show that, in 2017, workforce jobs increased more sharply (1.3%) than CE had forecast for Working Futures 2014-2024 (0.5%).

After 2017 (which is a forecast in previous Working Futures results), we now expect overall employment growth up to 2020 to be slower than was forecast for Working Futures 2014-2024. From 2020 onwards, the Working Futures 2017-2027 forecast for employment growth is slower than the WF6 forecast. This is, in part, because of the uncertainty following the UK's decision to leave the EU. With the precise form of the future UK-EU relationship and the resulting impacts on barriers to trade and the movement of people still unknown, business' investment decisions and people's migration patterns are likely to be affected in the short-term, with potential effects continuing into the longer-term.

Table B.1 compares the Working Futures 2017-2027 and Working Futures 2014-2024 forecasts by broad sector. The table shows how growth in employment was faster than expected (using data for Working Futures 2017-2027 rather than the forecast for 2014-2024) over 2014-2017 in all the broad sectors. Employment growth in construction was especially high, at 8% over 2014-2017, while trade, accommodation and transport employment growth

was also far higher than expected, at 7.2% compared to the Working Futures 2014-2024 forecast of 3.9%. Employment in the Primary sector & utilities and non-marketed services, which were forecast in Working Futures 2014-2024 to fall by 3.7% and 1.2% respectively, actually grew by 5.7% and 2% respectively according to the official data. As is evident from Figure B.1, growth over this three year period was largely driven by an upward surge in employment in 2016 and 2017.

Over 2017-24, the absolute change in employment in the Working Futures 2017-2027 forecast (0.6m) is around 340,000 jobs fewer than the Working Futures 2014-2024 forecast (1m), although the level of employment in 2017 in the Working Futures 2017-2027 forecast is 0.8m higher than in the Working Futures 2014-2024 forecast (in part due to revised data and in part due to the sharp increase in employment seen in 2016 and 2017).

Although in broad terms, the Working Futures 2017-2027 forecast is only slightly slower over the long term (2017-24), with overall growth of 1.8% forecast in Working Futures 2017-2027 compared with 2.8% in Working Futures 2014-2024, the outcomes by broad sector can be quite different. The forecast for growth in construction is considerably different from Working Futures 2014-2024, with growth of 1.4% forecast over 2017-24 in Working Futures 2017-2027 compared with a higher growth forecast of 7.2% in Working Futures 2014-2024. This is partly driven by an expected slowdown in investment due to uncertainty around Brexit, as well as the skills shortage facing the sector, which is amplified by the high concentration of EU migrants employed in the sector that may be affected following Brexit. The forecast for decline in manufacturing, on the other hand, is lower in Working Futures 2017-2027, with a decline of 7.1% forecast over 2017-24 in Working Futures 2017-2027 compared with a larger decline of 10.5 percent forecast in Working Futures 2014-2024. This is partly because the absolute level of employment in this sector was higher in 2017 than previously expected and future growth is expected to be supported by global growth in advanced manufacturing demand, especially for industries in which the UK has specialised such as aerospace, pharmaceuticals and other technology-intensive industries.

Table B.2 compares the two forecasts by status of employment (full-time, part-time, self-employment, by gender). Over 2014-2017, which is historical data for Working Futures 2017-2027 compared with forecast for Working Futures 2014-2024, the overall change in employment that took place is larger than was forecast in Working Futures 2014-2024, as already discussed. In terms of growth rates, some of the greatest differences are in female part-time (8.7% in Working Futures 2017-2027 compared to 4.3% in Working Futures 2014-2024), and female self-employment (3.9% in Working Futures 2017-2027

compared to 14.4% in Working Futures 2014-2024). Male self-employment, which was expected to grow by 3.9%, declined by 2%, ending more than a decade of strong growth in self-employment, which was fuelled by limited job opportunities during the recession (with self-employment providing an alternative to unemployment).

Over 2017-24, the growth across all of the employment statuses is expected to be slower than the Working Futures 2014-2024 forecast as, among other factors, uncertainty around the future impacts of Brexit continues. The most obvious difference between the employment status forecasts is in both male and female self-employment, which is expected to decline by 2.9% and 0.6% respectively in the Working Futures 2017-2027 forecast, compared to a decline of 0.8% for the former status and growth of 0.3% for the latter status in the Working Futures 2014-2024 forecast. This suggests that the recent boom in self-employment following the recession is coming to an end. The strongest growth over this period, as in Working Futures 2014-2024, is expected to be seen in male part-time employment, as the long term trend continues. This is also true in absolute terms, with male part-time employment expected to increase by about 300,000 over 2017-24.

Table B.1 Comparison of Working Futures 2017-2027 and 2014-2024 – Employment by Broad Sector

Working Futures 2014-2024	2014	2017	2024		2027	2014-2017	2017-2024	2014-2024
		Employment (000s)						
Primary sector & utilities	837	806	765		n.a.	-31	-41	-72
Manufacturing	2,591	2,627	2,350		n.a.	36	-277	-241
Construction	2,092	2,233	2,393		n.a.	141	160	301
Trade, accomod. & transport	8,604	8,942	9,248		n.a.	338	306	644
Business & other services	10,523	10,988	11,552		n.a.	465	564	1,029
Non-marketed services	8,684	8,582	8,833		n.a.	-102	251	149
Total	33,331	34,177	35,141		n.a.	846	964	1,810
		Shares (%)				Growth (%)		
Primary sector & utilities	2.5	2.4	2.2		n.a.	-3.7	-5.1	-8.6
Manufacturing	7.8	7.7	6.7		n.a.	1.4	-10.5	-9.3
Construction	6.3	6.5	6.8		n.a.	6.7	7.2	14.4
Trade, accomod. & transport	25.8	26.2	26.3		n.a.	3.9	3.4	7.5
Business & other services	31.6	32.2	32.9		n.a.	4.4	5.1	9.8
Non-marketed services	26.1	25.1	25.1		n.a.	-1.2	2.9	1.7
Total	100.0	100.0	100.0		n.a.	2.5	2.8	5.4
Working Futures 2017-2027	**2014**	**2017**	**2024**		**2027**	**2014-2017**	**2017-2024**	**2014-2024**
		Employment (000s)						
Primary sector & utilities	812	858	845		842	46	-13	33
Manufacturing	2612	2672	2483		2414	60	-189	-129
Construction	2117	2286	2318		2336	169	32	201
Trade, accomod. & transport	8599	9218	9228		9323	619	10	629
Business & other services	10594	11176	11701		11838	582	525	1,107
Non-marketed services	8621	8793	9050		9212	172	257	429
Total	33355	35004	35626		35966	1,649	622	2,271
		Shares (%)				Growth (%)		
Primary sector & utilities	2.4	2.5	2.4		2.3	5.7	-1.6	4.0
Manufacturing	7.8	7.6	7.0		6.7	2.3	-7.1	-4.9
Construction	6.3	6.5	6.5		6.5	8.0	1.4	9.5
Trade, accomod. & transport	25.8	26.3	25.9		25.9	7.2	0.1	7.3
Business & other services	31.8	31.9	32.8		32.9	5.5	4.7	10.5
Non-marketed services	25.8	25.1	25.4		25.6	2.0	2.9	5.0
Total	100.0	100.0	100.0		100.0	4.9	1.8	6.8

Source: Cambridge Econometrics, MDM revision 13406

Table B.2 Comparison of Working Futures 2017-2027 and 2014-2024 – Employment by Status

Working Futures 2014-2024	2014	2017	2024	2027	2014-2017	2017-2024	2014-2024
	Employment (000s)						
Male FT	11,579	12,096	12,420	n.a.	518	324	841
Female FT	7,070	7,377	7,800	n.a.	307	423	730
Male PT	2,375	2,487	2,876	n.a.	112	389	501
Female PT	6,592	6,827	7,204	n.a.	235	377	612
Male SE	2,857	2,968	2,945	n.a.	110	-23	87
Female SE	1,378	1,576	1,580	n.a.	199	4	203
Total	31,851	33,331	34,825	n.a.	1,480	1,494	2,974
	Shares (%)				Growth (%)		
Male FT	36.4	36.3	35.7	n.a.	4.5	2.7	7.3
Female FT	22.2	22.1	22.4	n.a.	4.3	5.7	10.3
Male PT	7.5	7.5	8.3	n.a.	4.7	15.7	21.1
Female PT	20.7	20.5	20.7	n.a.	3.6	5.5	9.3
Male SE	9.0	8.9	8.5	n.a.	3.9	-0.8	3.0
Female SE	4.3	4.7	4.5	n.a.	14.4	0.3	14.7
Total	100.0	100.0	100.0	n.a.	4.6	4.5	9.3
Working Futures 2017-2027	**2014**	**2017**	**2024**	**2027**	**2014-2017**	**2017-2024**	**2014-2024**
	Employment (000s)						
Male FT	12,067	12,811	12,691	12,662	744	-120	623
Female FT	7,378	8,022	8,276	8,403	643	255	898
Male PT	2,516	2,651	2,949	3,086	134	299	433
Female PT	6,846	6,973	7,258	7,400	127	285	411
Male SE	2,971	2,912	2,826	2,794	-60	-86	-145
Female SE	1,575	1,636	1,626	1,621	61	-10	50
Total	33,355	35,004	35,626	35,966	1,649	622	2,271
	Shares (%)				Growth (%)		
Male FT	36.2	36.6	35.6	35.2	6.2	-0.9	5.2
Female FT	22.1	22.9	23.2	23.4	8.7	3.2	12.2
Male PT	7.5	7.6	8.3	8.6	5.3	11.3	17.2
Female PT	20.5	19.9	20.4	20.6	1.8	4.1	6.0
Male SE	8.9	8.3	7.9	7.8	-2.0	-2.9	-4.9
Female SE	4.7	4.7	4.6	4.5	3.9	-0.6	3.2
Total	100.0	100.0	100.0	100.0	4.9	1.8	6.8

Source: Cambridge Econometrics, MDM revision 13406. Note: FT = full-time, PT = part-time, SE = self-employed.

Table B.3 Comparison of Working Futures 2017-2027 and 2014-2024 – Productivity

Working Futures 2014-2024	Change (%) 2014-2017	2017-2024	2014-2024
Primary sector & utilities	10.0	6.0	16.6
Manufacturing	5.4	24.5	31.2
Construction	6.1	11.5	18.4
Trade, accomod. & transport	4.8	9.7	15.0
Business & other services	3.8	10.9	15.1
Non-marketed services	4.1	13.2	17.8
Total	4.8	12.5	17.9
Working Futures 2017-2027	**Change (%) 2014-2017**	**2017-2024**	**2014-2024**
Primary sector & utilities	-2.1	3.7	1.5
Manufacturing	-0.8	14.9	14.0
Construction	7.5	4.2	12.0
Trade, accomod. & transport	1.1	7.6	8.7
Business & other services	2.7	5.1	8.0
Non-marketed services	-1.3	5.5	4.1
Total	1.0	6.4	7.4

Source: Cambridge Econometrics, MDM revision 13406

Table B.3 compares productivity growth in the two forecasts. The table shows that over 2014-2017, rather than increasing by 4.8% as forecast in Working Futures 2014-2024, productivity increased by a much slower rate of 1 per cent, as employment levels grew more strongly than expected (in 2016 and 2017). The greatest differences in actual productivity growth over 2014-2017 compared to the Working Futures 2014-2024 forecast were in the primary sector & utilities (-12.1 percentage points) and manufacturing (6.1 percentage points).

Over 2017-24, overall productivity growth (6.4%) is now forecast to be lower than in the Working Futures 2014-2024 forecast (12.5%). The greatest change in the forecast for productivity by broad sector is in manufacturing and construction, which are now forecast to increase by around 14.9% and 4.2% respectively over this period, compared with 24.5% for the former sector and 11.5% for the latter sector in Working Futures 2014-2024. The strongest growth in productivity is still expected to be in manufacturing, as employment is expected to decline over this period while output is expected to continue to grow.

B.2 Comparison with previous forecasts for occupations and qualifications

Table B.4 presents a comparison of the results by occupation. There have been some minor changes with regard to trends in occupational structure between Working Futures 2014-2024 and Working Futures 2017-2027, the main differences arise as a result of the more rapid recovery of overall employment levels now expected and differences in the pace of change between sectors.

The main difference between the two sets of projections is the fact that in the Working Futures 2017-2027 projections total employment is now expected to rise by around 2.2 million between 2014 and 2024 (as opposed to 1.8 million in Working Futures 2014-2024). This is principally due to the unexpected sharp rise in employment in 2014 rather than a faster rate of growth over the period as a whole. This benefits most occupations to some degree but the main beneficiaries are those that are already projected to be on a positive trend (managers, professionals, associate professionals and caring leisure and other service occupations (SOC Major Groups 1, 2, 3 and 6)). The employment falls in “declining” occupations are expected to be less pronounced as a result of general employment growth in early part of period.

Job losses are still expected for administrative and secretarial occupations, skilled trades, Sales and customer service occupations, and process, plant and machine operatives (SOC Major Groups 4, 5, 7 and 8).

Employment amongst elementary occupations (SOC Major Group 9) is now projected to decline slightly.

Overall at the Major Group level, the occupational trends (in structure and percentage shares) projected remain very similar to those observed over the period since the early 1980s, as presented in previous Working Futures projections.

Table B.4 Comparison of Working Futures 2017-2027 and 2014-2024 by Occupation

Working Futures 2014-2024	Employment (000s)				Growth (000s)				
	2009	2014	2019	2024	2009-2014	2014-2019	2009-2024	2014-2024	2019-2024
1. Managers, directors and senior officials	2,919	3,304	3,612	3,802	385	308	883	499	191
2. Professional occupations	5,874	6,596	7,115	7,471	722	519	1,597	875	356
3. Associate professional and technical	4,284	4,638	4,964	5,176	354	326	892	538	212
4. Administrative and secretarial	3,624	3,565	3,315	3,176	-59	-250	-448	-389	-140
5. Skilled trades occupations	3,584	3,611	3,576	3,514	28	-35	-70	-98	-62
6. Caring, leisure and other service	2,736	3,134	3,359	3,543	398	226	807	409	183
7. Sales and customer service	2,553	2,600	2,605	2,603	47	5	50	3	-2
8. Process, plant and machine operatives	2,102	2,067	1,991	1,936	-35	-76	-166	-131	-55
9. Elementary occupations	3,651	3,652	3,722	3,771	1	70	120	119	50
All occupations	**31,327**	**33,167**	34,259	34,992	1,840	1,092	3,665	1,825	734
	Share (%)				**Growth (%)**				
1. Managers, directors and senior officials	9.3	10.0	10.5	10.9	13.2	9.3	30.3	15.1	5.3
2. Professional occupations	18.8	19.9	20.8	21.4	12.3	7.9	27.2	13.3	5.0
3. Associate professional and technical	13.7	14.0	14.5	14.8	8.3	7.0	20.8	11.6	4.3
4. Administrative and secretarial	11.6	10.7	9.7	9.1	-1.6	-7.0	-12.4	-10.9	-4.2
5. Skilled trades occupations	11.4	10.9	10.4	10.0	0.8	-1.0	-2.0	-2.7	-1.7
6. Caring, leisure and other service	8.7	9.4	9.8	10.1	14.5	7.2	29.5	13.1	5.5
7. Sales and customer service	8.1	7.8	7.6	7.4	1.8	0.2	2.0	0.1	-0.1
8. Process, plant and machine operatives	6.7	6.2	5.8	5.5	-1.7	-3.7	-7.9	-6.3	-2.8
9. Elementary occupations	11.7	11.0	10.9	10.8	0.0	1.9	3.3	3.3	1.3
All occupations	100.0	100.0	100.0	100.0	5.9	3.3	11.7	5.5	2.1

Table B.4 (continued) Comparison of Working Futures 2017-2027 and 2014-2024 by occupation

Working Futures 2017-2027	Employment (000s)				Growth (000s)				
	2009	2014	2019	2024	2009-2014	2014-2019	2009-2024	2014-2024	2019-2024
1. Managers, directors and senior officials	2,853	3,269	3,655	3,886	416	386	1,033	617	230
2. Professional occupations	5,677	6,311	7,016	7,456	634	705	1,778	1,145	440
3. Associate professional and technical	4,193	4,525	4,979	5,203	332	454	1,010	677	223
4. Administrative and secretarial	3,784	3,712	3,554	3,231	-72	-158	-553	-481	-323
5. Skilled trades occupations	3,385	3,387	3,373	3,209	2	-14	-176	-178	-164
6. Caring, leisure and other service	2,724	3,122	3,424	3,658	397	303	934	536	234
7. Sales and customer service	2,811	2,864	2,918	2,878	53	55	67	14	-40
8. Process, plant and machine operatives	2,203	2,165	2,127	2,015	-38	-38	-188	-149	-111
9. Elementary occupations	3,824	3,837	3,950	3,943	12	114	119	106	-8
All occupations	**31,455**	**33,191**	34,997	35,478	1,736	1,806	4,023	2,287	481
	Share (per cent)				**Growth (per cent)**				
1. Managers, directors and senior officials	9.1	9.8	10.4	11.0	14.6	11.8	36.2	18.9	6.3
2. Professional occupations	18.0	19.0	20.0	21.0	11.2	11.2	31.3	18.1	6.3
3. Associate professional and technical	13.3	13.6	14.2	14.7	7.9	10.0	24.1	15.0	4.5
4. Administrative and secretarial	12.0	11.2	10.2	9.1	-1.9	-4.3	-14.6	-13.0	-9.1
5. Skilled trades occupations	10.8	10.2	9.6	9.0	0.1	-0.4	-5.2	-5.3	-4.9
6. Caring, leisure and other service	8.7	9.4	9.8	10.3	14.6	9.7	34.3	17.2	6.8
7. Sales and customer service	8.9	8.6	8.3	8.1	1.9	1.9	2.4	0.5	-1.4
8. Process, plant and machine operatives	7.0	6.5	6.1	5.7	-1.7	-1.8	-8.5	-6.9	-5.2
9. Elementary occupations	12.2	11.6	11.3	11.1	0.3	3.0	3.1	2.8	-0.2
All occupations	100.0	100.0	100.0	100.0	5.5	5.4	12.8	6.9	1.4

Table B.5 makes a similar comparison of the qualifications projections. As with the occupational results a key difference is the overall scale of employment change projected which boosts the net growth for many categories (namely RFQ 4-8).

There have been some further revisions to the projected patterns employed by highest level of qualifications held. These revisions reflect the amendments made to the supply side. They lower the projected proportion of those in employment who are qualified at RQF levels 6 and a rise in those qualified at RQF levels 7 and 8 compared with the previous projections. However, the broad patterns of change are very similar to those published previously with the employed workforce becoming increasingly well qualified. The overall message, of rapidly increasing shares and numbers at higher level (RQF level 4-8) and declines at RQF level 0-1, remains.

Table B.5 Comparison of Working Futures 2017-2027 and 2014-2024 by Qualification

Working Futures 2014-2024	Employment (000s)				Growth (000s)				
(RQF 0-8)	2009	2014	2019	2024	2009-2014	2014-2019	2009-2024	2014-2024	2019-2024
RQF8	344	394	462	513	50	69	170	120	51
RQF7	2,329	2,714	3,207	3,517	384	493	1,188	803	310
RQF6	4,970	6,617	8,367	9,848	1,647	1,750	4,878	3,231	1,480
RQF5	1,879	2,048	2,267	2,436	170	219	557	387	168
RQF4	1,545	1,861	2,288	2,614	316	427	1,069	753	326
RQF3	6,134	6,633	6,448	6,243	499	-186	108	-391	-205
RQF2	6,771	6,607	6,450	6,134	-165	-157	-637	-472	-316
RQF1	5,152	4,488	3,711	3,008	-664	-778	-2,144	-1,480	-703
No Qual	2,202	1,804	1,058	680	-397	-746	-1,522	-1,125	-379
All Qualifications	**31,327**	**33,167**	34,259	34,992	1,840	1,092	3,665	1,825	734
	Share (per cent)				Growth (per cent)				
RQF8	1.1	1.2	1.3	1.5	14.5	17.5	49.3	30.4	11.0
RQF7	7.4	8.2	9.4	10.1	16.5	18.2	51.0	29.6	9.7
RQF6	15.9	20.0	24.4	28.1	33.1	26.4	98.1	48.8	17.7
RQF5	6.0	6.2	6.6	7.0	9.0	10.7	29.7	18.9	7.4
RQF4	4.9	5.6	6.7	7.5	20.4	22.9	69.1	40.4	14.2
RQF3	19.6	20.0	18.8	17.8	8.1	-2.8	1.8	-5.9	-3.2
RQF2	21.6	19.9	18.8	17.5	-2.4	-2.4	-9.4	-7.2	-4.9
RQF1	16.4	13.5	10.8	8.6	-12.9	-17.3	-41.6	-33.0	-18.9
No Qual	7.0	5.4	3.1	1.9	-18.0	-41.4	-69.1	-62.3	-35.8
All Qualifications	100.0	100.0	100.0	100.0	5.9	3.3	11.7	5.5	2.1

Table B.5 (continued) Comparison of Working Futures 2017-2027 and 2014-2024 by Qualification

Working Futures 2017-2027	Employment (000s)				Growth (000s)				
(RQF 0-8)	2009	2014	2019	2024	2009-2014	2014-2019	2009-2024	2014-2024	2019-2024
RQF8	345	395	570	677	50	175	333	282	107
RQF7	2,331	2,717	4,000	4,723	385	1,283	2,392	2,007	723
RQF6	4,989	6,621	7,677	8,697	1,632	1,056	3,708	2,076	1,020
RQF5	1,878	2,050	2,112	2,217	172	62	340	167	105
RQF4	1,551	1,867	2,104	2,334	316	237	782	466	230
RQF3	6,168	6,627	6,723	6,512	459	96	344	-115	-211
RQF2	6,808	6,611	6,449	6,041	-196	-162	-767	-570	-408
RQF1	5,179	4,493	4,021	3,291	-686	-472	-1,889	-1,202	-730
No Qual	2,206	1,809	1,341	986	-397	-468	-1,220	-823	-355
All qualifications	31,455	33,191	34,997	35,478	1,736	1,806	4,023	2,287	481
	Share (per cent)				Growth (per cent)				
RQF8	1.1	1.2	1.6	1.9	14.6	44.3	96.5	71.5	18.8
RQF7	7.4	8.2	11.4	13.3	16.5	47.2	102.6	73.9	18.1
RQF6	15.9	19.9	21.9	24.5	32.7	15.9	74.3	31.4	13.3
RQF5	6.0	6.2	6.0	6.2	9.2	3.0	18.1	8.2	5.0
RQF4	4.9	5.6	6.0	6.6	20.4	12.7	50.4	25.0	10.9
RQF3	19.6	20.0	19.2	18.4	7.4	1.5	5.6	-1.7	-3.1
RQF2	21.6	19.9	18.4	17.0	-2.9	-2.5	-11.3	-8.6	-6.3
RQF1	16.5	13.5	11.5	9.3	-13.3	-10.5	-36.5	-26.8	-18.2
No Qual	7.0	5.5	3.8	2.8	-18.0	-25.9	-55.3	-45.5	-26.5
All qualifications	100.0	100.0	100.0	100.0	5.5	5.4	12.8	6.9	1.4

Source: Sheet WF5v6QUALcomp in: M:\IE\Projects\WorkingFutures\data\Results\Workbooks\Summary%20tables%20&%20charts\WFComparisonWF6-WF7.xlsx

C Projections at the most detailed occupational level (SOC2010 4-digit categories)

C.1 Development of the detailed 4-digit occupational projections

This Annex describes indicative results at the more detailed 4-digit level of SOC2010, including a brief description of how they have been produced. There are some 369 4- digit categories, so this represents a very significant expansion of the level of detail. Robust official data at this level only exist at a very aggregate level due to the limited sample size of the key data source (the LFS).

These update the initial set of estimates produced for the LMI for All[52] project. This is done by applying a very simple expansion technique. LFS data are combined for a number of years. These data are used to generate shares of 4-digit occupational categories within the 2-digit occupational categories (sub-major groups). These shares are then applied for all years and across all industries.

This imposes the strong assumptions that these patterns do not change over time and that they are common across industries, both of which are unlikely to hold true in all cases.

With regard to changes over time, the LFS sample is not regarded as sufficiently large to generate meaningful differences over time when broken down by industry and other key dimensions. Analysis of changes over time is possible if all other dimensions are combined. However the number of independent observations is limited due to the change in classification to SOC2010 in 2011. For the present, these patterns are therefore assumed fixed over time. In future, as more data become available on a SOC2010 basis, this assumption will be revisited.

The assumption of similar patterns across industries is also problematic. It is apparent by inspection of the detailed results that some 4-digit occupations are concentrated in particular sectors. Taking this into account is important if more plausible patterns are to be generated. For example, assuming the same patterns across all industries, the distribution of 4-digit occupational categories

[52] See http://www.lmiforall.org.uk/ for more details about LMI for All.

such as textile process operatives are spread over all sectors (including food products, which ends up being the largest sector for employment of this group). This is at odds with intuition, which suggests that this category should be heavily concentrated in the textile sector. This is an inevitable consequence of the implicit assumption that distribution of employment by industry at 4-digit SOC level is essentially the same as for the parent 2-digit sub-major group.

The only way to avoid such anomalies is to use sector specific patterns. The scope for doing this is however severely limited by the sample size in the LFS. An analysis at the level of the 6 broad sectors used in section 2 of the main report is possible, but this still does not provide sufficient granularity to avoid the problem highlighted for textile process operatives. In order to avoid this problem it is necessary to go to a much more detailed level. However this then increases the probability that cells are empty or contain very few numbers, even though in reality there may be significant numbers employed in such categories. Even where cells are occupied, the small sample numbers involved mean that they may not provide a reliable picture of the shares of interest. Combining together a number of LFS quarters mitigates these problems.

LFS data are used to produce detailed 369 occupation by 75 industry arrays using the data currently available (combining all years). These data arrays are sparsely populated for many industries, (especially when also classified by gender, employment status, region and qualification). Therefore an algorithm has been developed to fill the gaps. In order to ensure consistency with the other Working Futures estimates, the estimates are constrained to match the industry totals (75 industries) and the SOC 2- digit employment totals. Full details are given in the Technical Report.[53]

C.2 Indicative results for 4-digit occupational projections

It is only possible to provide a broad summary of the results at the 4-digit level. The full detail can be found in the Working Futures workbooks and at the LMI for All data portal.[54]

[53] Wilson, R. A., M. May-Gillings, S. Patel and H Bui, (2019). *Working Futures 2017-2027: Technical report on sources and methods.* Department for Education.
[54] See http://www.lmiforall.org.uk/

Tables C1-C.6 provide results for a selection of the 369 occupational categories. The tables highlight those occupations that are:

- the most important in terms of 2017 employment levels (Table C.1);
- expected to show the most significant increases between 2017 and 2027, in absolute and % growth terms (Tables C.2 and C.3 respectively);
- expected to show the most significant job losses between 2017 and 2027, in absolute and % growth terms (Tables C.4 and C.5 respectively); and finally
- expected to show the most significant replacement needs between 2017 and 2027, in absolute terms (Table C.6).

It should be emphasised that that when looking at some of these results, especially for rates of change between years, this may involve categories with small cell sizes which are much more subject to statistical “noise”.

Table C.1 shows that the largest 4-digit occupational categories (in terms of numbers of jobs in 2017) are dominated by sales, administrative, teaching, caring occupations and cleaners. The largest occupations in the professional and managerial categories are Nurses (SOC #2231), Teachers (SOC #2314 and #2315), Managers and directors of retail and wholesale establishments (SOC #1190) and Medical Practitioners ((SOC #5241) who just make it into the top 20.

Table C.2 shows that the largest projected increases in employment in absolute terms over the period 2017-2027 are not surprisingly in the same categories (notably various caring occupations and sales related ones (especially at higher skill levels)). However, various highly skilled occupations in financial and business also appear in Table C.2. These increases are largely driven by industry effects as the sectors that employ such people are expected to grow rapidly.

The largest job losses are highlighted in Table C.3. These also affect some of the same categories featured in Table C.1, notably in the areas such as administrative officers and assistants, secretaries, PAs and receptionists, lower level sales occupations and cleaning staff. The continuing negative impact of IT on jobs that can be easily automated, as well as cutbacks in public administration as a result of austerity policies are key drivers.

Table C.4 shows that the occupations with fastest rates of increase between 2017 and 2027 are those within Sub-major Group 61, Caring personal service occupations. It should be noted that because of the expansion technique used

percentage growth rates are common for all 4-digit categories within each 2-digit occupation.

Table C.5 shows that the most rapid rate of job losses between 2017 and 2027 are concentrated in Sub-major Group 81 Process, plant and machine operatives. Again, this is by assumption as the expansion technique used % growth rates are common for all 4-digit categories within each 2-digit occupation. This is driven by technological change and continuing employment decline in certain construction and manufacturing industries which impacts especially hard on this sub-major group.

The final table in this series (Table C.6) shows the scale of replacement demands over the period 2017-2027. This is largely dependent on the level of employment in the occupation in 2017. The occupations are therefore similar to those emphasised in Table C.1. If replacement needs are combined with so called expansion demands (the net change in employment between 2017 and 2027), this gives a measure of the total number of job openings. For those occupations expected to lose jobs between 2017 and 2027 (as highlighted in Table C.6), these structural changes partly offset the replacement demands. For those occupations where employment is expected to rise, the structural and replacement demand elements reinforce each other.

Note that in the calculations replacement demand rates have not been differentiated at the 4-digit level of SOC. The same rates have been assumed for all 4-digit categories within a particular SOC sub-major group (the 2-digit level).

Table C.1 Top 20 4-digit occupations in terms of Employment levels in 2017

Occ(369) Name	Occ(25)	2017	rank	2027	rank
7111 Sales and retail assistants	71	1,347,223	1	1,254,130	1
6145 Care workers and home carers	61	885,606	2	1,049,802	2
2231 Nurses	22	717,615	3	824,774	3
9233 Cleaners and domestics	92	714,339	4	717,514	4
4159 Other administrative occupations nec	41	711,938	5	652,793	5
9272 Kitchen and catering assistants	92	539,607	6	542,006	7
9260 Elementary storage occupations	92	508,657	7	510,918	10
2315 Primary and nursery education teaching professionals	23	485,090	8	544,895	6
4122 Book-keepers, payroll managers and wages clerks	41	482,146	9	442,091	13
3545 Sales accounts and business development managers	35	473,992	10	530,295	8
2314 Secondary education teaching professionals	23	470,989	11	529,055	9
1190 Managers and directors in retail and wholesale	11	422,162	12	480,466	12
6125 Teaching assistants	61	413,237	13	489,853	11
6141 Nursing auxiliaries and assistants	61	366,720	14	434,712	14
1121 Production managers and directors in manufacturing	11	345,695	15	393,439	15
8211 Large goods vehicle drivers	82	334,853	16	333,686	17
7219 Customer service occupations nec	72	315,705	17	361,828	16
9273 Waiters and waitresses	92	304,634	18	305,988	21
2136 Programmers and software development professionals	21	286,644	19	312,704	19
2211 Medical practitioners	22	286,065	20	328,783	18

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

Table C.2 Top 20 4-digit occupations, based on employment growth (000s), 2017-2027

sector specific Occ(369) Name	Occ(25)	Employment 2017	rank	2027	rank	Change 2017-2027 000s	rank	%	rank
6145 Care workers and home carers	61	885,606	2	1,049,802	2	164,196	1	18.5	13
2231 Nurses	22	717,615	3	824,774	3	107,159	2	14.9	32
6125 Teaching assistants	61	413,237	13	489,853	11	76,616	3	18.5	9
6141 Nursing auxiliaries and assistants	61	366,720	14	434,712	14	67,992	4	18.5	15
2315 Primary and nursery education teaching professionals	23	485,090	8	544,895	6	59,805	5	12.3	74
1190 Managers and directors in retail and	11	422,162	12	480,466	12	58,305	6	13.8	68
2314 Secondary education teaching	23	470,989	11	529,055	9	58,066	7	12.3	76
3545 Sales accounts and business development managers	35	473,992	10	530,295	8	56,303	8	11.9	93
1121 Production managers and directors in	11	345,695	15	393,439	15	47,744	9	13.8	65
7219 Customer service occupations nec	72	315,705	17	361,828	16	46,123	10	14.6	45
2211 Medical practitioners	22	286,065	20	328,783	18	42,717	11	14.9	31
6121 Nursery nurses and assistants	61	207,517	43	245,992	26	38,475	12	18.5	10
1131 Financial managers and directors	11	273,298	22	311,043	20	37,745	13	13.8	59
6126 Educational support assistants	61	156,696	64	185,748	51	29,052	14	18.5	8
1132 Marketing and sales directors	11	209,465	42	238,394	29	28,929	15	13.8	62
1122 Production managers and directors in construction	11	203,492	45	231,596	35	28,104	16	13.8	64
2319 Teaching and other educational	23	224,854	36	252,575	23	27,721	17	12.3	70
6122 Childminders and related occupations	61	148,885	68	176,489	57	27,604	18	18.5	6
2421 Chartered and certified accountants	24	224,919	35	251,475	24	26,557	19	11.8	115
2424 Business and financial project management professionals	24	221,835	37	248,028	25	26,193	20	11.8	120

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

Table C.3 Top 20 4-digit occupations, based on job losses (largest fall, 000s) 2017-2027

sector specific		Employment				Change 2017-2027			
Occ(369) Name	Occ(25)	2017	rank	2027	rank	000s	rank	%	rank
5435 Cooks	54	108,763	95	91,675	115	-17,088	350	-15.7	332
8133 Routine inspectors and testers	81	80,643	124	62,802	159	-17,841	351	-22.1	336
4214 Company secretaries	42	39,770	224	20,651	298	-19,119	352	-48.1	363
7112 Retail cashiers and check-out operators	71	277,237	21	258,080	22	-19,157	353	-6.9	273
4112 National government administrative occupations	41	254,042	25	232,937	34	-21,105	354	-8.3	293
4212 Legal secretaries	42	45,733	197	23,747	283	-21,986	355	-48.1	367
8149 Construction operatives nec	81	102,277	99	79,650	127	-22,627	356	-22.1	351
4217 Typists and related keyboard occupations	42	47,787	189	24,814	276	-22,973	357	-48.1	366
5223 Metal working production and maintenance fitters	52	200,707	48	170,597	61	-30,110	358	-15.0	311
5231 Vehicle technicians, mechanics and electricians	52	212,243	41	180,402	53	-31,841	359	-15.0	314
8111 Food, drink and tobacco process operatives	81	147,697	70	115,021	92	-32,676	360	-22.1	361
4213 School secretaries	42	69,319	141	35,995	232	-33,324	361	-48.1	365
4211 Medical secretaries	42	74,472	133	38,670	225	-35,801	362	-48.1	369
5241 Electricians and electrical fitters	52	259,288	24	220,389	41	-38,899	363	-15.0	299
4122 Book-keepers, payroll managers and wages clerks	41	482,146	9	442,091	13	-40,055	364	-8.3	284
5434 Chefs	54	265,811	23	224,050	39	-41,761	365	-15.7	334
4159 Other administrative occupations nec	41	711,938	5	652,793	5	-59,146	366	-8.3	285
7111 Sales and retail assistants	71	1,347,223	1	1,254,130	1	-93,093	367	-6.9	274
4215 Personal assistants and other secretaries	42	229,522	33	119,181	90	-110,340	368	-48.1	364
4216 Receptionists	42	242,383	26	125,860	84	-116,523	369	-48.1	368

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

Table C.4 Top 20 4-digit occupations, based on Employment Growth (%) 2017-2027

sector specific Occ(369) Name	Occ(25)	Employment 2017	rank	2027	rank	Change 2017-2027 000s	rank	%	rank
6132 Pest control officers	61	9,507	351	11,269	338	1,763	167	18.5	1
6131 Veterinary nurses	61	15,196	327	18,013	309	2,817	150	18.5	2
6139 Animal care services occupations nec	61	70,860	139	83,998	123	13,138	49	18.5	3
6148 Undertakers, mortuary and crematorium assistants	61	23,055	287	27,329	266	4,274	121	18.5	4
6147 Care escorts	61	19,833	300	23,510	286	3,677	134	18.5	5
6122 Childminders and related occupations	61	148,885	68	176,489	57	27,604	18	18.5	6
6123 Playworkers	61	38,301	229	45,403	195	7,101	85	18.5	7
6126 Educational support assistants	61	156,696	64	185,748	51	29,052	14	18.5	8
6125 Teaching assistants	61	413,237	13	489,853	11	76,616	3	18.5	9
6121 Nursery nurses and assistants	61	207,517	43	245,992	26	38,475	12	18.5	10
6144 Houseparents and residential wardens	61	48,027	188	56,932	173	8,905	68	18.5	11
6142 Ambulance staff (excluding paramedics)	61	23,082	286	27,362	265	4,280	120	18.5	12
6145 Care workers and home carers	61	885,606	2	1,049,802	2	164,196	1	18.5	13
6146 Senior care workers	61	91,615	106	108,601	97	16,986	38	18.5	14
6141 Nursing auxiliaries and assistants	61	366,720	14	434,712	14	67,992	4	18.5	15
6143 Dental nurses	61	60,327	155	71,512	139	11,185	53	18.5	16
3234 Housing officers	32	56,123	164	64,906	151	8,783	71	15.6	17
3233 Child and early years officers	32	36,271	234	41,947	208	5,676	103	15.6	18
3231 Youth and community workers	32	84,683	116	97,936	106	13,252	48	15.6	19
3235 Counsellors	32	34,376	241	39,756	220	5,380	107	15.6	20

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

Table C.5 Top 20 4-digit occupations Job Losses (largest % decline) 2017-2027

sector specific		Employment				Change 2017-2027			
Occ(369) Name	Occ(25)	2017	rank	2027	rank	000s	rank	%	rank
8124 Energy plant operatives	81	7,746	359	6,032	361	-1,714	276	-22.1	350
8149 Construction operatives nec	81	102,277	99	79,650	127	-22,627	356	-22.1	351
8139 Assemblers and routine operatives nec	81	41,067	219	31,982	250	-9,086	336	-22.1	352
8114 Chemical and related process operatives	81	50,233	182	39,120	223	-11,113	339	-22.1	353
8142 Road construction operatives	81	23,732	284	18,482	307	-5,250	313	-22.1	354
8113 Textile process operatives	81	15,120	328	11,775	336	-3,345	296	-22.1	355
8122 Coal mine operatives	81	2,279	369	1,775	369	-504	238	-22.1	356
8127 Printing machine assistants	81	16,186	314	12,605	330	-3,581	301	-22.1	357
8121 Paper and wood machine operatives	81	29,434	266	22,922	290	-6,512	322	-22.1	358
8134 Weighers, graders and sorters	81	18,440	305	14,360	321	-4,080	306	-22.1	359
8137 Sewing machinists	81	33,166	245	25,829	272	-7,338	328	-22.1	360
8111 Food, drink and tobacco process operatives	81	147,697	70	115,021	92	-32,676	360	-22.1	361
8126 Water and sewerage plant operatives	81	9,169	353	7,141	357	-2,029	280	-22.1	362
4214 Company secretaries	42	39,770	224	20,651	298	-19,119	352	-48.1	363
4215 Personal assistants and other secretaries	42	229,522	33	119,181	90	-110,340	368	-48.1	364
4213 School secretaries	42	69,319	141	35,995	232	-33,324	361	-48.1	365
4217 Typists and related keyboard occupations	42	47,787	189	24,814	276	-22,973	357	-48.1	366
4212 Legal secretaries	42	45,733	197	23,747	283	-21,986	355	-48.1	367
4216 Receptionists	42	242,383	26	125,860	84	-116,523	369	-48.1	368
4211 Medical secretaries	42	74,472	133	38,670	225	-35,801	362	-48.1	369

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

Table C.6 Top 20 4-digit occupations based on Replacement Demand (000s), 2017-2027

sector specific		Employment				Change 2017-2027				Replacement demand		
Occ(369) Name	Occ(25)	2017	rank	2027	rank	000s	rank	%	rank	000s	rank	%
7111 Sales and retail assistants	71	1,347,223	1	1,254,130	1	-93,093	367	-6.9	274	406,447	1	30.2
6145 Care workers and home carers	61	885,606	2	1,049,802	2	164,196	1	18.5	13	369,111	2	41.7
2231 Nurses	22	717,615	3	824,774	3	107,159	2	14.9	32	281,860	3	39.3
4159 Other administrative occupations	41	711,938	5	652,793	5	-59,146	366	-8.3	285	233,241	4	32.8
9233 Cleaners and domestics	92	714,339	4	717,514	4	3,175	143	0.4	211	233,205	5	32.6
2315 Primary and nursery education teaching professionals	23	485,090	8	544,895	6	59,805	5	12.3	74	178,297	6	36.8
9272 Kitchen and catering assistants	92	539,607	6	542,006	7	2,399	157	0.4	213	176,162	7	32.6
2314 Secondary education teaching	23	470,989	11	529,055	9	58,066	7	12.3	76	173,114	8	36.8
6125 Teaching assistants	61	413,237	13	489,853	11	76,616	3	18.5	9	172,233	9	41.7
9260 Elementary storage occupations	92	508,657	7	510,918	10	2,261	161	0.4	198	166,058	10	32.6
1190 Managers and directors in retail and wholesale	11	422,162	12	480,466	12	58,305	6	13.8	68	159,529	11	37.8
3545 Sales accounts and business development managers	35	473,992	10	530,295	8	56,303	8	11.9	93	159,062	12	33.6
4122 Book-keepers, payroll managers and wages clerks	41	482,146	9	442,091	13	-40,055	364	-8.3	284	157,957	13	32.8
6141 Nursing auxiliaries and assistants	61	366,720	14	434,712	14	67,992	4	18.5	15	152,845	14	41.7
1121 Production managers and directors in manufacturing	11	345,695	15	393,439	15	47,744	9	13.8	65	130,633	15	37.8
8211 Large goods vehicle drivers	82	334,853	16	333,686	17	-1,167	252	-0.3	223	118,903	16	35.5
2211 Medical practitioners	22	286,065	20	328,783	18	42,717	11	14.9	31	112,359	17	39.3
7219 Customer service occupations nec	72	315,705	17	361,828	16	46,123	10	14.6	45	105,899	18	33.5
1131 Financial managers and directors	11	273,298	22	311,043	20	37,745	13	13.8	59	103,275	19	37.8
9273 Waiters and waitresses	92	304,634	18	305,988	21	1,354	175	0.4	214	99,452	20	32.6

Source for all the 4-digit tables: M:\IE\Projects\WorkingFutures\data\workbooks\FourDigit\4DigitAnalysis.xlsm (Tables 4.10-4.15).

Notes: Highlighted occupations are sector specific.

D Trends in employment and output by nation of the UK and region of England, 2017-2027

This section presents the results from the Working Futures 2017-2027 labour market projections for the nations of the UK (England, Wales, Scotland and Northern Ireland) and the regions of England for the period 2017 to 2027. The projections are placed within the context of the recent past (2007 to 2017). These results are presented with minimal commentary

The period 2004 to 2017 was turbulent. It saw the UK move from rapid economic expansion through a short slowdown in 2005-6 to the economic crisis of 2007/8, followed by the longest and deepest recession experienced since the 1930s. The economy recovered after 2012, but this has been weaker and more uncertain than the recoveries which followed earlier recessions. The ten years from 2017 are likely to experience further economic volatility due to the uncertainties associated with Brexit.

Previous Working Futures exercises have revealed a pattern of geographical differences within the UK, with economic inequality between the most prosperous regions of London and the south and east of England and the north of England and the other nations of the UK increasing over time. Employment change was also most favourable in the south and east of the UK. This section explores whether these trends are likely to continue between 2017 and 2027.

Annex D is structured as follows:

- changes in employment and gross value added (GVA);
- change in employment by gender;
- trends in employment by status;
- comparative trends in GVA;
- comparative trends in GVA per employee;
- changing industrial structure of employment;
- changing occupational structure of employment;
- changing qualification profile of employment;
- replacement and net labour demand;
- change in other labour market measures.

D.1 Changes in employment and gross value added (GVA)

The annual average rate of increase in GVA is projected to be slightly higher for the period 2017 to 2027 than for 2007-2017 (Table D.1). However, the projected regional pattern of change is quite different from the preceding ten years. Projected variations in rates of change between nations and regions are much smaller than before and the differential between London and the remainder of the UK is much narrower. Thus, the projected rate of GVA growth is much slower than for 2007-2017 in London, and much faster in the rest of the UK, with the exception of the South East. The projected improvement in growth is greatest for the northern regions of England, Wales, Northern Ireland and Scotland.

In contrast, the projected annual average rate of employment growth for 2017-2027 is a third of that recorded between 2007-2017. There is very little variation projected at the regional/national scale, with employment growing fastest in London and the East of England and slightly faster in Wales, Scotland and South West England than in the remainder of the UK. The projected decline in growth rate is fastest for London and the South-East, while North-East England is projected to experience the greatest improvement in rates of employment change.

Table D.1: Changes in employment and gross value added (GVA), 2007-2027

UK Nation or region of England	Annual; average rate of change (%)			
	GVA		Employment	
	2007-2017	2017-2027	2007-2017	2017-2027
London	2.0	1.4	2.0	0.4
South East	1.2	1.1	1.2	0.2
East of England	0.9	1.2	0.9	0.4
South West	0.8	1.2	0.9	0.3
West Midlands	1.0	1.1	0.9	0.2
East Midlands	0.7	1.1	0.8	0.2
Yorkshire and the Humber	0.1	1.0	0.4	0.2
North West	0.4	1.1	0.6	0.2
North East	0.1	1.0	-0.2	0.2
England	1.1	1.2	1.0	0.3
Wales	0.5	1.1	0.8	0.3
Scotland	0.6	1.0	0.3	0.3
Northern Ireland	0.5	1.1	0.3	0.2
United Kingdom	1.0	1.2	0.9	0.3

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.2 Comparative trends in total employment, 1994-2024

Table D.2 shows that the number of new jobs projected for 2017-2027 is less than a third of the employment increase experienced between 2007 and 2017. The fall in projected employment growth in London and the rest of southern England is even faster, though London is still projected to experience the largest percentage increase in employment. Employment growth is projected to increase slightly in Scotland, while North-East England is projected to switch from employment decline to very slight expansion.

Table D.2: Comparative trends in total employment, 2007-2027

UK Nation or region of England	Change 2007-2017			Change 2017-2027		
	000s	%	% p.a.	000s	%	% p.a.
London	1,039	21.8	2.0	234	4.0	0.4
South East	546	12.4	1.2	110	2.2	0.2
East of England	263	9.2	0.9	119	3.8	0.4
South West	250	9.4	0.9	90	3.1	0.3
West Midlands	260	9.6	0.9	62	2.1	0.2
East Midlands	194	8.8	0.8	53	2.2	0.2
Yorkshire and the Humber	108	4.2	0.4	46	1.7	0.2
North West	204	5.9	0.6	86	2.4	0.2
North East	-30	-2.5	-0.2	20	1.7	0.2
England	2,834	10.6	1.0	820	2.8	0.3
Wales	121	8.6	0.8	39	2.6	0.3
Scotland	76	2.8	0.3	93	3.3	0.3
Northern Ireland	27	3.2	0.3	20	2.3	0.2
United Kingdom	3,058	9.6	0.9	973	2.8	0.3

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.3 Change in employment by gender and employment status

Male employment is projected to barely increase between 2017 and 2027, while female employment is projected to grow nearly five times faster (Table D.3). The rate of employment increase for both men and women is projected to be much slower than for the period 2007-2017, which was itself much slower than the 1997 to 2007 period. This reflects the much greater impact which the 2008/9 recession upon male than female employment. This was most marked for north-East England, in while male employment fell. Male employment is projected to continue to decline in this region, together with the West Midlands and Yorkshire and Humber. Slow growth in male employment is projected elsewhere, with the fastest growth expected for London, the East of England and Scotland. Female employment growth grew in all

parts of the UK except North-East England between 2007 and 2017, with rates of growth being faster than for 1997 to 2007 in the Midlands and much faster in London, but slower in the East and South West of England, Scotland and Northern Ireland. Projected employment growth for 2017 to 2027 varies little around the UK average, being fastest in the East of England, Scotland, South-West England and London. The slowest projected rates of growth are for Northern Ireland and North-East England.

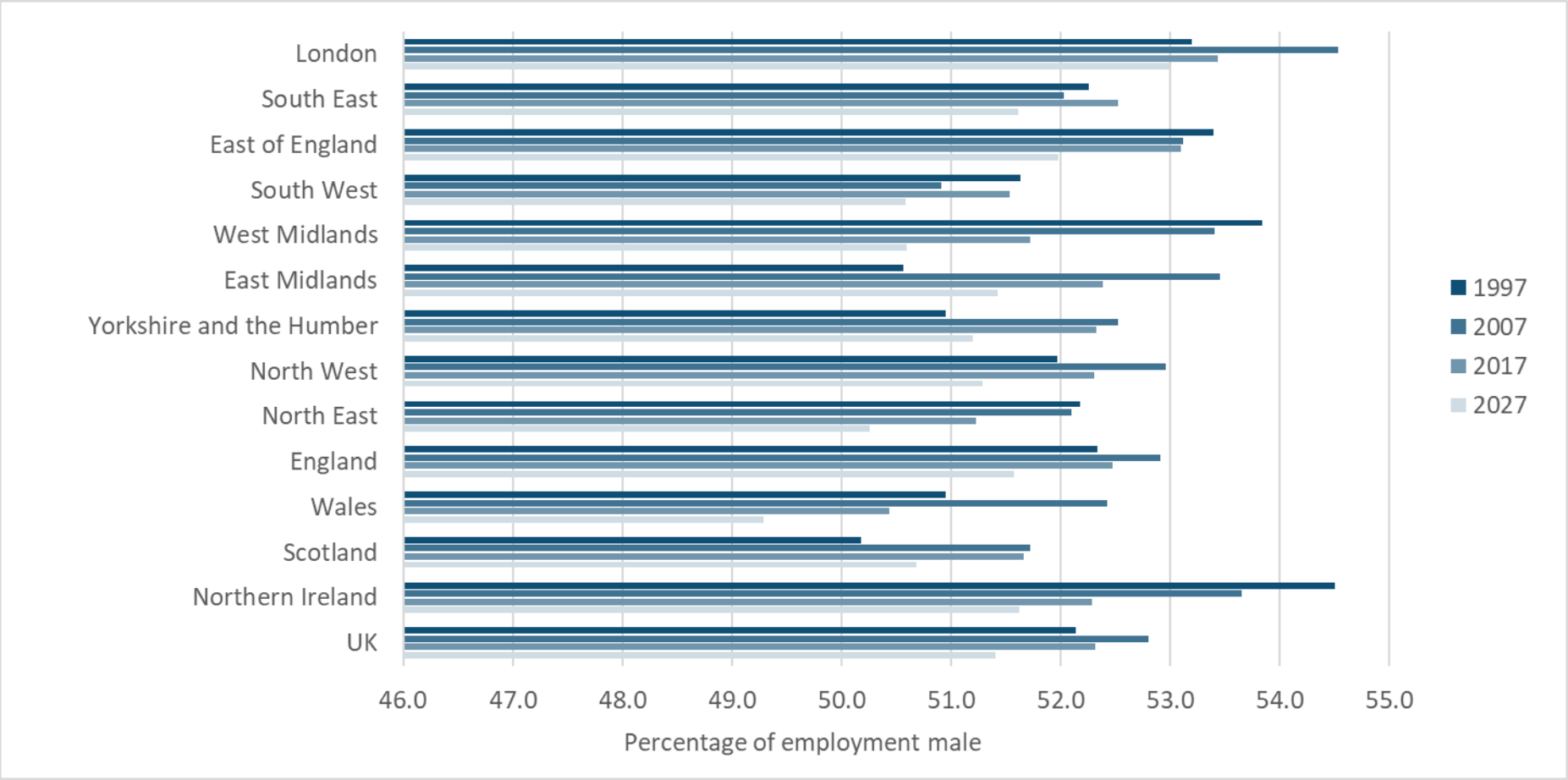
Table D.3: Change in employment by gender, 1997-2017

UK Nation or region of England	Male			Female			Change in male share of employment, 2017-2027
	1997-2007	2007-2017	2017-2027	1997-2007	2007-2017	2017-2027	
	% change	% change	% change	% change	% change	% change	
London	20.1	19.3	3.2	13.8	24.7	5.0	-0.4
South East	11.8	13.5	0.5	12.9	11.3	4.2	-0.9
East of England	14.6	9.2	1.6	15.8	9.2	6.3	-1.1
South West	9.9	10.8	1.2	13.2	8.0	5.1	-1.0
West Midlands	4.4	6.2	-0.1	6.2	13.6	4.5	-1.1
East Midlands	16.9	6.6	0.3	4.1	11.3	4.3	-1.0
Yorkshire and the Humber	13.6	3.8	-0.5	6.7	4.6	4.1	-1.1
North West	10.4	4.6	0.4	6.1	7.4	4.5	-1.0
North East	10.2	-4.1	-0.2	10.5	-0.7	3.8	-1.0
England	12.9	9.7	1.0	10.3	11.6	4.7	-0.9
Wales	19.1	4.5	0.3	12.3	13.1	4.9	-1.1
Scotland	14.9	2.7	1.4	8.1	2.9	5.4	-1.0
Northern Ireland	17.8	0.6	1.0	21.9	6.2	3.7	-0.7
United Kingdom	13.4	8.6	1.0	10.5	10.7	4.8	-0.9

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

The shift of employment from male to female is projected to continue, with the male share of employment being 0.9 per cent lower in 2027 than in 2017. There is little regional variation in this shift, but the reduction in male employment share is lowest in London, Northern Ireland and South-East England. The longer-term trend in the share of male employment is depicted in Figure D.1, with a general trend for decline from 1997 to 2017 projected to continue to 2027. The male share of employment reached a peak in 2007 in London, the East Midlands, North-West England, Wales and Scotland, but was highest in 2017 in South-East England. The South-East and South-West of England were distinctive in experiencing an increase in the male share of employment between 2007 and 2017, but regions and nations in which manufacturing was significant experienced a marked fall in the percentage of employment male over this period. The male share of employment is projected to fall below half by 2027 in Wales.

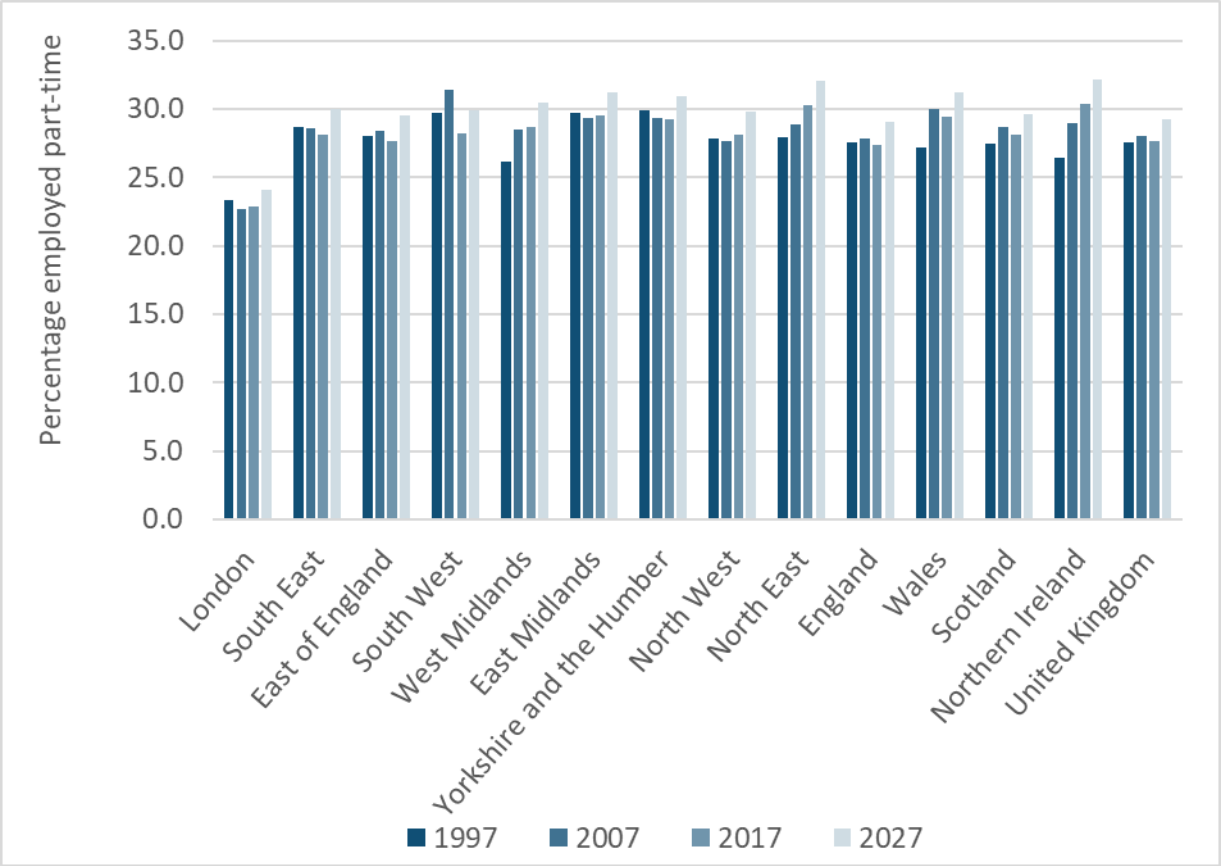
Figure D.1: Longer-term trend in the shift from male to female employment



Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

Trends in two aspects of employment status over the period 1997 to 2027 are presented in Figures D.2 (part-time employment) and D.3 (self-employment).

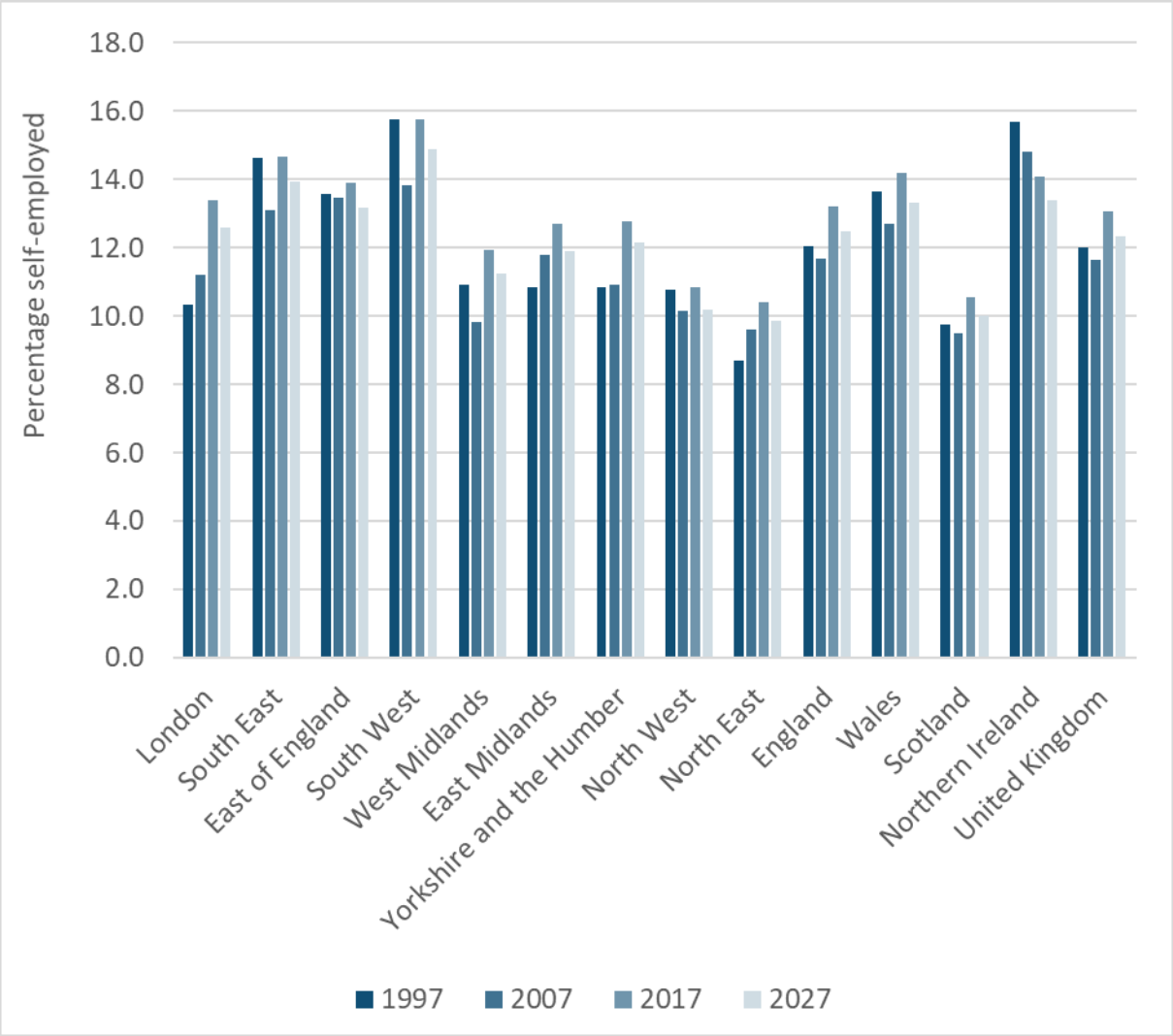
Figure D.2: Percentage employed part-time, 1997-2027



Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

Growth in the percentage working part-time is projected to continue to 2027. However, there are clear geographical differences, with the share of part-time workers well below average and growing slowly in London, but above average and growing relatively quickly in Northern Ireland, North-East England, Wales and the West Midlands. The percentage working part-time is projected to be lower in 2027 than in 2007 in South-West England, and the growth in the share of part-time workers in total employment is generally slower in southern England.

Figure D.3: Percentage self-employed, 1997-2027



Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

The share of self-employment in total employment is projected to fall between 2017 and 2027, following an increase in the previous decade (Figure D.3). This pattern is found in all nations of the UK and regions of England. Up to 2017, the growth in the percentage self-employed was fastest in London, the East Midlands, Yorkshire and the Humber and North-East England. The fall in the percentage self-employed is projected to be most marked in Northern Ireland, continuing the trend from 2007 to 2017. The percentage self-employed is projected to remain highest in South-West England.

D.4 Comparative trends in GVA 2017-2027

Table D.4 presents annual average rates of change in GVA by industry sector between 2017 and 2027. The projected annual rate of increase in GVA between 2017 and 2017 is highest for business and other and non-market services and

lowest for the primary sector. London is projected to grow faster than the rest of the UK in most sectors. The growth of GVA is projected to be fastest in London in the primary sector, business and non-market services. The manufacturing sector is projected to grow fastest in the West Midlands, Wales, Scotland and the East of England, slower than average in London and slowest in Yorkshire and the Humber and North-East England.

Table D.4: Comparative trends in GVA by industry sector, 2017-2027

UK Nation or region of England	Annual average rate of change in GVA 2017-2027						
	Primary sector and utilities	Manufacturing	Construction	Trade, accomod. and transport	Business and other services	Non-market services	All sectors
London	1.0	0.8	0.8	1.1	1.5	1.6	1.4
South East	0.9	0.6	1.0	1.0	1.2	1.3	1.1
East of England	0.6	1.1	0.9	1.3	1.1	1.4	1.2
South West	0.8	1.0	0.9	1.3	1.2	1.2	1.2
West Midlands	0.7	1.2	0.8	1.1	1.1	1.3	1.1
East Midlands	0.7	1.0	0.8	1.2	1.0	1.4	1.1
Yorkshire and the Humber	0.3	0.5	0.8	1.0	1.2	1.2	1.0
North West	0.4	0.9	0.6	1.1	1.2	1.2	1.1
North East	0.8	0.5	0.6	1.1	1.3	1.0	1.0
England	0.7	0.9	0.8	1.1	1.3	1.3	1.2
Wales	0.7	1.2	0.6	1.2	1.1	1.1	1.1
Scotland	0.4	1.1	0.4	1.0	1.2	1.0	1.0
Northern Ireland	1.0	1.0	1.2	1.1	1.3	0.9	1.1
United Kingdom	0.7	0.9	0.8	1.1	1.3	1.3	1.2

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.5 Comparative trends in GVA per employee, 1997-2027

Table D.5 expresses GVA relative to employment (as an indicator of productivity), representing the amount of economic output generated by each person in work. This quantity is projected to increase from £45.6 thousand in 2007 to £45.9 thousand in 2017 and £50.2 thousand in 2027. The amount of GVA per employees is highest in London throughout this period and generally higher in southern than northern England and the rest of the UK. Wales and Northern Ireland display markedly lower values than England, but Scotland's GVA per employee is higher. Expressing GVA per employee relative to the UK average emphasises the geographical contrasts over the period 2007 to 2027. London was already well ahead of the rest of the UK at the start of the period and this advantage is projected to widen slightly by 2027. In the rest of the UK, only South East England was above the UK average in 2007 and this region is projected to be above the UK average in 2027. The relative score for South-East England is projected to increase slightly between 2017 and 2027, but the relative position of all other regions of England is projected to deteriorate between 2017 and 2027. Relative GVA per employee is projected to shrink markedly in Scotland.

Table D.5: Comparative trends in GVA per employee, 2007-2027

UK Nation or region of England:	GVA per employee (£000s)			Relative GVA per employee (UK=100)		
	2007	2017	2027	2007	2017	2027
London	64.3	64.3	71.0	140.9	140.0	141.6
South East	47.5	47.5	51.9	104.0	103.4	103.5
East of England	44.4	44.5	48.1	97.2	96.9	96.0
South West	41.4	41.0	44.6	90.7	89.2	88.9
West Midlands	40.3	40.5	44.3	88.3	88.1	88.4
East Midlands	39.5	39.0	42.6	86.5	85.0	84.8
Yorkshire and the Humber	40.7	39.6	42.9	89.2	86.2	85.6
North West	42.3	41.4	44.9	92.6	90.1	89.6
North East	38.7	40.1	43.5	84.7	87.3	86.7
England	46.4	46.7	51.1	101.8	101.6	101.9
Wales	37.7	36.5	39.6	82.6	79.4	79.0
Scotland	43.6	44.8	47.9	95.5	97.5	95.5
Northern Ireland	40.1	40.8	44.3	88.0	88.7	88.4
United Kingdom	45.6	45.9	50.2	100.0	100.0	100.0

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.6 Changing industrial structure of employment, 2017-2027

The primary and manufacturing sectors are projected to lose employment in all parts of the UK (except London, Wales and Northern Ireland in the case of the former), while employment is projected to expand in nearly all parts of the UK (the exception being the contraction of construction employment in Scotland) in the other sectors (Table D.6). The rate of loss of jobs in the primary sector is greatest in the East of England, East Midlands and Yorkshire and the Humber, while the rate of job loss in manufacturing is projected to be fastest in South-East England, Yorkshire and the Humber and London. Manufacturing is projected to contract most slowly in Scotland, the East Midlands South-West England and Wales. Construction is projected to grow slowly everywhere except Scotland and Northern Ireland, which displays the fastest projected employment growth. There is little geographical variation in rates of growth of employment in the three services sectors, but non-market services is projected to gain employment more slowly than average in Northern Ireland and North-East England.

Table D.6: Change in employment by industry, 2017-2027

UK Nation or region of England	Annual average rate of change, 2017-2027 (%)						
	Primary sector and utilities	Manufacturing	Construction	Trade, accomod. and transport	Business and other services	Non-market services	All sectors
London	0.6	-1.2	0.3	0.1	0.6	0.5	0.4
South East	-0.1	-1.5	0.1	0.0	0.5	0.4	0.2
East of England	-0.6	-1.0	0.4	0.3	0.6	0.7	0.4
South West	-0.3	-0.7	0.3	0.1	0.6	0.6	0.3
West Midlands	-0.2	-1.0	0.2	0.1	0.5	0.4	0.2
East Midlands	-0.6	-0.6	0.3	0.2	0.4	0.5	0.2
Yorkshire and the Humber	-0.5	-1.5	0.3	0.0	0.6	0.5	0.2
North West	-0.4	-1.0	0.1	0.1	0.6	0.4	0.2
North East	-0.1	-1.0	0.1	0.0	0.7	0.3	0.2
England	-0.3	-1.1	0.2	0.1	0.6	0.5	0.3
Wales	0.1	-0.9	0.1	0.2	0.6	0.4	0.3
Scotland	-0.1	-0.6	-0.1	0.0	0.7	0.6	0.3
Northern Ireland	0.2	-1.1	0.6	0.2	0.8	0.2	0.2
United Kingdom	-0.2	-1.0	0.2	0.1	0.6	0.5	0.3

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates

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The service sector is projected to account for 84.4% of UK employment in 2027 and 91.9% of employment in London (Table D.7). The primary sector is projected to account for a much larger share of employment in Wales, Northern Ireland and Scotland than in the English regions, while manufacturing is projected to be most important in the midland and norther regions of England. The share of employment accounted for by construction is similar in most parts of the UK, but highest in the East and South-West of England. Trade, accommodation and transport is projected to account for around a quarter of employment in most parts of the UK, its share of employment being largest in the midlands. It is projected that business and other services will account for nearly half of London's employment in 2027. The dominance of London in this sector is reflected by the South-East and South-West of England being the only other parts of the UK with an employment share higher than the UK average. The share of this sector in employment is projected to be particularly low in Wales and Northern Ireland. In contrast, the projected share of non-market services in total employment is well below the UK average in London, but well above average in North-East England, Wales and Northern Ireland.

Table D.7: Industrial structure of employment, 2027

UK Nation or region of England	Percentage of employment, 2027 (%)					
	Primary sector and utilities	Manufacturing	Construction	Trade, accomod. and transport	Business and other services	Non-market services
London	0.6	1.9	5.6	22.9	48.5	20.4
South East	2.3	5.2	7.5	25.2	35.9	24.0
East of England	1.7	6.5	8.2	27.2	33.0	23.3
South West	3.6	7.7	7.4	26.7	27.6	27.0
West Midlands	2.1	9.4	5.6	28.0	29.1	26.0
East Midlands	2.7	11.0	6.9	28.5	26.3	24.6
Yorkshire and the Humber	1.7	8.2	6.8	27.0	28.8	27.6
North West	1.7	8.3	5.7	27.9	30.1	26.3
North East	1.7	9.4	5.3	26.1	26.4	31.1
England	1.9	6.6	6.6	26.2	34.1	24.6
Wales	5.3	8.6	6.9	24.7	22.8	31.7
Scotland	4.9	6.1	5.9	25.3	30.2	27.7
Northern Ireland	5.2	9.1	6.6	25.8	23.9	29.4
United Kingdom	2.4	6.7	6.5	26.0	33.0	25.3

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.7 Changing occupational structure of employment, 2017-2027

Table D.8 summarises the projected pattern of occupational employment change by aggregating occupations into three groups: “Managers, professionals and technical” (SOC Major Groups 1 to 3); “Administrative, caring, and sales” (SOC Major Groups 4, 6 and 7); and “Skilled, process and elementary workers” (SOC Major Groups 5, 8 and 9). The projected annual rate of employment change for the first of these three groups varies little around the UK average of 1% per annum. The total increase in employment is projected to be greatest in London, SouthEast England and Scotland, while the rate of increase is projected to be highest in Scotland. Jobs in administrative, caring and sales occupations are projected to decline slowly (by 0.2% per annum), but the rate of decline (and the numbers involved) is projected to be highest in London and South East England. The number of workers in skilled manual, process and machine operator and elementary occupations is projected to fall by 0.6% per annum overall, with job loss projected to be faster than average in the East and West Midlands and Yorkshire and the Humber and slower than average in London, the East of England and Northern Ireland.

Table D.8: Employment change by broad occupational group, 2017-2027

UK Nation or region of England	Managers, professional & technical		Administrative, caring, and sales		Skilled, process and elementary workers	
	(000s)	(% p.a.)	(000s)	(% p.a.)	(000s)	(% p.a.)
London	361	1.0	-74	-0.6	-53	-0.4
South East	231	1.0	-51	-0.4	-70	-0.6
East of England	165	1.2	-10	-0.1	-37	-0.4
South West	138	1.1	-7	-0.1	-42	-0.5
West Midlands	134	1.1	-15	-0.2	-58	-0.7
East Midlands	98	1.0	2	0.0	-48	-0.7
Yorkshire and the Humber	111	1.0	-8	-0.1	-57	-0.7
North West	151	1.0	-6	0.0	-60	-0.6
North East	46	1.0	-1	0.0	-25	-0.7
England	1437	1.0	-169	-0.2	-448	-0.6
Wales	70	1.1	-5	-0.1	-26	-0.5
Scotland	144	1.2	-12	-0.1	-39	-0.5
Northern Ireland	34	1.0	-5	-0.2	-9	-0.4
United Kingdom	1685	1.0	-190	-0.2	-522	-0.6

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

Table D.9 presents the projected detailed occupational profile of nations of the UK and regions of England in 2027. The share of managers in employment is projected

to be highest in South-East England and other regions of southern England, while the percentage of employment in professional and associate professional occupations is projected to be highest by far in London and to be below average in northern England, Wales and Northern Ireland. The share of administrators in employment is projected to be well above average in northern England and Northern Ireland, but well below in London.

The share of skilled manual occupations in employment is projected to be highest in Wales, Northern Ireland, South-West and North-East England, and well below average in London. The share of employment accounted for by caring occupations is projected to be highest in the midlands, Wales and northern England, and lowest in London. Sales and customer services occupations are projected to account for well above the UK average share of employment in North-West and North-East England, and again to be well below average in London. The share of process, plant and machine operative occupations in employment is projected to vary less across the UK, but to be largest in the East and West Midlands and below average in London, South-East England and Northern Ireland. The share of elementary occupations in employment is projected to be well above average in Scotland and well below I London, with relatively little variation around the average in the remainder of the UK.

Table D.9 Occupational structure of employment, 2027

UK nation or region of England	Percentage of employment, 2027								
	Managers, directors and senior officials	Professional occupations	Associate professional and technical	Administrative and secretarial	Skilled trades occupations	Caring, leisure and other service	Sales and customer service	Process, plant and machine operatives	Elementary occupations
London	12.7	27.9	20.6	6.3	6.9	7.1	6.0	3.5	9.0
South East	13.2	21.7	15.5	7.9	8.3	10.9	7.0	4.5	10.9
East of England	12.4	20.1	14.5	8.2	8.8	10.8	7.9	5.7	11.6
South West	12.0	20.8	13.4	7.8	10.2	11.7	8.7	5.0	10.5
West Midlands	10.0	19.4	13.7	9.9	8.8	12.2	7.9	7.2	10.9
East Midlands	11.0	18.3	12.9	8.5	8.6	12.8	8.7	7.4	11.8
Yorkshire and the Humber	10.5	18.8	12.9	10.3	8.9	11.8	8.9	6.8	11.0
North West	9.7	19.6	12.8	10.4	8.2	11.7	10.0	6.3	11.2
North East	8.2	20.4	12.3	9.2	9.3	10.8	11.2	6.2	12.4
England	11.5	21.6	15.1	8.4	8.4	10.7	8.0	5.5	10.7
Wales	8.7	20.7	12.0	8.8	12.1	12.0	7.8	6.6	11.2
Scotland	9.4	21.1	13.9	9.7	9.1	9.0	8.3	5.4	14.0
Northern Ireland	9.0	20.2	12.8	10.0	11.5	12.4	8.7	4.8	10.7
United Kingdom	11.2	21.5	14.8	8.6	8.7	10.6	8.0	5.5	11.0

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.8 Changing qualification profile of employment, 1997-2027

Table D.10 presents the changing geographical distribution of the highly qualified in the UK, represented by the percentage of employed people holding a first or postgraduate degree as their highest qualification for the years 2007 to 2027. The percentage highly qualified is projected to nearly double, from just over a quarter to nearly half. London stands out as having the highest percentage of graduates throughout the period, followed by Scotland and South-East England. The East Midlands, North East and West Midlands of England display the lowest percentages throughout the period.

Table D.10: Changing qualification profile of employment, 1997-2027

UK Nation or region of England	Percentage of employed persons with first or higher degree			
	1997	2007	2017	2027
London	35.6	38.6	51.8	64.4
South East	27.0	28.6	39.4	51.1
East of England	23.1	25.7	33.1	44.4
South West	24.7	26.5	37.0	47.6
West Midlands	22.0	25.3	31.6	39.3
East Midlands	21.9	22.8	31.5	39.1
Yorkshire and the Humber	21.2	24.3	33.1	39.9
North West	23.5	25.7	33.9	44.4
North East	20.9	22.7	31.3	39.3
England	25.6	28.0	37.9	48.3
Wales	22.2	25.0	33.9	42.8
Scotland	27.9	31.4	41.0	55.1
Northern Ireland	24.5	26.7	33.0	39.5
United Kingdom	25.6	28.1	37.9	48.4

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

Marked geographical differences are projected for the changing number of people in employment by highest level of qualification over the period 2017 to 2027 (Table D.11). In general, rates of increase are projected to be highest for the highest qualifications (postgraduate and first degrees), with greater variability for postgraduates than those with first degrees. The number qualified to RQF3 and 4 is projected to grow slowly in most parts of the UK and decline in Scotland and South-East England. The number whose highest qualification is RQF 1 and 2 is projected to decline everywhere, most rapidly in London and least rapidly in Northern Ireland. The number with no qualifications is projected to fall everywhere, fastest in London and southern England and most slowly in the West Midlands.

Table D.11: Change in employed persons by highest qualification, 2017-2027

UK Nation or region of England	Annual average rate of change, 2017-2027 (%)				
	Postgraduate degree	First degree	RQF 3 & 4	RQF 1 & 2	None
London	2.7	2.5	0.2	-4.7	-9.2
South East	3.1	2.8	-0.7	-2.7	-7.2
East of England	3.2	3.4	0.3	-2.3	-6.2
South West	3.5	2.5	0.3	-2.9	-8.1
West Midlands	0.8	3.1	0.5	-1.9	-2.9
East Midlands	2.9	2.2	0.6	-1.5	-7.3
Yorkshire and the Humber	0.7	2.6	0.7	-1.8	-3.8
North West	4.0	2.5	0.3	-2.6	-6.2
North East	1.3	3.0	0.9	-2.1	-6.1
England	2.7	2.7	0.2	-2.6	-6.2
Wales	3.4	2.3	0.4	-1.9	-5.9
Scotland	3.9	3.1	-1.3	-2.9	-4.9
Northern Ireland	2.3	2.0	0.1	-0.4	-4.9
United Kingdom	2.8	2.7	0.1	-2.5	-6.0

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

The result of this pattern of change is shown in the projected profile of highest qualifications by nation and region of the UK in 2027 (Table D.12). In London, more than a quarter are projected to have a postgraduate degree and a further quarter a first degree, with only 1.5% having no educational qualification. Scotland, London and the South East of England are the only other parts of the UK in which more than half of the workforce is projected to be qualified to degree level or above. The projected percentages with no qualifications is lowest in southern England, and highest in Northern Ireland, while a highest qualification lower than RQF3 is projected to be most common in the East Midlands and Yorkshire and the Humber, together with Northern Ireland.

Table D.12: Projected breakdown of employed population by highest qualification, 2027

UK Nation or region of England	Percentage of employed with highest qualification				
	Postgraduate degree	First degree	RQF 3 & 4	RQF 1 & 2	None
London	25.7	38.7	19.9	14.2	1.5
South East	18.0	33.1	24.3	23.3	1.4
East of England	14.3	30.0	25.4	27.8	2.5
South West	16.0	31.6	28.1	23.1	1.3
West Midlands	9.8	29.5	27.1	29.4	4.1
East Midlands	11.7	27.4	27.8	30.9	2.2
Yorkshire and the Humber	11.2	28.7	26.8	30.0	3.4
North West	15.8	28.7	26.9	26.4	2.3
North East	10.3	29.0	29.0	28.9	2.8
England	16.4	31.8	25.2	24.3	2.2
Wales	15.2	27.7	26.7	27.5	3.0
Scotland	15.7	39.4	21.0	20.6	3.3
Northern Ireland	12.3	27.2	24.7	29.7	6.2
United Kingdom	16.2	32.1	24.9	24.3	2.4

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.9 Replacement and net labour demand, 2017-2027

Replacement demand is expected to greatly outweigh expansion demand over the period 2017 to 2027, in all parts of the UK (Table D.13). Expansion demand represents 0.97 million jobs, but there will be a need for 11.58 million workers to replace those leaving the labour force over this decade. The relative size of replacement demand is much greater for females than males. Replacement demand is largest in London and South-East England and least in North-East England and Wales. There is relatively little geographical variation in replacement demand 2017-24 as a percentage of employment in 2017, but this is highest in South-West England and London and lowest in the East Midlands. The patterns for both males and females are similar.

Table D.13: Replacement and net labour demand, 2017-2027

UK Nation or region of England	Employment demand (000s)			Percentage employment demand			Percentage replacement demand	
	Expansion	Replacement	Total	Expansion	Replacement	Total	Males	Females
London	234.4	1951.2	2185.6	4.0	33.6	37.6	28.6	39.3
South East	110.3	1640.7	1751.0	2.2	33.2	35.5	27.9	39.1
East of England	118.5	1046.4	1164.9	3.8	33.5	37.3	28.1	39.7
South West	89.7	977.6	1067.3	3.1	33.7	36.8	28.1	39.6
West Midlands	61.8	983.5	1045.3	2.1	33.2	35.3	27.4	39.5
East Midlands	53.3	788.2	841.4	2.2	32.8	35.0	27.5	38.6
Yorkshire and the Humber	45.7	883.2	929.0	1.7	32.9	34.7	27.3	39.2
North West	86.0	1208.6	1294.6	2.4	33.1	35.4	27.4	39.3
North East	20.4	386.1	406.5	1.7	33.1	34.8	27.1	39.4
England	820.1	9865.5	10685.6	2.8	33.3	36.1	27.8	39.3
Wales	39.4	503.5	542.9	2.6	32.9	35.5	27.1	38.8
Scotland	93.2	924.9	1018.2	3.3	33.0	36.3	27.3	39.0
Northern Ireland	20.2	287.0	307.2	2.3	32.9	35.2	27.3	38.9
United Kingdom	973.0	11580.9	12553.8	2.8	33.2	36.0	27.8	39.2

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.10 Change in other labour market measures, 2017-2027

This final section focuses on some key labour market indicators for the UK and its constituent parts. The UK is projected to gain an additional 3.6 million people between 2017 and 2027 (3.3 million of the addition being in England), 3.1 million of which will be aged over 16. However, the population of working age is projected to only grow by 779,000, suggesting that much of the population growth will be in elderly people, as the workforce is projected to grow by a million over this period (Table D.14). London is projected to account for nearly a quarter of population growth, most of the growth in the population aged over 16 and the workforce will be concentrated in the south and east of England. Northern England, Wales and Scotland will lose working age population and experience the smallest projected increases in labour force, though the workforce is projected to increase strongly in Scotland.

Economic activity rates are projected to fall in all parts of the UK, to slightly smaller extent in England than the rest of the UK, with the smallest falls in London and the West Midlands and the largest falls occurring in North-East England and Northern Ireland.

The number of employed residents is projected to grow by 1.1 million with workplace employment projected to grow by just under a million. Projected growth in both is strongest in the South and East of England and weakest in the North of England and the other nations of the UK. The projected change in workforce employment is close to the projected change in the workforce in most parts of the UK, but workforce growth is projected to outstrip workplace employment growth in Wales, with the opposite occurring in Northern Ireland. Weak employment growth and continued growth in labour supply will result in a small projected increase in unemployment, with ILO unemployment increasing by 131,000 and claimant unemployment growing by 100,000 less. ILO unemployment levels are projected to grow most in the more populous parts of the UK, while claimant unemployment is projected to fall in Northern Ireland but increase strongly in North-West England. Projected changes in unemployment rates are small for both the ILO and claimant count definitions. The ILO unemployment rate is projected to increase most in south-east England and Wales, but the claimant count rate is projected to fall most in Northern Ireland. The labour market residual is the difference between the change in employed residents and the change in workforce employment. This is negative in the south and midlands of England and largest in London. It is positive in northern England and Scotland. As noted earlier in this report, this residual includes net commuting, indicating that the south and east of England will continue to draw in commuters from the rest of the UK over 2017-2027.

Table D.14: Projected change in key labour market indicators, 2017-2027

UK Nation or region of England	Changes, 2017-2027												
	Population			Labour Force	Workforce (1)	Economic activity rate	Unemployment				Employment		Labour Market Residual
	Total	16+	Working age				ILO level	ILO rate	Claimant level	Claimant rate	Employed residents	Workplace employment (2)	
	000s	000s	000s	000s	000s	%	000s	%	000s	%	000s	000s	000s
London	790	662	404	414	241	-0.6	32	0.2	5	0.0	383	221	-162
South East	581	508	149	219	114	-1.4	35	0.6	5	0.1	184	118	-65
East of England	453	369	129	170	122	-1.2	14	0.2	2	0.0	155	127	-30
South West	369	309	68	119	88	-1.5	-2	-0.2	4	0.1	119	79	-41
West Midlands	319	259	88	118	68	-0.8	-1	-0.2	8	0.2	121	59	-62
East Midlands	288	239	52	85	50	-1.4	5	0.1	-1	-0.1	79	51	-29
Yorkshire and the Humber	191	170	-4	35	44	-1.5	12	0.4	-2	-0.1	23	47	23
North West	248	199	-21	39	101	-1.3	12	0.3	14	0.3	26	86	57
North East	52	50	-43	-16	22	-2.0	4	0.4	2	0.1	-21	22	43
England	3,290	2,765	821	1,183	850	-1.2	111	0.2	38	0.1	1,069	810	-266
Wales	99	88	-16	18	41	-1.3	10	0.6	0	0.0	7	36	28
Scotland	179	164	-30	30	94	-1.5	5	0.1	1	-0.1	25	97	71
Northern Ireland	80	79	3	22	14	-1.6	5	0.4	-8	-0.9	18	21	3
United Kingdom	3,649	3,096	779	1,253	998	-1.2	131	0.2	31	0.0	1,119	964	-164

Source: Cambridge Econometrics, MDM revision 12015 and 12956 and IER estimates.

D.11 Conclusion

The Working Futures 7 projections reveal that spatial differentials within the UK are set to widen over the period 2017 to 2027. The trend established in previous decades for London to become a global city in which higher end economic activity, people in higher status occupations with higher level educational qualifications concentrate resulting in a marked differential in productivity and wealth generation will continue, but at a slower rate. Manufacturing, public sector employment and more routine occupations will continue to be important in the midlands, northern England and the three other nations of the UK. The shift from male to female employment is expected to continue in all parts of the UK. Replacement demand will become more significant for female than male employment, but the relative impact of the need to recruit replacement workers will vary little within the UK.

The relative situation of Northern Ireland and Wales compared with England and London will deteriorate, but the position of Scotland will be more favourable. Within England, the gap between the south and east and the north will widen. Economic activity rates are projected to fall most in the less successful parts of the UK, but unemployment rates are projected not to increase greatly.

Department for Education

Other outputs available from Working Futures include:

Working Futures 2017-2027 Main report and associated technical reports. Full details on sources and methods are to be found in the technical report.

The full length evidence report and associated Annexes contain:

- More detailed results for both sectors and occupations in the UK;
- Results for the various devolved administrations with the UK and the English regions;
- Comparisons with previous projections;
- Methodological details relating to the projections, including the macroeconomic model, methods used to derive implications for the demand for and supply of skills and the spatial analysis.
- Excel workbooks containing analysis for the UK, nations and English regions (to be published in due course).

For further details and to access the Working Futures 2017-2027 reports see www.gov.uk/government/publications and for previous Working Futures reports see warwick.ac.uk/fac/soc/ier/research/wf/.

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