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Do the Earnings of Manufacturing and Service Workers Grow at the Same Rate Over Their Careers?

by Randall Eberts
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Introduction

The U.S. labor market has undergone dramatic structural changes over the last several decades. Total employment has increased by 37 percent since 1976, but most of this growth has been concentrated disproportionately in the service-producing sectors. For instance, service employment (SICs 70 through 89) has increased 80 percent since 1976, while manufacturing employment (SICs 20 through 39) has increased only 5 percent.[1]

This uneven growth across sectors has resulted in a significant change in the industrial composition of the labor force. Twelve years ago, manufacturing claimed 24 percent of total employment while the services comprised 18 percent. Today, those roles have been completely reversed with the service sectors claiming 24 percent of total employment and manufacturing claiming 18 percent.

■ **1** Service industries in Standard Industrial Classifications (SICs) 70 through 89 include hotels, personal services, business services, automotive and other repair, health services, educational services, social services, and engineering, accounting and related services. Manufacturing industries in SICs 20 through 39 include all durable and nondurable sectors.

The transition from an economy dominated by manufacturing jobs to one with predominantly more service jobs raises the question of whether or not service jobs in general offer the same earnings potential for workers as manufacturing jobs. A popular notion is that the economic restructuring that has taken place over the last decade or so has relegated skilled production workers to jobs as hamburger flippers. Krueger and Summers (1987), for example, support the view that service jobs are lower paying by reporting that workers in service sectors such as medical, welfare, education, and personal services earn significantly less than workers in manufacturing sectors.

Wage differentials between service and manufacturing industries are even evident for workers in the same occupational categories, as shown in table 1. Within occupation, manufacturing wage premiums range from a high of 45 percent for male equipment cleaners and handlers to a low of 3 percent for female production, craft, and repair workers. Also note that the distribution of occupations employed in the two sectors is quite different. For instance, the largest occupational category for women in the service sector is professionals and specialists, while in manufacturing, machine operators and assembly occupations employ the largest number of women.

Bluestone and Harrison (1986) report some disturbing consequences of the restructuring of

TABLE

Average Hourly Earnings by Selected Occupation and Industry in 1987

1. Males

Selected Occupation	Manufacturing Number	Manufacturing **Mean Earnings**	Services Number	Services **Mean Earnings**
Executives, Administrators, & Managers	2,156	$16.26	2,428	$13.98
Professional & Specialists	1,964	16.38	5,162	13.20
Technical & Related Support	858	12.94	971	11.15
Sales Personnel	701	13.55	370	9.85
Administrative Support & Clerical	1,068	10.04	943	7.75
Production, Craft & Repair	4,977	11.03	1,788	8.80
Machine Operators & Assembly	5,863	8.89	486	6.79
Transportation & Material Movers	1,111	8.98	403	7.47
Handlers & Equipment Cleaners	1,311	7.64	393	5.72

2. Females

Selected Occupation	Manufacturing Number	Manufacturing Mean **Earnings**	Services Number	Services Mean **Earnings**
Executives, Administrators, & Managers	*849*	*$11.76*	*2,755*	*$10.57*
Professional & Specialists	*565*	*12.30*	*9,926*	*10.96*
Technical & Related Support	*296*	*10.49*	*2,100*	*9.28*
Sales Personnel	*307*	*9.89*	*621*	*6.48*
Administrative Support & Clerical	*2,770*	*8.09*	*8,074*	*7.09*
Production, Craft & Repair	*979*	*7.66*	*164*	*7.51*
Machine Operators & Assembly	*4,391*	*6.20*	*448*	*5.18*
Transportation & Material Movers	*68*	*9.40*	*237*	*7.15*
Handlers & Equipment Cleaners	534	*6.26*	*96*	*4.60*

SOURCE: Female and male wage and salary workers aged 18 to 54 working in the indicated industries and occupations in the one-quarter earnings sample drawn from all monthly ***Current Population Surveys*** in ***1987.***

employment. Their analysis shows that "...all of the employment increases experienced since *1979* have been generated by the creation of jobs which paid less than the median wage in *1973."* (p. *5)* They go on to add that the disproportionate expansion of the low-wage sector is found to be especially prevalent among younger entry-level workers between the ages of *16* and *34.*

Although these latter results have stirred some controversy, they point to an essential question in discussing the earning potential of the great number of service jobs created in the economy. As noted earlier, several studies, including this one, have found that service workers consistently earn less than their manufacturing counterparts. The question that has not been addressed is whether or not service workers can expect the same growth rate in wages over their work life as manufacturing workers enjoy, even though they start out earning less.

To answer this question, we estimate age-earnings profiles, which approximate the growth rate of earnings of individuals over their work lives. Each profile depicts the pattern of earnings of a cross section of individuals at each age level. We then look for significant differences in age-earnings profiles between comparable workers in manufacturing and service sectors. We interpret the results of this approach to represent the earnings potential of typical service and manufacturing workers over their work lives. This interpretation rests on the assumption that the behavior of individuals and labor market conditions affecting their earnings do not vary signifi-

cantly among cohorts. Although this assumption may be open to question, the approach provides a starting point for analyzing this issue.

We estimate cross-sectional age-earnings profiles using the 1987 ***Current Population Survey*** (CPS).[2] The year 1987 was chosen because it provides the most recent evidence. In other work not reported here, the same models were estimated for 1976 and 1986. Differences in age-earnings profiles between the two sectors were qualitatively similar in all three years. The similarity in results across years also suggests that cohort effects are probably not the driving force behind the lack of sectoral differences in age-earnings profiles.

We test for sectoral differences in age-earnings profiles at two levels of model complexity. First, we test whether earnings increase at the same rate over an individual's career for each of the two sectors by simply interacting the service-sector dummy variable with the age variables. Next, we examine whether age-earnings profiles differ between service and manufacturing sectors within relatively broad occupational categories.

Our basic finding is that only slight differences in age-earnings profiles exist between the two sectors. However, when age-earnings profiles are estimated separately for major occupational groups, the differences between sectors all but disappear. Consequently, the notion that service jobs do not offer the same earnings growth as the manufacturing jobs they are replacing is not supported by this analysis. However, since the earnings growth rates are similar between sectors, the gap between manufacturing and service wages persists throughout the individual's career.[3]

I. Age-Earnings Profiles

Why might age-earnings profiles differ across sectors and over time? The stylized relationship between earnings and age is that wages rise steeply during the first part of a worker's career, level off in the middle years, and perhaps even decline slightly in the final years. This pattern was strikingly documented by Mincer (1974) using 1960 census data. Since then, a number of studies have explored various aspects of the relationship in more detail.[4] However, no one has studied the age-earnings relationship for workers in specific industries, in particular, service and manufacturing.

Several reasons for this pattern have been advanced. The most widely cited hypothesis is the accumulation of human capital through on-the-job training (for example, Mincer [1974]). Other explanations attribute the age-earnings pattern to the knowledge an individual gains about a specific firm (Oi [19621) or to workers' showing their commitment to a firm by accepting low pay early in their career in exchange for high pay later in their work life (Lazear [1981]). In all three cases, prolonged participation in the labor force or attachment to a firm increases the value of the worker to the firm; consequently, the worker's wages increase with age.

Differences in demand and supply characteristics can account for differences in age-earnings profiles across sectors and over time. On the demand side, for example, differences in age-earnings profiles across industries may arise because of differencesin the amount of human capital accumulated during a worker's career. Workers in low skill-accumulation jobs would exhibit a shallower age-earnings profile that would probably peak at a young age. Thus, if service jobs are generally characterized as low-skill and manufacturing jobs as high-skill, then the age-earnings profiles of service jobs should be shallower than those of manufacturing jobs. However, if workers in the two sectors are comparable to begin with, total (discounted) earnings in the two sectors should equalize over the course of the workers' careers.

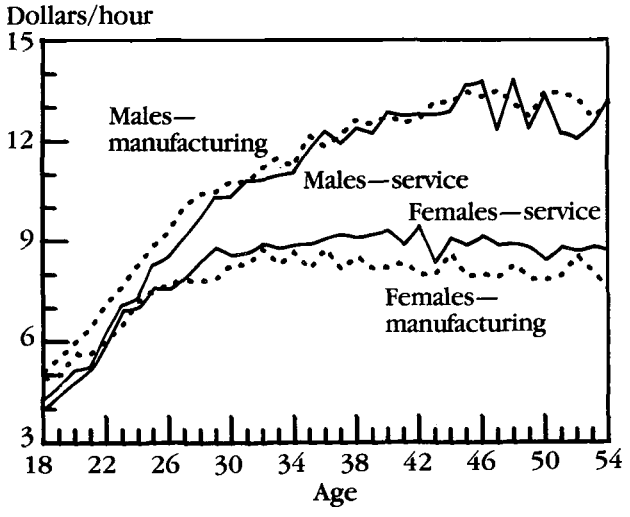
□ **2** Estimation of the relationship between earnings and age is performed using both cross-sectional and longitudinal data. For example, Freeman (1980) analyzes cross-sectional CPS data, Nakosteen and Zimmer (1987) use PSID longitudinal data, and Hanoch and Honig (1985) use panel records of the Social Security Administration. Ideally, one would follow an individual over that person's entire career in order to avoid cohort effects when estimating the age-earnings profile. Two data sets are typically used in longitudinal studies: the Panel Survey of Income Dynamics (PSID) and the National Longitudinal Survey (NLS). Cross-sectional analysis almost exclusively uses the Current Population Survey (CPS). The CPS offers a major advantage over NLS: it includes significantly more individuals. Thus, estimates based on subgroups, such as men and women in manufacturing and services, are more reliable.

■ **3** This paper addresses only the age-earnings profile question. Another equally interesting question is why service workers receive lower pay at each age level than their manufacturing counterparts. While a number of explanations for the existence of interindustry wage differentials have been advanced, none has been generally accepted. See Dickens and Katz (1987) for a summary of the state of current research on the topic.

4 A recent strand of literature explores the extent to which profiles are primarily due to increases in seniority (or tenure) rather than general experience. Several studies, including Abraham and Farber (1987) and Altonji and Shakotko (1987), have challenged the empirical validity of a positive relationship between wages and tenure. Although there is support for this relationship when employer characteristics are included (Hersch and Reagan [1987]), this controversy does not directly pertain to our study since we do not distinguish between tenure and experience.

FIGURE 1

Age-Earnings Profiles, Males and Females in Manufacturing and Service Industries, 1987



SOURCE: *Current Population Survey,* one-quarter earnings sample, 1987.

The age-earnings profile may also be affected by the relative abundance of workers of various ages across industries. The effect of the supply of workers in various age groups depends upon the extent of, and variations in, the substitutability between groups among sectors. For instance, if younger service workers were imperfect substitutes for older workers in one sector, then an influx of young workers into the sector would bid down the wages of younger workers and, thus, make the profile steeper in that sector. On the other hand, if younger workers were perfect substitutes for older workers in all industries, then an influx of younger workers would leave the profile unchanged, but would reduce wages of workers of all ages. Estimates of elasticities of substitution between old and young workers generally find them to be somewhat imperfect substitutes, especially among men and the highly educated (see Freeman [1980] and Hamermesh [1986]).

II. Estimation of Age-Earnings Profiles

Our sample of workers is drawn from the one-quarter earnings sample of the 1987 CPS. We limit the sample to manufacturing (SICs 20 through 39) and service (SICs 70 through 89) workers between the ages of 18 and 54. Earnings are measured as hourly wages: weekly earnings divided by usual weekly hours. Some studies use weekly earnings and typically find little difference (except for higher variation) in compensation patterns from those derived from using hourly wages. We choose hourly earnings to minimize the problem of differences in hours worked across the various groups.

Plots of the cross-sectional patterns of mean hourly wages by age for male and female service and manufacturing workers, aged 18 to 54, in 1987 are shown in figure 1. Although these plots do not control for attributes of workers other than age, sex, and industry, they provide a starting point for this discussion. This figure and the analysis below can be viewed as a snapshot of workers frozen at various stages in their careers.[5]

First, we see the familiar shape of the age-earnings profile in both sectors, but with marked differences between the patterns of men and women. Second, we see that wages for men are lower in the service industries than in the manufacturing industries for most but not all ages. Third, although the youngest women earn more in manufacturing than do their service-sector counterparts, by the age of 28 female service workers appear to be more highly compensated. Finally, the service-sector profiles in these plots are steeper than the manufacturing profiles. The difference between manufacturing and service earnings is greatest in the earlier years and narrows with the age of workers.

To investigate age-earnings relationships while controlling for other employee characteristics, the log of hourly earnings is regressed against age and age-squared along with other worker characteristics, such as education, race, union affiliation, and full-time status. Age-earnings profiles are estimated by entering age and age-squared into the wage regression and then interacting these two variables with a service-sector dummy to distinguish between profiles for service and manufacturing jobs.[6]

5 As discussed above, this approach does not control for cohort effects. That is, some cohorts — such as the baby boomers — may differ in their average characteristics from the members of other cohorts. These average differences in unnoted characteristics (say, size of cohort, health, or attitude) could affect the results reported here.

6 To be consistent with other empirical studies of age-earnings profiles, we specify a quadratic relationship between age and earnings. Further exploration of this topic should consider alternative specifications.

TABLE 2

Characteristics of Manufacturing and Service Workers by Sex in 1987

Characteristic	Females	Males
Mean Hourly Earnings	$ 8.13	*$10.85*
Services	8.24	*10.41*
Manufacturing	7.82	*11.21*
Std. Dev. (Log Earnings)	0.517	*0.545*
Mean Log Earnings	1.967	*2.249*
Services	1.972	*2.174*
Manufacturing	1.952	*2.309*
Service Sector	74.7%	*44.2%*
Part Time	22.9%	*7.6%*
Services	27.7	*13.1*
Manufacturing	8.9	*3.2*
Union	15.0%	21.3%
Services	15.1	16.0
Manufacturing	14.5	25.4
Nonwhite	15.5%	12.7%
Services	15.1	14.2
Manufacturing	16.6	11.4
Highest Grade Completed	13.4	13.4
Services	13.8	14.3
Manufacturing	12.2	12.7
Age in Years	35.0	34.9
Services	34.9	34.1
Manufacturing	35.0	35.6
Number of Observations	42,950	36,669

SOURCE: Female and male wage and salary workers aged 18 to 54 working in manufacturing or service industries in the one-quarter earnings sample **drawn** from all monthly ***Current* Population** *Surveys* in 1987.

The means of these variables are displayed in table *2* by sex and industry. One interesting fact is that women's earnings are actually higher in service jobs than they are in manufacturing jobs. The apparent inconsistency of this finding with the numbers in table *1* is due to sectoral differences in occupational distribution. In general, women in the service sector are more concentrated in the highly paid occupations than are women in the manufacturing sector.

Women are much more likely to work in service-sector jobs than are men. And, it is apparent that, compared to manufacturing workers, a higher percentage of service workers are part time, especially among women. Also, male service workers are less heavily represented by unions than are male manufacturing workers.

Regression Results

The results of the earnings regressions are displayed in several tables. Table *3* presents the coefficient estimates for variables that are not part of the age-earnings profiles. These estimates determine the intercepts of the estimated profiles for each group. For example, the coefficient of the service-sector dummy variable shows that, controlling for the human capital and demographic characteristics listed, service workers' earnings are lower than manufacturing workers' earnings for both males and females. It is interesting to note that, in contrast to figure *1* and table *2* (which do not control for other characteristics), the "corrected" service-sector earnings effect (that is, the coefficient on the service dummy) for female workers is strongly negative.

The next two rows in table *3* present evidence of the wage penalty experienced by part-time workers. We see that for women the wage penalty for working part time is smaller in the service sector than it is in manufacturing. For males in manufacturing, the penalty for part-time work is larger than that for women in both sectors.

The relative attractiveness of unionism is similar between the two sectors for both sexes. For both men and women, the union wage differential is only slightly higher in services than in manufacturing.

Far more striking is the smaller racial differential in services compared to manufacturing, also found by Montgomery and Wascher *(1987)*. For both sexes, this differential is reduced by almost half in the service sector. The importance of differences in the returns to schooling vary by sex. The results in table 3 suggest that returns to education are significantly higher for women in services, but the difference between sectors is small and statistically insignificant for men.

Age-Earnings Profiles

Age-earnings profile coefficient estimates are presented in table *4*. Hourly wages exhibit typical profiles for men and women in each sector. Males appear to have a steeper, more pronounced earnings path than women in both sectors. Presumably this is due in part to more instances of nonparticipation in the labor force or preferences for part-time work among women. In addition, earnings taper off more quickly for men than for women.

In general, female service workers exhibited a steeper earnings path with greater curvature than manufacturing workers. Male service workers

TABLE 3

Coefficient Estimates of Age-Earnings Equations by Sex in 1987

Variable	Females		Males	
Intercept	-0.276	(-4.52)	-0.508	(-11.58)
Service Dummy	-0.361	(-5.21)	-0.174	(-2.82)
Part Time Dummy	-0.204	(14.14)	-0.295	(-17.38)
Part Time x Service	0.029	(1.88)	-0.083	(-4.15)
Union Member	0.140	(11.85)	0.085	(12.33)
Union x Service	0.014	(1.02)	0.007	(0.60)
Nonwhite Dummy	-0.129	(-11.69)	-0.153	(-16.67)
Nonwhite x Service	0.055	(4.27)	0.075	(5.67)
Years of School	0.082	(48.49)	0.079	(28.47)
School x Service	0.008	(4.07)	-0.002	(-1.48)
R-squared	.325		.411	

NOTE: T-statistics appear in parentheses next to coefficient estimates. The symbol "x" signifies multiplying the two variables shown, which results in an interaction term. The dependent variable is log (earnings). Other variables in the model estimated are age and age-squared interacted with the service dummy variable. Coefficients for those variables are reported in table 4.
SOURCE: Female and male wage and salary workers aged 18 to 54 working in manufacturing or service industries in the one-quarter earnings sample drawn from all monthly *Current Population Surveys* in 1987.

TABLE 4

Age-Earnings Profile Coefficient Estimates by Sex in 1987

Variable	Females		Males	
Age	0.053	(15.79)	0.070	(28.47)
Service x Age	0.010	(2.71)	-0.001	(-0.25)
Age²/1,000	-0.604	(-13.21)	-0.713	(-21.37)
Service x Age²/1,000	-0.136	(-2.27)	-0.024	(-0.49)
Implied Age of Peak Earnings				
Manufacturing	44		49	
Services	43		47	

NOTE: T-statistics appear in parentheses next to coefficient estimates. The symbol "x" signifies multiplying the two variables, which results in an interaction term. The dependent variable is log (earnings). Coefficients on the other variables included in the model estimated are reported in table 3.
SOURCE: Female and male wage and salary workers aged 18 to 54 working in manufacturing or service industries in the one-quarter earnings sample drawn from all monthly *Current Population Surveys* in 1987.

had earnings paths that were not significantly different from those of male manufacturing workers. However, since the age at which wage growth stops is a function of both initial slope and degree of curvature, one way to compare the various age-earnings profiles is to calculate the age at which earnings peak. The results of such calculations are shown in the lower two rows of table 4. Using the coefficient estimates in the first four rows, hourly wages peak for male service workers at age 47 while wages peak for comparable manufacturing workers at age 49. The results for women also suggest that earnings peak at an earlier age in the service sector. However, the difference between the sexes far dominates the difference between sectors.

III. Effect of Age-Earnings Profiles on Sectoral Wage Differentials

We have addressed the question of differences in age-earnings profiles between manufacturing and service workers by interacting service-sector dummy variables with age and age-squared. The next question is whether entry-level workers should expect the wage differences they initially encounter between sectors to persist, or to dissipate over their work life. Another way to ask the same question is: do the service and manufacturing jobs have the same earnings growth potential?

The earnings equation estimates reported in tables 3 and 4 allow us to calculate the earnings difference between service and manufacturing jobs (compared to manufacturing earnings) for the average 18-year-old with 12 years of education. The top two rows of table 5 report the results of that exercise for men and women in four demographic groups. The upper row is based on regressions on men's earnings; the lower row on women's earnings. For instance, the average nonwhite 18-year-old female working in a full-time, nonunion service job earns 9.8 percent less than does a comparable worker in a full-time, nonunion manufacturing job.

Note that in no case do the wages of entry-level service workers exceed those of entry-level manufacturing workers. And, the service differentials among women are sometimes larger and sometimes smaller than those found for men. Perhaps most interesting is the extent to which the service differentials vary, from a low of 6.4 percent to a high of 20.0 percent for men and from a low of 9.8 percent to a high of 14.6 percent for women. The relative disadvantage of

TABLE 5

Comparison of Entry-Level Sectoral Earnings Differentials to Lifetime Sectoral Earnings Differentials

	White Nonunion Full Time	Nonwhite Nonunion Full Time	White Union Full Time	White Nonunion Part Time
Proportional Earnings Differential of Entry-Level Service Workers Compared to Entry-Level Manufacturing Workers (Age 18)				
Males	–.131	–.064	–.125	–.200
Females	–.146	–.098	–.134	–.121
Discounted Present Value of Proportional Earnings Differential From Age 18 to Age 54				
Males	–.166	–.101	–.160	–.232
Females	–.117	–.067	–.105	–.091

NOTE: The predicted wage differential between sectors for each demographic group is converted to a proportion of manufacturing workers' earnings. Estimates of proportional discounted total earnings differentials are based on integration of the estimated earnings functions for each sector, as reported in tables 3 and 4, assuming a 3 percent real discount rate and 12 years of education.
SOURCE: Derived from estimates shown in tables 3 and 4.

service-sector employment compared to a manufacturing job varies strongly with race, sex, and part-time status.

To determine whether these differentials will persist over the workers' careers, we calculate the discounted present value of the earnings stream over the work life. The discounted present value simply adds up the annual earnings of an individual between the ages of 18 and 54. Earnings are valued at the beginning of the career and so earnings received after age 18 are discounted at a 3 percent annual rate. The present value takes into account the estimated differences between age-earnings profiles between sectors.

The lower two rows of table 5 present estimates of the service differential in the present value of earnings from a work life beginning at age 18 and lasting until age 54, using the model with varying age-earnings profiles between sectors estimated in tables 3 and 4. Results from this exercise show that the earnings differential between service and manufacturing workers is primarily due to the straight differential paid to all ages, although differences in profiles do affect these sectoral wage differentials to some extent.

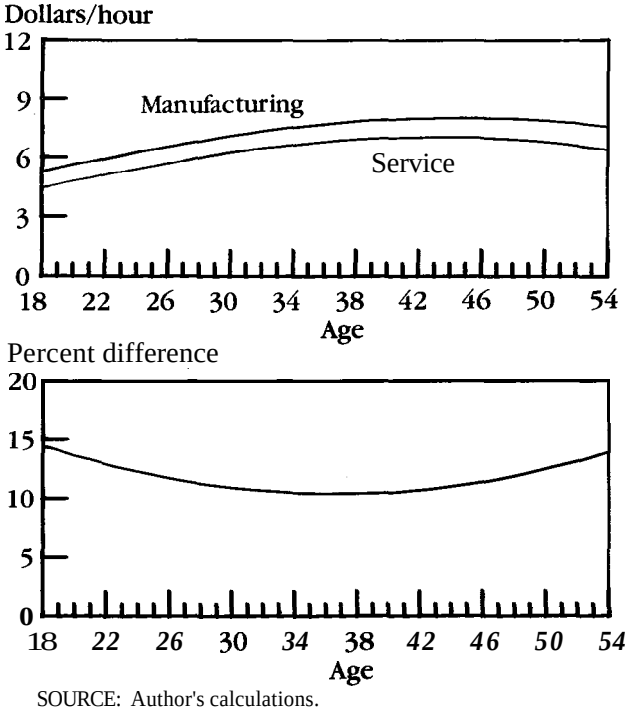
Again, all differentials suggest higher earnings in manufacturing; white nonunion women working full time experience an average difference of 11.7 percent over their work life. And the average, white, nonunion, full-time, male worker earns 16.6 percent less in a service job. For nonwhites, the service differentials are much smaller.

These earnings differences over the entire work life differ from the entry-level wage differentials because they depend on the relative shape of the age-earnings profile in each sector. In general, the lifetime sectoral differences in age-earnings profiles shown in table 5 suggest that starting wages underestimate the ultimate earnings differences for men and overestimate the lifetime pattern for women. The reason for the difference is shown in figures 2 and 3. The upper graph in figure 2 shows that for women, the percent differential increases during their middle years and then narrows during their later years. For men (shown in figure 3), the earnings gap continually increases, since service wages peak earlier and taper off more quickly than manufacturing wages.

It is interesting that the impact of service employment on males' earnings patterns appears stronger than that for females, even though the estimated service-age interaction coefficients (reported in table 4) are far larger for females than for males. This apparent anomaly stems from the offsetting nature of the age and age-squared interaction coefficients for females. For females, an increase in age increases the service differential through the service effect on the age coefficient, but reduces the service differential through the service impact on the age-squared coefficient. Among males, an increase in age is associated with a lower wage for service workers through the service impact on both the age and

FIGURE 2

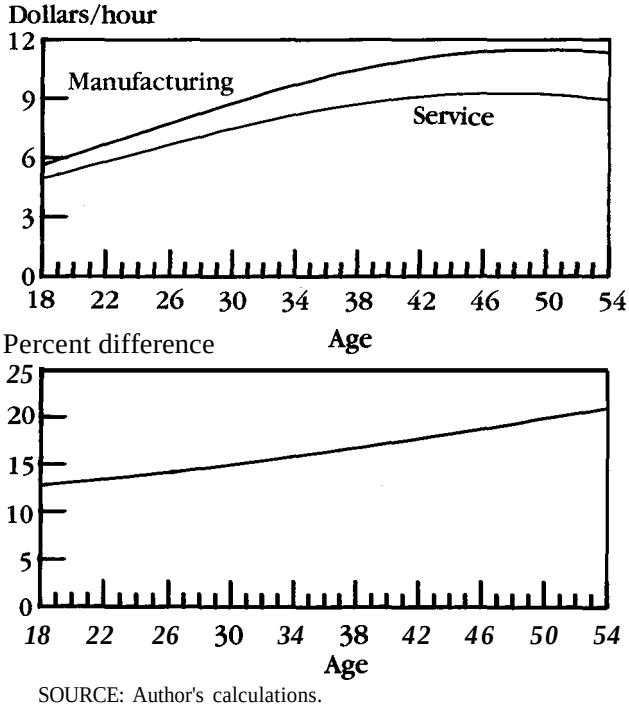
Estimated Sectoral Difference in Female Age-Earnings Profile



SOURCE: Author's calculations.

FIGURE 3

Estimated Sectoral Difference in Male Age-Earnings Profile



SOURCE: Author's calculations.

the age-squared coefficients. since the results for men are based on statistically insignificant sectoral differences in wage growth, any conclusion must be drawn with care.

IV. Age-Earnings Profiles Within Occupations

Implicit in the model presented above is the assumption that education and other demographic variables are good controls for human capital. Occupation provides another way to control for human capital. An alternative assumption is that sectoral differences in profiles result from occupational differences that are constant across industries. Since manufacturing and services employ a different mix of occupations, differences between the sectors may be largely a product of differences in occupations employed.

To address this issue, we estimate separately the simple wage equation with age and age-squared for various occupational categories. The sectoral differencesin age-earnings profiles found earlier disappear within many of the occupations. This finding suggests that employment in the services has no independent effect on age-earnings profiles. But, it does not suggest that the changing industrial structure of employment has no impact. Rather, the impact stems from the effect of the industrial shift on the occupational distribution.

V. Summary and Conclusion

Over the last decade, service-sector employment has grown at twice the rate of total employment, while manufacturing employment has grown very little. As a result, service-sector employment now claims a larger proportion of total employment than manufacturing. This restructuring has drawn attention to concerns that service-sector jobs don't pay as much as manufacturing jobs.

To answer the question posed by the title of this paper, our findings suggest that service workers start out at a lower wage than that of comparable manufacturing workers, but then service-sector wages grow at roughly the same rate as manufacturing-sector wages.

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