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# Construction of Average Weekly Hours for Supervisory and Nonproduction Wage and Salary Workers in Private Nonfarm Establishments

To construct hours for productivity measures, the Division of Major Sector Productivity (DMSP) in the Bureau of Labor Statistics (BLS) primarily uses establishment reports from the BLS Current Employment Statistics program (CES).  The CES, however, only collects hours for production and nonsupervisory workers.  Therefore, to generate measures of hours for all employees, BLS must estimate the hours of nonproduction and supervisory workers.

Using data from the BLS-sponsored Current Population Survey (CPS), we construct estimates of the number of nonproduction and supervisory workers and their hours worked as well as the number of production and nonsupervisory workers and their hours worked by NAICS supersector[1].  We estimate the ratio of supervisory to nonsupervisory employee average weekly hours from the CPS and multiply this ratio by the level of nonsupervisory worker average weekly hours from the CES (as adjusted from hours paid to hours at work using data from the ECI) to estimate the level of supervisory employee average weekly hours.  The level of nonproduction employee average weekly hours for goods-producing industries is constructed accordingly.

Information on the effects of using these estimates of average weekly hours, along with a discussion of how we evaluated the data, can be found at www.bls.gov/opub/mlr/2004/04/art2full.pdf

**The methodology**

There are several distinctions that exist between the establishment survey (CES) and the household survey (CPS).  First, the establishment survey excludes proprietors and unpaid family workers, who are covered by the household survey.  Second, the establishment survey measures jobs, counting a person who is employed by two or more establishments at each place of employment.  In contrast, the household survey employment measure counts a person only once, and classifies the person according to his or her primary job.  Finally, certain persons on unpaid leave for the entire reference period are counted as employed under the household survey, but are not included in the employment count derived from the establishment survey.

To conduct industry analysis using CPS data, it is necessary to make adjustments to the employment information to capture multiple jobholders and to redistribute hours to the industry where they were worked.[2]  In the revised CPS, beginning in January 1994 for outgoing rotation groups, information on hours, industry, and occupation are collected separately for the primary

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[1] Separate measures are constructed for the following aggregations: natural resources and mining, construction, durable goods manufacturing, nondurable goods manufacturing, wholesale trade, retail trade, transportation and warehousing, utilities, information, financial activities, professional and business services, education and health services, leisure and hospitality, and other services.

[2] Multiple jobholders are employed persons who, during the reference week, had either two or more jobs as a wage and salary workers, or were self-employed and also held a wage and salary job, or worked as an unpaid family worker and also held a wage and salary job.

and secondary jobs; information is also collected on hours at all jobs. These multiple jobholder data allow the CPS data to be adjusted to a jobs basis.

Because the CES reports the number of employees on the payroll, DMSP defines a worker in the CPS as employed if he or she worked or received pay in a given pay period. The CPS collects data on the employed at work, employed absent from work, and whether an individual was paid for time off. In our estimates using CPS data, "employed" is defined by "employed at work" or "employed, absent from work *and* paid for time off."

*Counting jobs*

The first step is to extract records from the CPS for persons who are holding at least one job that would be included in the CES. Our first selection criterion was to choose individuals if and only if they were either (1) employed, at work, and reported being at work for at least one hour at their primary or secondary job, or were (2) employed, not at work, and were receiving pay from their employer.[3] For those who fit the initial criterion, our second criterion was to then choose only those individuals who were employed as private wage and salary workers in either their first or second job. Self-employed persons whose business is incorporated are counted as wage and salary workers of their business.[4]

We counted persons as employed in their primary job if they were classified as private wage and salary workers or self-employed in their own corporation and were either at work or receiving pay during the survey week. Each individual was assigned their final CPS weight.[5] By NAICS supersector, aggregate hours of persons in their primary jobs were calculated as $\sum W_i H1_i$ for all persons who were at work at that job for at least one hour during the survey week, where $W_i$ represents the final CPS weight of these individuals and $H1_i$ represents the number of hours the individual reported that they worked in their primary job.[6]

For the second job, we counted persons as employed if they were classified as private wage and salary workers or self-employed in their own corporation and who worked at least one hour at that second job during the survey week. Although it is possible that people could be on paid leave for their second jobs, we expect that most of these jobs are part-time and unlikely to offer much paid leave. Because nearly all of the information on second jobs that the CPS collects comes from interviews of the outgoing rotation group, we used outgoing rotation weights to count employment for second jobs.[7] Aggregate hours for second jobs are calculated as $\sum W_i H2_i$. This was calculated separately for each NAICS supersector.

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[3] In terms of the CPS variables, we chose those for whom (1) PEMLR = 1 (employed—at work) and PEHRACT1 (actual hours at work, first job) >-1 or (2) PEMLR = 2 (employed—absent) and PEABSPDO = 1 (being paid by employer for time off last week).

[4] That is, either PEI01COW or PEI02COW equaled 4 (wage or salary worker at private for-profit firm), 5 (wage or salary worker at private nonprofit firm), or 6 (self-employed worker at incorporated firm).

[5] The variable PWSSWGT was used. This differs from the composited final weight (PWCMPWGT) used for the official BLS labor force survey reports that include only persons sixteen years of age or older.

[6] Hours at work are reported actual hours at work. The CPS variable used for the primary job was PEHRACT1 and that for the second job was PEHRACT2.

[7] The CPS variable used is PWORWGT.

*Defining nonproduction and supervisory workers*

In the CPS, respondents are not asked to classify themselves as production, nonproduction, nonsupervisory or supervisory workers.  They are asked, however, to report information on their occupation and industry of employment.  Using this information, we constructed employment counts and occupational and industry groupings in a manner that is highly consistent with the way employers report on workers for the CES.

In the CES, "production workers" in manufacturing and natural resources and mining refer to employees who engage directly in the manufacture of the establishment's products.[8] Production workers are defined to include working supervisors and group leaders who may be in charge of a group of employees, but whose supervisory function is only incidental to their regular work.  In construction, the term "construction workers" covers workers, up through the level of working supervisors, who are engaged directly on the construction project either at the site or in shops or yards at jobs ordinarily performed by members of construction trades.[9]  In the remaining private-sector industries (wholesale trade, retail trade, transportation and warehousing, utilities, information, financial activities, professional and business services, education and health services, leisure and hospitality, and other services) data are collected for nonsupervisory workers.  Nonsupervisory workers are defined to include most employees except those whose major responsibility is to supervise, plan or direct the work of others, such as top executive and managerial positions, officers of corporations, department heads, and superintendents.  Non-supervisory employees include working supervisors and group leaders who may be in charge of a group of employees, but whose supervisory function is only incidental to their regular work.

We use CPS micro data for all private wage and salary workers who were employed at work or on paid leave beginning with data for January 1979.[10]  We then sorted these reports into categories of nonproduction (supervisory) or production (nonsupervisory) workers based upon industry and occupation codes.  Our study uses broad occupation categories to group respondents as nonproduction (supervisory) or production (nonsupervisory) workers.

Beginning with 2000, we use the industry and occupation codes consistent with the 2000 population census.  We define nonproduction workers in goods-producing industries to include the following:

> Management occupations
> Business and financial operations occupations
> Computer and mathematical occupations
> Architecture and engineering occupations
> Life, physical, and social science occupations
> Community and social services occupations

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[8] Among those excluded from this category are persons in executive and managerial positions and persons engaged in activities such as accounting, sales, advertising, routine office work, professional and technical functions, and force-account construction.  (Force account construction is construction work performed by an establishment, primarily engaged in some business other than construction, for its own account and for use by its own employees.)
[9] Excluded from this category are executive and managerial personnel, professional and technical employees, and workers in routine office jobs.
[10] The full sample CPS data, that is all four rotation groups, was used for all years.

> Legal occupations
> Education, training, and library occupations
> Arts, design, entertainment, sports, and media occupations
> Healthcare practitioners and technical occupations
> Sales and related occupations
> Office and administrative support occupations

In nongoods-producing industries, supervisory workers include:

> Management occupations
> Business and financial operations occupations

In all industries, production (nonsupervisory) workers are calculated by subtracting the number of nonproduction (supervisory) workers from the total. A list of the industries included in each industry group is included in the appendix.

*Calculating average weekly hours*

Once the employment and hours for nonproduction (supervisory) and production (nonsupervisory) workers by primary and secondary jobs and by industry grouping are summed, the employment and hours counts for the primary and secondary jobs are combined. Then, averages for each calendar quarter are obtained by averaging the employment and hours of the three component months.

For each quarter, average weekly hours for supervisory (nonproduction) workers and nonsupervisory (production) workers by industry group are calculated by dividing total hours at work by the weighted count of the number of persons employed.[11] Then a ratio of the former to the latter is obtained. These quarterly ratios are adjusted for possible seasonal variation using the X11 seasonal adjustment routine contained in the Census Bureau's X12-ARIMA package.

Average weekly hours at work for nonsupervisory and production workers by NAICS supersector are obtained by calculating hours paid as CES employment counts times CES average weekly hours from monthly data. We then obtain the quarterly values of employment and hours by averaging the three months of data; average weekly hours equal quarterly hours divided by quarterly employment. Hours at work for nonsupervisory and production workers equal the quarterly average weekly hours paid multiplied by the appropriate ratio of hours at work to hours paid from the National Compensation Survey (NCS). See www.bls.gov/lpc/lprhws/lprhwhp.pdf.

Average weekly hours at work for supervisory (nonproduction) workers by supersector equal average weekly hours at work for nonsupervisory (production) workers from the CES and NCS, as described in the previous paragraph, multiplied by the ratios of average weekly hours at work derived from the CPS. Ratios for each supersector are shown in the table at the end of this note.

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[11] The number of employed, rather than the number at work, was chosen for consistency with the CES and the ratios of hours at work to hours paid data used for production workers.

**Adjustments to historical data**

*Multiple jobholding*

Prior to 1994, monthly CPS information by industry and occupation referred only to the respondent's primary job. Information on the industry and occupation of the second job, and information on hours worked at each job, were available only from supplements to the CPS conducted in May of 1957-80, 1985, 1989, and 1991. This study interpolates the available data in order to convert CPS hours and employment data to a jobs basis prior to 1994.

*Occupational classification changes*

A different occupational classification system was in place prior to 2000. Under this system, we classified nonproduction workers in goods-producing industries as those in the following occupational groups:

> Executive, administrative, and managerial occupations
> Professional specialty occupations
> Technical, sales, and administrative support occupations

In nongoods-producing industries, supervisory workers were classified as those persons in executive, administrative, and managerial occupations.

There is a break in our CPS series at 1982-83 as a result of an earlier change in the occupational classification system. This break made a noticeable shift in the data we used. Prior to the break the method we used to classify workers tracked very closely with a second alternative[12]. We imposed the growth rate of the alternative method for 1982-83 on the chosen system and adjusted our numbers from 1979-83.

*CPS redesign*

There is another break between 1993 and 1994 due to the major redesign of the CPS questionnaire and survey methods that was implemented beginning in January 1994. We evaluated annual and quarterly movements of the CPS-adjusted series over this break and determined that it was in a normal range of volatility. Thus, we elected not to link the data over this time period.

*Industry classification change (NAICS conversion)*

Prior to 2000, the Census Bureau's classification system for the CPS was based on the Standard Industrial Classification (SIC) system. SIC-based seasonally-adjusted ratios of

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[12] The alternative classification differed slightly from the system we chose in goods-producing industries and more so for service-producing industries. In the alternative system, we defined supervisors in service-producing industries to include those specified in our chosen system, as well as those who have the word "supervisor" in their occupational code title. In goods-producing industries we defined nonproduction workers as those defined in the chosen system plus medical, food, and personal service workers. (CPS codes 433-446, 456-469. We decided not to include those with supervisory titles because the workers remaining in occupations 417-889 seemed to be in professions where one envisions working supervisors who are involved in production.)

supervisory worker average weekly hours to nonsupervisory worker average weekly hours in services- producing sectors and nonproduction worker average weekly hours to production worker average weekly hours in goods-producing sectors were converted to NAICS supersectors in a two-step process.

First, quarterly employment and hours at work for nonproduction (supervisory) and production (nonsupervisory) workers were calculated on an SIC basis.[13] Then employment and hours were reallocated to NAICS supersectors using information on the distribution of employment from SIC divisions to NAICS supersectors for the first quarter of 2001 from the BLS Quarterly Census of Wages and Employment program. (See www.bls.gov/ces/cesdist.htm) After reallocating both employment and hours, new ratios of average weekly hours for supervisory to nonsupervisory workers and for nonproduction to production workers were calculated and a ratio of the former to the latter was obtained.

These initial ratios were then adjusted to the actual levels obtained for the period 2000-02 from the CPS data that had been processed using NAICS. A ratio of the "true" NAICS ratio to the initial ratio was calculated in each supersector for the twelve overlap quarters and an average of the twelve values was obtained. The historical 1979-99 data were then linked to the true NAICS levels using this adjustment ratio.

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[13] CPS data for 2000-02 are available on both old and new industry and occupational classification systems. The ratios of average weekly hours used with the SIC-based system reflect both the SIC and the older occupational classification system used in earlier years.

Ratios of average weekly hours of supervisory (nonproduction) workers to nonsupervisory (production) workers by NAICS supersector, 1979-2003

| | Natural resources and mining | Construc- tion | Durable goods manufac- turing | Nondura- ble goods manufac- turing | Whole- sale trade | Retail trade | Transpor- tation and ware- housing | Utilities | Infor- mation | Financial activities | Profes- sional and business services | Educa- tion and health services | Leisure and hospi- tality | Other services |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1979 | 0.9774 | 1.0648 | 1.0150 | 0.9917 | 1.0878 | 1.3053 | 1.0875 | 1.0299 | 1.1079 | 1.1118 | 1.1668 | 1.2635 | 1.5557 | 1.2583 |
| 1980 | 0.9359 | 1.0700 | 1.0253 | 0.9966 | 1.0875 | 1.3045 | 1.0828 | 1.0252 | 1.1085 | 1.1094 | 1.1552 | 1.2421 | 1.5478 | 1.2380 |
| 1981 | 0.9169 | 1.0585 | 1.0166 | 0.9968 | 1.0815 | 1.2993 | 1.0993 | 1.0415 | 1.1189 | 1.1052 | 1.1522 | 1.2351 | 1.5406 | 1.2311 |
| 1982 | 0.9297 | 1.0608 | 1.0435 | 1.0191 | 1.0768 | 1.3105 | 1.1039 | 1.0457 | 1.1329 | 1.1220 | 1.1682 | 1.2571 | 1.5575 | 1.2521 |
| 1983 | 0.9514 | 1.0628 | 1.0248 | 1.0106 | 1.0664 | 1.3141 | 1.1064 | 1.0477 | 1.1335 | 1.1381 | 1.1706 | 1.2593 | 1.5621 | 1.2544 |
| 1984 | 0.9484 | 1.0568 | 1.0178 | 1.0158 | 1.0616 | 1.3004 | 1.1029 | 1.0442 | 1.1380 | 1.1342 | 1.1804 | 1.2701 | 1.5528 | 1.2653 |
| 1985 | 0.9565 | 1.0620 | 1.0271 | 1.0222 | 1.0654 | 1.3001 | 1.1071 | 1.0478 | 1.1440 | 1.1352 | 1.1852 | 1.2688 | 1.5501 | 1.2653 |
| 1986 | 0.9819 | 1.0431 | 1.0265 | 1.0176 | 1.0667 | 1.3004 | 1.1239 | 1.0639 | 1.1507 | 1.1304 | 1.1791 | 1.2591 | 1.5460 | 1.2549 |
| 1987 | 0.9698 | 1.0267 | 1.0118 | 1.0076 | 1.0876 | 1.2936 | 1.1037 | 1.0442 | 1.1382 | 1.1261 | 1.1697 | 1.2481 | 1.5337 | 1.2444 |
| 1988 | 0.9738 | 1.0459 | 1.0146 | 1.0171 | 1.0784 | 1.2929 | 1.0970 | 1.0377 | 1.1419 | 1.1255 | 1.1604 | 1.2322 | 1.5272 | 1.2291 |
| 1989 | 0.9988 | 1.0441 | 1.0224 | 1.0243 | 1.0982 | 1.2854 | 1.1125 | 1.0529 | 1.1523 | 1.1196 | 1.1594 | 1.2283 | 1.5166 | 1.2248 |
| 1990 | 0.9829 | 1.0465 | 1.0273 | 1.0214 | 1.0616 | 1.2775 | 1.0965 | 1.0377 | 1.1439 | 1.1137 | 1.1544 | 1.2246 | 1.5098 | 1.2209 |
| 1991 | 0.9762 | 1.0563 | 1.0356 | 1.0203 | 1.0513 | 1.2996 | 1.1082 | 1.0489 | 1.1519 | 1.1232 | 1.1618 | 1.2315 | 1.5320 | 1.2281 |
| 1992 | 0.9771 | 1.0606 | 1.0262 | 1.0163 | 1.0530 | 1.2962 | 1.0974 | 1.0383 | 1.1442 | 1.1184 | 1.1474 | 1.2111 | 1.5204 | 1.2088 |
| 1993 | 0.9878 | 1.0421 | 1.0227 | 1.0233 | 1.0429 | 1.2837 | 1.1100 | 1.0510 | 1.1530 | 1.1157 | 1.1499 | 1.2131 | 1.5100 | 1.2107 |
| 1994 | 1.0011 | 1.0348 | 1.0191 | 1.0190 | 1.0566 | 1.2766 | 1.1109 | 1.0519 | 1.1550 | 1.1177 | 1.1580 | 1.2228 | 1.5057 | 1.2200 |
| 1995 | 0.9899 | 1.0319 | 1.0335 | 1.0335 | 1.0539 | 1.2879 | 1.1262 | 1.0666 | 1.1661 | 1.1224 | 1.1583 | 1.2202 | 1.5142 | 1.2178 |
| 1996 | 0.9872 | 1.0131 | 1.0237 | 1.0333 | 1.0753 | 1.2689 | 1.1170 | 1.0580 | 1.1620 | 1.1054 | 1.1490 | 1.2090 | 1.4911 | 1.2065 |
| 1997 | 0.9786 | 1.0213 | 1.0189 | 1.0261 | 1.0673 | 1.2662 | 1.1096 | 1.0507 | 1.1609 | 1.1237 | 1.1572 | 1.2190 | 1.4925 | 1.2176 |
| 1998 | 0.9714 | 1.0305 | 1.0167 | 1.0269 | 1.0597 | 1.2620 | 1.0969 | 1.0383 | 1.1514 | 1.1103 | 1.1401 | 1.2006 | 1.4803 | 1.1988 |
| 1999 | 0.9878 | 1.0199 | 1.0252 | 1.0317 | 1.0509 | 1.2552 | 1.1008 | 1.0424 | 1.1591 | 1.1059 | 1.1416 | 1.2000 | 1.4751 | 1.1983 |
| 2000 | 0.9567 | 1.0291 | 1.0209 | 1.0236 | 1.0603 | 1.2637 | 1.1075 | 1.0491 | 1.1690 | 1.0934 | 1.1311 | 1.1892 | 1.4625 | 1.1871 |
| 2001 | 0.9526 | 1.0113 | 1.0325 | 1.0286 | 1.0545 | 1.2275 | 1.0909 | 1.0404 | 1.1498 | 1.0995 | 1.1297 | 1.1805 | 1.4570 | 1.1763 |
| 2002 | 0.9431 | 1.0177 | 1.0311 | 1.0332 | 1.0632 | 1.2403 | 1.0982 | 1.0327 | 1.1442 | 1.1032 | 1.1177 | 1.1783 | 1.4478 | 1.1788 |
| 2003 | 0.9226 | 1.0159 | 1.0320 | 1.0386 | 1.0614 | 1.2237 | 1.0795 | 1.0315 | 1.1418 | 1.0956 | 1.1171 | 1.1780 | 1.4850 | 1.1832 |

October 2004

# Appendix

## Industry classification (NAICS supersectors matched to Census codes)

GOODS-PRODUCING INDUSTRIES

Natural resources and mining
0190 Forestry, except logging
0270 Logging
0280 Fishing, hunting, and trapping
0290 Support activities for agriculture and forestry
0370-0490 Mining

Construction
0770 Construction

Nondurable manufacturing
1070-2390 Manufacturing, nondurable goods manufacturing

Durable manufacturing
2470-3990 Manufacturing, durable goods manufacturing

NONGOODS-PRODUCING INDUSTRIES

Utilities
0570-0690 Utilities

Wholesale trade
4070-4590 Wholesale trade

Retail trade
4670-5790 Retail trade

Transportation and warehousing
6070 Air transportation
6080 Rail transportation
6090 Water transportation
6170 Truck transportation
6180 Bus service and urban transit
6190 Taxi and limousine service
6270 Pipeline transportation
6280 Scenic and sightseeing transportation
6290 Services incidental to transportation
6380 Couriers and messengers
6390 Warehousing and storage

Information
6470-6780 Information

Financial activities
6870-7190 Finance, insurance, real estate, and rental and leasing

<u>Professional and business services</u>
7270-7790 Professional, scientific, management, administrative and waste management services

<u>Education and health services</u>
7860-8470 Educational, health and social services

<u>Leisure and hospitality</u>
8560-8690 Arts, entertainment, recreation, accommodation, and food services

<u>Other services</u>
8770 Automotive repair and maintenance
8780 Car washes
8790 Electronic and precision equipment repair and maintenance
8870 Commercial and industrial machinery and equipment repair and maintenance
8880 Personal and household goods repair and maintenance
8890 Footwear and leather goods repair
8970 Barber shops
8980 Beauty salons
8990 Nail salons and other personal care services
9070 Dry-cleaning and laundry services
9080 Funeral homes, cemeteries, and crematories
9090 Other personal services
9160 Religious organizations
9170 Civic, social, advocacy organizations, and grantmaking and giving services
9180 Labor unions
9190 Business, professional, political, and similar organizations