

Enriched ASHE Quick Start Guide

Wage and Employment Dynamics

www.wagedynamics.com

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Note: This work was produced using survey data accessed through the ONS Secure Research Service. The use of the ONS data in this work does not imply the endorsement of the ONS or data owners in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates. National Statistics follow consistent statistical conventions over time and cannot be compared to these findings.

The Wage and Employment Dynamics Project

The Wage and Employment Dynamics (WED) project was funded by Administrative Data Research 2019-2022 to review, quality assure and enhance ASHE data. The project was also provided with ASHE data linked to the 2011 Census for England and Wales. This document describes the 'Enriched ASHE' dataset created by the code, which can be applied to the standard ASHE dataset. The code can also be applied to the ASHE-2011 Census dataset, creating an 'Enriched ASHE – 2011 Census' dataset. A separate [document](#) describes the ASHE - 2011 Census base dataset. The code is available to researchers within the Secure Research Service (SRS). Note that the ASHE – 2011 Census dataset does not hold geography for individuals below the level of Local Authority.

Enriched ASHE - Overview

The Annual Survey of Hours and Earnings (ASHE) is carried out in Spring each year by the UK Office for National Statistics (ONS). It is intended to be a 1% sample of employees, with data provided by employers. The same individuals are sampled in April each year that they hold an employee job, meaning their longitudinal employment path can be studied.

As data is supplied by employers, the information is limited to what can be supplied from payroll records: detailed information on wages and paid hours, employer pension contributions, occupation, industry and location, but only age and gender for personal characteristics. From the survey form and its own records, ONS generates several useful derived variables.

The data can be linked to other ONS business datasets that contain data on the employer (the enterprise) through the Inter-departmental Business Register (IDBR) Enterprise Reference numbers that are provided on the ASHE dataset. However, workplaces can only be indirectly linked to workplace data in other datasets as ASHE uses its own reference system for workplaces.

ASHE data is available from 2004 onwards. Its predecessor, the New Earnings Survey (NES) ran from 1975; it used the same sampling frame and collected much the same variables, so potentially information is available on some workers for over 40 years. There are some concerns about linking individuals over this period, but the 'ASHE' data files supplied to researchers by ONS include NES data from 1998-2003 which has been reliably linked.

ASHE is generally seen as high-quality data as it is provided by employers from payroll records rather than relying on employee recall. Large employers directly supply ONS with payroll records, rather than completing individual forms for members of staff. A major potential issue with ASHE is the sampling and weighting (see below).

ASHE is point-in-time information. There is no information on what ASHE respondents do through the rest of the year, while employees in the ASHE population but not working during the April reference week are not included in the dataset.

The standard ASHE dataset has been available to researchers through the ONS's SRS and the UK Data Archive Secure Data Service for many years, as well as being directly distributed to government departments. The Wage and Employment Dynamics (WED) team have generated an enriched dataset (Enriched ASHE), which includes additional variables derived by the WED team. The key

difference between the Enriched ASHE and standard ASHE datasets is the creation of additional variables by running Stata code available to all approved researchers¹.

ASHE does not cover NI; data is collected by NISRA on a consistent basis, but this is not generally available to GB researchers.

Survey basis and sample selection

The ASHE population is based on a random 1% sample of national insurance numbers (NINOs). These same numbers are used every year, so a person is either in the sampling frame for the whole of their employment career or not in at all. The sample changes as migrants or young workers join the labour force, and emigrants or retirees leave. Hence ASHE should be seen as a rolling random sample with replacement. NINOs are not available in the research dataset but are replaced with a random index.

The sampling frame is the HMRC record of employees registered for PAYE. HMRC supplies ONS with details of the employer of every employee in scope in February. Forms of employment that are not on the register (e.g., self-employment) will not be included. People with multiple employers (e.g., doing two part-time jobs) will have all of their jobs reported. ONS writes to employers at the addresses identified by HMRC. Large employers have the option of supplying ONS with extracts from their payroll systems. Other employers receive paper or electronic forms, with some fields (such as employee name, NINo and workplace address) pre-filled. If any employer reports to ONS that the employee has left the organisation since being selected for the survey, ONS contacts HMRC to see if the worker can be followed up.

Employers are required to report on the earnings of employees in a particular week in April of the survey year. The date varies to take account of Easter. The attained sample is around 0.67% of the workforce, two-thirds of the target. While completion of the form is a legal requirement, ONS typically will only chase responses until mid-August, when the attained sample is around 170,000 employees. This is because ASHE follows a very tight reporting schedule, with statistical results needed by October to facilitate Low Pay Commission and HM Treasury forecasts for the next financial year. The attained sample is thought to be sufficient for official statistics. However, there is clearly an incentive for less diligent employers to delay reporting in the hope of avoiding compliance altogether. WED analysis shows that the responses probabilities appear to be non-random², which potentially compromises both the cross-sectional and panel (longitudinal) dimension of the dataset³.

There is also some evidence that ASHE misses some low-paying employees⁴.

Numbers of observations

Numbers of individuals and jobs observed in the dataset are given in Table 1

| Year | Number of jobs held at survey time | | | Total |
|------|------------------------------------|---|-----------|-------|
| | 1 | 2 | 3 or more | |

¹ The code is available to researchers in the SRS, along with additional documentation. There is an additional data set generated by ONS with some extra variables (WED-ASHE). This dataset is not currently available for general use by researchers but is expected to be released in October 2022.

² Internal WED calculations based on Business Structure Database; available on request within SRS

³ Forth, J., Phan.V., Stokes, L., 2021. *Longitudinal Attrition in ASHE*. Methodology Paper. The WED Project.

⁴ Bird, D., 2004. *Methodology for the 2004 Annual Survey of Hours and Earnings*. Labour Market Trends. [online] Office for National Statistics. Available at:

<<https://www.beta.ons.gov.uk/file?uri=/employmentandlabourmarket/peopleinwork/earningsandworkinghours/methodologies/annualsurveyofhoursandearningsashemethodologyandguidance/ashemethodarticletcm77254753.pdf>>

| | | | | |
|-------|-----------|--------|-------|-----------|
| 2004 | 156,444 | 3,307 | 170 | 159,921 |
| 2005 | 159,288 | 2,681 | 87 | 162,056 |
| 2006 | 160,609 | 2,654 | 102 | 163,365 |
| 2007 | 134,017 | 2,204 | 80 | 136,301 |
| 2008 | 133,731 | 2,326 | 119 | 136,176 |
| 2009 | 163,281 | 2,987 | 117 | 166,385 |
| 2010 | 165,394 | 3,470 | 135 | 168,999 |
| 2011 | 173,414 | 4,280 | 208 | 177,902 |
| 2012 | 168,160 | 3,995 | 218 | 172,373 |
| 2013 | 170,878 | 4,020 | 216 | 175,114 |
| 2014 | 176,048 | 4,143 | 227 | 180,418 |
| 2015 | 174,035 | 3,912 | 233 | 178,180 |
| 2016 | 170,231 | 3,607 | 203 | 174,041 |
| 2017 | 170,145 | 3,677 | 193 | 174,015 |
| 2018 | 171,782 | 3,513 | 189 | 175,484 |
| Total | 2,447,457 | 50,776 | 2,497 | 2,500,730 |

Table 1 Numbers of individuals and the jobs they hold (SRS dataset)

Table 2 displays how often individuals are observed subsequent to their first appearance. The rate of attrition is higher than expected simply from people leaving work. Analysis suggests that this is affected by the sampling strategy; work is still ongoing on this⁵.

| Year (T) | T+1 | T+2 | T+3 | T+4 | T+5 | T+6 | T+7 | T+8 | T+9 | T+10 | T+11 | T+12 | T+13 | T+14 | T+15 |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 2004 | 77.3 | 71.6 | 55.3 | 52.3 | 61.4 | 58.8 | 58.4 | 54.5 | 53.2 | 51.5 | 48.4 | 45.1 | 43.2 | 41.2 | 38.8 |
| 2005 | 78.1 | 59.0 | 55.1 | 64.4 | 61.2 | 60.8 | 56.6 | 55.3 | 53.7 | 50.3 | 46.9 | 44.9 | 42.8 | 40.2 | |
| 2006 | 64.1 | 58.6 | 67.8 | 64.0 | 63.3 | 58.9 | 57.4 | 55.7 | 52.2 | 48.6 | 46.5 | 44.3 | 41.8 | | |
| 2007 | 75.7 | 71.2 | 66.3 | 65.4 | 60.8 | 59.1 | 57.4 | 53.7 | 50.0 | 47.9 | 45.4 | 42.8 | | | |
| 2008 | 77.2 | 70.2 | 68.5 | 63.3 | 61.6 | 59.6 | 55.7 | 52.0 | 49.7 | 47.1 | 44.5 | | | | |
| 2009 | 77.4 | 73.1 | 67.0 | 64.8 | 62.5 | 58.2 | 54.3 | 51.9 | 49.3 | 46.5 | | | | | |
| 2010 | 78.6 | 70.7 | 67.9 | 65.3 | 60.7 | 56.5 | 54.1 | 51.9 | 48.9 | | | | | | |
| 2011 | 76.0 | 71.5 | 68.1 | 63.1 | 58.5 | 55.9 | 53.2 | 50.2 | | | | | | | |
| 2012 | 77.8 | 72.4 | 66.6 | 61.4 | 58.6 | 55.5 | 52.4 | | | | | | | | |
| 2013 | 78.1 | 70.3 | 64.4 | 61.1 | 57.9 | 54.5 | | | | | | | | | |
| 2014 | 75.0 | 67.5 | 63.3 | 59.7 | 56.2 | | | | | | | | | | |
| 2015 | 73.7 | 67.1 | 62.4 | 58.5 | | | | | | | | | | | |
| 2016 | 73.4 | 66.3 | 61.6 | | | | | | | | | | | | |
| 2017 | 72.7 | 65.6 | | | | | | | | | | | | | |
| 2018 | 71.3 | | | | | | | | | | | | | | |
| Average | 75.1 | 68.2 | 64.2 | 61.9 | 60.2 | 57.8 | 55.5 | 53.1 | 51.0 | 48.7 | 46.3 | 44.3 | 42.6 | 40.7 | 38.8 |

Note: Shading is used to indicate the scale of sample retention: darker green for higher rates, amber for middling rates, then darker shades of red for lower rates.

Source: ASHE

Table 2 Individuals followed over time in the ASHE⁶

Tables 1 and 2 reflect a sample cut in 2007 and 2008, targeted at industries or occupations with relatively little wage variation (particularly the public sector, education workers, health workers). The full sample was restored in 2009 but this has affected the longitudinal integrity of the data.

⁵ Forth, J., Phan.V., Stokes, L., 2021. *Longitudinal Attrition in ASHE*. Methodology Paper. The WED Project.

⁶ Forth, J., Phan.V., Stokes, L., 2021. *Longitudinal Attrition in ASHE*. Methodology Paper. The WED Project.

Appendix tables show the numbers of jobs (not individuals) broken down by region, high level industry/occupation, and sector. Numbers do not tally across tables due to missing values.

Dataset structure

The data is collected in annual year files from 1998 onwards. These contain all the variables supplied by ONS or created by the WED team.

The WED team produces a panel dataset. This contains all observations 1998 onwards, but only a limited subset of the most relevant variables to prevent the file becoming too large to handle. Variables from the annual files can be added back by merging on year and 'serno', the unique observation references.

ONS also produces a panel dataset with all the variables but with only the 'main job' included for multiple job holders. Numbers also show some inconsistencies with the yearly files.

ASHE-NES datasets are also available (see below).

Variables

The table below summarises topics covered and some of the core variables on the dataset. There are many more variables derived from these; for example, home and work postcodes are used to derive multiple geographical areas, urban/rural markers, and eastings/northings.

In the final column, 'src' implies the data are collected from the survey form – these are described in the core ASHE documentation produced by ONS; 'ons' variables are generated as part of ONS survey processing; 'wed' means additional variables created by the WED team – see documentation for details.

| Employee characteristics | | |
|---|--|---------|
| ID | Permanent person ID | src |
| Age | Year | src |
| Sex | M/F/missing | src |
| Apprentice | If apprentice and when started (2013 onwards) | src |
| Home address | Postcode | src |
| Employment characteristics (for each job if multiple) | | |
| Industry | 5-digit (SIC2003, SIC2007) | src |
| Occupation | 3 digit (SOC90) 4 digit (SOC2K, SOC2010) | src |
| Employer reference | Links to IDBR (for size, type) | src |
| Work address | Postcode of establishment | src |
| Main job | Main job (different definitions) | ons/wed |
| Same job | Same job (not employer) for >12 months | src |
| Job number | Link to job in previous period | ons/wed |
| Time with employer | Start date with current employer | src |
| Contract | FT/PT, temp/permanent | src |
| Collective agreement | Whether covered and if so by which | src |
| Wage and hours data (for each job if multiple) | | |
| Components of wages | Reported as weekly, converted to hourly Annual earnings | src |
| Hourly wage | Reported separately if hourly paid | src |
| Hours | Actual, expected, overtime | src |
| Adjustments | Matters affecting pay in this period | src |
| Pay period | Pay period | src |
| Minimum wage | MW at reference data and previous quarter | wed |
| Sample characteristics | | |
| CS weights | Regular and adjusted for low pay statistics | src |
| Sample dates | Survey reference data, and date for Easter | wed |
| Special arrangements | Whether eligible to submit form electronically | src |
| Sample appearances | Time in dataset and with employer | wed |

Weights

ASHE data has two sets of cross-sectional weights supplied by ONS: a regular weight ('weight'), and a 'low pay' weight ('weightLP')⁷. ASHE is weighted to the employment estimates in the Labour Force Survey, which itself is weighted to the decennial Census and the intercensal population estimates. Low pay weights exclude employees that experienced loss of pay due to absence (variable 'lop'). The weights in the core documentation are those used in official statistics from ONS and the Low Pay Commission.

In addition to those core weights, the WED team have constructed two additional weights. Two-period longitudinal weights are designed to support analysis of changes in earnings over two years. In addition, the team have identified potential issues with sampling that suggest revised cross-sectional weights are necessary. These weights are available as separate files, linkable to the core data by the variable 'serno'.

⁷ These variables are called 'calwgt' and 'lpcalwgt' in the original files; the name was changed for clarity.

Longitudinal analysis

ONS does not treat ASHE as a longitudinal dataset (that is, seeking to maintain its longitudinal integrity as a design requirement). ASHE is longitudinal as a consequence of the sampling strategy (always the same 1% of NINOs are surveyed). Hence ASHE is longitudinal and can be analysed using panel methods, but users should be aware of some issues (the rate of employees exiting the ASHE is three times more likely than the rate of employees exiting employment; Employer non-response is a large contributor to employees exiting the ASHE; panel attrition is non-random⁸)

While individuals are followed through time with the same personal identifier, jobs in general are not. Jobs are identified by 'serial number' (the variable *serno*), which is assigned each year without reference to other years. The binary variable 'j12m' indicates whether, in the opinion of the person completing the form, the person has been doing the same job for over a year. WED team analysis suggests that, when this variable is set to 'true', the employee is genuinely in the same job. However, if an employee has multiple jobs, it is not clear which of the jobs the 'same job' refers to.

As part of the WED project, ONS identified a variable called 'serno1' which provided a direct link to the job in the previous year, even if the individual had multiple jobs. Analysis by the WED team suggest this is accurate, and it has been used to construct a variable 'job_number' which is a consistent reference to track jobs over time. This variable is currently only available in the Enhanced ASHE⁹.

Linking to other datasets

ASHE 2004 onwards contains IDBR references, allowing it to be linked to all the other ONS business surveys. This linking has to happen at 'enterprise' level; ASHE does not use the IDBR identifiers for local units to say which establishment an employee works at. The WED team have created local area identifiers based on Census output area, which should work for most businesses. Where business report at 'reporting units' below the level of the enterprise (as for example in the BERD and ABS), these need to be aggregated to the enterprise level.

As IDBR references can be linked to Companies House and Dun & Bradstreet numbers, it is possible to link to other business datasets such as FAME.

ONS does retain name and address information on ASHE going back some years. This allows ASHE data to be linked to other sources (this is used in the WED project that links ASHE and 2011 Census data¹⁰). The use of NINO as the sampling frame also means that ASHE data can be directly linked to other datasets that also indexed by NINO, for example those held by HMRC and DWP (not linked at present).

All new linking other than using the IDBR references is carried out by ONS, and requires ethical review and the approval of all data holders.

ASHE and NES

ASHE and NES share the same sample frame, mostly identical questionnaires, and almost sampling strategies. In theory, they can be linked as complete dataset from 1975 onwards, for individuals who

⁸ Forth, J., Phan, V., Stokes, L., 2021. *Longitudinal Attrition in ASHE*. Methodology Paper. The WED Project. <http://www.wagedynamics.com/wp-content/uploads/2022/07/Longitudinal-attrition-in-ASHE-Version-1b-13.04.22.pdf>

⁹ Ritchie, F., McKenzie, A., 2021. *'Same job' marker*. Quality Assurance paper. The WED Project.

¹⁰ Forth, J., Phan, V., Singleton, C., 2021. *ASHE-Census Linkage*. WPEG Conference. Available at: <http://www.wagedynamics.com/wp-content/uploads/2021/08/ASHE-Census-linkage-WPEG-July2021.pdf>

have been working throughout this period. In practice, some of the information about NINOs was not retained in the NES dataset, and so there are a large number of ambiguous references. As a result, some individuals observed before 2004 may not be linked to their later appearances. Longitudinal analysis using data prior to 2004 should be treated with caution.

NES is also missing IDBR references, meaning the data cannot be linked to other datasets. In practice, the 'ASHE' data from 1998-2003 (which is simplify NES data retrofitted with weights) does have some enterprise references, but the proportion of these drops as the data goes back further. Again, use of IDBR references prior to 2004 should be treated with caution.

Detailed documentation, and where to find it

The WED website (www.wagedynamics.com) hosts research publications, training material, and documentation (QA and data creation) to create these datasets. The table below gives links to a range of documentation.

| Description | Source |
|---|-------------------------------|
| Characteristics of the datasets | |
| ONS official ASHE description | ONS |
| ASHE questionnaires 2004-2014 | ONS |
| List of core SRS variables | SRS catalogue |
| List of additional WED variables | SRS catalogue |
| Recordings of ASHE training sessions | WED |
| Weighting | |
| Longitudinal weights | WED |
| Cross-section weights | WED |
| QA Information and Commentary on ASHE | |
| WED page containing methodological and QA reports | WED |
| Code and descriptions (available inside SRS) | WED |
| 2004 methodology paper for ASHE | ONS |

Appendix: characteristics of the sample

The statistics below relate to the standard SRS dataset.

| Year | NE | NW | Yorks | EM | WM | SW | East | London | SE | Wales | Scot | Total |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|
| 1997 | 6,581 | 17,288 | 14,077 | 10,988 | 15,274 | 12,409 | 13,986 | 22,209 | 20,667 | 6,298 | 14,173 | 153,950 |
| 1998 | 6,946 | 17,820 | 14,789 | 11,915 | 15,589 | 13,455 | 14,482 | 23,091 | 21,539 | 6,878 | 14,874 | 161,378 |
| 1999 | 6,837 | 18,054 | 14,157 | 12,115 | 15,462 | 13,454 | 14,758 | 23,459 | 22,187 | 6,991 | 14,276 | 161,750 |
| 2000 | 6,882 | 17,637 | 13,997 | 11,705 | 14,452 | 13,682 | 14,567 | 22,846 | 21,711 | 7,004 | 14,415 | 158,898 |
| 2001 | 6,951 | 18,036 | 14,363 | 11,522 | 15,148 | 13,658 | 14,733 | 22,997 | 21,931 | 7,034 | 14,827 | 161,200 |
| 2002 | 6,769 | 18,038 | 14,827 | 11,734 | 15,118 | 13,790 | 15,120 | 23,863 | 22,032 | 7,470 | 14,932 | 163,693 |
| 2003 | 6,923 | 18,551 | 14,681 | 12,014 | 15,394 | 14,426 | 15,035 | 23,621 | 22,427 | 7,682 | 15,356 | 166,110 |
| 2004 | 7,031 | 18,513 | 14,652 | 12,053 | 15,205 | 14,522 | 15,136 | 23,748 | 22,677 | 7,725 | 15,532 | 166,794 |
| 2005 | 7,050 | 18,966 | 14,941 | 12,345 | 15,785 | 14,622 | 15,277 | 23,197 | 22,967 | 7,584 | 15,609 | 168,343 |
| 2006 | 7,064 | 19,386 | 14,693 | 12,437 | 15,813 | 14,686 | 15,986 | 23,266 | 23,026 | 7,665 | 15,911 | 169,933 |
| 2007 | 5,844 | 15,736 | 12,014 | 9,794 | 12,629 | 12,265 | 13,357 | 20,660 | 19,487 | 6,230 | 12,920 | 140,936 |
| 2008 | 5,637 | 15,769 | 11,882 | 9,922 | 12,483 | 12,183 | 13,608 | 20,548 | 18,910 | 6,267 | 13,494 | 140,703 |
| 2009 | 7,152 | 19,097 | 15,227 | 12,428 | 15,297 | 14,968 | 15,626 | 24,540 | 23,668 | 7,751 | 16,137 | 171,891 |
| 2010 | 7,116 | 19,416 | 15,116 | 12,534 | 15,695 | 14,989 | 16,324 | 25,341 | 24,071 | 7,952 | 16,577 | 175,131 |
| 2011 | 7,410 | 20,360 | 15,758 | 13,123 | 16,430 | 15,943 | 17,045 | 27,071 | 25,940 | 8,432 | 16,989 | 184,501 |
| 2012 | 7,077 | 19,631 | 15,032 | 12,764 | 15,913 | 15,463 | 16,627 | 26,003 | 24,557 | 8,004 | 16,393 | 177,464 |
| 2013 | 7,358 | 20,129 | 15,117 | 12,985 | 15,965 | 15,613 | 16,926 | 26,398 | 24,723 | 8,190 | 16,678 | 180,082 |
| 2014 | 7,504 | 20,563 | 15,284 | 13,292 | 16,674 | 16,132 | 17,420 | 27,760 | 25,547 | 8,549 | 17,037 | 185,762 |
| 2015 | 7,297 | 20,591 | 15,216 | 13,436 | 16,369 | 16,010 | 17,567 | 26,805 | 25,312 | 8,274 | 16,598 | 183,475 |
| 2016 | 7,107 | 20,017 | 15,034 | 13,160 | 15,924 | 15,731 | 16,994 | 26,356 | 24,298 | 7,932 | 16,469 | 179,022 |
| 2017 | 7,261 | 20,343 | 15,133 | 12,874 | 15,839 | 15,664 | 16,777 | 25,986 | 24,514 | 8,059 | 16,493 | 178,943 |
| 2018 | 7,221 | 20,478 | 15,421 | 13,284 | 16,202 | 15,668 | 16,781 | 26,082 | 24,361 | 8,254 | 16,433 | 180,185 |
| Total | 153,018 | 414,419 | 321,411 | 268,424 | 338,660 | 319,333 | 344,132 | 535,847 | 506,552 | 166,225 | 342,123 | 3,710,144 |

Table A. 1 Number of jobs, by region; standard SRS dataset

| Year | primary | manuf | utilities | construct | sales | services | fin/law | public | health | creative | other | Total |
|-------|---------|---------|-----------|-----------|---------|----------|---------|---------|---------|----------|--------|-----------|
| 1997 | 1,768 | 31,263 | 1,382 | 4,436 | 23,566 | 14,689 | 25,089 | 28,650 | 16,236 | 2,833 | 4,038 | 153,950 |
| 1998 | 1,819 | 31,925 | 1,465 | 5,363 | 25,006 | 15,988 | 26,332 | 30,870 | 16,922 | 2,860 | 2,828 | 161,378 |
| 1999 | 1,565 | 29,945 | 1,434 | 5,431 | 25,560 | 16,027 | 26,774 | 31,764 | 17,345 | 2,964 | 2,941 | 161,750 |
| 2000 | 1,520 | 27,296 | 1,251 | 5,462 | 23,504 | 16,000 | 28,616 | 31,993 | 17,372 | 3,077 | 2,874 | 158,965 |
| 2001 | 1,398 | 26,828 | 1,063 | 5,542 | 24,390 | 16,278 | 29,446 | 33,370 | 17,136 | 3,095 | 2,812 | 161,358 |
| 2002 | 1,297 | 25,220 | 970 | 5,903 | 24,831 | 15,961 | 30,299 | 34,520 | 18,383 | 3,257 | 3,180 | 163,821 |
| 2003 | 1,299 | 23,965 | 758 | 6,206 | 25,188 | 16,667 | 31,405 | 35,320 | 19,130 | 3,480 | 2,888 | 166,306 |
| 2004 | 1,302 | 22,847 | 730 | 6,223 | 28,123 | 16,692 | 29,183 | 35,763 | 19,375 | 3,539 | 2,850 | 166,627 |
| 2005 | 1,254 | 22,441 | 655 | 6,121 | 29,277 | 17,023 | 29,674 | 35,773 | 19,611 | 3,449 | 2,954 | 168,232 |
| 2006 | 1,272 | 21,007 | 887 | 6,412 | 28,720 | 17,287 | 30,975 | 36,313 | 20,441 | 3,670 | 2,874 | 169,858 |
| 2007 | 938 | 14,817 | 827 | 6,139 | 24,190 | 14,298 | 30,892 | 28,006 | 14,678 | 3,543 | 2,530 | 140,858 |
| 2008 | 1,003 | 14,469 | 829 | 6,230 | 24,288 | 13,327 | 30,998 | 28,253 | 15,080 | 3,555 | 2,596 | 140,628 |
| 2009 | 1,108 | 17,173 | 2,079 | 6,430 | 29,424 | 21,571 | 29,326 | 37,293 | 21,505 | 2,904 | 2,973 | 171,786 |
| 2010 | 1,175 | 16,556 | 2,199 | 6,215 | 29,895 | 22,343 | 29,072 | 37,381 | 23,588 | 3,160 | 3,196 | 174,780 |
| 2011 | 1,234 | 16,824 | 2,191 | 5,956 | 31,388 | 24,075 | 32,147 | 38,655 | 25,300 | 3,178 | 3,517 | 184,465 |
| 2012 | 1,211 | 16,143 | 2,203 | 5,628 | 31,166 | 23,416 | 30,482 | 36,239 | 24,461 | 3,266 | 3,214 | 177,429 |
| 2013 | 1,178 | 16,574 | 2,113 | 5,565 | 31,408 | 23,631 | 30,588 | 36,273 | 26,046 | 3,343 | 3,311 | 180,030 |
| 2014 | 1,286 | 16,774 | 2,166 | 5,663 | 32,313 | 24,900 | 32,865 | 35,699 | 26,853 | 3,627 | 3,548 | 185,694 |
| 2015 | 1,270 | 16,166 | 2,164 | 5,779 | 31,982 | 25,237 | 32,818 | 34,091 | 26,860 | 3,402 | 3,644 | 183,413 |
| 2016 | 1,239 | 15,814 | 2,136 | 5,729 | 30,864 | 25,281 | 31,464 | 33,349 | 26,060 | 3,461 | 3,583 | 178,980 |
| 2017 | 1,221 | 15,694 | 2,195 | 5,849 | 30,392 | 25,573 | 31,304 | 33,433 | 25,920 | 3,637 | 3,675 | 178,893 |
| 2018 | 1,301 | 16,625 | 2,326 | 6,366 | 29,594 | 24,907 | 31,552 | 32,420 | 27,124 | 3,921 | 3,973 | 180,109 |
| Total | 28,658 | 456,366 | 34,023 | 128,648 | 615,069 | 431,171 | 661,301 | 745,428 | 465,426 | 73,221 | 69,999 | 3,709,310 |

Table A. 2 Number of jobs by major industrial group

| Year | Managers, Directors And Senior Official | Professional Occupations | Associate Professional And Technical Occupations | Administrative And Secretarial Occupations | Skilled Trades Occupations | Caring, Leisure And Other Service Occup | Sales And Customer Service Occupations | Process, Plant And Machine Operatives | Elementary Occupations | Total |
|-------|--|-----------------------------|---|--|-------------------------------|---|---|--|---------------------------|-----------|
| 1997 | 20,051 | 15,630 | 14,698 | 29,660 | 14,498 | 16,346 | 12,756 | 16,699 | 13,612 | 153,950 |
| 1998 | 21,251 | 16,150 | 15,315 | 30,774 | 15,341 | 17,651 | 13,583 | 17,313 | 14,000 | 161,378 |
| 1999 | 21,873 | 16,589 | 15,522 | 30,982 | 14,775 | 18,122 | 13,526 | 16,620 | 13,741 | 161,750 |
| 2000 | 22,239 | 16,643 | 15,653 | 30,543 | 13,944 | 18,224 | 13,348 | 15,074 | 13,297 | 158,965 |
| 2001 | 22,960 | 17,288 | 16,276 | 31,017 | 13,620 | 18,459 | 13,864 | 14,639 | 13,235 | 161,358 |
| 2002 | 19,816 | 18,813 | 20,690 | 29,221 | 13,396 | 11,940 | 13,679 | 13,279 | 22,987 | 163,821 |
| 2003 | 20,248 | 18,966 | 21,952 | 28,825 | 12,890 | 12,287 | 14,678 | 12,900 | 23,685 | 166,431 |
| 2004 | 19,910 | 18,506 | 22,397 | 28,532 | 12,539 | 12,682 | 16,091 | 12,437 | 23,700 | 166,794 |
| 2005 | 20,251 | 18,093 | 22,803 | 28,703 | 12,112 | 12,615 | 17,795 | 12,270 | 23,701 | 168,343 |
| 2006 | 21,211 | 18,885 | 24,462 | 27,240 | 11,768 | 13,078 | 17,607 | 11,427 | 24,255 | 169,933 |
| 2007 | 18,533 | 15,592 | 19,341 | 22,587 | 9,304 | 10,645 | 16,007 | 8,766 | 20,161 | 140,936 |
| 2008 | 18,446 | 15,773 | 19,498 | 22,171 | 8,968 | 11,175 | 16,302 | 8,652 | 19,718 | 140,703 |
| 2009 | 23,325 | 19,830 | 24,456 | 26,080 | 10,665 | 15,211 | 18,535 | 10,718 | 23,071 | 171,891 |
| 2010 | 23,228 | 20,269 | 24,926 | 24,948 | 10,574 | 16,585 | 18,636 | 10,550 | 25,415 | 175,131 |
| 2011 | 24,362 | 21,231 | 25,797 | 26,527 | 10,738 | 18,032 | 19,284 | 11,406 | 27,124 | 184,501 |
| 2012 | 14,579 | 29,541 | 21,856 | 25,688 | 11,225 | 17,821 | 20,149 | 11,127 | 25,478 | 177,464 |
| 2013 | 14,717 | 30,723 | 22,022 | 25,550 | 11,191 | 18,583 | 20,587 | 11,152 | 25,557 | 180,082 |
| 2014 | 14,573 | 31,258 | 22,189 | 25,734 | 11,384 | 19,650 | 21,444 | 11,332 | 28,198 | 185,762 |
| 2015 | 14,180 | 30,705 | 21,110 | 25,872 | 11,120 | 19,783 | 21,049 | 11,086 | 28,570 | 183,475 |
| 2016 | 13,445 | 30,328 | 20,759 | 24,968 | 11,029 | 19,111 | 20,744 | 10,912 | 27,726 | 179,022 |
| 2017 | 13,439 | 30,587 | 21,375 | 25,314 | 10,921 | 18,989 | 20,676 | 10,878 | 26,764 | 178,943 |
| 2018 | 13,834 | 30,633 | 21,505 | 26,113 | 11,323 | 19,628 | 18,989 | 11,251 | 26,909 | 180,185 |
| Total | 416,471 | 482,033 | 454,602 | 597,049 | 263,325 | 356,617 | 379,329 | 270,488 | 490,904 | 3,710,818 |

Table A. 3 Number of jobs by major occupation group

| Year | Private Sector Jobs | Public Sector Jobs | Total |
|-------|---------------------|--------------------|-----------|
| 1997 | 105,430 | 39,021 | 144,451 |
| 1998 | 111,460 | 41,010 | 152,470 |
| 1999 | 111,290 | 41,518 | 152,808 |
| 2000 | 108,829 | 41,168 | 149,997 |
| 2001 | 111,132 | 41,078 | 152,210 |
| 2002 | 109,847 | 42,804 | 152,651 |
| 2003 | 110,623 | 44,643 | 155,266 |
| 2004 | 110,859 | 43,968 | 154,827 |
| 2005 | 112,203 | 44,456 | 156,659 |
| 2006 | 112,850 | 44,913 | 157,763 |
| 2007 | 96,574 | 34,964 | 131,538 |
| 2008 | 96,047 | 35,246 | 131,293 |
| 2009 | 111,267 | 47,408 | 158,675 |
| 2010 | 112,581 | 49,947 | 162,528 |
| 2011 | 120,622 | 51,218 | 171,840 |
| 2012 | 117,611 | 46,582 | 164,193 |
| 2013 | 119,755 | 46,214 | 165,969 |
| 2014 | 142,287 | 43,407 | 185,694 |
| 2015 | 141,216 | 42,197 | 183,413 |
| 2016 | 137,575 | 41,405 | 178,980 |
| 2017 | 138,092 | 40,801 | 178,893 |
| 2018 | 140,999 | 39,110 | 180,109 |
| Total | 2,579,149 | 943,078 | 3,522,227 |

Table A. 4 Number of jobs by public/private sector