



Department
for Business
Innovation & Skills

**Sampling variance in the Trade
Union Membership Statistics**

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Sampling variance in the Trade Union Membership Statistics

Introduction on sampling variation

The labour force survey (LFS) is a sample survey, which provides estimates of various measures of the population that reflect the particular sample selected. As any valid sample from the population is likely to produce different estimates for the population than other valid samples, there is uncertainty around the population estimates resulting from the selection of a particular sample (as opposed to any other valid sample). This is known as the sampling error. As the LFS uses random sampling of households it is possible to provide estimates of the sampling error (measured as the standard error), which forms the basis of the confidence interval placed around estimate. Normally a 95% confidence interval would be used, which means that in 19 out of 20 different samples we would expect the true (population) level or rate considered to be within the 95% confidence interval for the sample estimate. Where a simple random sample is used, the 95% confidence interval for an estimate is set at ± 1.96 standard errors around the sample estimate.

Any estimate of the range of sampling variability should take into account the sampling approach, as this will affect the probability of selection of individuals within the population, and therefore the extent of the variability around the survey estimate relative to that obtained from a simple random sample. The design factor measures the ratio of the standard error produced by a complex sample design relative to the standard error that would result from simple random sampling. To take account of the sampling design, the 95% confidence interval can be calculated as:

$$\pm 1.96 \times \text{design factor} \times \text{SE (standard error)}$$

Method used to calculate confidence intervals for the Trade Union Membership Statistics

The LFS sample design has two additional elements: implicit stratification by geography (from the use of a systematic sample of addresses based on postcode area), and clustering, based on collecting results for individuals based on a sample of addresses (as individuals within a household are more likely to share some characteristics). Some calculated design factors for headline measures are presented in *ONS's LFS User Guide, Volume 1 – LFS Background and Methodology 2011*¹. However, these do not directly relate to the estimates of trade union membership.

¹ <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/labour-market-statistics/volume-1---2011.pdf>

In the methodology user guide, ONS advise that users can calculate their own confidence intervals by estimating their own design factors by applying a 'complex samples' analysis in a statistical package. These will be '*conservative*' because while such an approach will take account of the LFS's design, it won't take account of the calibration weighting that ONS undertakes to ensure estimates are consistent across those groups calibrated on, thus reducing the standard errors.

We have estimated standard errors and confidence intervals for the 2011 estimates of trade union membership using a complex samples approach in SPSS. The address variable, ADD, has been used as the cluster variable, in line with ONS's suggestion, and UALA, representing unitary and local authorities, has been used as a stratum variable.

The calculated 95% confidence intervals for the key trade union membership levels and density estimates for 2011 presented in the latest trade union membership publication (for 2011). The tables present the estimate, and the upper and lower bounds of the estimate at 95% confidence. If the confidence intervals of two estimated values do not overlap then they are considered statistically significantly different at the 5% significance level. Confidence intervals will be provided for all the 2012 figures provided in this year's bulletin when it is published in April.

If you have any comments or would like further information, please contact us at:

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Table 1 95% Confidence intervals for trade union membership by gender and sector

Trade union membership, 2011		95% confidence interval	
	population estimate	lower bound	Upper bound
in employment, UK			
<u>whole economy</u>	<u>numbers (000s)</u>		
all	6,665	6,282	7,048
men	3,089	2,897	3,281
women	3,577	3,365	3,789
<u>whole economy</u>	<u>density %</u>		
all	23.2%	22.7%	23.7%
men	20.2%	19.5%	20.9%
women	26.8%	26.1%	27.5%
employees, UK			
<u>whole economy</u>	<u>numbers (000s)</u>		
all	6,389	6,022	6,756
men	2,913	2,731	3,096
women	3,476	3,270	3,681
<u>public sector</u>			
all	3,882	3,654	4,110
men	1,299	1,209	1,389
women	2,583	2,427	2,739
<u>private sector</u>			
all	2,507	2,343	2,671
men	1,614	1,499	1,729
women	893	824	962
<u>whole economy</u>	<u>density %</u>		
all	26.0%	25.4%	26.6%
men	23.4%	22.6%	24.2%
women	28.7%	28.0%	29.4%
<u>public sector</u>			
all	56.5%	55.5%	57.6%
men	55.4%	53.6%	57.2%
women	57.1%	55.8%	58.4%
<u>private sector</u>			
all	14.1%	13.6%	14.7%
men	15.9%	15.2%	16.7%
women	11.8%	11.2%	12.4%

Table 2 95% confidence intervals for trade union membership by nation and region, 2011

Trade union membership, 2011

	population estimate numbers (000s)	95% confidence interval	
		<u>lower bound</u>	<u>upper bound</u>
Employees			
Nation			
England	5,125	4,784	5,466
Wales	400	302	499
Scotland	638	548	728
Northern Ireland	226	190	262
Regions			
North East	341	257	425
North West	825	668	983
Yorkshire & Humberside	555	463	647
East Midlands	456	342	569
West Midlands	550	443	656
East of England	535	404	666
London	636	568	705
South East	719	581	856
South West	509	407	610
	<u>density %</u>		
Nation			
England	24.8%	24.2%	25.4%
Wales	34.9%	32.3%	37.6%
Scotland	29.8%	28.0%	31.7%
Northern Ireland	33.6%	31.4%	35.9%
Regions			
North East	34.2%	31.6%	36.8%
North West	30.3%	28.7%	31.9%
Yorkshire & Humberside	27.0%	25.3%	28.7%
East Midlands	25.4%	23.4%	27.5%
West Midlands	26.6%	24.9%	28.4%
East of England	22.4%	20.9%	23.9%
London	20.6%	19.1%	22.1%
South East	20.7%	19.4%	22.2%
South West	24.7%	22.9%	26.6%

Table 3 95% confidence intervals for average (mean) employee wages, 2011, by gender and sector

Mean hourly earnings (£), 2011

UK employees	<u>Estimate</u>	95% confidence interval	
		<u>lower bound</u>	<u>higher bound</u>
<u>whole economy</u>			
all employees	£12.60	£12.39	£12.81
trade union members	£14.18	£13.92	£14.44
non-members	£12.01	£11.75	£12.27
by sector			
<u>public sector</u>			
all employees	£14.11	£13.83	£14.38
trade union members	£15.06	£14.74	£15.39
non-members	£12.76	£12.30	£13.22
<u>private sector</u>			
all employees	£12.03	£11.77	£12.29
trade union members	£12.83	£12.42	£13.25
non-members	£11.88	£11.58	£12.18
by gender			
<u>male</u>			
all employees	£13.74	£13.44	£14.04
trade union members	£14.72	£14.32	£15.12
non-members	£13.40	£13.03	£13.77
<u>female</u>			
all employees	£11.43	£11.23	£11.64
trade union members	£13.73	£13.43	£14.03
non-members	£10.50	£10.25	£10.76

Table 4 95% confidence intervals for trade union membership density by industry and workplace size, 2011

Trade union membership, 2011

UK employees	population estimate	95% confidence interval	
		<u>lower bound</u>	<u>upper bound</u>
by industry	<u>density, %</u>		
Agriculture, forestry & fishing	*	*	*
Mining & quarrying	23.5%	16.8%	31.9%
Manufacturing	18.7%	17.2%	20.2%
Electricity, gas, steam & air conditioning supply	43.2%	37.1%	49.6%
Water supply, sewerage, waste & remediation activities	28.7%	23.7%	34.3%
Construction	14.8%	13.1%	16.6%
Wholesale, retail trade and motor repair	11.9%	10.9%	12.9%
Transport and storage	38.9%	36.3%	41.5%
Accommodation & food service	3.6%	2.8%	4.6%
Information & communication	11.7%	9.9%	13.8%
Financial & insurance activities	16.7%	14.8%	18.9%
Real estate activities	12.8%	9.0%	18.0%
Professional & administrative services	10.4%	9.3%	11.5%
Public administration and defence	53.4%	51.2%	55.5%
Education	51.5%	49.8%	53.1%
Human health & social work	41.4%	40.0%	42.9%
Other services	13.6%	11.9%	15.6%
by workplace size			
Less than 50	16.3%	15.7%	17.0%
50 or more	34.9%	34.1%	35.8%

Table 5 95% confidence intervals for trade union membership density by occupation and age, 2011

Trade union membership, 2011

UK employees	population estimate density, %	95% confidence interval	
		<u>lower bound</u>	<u>upper bound</u>
by occupation			
Managers and senior officials	13.8%	12.6%	15.1%
Professional occupations	45.4%	44.0%	46.7%
Associate professional and technical occupations	25.7%	24.4%	27.1%
Administrative and secretarial occupations	21.2%	19.9%	22.5%
Skilled trade occupations	20.1%	18.5%	21.7%
Personal service occupations	28.0%	26.5%	29.5%
Sales and customer service occupations	15.5%	14.2%	16.9%
Process, plant and machine operatives	28.6%	26.5%	30.7%
Elementary occupations	16.7%	15.5%	17.9%
by age			
16-19	3.1%	2.2%	4.3%
20-24	11.4%	10.2%	12.7%
25-29	18.2%	16.9%	19.6%
30 to 34	24.0%	22.5%	25.5%
35 to 39	26.7%	25.3%	28.2%
40 to 44	29.4%	28.1%	30.8%
45 to 49	33.6%	32.1%	35.2%
50 to 54	36.2%	34.6%	37.8%
55 to 59	35.3%	33.6%	37.0%
60 to 64	29.1%	27.0%	31.3%
65-69	14.1%	11.7%	17.0%
Over 70	13.5%	8.4%	21.0%

Table 6 95% confidence intervals for employees with trade union presence in the workplace by sector and industry, 2011

Employees with trade union presence in the workplace, 2011

UK employees, %	95% confidence interval		
	<u>Estimate</u>	<u>lower bound</u>	<u>higher bound</u>
all	44.8%	44.1%	45.5%
public sector	87.1%	86.3%	87.8%
private sector	28.5%	27.8%	29.2%
by industry			
Agriculture, forestry and fishing	*	*	*
Mining and quarrying	39.3%	31.8%	47.4%
Manufacturing	38.1%	36.2%	40.0%
Electricity, gas and steam & air conditioning supply	65.6%	59.3%	71.5%
Water supply, sewerage, waste & remediation activities	56.4%	50.7%	62.0%
Construction	27.3%	25.2%	29.5%
Wholesale, retail and motor trade	26.9%	25.5%	28.3%
Transport, storage	58.7%	56.0%	61.4%
accommodation and food services	7.6%	6.4%	8.9%
information and communications	23.8%	21.2%	26.5%
Financial and insurance activities	39.7%	36.9%	42.6%
Real estate services	35.6%	29.9%	41.7%
Professional & administrative services	21.0%	19.6%	22.5%
Public admin and defence	84.0%	82.3%	85.6%
Education	82.1%	80.8%	83.3%
Health and social work	63.3%	61.9%	64.8%
Other services	27.2%	24.8%	29.7%

Note: this table provides estimates for industry based on SIC 2007, and so is slightly different for some industries than in table 3.8 in the 2011 publication.

Table 7 95% confidence intervals for employees with trade union presence in the workplace by workplace size, nation and region, 2011

Employees with trade union presence in the workplace, 2011

UK employees, %	95% confidence interval		
by workplace size			
Less than 50	26.7%	26.0%	27.5%
50 or more	61.6%	60.7%	62.5%
Nation			
England	44.0%	43.3%	44.7%
Wales	55.8%	52.4%	59.2%
Scotland	48.1%	46.1%	50.0%
Northern Ireland	41.8%	38.8%	44.8%
Region			
North East	53.5%	50.5%	56.4%
North West	48.9%	47.1%	50.6%
Yorkshire and the Humber	47.5%	45.5%	49.5%
East Midlands	44.7%	42.6%	46.9%
West Midlands	45.4%	43.8%	47.0%
East of England	41.0%	39.4%	42.7%
London	38.0%	36.1%	40.0%
South East	40.4%	38.7%	42.2%
South West	45.7%	43.8%	47.6%

Table 8 95% confidence intervals for employees whose pay and conditions are affected by a collective agreement, by sector and industry, 2011

Employees whose pay and conditions are affected by a collective agreement, 2011

UK employees, %	95% confidence interval		
	Estimate	lower bound	higher bound
all	31.2%	30.6%	31.8%
public sector	67.8%	66.7%	68.8%
private sector	16.9%	16.4%	17.5%
by industry			
Agriculture, forestry and fishing	*	*	*
Mining and quarrying	22.0%	15.5%	30.3%
Manufacturing	23.2%	21.6%	25.0%
Electricity, gas and steam & air conditioning supply	50.9%	43.8%	58.1%
Water supply, sewerage, waste & remediation activities	39.6%	34.0%	45.4%
Construction	18.0%	16.0%	20.2%
Wholesale, retail and motor trade	16.0%	14.9%	17.3%
Transport, storage	47.3%	44.5%	50.2%
accommodation and food services	4.6%	3.7%	5.9%
information and communications	13.9%	11.9%	16.2%
Financial and insurance activities	25.0%	22.4%	27.8%
Real estate services	19.0%	14.1%	25.2%
Professional & administrative services	11.6%	10.5%	12.9%
Public admin and defence	71.1%	68.9%	73.1%
Education	59.0%	57.2%	60.8%
Health and social work	43.8%	42.2%	45.4%
Other services	17.5%	15.4%	19.7%

Note: this table provides estimates for industry based on SIC 2007, and so is slightly different for some industries than in tables 3.8 and 3.9 in the 2011 publication.

Table 9 95% confidence intervals for employees whose pay and conditions are affected by a collective agreement, by workplace size, nation and region, 2011

Employees whose pay and conditions are affected by a collective agreement, 2011

UK employees, %	95% confidence interval		
	<u>Estimate</u>	<u>lower bound</u>	<u>higher bound</u>
by workplace size			
Less than 50	17.3%	16.6%	18.0%
50 or more	44.1%	43.2%	45.0%
Nation			
England	30.0%	29.3%	30.7%
Wales	39.2%	35.6%	43.0%
Scotland	34.7%	32.8%	36.5%
Northern Ireland	40.6%	37.4%	43.9%
Region			
North East	35.8%	32.8%	38.8%
North West	34.6%	33.0%	36.2%
Yorkshire and the Humber	31.8%	29.9%	33.8%
East Midlands	31.1%	29.2%	33.0%
West Midlands	33.3%	31.3%	35.5%
East of England	28.1%	26.1%	30.2%
London	24.2%	22.6%	26.0%
South East	26.6%	24.8%	28.5%
South West	31.3%	29.7%	32.9%
by gender			
Male	28.4%	27.6%	29.3%
Female	34.0%	33.2%	34.8%
by union membership			
Member	73.2%	72.2%	74.2%
Non-member	15.5%	15.0%	16.1%

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