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Longitudinal data from the Occupational Employment Statistics survey

This article describes the longitudinal features of the Occupational Employment Statistics (OES) data and the composition of the establishments observed multiple times in the OES microdata. We discuss the design of the OES survey and changes over time that shape the composition of establishments sampled repeatedly for the OES. We show how differences in response rates shape the composition of establishments observed repeatedly. Finally, we examine the distributions of employer and employee characteristics in the longitudinal OES data. Overall, we find that establishment size, geographic area type, industry, occupation, and wage-range distributions in the longitudinal OES data are remarkably representative. We conclude that it is possible to use data collected from the OES to examine longitudinal employment and wage patterns for establishments observed repeatedly, not only for the largest establishments that are most likely to be selected for this survey but also for a broad range of establishment types.

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The Occupational Employment Statistics (OES) survey of the U.S. Bureau of Labor Statistics (BLS) is a large survey of employers in the United States. The data from this survey are used to produce estimates of employment and wages by occupation at industry, state, and metropolitan area levels. They are used by the Office of Foreign Labor Certification of the U.S. Department of Labor in setting pay rates for workers in the United States on certain work visas. They are also key inputs to the Employment Projections program, which is one of the most widely used products at BLS. However, the OES data are little known by most researchers.

While the published estimates of the OES program are not designed for making comparisons over time, the confidential microdata underlying these estimates do allow for following certain employers over time, and these data have several features that make them particularly useful for research purposes. Most notably, the microdata

are a very large set of data containing full staffing patterns, including occupation and wage information for all employees within surveyed establishments.

This article describes the longitudinal features of the OES data and the composition of the establishments that are observed longitudinally. We begin with a discussion of changes in the OES survey that affect the probability of sample selection over time for any particular establishment. We then show how the sample design shapes the composition of establishments sampled repeatedly for the OES program. Next, we show how differences in response rates also shape the composition of establishments observed repeatedly. Finally, we compare the distributions of employer and employee characteristics in the longitudinal OES data with the distribution of these characteristics in the cross-sectional data.

An overview of changes to the OES survey affecting the data available for longitudinal study

BLS began conducting surveys of employment by occupation in the 1960s.[1] It was in 1971 that the Occupational Employment Statistics survey began, and it was a collaboration between BLS and 10 State Employment Security agencies. The OES initially was a survey of 50,000 manufacturing establishments, asking these establishments about the distribution of their employees by occupation. Similar surveys were soon developed for other industries. Beginning in 1977, surveys were conducted in every state and the District of Columbia. Since then, major changes to the design of the OES survey have included the following:[2]

- In 1988, the OES program began collecting employment data by industry in a 3-year cycle, with manufacturing and hospitals surveyed in the first year; mining, construction, finance, insurance, real estate, and service in the second year; and trade, transportation, communications, public utilities, and government establishments in the third year of each cycle.
- In 1991, 15 states began to collect wage information along with the occupational employment information.
- The year 1996 saw the greatest changes in the history of the OES program. First, the sample was redesigned to collect data from all industries every year so that estimates for all industries could be produced annually, although the program retained some aspects of the 3-year cycle. Establishments were generally included in the survey no more than once in each 3-year cycle. Because some establishments are large enough to affect estimates of employment and wages in their industry or geographic area, 3 years of microdata continue to be used in the production of all program estimates (despite the annual release of updated estimates). Second, the sample was redesigned in order to produce estimates at the Metropolitan Statistical Area (MSA) and Balance of State (BOS) levels. This involved increasing the sample size from approximately 250,000 establishments per year to 400,000 establishments per year. Third, the OES program began collecting wage information in every state from every establishment responding to the survey.
- In 1997, the scope of the survey expanded to include very small establishments.
- In 1999, the OES program began using the Standard Occupational Classification System when collecting data on occupations. Although the program did not switch from using the Standard Industrial Classification System (SIC) to the North American Industry Classification System (NAICS) in the sample design until 2002, nearly all OES data collected in the 1999, 2000, and 2001 panels was recoded from SIC to NAICS to produce estimates for NAICS-defined industries in combination with the 2002 panel.

- In 2002, rather than 400,000 establishments being asking about their employment and wages in October, November, and December, 200,000 establishments were asked about their employment and wages in May and another 200,000 establishments were asked the same questions in November. This was done so that the OES data would better reflect year-round employment patterns. Employers are still surveyed no more than once in each 3-year (six-panel) collection cycle. The rural portion of the sample was redesigned to provide geographic estimates for more than one nonurban area in large states. These nonurban areas are known as Balance of State or BOS areas.
- Over the period of 2005–09, several changes were made to the OES sample design, affecting the probability that particular establishments would be selected for the OES sample. These changes included
    - simplifying the sample design to sample establishments in only two size classes per industry and geography area, rather than seven size classes
    - moving to a sample design closer to probability proportional to employment size within industries and geographic areas
    - allocating more of the sample to industries with more variation in occupational employment between establishments
    - moving to a Power Neyman allocation of the OES sample between industries and geographic areas[3]
    - lowering the employment level at which establishments from particular states were certain to be selected into the OES sample in each 3-year cycle (in 2009, these levels returned to the same levels used in other states)
    - more flexibly allocating the sample between states in order to decrease the variability of estimates between states.[4]

The OES sample design is a complex stratified random sample, which differs in several ways from a simple random sample of employers. The goal of the sample design is to produce estimates of employment and wages for each occupation with as little sampling variability as possible given the overall sample size. Portions of the sample are allocated to each industry, each geographic region, and (before 2005) each employer size class to reduce the variation of estimates of employment and wages by occupation for detailed industries and detailed geographic areas. Since 2006, the occupational variability of industries has also been a factor in the sample design—to increase the precision of the estimates, the sample size is larger in industries with more variation in the composition of occupations, and these industries are more likely to be selected for the OES sample.

In addition, the sample design considers the size of employers as a criterion for selection. Large employers, which affect overall average employment and wage levels in their industry or geographic area, are always selected for the OES sample during the six-panel cycle. Smaller employers are selected with a probability that varies by the number of employers in their stratum (industry and geographic area) and by the number of employees in their establishment.[5] Current methodology selects small- and medium-sized employers within each stratum with a probability proportionate to their employment levels. However, even very small employers are almost certain to be selected for the OES sample in each six-panel cycle if there are few other employers in their industry and geographic area. When there are fewer than four establishments in a stratum, all are selected for the OES sample. When there are 4–12 establishments (4–18 establishments in Idaho, Montana, or Wyoming until 2009) in a stratum, at least 3 are selected for the OES sample. When there are additional establishments in a stratum, at least six are selected for the sample.[6]

To reduce the burden of survey response for smaller employers, BLS assigns each known establishment a permanent random number (PRN) between 0 and 1. Within each stratum, establishments are selected for the OES sample beginning with those having a PRN value of 0.4, and establishments with PRN values greater than 0.4 have an increased probability of sample selection in every wave of the OES sample. Other BLS surveys begin selecting their random samples at different PRN values, making it unlikely that small establishments will be selected for multiple BLS surveys.[7]

The large number of employers in the OES sample and the stratified design of the sample mean that hundreds of thousands of employers have been included in the OES sample multiple times, albeit usually at least 3 years apart. This feature allows researchers with access to the OES microdata the opportunity to study changes in the occupational employment and wage patterns of the repeatedly sampled employers.

Repeated sampling in the OES survey

As described above, the sample design of the OES survey leads to an increased probability of selection for large employers, employers in geographic areas with relatively few employers, employers in industries with a greater variability of occupational employment, and employers with a BLS internally assigned PRNr greater than 0.4. Such employers are particularly likely to be sampled repeatedly in the OES survey.

Repeated sampling magnifies differences in sampling probability that occur in each wave of a survey. Consider a much simpler example than the complex OES survey: large employers have a 50-percent chance of being sampled, and small employers have a 10-percent chance of being sampled. To make population estimates for a single wave of data collection of this simple survey, weights of 2 should be applied for large employers and weights of 10 should be applied to small employers. However, if there are two independent samples drawn for two waves of this survey, the chance that a large employer will appear in both waves is .5 × .5, or 25 percent, while the chance that a small employer will appear in both waves is .10 × .10, or 1 percent. In this example, the weights used for a single wave of data collection will be inappropriate to use in weighting the data observed twice to population levels. Furthermore, the sample of smaller employers observed twice may be too small to make conclusions about this subpopulation.

We examine how differences in the OES cross-sectional sampling probabilities across establishment sizes, geographic area types, and industries translate into differences in the probability that establishments with different characteristics appear in longitudinal OES data. For our analyses, we begin with private sector data from 1999, as these data are comparable to later data in their industry and occupational coding systems. (We drop 4,238 establishments from our analyses because they were not used for the 2002 estimates and so their industries were not recoded using the NAICS.) We omit the large number of public sector establishments included in the OES survey (such as publicly owned schools and hospitals), as well as establishments sampled in Guam, Puerto Rico, and the Virgin Islands. The frame for this sample is the Quarterly Census of Employment and Wages (QCEW), assembled from the reports to the unemployment insurance system made by nonfarm establishments in every state, and supplemented with a list of rail transportation employers (not covered by the unemployment insurance system).[8]

Table 1 shows the number of private sector establishments selected for sampling by the OES program from fall 1999 through May 2014, by establishment size. In all, more than 2.8 million establishments have been selected for the OES sample, of which nearly 1.3 million (46 percent) have been sampled more than once and nearly 80,000

have been sampled five or more times during this period.[9] This table uses the employer sizes reported in the QCEW, as these are the estimates of employer size used to select the sample. Establishments sampled more than once are classified in this table by their largest size class.

Table 1. Count of private sector establishments in the Quarterly Census of Employment and Wages (QCEW) and sampled for the Occupational Employment Statistics (OES) survey, by number of times sampled and establishment size at last sampling date, fall 1999–May 2014

Establishment size (number of employees)	QCEW establishments	Number of times sampled in the OES					Total OES establishments	Percentage of OES establishments repeated
		1	2	3	4	5 or more		
Less than 5	10,228,755	468,995	100,627	31,920	9,022	1,006	611,570	23.3
5–9	3,536,326	324,004	120,095	52,938	18,822	2,328	518,187	37.5
10–19	2,544,162	298,622	137,637	78,377	38,690	7,663	560,989	46.8
20–49	1,744,980	255,205	138,405	91,686	60,039	17,465	562,800	54.7
50–99	595,170	118,501	72,546	50,952	36,775	12,711	291,485	59.3
100–249	333,982	58,996	49,356	39,800	33,733	15,900	197,785	70.2
250 or more	139,708	19,876	17,921	17,296	20,155	22,859	98,107	79.7
Total	19,123,083	1,544,199	636,587	362,969	217,236	79,932	2,840,923	45.6

Source: U.S. Bureau of Labor Statistics.

As shown in table 1, large establishments are more likely than small establishments to be sampled repeatedly by the OES program. Only 23 percent of the establishments with fewer than five employees that are ever sampled for the OES survey are sampled more than once (7 percent are sampled at least three times). However, 80 percent of the establishments with 250 or more employees that are ever sampled for the OES survey are sampled more than once, and 61 percent of these establishments are sampled at least three times.

Table 2 shows the number of establishments selected for sampling by the OES program during this same period by area type. (Some area definitions change over time, and so establishments sampled more than once are classified in this table by the type of area in which they are located the final time they are sampled.) Approximately 46 percent of establishments ever sampled by the OES program in urban (MSA) areas and 45 percent ever sampled in rural (BOS) areas are selected for sampling more than once. Within urban (MSA) areas, establishments located in areas with less employment are more likely to be repeatedly sampled. About 48 percent of establishments ever sampled by the OES program in MSAs with employment of less than 100,000 are sampled more than once, while 45 percent of establishments ever sampled by the OES program in MSAs with employment of more than 1,000,000 are sampled more than once.

Table 2. Count of private sector establishments in the Quarterly Census of Employment and Wages (QCEW) and sampled for the Occupational Employment Statistics (OES) survey, by number of times sampled, type of geographic area, and employment level, fall 1999–May 2014

Type of area and employment level	QCEW establishments	Number of times sampled in the OES					Total OES establishments	Percentage of OES establishments repeated
		1	2	3	4	5 or more		
Rural								
Less than 100,000	2,112,957	136,957	53,980	29,850	15,440	3,956	240,183	43.0
100,000–249,999	1,524,318	160,407	70,899	40,923	23,818	7,724	303,771	47.2
250,000–499,999	266,405	29,207	10,557	5,791	3,628	1,351	50,534	42.2
Urban								
Less than 100,000	1,402,735	234,579	109,340	64,462	35,663	9,558	453,602	48.3
100,000–249,999	2,030,685	266,522	107,278	62,331	37,055	11,933	485,119	45.1
250,000-499,999	1,768,309	163,046	71,291	40,982	25,153	9,797	310,269	47.5
500,000–999,999	2,730,586	199,147	74,989	41,935	26,212	10,564	352,847	43.6
1,000,000 or more	7,287,088	354,334	138,253	76,695	50,267	25,049	644,598	45.0
Total	19,123,083	1,544,199	636,587	362,969	217,236	79,932	2,840,923	45.6

Source: U.S. Bureau of Labor Statistics.

Table 3 shows the number of establishments selected for the OES sample during this period, by industry. (Establishments may change industry classifications over time, and so establishments sampled more than once are classified in this table by the industry they report to the QCEW the final time they are sampled.) The frequency with which establishments are sampled more than once by the OES program varies by industry. The industry with the least amount of repeated sampling is accommodation and food services (NAICS code 72), in which 38 percent of establishments sampled are sampled more than once. This relatively low percentage is due to a combination of little variation by occupation between establishments, a large number of establishments, a large number of small establishments, and a large number of establishment openings and closures. The industries with the greatest amount of repeated sampling are manufacturing (NAICS code 31–33) and utilities, in which, respectively, 56 percent and 57 percent of establishments sampled are sampled more than once. Establishments in these industries are sampled more frequently because of their large size.

Table 3. Count of private sector establishments in the Quarterly Census of Employment and Wages (QCEW) and sampled for the Occupational Employment Statistics (OES) survey, by number of times sampled and two-digit industry, fall 2000–May 2014

Industry[1]	QCEW establishments	Number of times sampled in the OES					Total OES establishments	Percentage of OES establishments repeated
		1	2	3	4	5 or more		

See footnotes at end of table.

Table 3. Count of private sector establishments in the Quarterly Census of Employment and Wages (QCEW) and sampled for the Occupational Employment Statistics (OES) survey, by number of times sampled and two-digit industry, fall 2000–May 2014

Industry[1]	QCEW establishments	Number of times sampled in the OES					Total OES establishments	Percentage of OES establishments repeated
		1	2	3	4	5 or more		
Agriculture, forestry, fishing and hunting (11)	194,450	8,650	3,466	1,797	896	291	15,100	42.7
Mining, quarrying, and oil and gas extraction (21)	68,583	9,551	4,226	2,404	1,639	580	18,400	48.1
Utilities (22)	29,523	6,159	3,374	2,401	1,679	695	14,308	57.0
Construction (23)	1,870,464	133,353	50,783	27,993	16,210	5,550	233,889	43.0
Manufacturing (31–33)	706,382	125,711	65,553	45,833	32,498	13,820	283,415	55.6
Wholesale trade (42)	1,395,271	107,842	47,141	28,527	18,881	6,692	209,083	48.4
Retail trade (44–45)	2,204,123	237,797	91,760	47,008	25,330	6,758	408,653	41.8
Transportation and warehousing (48–49)	539,593	56,594	24,116	13,975	8,020	2,923	105,628	46.4
Information (51)	378,723	47,610	20,069	11,119	6,327	1,993	87,118	45.3
Finance and insurance (52)	1,038,620	89,597	33,906	18,080	9,748	3,245	154,576	42.0
Real estate and rental and leasing (53)	788,909	56,208	22,638	12,189	6,471	1,916	99,422	43.5
Professional, scientific, and technical services (54)	2,361,651	140,347	55,123	30,217	16,755	5,874	248,316	43.5
Management of companies and enterprises (55)	116,372	13,699	6,456	4,103	3,184	1,889	29,331	53.3
Administrative and support and waste management and remediation (56)	1,131,403	109,550	43,898	23,788	12,909	4,874	195,019	43.8
Educational services (61)	199,999	25,361	10,774	6,211	3,633	1,815	47,794	46.9
Health care and social assistance (62)	2,543,242	135,419	61,945	37,023	22,664	10,752	267,803	49.4
Arts, entertainment, and recreation (71)	272,803	34,788	14,362	8,384	5,566	2,479	65,579	47.0
Accommodation and food services (72)	1,377,978	103,306	33,345	16,487	9,898	3,175	166,211	37.8
Other services (81)	1,904,994	102,657	43,652	25,430	14,928	4,611	191,278	46.3
Total	19,123,083	1,544,199	636,587	362,969	217,236	79,932	2,840,923	45.6

Notes:

[1] These are two-digit industries according to the National American Industry Classification System (NAICS). NAICS codes are shown in parentheses.
See footnotes at end of table.

Source: U.S. Bureau of Labor Statistics.

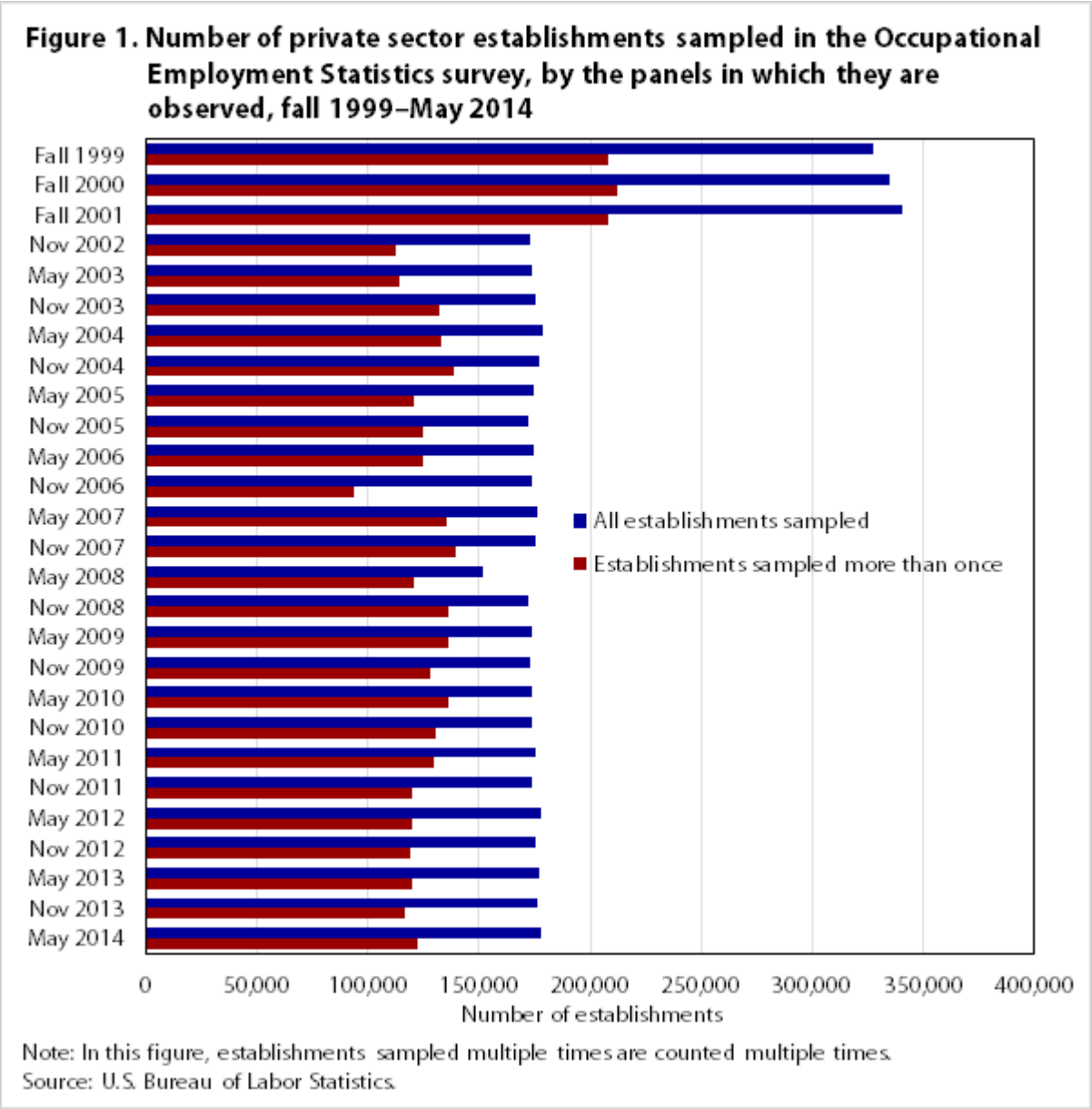


Figure 1 shows the number of establishments sampled by the OES program and those sampled more than once, by the panels in which they are sampled. This figure shows that establishments sampled more than once for the OES program come from all waves of data collection. It also shows the clear drop in sample size per panel in 2002, when the sample collection was split from one panel each fall to two panels, in May and November, of each year. Otherwise, the distribution of the potential sample for longitudinal observations of the OES data is remarkably similar from panel to panel, aside from an unusually small overall sample size in May 2008 because of budget constraints[10] and an unusually small number of the establishments sampled multiple times that were sampled in November 2006.[11]

By far the most common interval between sample dates is exactly 3 years. Intervals of exactly 3 years represent 47 percent of all intervals between successive sample dates. Intervals of whole years are more common than

intervals, such as 3 ½ years, that are off by half a year (because all establishments of very large companies are sampled at regular 3-year intervals), but the frequency with which each interval is observed is otherwise decreasing in interval length—that is, there are more intervals of 3 years than of 4 years, more intervals of 4 years than of 5 years, and so forth. The greater the number of times an establishment is sampled, the shorter the average interval between sample dates. Less than 1 percent of intervals between sample dates are spaced less than 3 years apart. About 3 percent of intervals between sample dates are 10 years or longer.

Nonresponse in the OES survey

The composition of longitudinal data from the OES survey is affected not only by the sample design but also by differential response rates to the OES survey. The OES survey is primarily conducted by mail, in a collaboration between BLS and State Workforce Agencies. There is an open-ended form to collect data from small employers, and, until November 2015, there were 97 different industry-specific forms used for collecting occupational employment and wage data from medium- and large-sized employers. After the initial mailing of forms, three industry-specific followup mailings are sent to nonrespondents at intervals of 3–4 weeks. The State Workforce Agencies also conduct followup by telephone, with timing varying by state.[12] These agencies collect some data for large establishments via personal visits. Large numbers of respondents choose to respond to the survey in electronic format.

Establishments that are sampled more than once may respond to the survey in some panels but not in others. Table 4 shows the number of times that establishments are sampled, by the number of times they respond. There were 2,840,923 establishments sampled for the OES survey between fall 1999 and May 2014, and over this period, these establishments were sampled 5,283,824 times. The probability of always responding declines as the number of times sampled increases: 78 percent of establishments sampled only once responded to the survey (some went out of business in the year between the sample frame date and the survey date), while 65 percent of those sampled twice responded twice, 57 percent of those sampled three times responded three times, 50 percent of those sampled four times responded four times, and 38 percent of those sampled five times responded five times. However, enough of those sampled responded each time that 76 percent of establishments responding exactly twice were sampled only twice, 76 percent of those responding exactly three times were sampled only three times, and 85 percent of those responding exactly four times were sampled only four times.

Table 4. Number of times that private sector establishments are sampled in the Occupational Employment Statistics data by the number of times that they respond to the OES survey, fall 1999–May 2014

Number of times sampled	Number of OES responses						Total	Percentage always responding
	0	1	2	3	4	5 or more		
1	344,118	1,200,081	0	0	0	0	1,544,199	77.7
2	63,325	156,900	416,362	0	0	0	636,587	65.4
3	20,951	44,873	90,393	206,752	0	0	362,969	57.0
4	9,401	17,631	30,546	52,094	107,564	0	217,236	49.5
5 or more	3,786	6,000	8,816	12,599	18,363	30,368	79,932	38.1
Total	441,581	1,425,485	546,117	271,445	125,927	30,368	2,840,923	69.0

Source: U.S. Bureau of Labor Statistics.

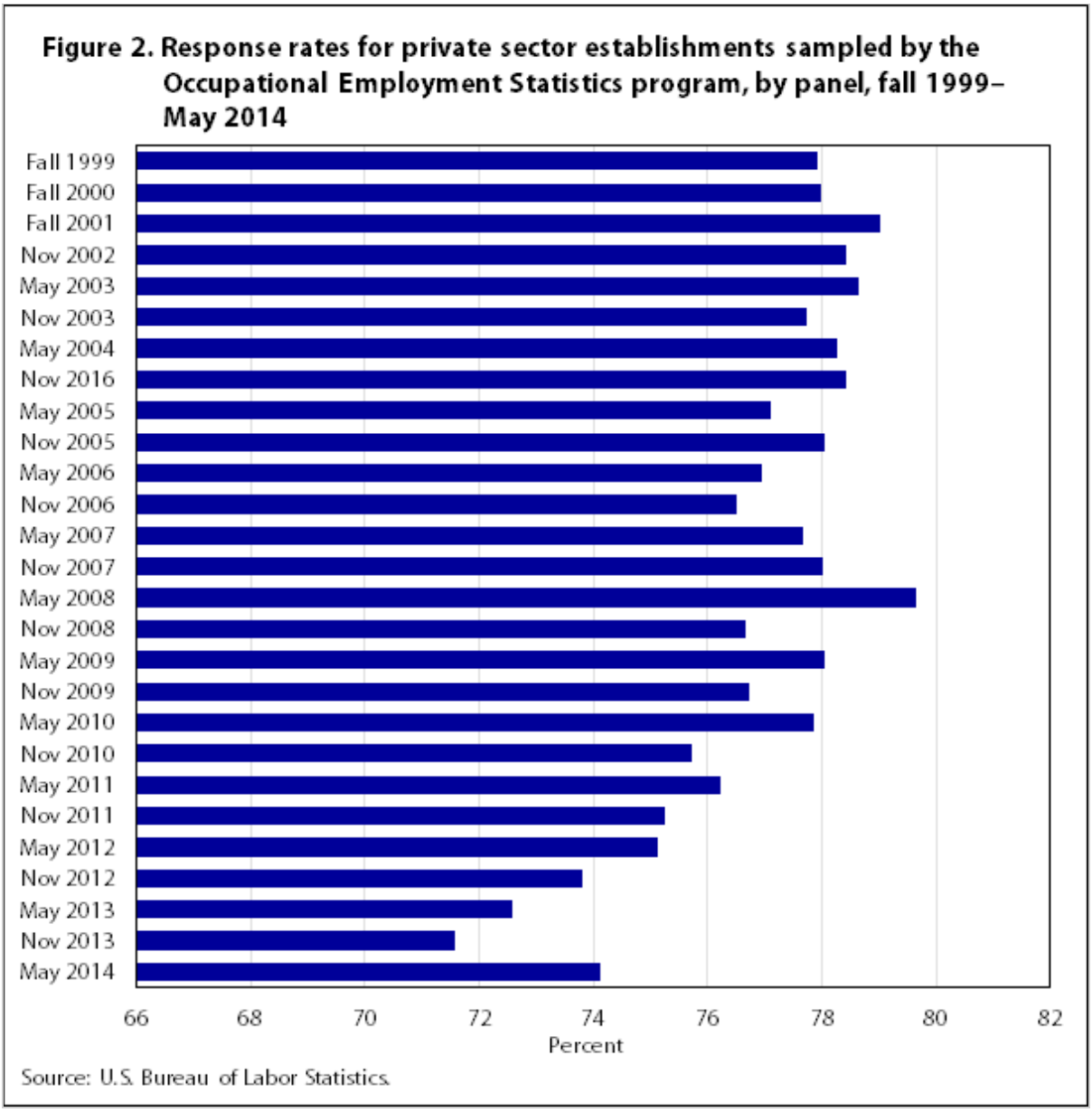


Figure 2 shows response rates for private sector establishments sampled by the OES program were steady at about 77 percent from 1999 through 2010 or 2011. There was a noticeable decline in response rates in 2013 because of the federal government shutdown in October 2013.[13] State Workforce Agencies are required to follow up with employers (except when funding for this work lapses in a federal government shutdown) until the overall response rate for the survey reaches at least 75 percent overall (including the establishments of state and local governments) and 75 percent in each MSA. Data are collected from state governments only in the November panels, and so state analysts do not need to follow up with as many private sector establishments to reach these response targets in the November panels as in other months. Response to the OES survey has been mandatory in North Carolina since 1995, Oklahoma since 2000, South Carolina during the 2002–05 period, Georgia since 2005, Vermont since November 2012, Wyoming since May 2013, the District of Columbia since November 2014, and Hawaii and Oregon since May 2015. Private sector response rates are about 85 percent in these states when response is mandatory.[14]

Table 5 shows that small establishments generally have higher response rates than large establishments. Polly A. Phipps and Carrie K. Jones report that this is due to the preference of state analysts for focusing followup work on the smallest establishments.[15] When analysts contact employers by phone, it is easiest both to find someone who can report on the occupational employment and wage information and to code occupational data over the phone for the smallest establishments. Hence, in working to reach the required 75-percent response targets across all establishments, state analysts find it easiest to focus on these small establishments.

Table 5. Response rates of private sector establishments in the Occupational Employment Statistics data, by size of establishment, fall 1999–May 2014

Size of establishment (number of employees)	Sample units	Responses	Response rate (percent)
Less than 5	986,296	866,805	87.89
5–9	910,993	763,726	83.83
10–19	1,040,612	828,966	79.66
20–49	1,090,078	802,078	73.58
50–99	589,566	390,217	66.19
100–249	432,045	272,761	63.13
250 or more	234,234	140,972	60.18
Total	5,283,824	4,065,525	76.94

Source: U.S. Bureau of Labor Statistics.

Table 6 shows that rural areas (BOS areas) have higher response rates than urban areas (MSAs), and among urban areas, response rates are higher in smaller MSAs than in larger MSAs. Phipps and Jones report that establishments in larger MSAs are both less likely to respond by mail to the survey forms and more difficult for state analysts to reach by telephone; these establishments often state that they are too busy to respond to the OES survey.[16]

Table 6. Response rates of private sector establishments in the Occupational Employment Statistics data, by type of area and employment level, fall 1999–May 2014

Type of area and employment level	Sample units	Responses	Response rate (percent)
Rural			
Less than 100,000	583,344	462,771	79.33
100,000–249,999	479,335	381,796	79.65
250,000–499,999	27,832	22,290	80.09
Urban			
Less than 100,000	1,029,513	822,499	79.89
100,000–249,999	902,216	705,597	78.21
250,000–499,999	561,345	431,676	76.90
500,000–999,999	783,801	580,604	74.08
1,000,000 or more	916,438	658,292	71.83
Total	5,283,824	4,065,525	76.94

Source: U.S. Bureau of Labor Statistics.

Table 7 shows response rates by industry. Response rates are particularly high in establishments within the agriculture, forestry, fishing, and hunting sector (farms are outside the scope of the survey) and in some service industry establishments. Response rates are particularly low for company headquarters establishments; administrative and support and waste management and remediation establishments; mining, quarrying, and oil and gas extraction establishments; and information establishments.

Table 7. Response rates of private sector establishments in the Occupational Employment Statistics data, by two-digit industry, fall 1999–May 2014

Industry[(1)]	Sample units	Responses	Response rate (percent)
Agriculture, forestry, fishing and hunting (11)	26,441	22,254	84.17
Mining, quarrying, and oil and gas extraction (21)	35,421	25,021	70.64
Utilities (22)	31,097	23,070	74.19
Construction (23)	416,527	333,016	79.95
Manufacturing (31–33)	607,338	466,177	76.76
Wholesale trade (42)	404,447	302,197	74.72
Retail trade (44–45)	722,334	584,131	80.87
Transportation and warehousing (48-49)	199,623	150,713	75.50
Information (51)	161,908	114,783	70.89
Finance and insurance (52)	273,910	203,061	74.13
Real estate and rental and leasing (53)	177,584	139,780	78.71
Professional, scientific, and technical services (54)	445,644	338,456	75.95
Management of companies and enterprises (55)	57,787	38,099	65.93
Administrative and support and waste management and remediation (56)	350,736	246,877	70.39
Educational services (61)	89,970	67,521	75.05
Health care and social assistance (62)	522,261	406,286	77.79
Arts, entertainment, and recreation (71)	124,370	97,198	78.15
Accommodation and food services (72)	280,480	209,736	74.78
Other services (81)	355,946	297,149	83.48
Total	5,283,824	4,065,525	76.94

Notes:

(1) These are two-digit industries according to the National American Industry Classification System (NAICS). NAICS codes are shown in parentheses.

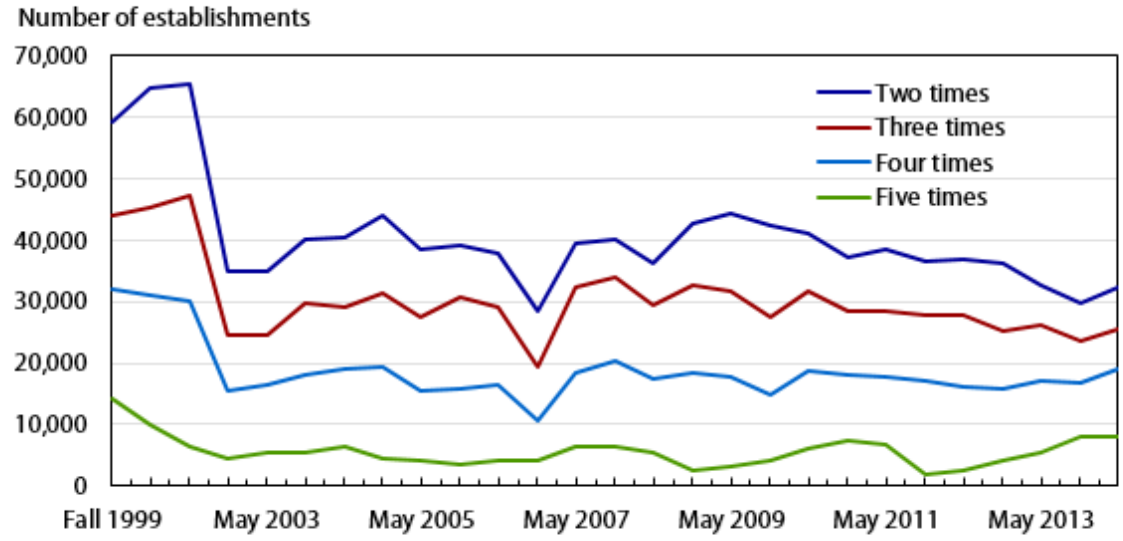
Source: U.S. Bureau of Labor Statistics.

When sampled establishments do not respond to the OES survey, data for these establishments are imputed in order to produce estimates of occupational employment and wages by industry and geographic area. These imputations proceed in two steps. First, occupational staffing patterns are taken from establishments similar in industry, overall employment size (as reported to the unemployment insurance system), and geographic area. Second, wage distributions are taken from the distribution of wages for the same occupation among employers in the same geographic area, in the same industry, and with the same overall employment size.[17] In assembling the longitudinal OES data described in the next section, we do not include this imputed data for establishments that do not respond to the OES survey.

Establishments observed longitudinally in the OES data

The combination of sampling and response patterns described above shape the composition of establishments that respond more than once to the OES survey, sometimes in opposing ways. Figure 3 shows the composition of the longitudinal data by panel and by the number of times establishments appear in the longitudinal data. Establishments are disproportionately likely to be observed in the fall 1999, fall 2000, and fall 2001 panels, which had larger sample sizes than more recent panels. Because of an error in the selection of the sample for the November 2006 panel, establishments in the longitudinal data are less likely to appear in that panel.[18] Establishments appearing five times in the longitudinal data are less likely to appear in the November 2011 or November 2008 data. We believe this pattern will disappear once the data of the November 2014 panel are added to the longitudinal data, because so many establishments are sampled at regular 3-year intervals.

Figure 3. Number of establishments in the longitudinal Occupational Employment Statistics (OES) data observed in each panel, by the number of times they appear in the longitudinal OES data



Source: U.S. Bureau of Labor Statistics.

The distribution of establishment and (weighted) employee characteristics in the longitudinal sample is remarkably similar to the distribution of each characteristic within the cross-section of OES data as a whole. OES employment estimates use establishment weights based on the inverse of the probability of sample selection. These estimates are then benchmarked to total employment levels by industry and geographic area.[19] We use these same weights in tables 8 through 11.[20] Overall, 973,857 of the 2.8 million private sector establishments ever sampled by the OES program, or 34 percent, appear in the longitudinal data. These 973,857 establishments are all observed multiple times in the longitudinal data, and establishment observations total 2,562,195. These 2,562,195 establishment observations in the longitudinal data represent 48 percent of the 5,283,824 private sector observations and imputed observations in the OES data. Summed over all panels from 1999 through May 2014, weighted employment in the longitudinal sample is 268 million, half the weighted private sector employment in the OES data. Estimation weights in the OES data are designed to represent the U.S. workforce at the end of each 3-year data collection period: reweighting to an average of these employment levels over the fall 1999–May 2014 period gives an employment level in the longitudinal data of 57 million workers out of a total private sector workforce of 113.8 million (not shown in the tables below).

Table 8 shows the distribution by establishment size class, categorizing establishments in the longitudinal sample by their size when they last responded. The smallest establishments are the size class that appears least frequently in the longitudinal data relative to the number of times these establishments are observed in the OES data as a whole. Such establishments represent 12.6 percent of all establishments (16.5 percent of observations) in the longitudinal data and 21.5 percent of all establishments (18.7 percent of observations) in the OES data as a whole. Because the probability that small units will be sampled is low, they are assigned higher weights for calculating estimates; their weighted employment is 6.3 percent of the employment in the longitudinal data, which is remarkably close to their 6.7 percent of weighted employment in the OES data as a whole. After estimation weights are used to calculate employment totals, the most overrepresented size class in the longitudinal data is the class of establishments with 10–19 employees, which has weighted employment representing 12.7 percent of all employment in the longitudinal data and 11.9 percent of employment in the OES data as a whole.

Table 8. Comparison of establishment, establishment-observation, and weighted-employment counts and column percentages in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by establishment size, fall 1999–May 2014

Size of establishment (number of employees)	Longitudinal sample OES data			All OES data		
	Number of establishments	Number of establishment observations	Sum of weighted employment	Number of establishments	Number of establishment observations	Sum of weighted employment
Less than 5	122,667	422,448	16,891,173	611,570	986,296	35,846,005
Percent of total	12.6	16.5	6.3	21.5	18.7	6.7
5–9	159,619	453,900	23,421,426	518,187	910,993	44,967,486
Percent of total	16.4	17.7	8.7	18.2	17.2	8.4
10–19	207,280	540,139	34,007,075	560,989	1,040,612	64,079,837
Percent of total	21.3	21.1	12.7	19.7	19.7	11.9
20–49	228,322	553,239	49,142,412	562,800	1,090,078	95,153,047
Percent of total	23.4	21.6	18.3	19.8	20.6	17.7
50–99	115,707	273,888	34,501,796	291,485	589,566	72,419,770
Percent of total	11.9	10.7	12.9	10.3	11.2	13.5
100–249	89,741	206,741	41,163,139	197,785	432,045	84,154,293
Percent of total	9.2	8.1	15.3	7.0	8.2	15.7
250 or more	50,521	111,840	69,057,045	98,107	234,234	140,628,219
Percent of total	5.2	4.4	25.7	3.5	4.4	26.2
Total	973,857	2,562,195	268,184,068	2,840,923	5,283,824	537,248,657
Percent of total	100.0	100.0	100.0	100.0	100.0	100.0

Source: U.S. Bureau of Labor Statistics.

Table 9 shows a similar comparison by area type. Establishments and employment in rural areas are slightly overrepresented in the longitudinal data: rural establishments comprise 21.5 percent of establishments, 21.5 percent of establishment-observations, and 14.0 percent of weighted total employment in the longitudinal data, compared with 20.9 percent of establishments, 20.6 percent of establishment-observations, and 13.3 percent of weighted total employment in the private sector OES data as a whole. The area type most underrepresented in the longitudinal data is those with employment greater than 1 million: these establishments comprise 20.9 percent of

total establishments and 29.9 percent of weighted total employment in the longitudinal data, compared with 22.7 percent of establishments and 31.8 percent of weighted total employment in the OES data as a whole.

Table 9. Comparison of establishment, establishment-observation, and weighted-employment counts and column percentages in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by type of area and employment level, fall 1999–May 2014

Type of area and employment level	Longitudinal sample OES data			All OES data		
	Number of establishments	Number of establishment observations	Sum of weighted employment	Number of establishments	Number of establishment observations	Sum of weighted employment
Rural	209,604	551,833	37,667,214	594,488	1,090,511	71,602,980
Percent of total	21.5	21.5	14.0	20.9	20.6	13.3
Less than 100,000	79,934	303,089	16,908,045	240,183	608,305	33,199,720
Percent of total	8.2	11.8	6.3	8.5	11.5	6.2
100,000–249,999	112,940	237,123	19,597,654	303,771	459,730	36,351,654
Percent of total	11.6	9.3	7.3	10.7	8.7	6.8
250,000–499,999	16,730	11,621	1,161,515	50,534	22,476	2,051,606
Percent of total	1.7	0.5	0.4	1.8	0.4	0.4
Urban	764,253	2,010,362	230,516,854	2,246,435	4,193,313	465,645,675
Percent of total	78.5	78.5	86.0	79.1	79.4	86.7
Less than 100,000	171,641	555,014	29,866,137	453,602	1,066,381	55,250,347
Percent of total	17.6	21.7	11.1	16.0	20.2	10.3
100,000–249,999	167,941	440,145	36,287,734	485,119	890,038	69,278,776
Percent of total	17.2	17.2	13.5	17.1	16.8	12.9
250,000–499,999	110,588	287,261	32,103,597	310,269	592,373	62,183,364
Percent of total	11.4	11.2	12.0	10.9	11.2	11.6
500,000–999,999	110,791	346,776	51,978,068	352,847	774,220	107,986,734
Percent of total	11.4	13.5	19.4	12.4	14.7	20.1
1,000,000 or more	203,292	381,166	80,281,318	644,598	870,301	170,946,454
Percent of total	20.9	14.9	29.9	22.7	16.5	31.8
Total	973,857	2,562,195	268,184,068	2,840,923	5,283,824	537,248,655
Percent of total	100.0	100.0	100.0	100.0	100.0	100.0

Source: U.S. Bureau of Labor Statistics.

Table 10 gives a similar comparison by industry. Again, the similarity of distributions in the composition by industry of establishments, establishment observations, and weighted employment levels between the longitudinal sample and the OES data as a whole is remarkable. The industry most overrepresented in the distribution of establishments (and establishment observations) in the longitudinal data is manufacturing (NAICS code 31–33), which contains 12.5 percent of establishments (13.0 percent of establishment observations) in the longitudinal data and 10.0 percent of establishments (11.5 percent of establishment observations) in the OES data as a whole. This is not surprising, given the large establishment sizes in manufacturing described above. The industry most underrepresented in the distribution of establishments is accommodation and food services (NAICS code 72), which contains 4.6 percent of establishments in the longitudinal data and 5.9 percent of establishments in the OES data as a whole. This is not surprising, given the low variation in the occupational composition of establishments in this industry, reducing sampling probabilities. The industries in which the fraction of weighted employment in the longitudinal data differs most from the fraction of weighted employment in the OES data as a whole are health care and social assistance (NAICS code 62), which contains 15.9 percent of weighted employment in the longitudinal data and 14.0 percent of weighted employment in the OES data as a whole, and administrative and support and waste management and remediation (NAICS code 56), which contains 5.7 percent of weighted employment in the longitudinal data and 7.1 percent of weighted employment in the OES data as a whole. Administrative support and waste management and remediation is somewhat underrepresented in the weighted employment of the longitudinal data because of the low response rate among establishments in this industry, as described above. Health care and social assistance is somewhat overrepresented in the weighted employment of the longitudinal data because of a combination of a large industry size, a higher-than-average rate of repeated sampling and a slightly-higher-than-average response rate.

Table 10. Comparison of establishment, establishment-observation, and weighted-employment counts and column percentages in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by two-digit industry, fall 1999–May 2014

Industry[1]	Longitudinal sample OES data			All OES data		
	Number of establishments	Number of establishment observations	Sum of weighted employment	Number of establishments	Number of establishment observations	Sum of weighted employment
Agriculture, forestry, fishing and hunting (11)	5,335	13,934	1,065,211	15,100	26,441	1,842,915
Percent of total	0.5	0.5	0.4	0.5	0.5	0.3
Mining, quarrying, and oil and gas extraction (21)	6,036	15,891	1,222,543	18,400	35,421	3,091,855
Percent of total	0.6	0.6	0.5	0.6	0.7	0.6
Utilities (22)	5,973	16,675	1,469,998	14,308	31,097	2,583,031
Percent of total	0.6	0.7	0.5	0.5	0.6	0.5
Construction (23)	78,852	206,549	17,210,413	233,889	416,527	33,360,389
Percent of total	8.1	8.1	6.4	8.2	7.9	6.2
Manufacturing (31–33)	121,725	332,598	32,723,438	283,415	607,338	60,318,059
Percent of total	12.5	13.0	12.2	10.0	11.5	11.2

See footnotes at end of table.

Table 10. Comparison of establishment, establishment-observation, and weighted-employment counts and column percentages in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by two-digit industry, fall 1999–May 2014

Industry[1]	Longitudinal sample OES data			All OES data		
	Number of establishments	Number of establishment observations	Sum of weighted employment	Number of establishments	Number of establishment observations	Sum of weighted employment
Wholesale trade (42)	74,106	196,825	12,962,191	209,083	404,447	27,126,934
Percent of total	7.6	7.7	4.8	7.4	7.7	5.0
Retail trade (44–45)	132,765	346,269	40,659,870	408,653	722,334	76,580,487
Percent of total	13.6	13.5	15.2	14.4	13.7	14.3
Transportation and warehousing (48–49)	35,960	93,168	10,312,104	105,628	199,623	20,737,879
Percent of total	3.7	3.6	3.8	3.7	3.8	3.9
Information (51)	26,787	69,859	5,496,517	87,118	161,908	13,492,553
Percent of total	2.8	2.7	2.0	3.1	3.1	2.5
Finance and insurance (52)	46,176	119,158	12,684,963	154,576	273,910	29,337,205
Percent of total	4.7	4.7	4.7	5.4	5.2	5.5
Real estate and rental and leasing (53)	33,084	85,471	4,859,550	99,422	177,584	10,248,220
Percent of total	3.4	3.3	1.8	3.5	3.4	1.9
Professional, scientific, and technical services (54)	79,666	207,674	16,756,831	248,316	445,644	36,852,314
Percent of total	8.2	8.1	6.2	8.7	8.4	6.9
Management of companies and enterprises (55)	10,088	24,601	4,000,724	29,331	57,787	9,700,806
Percent of total	1.0	1.0	1.5	1.0	1.1	1.8
Administrative and support and waste management and remediation (56)	57,722	147,101	15,295,441	195,019	350,736	38,134,521
Percent of total	5.9	5.7	5.7	6.9	6.6	7.1
Educational services (61)	16,403	42,837	6,190,217	47,794	89,970	12,124,895
Percent of total	1.7	1.7	2.3	1.7	1.7	2.3
Health care and social assistance (62)	101,719	271,282	42,645,992	267,803	522,261	75,309,497
Percent of total	10.4	10.6	15.9	9.4	9.9	14.0
Arts, entertainment, and recreation (71)	23,834	63,458	4,634,386	65,579	124,370	8,966,961
Percent of total	2.4	2.5	1.7	2.3	2.4	1.7
Accommodation and food services (72)	44,582	113,818	27,414,611	166,211	280,480	58,409,686
Percent of total	4.6	4.4	10.2	5.9	5.3	10.9
Other services (81)	73,044	195,027	10,579,071	191,278	355,946	19,030,449
Percent of total	7.5	7.6	3.9	6.7	6.7	3.5

See footnotes at end of table.

Table 10. Comparison of establishment, establishment-observation, and weighted-employment counts and column percentages in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by two-digit industry, fall 1999–May 2014

Industry[1]	Longitudinal sample OES data			All OES data		
	Number of establishments	Number of establishment observations	Sum of weighted employment	Number of establishments	Number of establishment observations	Sum of weighted employment
Total	973,857	2,562,195	268,184,071	2,840,923	5,283,824	537,248,656
Percent of total	100.0	100.0	100.0	100.0	100.0	100.0

Notes:

[1] These are two-digit industries according to the National American Industry Classification System (NAICS). NAICS codes are shown in parentheses.

Source: U.S. Bureau of Labor Statistics.

Table 11 makes a comparison (only for weighted employment) of longitudinal sample data and all OES data by the occupations of employees.[21] Once again, the distributions of occupations are remarkably similar. The most underrepresented occupations in the longitudinal data is the management, business, and financial occupations group, which comprises 8.7 percent of weighted employment in the longitudinal data and 9.4 percent of weighted employment in the OES data as a whole. The most overrepresented occupations in the longitudinal data are the healthcare practice occupations, which comprise 6.1 percent of occupations in the longitudinal data and 5.4 percent of occupations in the OES data as a whole. Given the small overrepresentation of employment in the healthcare and social assistance industry in the longitudinal data, some overrepresentation of the occupational category associated with this industry is not surprising.

Table 11. Comparison of weighted employment in the Occupational Employment Statistics (OES) longitudinal data and OES data as a whole, by occupation, fall 1999–May 2014

Occupation[1]	Longitudinal sample data		All OES data	
	Number	Percent distribution	Number	Percent distribution
Management, business, and financial occupations (11, 13)	23,374,372	8.7	50,451,962	9.4
Computer, engineering, and science occupations (15, 17, 19)	12,018,833	4.5	26,769,703	5.0
Education, legal, community service, arts, and media occupations (21, 23, 25, 27)	12,906,575	4.8	25,482,588	4.8
Healthcare practitioners and technical occupations (29)	16,250,249	6.1	29,138,257	5.4
Service occupations (31, 33, 35, 37, 39)	54,139,466	20.2	108,192,549	20.2
Sales and related occupations (41)	33,745,410	12.6	68,478,431	12.8
Office and administrative support occupations (43)	45,983,438	17.2	92,273,301	17.2
Farming, fishing, and forestry occupations (45)	1,078,612	0.4	1,950,072	0.4
Construction and extraction occupations (47)	13,372,319	5.0	26,509,977	4.9
Installation, maintenance, and repair occupations (49)	11,700,164	4.4	22,462,233	4.2
Production occupations (51)	22,898,336	8.6	43,469,506	8.1
Transportation and material moving occupations (53)	20,327,148	7.6	41,110,559	7.7
Total	267,794,922	100.0	536,289,138	100.0

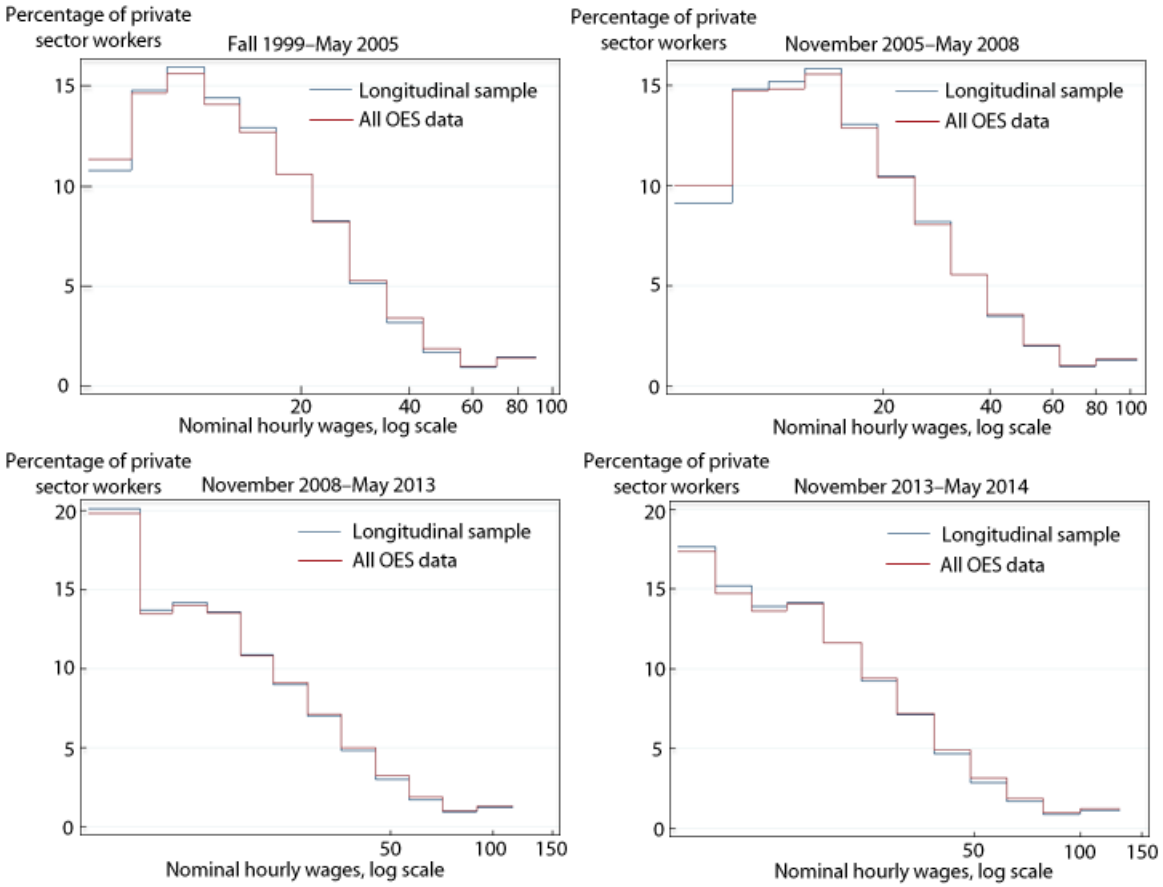
See footnotes at end of table.

Notes:

(1) These are major occupation groups according to the Standard Occupational Classification (SOC) system. SOC codes are shown in parentheses.

Source: U.S. Bureau of Labor Statistics.

Figure 4. Wage distributions for the longitudinal sample and for all Occupational Employment Statistics (OES) data, grouped by nominal wage ranges used in data collection



Source: U.S. Bureau of Labor Statistics.

The OES program collects information on wages from each establishment surveyed. Employers are asked to report the number of employees in each occupation by wage range; employers select among 12 wage ranges. These wage ranges were constant from 1999 through May 2005 and were then adjusted in November 2005, November 2008, and November 2013.[22] Figure 4 shows nominal wage distributions for private sector establishments in the longitudinal sample compared with wage distributions from all private sector establishments in the OES survey (including those with imputed wage data), in groups of panels with common wage ranges. For example, wage data for all panels from fall 1999 through May 2005 are combined in the upper left wage density plot, including multiple observations from establishments in the longitudinal sample if they responded more than once during this period.

Overall, the wage distributions for private sector establishments in the longitudinal data are quite similar to wage distributions in the private sector of the OES data as a whole. However, the patterns of differences between these distributions vary over time. In the panels of 1999–May 2005, establishments in the longitudinal data had a larger percentage of workers earning $6.75–$16.99 per hour and a smaller percentage of workers earning less than

$6.75 per hour than the OES data as a whole. Similarly, in the panels of November 2005–May 2008, establishments in the longitudinal data having a larger percentage of workers earning $9.50–$30.99 per hour and a smaller percentage of workers earning less than $9.50 per hour than the OES data as a whole. Overall, for the panels of fall 1999–May 2005 and November 2005–May 2008, there was less employment in the very bottom of the wage distribution and more employment in the middle of the wage distribution in the establishments of the longitudinal sample than in the establishments of the OES data as a whole. Later panels show more similarity between the longitudinal data and the OES data as a whole, and the patterns of differences change. For the panels of November 2008–May 2013 and November 2013–May 2014, there was more employment in the lower portion of the wage distribution and less employment in the upper portion of the wage distribution in the establishments of the longitudinal sample than in the establishments of the OES data as a whole.

Research efforts and opportunities

Although the OES program is designed to produce estimates of occupational employment and wages for specific industries and geographic areas, assembling the microdata collected by this program longitudinally permits the study of many additional topics. Zachary Warren used data from establishments that responded at least twice to the OES survey from 2000 to 2005 to examine changes in employment by occupation in growing and shrinking establishments.[23] Dina Itkin used data from establishments that responded exactly twice to the OES survey from 2000 to 2006 to examine changes in employment and wages by occupation in establishments that changed ownership between their responses.[24] Itkin and Laurie Salmon used data from establishments that appeared in the Mass Layoff Statistics Survey and responded at least twice to the OES survey from 1999 to 2008 to examine changes in employment and wages by occupation in establishments that were affected by mass layoffs.[25]

Those interested in using longitudinal microdata from the OES program should be aware that the establishments responding two or more times to the OES survey are not designed to be a representative sample of establishments or of employees in the United States. The OES sample is not a simple random sample but is designed to minimize the variance of estimates produced for the nation as a whole, for each industry, and for each geographic area. Therefore, larger establishments, establishments in certain industries, and establishments in geographic areas with fewer establishments are more likely to be sampled repeatedly. These differences in the probability of selection for different types of establishments will be compounded when researchers examine establishments that are selected for the survey more than once. However, the use of permanent random numbers in the OES sample design increases the likelihood that establishments will be repeatedly sampled for this survey. Furthermore, response to the OES survey is not random, and patterns of nonresponse act in opposite ways to the intent of the sample design. Smaller establishments and establishments in geographic areas with fewer establishments are more likely to respond to the survey. Overall, the characteristics of longitudinal microdata from the OES are remarkably representative of the OES data as a whole regardless of whether one examines establishment size, geographic area type, industry, occupation, or wage range.

Thus, it is possible to use data collected from the OES to examine employment and wage patterns for establishments observed longitudinally—not only for the largest establishments that are most likely to be selected for this survey but for a broad range of establishment types.

Visiting researcher program

Longitudinal data from the Occupational Employer Statistics Survey are not publicly available. However, the BLS onsite Visiting Researcher program allows eligible researchers the opportunity to visit BLS as temporary special employees for the purpose of working with confidential data in approved statistical research projects.[26] Under a grant from the National Science Foundation, BLS and the American Statistical Association offer research fellowships for this type of research by academic scholars.[27] Funding opportunities for junior faculty and senior graduate students to engage in such research include the CSWEP Summer Economics Fellows Program.[28]

SUGGESTED CITATION

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NOTES

1 Shail Butani and Michael McElroy, “Managing various customer needs for Occupational Employment Statistics survey,” 1999 proceedings of the American Statistical Association, section on government statistics, pp. 370–73.

2 *Handbook of methods*, chapter 3 (U.S. Bureau of Labor Statistics), https://www.bls.gov/opub/hom/pdf/oes-20081209.pdf.

3 For further reading, see Ernest Lawley, Marie Stetster, and Eduaras Valaitis, “Alternative allocation designs for a highly stratified establishment survey,” (U.S. Bureau of Labor Statistics), December 2007, https://www.bls.gov/osmr/research-papers/2007/pdf/st070020.pdf.

4 David Piccone and Marie C. Stetser, “National sample reallocation for the Occupational Employment Statistics survey,” 2009 proceedings of the American Statistical Association, section on government statistics, pp. 3626–38.

5 “Survey methods and reliability statement for the May 2014 Occupational Employment Statistics survey,” (U.S. Bureau of Labor Statistics), https://www.bls.gov/oes/methods_14.pdf.

6 Piccone and Stetser, “National sample reallocation,” pp. 3626–38.

7 Shail Butani, Kenneth W. Robertson, and Kirk Mueller, “Assigning permanent random numbers to the Bureau of Labor Statistics longitudinal (universe) data base,” proceedings of the 1998 American Statistical Association, section on survey research methods, https://www.bls.gov/osmr/research-papers/1998/pdf/st980080.pdf.

8 *Handbook of methods*, chapter 3.

9 In the analyses of sampling and response rates, we include 108,550 establishments, largely from the 1999 and 2000 OES panels, which cannot be linked uniquely to the QCEW data; therefore, we cannot determine if there is any longitudinal link to establishments sampled in the OES data in other panels.

10 The May 2008 sample was reduced from the usual 200,000 establishments overall (including state and local government and establishments in Guam, Puerto Rico, and the Virgin Islands) to approximately 174,000 establishments overall because of budget

constraints, as described on page 7 of *Occupational employment and wages, 2008*, USDL-09-0457 (U.S. Department of Labor, May 1, 2009, reissued May 29, 2009), https://www.bls.gov/news.release/archives/ocwage_05012009.pdf.

11 The sample for the November 2006 panel was accidentally drawn without using the permanent random numbers on the sample frame.

12 Polly A. Phipps and Carrie K. Jones, "Factors affecting response to the Occupational Employment Statistics survey," 2007 proceedings of the Federal Committee on Statistical Methodology, November 2007, https://www.bls.gov/osmr/research-papers/2007/pdf/st070170.pdf.

13 Technical note to *Occupational employment and wages—May 2013, USDL-14-0528* (U.S. Department of Labor, April 11, 2014), https://www.bls.gov/news.release/archives/ocwage_04012014.pdf.

14 Phipps and Jones, "Factors affecting response." Note that some employers go out of business in the year between the sample date and the survey date.

15 Ibid.

16 Ibid.

17 *Handbook of methods,* chapter 3.

18 See endnote 9.

19 For details, see *Handbook of methods*, chapter 3.

20 We use the final benchmark weights that were created to produce estimates for November 2002, May 2005, May 2008, May 2011, and May 2014.

21 There were changes to the Standard Occupational Classification (SOC) system in 2010 that affect occupational categories. For this table, we use occupational groupings that are consistent over time, but differ slightly from the 2010 SOC categories.

22 For the 1999–May 2005 wage ranges, see *Occupational employment and wages in 1999 based on the new Standard Occupational Classification system*, USDL-00-368 (U.S. Department of Labor, December 20, 2000), concepts section of the technical note, https://www.bls.gov/news.release/History/ocwage_12202000.txt; for the November 2005 adjustment, see *Occupational employment and wages,* 2006, USDL-07-0712 (U.S. Department of Labor, May 17, 2007), p. 5, https://www.bls.gov/news.release/archives/ocwage_05172007.pdf; for the November 2008 adjustment, see *Occupational employment and wages–May 2009*, USDL-10-0646 (U.S. Department of Labor, May 14, 2010), p. 6, https://www.bls.gov/news.release/archives/ocwage_05142010.pdf; and for the November 2013 adjustment, see *Survey methods and reliability statement for the May 2015 Occupational Employment Statistics survey,* (U.S. Bureau of Labor Statistics), p. 4, https://www.bls.gov/oes/methods_15.pdf.

23 Zachary Warren, "Occupational shares in growing and shrinking establishments," *Occupational employment and wages, May 2005*, bulletin 2585, (U.S. Department of Labor, May 2007), pp. 6–19, https://www.bls.gov/oes/shares.pdf.

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26 More information about the Visiting Researcher program is available at https://www.bls.gov/rda/home.htm.

27 More information about the ASA/NSF/BLS Research Fellow Program is available at https://www.bls.gov/osmr/asa_nsf_bls_fellowship_info.htm.

28 For a description of the CSWEP Summer Economics Fellows Program, see https://www.aeaweb.org/about-aea/committees/summer-fellows-program.

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