

Oxford Economics Technical Note

Oxford Economics Forecasts

October 2019

Introduction

Skills Development Scotland (SDS) appointed Oxford Economics to produce economic and labour market forecasts for Scotland up to the year 2029.

The forecasts provided are produced by Oxford Economics Local Authority District Forecasting Model. Results have been provided for Regional Outcome Agreement areas (ROAs), City Region areas, Growth Deal areas, local authorities as well as Scotland and the UK.

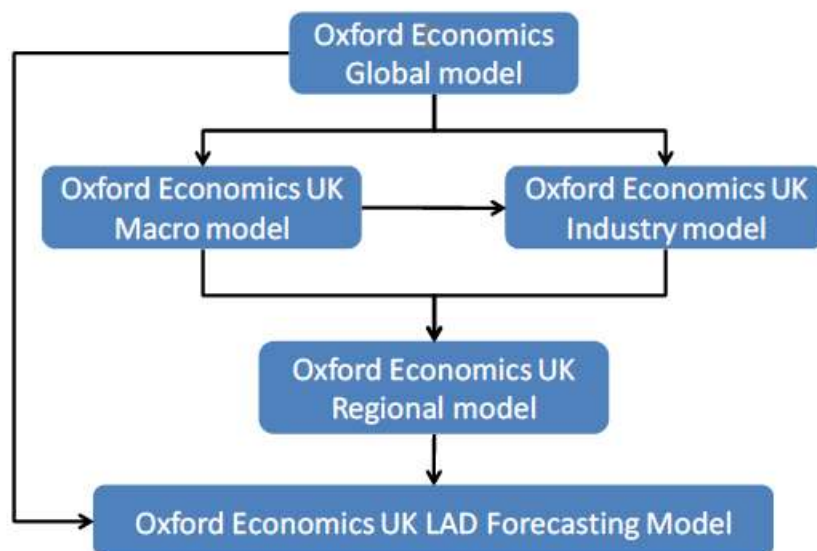
This technical note is intended to provide information on the methodology and data sources underpinning these forecasts.

Model Overview

Local authority district forecasting model

Oxford Economics Local Authority District Forecasting Model sits within the Oxford suite of forecasting models. This structure is unique as it ensures global and national factors (such as developments in the Eurozone, UK Government fiscal policy and Brexit) have an appropriate impact on the forecasts for a local authority. This empirical framework (or set of 'controls') is critical in ensuring the local area forecasts are much more than just an extrapolation of historical trends and reflect external economic conditions. Rather, the trends in our global, national and sectoral forecasts have an impact on the local area forecasts.

Figure 1: Hierarchical structure of Oxford Economics' suite of models



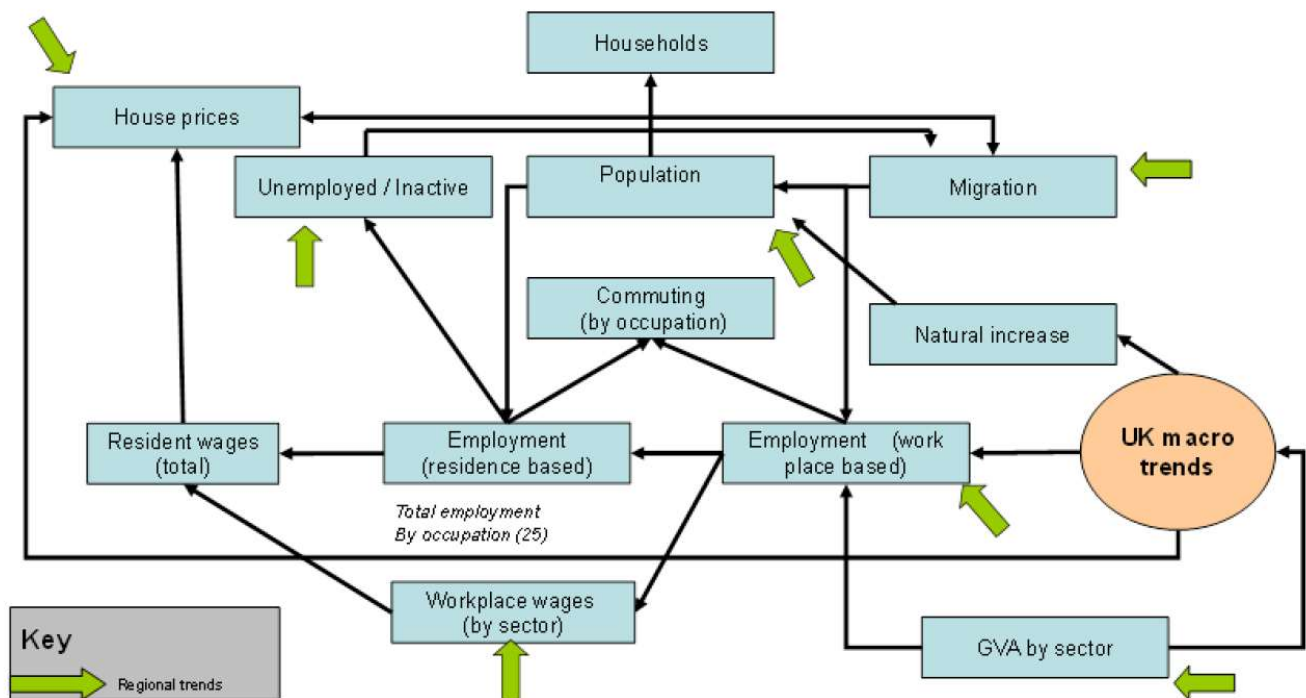
Their local forecasting model depends essentially upon three factors:

- International, national and regional outlooks;
- Historical trends in an area; and
- Fundamental economic relationships.

As with all Oxford Economics' models, their local authority model is economically driven, with all aspects of the economy interlinked. All their models are economically driven as they believe that this is the best way to estimate the future outlook for the area. Given changes in economic conditions drive labour market performance, which in turn affects migration patterns and housing demand / make-up, economic based forecasts are essential. For example, if employment or productivity changes in one sector, there are implications for all sectors of the economy through indirect (supply chain) and induced impacts. The employment creation will then put downward pressure on unemployment, while encouraging increased commuting into the economy, and making it a more attractive location for migrants. This would effectively drive up population and housing demand (and put more demand on public services).

The main internal relationships between variables are summarised in Figure 2. Each variable is related to others within the models. Key variables are also related to variables in the other Oxford Economics models.

Figure 2: Main Relationships between variables



The model is constructed on an annual basis. Historic data for most variables has been collected for 20 or more years to provide a basis for estimating interrelationships between variables and future trends. Forecasts are currently set up for the period up to 2029 consistent with existing available global, national and regional forecasts.

Using the Model

The model provides projections on a 'policy neutral' basis. Unconfirmed, aspirational or policies at planning/development stage are not included. Though forecasts are built primarily around the economic relationships above, the use of local knowledge and published material on local development is required to augment the results of the formal modelling process.

The baseline forecasts reflect the UK decision to leave the European Union. This decision will inevitably have a marked impact on the future development of the UK and Scottish economies. The forecast assumes that after a brief extension to the Article 50 negotiations, the withdrawal agreement is implemented. This means that there is then a transition period until the end of 2020 during which trading arrangements remain unchanged. But there is a sizeable risk that the process is derailed by the UK parliament failing to approve the deal. The Withdrawal Agreement includes an open-ended UK-EU customs union and, if the agreement is implemented, we think that the UK will struggle to formulate a plan to supersede this arrangement. Therefore, our forecast assumes that the customs union remains in place for a prolonged period. Once outside of the EU, the forecast is predicated on the assumption that the UK pursues 'populist' policies in areas such as immigration, which will be associated with lower net migration into the UK than has been the case in recent years.

As with all forms of forecasting there are margins of error associated with the results which get larger over time. Furthermore, the quality of data decreases as the geography gets smaller. Models of this form under current data quality levels are most helpful for identifying trends, growth rates and relativities either across or within areas. The long-term trends are therefore important, and users are encouraged to use the time series information and not rely on 'point-in-time' estimates.

Variables Covered

The list below provides a summary of the variables provided in the Regional Skills Assessments:

- Gross Value Added (GVA);
- Employment;
- Occupational change;
- Industry and key sector change;
- Total requirement including expansion and replacement demand; and
- Employment by gender and status.

Data Sources and Forecast Approach

The section below sets out details of the data sources used as well as an overview of the Oxford Economics methodology.

Total employment

Total employment estimates have been provided on both a 1 digit and 2 digit basis. The results include employees in employment, the self-employed and Her Majesty's Forces, and are measured on a workplace basis. The results are fully consistent with Workforce Jobs (WFJ) data available from the Office for National Statistics (ONS). Total employment data is published for Scotland, however such information is not available for the local authorities. These will be constructed using the components below. Note total employment is a job and not people measure (i.e. one person can have more than one job and would be counted more than once in this indicator).

The Business Register and Employment Survey (BRES) is the starting point for constructing the employment forecasts. BRES is the most comprehensive source of employment data, both geographically and sectorally.

There are a number of steps in constructing regional employee jobs, due to changes in sectoral classifications across the various sources, and restrictions on data availability over particular periods of time. Initially, we take employee jobs data for each sector directly from the BRES over the years 2009-17, which reflects recent methodological changes to the BRES in accounting for working proprietors. This relates to September figures and is based upon SIC 2007 sectors. In 2008, levels of employee jobs are constructed by extrapolating back the trend in the old BRES. Data from the ABI and AES is used to construct the data back to 1991.

This constructed dataset is then controlled to the UK employee jobs series from WFJ, by applying sectoral adjustment factors which converts the data to annual average values (seasonally adjusted). This is measured on a workplace basis.

The starting point in producing total employment forecasts is the determination of workplace-based employees in employment in each of broad 19 SIC2007 based sectors consistent with the regional and UK outlooks. At local authority level some of the sectors are driven predominantly by population estimates, others by total employment in the area and the remainder relative to the regional performance (largely exporting sectors). All sectors are also influenced by past trends in the local area. Taken in totality, employment is cross referenced with a number of variables (including population, relative performance across similar areas, historical cyclical performance and known policy) for checking and validation purposes. Where necessary, manual adjustments are made to the projected trends to reflect this validation process. The methods of sectoral projection are as follows, each of which are forecast based upon recent trends:

- Agriculture - share of Scotland
- Mining and quarrying - share of Scotland
- Manufacturing - share of Scotland
- Electricity, gas, & steam - share of Scotland
- Water supply; sewerage, waste management - share of Scotland
- Construction - location quotient based upon total employment
- Wholesale and retail trade - location quotient based upon consumer spending
- Transportation and storage - location quotient based upon consumer spending
- Accommodation and food service activities - location quotient based upon consumer spending
- Information and communication - share of Scotland
- Financial and insurance activities - share of Scotland
- Real estate activities - location quotient based upon total employment
- Professional, scientific and technical activities - location quotient based upon total employment
- Administrative and support service activities - location quotient based upon total employment
- Public administration and defence - location quotient based upon population
- Education - location quotient based upon population
- Human health and social work activities - location quotient based upon population
- Arts, entertainment and recreation - location quotient based upon consumer spending
- Other service activities - location quotient based upon consumer Spending

Employment by key sectors

The sector level data provided for employment described above has the benefit of aggregating to total employment. However, this sector breakdown does not allow a sufficiently precise examination of Scotland's key sectors. Such sectors are seen as being particularly important in helping to drive economic growth and competitiveness in the local area. And for that reason, it was

necessary to undertake additional work to accurately measure the size and performance of these sectors.

Results for the following sectors have been provided (please see Appendix A for more detail):

- Chemical sciences
- Creative industries
- Construction
- Energy
- Engineering
- Financial and business services
- Food and drink
- Health and social care
- Child-day care activities
- ICT/digital
- Life sciences
- Tourism

The key sector estimates have been derived using a sub-model, driven by and entirely consistent with the main model. The sub-model provides historical data and forecasts for workplace-based employment. It uses the BRES data to split the broad sector forecasts into their detailed sub-sectors to allow the construction of key sectors.

Employment by status and gender

The Business Register and Employment Survey (BRES) provides data on employment by status for Scotland and its local authority districts. Shares of part-time employees (which are trend forecasts linked to national projections) have been applied to the workplace total employment estimates described above. Full-time employment is simply total employment less the part-time employment. The forecasts are controlled to ensure consistency with national and regional forecasts.

Data on employment by gender is published for Scotland as part of ONS Workforce Jobs (WFJ) release. Shares of female employment (which are trend forecasts linked to national projections) are applied to the workplace employment estimates described above. Male total employment is simply the total of employment less female employment. Locally, employment by gender data is not published. Rather, we have applied the gender shares for Scotland adjusted to reflect the Census of Population to the employment forecast for each area.

Employment by industry and occupations

The Annual Population Survey (APS) provides data on employment by occupation for Scotland and its local authority districts. The forecasts are derived using a SIC/SOC matrix. The ratio of occupations within each sector for 2001 and 2011 is calculated from the Census. For all other years we use Labour Force Survey for Scotland. The share of each occupation by sector is forecast based upon trend and are applied to the sectoral employment data for each local area, to give an estimate of occupations within each sector. The results are adjusted to reflect the APS data for each local area. The occupations by sector are then aggregated to give occupations by 25 minor occupation groupings. Therefore, the overall economy occupational structure is heavily dependent upon sectoral composition and future trends can be largely explained by sectoral trends. A more detailed breakdown of employment by occupation is available for Scotland, with results provided for both the 3 digit and 4 digit occupation classification. The Annual Population Survey (APS) provides data on employment by 3 and 4 digit occupation for Scotland. The forecasts are produced using a detailed SIC/SOC matrix from the Annual Population Survey. The share of each 3 digit occupation by sector is forecast, and are applied to the sectoral employment data, to give an estimate of 3 digit occupations. The forecasts are controlled to ensure consistency

with the 2 digit occupations. Occupations at the 4 digit level are forecast using shares of their 3 digit occupation group. These shares are kept flat over the forecast period and applied to the 3 digit results to give an estimate of 4 digit occupations. The forecasts are controlled to ensure consistency with the 3 digit occupations.

Expansion demand by occupation

Expansion demand refers to the net change in total employment by occupation over the forecast period and thus the results can be positive or negative. The results are presented for each of the 25 occupation minor groupings. Note: these results are people based. The results are also provided for the 3 digit occupation classification for Scotland.

Replacement demand by occupation

Replacement demand represents how many more people will be required at each level due to people leaving the workforce. There are many reasons why people leave the labour market - with retirement perhaps the prime example – and need to be replaced. Whilst replacing the vacant position creates additional labour demand, it has no net effect on total employment. Reasons for leaving employment include:

- Unemployment;
- Inactivity;
- Out migration;
- Retirement;
- Death; and,
- Leaving for another job in a different occupational group or sector.

This ‘replacement’ category is much larger than expansion demand and explains why even declining sectors such as manufacturing still require new staff / advertise vacancies. Leaver rates by occupation are calculated from the Labour Force Survey for Scotland. These rates are applied across all geographies. Note: the replacement demand by occupation results are people based. The results are also provided for the 3 digit occupation classification for Scotland. These are derived using leaver rates by 3 digit occupation from the Labour Force Survey for Scotland. These rates are applied across to the 3 digit occupations for Scotland. The forecasts are controlled to ensure consistency with the 2 digit occupations.

Total requirement by occupation

Replacement demand and expansion demand are summed to produce total occupation demand (people based). The results are also provided for the 3 digit occupation classification for Scotland.

Expansion demand by industry

Expansion demand refers to the net change in total employment by industry over the forecast period and thus the results can be positive or negative. The results presented are jobs based for each of the 1 digit industries and key sectors.

Replacement demand by industry

Leaver rates by industry are calculated from the Labour Force Survey for Scotland. These rates are forecast and applied across all geographies. The number of leavers by 1 digit industry and apportioned to key sectors using employment shares from BRES. Note: the replacement demand by industry results are jobs based.

Total requirement by occupation

Replacement demand and expansion demand are summed to produce total demand by industry and key sector (jobs based).

Output

GVA data by sector is published on a nominal basis by the Office for National Statistics for Scotland and the local authority districts. These are converted to real prices using the chain linked volume measures which are available for Scotland, NUTS2 regions, NUTS 3 regions and local authority districts. The GVA forecast is driven by sectoral employment in each area and Scottish productivity forecast adjusted by relative earnings. At the Scotland level, GVA is driven by sectoral employment and sectoral productivity relative to UK.

Output (GVA) by key sector

GVA forecasts by key sector are driven by key sector employment and local estimates of productivity adjusted by relative detailed sectoral earnings.

Productivity

Productivity is calculated as GVA per job.

Appendix A

The SIC definitions for the SDS Key Sectors.

SIC 2007 code	Description	Attributable Activity
Financial and Business Services		
64.1	Monetary intermediation	100%
64.3	Trusts, funds and similar financial entities	100%
64.9	Other financial service activities, except insurance and pension funding	100%
65	Insurance, reinsurance and pension funding, except compulsory social security	100%
66	Activities auxiliary to financial services and insurance activities	100%
69.1	Legal activities	100%
69.2	Accounting, bookkeeping and auditing activities; tax consultancy	100%
70.2	Management consultancy activities	100%
71.129	Other engineering activities (not including engineering design for industrial process and production or engineering related scientific and technical consulting activities)	100%
73.2	Market research and public opinion polling	100%
74.3	Translation and interpretation activities	100%
78.109	Activities of employment placement agencies (other than motion picture, television and other theatrical casting) n.e.c.	100%
78.3	Other human resources provision	100%
82.1	Office administrative and support activities	100%
82.2	Activities of call centres	100%
82.30	Organisation of conventions and trade shows	100%
82.91	Activities of collection agencies and credit bureaus	100%
82.99	Other business support service activities n.e.c.	100%
Chemical Sciences		
20.11	Manufacture of industrial gases	100%
20.12	Manufacture of dyes and pigments	100%
20.13	Manufacture of other inorganic basic chemicals	100%
20.14	Manufacture of other organic basic chemicals	100%
20.15	Manufacture of fertilisers and nitrogen compounds	100%

20.16	Manufacture of plastics in primary forms	100%
20.17	Manufacture of synthetic rubber in primary forms	100%
20.20	Manufacture of pesticides and other agrochemical products	100%
20.30/1	Manufacture of paints, varnishes and similar coatings, mastics and sealants	100%
20.30/2	Manufacture of printing ink	100%
20.41/1	Manufacture of soap and detergents	100%
20.41/2	Manufacture of cleaning and polishing preparations	100%
20.51	Manufacture of explosives	100%
20.52	Manufacture of glues	100%
20.53	Manufacture of essential oils	100%
20.59	Manufacture of other chemical products n.e.c.	100%
20.60	Manufacture of man-made fibres	100%
21.1	Manufacture of basic pharmaceutical products	100%
21.2	Manufacture of pharmaceutical preparations	100%

Creative industries

73.11	Advertising agencies	100%
73.12	Media representation	100%
71.11	Architectural activities	100%
90.03	Artistic creation	70%
47.78/1	Retail sale in commercial art galleries	100%
31.09	Manufacture of other furniture	100%
16.29	Manufacture of other wood products	30%
32.12	Manufacture of jewellery and related products	100%
32.13	Manufacture of imitation jewellery and related articles	100%
23.41	Manufacture of ceramic household and ornamental articles	35%
23.49	Manufacture of other ceramic products	35%
23.13	Manufacture of hollow glass	15%
23.19	Manufacture of other glass	15%
47.79/1	Retail sale of antiques and antique books	100%
95.24	Repair of furniture and home furnishings	100%
13	Manufacture of textiles	25%
14	Manufacture of wearing apparel	20%
15	Manufacture of leather and related products	20%
74.1	Specialised design activities	25%
71.12/1	Engineering design activities for industrial process and production	100%
74.1	Specialised design activities	75%
90.01	Performing arts	100%
90.02	Support activities to performing arts	100%
90.04	Operation of arts facilities	100%
78.10/1	Motion picture, television and other theatrical casting	100%
59.2	Sound recording and publishing activities	100%
18.20/1	Reproduction of sound recording	100%
32.2	Manufacture of musical instruments	100%
74.20/1	Portrait photographic activities	100%
74.20/2	Other specialist photography (not including portrait photography)	100%
74.20/9	Other photographic activities (not including portrait and other specialist photography and film processing) n.e.c.	100%
18.20/2	Reproduction of video recording	100%
59.11/1	Motion picture production activities	100%

59.11/2	Video production activities	100%
59.12	Motion picture, video and television programme post-production activities	25%
59.13/1	Motion picture distribution activities	100%
59.13/2	Video distribution activities	100%
59.14	Motion picture projection activities	100%
58.21	Publishing of computer games	100%
62.01/1	Ready-made interactive leisure and entertainment software development	100%
59.11/3	Television programme production activities	100%
59.13/3	Television programme distribution activities	100%
59.12	Motion picture, video and television programme post-production activities	75%
60.1	Radio broadcasting	100%
60.2	Television programming and broadcasting activities	100%
90.03	Artistic creation	30%
58.11	Book publishing	100%
58.13	Publishing of newspapers	100%
58.14	Publishing of journals and periodicals	100%
58.19	Other publishing activities	100%
18.11	Printing of newspapers	100%
18.129	Other printing (not labels)	100%
18.13	Pre press and media services	100%
63.91	News agency activities	100%
91.01	Libraries and archive activities	100%
58.29	Other software publishing	100%
62.01/2	Business and domestic software development	100%
62.02	Computer consultancy activities	100%
85.52	Cultural Education	100%

Construction

02.2	Logging	20%
08.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate	70%
08.12	Operation of gravel and sand pits; mining of clays and kaolin	70%
16.23	Manufacture of other builders' carpentry and joinery	40%
20.30/1	Manufacture of paints, varnishes and similar coatings, mastics and sealants	25%
20.30/2	Manufacture of printing ink	25%
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	20%
22.19	Manufacture of other rubber products	20%
22.23	Manufacture of builders' ware of plastic	35%
23.32	Manufacture of bricks, tiles and construction products, in baked clay	85%
23.41	Manufacture of ceramic household and ornamental articles	60%
23.42	Manufacture of ceramic sanitary fixtures	60%
23.43	Manufacture of ceramic insulators and insulating fittings	60%
23.44	Manufacture of other technical ceramic products	60%
23.49	Manufacture of other ceramic products	60%
23.51	Manufacture of cement	25%
23.52	Manufacture of lime and plaster	25%
23.61	Manufacture of concrete products for construction purposes	90%

23.62	Manufacture of plaster products for construction purposes	90%
23.63	Manufacture of ready-mixed concrete	90%
23.64	Manufacture of mortars	90%
23.65	Manufacture of fibre cement	90%
23.69	Manufacture of other articles of concrete, plaster and cement	90%
25.11	Manufacture of metal structures and parts of structures	60%
25.12	Manufacture of doors and windows of metal	60%
25.21	Manufacture of central heating radiators and boilers	40%
25.29	Manufacture of other tanks, reservoirs and containers of metal	40%
25.3	Manufacture of steam generators, except central heating hot water boilers	40%
26.11	Manufacture of electronic components	35%
41.10	Development of building projects	100%
41.20/1	Construction of commercial buildings	100%
41.20/2	Construction of domestic buildings	100%
42.11	Construction of roads and motorways	100%
42.12	Construction of railways and underground railways	100%
42.13	Construction of bridges and tunnels	100%
42.21	Construction of utility projects for fluids	100%
42.22	Construction of utility projects for electricity and telecommunications	100%
42.91	Construction of water projects	100%
42.99	Construction of other civil engineering projects n.e.c.	100%
43.11	Demolition	100%
43.12	Site preparation	100%
43.13	Test drilling and boring	100%
43.21	Electrical installation	100%
43.22	Plumbing, heat and air-conditioning installation	100%
43.29	Other construction installation	100%
43.31	Plastering	100%
43.32	Joinery installation	100%
43.33	Floor and wall covering	100%
43.34/1	Painting	100%
43.34/2	Glazing	100%
43.39	Other building completion and finishing	100%
43.91	Roofing activities	100%
43.99/1	Scaffold erection	100%
43.99/9	Specialised construction activities (other than scaffold erection) n.e.c.	100%
46.13	Agents involved in the sale of timber and building materials	50%
46.63	Wholesale of mining, construction and civil engineering machinery	50%
46.73	Wholesale of wood, construction materials and sanitary equipment	50%
71.11/1	Architectural activities	100%
71.11/2	Urban planning and landscape architectural activities	50%
71.12/1	Engineering design activities for industrial process and production	50%
71.12/2	Engineering related scientific and technical consulting activities	50%
71.12/9	Other engineering activities (not including engineering design for industrial process and production or engineering related scientific and technical consulting activities)	50%

74.90/2	Quantity surveying activities	100%
Energy		
05	Mining of coal and lignite	100%
06	Extraction of crude petroleum and natural gas	100%
09	Mining support service activities	100%
19	Manufacture of coke and refined petroleum products	100%
20.14	Manufacture of other organic basic chemicals	100%
35	Electricity, gas, steam and air conditioning supply	100%
36	Water collection, treatment and supply	100%
38.22	Treatment and disposal of hazardous waste	100%
71.12/2	Engineering related scientific and technical consulting activities	100%
74.90/1	Environmental consulting activities	100%
Engineering		
24	Manufacture of basic metals	100%
25	Manufacture of fabricated metal products, except machinery and equipment	100%
26	Manufacture of computer, electronic and optical products	100%
27	Manufacture of electrical equipment	100%
28	Manufacture of machinery and equipment n.e.c.	100%
29	Manufacture of motor vehicles, trailers and semi-trailers	100%
30	Manufacture of other transport equipment	100%
33	Repair and installation of machinery and equipment	100%
71	Architectural and engineering activities; technical testing and analysis	100%
72.19	Other research and experimental development on natural sciences and engineering	100%
13.94	Manufacture of cordage, rope, twine and netting	100%
38.31	Dismantling of wrecks	100%
Food and Drink		
01	Crop and animal production, hunting and related service activities	100%
03	Fishing and aquaculture	100%
10	Manufacture of food products	100%
11	Manufacture of beverages	100%
Health and Social Care		
86.1	Hospital activities	100%
86.21	General medical practice activities	100%
86.22	Specialist medical practice activities	100%
86.23	Dental practice activities	100%
86.9	Other human health activities	100%
87.1	Residential nursing care activities	100%
87.2	Residential care activities for learning disabilities, mental health and substance abuse	100%
87.3	Residential care activities for the elderly and disabled	100%
87.9	Other residential care activities	100%
88.1	Social work activities without accommodation for the elderly and disabled	100%
88.91	Child day-care activities	100%
88.99	Other social work activities without accommodation n.e.c.	100%
Child day-care activities		
85.1	Pre-primary education	100%

88.91	Child day-care activities	100%
ICT/Digital		
18.20/3	Reproduction of computer media	100%
26.11	Manufacture of electronic components	100%
26.12	Manufacture of loaded electronic boards	100%
26.20	Manufacture of computers and peripheral equipment	100%
26.30	Manufacture of communication equipment	100%
26.40	Manufacture of consumer electronics	100%
26.8	Manufacture of magnetic and optical media	100%
27.31	Manufacture of fibre optic cables	100%
58.21	Publishing of computer games	100%
58.29	Other software publishing	100%
61.1	Wired telecommunications activities	100%
61.2	Wireless telecommunications activities	100%
61.3	Satellite telecommunications activities	100%
61.9	Other telecommunications activities	100%
62.01	Computer programming activities	100%
62.02	Computer consultancy activities	100%
62.03	Computer facilities management activities	100%
62.09	Other information technology and computer service activities	100%
63.11	Data processing, hosting and related activities	100%
63.12	Web portals	100%
63.99	Other information service activities n.e.c.	100%
95.11	Repair of computers and peripheral equipment	100%
95.12	Repair of communication equipment	100%
Life Sciences		
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	100%
26.6	Manufacture of irradiation, electromedical and electrotherapeutic equipment	100%
32.5	Manufacture of medical and dental instruments and supplies	100%
72.11	Research and experimental development on biotechnology	100%
72.19	Other research and experimental development on natural sciences and engineering	100%
Tourism		
55.1	Hotels and similar accommodation	100%
55.2	Holiday and other short-stay accommodation	100%
55.3	Camping grounds, recreational vehicle parks and trailer parks	100%
56.1	Restaurants and mobile food service activities	100%
56.3	Beverage serving activities	100%
79.12	Tour operator activities	100%
79.9	Other reservation service and related activities	100%
91.02	Museum activities	100%
91.03	Operation of historical sites and buildings and similar visitor attractions	100%
91.04	Botanical and zoological gardens and nature reserve activities	100%
93.11	Operation of sports facilities	100%
93.19/9	Other sports activities (not including activities of racehorse owners) n.e.c.	100%
93.21	Activities of amusement parks and theme parks	100%
93.29	Other amusement and recreation activities	100%

