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Manufacturers' Outsourcing to Employment Services

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ABSTRACT

We estimate the effects of manufacturers' use of employment services—comprised primarily of temporary help and professional employer organizations—on measured employment and labor productivity in manufacturing between 1989 and 2004. A major contribution of the paper is the construction of panel data on employment by occupation and industry from the Occupational Employment Statistics program. We use these data to document the dramatic rise of production and other manual occupations within the employment services sector and, in conjunction with information from the Contingent Worker Supplements, to estimate the number of employment services workers assigned to manufacturing over the period. Although measured employment in manufacturing declined by 4.1 percent from 1989 to 2000, counting employment services workers assigned to manufacturing, employment in that sector actually rose by an estimated 1.4 percent. Factoring in manufacturers' use of employment services workers does not erase the large declines in manufacturing employment since 2000, but a growing share of manufacturing work in the United States is being performed by employees of staffing agencies. In 2004, employment services workers added an estimated 8.7 percent to direct-hire manufacturing employment, compared to just 2.3 percent in 1989. In addition, we estimate that manufacturers' outsourcing to employment services significantly inflated manufacturing labor productivity measures, accounting for 0.5 percentage points of the annual growth rate from 1989 to 2000 and from 2001 to 2004. Although multifactor productivity measures should adjust for such outsourcing, available evidence suggests that KLEMS, the multifactor productivity measure for manufacturing, does not fully capture the relatively large effects that outsourcing to staffing services has on manufacturing productivity.

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JEL Classification Codes: J24, J40, D24

The decline of manufacturing employment represents one of the most fundamental—and many believe worrisome—changes to the U.S. economy in recent years. The decade of the 1990s was a period marked by high trend job growth in the economy overall. Yet, manufacturing employment actually fell: from 1989 to 2000, while aggregate employment grew by 22 percent, manufacturing employment dropped by 4 percent. Since 2000, the decline has been precipitous. From 2000 to 2005 the manufacturing sector lost 2.2 million jobs, or about 13 percent of its 2000 employment base of 17.3 million.

The decline of manufacturing jobs has been widely attributed to new technology, competition from foreign companies, and the offshoring of production and service jobs by U.S. manufacturers. Another, less discussed factor is outsourcing to domestic contractors. When, for example, a U.S. manufacturer outsources janitorial work to a contract cleaning company, packing and shipping to a transportation company, information technology (IT) to a computer services company, and clerical and production work to a staffing agency, manufacturing employment declines in official statistics, but the occupational structure of employment in the economy may not change. Quantifying such domestic outsourcing is important for understanding the true nature of structural changes in employment in the economy. Documenting the extent to which industries outsource various jobs is a prerequisite for understanding why companies outsource and the practice's implications for workers.

We present new estimates of an important component of outsourcing by manufacturers: outsourcing to staffing services, or what is termed employment services in government statistics.¹ Employment services is composed primarily of temporary help agencies and professional employer organizations (PEOs), which assign workers to client organizations. In documenting manufacturers' outsourcing to employment services, we obtain a more accurate picture of the employment levels and employment trends in manufacturing over the 15-year period from 1989 to 2004. Our analysis also highlights the occupational shift that has occurred in employment services, the role employment services

¹ We use “employment services,” the term in government statistics, and “staffing services,” the term more commonly used in the business literature, interchangeably in this paper.

played in the adjustment of employment during the most recent recession, and the implications that outsourcing to employment services has for productivity measurement in manufacturing.

A major contribution of our paper is the development of a longitudinal data set from the Occupational Employment Statistics (OES) program, with information on employment by occupation and industry. We first use this data set to examine the shift in the occupational composition of employment within industries, including the employment services sector. Our data provide a detailed and updated picture of the shift in the composition of employment within staffing services away from office and clerical occupations and toward production and other manual occupations, a trend first noted by Segal and Sullivan (1997). Based on our estimates, the share of employment services workers in blue-collar occupations rose from 28 percent in 1989 to 48 percent in 2004.

The shift in the occupational composition of employment within employment services mirrored the growing share of workers in blue-collar occupations economy-wide who were employed in that sector. For instance, the share of all production workers who were employed in the staffing sector rose from less than 1 percent in 1989 to almost 6 percent by 2000. The rise in the share of low-skilled manual workers employed in the staffing sector has been even more dramatic: The share of helpers, laborers, and hand material movers employed in the staffing sector increased from about 6 percent in 1989 to 16 percent in 2000 and to 18 percent in 2004.

The rapid growth of production and low-skilled manual workers in the staffing sector, coupled with stagnant or declining employment in manufacturing, caused much speculation in the business press and among researchers that manufacturers were largely responsible for the employment surge in the staffing sector. Studies conducted in the late 1990s by Segal and Sullivan (1997) and Estavão and Lach (1999a,b) attempted to quantify that phenomenon but were hampered by the absence of good data on the characteristics of jobs in staffing agencies and in the industries to which staffing agency employees were assigned.

Drawing on our longitudinal industry by occupation employment data in conjunction with information in the Contingent Worker Supplements (CWS) to the Current Population Survey (CPS) on

the industry to which temporary help workers are assigned, we develop better estimates of manufacturers' use of employment services than were possible with the data used in previous studies. We estimate that whereas the staffing industry added 2.3 percent to manufacturing employment in 1989, it increased manufacturing employment by 8.7 percent in 2004. Although measured employment in manufacturing shrank by 4.1 percent from 1989 to 2000, including staffing workers who are assigned to manufacturing and who typically work alongside regular manufacturing employees, employment in the manufacturing sector actually rose by an estimated 1.4 percent over that period. Accounting for staffing industry employment does not erase the dramatic decline in manufacturing employment since 2000, but our analysis shows that a growing share of manufacturing work in the United States is performed by workers employed in the staffing sector.

In addition to having important implications for employment measurement, outsourcing to staffing services significantly affects labor productivity measurement in manufacturing. Outsourcing will distort simple labor productivity measures—defined as manufacturing output divided by manufacturing employment—if tasks are contracted out to workers who are employed in another sector, because labor supplied by the contract sector is not counted in the denominator of the labor productivity measures. We estimate that contracting out to the staffing industry accounted for 0.5 percentage points of the annual growth rate of output per person in manufacturing from 1989 to 2000, or about 14 percent of the growth. From 2000 to 2001 staffing agency workers bore a disproportionate share of employment reductions in manufacturing, and failure to account for these reductions depressed the measure of labor productivity in manufacturing by 1.2 percentage points. Outsourcing to staffing services expanded again from 2001 to 2004 and accounted for a half-percentage point of the annual growth rate of manufacturing labor productivity over the period. Although multifactor productivity measures should account for such outsourcing, available evidence suggests that KLEMS, the multifactor productivity measure for manufacturing, does not fully capture the relatively large effects that outsourcing to staffing services has on labor productivity.

CONTRACTING OUT TO EMPLOYMENT SERVICES

Companies decide what functions to perform in-house—that is, with company employees—and what to contract out or outsource—that is, with workers who are not employees. Commonly outsourced functions include legal, accounting, janitorial services, cafeteria services, shipping and handling, and IT services. Over time, companies may change the mix of tasks performed in-house and contracted out. Evidence suggests that there has been substantial growth in contracting out, especially of business services, since the 1980s (Abraham 1990; Abraham and Taylor 1996; Houseman 2001; ten Raa and Wolff 2001).

This paper focuses on the special case of outsourcing to employment services, the component of business services that has grown most rapidly over the past couple of decades. The employment services sector is comprised of three industries—1) temporary help services, 2) professional employer organizations (PEOs), and 3) employment agencies—which accounted for 71 percent, 21 percent, and 8 percent, respectively, of employment in the sector in 2005. Temporary help agencies assign workers to clients on a temporary basis, though the assignment can vary considerably in length. Clients may utilize temporary agency workers for work that is truly temporary in nature (e.g., seasonal work or special projects) or to screen workers for permanent positions (Abraham 1990; Autor 2001; Autor 2003; Houseman 2001; Houseman, Kalleberg, and Erickcek 2003; Kalleberg, Reynolds, and Marsden 2003). Use of temporary help agencies to meet long-term staffing needs sometimes has been termed “perma-temping.” PEOs lease employees back to the client company. PEOs handle payroll, benefits, and government compliance issues for the company, and hence represent the full outsourcing of an organization’s human resources function. Employment agencies, often known as headhunters, assist in matching employers and workers.

Except in employment agencies, which account for a small minority of employment in the sector, almost all employees in the employment services sector are assigned to a client organization where they

perform work.² Unlike most other types of contract company workers, staffing agency workers typically work under the supervision of the client organization's management and often are employed in the client's core functions. Thus, in sectors where use of staffing services is high, it is important to take their use into account to obtain an accurate picture of employment levels and trends.

THE DIFFICULTY OF MEASURING MANUFACTURERS' USE OF EMPLOYMENT SERVICES

Although it is important to understand where employees of staffing agencies perform work, this information is difficult to glean from existing data. The Current Employment Statistics (CES) program, which is the BLS's monthly establishment survey, and the Current Population Survey (CPS) program, which is the BLS's monthly household survey, provide independent estimates of employment in the employment services sector, but neither has information on the industry to which employment services workers are assigned. The monthly CPS does have information on workers' occupations, which is helpful for inferring industry of assignment for employment services. However, the number of employment services workers included in any month's sample is small, and more importantly, CPS estimates, which have been systematically lower than the CES estimates, are considered less reliable than the CES figures.³

The Contingent Worker Supplements (CWS) to the CPS, which have been conducted five times since 1995, partly fill this information gap. Respondents in the CWS were asked if they were paid by a temporary help agency, even if they did not report working for a temporary help agency earlier in the

² Administrative staff comprise just 3 percent of workers in other types of staffing agencies (BLS 1988). Workers who use employment agencies to find permanent jobs typically do not form a contractual employment relationship with the agency, and hence would not be counted as an employment agency employee in government data. Below, we note that there are many exceptions to this general rule and that it is impossible to break out employment agency employment from other employment services employment in the early years of our data. Using data from later years, we show that excluding employment agency employment from our calculations has no substantive effect on our reported estimates.

³ Confusion among household respondents working for temporary help agencies or PEOs about who their actual employer is likely contributes to the difference. For instance, in the Contingent Worker Supplements to the CPS which have been conducted periodically since 1995, about half of individuals identified as being paid by a temporary help agency in the supplement reported the client company as their employer in the main survey (Polivka 1996).

survey. Those identifying themselves as being paid by a temporary help agency were asked for information on the company to which they were assigned.

The CWS suffers from several drawbacks as an information source on workers in the employment services sector, however. No information was collected on individuals working for PEOs, and the sample sizes on those reporting that they worked for temporary help agencies is small in each wave, making it difficult to draw statistically valid inferences from individual CWS samples. Additionally, in spite of questions designed to increase reporting accuracy, the number of temporary agency workers is still significantly lower in the CWS waves than in the CES.⁴

Input-output benchmark tables generated by the Bureau of Economic Analysis (BEA) provide alternative estimates of manufacturing's use of staffing services. Specifically, BEA I-O tables estimate the fraction of the staffing services commodity used by the manufacturing industry. If the wages of workers assigned to various industries do not systematically vary, this fraction, which is measured in real value terms, is also an estimate of the labor input from the staffing industry used by manufacturers. The BEA's imputation of the staffing services commodity to manufacturing is based on indirect and very limited evidence, however, and the BEA's estimates of manufacturers' use of staffing services in the 1992 and 1997 benchmark tables are at odds with point estimates and trend information contained in several other government surveys.⁵

Despite these data shortcomings, several studies conducted in the late 1990s endeavored to estimate manufacturers' use of staffing services and the practice's evolution over time. Segal and Sullivan (1997) used data on industry of assignment for temporary agency workers from the 1995 CWS to compute what they termed "rough" estimates of the number of staffing services workers—temporary

⁴ One reason for the discrepancy is that the CES captures all jobs, whereas the CWS only asks individuals about their main job. This difference between the surveys, however, cannot explain all of the discrepancy (Polivka 1996). A new supplement to the CES scheduled to be implemented in 2007 will provide data on the number of temporary agency workers and leased workers the establishment uses, although neither information on the temporary agency and leased workers' occupations nor retrospective information on establishments' use of these arrangements in previous years will be provided in the supplement.

⁵ The shortcomings of the input-output benchmark estimates for the employment services commodity is discussed more thoroughly below and in Houseman (2006).

help and PEO workers—assigned to manufacturing in 1991 and 1995. Their calculation assumed that the fraction of PEO workers assigned to manufacturing was the same as the fraction of temporary agency workers and that manufacturing’s share of staffing services workers had not changed over this time period.

Estavão and Lach (1999a,b) sought to extend and improve upon the Segal and Sullivan estimates of manufacturers’ use of staffing services. Using various pieces of direct and indirect evidence on the industry of assignment of staffing workers from the BEA input-output benchmark tables, the March Income Supplements to the CPS, and the 1995 and 1997 CWS to the CPS, they generated several estimates of the number of staffing workers in manufacturing from 1972 to 1997. Although Estavão and Lach’s approaches to imputing staffing services to manufacturing were creative, their efforts to generate plausible and precise estimates of manufacturers’ use of staffing services were severely hampered by the limitations of the data. Their point estimates were sometimes implausible, were associated with large bounds, and contained large discontinuities in the time series.⁶

OUR APPROACH

We develop a simple, transparent methodology for imputing employment services workers to the manufacturing sector that overcomes key problems inherent in earlier attempts. Our main innovation is the development of a panel data set from the Occupational Employment Statistics (OES) program—a large, nationally representative establishment survey—on employment by occupation by industry over the 1989-to-2004 period. One of the industries in the panel is employment services. We estimate the number

⁶ Some of Estavão and Lach’s estimates were based on individual CPS and CWS surveys in which the number of staffing workers is extremely small and the incidence of temp agency work is underreported. Their preferred estimates relied on a combination of BEA input-output data and direct estimates from the CWS to obtain a measure over time of the proportion of temporary help agency workers assigned to manufacturing. In addition to issues with the small sample size of the CWS, combining imputations based on BEA input-out data with imputations based on the CWS led to large discontinuities in the share of staffing services workers imputed to manufacturing. These large discontinuities between the CWS based estimates and the input-output estimates probably arose because of problems with BEA estimates of manufacturers’ use of staffing services, discussed below.

of Employment Service workers within each occupation who are assigned to manufacturing based on industry assignment probabilities from the five waves of the CWS. Each of these steps—the construction of a panel data set from the OES and the imputation of the resulting occupational employment estimates for employment services to manufacturing—is detailed below.

Constructing a Panel Data Set from the OES

The OES program, which is operated by the Bureau of Labor Statistics (BLS), generates employment and wage estimates by detailed occupation. The OES program currently surveys approximately 200,000 establishments semiannually (in May and November) and collects wage and employment information for each occupation employed by the establishment. By collecting payroll information for a large number of establishments, the OES program allows precise estimation of industry-occupation employment levels at the national level.

Although the OES program has operated in its current form since 1988, thereby allowing for an extensive time series analysis, the program has undergone several changes that pose significant challenges to the construction of a consistent industry-occupation employment time series. The OES underwent a redesign of its sampling scheme in 1996, a change in its occupational coding scheme in 1999, and a change in its industry coding scheme in 2002. A necessary result of the coding changes is that some of the industry and occupation detail that is a great strength of the cross-sectional data must be suppressed in the time series data. With this fact in mind, we are able to estimate employment levels for 18 major occupation groups and 16 major industry sectors from 1989 to 2004.⁷ In this paper, we utilize occupation data for only two sectors: employment services and manufacturing. Below, we describe our procedures for estimating employment by industry and occupation with the pre- and post-1996 OES data.

⁷ Appendix tables detailing the crosswalks used in constructing the 18 occupation categories and 16 industry sectors are available from the authors.

Data before 1996

Prior to 1996, the OES program collected occupational employment data for selected industries in one year of a three-year survey cycle. For example, manufacturing establishments were surveyed in 1989, 1992, and 1995, while establishments in the service sector, including employment services, were surveyed in 1990 and 1993. These data were designed to yield accurate, periodic estimates of staffing patterns within industries but were not specifically designed to yield comparisons of the occupational structure across industries. To examine changes in occupational structure over time in the pre-1996 period, we combine three years of OES data and assume that the occupational distribution of employment within an industry remains constant over a three-year period. For example, we combine OES data from 1988 to 1990 to estimate the occupational distribution of employment for each industry in 1989, we combine OES data from 1989 to 1991 to estimate the occupational distribution of employment for each industry in 1990, and so forth. For any particular year, the estimates of the occupational distribution of employment within an industry will be based on an OES survey of the industry that was conducted in that year, in the previous year, or in the following year. Because we use these early OES data primarily to examine trends in the occupational distribution of employment across industries over long (10-to-15 year) time horizons, the assumption inherent in our data construction for these early years should not unduly affect our results.

To construct estimates of industry-occupation employment in any given year from 1989 to 1995, we benchmark the OES data to each sector's employment levels as measured in the CES in the specified year. During this period, the OES was conducted once a year in November, and hence we use November CES industry employment estimates that have not been seasonally adjusted for the benchmarking.⁸ To generate estimates of the number of employees in a specific occupation within an industry in a particular year, we multiply the industry total employment in that year, as measured by the CES, by the share of

⁸ Benchmarking to the CES helps minimize sampling error that is inherent in the random component of the OES sample design. In addition, such benchmarking is necessary for the years from 1989 to 1995 because the OES data were not collected for each industry in each year.

employment in that occupation, as measured in the OES. More formally, we estimate employment in occupation group i and sector j in year t (where t runs from 1989 to 1995), \hat{E}_{ijt} , according to the equation

$$(1) \quad \hat{E}_{ijt} = E_{jt}^c \times \left(\frac{E_{ijs}^o}{E_{js}^o} \right),$$

where $s \in \{t-1, t, t+1\}$; E_{jt}^c is CES employment in sector j and year t ; E_{ijs}^o is the employment level in occupation group i and sector j in year s reported by the OES program; and $E_{js}^o = \sum_i E_{ijs}^o$ represents OES

employment in sector j in year s . Therefore, $\left(\frac{E_{ijs}^o}{E_{js}^o} \right)$ is the share of employment in occupation i in sector j

in year s as measured in the OES data, which we assume not to vary significantly in the short run. In this way, we generate estimates of employment by occupation for each sector in each year, for the purpose of examining shifts in the pattern of occupational employment across industries over relatively long time horizons.

Data from 1996 forward

Beginning in 1996, the OES program adopted a three-year sampling scheme that allows the estimation of employment and wage levels for narrowly defined geographic regions, industries, and occupations. Over a three-year period, the OES samples and contacts approximately 1.2 million establishments (about 400,000 establishments per year), with each industry surveyed in every year. Although the OES has been designed to produce estimates using the full three years of the sample, we only produce national estimates at a fairly aggregated occupation and industry level, and thus, for our purposes, we can use a single year of data from the OES.⁹ Specifically, for the years 1996 to 2004 we estimate employment by occupation by sector according to the following formula:

⁹ When generating employment estimates at the national level for fairly aggregated industry and occupation categories, as we do, use of data from a single year has some advantages over combining data from three years. The annual sample sizes are sufficient to generate fairly precise estimates within broad industry and occupation

$$(2) \quad \hat{E}_{ijt} = E_{jt}^c \times \left(\frac{E_{ijt}^o}{E_{jt}^o} \right) .$$

As for the years prior to 1996, we benchmark all sector employment numbers to the not seasonally adjusted November employment figures in the CES.¹⁰ The only conceptual difference between our industry-by-occupation employment estimates beginning in 1996 and estimates constructed for the pre-1996 period is that the occupational share of employment within each sector always comes from OES data collected for the same year. The change in the sample design of the OES allows us to examine year-to-year shifts in the occupational distribution of employment across sectors for more recent years. Of particular interest, we can examine the role staffing services played in adjusting employment in various occupational categories during the recent downturn and recovery. For the 1996-to-2004 period we have access to the establishment-level OES data, and we compute standard errors for our industry-occupation employment estimates in these years using standard jackknife methods, as described in the appendix.

Imputing Employment Services Workers to Manufacturing

Our panel data includes information on employment for 18 occupations in the employment services sector over the 1989-to-2004 period. Our next step is to impute the number of employment services workers assigned to manufacturing within each occupation for each year. The only direct evidence about industry of assignment comes from the CWS. We pool data on industry of assignment of temporary agency workers in the five waves of the CWS, using supplement weights, to generate estimates of the probability that an employment services worker in a particular occupation is assigned to

categories, and for cyclically sensitive and dynamic industries, like employment services, the occupational distributions can significantly change over a three-year period.

¹⁰ In 2003 the OES shifted from an annual survey of approximately 400,000 establishments conducted in November to a semiannual survey of approximately 200,000 establishments conducted in May and November. We combine May and November OES samples to compute occupation shares within sectors, and, for comparability to the earlier years, we continue to benchmark sector employment totals to the not seasonally adjusted November CES figures.

manufacturing.¹¹ Specifically, we estimate the number of employment services workers assigned to manufacturing as follows:

$$(3) \quad \hat{M}_t = \sum_i P_i \hat{E}_{it}^H, \quad ,$$

where M_t is the number of employment services workers assigned to manufacturing in year t ; P_i is the probability that an employment services worker in occupation i is assigned to manufacturing, computed from the five waves of the CWS; and E_{it}^H is the number of employment services workers in occupation i in year t , as estimated in Equation (2). We also compute standard errors for the estimated number of employment services workers assigned to manufacturing for the years 1996 to 2004 using jackknife methods, as described in the appendix.

In pooling data on industry of assignment of temporary agency workers from the five waves of the CWS to construct these assignment probabilities, we make several assumptions. First, we assume that within each occupational category the probability that temporary agency workers—who compose the large majority of workers in the employment services sector—are assigned to manufacturing is the same as that for workers in other employment services industries, notably PEOs. For instance, we assume that the probability that a PEO production worker is assigned to manufacturing is the same as the probability that a temporary agency production worker is assigned to manufacturing. At this time, no information exists on outsourcing to PEOs by industry.¹² Arguably, employees of employment placement agencies, though small in number, should not be included in our estimates. However, we cannot separate employment agency employees from other employment services employees in the early years of our data. Below, we show that excluding employment agency employees from our calculations in the later years has virtually no impact on our imputations of employment services workers to manufacturing. We also

¹¹ These estimates of industry of assignment are based on NAICS industry codes. Because CWS data prior to 2003 were coded using the SIC system, we develop a crosswalk to convert SIC codes to NAICS codes.

¹² Some case study evidence suggests that outsourcing to PEOs by manufacturers is higher than average, which, among other things, prompted new a CES supplement that is scheduled to collect information on PEO use beginning in 2008. Previous estimates by Segal and Sullivan (1997) and by Estavão and Lach (1999a,b) also assume that the industry-of-assignment probabilities of PEO workers is the same as that of temporary agency workers.

show that our results are qualitatively similar when we base our imputations solely on temporary agency workers, which can be distinguished from other types of employment services workers beginning in 1999.

Second, we assume that within occupations, the probability that an employment services worker is assigned to manufacturing does not change over time. This assumption does not imply that the probability that an employment services worker is assigned to manufacturing is fixed. However, changes in that probability arise entirely from changes in the occupational distribution of employment services workers—and hence the probability that an employment services worker is in a particular occupation—not from changes in the probability that a worker is assigned to manufacturing given that worker's occupation. Three occupations—1) production, 2) laborer and helper, and 3) office and administrative support—account for over 60 percent of all employment services workers and over 75 percent of the employment services workers assigned to manufacturing, according to estimates presented below. Formal tests support our assumption that the probability a that temporary agency worker in each of these key occupations is assigned to manufacturing is constant, at least over the 1995-to-2005 period covered by the CWS Supplements.¹³

The CPS and CWS are believed to undercount temporary agency workers, and previous estimates (Segal and Sullivan 1997; Estavão and Lach 1999a,b) assumed that workers represented in the CWS were an unbiased sample of all temporary agency workers. Because we use data on employment by occupation for the employment services sector that are generated from the OES, we need only make the less restrictive assumption that, conditional on their occupation, temporary agency workers in the CWS are representative of all temporary agency workers in terms of the industry to which they are assigned. For

¹³ We pool samples of temporary agency workers in a particular occupation category for the five waves of the CWS, and, using dummy variables representing the CWS waves as explanatory variables, estimate a linear probability model of the probability that the temporary help worker in that occupation will be assigned to manufacturing. The *P*-value in the *F*-test of the joint significance of the wave dummy variables was 0.14 for office and administrative workers; 0.09 for production workers; and 0.65 for laborers, helpers, and material movers. The marginally significant estimate for production workers is due entirely to the 2001 CWS, in which the fraction of production workers reporting being assigned to manufacturing was relatively low, a fact consistent with temporary help production workers bearing a disproportionate share of adjustment of core manufacturing jobs during the recent recession. The fraction of temporary help production workers who reported being assigned to manufacturing was the highest in the most recent 2005 CWS wave. Consequently, if there was a decline in the fraction of temporary agency production workers being assigned to manufacturing during the recession, it appears to have been temporary.

instance, while temporary agency helpers and laborers appear to be underrepresented, even relative to other occupations, in the CWS, we assume that the temporary agency helpers and laborers who are surveyed are neither more nor less likely to be assigned to manufacturing clients than is the case in the general population of temporary agency helpers and laborers.

OCCUPATIONAL TRENDS WITHIN EMPLOYMENT SERVICES

Employment services represented just 1.3 percent of aggregate employment in 1989. From 1989 to 2000, employment services expanded its share of total employment to 3.0 percent and accounted for over 10 percent of net employment growth in the economy. Just as employment services accounted for much of the growth in aggregate employment during the 1990s, it represented a disproportionate share of employment reduction in the recession that began in 2001. From November 2000 to November 2001, employment in the employment services sector dropped by 17 percent, and although it expanded in the subsequent years, it did not recover to its 2000 employment level until 2005.¹⁴

The panel data we have constructed from the OES permit a detailed picture of the occupations that drove the sharp growth of employment services in the 1990s and the subsequent drop in 2001. The first set of columns in Table 1 shows the share of employment in the employment services sector in each of the 18 occupational categories in selected years. The second set of columns shows the growth rate of employment in employment services over varying time periods and the share of that growth that is accounted for by each occupation.

Note that just three occupations—1) office and administrative support, 2) production, and 3) helpers, laborers, and hand material movers—together accounted for 60 to 65 percent of all employment services workers throughout the 1989-to-2004 period. However, the relative importance of these occupational categories changed. In 1989, 41.8 percent of all employment services workers were in

¹⁴ These figures are based on CES data.

office and administrative support occupations, but the growth of employment in manual occupations greatly outpaced the growth in office and administrative support occupations, and by 2000 the employment share of office and administrative support within employment services had fallen to 29.9 percent. The share of employment services workers in less skilled manual occupations—helpers, laborers, and hand material movers—grew from 16.0 percent in 1989 to 18.0 percent in 2000. However, the most dramatic growth occurred in production occupations: The share in production occupations increased from 6.3 percent to 14.8 percent between 1989 and 2000, and production occupations accounted for almost a fourth of all of the industry’s employment growth during that period. By 2000, almost as many employment services workers were employed in production occupations as in the less skilled occupational category helpers, laborers, and material movers.

During the last recession, office and administrative support workers and production workers absorbed most of the losses in employment services. The sharp decline in office and administrative workers actually began in 2000, and at least some of the decline seems to be related to the termination of projects involving the transition of computer programs at the start of the new millennium.¹⁵ The drop in the number of workers in office and administrative support occupations continued through 2004 and appears to be part of a trend decline in employment in these occupations economywide. The number of production workers in employment services declined sharply from 2000 to 2002, but by 2004 production employment in employment services had recovered about half of its losses. The number of helpers, laborers, and material movers continued to expand throughout the recession.

Segal and Sullivan (1997) first documented a shift in the composition of workers in this sector away from clerical occupations and toward blue-collar occupations using CPS data. As illustrated in Figure 1, in which we aggregate several manual occupations into a single blue-collar category, our data

¹⁵ Employment services employment in office and administrative support occupations spiked in 1999 and fell dramatically in subsequent years. An examination of this spike in the microdata reveals that most of the increase and subsequent decline was in data entry occupations, and thus we infer that this spike was related to the Year 2000 (Y2K) transition.

reveal that this trend continues to the present.¹⁶ Between 1989 and 2004 the relative importance of office and administrative support occupations and blue-collar occupations within employment services reversed. In 1989, office and administrative support workers comprised 42 percent of those in employment services, while blue-collar workers made up just 28 percent. By 2004, blue-collar workers accounted for 48 percent of all those in employment services, while office and administrative support workers accounted for just 24 percent.

Although the employment services sector constitutes a relatively small share of overall employment, its rapid growth in the 1990s and contraction during the most recent recession is indicative of the significant role it plays in aggregate employment changes. Moreover, the fact that changes in the number of workers employed in employment services have been concentrated in specific occupations suggests that this sector plays a particularly important role in certain segments of the economy. Table 2 sheds some light on this role. The top panel of Table 2 displays the employment services and manufacturing sectors' shares of employment for the aggregate economy and for selected occupations in selected years. The bottom panel shows the growth rate of aggregate employment and the economywide growth rate of employment in selected occupations over the 1989-to-2000 and the 1989-to-2004 periods. It also shows the share of the growth within a particular occupation accounted for by employment services and manufacturing.

Although office and administrative support occupations declined in relative importance within employment services, the employment services sector still accounted for a disproportionate share of the aggregate employment growth in that occupational category over the period. The share of office and administrative support workers employed in employment services grew from 2.8 percent in 1989 to 5.0 percent in 2000, before declining to 3.7 percent in 2004.¹⁷ From 1989 to 2000, over 30 percent of the

¹⁶ The occupations that we classify as blue collar are the following: supervisors of production, construction, and maintenance workers; installation, maintenance, and repair; construction and extraction; production; transportation and material moving; and helpers, laborers, and hand material movers.

¹⁷ Actually, the share all office and administrative support workers in employment services peaked at 6.0 percent in 1999, probably reflecting the use of employment services workers for special projects in connection with the Y2K transition.

growth of workers in office and administrative support occupations occurred in the employment services sector.

The role of employment services in changes in production and helper, laborer, and material mover occupations was far more prominent. In 1989 less than 1 percent of all production workers economywide were employed in employment services. By 2000, employment services accounted for 5.9 percent of all production workers and for 79 percent of the growth of production workers economywide from 1989 to 2000. Employment services production workers bore a disproportionate share of the decline in production employment during the recession, but, whereas employment in production occupations in the aggregate continued to decline following the end of the recession, employment of production workers within the employment services sector began to recover in 2003.

Employment services already accounted for a sizable share—6.3 percent—of all helpers, laborers, and hand material movers in 1989, but that share swelled to 15.8 percent by 2000. While the total number of helpers, laborers, and hand material movers declined slightly from 2000 to 2004 economywide, employment services continued to register strong growth in those occupations. By 2004, employment services accounted for 17.6 percent of all workers in these low-skilled manual occupations.

Although the CES and our estimates suggest that the share of workers in employment services was somewhat lower overall and in selected occupations in 2004 than in 2000, these estimates somewhat understate the importance of employment services in the economy in recent years because of changes in the treatment of PEO workers by the Quarterly Census of Employment and Wages (QCEW).¹⁸ Specifically, several states began implementing changes in their collection of employment data in the QCEW so that PEO workers assigned to clients would be recorded in the clients' industries rather than in the PEO industry. Changes to the QCEW influence our estimates because the QCEW serves as the sampling frame for both the OES and the CES, and both surveys benchmark their estimates of employment to the QCEW. These changes have been limited to a minority of states, and in those states that have changed their data collection procedures regarding PEOs, implementation appears to have been

¹⁸ The QCEW was formerly known as the 202 data.

slow and uneven. Thus, while the potential effect on our estimates should be noted, we believe that any effect on the time series for PEO employment or for all employment services employment that results from changes to the QCEW is relatively small prior to 2005.¹⁹

MANUFACTURERS' OUTSOURCING TO EMPLOYMENT SERVICES

Following a period of recovery after the recession of the early 1990s, employment in manufacturing gradually declined from 1998 to 2000. This decline occurred at a time when aggregate employment was rising sharply and employment in production and low-skilled manual occupations was increasing rapidly in employment services. Over the 1989-to-2000 period, manufacturing employment fell by 4 percent, compared to a 22 percent rise in non-farm payroll employment. Reflecting the different employment trends in manufacturing and the aggregate economy between 1989 and 2000, manufacturing's share of aggregate employment fell from 16.3 to 12.9 percent, its share of production workers declined from 76.6 to 71.0 percent, and its share of helpers, laborers, and material movers dropped from 35.0 to 26.2 percent.

The decline in manufacturing's share of workers in these occupations parallels the rise in employment services' share of workers in these occupations. Anecdotal evidence, along with evidence presented by Segal and Sullivan (1997) on the change in the occupational composition of staffing services workers, caused many to speculate that manufacturing was simply shifting employment into the staffing sector and that the employment declines and productivity growth of the late 1990s were exaggerated. We

¹⁹ Starting in the early 2000s, several states required PEOs to report their clients' employment and wages in separate unemployment insurance accounts and to assign the industry of the client to these accounts. In addition, several states started requiring PEOs to fill out multiple worksite reports, and where this was done, PEOs assigned to a client should have been counted in the client's industry. We provide a detailed discussion of these changes and their apparent effects on PEO employment in an appendix available from the authors upon request.

revisit this issue as well as examine the post-2000 period, one characterized by much steeper declines in manufacturing employment and more modest growth in employment services.²⁰

Using Equation (3), we estimate the number of employment services workers assigned to manufacturing for each year within each of the 18 occupational categories and sum these figures across all occupations to yield an estimate of the total number assigned to manufacturing.²¹ Figure 2 displays these estimates, along with measured manufacturing employment and manufacturing employment adjusted for use of employment services workers from 1989 to 2004. We estimate that the number of employment services workers assigned to manufacturing grew by about 1 million, from about 419,000 in 1989 to over 1.4 million in 2000. Whereas measured employment in manufacturing fell by 4.1 percent from 1989 to 2000, adjusting for employment services workers, employment in manufacturing actually grew by 1.4 percent over that period. The number of employment services workers assigned to manufacturing dropped sharply from 2000 to 2001, as agency workers bore a disproportionate share of the adjustment during the recession. The number of employment services workers in manufacturing increased after 2001, regaining almost half of these losses by 2004, while measured employment in manufacturing continued its sharp decline.

Figure 2 also displays the 95 percent confidence interval for our estimates of manufacturing employment adjusted for employment services workers for the years 1996 to 2004. The appendix provides a discussion of how the standard errors underlying the confidence interval were generated. Because the sample sizes in the OES are large and because the three occupations that represent the large majority of workers assigned to manufacturing are well represented in the CWS, we are able to place relatively tight bounds on our imputations of employment services workers to manufacturing.

²⁰ According to CES data, the average annual growth rate of employment in the employment services sector between 2001 and 2005 was 3 percent, down from the 9 percent growth rate experienced between 1995 and 2000.

²¹ Based on CWS data, we assign 85.5 percent of production workers; 49.9 percent of helpers, laborers, and hand material movers; and 19.3 percent of office and administrative support workers to manufacturing. As noted above, most of the workers we impute to manufacturing are classified in one of these three occupations. In each of these occupations, the fraction imputed to manufacturing is greater than manufacturing's share of employment in that occupation (net of employment services' share), implying that manufacturers' utilization of staffing services has been relatively greater than the average for other industries.

Table 3 breaks out the imputations of employment services workers for the three main occupations—production; helpers, laborers, and hand material movers; and office and administrative support—that account for an estimated 75 to 80 percent of all employment services workers in manufacturing throughout the period. The rise in production workers in manufacturing during the latter half of the 1990s is most dramatic. In 1989 clerical and unskilled manual employment services workers assigned to manufacturing greatly outnumbered those in production occupations assigned to manufacturing, but that pattern had changed by the mid-1990s. The rapid rise in employment services workers in manufacturing production jobs reflected a strategy to utilize staffing agencies not just in unskilled or peripheral occupations, but also in manufacturing’s core production jobs. We estimate that in 1989 only about 80,000 employment services workers in production occupations worked in manufacturing; that number peaked at about 579,000 in 2000 before dropping sharply during the recession.

The bottom panel of Table 3 displays the relative importance of staffing services within selected occupations and for the manufacturing sector overall. Employment services production workers, who added less than 1 percent to manufacturing production worker employment in 1989, increased employment in manufacturing production occupations by 7.0 percent in 2004. Relative use of staffing agency workers is the highest in less skilled, manual positions; it added 35.9 percent to manufacturing employment in laborer, helper, and hand material mover positions in 2004. For manufacturing overall, employment services workers added an estimated 2.3 percent to manufacturing employment in 1989; by 2004, they added 8.7 percent. Even though the estimated number of employment services workers assigned to manufacturing was lower in 2004 than at its peak in 2000, the sharp decline in employees at manufacturing establishments meant that staffing agency workers represented a growing share of those performing manufacturing work in the United States.²²

²² Our estimates of adjusted manufacturing employment—manufacturing employees plus employment services workers assigned to manufacturing—should not be biased as a result of these changes; only the fraction of those workers that is employed by staffing agencies should be affected. Because of changes in the underlying

IMPACTS ON MANUFACTURING PRODUCTIVITY

Simple labor productivity statistics measure output divided by labor input. In manufacturing, output is defined as shipments in constant dollars, net of shipments between manufacturing establishments, and labor input is measured as the number of employees at manufacturing establishments or, more commonly, as hours worked by employees of manufacturing establishments. Although simple labor productivity measures garner a great deal of attention, they have well-recognized limitations that make them difficult to interpret. Increases in measured labor productivity may reflect the ability of workers to produce more with given amounts of other inputs, or they may reflect technological improvements—both of which correspond to popular concepts of labor productivity growth. Alternatively, increases in measured labor productivity may simply reflect the substitution of other inputs for labor. In the case of outsourcing to employment services, staffing agency workers are counted as purchased business services rather than labor input in manufacturing productivity statistics. Consequently, all else being the same, the substitution of staffing agency workers for direct-hire employees will directly increase manufacturing labor productivity measures.

Table 4 shows the contribution of outsourcing to employment services on manufacturing labor productivity estimates, measured as output per worker, over various time horizons.²³ We use BLS output indices for manufacturing in the fourth quarter of the indicated year to correspond to the timing of the employment data, which come from OES and CES fourth quarter data. From 1989 to 2000, outsourcing to employment services added 0.5 percentage points to the annual growth rate of manufacturing labor productivity, accounting for 14 percent of the growth. This contribution was somewhat higher during the

sampling frame due to several states recently requiring PEOs to reassign workers to their clients' industries, these estimates may slightly understate the importance of employment services in manufacturing in recent years.

²³ The more commonly reported measure of labor productivity is output per worker hour. We estimate output per worker because our estimates of manufacturers' outsourcing to employment services measure workers, not hours. Although fluctuations in hours worked can significantly affect movements in measured labor productivity over short time horizons, over the longer time horizons measured in Table 4 output per worker and output per hour worked are quite similar in published statistics. Houseman (2006) examines the implications of outsourcing for productivity measures in greater detail and demonstrates that these results are not sensitive to the endpoints used in the analysis.

latter half of the 1990s than during the first half. Note that whereas outsourcing generally inflates manufacturing productivity statistics, from 2000 to 2001 it substantially depressed productivity statistics, because employment services workers in manufacturing bore a disproportionate share of employment adjustment to that downturn. We estimate that measured labor productivity growth in manufacturing would have been 1.2 percentage points higher were the reduction of employment services workers taken into account. From 2001 to 2004, growth in outsourcing to employment services resumed and added a half -percentage point to labor productivity growth in manufacturing, representing 9 percent of the growth.²⁴

A potential concern with these estimates is that employment services workers may work shorter hours than do manufacturing employees, and hence productivity adjustments based on the number of employment services workers rather than on their actual hours worked may overstate their contribution to manufacturing productivity growth. Evidence from the CPS Contingent Worker Supplements, however, indicates that weekly hours worked in the preceding week by temporary agency workers assigned to manufacturing are only slightly below the weekly hours worked by direct-hire manufacturing workers in comparable occupations. Within the three main occupations—production workers, laborers and helpers, and office and administrative workers—temporary agency workers assigned to manufacturing worked an average of 8 percent fewer hours weekly than did direct hires in manufacturing. Table 4 displays an estimate in which we adjust for differences in the average hours worked by staffing agency workers compared to manufacturing employees.²⁵ This adjustment has little effect on the estimated contribution

²⁴ As is consistent with our estimates, Estavão and Lach (1999a) estimate that failure to account for temporary help hours in manufacturing inflated the growth in labor productivity by 0.5 percentage points over the 1991-to-1997 period. Ten Raa and Wolff (2001) argue that services outsourcing by manufacturers, of which employment services is one component, can account for a significant share of multifactor productivity growth on the grounds that the outsourced activities experienced more sluggish productivity growth.

²⁵ Specifically, we multiply the number of workers in a particular occupation assigned to manufacturing by the ratio of hours worked by temporary agency workers assigned to manufacturing and manufacturing direct-hire employees in a particular occupational category. For instance, if the hours of temporary agency production workers assigned to manufacturing were on average 0.92 that of manufacturing direct-hire production workers' hours in the CWS data, we count each staffing agency production worker assigned to manufacturing as just 0.92 of a worker. The hours-worked data in the CWS pertain to temporary agency workers, who make up the large majority of employment services workers. Temporary help workers likely work slightly fewer weekly hours than manufacturing employees in comparable positions because they are less likely to work a full week; their assignment

of employment services outsourcing to manufacturing productivity growth and does not affect the qualitative nature of our findings. For example, even after adjusting for hours differences, we estimate that use of employment services increased measured labor productivity in manufacturing by 13 percent from 1989 to 2000.

The fact that outsourcing will result in misleading increases in manufacturing labor productivity is well recognized, and multifactor productivity statistics, which are designed to capture all inputs to the production process, in theory correct for this problem. Available evidence, however, suggests that KLEMS,²⁶ the multifactor productivity measure developed for manufacturing, does not fully capture employment services input to manufacturing, and hence multifactor productivity measures will also overstate productivity growth in manufacturing during the period. At least part of the problem appears to be related to underestimates of the share of employment services output imputed to manufacturing in the Bureau of Economic Analysis benchmark input-output tables, which are used in the KLEMS calculations. The benchmark I-O tables, constructed every five years, assign only about 15 percent of employment services output to manufacturing in 1992 and just 5 percent of employment services output to manufacturing in 1997, the years of the most recently available tables.²⁷ These estimates sharply contrast with our estimates that 29 and 36 percent of employment services workers were assigned to manufacturing in 1992 and 1997, respectively. In addition to the large discrepancy in the proportion of employment services assigned to manufacturing between the BEA I-O estimates and our estimates, the large decline in the fraction of employment services output imputed to manufacturing is striking given the

may start or end during the week. We would not expect PEO status to affect weekly hours, and hence these adjustments for hours worked, which we apply to all employment services workers, probably overstate the actual differences in average hours worked between employment services workers in manufacturing and manufacturing employees.

²⁶ KLEMS stands for capital (K), labor (L), energy (E), materials (M), and purchased business services (S). KLEMS measures of manufacturing productivity have been computed on an annual basis for the years 1987 to 2001.

²⁷ 2002 BEA I-O tables will become available in 2007.

conflicting evidence we present that manufacturers greatly increased their use of employment services during this time period.²⁸

ADDITIONAL ROBUSTNESS CHECKS ON OUR IMPUTATIONS

In this section we address several potential concerns about our imputations of staffing agency workers to manufacturing, and, where data permit, perform robustness checks on our estimates.

One potential criticism of our imputations is that we assume that all agency workers are assigned to clients in other industries. Yet some of these workers are permanent staff of the employment services organization. In the case of temporary help agencies and PEOs, the fraction of all employees that are permanent staff is extremely low, only 3 percent (BLS 1988). Moreover, permanent staff of these agencies would typically be in sales, clerical, or office management positions, occupations that, at least since the mid-1990s, have been a far less important part of manufacturers' outsourcing than production and other blue-collar occupations.

A related concern is the inclusion of employment agency staff in the estimation of workers assigned to manufacturing. Employment agencies are distinct from temporary help agencies or PEOs in that, in theory, they only assist in job placement. Importantly, an organization operating purely as an employment placement agency would not have the workers it places into jobs on its payroll, and thus it would be inappropriate to include employment agency staff in our imputations. Beginning in 1996, we have access to microdata that enable us to separate employment agency staff from other employment services workers, and hence assess the sensitivity of our estimates to their inclusion.

²⁸ Houseman (2006) discusses differences between our measures and measures in the I-O tables, offers possible reasons why the BEA I-O measures understate use of employment services by manufacturers, and provides a detailed comparison of our productivity estimates with those from KLEMS. Although KLEMS estimates of the separate contribution of employment services to the growth in manufacturing labor productivity are not available, KLEMS estimates of the contribution of all purchased services, of which employment services is one component, are the same as or substantially smaller than our estimates for employment services during the 1990s. Because manufacturing's offshoring of services and outsourcing to domestic contractors likely were growing over the period, our estimates appear inconsistent with KLEMS estimates during that period.

OES data are collected at the establishment level and an establishment has only one industry code, even if it engages in activities in more than one industry. If organizations classified as employment agencies operate solely as employment agencies, we would expect that few, if any, of their employees would be classified in manual occupations. While the fraction of employment agency workers classified in manual occupations is considerably lower than is the case in temporary help agencies and PEOs, it is considerably higher than expected, and thus we infer that some of the employment agencies also operate as temporary help or PEO organizations. Figure 3 displays the number of employment services workers imputed to manufacturing with and without employment agency workers in nonmanual occupations in recent years. As is evident from the figure, excluding these workers from our imputations has a negligible impact on our estimates.²⁹

Another possible concern with our estimates is that our imputations of employment services workers in a particular occupation to manufacturing is based on industry of assignment data in the CWS that pertain only to temporary help workers. For that reason, Figure 3 also separates out imputations of temporary help workers to manufacturing from all employment services workers for the years 1999 to 2004 and displays the 95 percent confidence interval for these estimates. Prior to the introduction of the NAICS industry coding system in the OES in 1999, temporary help agencies were combined with PEOs in the SIC industry “help supply services.”

Temporary help workers constitute the large majority of employment services workers assigned to manufacturing, between 72 and 79 percent of all employment services workers assigned to manufacturing during these years. Because production and other manual occupations are more heavily represented in temporary services than in other components of employment services, temporary help’s

²⁹ About half of the employment agency workers imputed to manufacturing are in manual occupations, and excluding all employment agency workers still has a small impact on our overall estimates. Because employment agencies made up a larger share of all employment services workers prior to 1996 and because office and administrative support workers made up a substantially larger share of all employment services assigned to manufacturing in the earlier period, any overstatement in our imputations may be greater in a relative, though not in an absolute, sense in the earlier period. However, the impact is still likely to be small, and, if anything, our results pertaining to the growth of the employment services workers in manufacturing would be understated.

share of employment services workers assigned to manufacturing is somewhat higher than its share of employment in the sector. Temporary help workers assigned to manufacturing increased manufacturing employment by an estimated 5.8 percent in 1999 and by an estimated 7.0 percent in 2004. Thus, restricting our analysis to temporary help workers provides a qualitatively similar picture of outsourcing by manufacturers to staffing services.

Finally, we examine our assumption that the fraction of employment services workers assigned to manufacturing was constant over time within each occupational category. As discussed above, based on pooled data from the five Contingent Worker Supplements to the CPS, formal tests accept the hypothesis that the fraction of workers assigned to manufacturing did not vary over time within occupational categories. Figure 4 provides further assurances that pooling data across the five CWS surveys has little impact on the magnitude of our imputations in any given year. We compare imputations based on pooling data across the CWS surveys with estimates based on a single CWS conducted in that year or in the proximate year. Basing estimates on individual CWS data, the total number of employment services workers imputed to manufacturing is slightly lower during the recent recession and slightly higher in 2004, indicating, if anything, that manufacturing used staffing services to adjust to recent cyclical fluctuations to a somewhat greater extent than suggested by estimates based on pooled CWS data.

CONCLUSION

Our findings illustrate the importance of taking into account outsourcing when interpreting employment and productivity trends in manufacturing. Through the construction of panel data from the OES, we document the dramatic rise of production workers as well as workers in other manual occupations within the employment services sector, a fact indicative of manufacturers' increased use of staffing services. Measured employment in manufacturing declined by 4.1 percent from 1989 to 2000, but if staffing agency workers (who typically work side-by-side direct-hire manufacturing employees and

under the manufacturer's supervision) were counted, we estimate manufacturing employment would have actually risen by 1.4 percent. Although factoring in manufacturers' use of staffing agency workers does not erase the large declines in manufacturing employment since 2000, a growing share of manufacturing work in the United States is being performed by employees of staffing agencies. In 2004, we estimate that employment services workers added 8.7 percent to direct-hire manufacturing employment, compared to just 2.3 percent in 1989. This growing share reflects a dramatic increase in manufacturers' outsourcing of core production and low-skilled manual jobs to staffing agencies.

Because the hours that staffing agency employees work in manufacturing are not counted in manufacturing labor productivity statistics, the substitution of staffing services employees for manufacturing employees will inflate manufacturing labor productivity statistics. We estimate that the growth in the use of employment services by manufacturers contributed a half-percentage point to the annual growth rate of labor productivity from 1989 to 2000 and again from 2001 to 2004.

In closing, we emphasize that our study measures only one type of outsourcing, albeit an important one for manufacturers. We do not examine manufacturers' outsourcing to domestic contractors in other industries. For instance, it is possible that the growth in outsourcing to staffing services, which largely fills production, unskilled manual, and clerical occupations, paralleled a trend to outsource to other business services industries for jobs in such areas as IT and shipping. Moreover, studies have begun to document recent growth in the offshoring of intermediate inputs and services. (See, for example, Amiti and Wei 2006; Burke, Epstein, and Choi 2004; Feenstra and Hanson 2001; GAO 2004; National Academy of Public Administration 2006.) In our estimates, use of staffing services by manufacturers plateaued in the late 1990s, and the subsequent slower growth in the staffing industry may reflect a greater emphasis among manufacturers toward offshoring production and services work, as opposed to outsourcing work to domestic contractors.³⁰ Our findings regarding manufacturers' outsourcing to

³⁰This view was expressed by a representative of Manpower, the country's largest staffing services company.

employment services, we believe, underscore the need to study the implications of other types of domestic outsourcing and of offshoring on employment and productivity measurement in manufacturing.

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Table 1 Trends in the Occupational Distribution of Employment within Employment Services

	Occupation's share of ES employment ^a			Occupation's share of ES growth ^b		
	1989	2000	2004	1989–2000	1989–2004	2000–2004
Management, business-finance	6.4 (n.a.)	4.4 (0.2)	5.2 (0.1)	3.3	4.5	-4.0
All other professional, paraprofessional, and technical	0.9 (n.a.)	2.3 (0.3)	1.5 (0.2)	3.1	1.9	10.8
Architecture and engineering	3.4 (n.a.)	1.9 (0.3)	1.4 (0.2)	1.1	0.1	7.1
Life, physical, and social science	0.2 (n.a.)	0.1 (0.0)	0.2 (0.0)	0.1	0.2	-0.3
Computer and mathematical	0.7 (n.a.)	2.2 (0.4)	1.4 (0.2)	3.2	1.8	11.4
Healthcare practitioners and technical	6.9 (n.a.)	3.7 (0.4)	4.5 (0.4)	1.8	2.9	-5.3
Sales and related	3.2 (n.a.)	2.2 (0.2)	3.0 (0.3)	1.6	2.9	-6.2
Office and administrative support	41.8 (n.a.)	29.9 (0.9)	23.7 (0.8)	22.8	11.1	93.7
All other service and agricultural	5.4 (n.a.)	4.2 (0.3)	5.4 (0.4)	3.5	5.4	-8.1
Protective service	0.4 (n.a.)	0.5 (0.1)	0.7 (0.2)	0.5	0.9	-1.8
Food preparation and serving	1.0 (n.a.)	2.5 (0.5)	3.5 (0.5)	3.4	5.3	-8.2
Building and grounds cleaning and maintenance	2.0 (n.a.)	2.2 (0.3)	1.9 (0.2)	2.4	1.8	5.6
Supervisors of product, construct, maintenance	0.3 (n.a.)	0.3 (0.0)	0.4 (0.0)	0.3	0.4	-0.1
Installation, maintenance, and repair	1.4 (n.a.)	1.49 (0.1)	1.5 (0.1)	1.4	1.6	0.2
Construction and extraction	1.3 (n.a.)	3.8 (0.4)	5.1 (0.6)	5.3	7.6	-9.0
Production	6.3 (n.a.)	17.2 (1.4)	14.8 (0.9)	23.6	20.7	41.3
Transportation and material moving	2.5 (n.a.)	3.1 (0.3)	3.9 (0.3)	3.5	4.9	-5.0
Helpers, laborers, material movers (hand)	16.0 (n.a.)	18.0 (0.8)	21.9 (1.3)	19.1	25.9	-22.1
Sum	100.0	100.0	100.0	100.0	100.0	100.0
Total growth rate				168.8	133.1	-8.9

^aReported figures are percentage of employment services employment in the indicated occupation. Standard errors of this percentage are in parentheses.

^bReported figures are the percentage of employment services growth over the period accounted for by growth in the indicated occupation.

SOURCE: Authors' calculations.

Table 2 Occupational Shares and Contribution to Aggregate Growth, Employment Services and Manufacturing, Selected Occupations and Years

Occupation	Employment services				Manufacturing			
	share of occupation ^a				share of occupation ^a			
	1989	2000	2001	2004	1989	2000	2001	2004
Office and administrative support	2.8 (n.a.)	5.0 (0.2)	3.5 (0.2)	3.7 (0.1)	8.6 (n.a.)	6.9 (0.1)	6.2 (0.1)	6.1 (0.1)
Building and grounds cleaning, and maintenance	0.9 (n.a.)	2.4 (0.3)	1.9 (0.2)	2.0 (0.2)	5.2 (n.a.)	3.5 (0.1)	2.9 (0.1)	2.6 (0.1)
Construction and extraction	0.5 (n.a.)	2.6 (0.3)	4.4 (0.5)	3.1 (0.4)	9.2 (n.a.)	5.1 (0.2)	4.8 (0.2)	4.1 (0.2)
Production	0.9 (n.a.)	5.9 (0.5)	4.1 (0.3)	5.9 (0.3)	76.6 (n.a.)	71.0 (0.8)	71.9 (1.0)	72.7 (0.7)
Transportation and material moving	0.8 (n.a.)	2.3 (0.2)	2.1 (0.2)	2.7 (0.2)	13.9 (n.a.)	11.4 (0.2)	10.3 (0.2)	10.4 (0.2)
Helpers, laborers, material movers (hand)	6.3 (n.a.)	15.8 (0.7)	17.2 (1.1)	17.6 (1.0)	35.0 (n.a.)	26.2 (0.7)	25.0 (0.7)	24.5 (0.5)
Total	1.3	3.0	2.5	2.7	16.3	12.9	12.0	10.8
Occupation	1989–2000			1989–2004				
	% change	Share of change		% change	Share of change			
		ES	Mfg.		ES	Mfg.		
Office and administrative support	8.3	31.5	-14.6	6.6	16.7	-32.2		
Building and grounds cleaning, and maintenance	12.4	14.6	-9.9	6.7	18.0	-34.8		
Construction and extraction	36.6	8.4	-6.2	37.2	10.3	-9.7		
Production	6.9	79.4	-9.2	-15.4	-26.8	97.7		
Transportation and material moving	19.2	9.9	-1.8	12.5	18.2	-17.8		
Helpers, laborers, material movers (hand)	20.5	62.1	-16.6	19.9	74.4	-28.4		
Total	21.3	10.6	-3.2	21.2	9.1	-15.6		

^aShares are written as a percentage. Standard errors are in parentheses.

SOURCE: Authors' calculations.

Table 3 Employment Services Workers Assigned to Manufacturing by Occupation, Selected Years

	Number of workers imputed to manufacturing (standard error)				
	1989	1996	2000	2001	2004
Office and administrative support	118,455 (n.a.)	204,840 (21,192)	227,405 (22,784)	161,876 (17,354)	164,195 (16,495)
Production	79,619 (n.a.)	347,353 (15,742)	578,992 (47,662)	343,009 (24,457)	455,628 (28,838)
Helpers, laborers, material movers (hand)	117,516 (n.a.)	178,683 (21,439)	354,007 (37,364)	384,116 (43,874)	392,632 (43,756)
All	419,100 (n.a.)	924,878 (33,812)	1,413,174 (59,032)	1,097,872 (52,174)	1,242,301 (56,609)
	As a percentage of all ES workers assigned to manufacturing				
	1989	1996	2000	2001	2004
Office and administrative support	28.3	22.1	16.1	14.7	13.2
Production	19.0	37.6	41.0	31.2	36.7
Helpers, laborers, material movers (hand)	28.0	19.3	25.1	35.0	31.6
All	100.0	100.0	100.0	100.0	100.0
	As a percentage of manufacturing employees within the occupation				
	1989	1996	2000	2001	2004
Office and administrative support	6.3	13.7	14.2	10.9	11.6
Production	1.0	4.2	7.2	4.9	7.0
Helpers, laborers, material movers (hand)	9.0	16.4	30.0	34.4	35.9
All	2.3	5.3	8.2	6.9	8.7

SOURCE: Authors' calculations.

Table 4 Manufacturing Labor Productivity Growth Adjusted for Employment Services

Time period	Annual growth rate of labor productivity	Labor productivity adjusted for employment services	Contribution of employment services
1989–2000	3.63	3.12	0.51
1989–2000, adj. for hours ^a	3.63	3.16	0.47
1989–1995	3.72	3.30	0.42
1995–2000	3.52	2.90	0.61
2000–2001	2.14	3.33	-1.19
2001–2004	6.14	5.60	0.54

^aContribution of employment services workers to productivity growth adjusted for differences in weekly hours worked by employment services workers assigned to manufacturing and manufacturing employees. See text for full discussion of adjustment.

SOURCE: Authors' calculations using 4th quarter manufacturing output indexes, CES November manufacturing employment figures, and authors' estimates of employment services workers assigned to manufacturing, as described in the text.

Figure 1: Trends in Occupation Shares, Employment Services

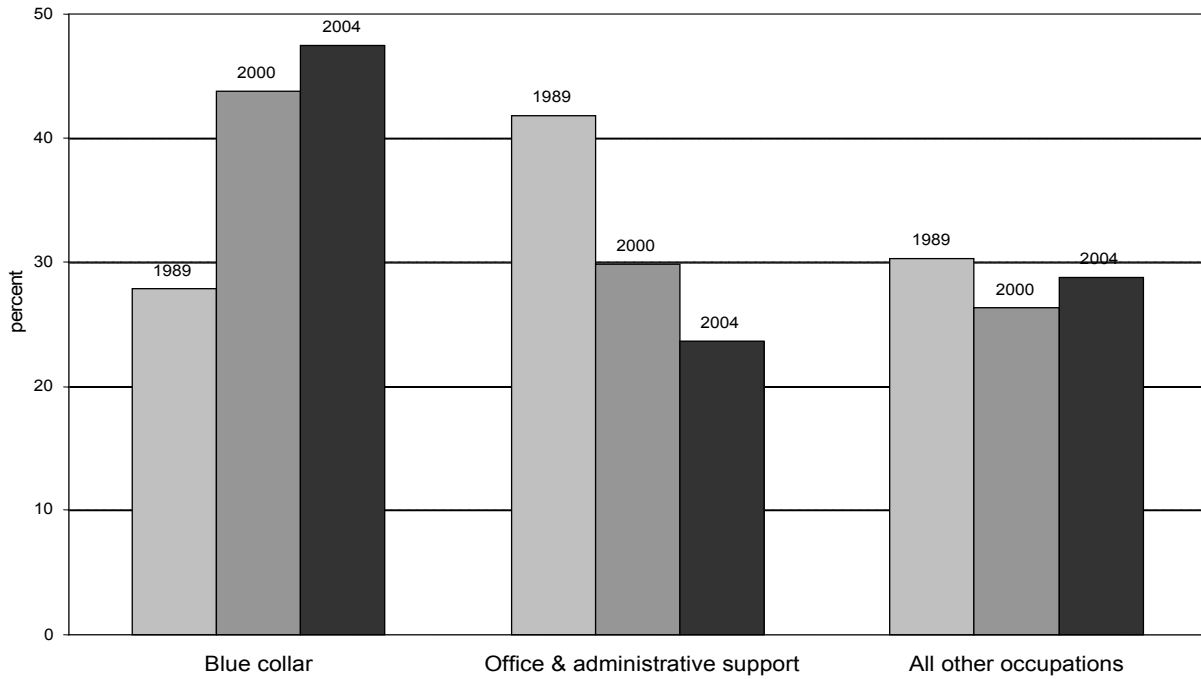
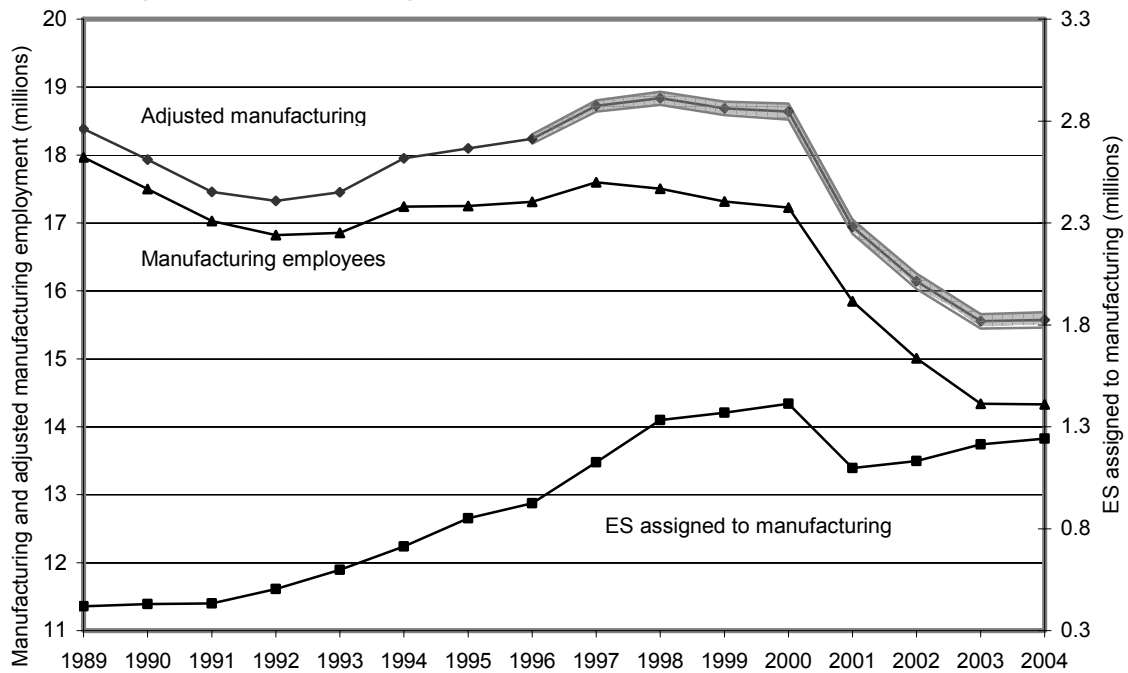
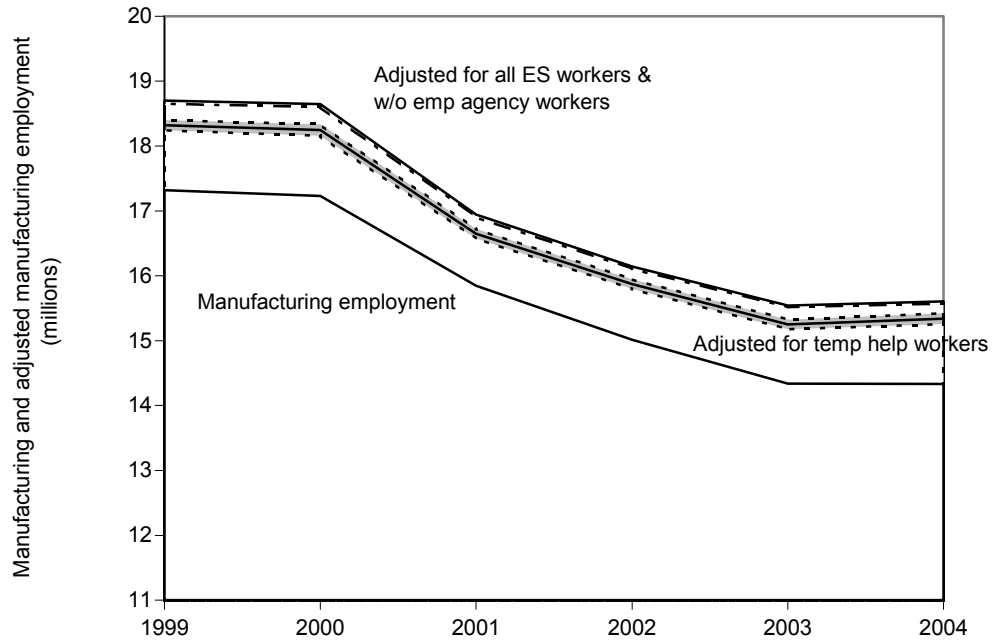


Figure 2: Trends in Manufacturing Employment and Employment Service Workers Assigned to Manufacturing



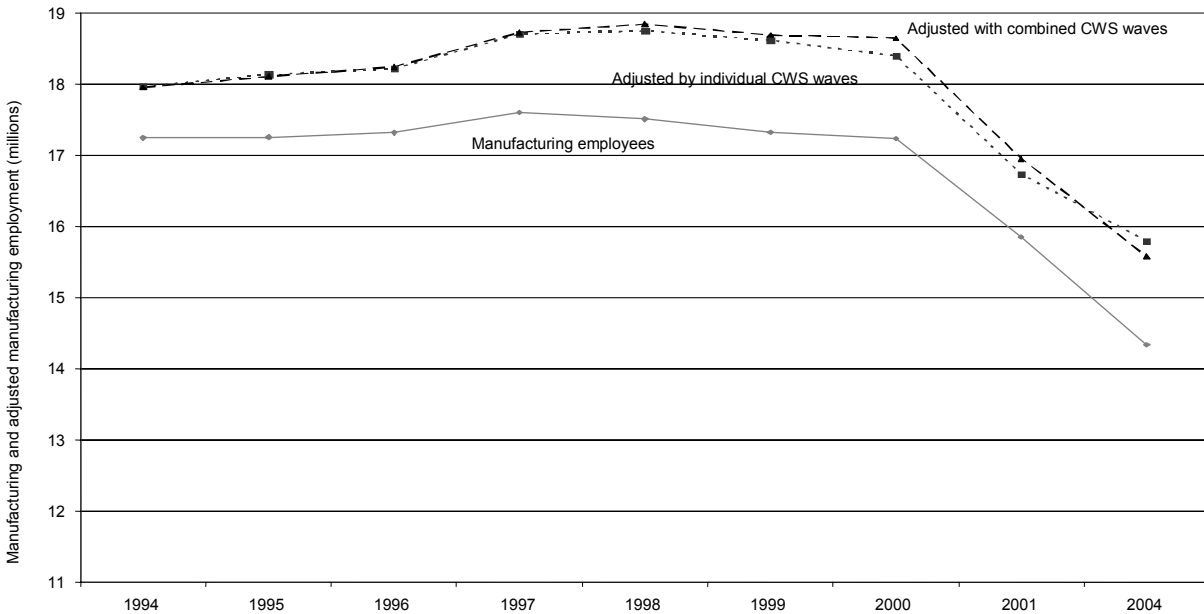
NOTE: Shaded area represents 95% confidence interval for employment adjusted for ES workers assigned to manufacturing.

Figure 3: Manufacturing Employment, Adjusted for Temporary Help and All Employment Services Workers, 1999-2004



NOTE: Shaded area represents 95% confidence interval for temporary workers assigned to manufacturing.

Figure 4: Comparing Imputations Based on Individual-Year CWS and Combined CWS



Appendix

1 Computing Standard Errors of Employment Estimates

1.1 Industry-Occupation Employment Estimates

In this section we detail the method employed to compute standard errors for our industry-occupation employment estimates based on OES and CES data. Recall that employment in occupation i , industry j , and year t is estimated according to the equation

$$\hat{E}_{ijt} = E_{jt}^c \times \left(\frac{E_{ijt}^o}{E_{jt}^o} \right) ,$$

where E_{jt}^c represents CES employment in industry j in year t , E_{ijt}^o equals employment in occupation i , industry j , and year t as reported by the OES, and E_{jt}^o represents employment in industry j and year t according to OES data. Furthermore, E_{ijt}^o is computed according to the equation

$$E_{ijt}^o = \sum_{k=1}^{K_{jt}} e_{ikt} ,$$

where e_{ikt} equals the weighted employment in occupation i for establishment k in year t and equals 0 if the establishment does not employ any workers in occupation group i .³¹ Note that the number of establishments contributing to the industry-occupation OES employment estimate, K_{jt} , depends on the particular industry and year and is therefore indexed by j and t . It follows directly that

$$E_{jt}^o = \sum_{i=1}^I E_{ijt}^o = \sum_{i=1}^I \sum_{k=1}^{K_{jt}} e_{ikt} .$$

Note that, by construction, our industry employment totals sum to the industry-level CES employment totals so that

$$\hat{E}_{jt} = \sum_{i=1}^I \hat{E}_{ijt} = \sum_{i=1}^I E_{jt}^c \times \left(\frac{E_{ijt}^o}{E_{jt}^o} \right) = E_{jt}^c \times \left(\frac{\sum_{i=1}^I E_{ijt}^o}{E_{jt}^o} \right) = E_{jt}^c .$$

³¹ In this case, weighted employment refers to the fact that OES establishments are a representative sample of establishments and therefore a weight is attached to each establishment to account for differences in the probability of being sampled.

1.2 Computing Standard Errors of Employment Estimates

We use standard jackknife methods to compute the standard error of \hat{E}_{ijt} . In particular, let $\hat{E}_{ijt(k)}$ denote estimated employment in occupation i , industry j , and year t after deleting establishment k , so that

$$\hat{E}_{ijt(k)} = E_{jt}^c \times \left(\frac{E_{ijt(k)}^o}{E_{jt(k)}^o} \right),$$

where

$$E_{ijt(k)}^o = E_{ijt}^i - e_{ikt}$$

and

$$E_{jt(k)}^o = \sum_{i=1}^I E_{ijt(k)}^o = E_{jt}^o - \sum_{i=1}^I e_{ikt} = E_{jt}^o - e_{kt},$$

where e_{kt} is the (weighted) employment of establishment k . Note that even if establishment k does not include workers in occupation group i , the estimated employment of occupation i in industry j and year t is affected by the omission of this establishment through the $E_{jt(k)}^o$ term. The jackknife estimate of the standard deviation is given by

$$\hat{\sigma}_{ijt} = \left[\frac{K_{jt} - 1}{K_{jt}} \times \sum_{k=1}^{K_{jt}} \left(\hat{E}_{ijt(k)} - E_{ijt(\cdot)} \right)^2 \right]^{\frac{1}{2}},$$

where

$$E_{ijt(\cdot)} = \frac{1}{K_{jt}} \sum_{k=1}^{K_{jt}} \hat{E}_{ijt(k)}.$$

2 Computing Standard Errors of Imputations of Employment Services Workers to Manufacturing

Pooling data from the five waves of the CWS, we use questions on the industry to which temporary help workers were assigned to create a binary variable that equals one if the temporary help agency worker in occupation i was assigned to manufacturing and zero otherwise, for each of the 18 exhaustive and mutually exclusive occupation categories. We use the supplement weights in computing the fraction of temporary help workers within each occupation assigned to the manufacturing sector, P_i , and the standard errors of these estimates, $\sigma_{P,i}$. Although the permanent staff of temporary help agencies only makes up three percent of employment in the agencies, 22 percent of all respondents who indicated that they were paid by temporary help agencies reported being assigned to the temporary help agency, including a large number of workers in low-skilled manual occupations. These anomalous results appear to have resulted from confusion over wording in the survey, and for this reason we dropped from our calculation all individuals who reported being both paid by and assigned to a temporary help agency.

Let \hat{E}_{it}^H denote the employment of workers in occupation i in year t in the employment services sector so that $\hat{E}_{it}^H = \hat{E}_{ijt}^H$, where j corresponds to the employment services sector. Similarly, let $K_t^H = K_{jt}^H$ for the j corresponding to the employment services sector. The estimates for the number of employment services workers in occupation i in year t assigned to the manufacturing sector is then given by

$$\hat{M}_{it} = P_i \cdot \hat{E}_{it}^H \quad .$$

Assuming P_i and \hat{E}_{it}^H are independent, the variances of \hat{M}_{it} is given by

$$\text{var}(\hat{M}_{it}) = E \left[\text{var}(\hat{M}_{it} | \hat{E}_{it}^H) \right] + \text{var} \left[E(\hat{M}_{it} | \hat{E}_{it}^H) \right] \quad .$$

The estimated variance is then computed according to the equation

$$\text{var}(\hat{M}_{it}) = \frac{1}{K_t^H} \sum_{k=1}^{K_t^H} (\hat{E}_{it(k)}^H)^2 \times \text{var}(P_i) + \frac{K_t^H - 1}{K_t^H} \times \sum_{k=1}^{K_t^H} (P_i \cdot \hat{E}_{it(k)}^H - \hat{M}_{it(\cdot)})^2 \quad ,$$

where

$$\hat{M}_{it(\cdot)} = \frac{1}{K_t^H} \sum_{k=1}^{K_t^H} P_i \cdot \hat{E}_{it(k)}^H \quad .$$

Finally, we want to estimate the total number of Employment Service workers that are assigned to the manufacturing sector, or

$$\hat{M}_t = \sum_{i=1}^I \hat{M}_{it} = \sum_{i=1}^I P_i \cdot \hat{E}_{it}^H \quad .$$

Since the occupation-specific employment estimates, \hat{E}_{it}^H , are functionally related, the variance of this estimate is given by

$$\text{var}(M_t) = E \left[\text{var} \left(M_t \left| \left\{ \hat{E}_{it}^H \right\}_{i=1}^I \right. \right) \right] + \text{var} \left[E \left(M_t \left| \left\{ \hat{E}_{it}^H \right\}_{i=1}^I \right. \right) \right] \quad .$$

It follows that the estimated variance is given by

$$\text{var}(\hat{M}_t) = \frac{1}{K_t^H} \sum_{k=1}^{K_t^H} \sum_{i=1}^I (\hat{E}_{it(k)}^H)^2 \times \text{var}(P_i) + \frac{K_t^H - 1}{K_t^H} \times \sum_{k=1}^{K_t^H} \sum_{i=1}^I (P_i \cdot \hat{E}_{it(k)}^H - \hat{M}_{it(\cdot)})^2 \quad .$$