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# BULLETIN

## Working Futures: New Projections of Occupational Employment by Sector and Region

### Introduction

This Bulletin presents a summary of recent work done by the Institute for Employment Research entitled 'Working Futures'.<sup>1</sup> The work builds up a picture of employment demand in the UK and provides a set of employment projections until 2012. In particular, forecasts of employment are made on the basis of:

- Employment by Industry. (Based on 67 two-digit categories of the SIC 1992 industrial classification).<sup>2</sup>
- Employment by Occupation. (Based on the 25 sub-major groupings of the SOC 2000 occupational classification).
- Employment by Region. (Based on the 12 Office for National Statistics Standard Regions and 47 Local Learning and Skills Councils (LLSCs)).
- Employment by Gender and Status. (Full-time, Part-time and Self-employed).

This project work was commissioned jointly by the Sector Skills Development Agency (SSDA) and the Learning and Skills Council (LSC) and builds upon previous forecasting work. The history of forecasting at the IER stems back many years and the 'Working Futures' project utilises the Local Economy Forecasting Model (LEFM), which has been used since 1993 to provide employment forecasts.<sup>3</sup> The current projections present analysis at a much more detailed level

than hitherto. The number of industries considered has been increased from 49 to 67 and the regional geography has been extended down to the level of the Local Learning and Skills Councils (LLSCs) in England.

As well as the ongoing task of updating the forecasts, the new figures provide useful labour market intelligence on numbers employed and the evolving patterns of demand, aimed at a potentially wide audience. The results are intended to provide a sound statistical foundation for the deliberations of central and local government bodies including the Sector Skills Councils (SSCs), Regional Development Agencies (RDAs) and LLSCs.

### The Model

Changes in employment structure are intimately tied up with the development of the economy more generally. The demand for labour is a derived demand and employment levels depend critically on the output of goods and services and the technologies used to produce them. Therefore, in order to assess the prospects for the changing pattern of demand for employment, it is essential to ground the analysis on a foundation and understanding of the key economic factors influencing the economy and its structure. To do this a multi-sector macroeconomic model is required.

The macroeconomic factors that produce the demand for labour are modelled using the Cambridge Econometrics (CE) Multi-sectoral Dynamic Model (MDM). The outputs of this model, employment demand by industrial sectors for each of the UK regions, are then utilised by the IER replacement demand model (REPMOD). In this secondary stage, employment demand is projected for occupational groups by region and taking into account gender.

Within the MDM, the level of aggregate demand for goods and services is determined by a system of structural relationships in the economy, which are set up in a Keynesian

<sup>1</sup> For details see Wilson *et al.* (2004) and Green *et al.* (2004). For a more general background on employment forecasting in the UK see Lindley (2003). The research summarised in this Bulletin was commissioned by the Sector Skills Development Agency and the Learning and Skills Council. The views expressed are those of the authors. For further details please contact: ier@warwick.ac.uk.

<sup>2</sup> All of the 49 two-digit categories of the 1992 Standard Industrial Classification (SIC92) have been distinguished, as well as some other more detailed categories, resulting in 67 industries in total.

<sup>3</sup> At the time of writing, only limited data have been made available from the 2001 Census. So, although the results take into account headline data from the Census, they have not yet incorporated the detailed insights into changes in occupational employment structure that the Census allows.

framework. Its main components are equations explaining consumption, investment, employment, exports, imports and prices. These equations are solved simultaneously so that the final results are consistent with the various identities required by the national accounts. Additionally, in order to determine outputs and employment for each sector, a Leontief input-output system is incorporated into the model. In simple terms, this captures the fact that industries are inter-dependent and the outputs of one sector are the inputs to another sector (consider the example of forestry and paper).

The parameterisation of key relationships within the model, for example the relationship between employment and the output of goods and services, are established based on past data using the standard econometric technique of cointegration. This technique also provides a so-called 'error correction' formulation so that the economy is projected to adjust slowly over time towards its equilibrium level. This adds a dynamic element to the model and facilitates forecasting over time.

Within the model, each of the 12 nations and regions of the UK (hereafter termed regions) are modelled separately (aggregate results are obtained by summation) and the level of disaggregation of commodities and industries is considerable. Primarily because of the degree of disaggregation, the model is a large one and comprises over 5,000 behavioural and technical relationships (excluding accounting identities).

Finally, the output of the model depends upon a few key assumptions regarding external factors (or exogenous variables). The key exogenous assumptions are:

- World growth in industrial production;
- World inflation in wholesale prices and in the prices of traded goods such as crude oil;
- UK population and regional activity rates for men and women;
- UK natural resources (the main natural resources being coal, oil and natural gas);
- Current and capital spending of the UK government;
- UK tax rates and allowances;
- The sterling-dollar and other exchange rates;
- UK and US interest rates.

### Replacement Demand Model

The chief objective of the work done by IER is to utilise the MDM forecasts by industrial sector in order to produce detailed projections of employment demand by occupation. This is done using the replacement demand model. The model distinguishes 25 sub-major occupational groups from the SOC 2000 occupational classification. Projections of employment demand are done for each of these groups for each geographical area. 'Working Futures' develops earlier work in this respect and contains a great deal of detail at local level. The nine English regions are further partitioned and forecasts are made available down to the level of the 47 LLSCs.

<sup>4</sup> The main source of information on these flows (as well as information on age structure, which is critical to the calculations) is the LFS. Due to data limitations, estimates are currently calculated using national data on flow rates and these are extrapolated back to occupational sectors and regions.

Employment projections by occupation are then obtained in two steps. Firstly, there is an intricate mapping exercise so that employment demand by industry is converted to employment demand by occupational sector. The starting point for this exercise is to estimate the occupational breakdown of each industrial sector, also taking into account participation by gender. This is done using a matrix of employment weights derived from the 2001 Census of Population and the Labour Force Survey (LFS). One can picture the detail of the calculations involved here. Since there are two sexes, 25 occupations and 67 industries, the matrix contains  $2 \times 25 \times 67 = 3,350$  weighting components. In addition to this, the matrix is customised to reflect variations in detailed occupational composition over time, hence giving a series of converter matrices (one for each year). The analysis is also repeated on a region-by-region basis, where procedures are put in place to ensure that the numbers aggregate back to the national picture.

The second step is to project the employment demand figures into the future. At this stage the occupational employment forecasts are then based on extrapolation of past trends, using standard time series techniques. The data used in this exercise relate past employment levels and current occupational projections. Again this forecasting exercise is done at very detailed levels of disaggregation (by occupation, gender and region).

In the analysis, changes in occupational employment levels between years are also analysed to show changes due to replacement demand and expansion demand. Replacement demand is the amount of new job creation needed to offset outflows due to retirements, mortality, occupational and geographical mobility.<sup>4</sup> Expansion demand is the amount of job gains/losses within the sector (by gender and region) due to underlying structural change. For example, this may be due to the fact that certain industries are expanding/declining or that there are changes in occupational structure within industries. In the context of the analysis so far, expansion demand is calculated as the overall change in demand minus replacement demand.

Finally, a general point to note is that since the forecasts are made at a very detailed level of disaggregation, it is generally advised that the figures should be treated as indicative rather than precise forecasts. Whilst forecasts at aggregate level are fairly robust, at local level or for small occupational subgroups the limited data from the LFS on age structures and flows make the projections more susceptible to error.

### Key Findings

#### *Aggregate Labour Market*

A generally optimistic picture emerges for the labour market. Employment is expected to continue to rise at about half a per cent per annum, resulting in over 1.3 million additional jobs over the next decade, the vast majority of which are expected to be taken up by women. Further, the level of unemployment is expected to remain stable at relatively low levels compared with recent historical experience, with only a very modest increase anticipated.

Employment Sector	Net change 2002-2012
Other business services	365
Computing & related	335
Health	289
Retailing	280
Professional services	274
Miscellaneous services	267
Education	195
Wholesale distribution	43
Banking & insurance	42
Transport	33
Sale & maintenance of motor vehicles	30
Printing and publishing	22
Hotels & catering	15
Manufacturing nes & recycling	-6
Communications	-9
Mining and quarrying	-15
Utilities	-27
Public administration	-31
Wood and paper	-32
Food drink & tobacco	-47
Construction	-59
Agriculture, etc	-67
Metals & metal goods	-95
Textiles & clothing	-102
Chemicals & non-metallic mineral products	-106
Transport equipment	-129
Engineering	-144
All Industries	1,322

Table 1: Net Change in Employment by Industrial Sector (thousands), 2002 - 2012. (Industries sorted by net change in employment)

#### Trends by Industrial Sector

Whilst employment is forecast to expand as a whole, there is likely to be a great deal of variation across industries. Table 1 shows the projected net change in employment for each of the main industrial sectors between 2002 and 2012. Clearly, some sectors will emerge as winners in terms of employment growth, and the largest employment gains are expected to be in the service sector. This continues the trend of the previous decade. Business services along with computing and related industries are expected to generate the most jobs. Health, retailing and education are also expected to show significant expansion over the coming decade. At the other end of the spectrum, the manufacturing sector is expected to show a net decrease in the number of workers employed. In particular, the engineering industry, transport equipment and heavy manufacturing such as metals and chemicals are expected to require fewer workers.

#### Trends by Occupation

The projected changes in employment demand by occupational group are summarised in Table 2. The table shows both the expansion demand and the replacement demand, along with the overall net requirement, for each industry.

Taking the projections as a whole, the magnitude of

replacement demand typically outstrips that of expansion demand by a factor of around 10 to one, ie. whilst there will be 1.3 million net jobs created in aggregate over the next decade, the gross number of new job openings is expected to be 13.5 million, the vast majority of which are to replace workers who are retiring. It is also interesting that this pattern can be seen across all of the occupational groups.

Secondly, there are likely to be some important underlying changes in terms of which occupational groups are expanding or declining. This has important implications, for example for levels of replacement demand in future decades. Expanding occupational groups include caring service occupations, corporate managers and most professional occupations (for example in teaching, health or science). In contrast, employment demand in other occupations, for example elementary clerical occupations or in skilled trades associated with metal, plant and machinery, are in structural decline. It is interesting, however, that in these declining sectors employment demand will increase over the next decade due to high levels of replacement demand. This serves to more than offset the jobs that would have been otherwise lost. In fact all the occupations listed in Table 2 have a positive net requirement between 2002 and 2012. This raises an important point with regard to education and training policy, since resources still need to be directed towards declining sectors to cope with replacement demand for the foreseeable future.

Occupation	Change in Demand 2002-2012		
	Expansion	Replacement	Net
Caring Personal Service Occs	703	633	1,336
Corporate Managers	662	1,321	1,983
Teaching/Research Prof.	273	552	825
Bus/Public Serv. Assoc Prof.	225	604	829
Science/Tech Professionals	203	299	502
Sales Occupations	202	755	957
Customer Service Occupations	196	211	407
Culture/Media/Sport Occs	193	252	445
Business/Public Service Prof.	178	244	422
Science Associate Prof.	144	178	322
Health Associate Prof.	130	514	644
Protective Service Occs	83	230	312
Transport Drivers and Ops	62	421	482
Health Professionals	50	93	143
Leisure/Oth Pers Serv Occs	45	214	259
Skilled Agricultural Trades	10	123	134
Other Skilled Trades	-54	248	194
Managers and Proprietors	-77	469	392
Skilled Construct. Trades	-90	342	252
Admin & Clerical Occupations	-180	1,309	1,129
Elementary: Trades/Plant/Mach	-213	376	163
Secretarial & Related Occs	-244	540	296
Transport & Mach Ops	-311	519	208
Skilled Metal/Elec Trades	-408	627	219
Elementary: Clerical/Service	-460	1,108	647
All Occupations	1,322	12,181	13,503

Table 2: Expansion, Replacement and Net Change in Employment by Occupational Group (thousands), 2002-2012. (Occupations sorted by expansion demand).

Region	Population	Working Age Population	Labour Force	Unemployment	Employment
	(000s)	(000s)	(000s)	(000s)	(000s)
London	609	641	306	21	288
South East	514	393	323	16	312
East	325	178	200	13	189
South West	294	260	127	10	120
West Midlands	32	49	120	27	94
East Midlands	118	60	83	14	70
Yorks & Humber	175	121	112	22	91
North West	5	10	111	26	86
North East	-1	-10	21	13	9
England	2,070	1,701	1,402	161	1,259
Wales	77	51	37	14	24
Scotland	-25	25	45	31	15
Northern Ireland	77	54	30	8	23
UK	2,198	1,831	1,514	213	1,322

Table 3: Changes in Population and Labour Market Activity by Region, 2002 – 2012

#### Trends by Region

The employment trends by region are summarised in Table 3. Detailed forecasts down to LLSC level are not summarised here, but are available in Green *et al.* (2004). The table shows the net changes in population, unemployment and employment by region. An interesting aspect of these changes is that the forecast increase in employment of 1.3 million is set against a backdrop of expanding population (the UK population will grow by 2.2 million between 2002 and 2012) and also an expanding working population and labour force. There is, however, evidence of regional inequality in the growth of employment opportunities. The expansion in employment will be largely centred around London and the South East, and these two regions also account for almost half of the new job creation. The East of England and South West also fare well in terms of net job creation. In contrast, the working population is expected to decline or increase only slowly in parts of the Midlands, the North and in Scotland, and in these areas the number of new jobs created is likely to be small. These trends may present pressing issues for the government in terms of managing the provision of housing and public services.

#### Conclusion

The set of employment projections in 'Working Futures' provides the most detailed and extensive ever produced for the UK. Over half a million time series have been estimated and projected for employment alone. This has built upon work done by IER over previous years, but has also been motivated by increasing requirements from organisations such as the

SSDA and LSC for information on detailed sectoral prospects and particular localities in order to meet the remits they have been set by the government.

In general, the results show a healthy outlook for UK employment, with a net total of 1.3 million new jobs expected to be created between 2002 and 2012. This, of course, disguises a mixed picture across industrial sectors, occupational groups and regions. Many sectors are expanding whilst others are in structural decline. These changes reflect both the changing pattern of demand for goods and services by consumers, but also technological and organisational changes affecting the manner in which goods and services are produced. However, a high volume of replacement demand, chiefly due to people retiring, will ensure the need to employ and train new people in all areas of the economy.

#### References

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