# Are the New Jobs Good Jobs?*

Katharine G. Abraham
University of Maryland and NBER

James R. Spletzer
U.S. Bureau of Labor Statistics

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## I. Introduction

Interest in whether the jobs generated in the U.S. economy are "good jobs" (high skill, high wage) or "bad jobs" (low skill, low wage) is a hardy perennial both in the public policy world and in more academic precincts. Research that relates to this issue most commonly has focused directly on the evolution of wages, but there is a strand of the literature that has used information on the industry and/or occupation of net additions to employment to learn about changes in the quality of jobs. The basic strategy employed in these latter studies is to characterize industries, occupations, or industry/occupation employment cells according to the average wage in the cell, and then to examine the growth in the number of jobs in higher versus lower wage cells. The present analysis follows in this tradition.

Research in the United States on the growth in employment in industry/occupation cells at different positions in the wage distribution has to date been based exclusively on household data from the Current Population Survey (CPS). There are at least two important limitations of using the CPS data for this purpose. First, individuals may not provide accurate reports of the industry and occupation in which they are employed. In particular, individuals may tend to exaggerate their occupational status. Table 1 reports published statistics on occupational employment in 2004 from the Current Population Survey and also from the Occupational Employment Statistics (OES) survey, a large employer survey. Although we recognize that the published numbers shown in the table are not strictly comparable,[1] the difference between the occupational distributions of employment in the two surveys is striking. Especially noticeable are the markedly higher share of employment in managerial occupations and the correspondingly smaller shares of employment in service occupations and office and administrative support occupations in the CPS as compared to the OES. Assuming that employer reports are more accurate, these figures suggest that it may be preferable to track changes in the occupation or industry/occupation mix of employment using employer-reported rather than household-reported data.

A further limitation of using CPS data to track changes in the industry/occupation mix of employment is the relatively modest number of cells that these data will support. This limits the analyst's ability to say exactly where in the wage level distribution employment growth is occurring and also may be a source of instability in the estimates. Recall that the basic strategy in this literature is to assign each industry/occupation cell to a category – for example, to classify an industry/occupation cell as high-, middle- or low-paying. The net change in employment in cells assigned to each of these categories then is calculated. When working with a small number of cells, however, cells that account for a large fraction of observed net employment change may be categorized in one wage category based on data for some years but in another wage category based on data for other years. Even though these changes in classification typically reflect small changes

[1] The most notable differences between the published numbers from the two sources are that the OES measures jobs while the CPS measures employed persons, and that the OES excludes the self-employed. We report more careful comparisons later in the paper.

in the relative wages of jobs in the industry/occupation cell, the consequence is that findings may not be entirely robust to the choice of year used to define the assignment of cells to wage rate categories. This problem is likely to be mitigated by using a larger number of industries and occupations to define employment cells, something that the larger OES sample size should facilitate. When employment cells are smaller, having any one cell cross over from one category to another has less impact on the aggregate results.

In this study, we have undertaken an analysis of trends in the industry and occupational composition of employment over the period from 1996 through 2004 using OES data. This is a particularly interesting period, as it contains the last several years of the economic boom of the 1990s, the 2001 recession, and the labor market's stagnation and eventual recovery following the 2001 recession. The OES survey is a very large employer survey that is designed to produce point-in-time estimates of occupational employment and wages at fine levels of industry, occupation, and geography. There are some difficulties with using the OES data to study year-to-year changes in the mix of employment: The survey sample is designed to support annual estimates based on a rolling three-year sample rather than estimates based on data for a single year; changes in the classification of occupation and industry have been implemented over time; and there also have been other changes in the OES methodology over the period covered by our study. We believe, however, that, despite these problems, the OES data can shed useful new light on recent trends in job quality.

We begin in Section II with a brief review of the literature on the use of data on employment by industry and occupation to learn about trends in job quality. Section III describes the CPS and OES data used in our analysis. Empirical results are presented in Section IV. Section V offers some concluding thoughts and outlines our plans for extending the analysis.

## II. Literature Review

Interest in the quality of new jobs tends to be most pronounced during periods when the economy is recovering from a recession or approaching a national election. It is tempting to use information about the industries or the occupations in which net employment growth has occurred to draw conclusions about job quality. For example, of the 20 million payroll jobs added between 1993 and 1999, 50 percent were in the services industry and 17 percent were in retail trade. These are the two lowest paying of the nine major industries, and the figures on job growth by industry have been cited in support of the view that "bad jobs" were being created. On the other hand, looking at the same 1993-1999 time period, management occupations accounted for 33 percent of net job growth and professional occupations for another 31 percent. These are the two highest

paying of the eight major occupations, and the figures on job growth by occupation have been cited as support for the view that "good jobs" were being created.[2]

Studies that characterize jobs based solely on the industry of employment ignore the very different rates of pay associated with different occupations. Similarly, occupational pay may differ across industries, which means that ignoring industry in deciding whether a job in a particular occupation is a "good" job or a "bad" job could be misleading. Because both are important, using cells defined on the basis of industry and occupation to track changes in the mix of employment is an appealing strategy and one that offers potential insights into the nature of the changes in labor demand that are driving the changes in the distribution of wages documented in other studies.

In the mid-1990s, the BLS began publishing employment and wage information for industry by occupation cells, using data from the CPS. Using these data, Ilg (1996) documents that, during the first half of the 1990s, employment grew more rapidly in industry/occupation cells in the top and the bottom thirds of the earnings distribution than in cells in the middle third of the earnings distribution. In a later article, Ilg and Haugen (2000) show that nearly all of employment growth from 1989 to 1999 was concentrated among relatively high and relatively low paid workers, with the strongest job growth occurring in the highest earnings group, and with scant employment growth among workers with mid-level wages. Ilg and Haugen refer to this as "polarization" in employment growth.

This polarization of the employment structure also has been documented in the academic literature. Using industry-occupation cells from the CPS covering the years 1983 to 1993, Acemoglu (1999) finds that over this decade employment in job categories that typically pay close to the median of the wage distribution were being replaced by employment in higher and lower quality jobs. Autor, Katz, and Kearney (2006) compare the 1980s and the 1990s, and show sharp differences between these two decades, with the 1990s being characterized by more rapid growth of employment in jobs at the bottom and top relative to the middle of the skill distribution. To explain this polarization, Autor, Katz, and Kearney put forward a model in which computers complement the skills found in high-wage jobs, directly substitute for the tasks of middle-wage jobs, and have little if any impact on workers in low-wage jobs.

Unfortunately, the simple methodology of using industry/occupation data to analyze employment growth for the top, middle, and bottom third of the earnings distribution runs into some problems when applied to CPS data from the 2000s. First, the CPS industry and occupation classification systems changed in 2003, and this complicates the creation of consistent industry and occupation employment time series; much of the work we have done for this paper has been focused on addressing this issue. Second, there are large employment cells that lie on the earnings boundaries that separate the thirds of the earnings distribution. Trying to change the boundaries from thirds to

[2] The statistics in this paragraph are from Levine and Labonte (2004). This Levine and Labonte paper is an excellent summary of the empirical literature that uses industry and occupation data to study the quality of new jobs.

halves results in other large employment cells on the new boundaries. As a result, analysts who have looked at the 2000s have found that rates of growth for wage level categories formed by grouping industry/occupation cells based on their average wage rates can be sensitive to the choice of years used in making the category assignments.

Our contribution to the literature is to replicate the types of analysis that have been done with the CPS data using data from the Occupational Employment Statistics (OES) survey.[3] Both the CPS and the OES provide the data elements necessary for the analysis of changes in employment in industry/occupation cells categorized by their position in the wage distribution. As mentioned in the introduction, two potential advantages of the OES are that employers, rather than individuals, are the source of the occupational information that is recorded and the very large sample size offered by the survey. Having employer-provided occupational information allows us to examine how biases in the reporting of occupation in household surveys such as the CPS may affect basic conclusions about the quality of new jobs and changes in staffing structures more generally. The large sample sizes will enable us – in the next version of this paper – to analyze more detailed industries and occupations than it is possible to examine in CPS data.

## III. Data

Our analysis rests on annual industry/occupation employment time series constructed using Occupational Employment Statistics (OES) survey data and comparable series constructed using Current Population Survey (CPS) data. We begin by describing the two data sources and how we used them to construct the necessary industry/occupation employment time series.

*The OES Data*

The OES survey is an annual mail survey that collects information on occupational employment from approximately 400,000 establishments each year. The survey excludes the self-employed, unpaid family workers, agriculture and household employees. Since 1996, the OES program has collected information on occupational wages in addition to occupational employment. The first portion of a typical OES survey form is displayed in Appendix A. Establishments selected for the OES survey are asked to report employment in each cell of a matrix in which the rows refer to different occupations and the columns to specific wage intervals. Generally, for firms with 20 or more employees, the survey forms contain between 50 and 225 occupations, depending on the industry of the establishment completing the form. Beginning in 2001, employers receiving these forms have been asked to provide detailed occupational information for workers who cannot be placed in one of the listed occupations. Smaller firms are mailed a short form that makes an open-ended request for detailed occupational information, but does not provide lists of likely occupation titles. Prior to 2001, employers receiving the

[3] The OES confidential microdata are available to eligible researchers via procedures described on the BLS website (http://www.bls.gov/bls/blsresda.htm).

longer form were asked to list numerically significant or new occupations that could not be reported in a detailed occupation and therefore were reported in an "all other" residual category. This information was used in revising the survey forms for later years.

As noted above, the OES survey sample is designed to support detailed point-in-time estimates of staffing patterns and wages developed from a sample pooled over three-years rather than estimates based on data collected in a single year. Samples of approximately 1,200,000 establishments are selected for the OES survey on a three-year cycle. Estimates are calculated by weighting the data collected across the three years and then benchmarking to employment totals for the most recent panel reference period. Prior to 2002, each panel consisted of approximately 400,000 establishments; within each panel, establishments were assigned an October, November or December reference date. In 2002, the survey transitioned to a six panel design. Under this new design, each panel consists of approximately 200,000 establishments; panel sample are drawn for each May and November reference date in the three years covered by the survey sample. [4] Survey responses from three annual or six semi-annual panels are combined to produce the three-year estimates. The May 2006 estimates, for example, rest on data collected for May 2006, November 2005, May 2005, November 2004, May 2004 and November 2003.

In our work with the OES microdata, we use only the data pertaining to a particular year to produce the estimates for that year. From 2002 onwards, because we wanted the data for the later years to be as comparable as possible to that for the earlier years, we use only the data from the November panel. Because public sector employment and wages may be determined through a rather different process than are private sector employment and wages, we have excluded government from our analysis.

OES weights are constructed at the level of cells defined on the basis of geography, industry and establishment size. Both certainty and non-certainty units are spread across the several panels associated with a sample. Each sampled establishment is assigned a current weight that reflects its probability of selection into a particular panel.[5] If every cell in a panel contained at least one establishment, the weighted sum of employment calculated for an industry using the current weights would be approximately equal to total employment in the industry as of the panel reference date(s). There are, however, a very large number of OES cells – as of 2004, the survey was stratified by 686 metropolitan or balance-of-state geographic areas, 343 industries and 7 establishment size classes – and individual panels contain a significant number of empty cells. Because employment in the cells that happen to be empty is not represented, using the current

[4] Prior to 1996, the three-year sample was divided by industry, with a non-overlapping set of industries accounting for about a third of total employment surveyed in each year. Beginning in 1996, the sample design was changed to have all industries represented in each panel and this feature of the design was carried over to the six-panel design introduced in 2002.

[5] The current weights also incorporate adjustments for differences between the way a unit was sampled and the way it was reported (e.g., one establishment at a company sampled but data reported for several establishments together). Nearest neighbor hot deck procedures are used to impute missing occupational employment totals for nonresponding establishments; missing wage distributions also are imputed using distributions for similar establishments.

weights to estimate employment in an industry based on the responses to any single panel yields an estimate that lies significantly below the industry's true employment level.

Although there are many empty cells for specific geographic areas or establishment size classes, even in the smaller panels most industries have a reasonable number of sampled establishments. To produce national employment estimates, we have developed weight adjustment factors that we apply to the OES current weights to replicate the November Current Employment Statistics (CES) employment for each industry. The adjustment factor for industry j is calculated as follows:

$$(1) \qquad ADJFACTOR_j = \frac{E_j^{CES}}{\sum_i CURRWT_{ij}^{OES} E_{ij}^{OES}}$$

where ADJFACTOR is the weight adjustment factor, E is employment, CURRWT is the current weight from the OES data file, j indexes industries and i indexes individual establishments. The estimation weights used in our analysis are:

$$(2) \qquad FINALWT_{ij} = ADJFACTOR_j \; x \; CURRWT_{ij}^{OES}$$

These weights reproduce CES national industry employment trends in estimates based on the OES microdata. Industry adjustment factors were calculated at the most detailed industry level possible. For 2004, we created weight adjustments for 1171 detailed NAICS industries, consisting of 424 at the 5-digit level, 520 at the 4-digit level, 172 at the 3-digit level, and 55 at the 2-digit level. For 1996, we created weight adjustments for 934 detailed SIC industries, consisting of 310 at the 4-digit level, 383 at the 3-digit level, 225 at the 2-digit level, and 16 at the 1-digit level.

Another problem with using the OES data to examine the behavior of employment over time is that the classification systems used to code occupation and industry have changed. The OES program converted from its own occupation coding system to the Standard Occupational Classification (SOC) system in 1999 and from the Standard Industrial Classification (SIC) system to the North American Industry Classification System (NAICS) in 2002. These conversions created significant breaks in series at the detailed occupation and industry level. In the present draft of our paper, we have relied upon concordances developed by Matthew Dey of the Bureau of Labor Statistics to construct more aggregated occupations and industries that can be defined with reasonable consistency across the breaks in series. Definitions for the 19 occupations and 12 industries used in our analysis are shown in Appendix B and Appendix C.

An advantage of working with relatively aggregated categories is that we are able to define comparable occupations and industries in the coding schemes used for the Current Population Survey (CPS) data, making it possible to compare results based on OES data to those based on CPS data. In future work, we also plan to construct more

disaggregated concordances to bridge across the break in coding of the OES data that will allow us to analyze trends in employment for more detailed industry/occupation cells.

As can be seen in Appendix A, the wage information provided by establishments in the OES survey is recorded in intervals corresponding to different ranges of hourly and annual rates of pay. Occupational wage data collected by the BLS Office of Compensation and Working Conditions for the National Compensation Survey (NCS) are used in determining the mean hourly wage for each interval. The interval mean for the bottom interval may vary across states depending on the level of the state minimum wage.[6]

*The CPS Data*

The Current Population Survey (CPS) is a monthly household survey that collects information about the labor force status of persons age 16 and older. The survey is conducted in person or by telephone. Approximately 60,000 households are interviewed each month, with a single respondent generally reporting for all members of the household. Households selected for the CPS sample are interviewed eight times, with each selected household present in the sample for four months (month in sample or MIS-1 through MIS-4), out for eight months, and then in for another four months (MIS-5 through MIS-8). The survey sample in each month represents the civilian non-institutionalized population.

Among other information, the CPS collects occupation and industry on the main job every month for all employed persons. Occupation and industry on the second job are collected only in MIS-4 and MIS-8, the so-called outgoing rotation groups. Data on earnings on the main job also are collected only for the outgoing rotation groups; the survey does not collect any information on earnings in jobs other than the main job. Because the information collected for the outgoing rotation groups is more complete and because restricting our attention to the outgoing rotation groups ensures that we are not artificially inflating our sample size by including multiple observations on the same job, we use these data in our analysis.

For convenience in carrying out our calculations, we make use of the Unicon CPS outgoing rotation group data file. Weighted counts of the total number of employed people computed using our version of the Unicon-supplied microdata do not always exactly match the published CPS employment counts. Minor discrepancies in 1996 and 1997 reflect the fact that the composite weights used in CPS estimation are not publicly available for these years. In 2000, 2001 and 2002, the total number of employed persons estimated using the Unicon data fall short of the published CPS counts by 1.7 to 2.2 million people. These more significant differences reflect the fact that the weights on the Unicon file do not incorporate adjustments associated with benchmarking to the 2000 Census. To address this problem, we created adjustment factors for the Unicon weights

[6] Kasturirangan, Butani, and Zimmerman (2007) provide further details on how mean hourly wages are calculated in the OES program.

based on the ratio of published to constructed employment in each of 53 age by race by sex cells and used these adjusted weights in our analysis.[7]

In contrast to the OES data, which pertain to *jobs*, the CPS data on main jobs pertain to *people.* We use the information on second jobs collected in the CPS outgoing rotation groups to construct a CPS-based measure of the number of *jobs* in different industry/occupation cells. This measure misses any extra jobs reported by those who hold three or more jobs, but there are a relatively small number of such positions. Unpublished BLS tabulations for 2006 show that 8.0 percent of multiple job holders had more than two jobs, almost exactly the same as the 7.8 percent share observed in tests conducted as part of the process of redesigning the CPS questionnaire in the early 1990s (Polivka and Rothgeb, 1993). For comparability with the OES data, we drop self-employment jobs, agriculture jobs, and jobs in private households, and government jobs have been dropped from both surveys.

As was true for the OES survey, the occupation and industry coding systems used in the CPS have changed. Since 2003, CPS occupations have been coded using the 2000 Census occupational classification system and CPS industries have been coded using the 2000 Census industry classification system. The 2000 Census occupation coding system mirrors the SOC system and the 2000 Census industry coding system mirrors the NAICS. Unfortunately, the 1990 Census classification systems used in the CPS prior to 2003 are very different from those introduced in later years. This is a particular problem for the 1990 Census occupation coding system, as there is no direct concordance available between that system and the old OES occupational coding system. This forced us to take an indirect path to assigning detailed 1990 Census occupations to our broader occupational groupings.

The first step in this process was to map the detailed post-2003 CPS occupations into the 19 broad occupational categories defined for the OES data. This mapping was relatively straightforward. Using a tabulation based on a sample of just under 100,000 wage and salary workers who completed the 1990 Census long form and whose occupations were dual-coded using both the 1990 and the 2000 Census occupation systems (Scopp 2003), we then mapped detailed 1990 Census occupations to detailed 2000 Census occupations. Given our mapping of detailed 2000 Census occupations to the 19 broader occupational categories, we then were able to determine how the 1990 Census occupations should be assigned to the broader categories.

The dual-coded 1990 Census data revealed a number of occupations that split across detailed 2000 Census occupations belonging to different broad occupational categories. In most cases, a clear majority belonged to a dominant category or the numbers of people involved were not large enough to matter very much. One exception was the 1990 Census occupation "Management, not elsewhere classified (n.e.c.)." There were 5.3 million people employed in this occupation in 1990. More than two-thirds of

[7] We are grateful to Peter Horner of the Bureau of Labor Statistics for guidance regarding the adjustments made to the original CPS weights to incorporate the 2000 Census benchmark and for providing us with the data needed to construct similar adjustment factors ourselves.

them were assigned to detailed 2000 Census occupations that belonged to our "Management" occupational category, but 14.8 percent were assigned to "Office and Administrative Support" occupations and 2.8 percent to "All Other Services" occupations, with the remaining cases spread broadly across other occupations. The "Office and Administrative Support" and "All Other Services" occupations to which people from "Management, n.e.c." were assigned had weekly wages that were notably lower than the wages of the other occupations that absorbed people from "Management, n.e.c." Further, assigning the full "Management, n.e.c." group to our "Management" occupation produced an obvious break in series, with management employment falling by approximately 1.4 million on a base of 12.5 million between 2002 and 2003. This suggests that many of those categorized as "Managers, n.e.c." under the 1990 Census system were not in fact managers according to the criteria applied in the post-2002 data. As a rough corrective, in each year from 1996 to 2002, we identified the 17.6 percent (14.8 percent plus 2.8 percent) of workers in the "Management, n.e.c." occupation with the lowest earnings, and probabilistically assigned 84 percent of them to "Office and Administrative Support" and the other 16 percent to the "All Other Services". Although it may be possible to develop a better solution, this adjustment eliminated the break in series observed for the "Management" occupation and also eliminated a noticeable discontinuity in the "Office and Administrative Support" occupation.

The same SIC and NAICS algorithms used to create the 12 industries in the OES also were applied to the CPS data. Our measure of earnings in the CPS is the mean hourly wage for the main job, calculated in the standard fashion as weekly earnings divided by usual hours per week at the main job. This mean hourly wage was averaged across those in an industry/occupation cell for the purpose of assigning cells to a position in the industry/occupation distribution of wages.

*Comparability of the OES and CPS Series with Each Other and Over Time*

As already noted, we have tried to make the samples from the OES and CPS microdata as similar as possible. The OES data refer to jobs rather than people, and we have used the information on second jobs that the CPS contains to create a CPS dataset that is "jobs-based" rather than "person-based". Because the OES does not include them, we have excluded the self-employed, agriculture jobs and private household jobs in the CPS data. In addition, government jobs are excluded from both samples.

One remaining difference between the OES and the CPS survey data is that they have different reference periods. The OES survey is collected with an October, November, or December reference period between 1996 and 2001, and we use the panels with November reference periods from 2002 through 2004. The CPS outgoing rotation group microdata represent all months in the calendar year. In the next draft of this paper, we plan to investigate more carefully whether this difference in reference periods has any noticeable effect on our key findings.

Another difference between the two datasets is that, consistent with the benchmarking of the OES data to the November CES control totals by industry, the two

sets of estimates display somewhat different patterns of aggregate employment growth. The employment totals estimated from our OES and CPS data are graphed in Figure 1. As can be seen, CPS employment lagged OES employment through 1999, but CPS employment outperformed OES employment in 2000 and 2001. These time series patterns mimic the well known discrepancy between the behavior of the CES and CPS employment series during this time period (see Bowler and Morisi, 2006).

As discussed above, the OES switched occupational classification systems in 1999 and industry classification systems in 2002; the CPS switched both occupational and industry classification systems in 2003. Breaks in series associated with these classification system changes are a potential concern. Had the changes occurred in 2000 or 2001, it would be more difficult to distinguish true business cycle changes from breaks in series due to coding incompatibilities. Given the actual dates of the changes, however, discontinuities in our industry and occupation time series that occur at the point of conversion to a new coding system seem most likely to reflect problems with our concordances and coding assignments. There are a few cases in which there do appear to be discontinuities. The jump in the CPS employment series for manufacturing between 2002 and 2003 seems suspicious, given the declines in manufacturing employment both in the year before and in the year after the coding system change. We also note an apparent discontinuity in the CPS occupational series for "All Other Services." In neither case do we appear to have an enormous problem – between 2002 and 2003, CPS manufacturing employment rose by about 0.7 million on a base of about 16.0 million and all other services employment by about 0.3 million on a base of 5.0 million. In the next iteration of the paper, we will take another look at the coding rules used for industry and occupation, and consider possible refinements. On the whole, however, we are reasonably comfortable that the bridges we have built across the changes in occupation and industry coding are sound and that any remaining problems are unlikely to have a significant effect on our findings.

## IV. Results

The work we have just described produced two sets of annual employment time series, one based on OES data and the other on CPS data, for 228 industry by occupation cells (12 industries by 19 occupations). In the CPS, 5 of these 228 industry by occupation cells are empty in one or more years between 1996 and 2004. We collapse these cells with other cells in the same industry, leaving us with 223 industry by occupation cells for use in our CPS analysis.[8]

[8] The five cells are Healthcare occupations in the Mining, Construction and Information industries and Food and Beverage occupations in the Mining and Construction industries. Healthcare occupations were collapsed into Other Professional and Technical occupations and Food and Beverage occupations into All Other Services, in each case within the same industry.

*Basic Results*

In order to characterize trends in job growth by position in the wage distribution, our first step was to assign each of our 228 (223) industry by occupation cells to a wage level category. We did this by sorting the cells in each data set in order of mean 2004 hourly earnings in that data set. Cells then were assigned to the bottom third, middle third or top third of the employment distribution, based on the 1996 employment figures. The cells that spanned the 1/3 and 2/3 points in the employment distributions were assigned to either the lower or the higher wage category on either side of the boundary to make the total base period employment assigned to each category as equal as possible. We then calculated the growth in employment in the cells assigned to each of the three wage categories over the following eight years. The cumulative percent growth in employment over the 1996-2004 period for the low-, middle- and high-wage cells is shown in the text table below:

Percent Growth in Employment,
1996 to 2004

| | CPS | OES |
|---|---|---|
| Low wage industry/occupation cells | 10.0% | 14.8% |
| Middle wage industry/occupation cells | 6.3% | 2.8% |
| High wage industry/occupation cells | 17.9% | 12.1% |

Over the eight year period, the CPS data show substantially more growth in high-paying industry/occupation cells (17.9 percent versus 12.1 percent cumulative growth) and the OES data show substantially more growth in low paying industry/occupation cells (14.8 percent versus 10.0 percent cumulative growth). In both sets of figures, consistent with there having been a "hollowing out" of the job structure, the lowest rate of job growth is observed for the middle wage category, but the difference in the growth observed for the middle category as compared to that in the high-wage and low-wage categories is much larger in the OES data than in the CPS data.

Graphing the employment series we have constructed allows us to look at the year-to-year patterns of growth by wage level category. Figure 2 displays employment indexes constructed from the underlying employment data by setting the 1996 index equal to 100 and then setting the index values for other years at levels that reflect the ratio of current year employment to employment in 1996. The CPS high-wage category shows more consistent employment growth than either the middle- or low-wage category. Indeed, although the cumulative growth of employment in the CPS low-wage category is a bit higher than that in the middle-wage category over the 1996-2004 period as a whole, through 2002 employment growth in the middle-wage category outpaced that in the low-wage category. In the OES data, employment in the middle wage category grew less than employment in either the high wage or the low wage category between 1996 and 2000, then fell sharply between 2000 and 2002 and did not regain its relative position between 2002 and 2004.

Rather than looking at the growth in employment in each of the three categories relative to the 1996 level, the data also can be characterized in terms of how the *share* of employment in each of the three categories has changed over time. This has the advantages that it highlights *relative* growth and that comparisons between the two data sets are not affected by the faster aggregate employment growth observed in the CPS as compared to the OES.

Percentage Point Change in Employment Share,
1996 to 2004

| | CPS | OES |
|---|---|---|
| Low wage industry/occupation cells | -0.42 | 1.44 |
| Middle wage industry/occupation cells | -1.52 | -2.16 |
| High wage industry/occupation cells | 1.93 | 0.73 |

Looking at the numbers this way sharpens the contrast between the implications of the CPS and OES data with regard to the "hollowing out" of the middle of the jobs distribution. In the CPS data, only high wage industry/occupation cells have increased their employment share. In contrast, in the OES data, both low wage and high wage industry/occupation cells have gained employment share, at the expense of middle wage industry/occupation cells.

This pattern is even more apparent in Figure 3, which graphs the cumulative change in the employment share of jobs in high-wage, middle-wage and low-wage industry/occupation cells. In the CPS data, only the high-wage industry/occupation share has grown. In contrast, the low-wage industry/occupation share fell markedly through 2002, even relative to the middle-wage industry/occupation share. Given our assignment of industry/occupation cells to wage level groups, it we had looked only at data for the 1996 to 2002 period, the CPS data would not have supported the hypothesis of a "hollowing out" in the employment structure. In contrast, in the OES data, the pattern of higher shares for the high- and low-wage jobs and a lower share for the middle-wage jobs is much more consistent. Interestingly, the two data sources are in agreement that the high-wage job share fell and the low-wage job share rose between 2002 and 2003, as the effects of the 2001 recession played themselves out in the labor market.

As noted above, other analysts have found that the choice of years used to assign industry/occupation cells to wage level categories can affect the results obtained. In the next iteration of this paper, we will look systematically at the sensitivity of our findings both to the choice of year used to rank industry/occupation cells by average wage level and to the choice of base year used to form the employment distribution on which the wage level category assignments are based. In addition, we plan to look at the patterns of growth obtained using different numbers of wage level categories (for example, breaking the employment distribution into quintiles rather than thirds). At this point, however, in part because of complications with calculating average wage rates using the OES microdata, this work has not yet been completed.

*Explaining the Differences in the CPS and OES Results*

Although they have some commonalities, the calculations we have carried out using CPS and OES data tell a somewhat different story about the pattern of job growth over the 1996 to 2004 period. We would like to know what accounts for the differences we observe. We frame our exploration by asking whether the differences between the findings based on the two data sets reflect differences in the assignment of industry/occupation cells to wage categories or differences in the measured rates of growth in employment within particular cells.

As background to this investigation, we ask first whether the CPS and the OES data tell a reasonably consistent story about the relative wages of different industry/occupation job cells as of 2004. In order to be able to compare the ordering of cells by wage level in the two surveys, we collapsed the five industry/occupation cells that sometimes were empty in the CPS in the OES data so that we had 223 cells for each data source. We then calculated the correlation between the ranks assigned to cells in the two data sets, based on a sorting by average 2004 hourly wage. The unweighted correlation between the rank order of the OES industry/occupation cells, sorted by the 2004 OES wage, and the rank order of the CPS industry/occupation cells, sorted by the 2004 CPS wage, is 0.9088. In other words, for the most part, the low-paying (high-paying) occupations in the OES employer-provided data are also the low-paying (high-paying) occupations in the CPS household-provided data.

To understand how differences between the wage category assignments in the two data sets might be affecting our results, we repeated the calculations described above but this time with the categorization of jobs as high-, middle- or low-wage in each data set based on information from the other data set. In the first alternate set of calculations, we compare the growth in high-, middle- and low-wage employment in the CPS and the OES with cells assigned to wage categories based on the wage rankings and employment distributions from the 2004 CPS data. Then, we reverse the exercise, comparing the growth in high-, middle- and low-wage employment in the CPS and the OES with cell categories assigned based on the wage rankings and employment distributions from the 2004 OES data. The text table below shows how the percent growth in employment in high-, middle- and low-wage jobs is affected by the choice of assignment rule. The first two columns report numbers based on the CPS-based category assignments and the next two columns show numbers based on the OES-based category assignments.

Percent Growth in Employment,
1996 to 2004

| | CPS Category Assignment | | OES Category Assignments | |
|---|---|---|---|---|
| | CPS Employment Growth | OES Employment Growth | CPS Employment Growth | OES Employment Growth |
| Low wage industry/occupation cells | 10.0% | 9.0% | 16.8% | 14.8% |
| Middle wage industry/occupation cells | 6.3% | 9.7% | -2.3% | 2.8% |
| High wage industry/occupation cells | 17.9% | 11.0% | 19.0% | 12.1% |

It is apparent from these numbers that the choice of assignment rule has a substantial impact on the estimated rates of growth in the number of low-wage and middle-wage jobs. In both data sets, under the OES assignment rule, employment in jobs categorized as low wage has grown rapidly, while employment in jobs categorized as middle-wage has changed only modestly. In contrast, in both surveys, under the CPS assignment rule, there has been much less growth in the number of low-wage jobs and much more growth in the number of middle-wage jobs.

Much of this observed discrepancy reflects the assignment of just two large cells to different wage level categories using the CPS versus the OES assignment rule. First, production workers in manufacturing – a cell that both data sources show has experienced a decline in employment of well over one million jobs – are categorized as middle-wage in the OES but low-wage in the CPS. Another categorization difference that contributes significantly to the faster rate of growth in middle-wage employment under the CPS rule as compared to the OES rule is the assignment of construction workers in the construction industry – a large and rapidly growing employment cell – to the high-wage category in the OES but the middle-wage category in the CPS. Both the manufacturing production worker cell and the cell for construction workers in the construction industry fall near the relevant wage category boundary in both surveys' wage rankings.

In contrast to the sensitivity of the low-wage and middle-wage employment growth rates to the choice of assignment scheme, the rate of growth of employment in the high-wage category is relatively insensitive to which survey's information is used to assign cells to wage level categories. The primary reason for the different rates of growth in employment in the high-wage category is that the CPS and the OES show different rates of growth in employment for the same industry/occupation cells. The occupation of "Manager" is categorized as high-wage in all 12 industries in both the CPS and the OES, and, between 1996 and 2004, management employment across all industries grew by 1.5 million in the CPS but fell by 2.6 million in the OES.

We also have replicated our earlier calculations of change in the *share* of employment by wage level category using the alternate assignment rules. The results are shown in the following table:

Percentage Point Change in Employment Share,
1996 to 2004

| | CPS Category Assignment | | OES Category Assignments | |
|---|---|---|---|---|
| | CPS Employment Share Change | OES Employment Share Change | CPS Employment Share Change | OES Employment Share Change |
| Low wage industry/ occupation cells | -0.42 | -0.28 | 1.28 | 1.44 |
| Middle wage industry/occupation cells | -1.52 | -0.01 | -4.05 | -2.16 |
| High wage industry/ occupation cells | 1.93 | 0.29 | 2.77 | 0.73 |

Consistent with the results of the employment growth rate calculations, in both surveys, the share of employment in low-wage jobs rises by more than a percentage point under the OES assignment rule but drops modestly under the CPS assignment rule. In addition, in both surveys, the share of employment in middle-wage jobs falls sharply under the OES assignment rule, but less so or not at all under the CPS assignment rule. Finally, whichever assignment rule is used, the CPS data show far greater growth in the share of employment in high-wage jobs than do the OES data.

To summarize, the differences in the findings obtained using CPS and OES data can be traced in part to differences in the location of particular industry/occupation cells within the wage distributions associated with the two surveys. The sensitivity of the findings regarding growth in low-wage and middle-wage employment to the assignment of just two large cells – production workers in manufacturing and construction workers in the construction industry – suggests the desirability of working with data for more disaggregated industry/occupation cells. This is something we plan for the next draft of the paper.

Our alternate calculations also highlight the importance of differences in the measurement of management employment in the CPS (household survey) and OES (employer survey) data. Earlier in the paper, we referred to published data from the CPS and the OES, noting the substantially larger share of management employment in the CPS. The published data are suggestive but not definitive because of differences both in the unit of observation (people versus jobs) and in scope (most importantly the inclusion or exclusion of the self employed). In Table 2, we use a jobs-based measure of employment and restrict our attention to private sector wage and salary employment

exclusive of agriculture and private households for both the CPS and the OES calculations. The employment share figures reported in Table 2 should be reasonably comparable. These more definitive calculations confirm the patterns observed in the published statistics. As before, we observe a markedly higher share of employment in managerial occupations in the CPS than in the OES, offset by correspondingly smaller shares of employment in service occupations and office and administrative support occupations.

In Figure 4, we have plotted the trends in management employment implied by our two data sources. The top panel of the figure shows the number of management jobs and the bottom panel shows the share of employment accounted for by management jobs. In the CPS, both the number of management jobs and the share of employment accounted for by management jobs drifted steadily upwards through 2002 and then leveled off in 2003 and 2004. In sharp contrast, in the OES, both the number of management jobs and the share of employment accounted for by management jobs have trended steadily downwards. The two surveys thus tell a very different story about the evolution of the occupational structure in the U.S. labor market.

The difference in these trends is so striking that we are led to ask whether any part of it might be due to changes in the measurement methods used in one or the other of the two surveys over time. Our first thought was that perhaps the differing trends might be a reflection of problems with our occupational concordances. Unlike other occupational categories, except for the problem already noted with "Management, n.e.c." in the CPS data, however, management jobs have been defined in a relatively similar fashion across surveys and over time. Further, there is no break in the OES management time series in 1999 when the conversion to the SOC classification system occurred. There is some evidence of a dip in the CPS management series in 2003, coincident with the introduction of the SOC, but the same dip is evident in the OES data. On the whole, it seems unlikely to us that problems with the occupational concordances explain the very different trends in management employment in the two surveys.

Another possible explanation suggested to us by Laurie Salmon of the OES program staff is that the marked decline in management employment in the OES over the period from 1999 through 2001 or 2002 might reflect changes in the editing rules applied to the OES survey data. Following the conversion to the SOC in 1999, OES staff members noticed a significant number of establishments in which management employment was reported without the presence of employment in any of the job categories in which one would have expected those supervised by these managers to be found. To address this problem, the program introduced a new series of edit checks that were used to flag establishment reports for further review. As applied to the affected management occupations, these so-called "dependent occupation" edit checks identified establishments in which employment was reported in a management occupation (e.g., financial manager) without the reporting of employment in any of the expected subordinate occupations (e.g., financial specialists or clerks). Reports that exhibited this sort of "missing occupation" problem were to be queried. In some cases, it might be determined that the initial coding of employment as management was accurate – for

example, a person might legitimately be a manager because s/he supervises contract employees who do not appear on the establishment's payroll. In other cases, jobs originally reported as management jobs would be recoded to another job classification. Implementation of these edit checks was very limited in 1999 and has been phased in gradually over the following years.[9]

To gauge how much the introduction of these new edit checks might have affected the trend in management employment, we created the "Edited Management" series shown in Figure 5. To construct this series, we began by applying the dependent occupation edits applicable to management occupations to the OES microdata for all establishments in all years from 1999 through 2004. If management employment in an establishment was flagged by the dependent occupation test, we make the assumption that this employment should have been categorized in a non-management occupation and subtract it from the management series. Since upon investigation some of this employment would have been determined to be properly classified, we are making too large an adjustment, but as there is no reason to think that the total amount of legitimate management employment that we are reclassifying has changed very much over time, the trend in our "Edited Management" series should not be much affected. It is clear from looking at Figure 5 that these changes in editing rules can explain only a very small portion of the decline in management employment observed in the OES data.

## V. Conclusion

Looking at our basic calculations, the OES data on employment by industry and occupation paint a rather different picture of recent trends than do the CPS data that have been analyzed in previous studies. Whereas the CPS data show disproportionate growth in employment in high-wage jobs and much less growth in the number of low wage jobs, in the OES data high-wage and low-wage job growth are more balanced. Both data sources show that the employment share of middle-wage jobs has fallen. As has been discussed, some of these patterns are sensitive to whether the CPS data or the OES data are used as the basis for assigning jobs to wage level categories and that is something we plan to explore more carefully in the next iteration of this paper. One finding that is not sensitive to which survey is used to assign industry/occupation cells to wage level categories is the finding that high wage employment has grown much more in the CPS data than in the OES data, reflecting the growing number of management jobs in the CPS as contrasted with the pronounced decline in the number of management jobs in the OES.

Should we believe that management employment has been stable or growing, as shown in the CPS, or that management employment has been falling, as shown in the OES? The possible biases in occupational information reported by individuals is a reason to be skeptical of the trend in management employment based on CPS data. There is ample evidence in other contexts of social desirability bias in reporting in situations in which answers may reflect either positively or negatively on individual survey

[9] Similar edit checks were introduced for other occupations that should not be expected to appear in isolation, but it is the management edits that are most relevant to our analysis.

respondents (CITES TO BE ADDED). It seems likely that individuals responding to household surveys will have a tendency to exaggerate their occupational status and, in an economy that is increasingly white collar, plausible that the number of people reporting that they hold management jobs when in fact their tasks are more menial might have grown. It is less obvious how or why employer-reported occupational information should be subject to systematic bias. Further, the business press is replete with reports of corporate restructuring and management downsizing that seem consistent with the decline in management employment that we observe in the OES data (CITES TO BE ADDED). For these reasons, we are inclined to believe that the OES data paint a more accurate picture of recent trends in management employment.

Conclusions about the changing role of managers in today's labor market could be affected by the use of OES information in place of data from the CPS. Osterman (2005), for example, remarks on the fact that, despite years of restructuring and downsizing, the management share of employment has been stable or growing. At least over the period we have studied, however, the OES data tell a different story. The conclusions of sector-specific studies also could be affected by the use of employer-reported rather than individual-reported occupational information. Dietz and Orr (2006), for example, use CPS data to analyze the skill mix of occupations within manufacturing. They conclude that the manufacturing workforce has become substantially more skilled since the early 1980s and that much of the increase in skill level can be accounted for by growth in employment in managerial and professional specialty occupations. Our findings suggest that it would be worthwhile to re-examine the trends in the occupational composition of manufacturing employment using data from the OES.

This paper is still a work in progress. The industry and occupational concordances that we have used to construct data series that are comparable both across surveys and over time are central to the credibility of our findings. In future iterations, we will revisit these concordances in an effort to ensure that they are as good as they possibly can be. We also need to know more about the sensitivity of our findings to the precise method used to assign industry/occupational employment cells to wage level categories (including sensitivity to the years on which the assignment is based) and to the number of categories into which those cells are divided (e.g., dividing the employment distribution into quintiles rather than thirds).

In addition, we plan to extend the analysis in at least two important ways. First, we plan to exploit more fully the enormous amount of detail in the OES to develop a more disaggregated classification of industry/occupation employment cells. This will allow us to look more closely at exactly where in the wage distribution job growth has occurred. In addition, we will explore the feasibility of attaching job characteristic information to our data files, so that we can say something not only about growth in employment at different points of the wage distribution but also about the *characteristics* of the jobs in which growth has occurred.

Second, we plan to extend the analysis backwards in time. Although OES microdata like those we have analyzed for the 1996-2004 period are not available for

earlier years, the Occupational Employment Projections (OEP) program at BLS has produced an annual employment matrix based primarily on the OES that tracks the number of jobs in fairly detailed industry/occupation cells defined on a consistent basis over the 1983-1998 time period. Because industries were surveyed for the OES only once every three years prior to 1996, industry staffing patterns had to be interpolated in the years between surveys. In addition, occupational wage data were not collected in the OES prior to 1996. Nonetheless, the OEP employment matrix contains information we would like to exploit.

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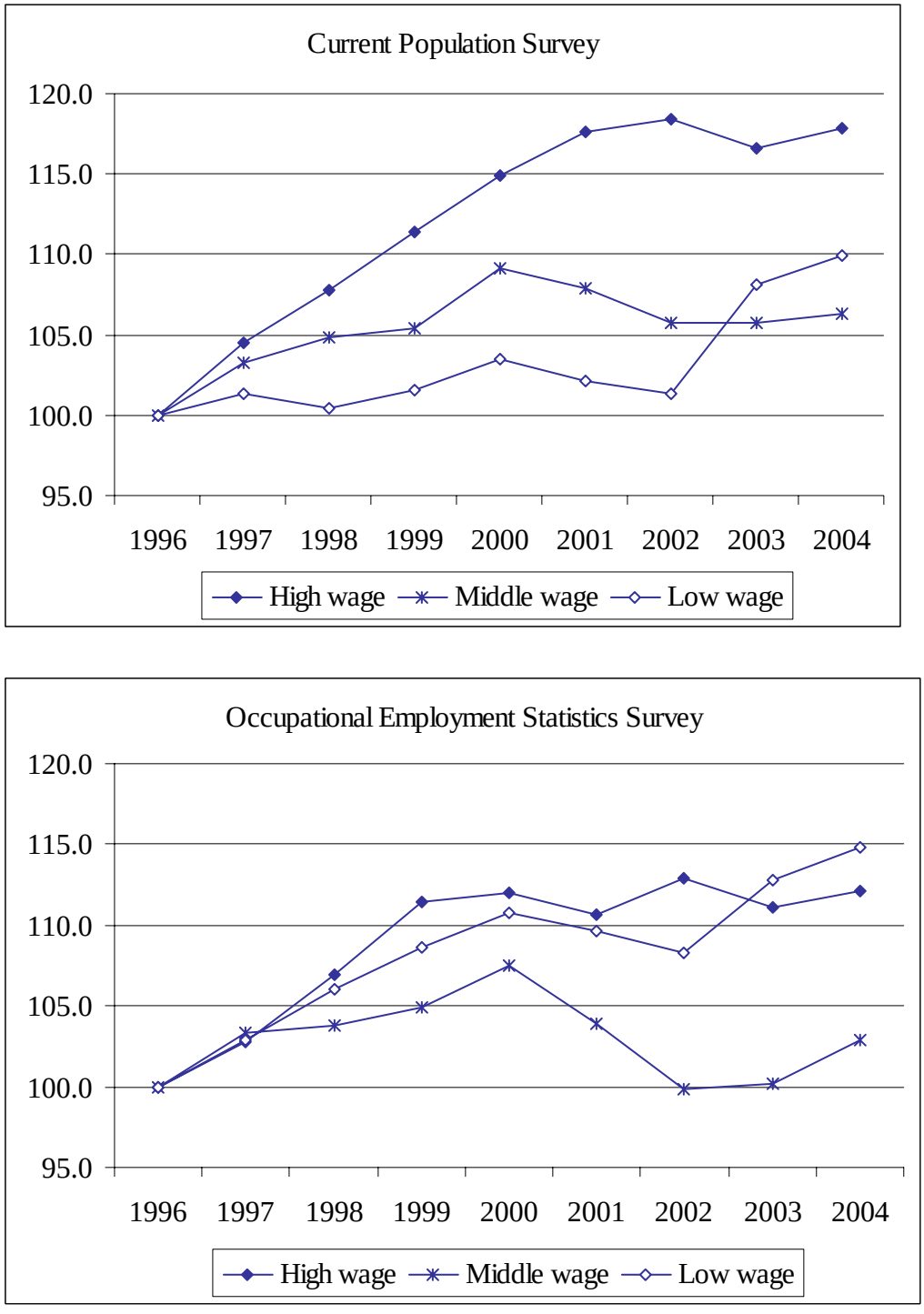
**Figure 1: Trend in Total Employment, Current Population Survey and Occupational Employment Statistics Survey, 1996 to 2004**

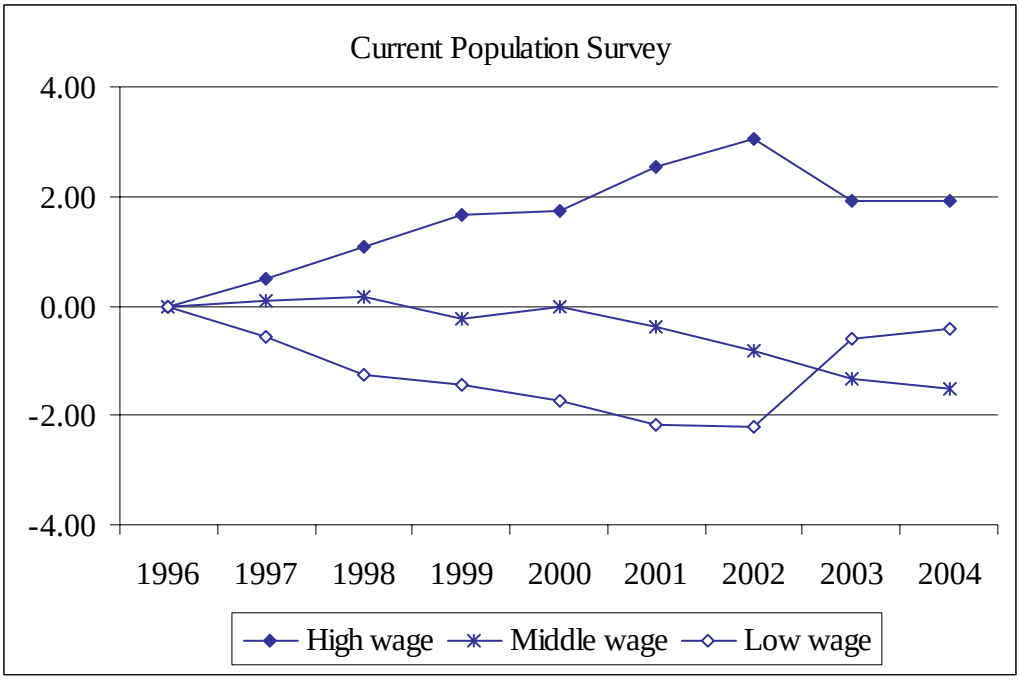

Source: Authors' calculations using survey microdata.

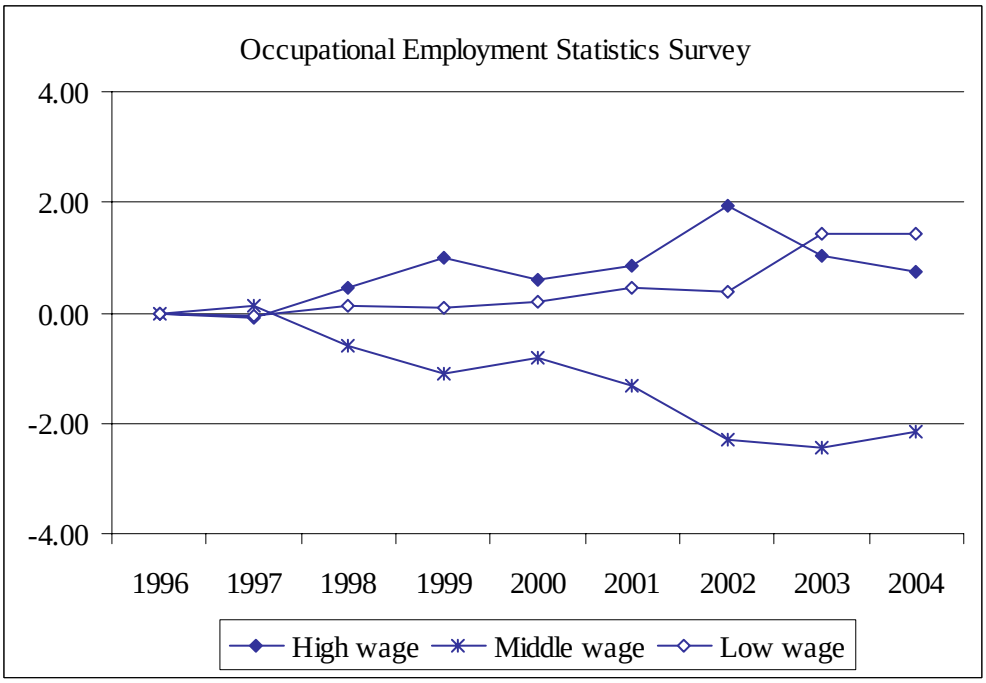
**Figure 2: Trends in the Number of Jobs by Wage Level Category, Current Population Survey and Occupational Employment Statistics Survey, 1996-2004 (1996=100)**




Source: Authors' calculations using survey microdata.

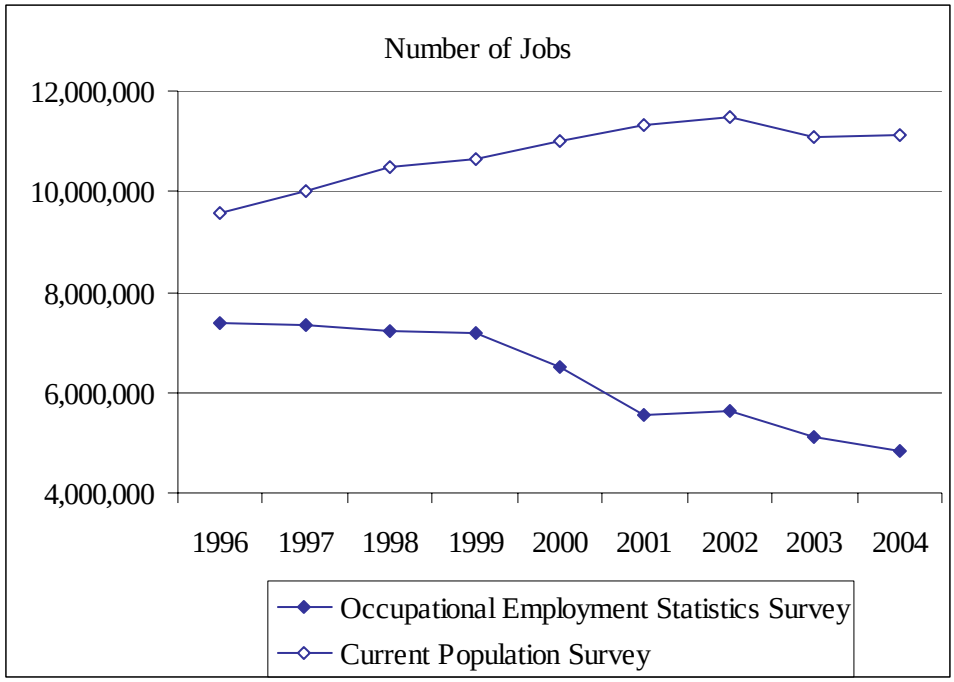
**Figure 3: Change in Employment Share by Wage Level Category, Current Population Survey and Occupational Employment Statistics Survey, 1996-2004 (cumulative change relative to 1996 share)**

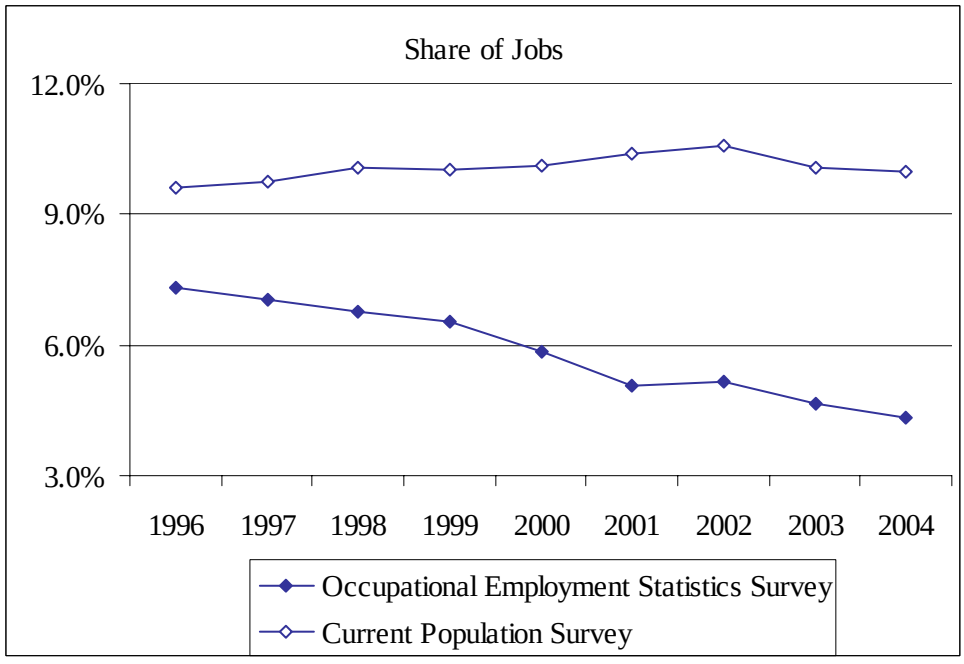



Source: Authors' calculations using survey microdata.

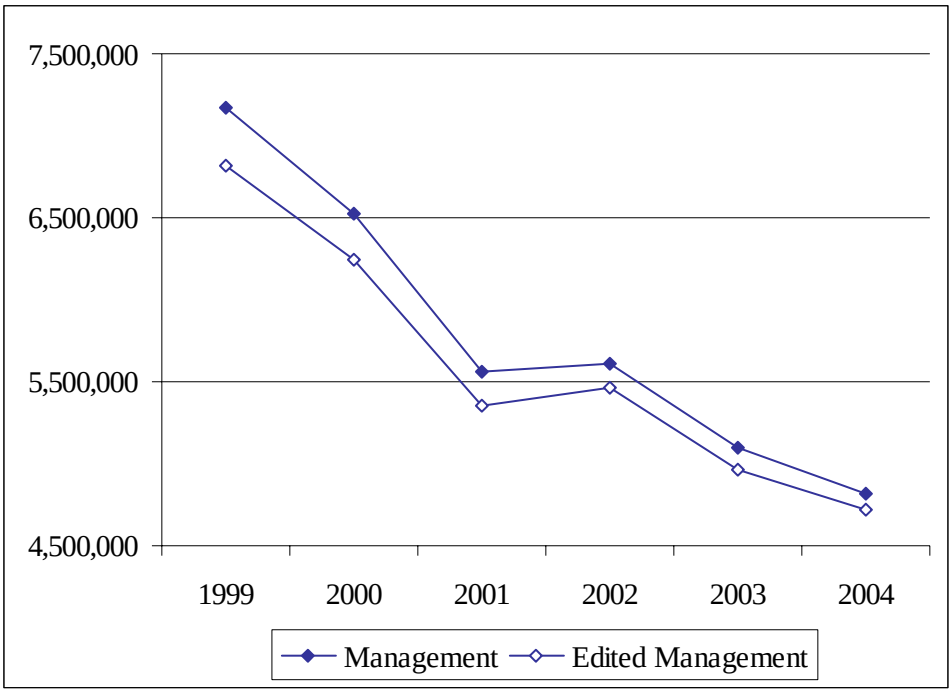
**Figure 4: Trend in Management Employment, Levels and Shares, Current Population Survey and Occupational Employment Statistics Survey, 1996-2004**




Source: Authors' calculations using survey microdata.

**Figure 5: Number of Management Jobs in the Occupational Employment Statistics Survey, With and Without Correction for Changes in Editing Rules, 1999 to 2004**




Source: Authors' calculations using survey microdata.

**Table 1: Published Occupational Distributions of 2004 Employment From the Current Population Survey (CPS) and the Occupational Employment Statistics (OES) Survey**

| Occupation | Number of Employed Persons from the Current Population Survey (CPS) | | Number of Jobs from the Occupational Employment Statistics (OES) Survey | |
|---|---|---|---|---|
| Management | 14,555 | 10.5% | 6,201 | 4.8% |
| Business and financial | 5,680 | 4.1% | 5,132 | 4.0% |
| Professional and related | 28,297 | 20.3% | 24,899 | 19.4% |
| Service | 22,720 | 16.3% | 24,185 | 18.9% |
| Sales and related | 15,983 | 11.5% | 13,508 | 10.5% |
| Office and administrative support | 19,481 | 14.0% | 22,649 | 17.7% |
| Farming, fishing, and forestry | 991 | 0.7% | 459 | 0.4% |
| Construction and extraction | 8522 | 6.1% | 6,170 | 4.8% |
| Installation, maintenance, and repair | 5069 | 3.6% | 5,215 | 4.1% |
| Production | 9462 | 6.8% | 10,128 | 7.9% |
| Transportation and material moving | 8491 | 6.1% | 9,581 | 7.5% |
| Total | 139,252 | | 128,127 | |

Note: The CPS figures shown are from Table 9 of Employment and Earnings and are household survey annual averages. The OES figures can be found at http://www.bls.gov/oes/2004/may/table1.pdf.

**Table 2: Occupational Distributions of 2004 Employment Calculated on a Comparable Basis using Current Population Survey (CPS) and Occupational Employment Statistics (OES) Survey Microdata**

| Occupation | Number of Jobs from the Current Population Survey (CPS) | | Number of Jobs from the Occupational Employment Statistics (OES) Survey | |
|---|---|---|---|---|
| Management | 11,109 | 10.0% | 4,817 | 4.3% |
| Business and financial | 4,496 | 4.0% | 4,638 | 4.2% |
| Professional and related | 19,045 | 17.1% | 17,719 | 16.0% |
| Service | 17,753 | 16.0% | 20,973 | 18.9% |
| Sales and related | 15,105 | 13.6% | 13,698 | 12.3% |
| Office and administrative support | 16,229 | 14.6% | 19,513 | 17.6% |
| Farming, fishing, and forestry | 0 | 0.0% | 0 | 0.0% |
| Construction and extraction | 5,972 | 5.4% | 5,402 | 4.9% |
| Installation, maintenance, and repair | 4,046 | 3.6% | 4,541 | 4.1% |
| Production | 12,741 | 11.5% | 15,132 | 13.6% |
| Transportation and material moving | 4,695 | 4.2% | 4,627 | 4.2% |
| Total | 111,191 | | 111,059 | |

Note: The figures for both surveys refer to jobs rather than people. They exclude the self-employed, agriculture jobs, private household jobs and government jobs. Details of the calculations are provided in the text.

| OCCUPATIONAL TITLE AND DESCRIPTION OF DUTIES | | NUMBER OF EMPLOYEES IN SELECTED WAGE RANGES (Report Part-time Workers According to an Hourly Rate) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J | K | L | T |
| | Hourly (part-time or full-time) | under $6.75 | $6.75 - 8.49 | $8.50 - 10.74 | $10.75 - 13.49 | $13.50 - 16.99 | $17.00 - 21.49 | $21.50 - 27.24 | $27.25 - 34.49 | $34.50 - 43.74 | $43.75 - 55.49 | $55.50 - 69.99 | $70.00 and over | Total Employment |
| | Annual (full-time only) | under $14,040 | $14,040 - 17,679 | $17,680 - 22,359 | $22,360 - 28,079 | $28,080 - 35,359 | $35,360 - 44,719 | $44,720 - 56,679 | $56,680 - 71,759 | $71,760 - 90,999 | $91,000 - 115,439 | $115,440 - 145,599 | $145,600 and over | |

## Management Occupations

**(Managers in this section have other managers/supervisors reporting to them.)**

| **Chief Executives -** Determine and formulate policies and provide the overall direction of companies or private and public sector organizations within the guidelines set up by a board of directors or similar governing body. **11-1011** | A | B | C | D | E | F | G | H | I | J | K | L | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| **General and Operations Managers -** Plan, direct, or coordinate the operations of companies or public and private sector organizations. Duties include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse in nature to be classified in any one functional area of management or administration. **11-1021** | A | B | C | D | E | F | G | H | I | J | K | L | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| **Marketing Managers -** Determine the demand for products and services offered by a firm and its competitors and identify potential customers. Develop pricing strategies with the goal of maximizing the firm's profits or share of the market. **11-2021** | A | B | C | D | E | F | G | H | I | J | K | L | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| **Computer and Information Systems Managers -** Plan, direct, or coordinate activities in such fields as electronic data processing, information systems, systems analysis, and computer programming. **11-3021** | A | B | C | D | E | F | G | H | I | J | K | L | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

**Appendix B: Our 19 Occupations**
(NOTE: DEFINITIONS TO BE PROVIDED IN NEXT DRAFT)

1 Management
2 Business and Financial Operations
3 Engineering
4 Life, Physical, and Social Science
5 Computer and Mathematical
6 Healthcare Practitioners and Technical
7 Other Professional and Technical
8 Sales and Related
9 Office and Administrative Support
10 Protective Service
11 Food Preparation and Serving Related
12 Building and Grounds Cleaning and Maintenance
13 All Other Services
14 Production Supervisors
15 Installation, Maintenance, and Repair
16 Construction and Extraction
17 Production
18 Transportation and Material Moving
19 Production Helpers

**Appendix C: Our 12 Industries**
(NOTE: DEFINITIONS TO BE PROVIDED IN NEXT DRAFT)

1 Mining
2 Trade, Transportation and Utilities
3 Construction
4 Manufacturing
5 Information
6 Finance and Real Estate
7 Professional and Business Services
8 Education Services
9 Health, Social Assistance
10 Arts, Entertainment, Recreation
11 Food, Lodging
12 Other Services