Gender differences in occupational distributions among workers

An investigation of gender differences in occupational attainment of prime-age U.S. workers reveals that such differences do exist, especially among women, but apparently are the results of voluntary choices and long-term changes in the labor market

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Recent analyses of gender employment patterns suggest that occupational differences between men and women are a persistent presence in the U.S. labor market. Traditional blue-collar occupations such as operatives and craft continue to be male dominated, while women remain concentrated in service and clerical occupations. (See table 1.) Other occupations, such as managerial, professional and technical, and sales appear to be distributed almost evenly by gender. For women, the most popular occupations are clerical (a traditionally female-dominated occupation) and professional and technical; for men, the most popular occupations are production and craft, professional and technical, and managerial. Table 1 also presents a well-known measure of the disparity in occupational distributions: the Index of Dissimilarity (ID). This index, based on the absolute deviation in the percentages of men and women across occupations, is defined as

$$(1) \qquad \text{ID} = \frac{1}{2} \sum_{j=1}^{J} \left| P_j^M - P_j^W \right|$$

where $P_j^{M,W}$ measures the percentage of men (M) or women (W) in occupational category j. The ID ranges from 0 to 100, with its numerical value indicating the percentage of men, women, or some combination of the two that need to shift occupations in order for the two distributions to equalize. An ID of 0 means equal occupational representation by gender, whereas a value of 100 denotes complete gender segregation across occupations. Thus, the data in table 1 indicate that, in 2001, 31 percent of men or women (or a combination of percentages that adds up to 31 percent) would have to change occupations for there to be complete gender equality in occupational distributions. This percentage is consistent with other estimates of occupational employment patterns reported from a variety of labor market data.[1]

Although the occupational differences reported in table 1 are well known, researchers continue to investigate whether these employment disparities result from gender differences in occupational choice, from differences in characteristics, or from market distortions such as occupational segregation. Occupational segregation occurs when workers are excluded from certain jobs, and overrepresented in others, for reasons such as race, gender, or national origin. Since the early 1960s, researchers have been interested in the measurement and consequences of occupational segregation in the labor market. Recent empirical work has employed discrete-choice, qualitative-response models of occupational attainment to investigate differences in occupational structures across groups of workers. These qualitative-response models

Table 1.	Employed persons 20 years and older in the civilian labor force, by occupation and gender, 2001					
			Men		Women	
Occupation	Percentage of occupation that are men	Percentage of occupation that are women	Number (in thousands)	Percentage of all men employed in each occupation	Number (in thousands)	Percentage of all women employed in each occupation
Total................................... …	…	…	67,334	100.0	59,787	100.0
Managerial	54	46	11,005	16.3	9,387	15.7
Professional and technical	46	54	12,063	17.9	13,952	23.3
Sales	52	48	7,601	11.3	6,953	11.6
Clerical and administrative support.....................................	21	79	3,751	5.6	14,128	23.6
Service	39	61	6,465	9.6	10,066	16.8
Production and craft	91	9	3,516	20.1	1,283	2.1
Operatives...............................	76	24	9,302	13.8	3,007	5.0
Laborers	78	22	3,631	5.4	1,011	1.7

NOTE: The Index of Dissimilarity across all occupations in 2001 was 31.1.

of occupational attainment were developed initially to predict the likelihood that workers are employed in a specified occupational category, given their individual traits.[2] The occupational segregation literature has adapted the models to determine whether, after controlling for differences in characteristics such as human capital variables, certain workers face unequal prospects for occupational achievement.[3]

This article assesses recent occupational distributions of prime-working-age ("prime-age") men and women in the U.S. labor market. The objective is to determine the extent of gender differences in occupations that are due to discrimination-based segregation, or due to other factors such as differences in human capital characteristics and labor market choices.

Empirical model

Occupational attainment refers to the net outcome of the processes that ultimately determine a worker's occupation. The demand side of occupational labor markets is influenced by employer-established requirements for jobs in terms of training, education, and experience and by other labor market factors, such as product demand and labor productivity. On the supply side, a worker's background, demographic characteristics, ability, and aptitude will influence occupational choice and placement. Empirical models of occupational attainment are therefore reduced-form specifications that attempt to incorporate both sup-

ply- and demand-side factors. This analysis uses a well-established occupational attainment model to estimate the statistical link between a worker's characteristics and the likelihood that he or she is employed in a given occupation. In our specification, we assume that the probability that a worker is employed in the jth occupation ($j = 1,…,J$) can be expressed as the logistic conditional probability function

$$(2) \qquad P_{ij} \big| X_i = \frac{e^{\delta_j X_i}}{\sum_j e^{\delta_j X_i}},$$

where P_{ij} is the expected probability that the ith individual ($i = 1, …, N$) is employed in the jth occupation, X_i is a vector of individual characteristics, and δ_j is a vector of coefficients to be estimated. The logistic model in (1) can be expressed in linear terms as the log of an odds ratio:

$$(3) \qquad \ln(P_{ij}/P_J) = \hat{\delta}_j X_i.$$

Estimating the parameters in δ_j yields an occupational structure in which the net influence on a worker's occupation is expressed as a function of personal characteristics that are statistically linked to occupational attainment.[4]

We can use equation (3) to investigate whether women face different prospects for occupational attainment than

their male counterparts. The initial step in this process is to estimate the parameter coefficients of (3) for men. Next, these estimated coefficients are applied to workers' characteristics from the women's sample. This step yields an estimated probability that a woman is employed in an occupation, given that her personal traits are evaluated according to the estimated occupational structure for men:

$$(4) \qquad \hat{P}_{ij}^{W} = \frac{e^{\hat{\delta}_{j}^{M} X^{W}}}{\sum_{j} e^{\hat{\delta}_{j}^{M} X^{W}}}.$$

Equation (4) can be used to derive the expected percentage of women in occupation j, assuming that they are assigned to occupations on the basis of their characteristics and qualifications in a fashion similar to the way men are.[5] The expected occupational distribution for women can be compared with their actual distribution to determine whether there are noticeable differences.

To compare the actual occupational distribution of men with the actual and expected occupational distributions of women, we calculate (1) the ID for the actual occupational distributions of men and women, and (2) the ID for the actual men's distribution and the expected women's distribution. A significant decline in the index from (1) to (2) suggests that if the characteristics of women are evaluated as though they were men, the occupational distributions of the two groups become more similar. This idea supports the notion of discrimination-based occupational segregation against women, assuming that men and women have similar tastes with respect to occupational choice. The approach assumes implicitly that any remaining disparity in occupational distributions, once the expected female distribution is determined, results from differences in occupational choice patterns by gender.[6] Thus, the empirical model used in this article is based on the standard neoclassical labor market approach to gender discrimination,[7] an approach which asserts that unequal labor market outcomes between men and women are due primarily to gender differences in skills, qualifications, and choice, as well as to labor market imperfections such as discrimination.[8]

Data and empirical results

Because the analysis that follows focuses on recent labor market outcomes for prime-age workers, two waves from the 1979 cohort of the National Longitudinal Survey of Youth (NLSY79) were selected: 1994 and 2000.[9] Longitudinal data sets are an excellent source of demographic information on individual workers and allow the speci-

fication of a relatively complete set of independent variables for the occupational attainment model given by equations (3) and (4). However, a potential drawback of the NLSY79 is the impossibility of constructing a representative nationwide sample of workers. For instance, in 2000, the NLSY79 comprised workers between the ages of 35 and 43. Although not representative of the entire U.S. labor force, prime-age workers are important to study because these workers are just entering their peak earnings years within their chosen professions.[10] In addition, this age group represents a significant portion of the labor market, accounting for approximately 27 percent of the U.S. civilian labor force in 2000.[11] The samples presented consist of nonagricultural workers who reported positive wage and salary income. Excluded are full-time military personnel, individuals who are enrolled in school, and those with missing information on their occupational status. The occupational categories are described more fully in exhibit 1, and the independent variables used to estimate the logit model of occupational attainment (X_i) are described in exhibit 2.

Table 2 compares the occupational distributions of prime-age men and women in 1994 and 2000.[12] In 1994, the gender disparity in occupational distributions, as measured by the ID, was 37.4. Thus, 37 percent of men or women, or a combination of the two, would have had to shift occupations in order for the two distributions to converge. By 2000, gender differences in the occupational distributions declined slightly, to 36.1. These results are comparable to estimates of gender disparities in employment patterns reported in table 1 and elsewhere.[13] Thus, the overall gender disparity in occupational distributions among prime-age workers remained relatively stable during the late 1990s.

Table 2 also compares the actual occupational distribution of men with the expected occupational distribution of women, derived from equation (4). The ID for 1994 declines by 33.6 points when the expected occupational distribution for women is compared with the actual male distribution. In other words, if women were assigned to occupations on the basis of their education, experience, and other characteristics according to the male occupational structure, the overall gender disparity in occupations declines by approximately 90 percent. For 2000, the change in the ID when the expected women's occupational distribution is compared with the actual men's is 31 points, a reduction of 86 percent. One interpretation of these findings is that unexplained differences in the occupational distributions of men and women fell, albeit slightly from 1994 to 2000. One also may interpret these findings as indicating that women continue to face significant

Table 2. Comparison of actual and expected occupational distributions for men and women, 1994 and 2000 National Longitudinal Survey of Youth

[In percent]

Occupation	1994			2000		
	Men (actual)	Women (actual)	Women (expected)	Men (actual)	Women (actual)	Women (expected)
Service	11.2	18.7	12.0	9.3	17.2	10.2
Laborers	10.0	1.4	10.5	7.9	1.9	8.8
Clerical	7.4	31.2	8.5	5.4	25.2	6.3
Operatives	17.1	8.7	15.3	16.9	7.9	15.6
Craft	19.8	2.4	18.9	21.5	2.5	19.9
Sales	4.5	3.5	4.6	3.8	4.7	3.8
Managerial	14.6	12.6	13.4	18.3	16.2	16.2
Professional and technical	15.5	21.6	16.7	16.8	24.2	19.3
Sample size	3,221	2,888	…	3,021	2,851	…

NOTE: The Index of Dissimilarity across men's actual and women's actual occupational distributions was 37.4 in 1994 and 36.1 in 2000. The Index of Dissimilarity across men's actual and women's expected occupational distributions was 3.8 in 1994 and 5.1 in 2000.

obstacles to occupational mobility than their predecessors did, even with more education and fewer children and with the presence of antidiscrimination laws.

However, a more detailed look at the data in table 2 reveals certain gender differences in occupational distributions that work to mitigate the segregation interpretation. For instance, suppose we consider occupations to be overrepresented by women if the expected percentage of an occupational category is lower than the actual percentage by more than 25 percent. Similarly, underrepresented occupations are those for which the opposite is true (that is, the expected percentage *exceeds* the actual percentage by more than 25 percent). According to these criteria, women appear to be overrepresented in the service, clerical, and professional and technical occupations, and underrepresented in the craft, operatives, and laborers categories in both 1994 and 2000. This implies that most of the hypothetical "shifting" in occupations between the actual and expected women's distributions results in women moving from service, clerical, and professional jobs into more traditional, blue-collar occupations. If women tend to avoid blue-collar occupations, it is unlikely that such hypothetical shifts are due to differential treatment in the labor market. Rather, these results are consistent with the notion that many women may prefer occupations that offer more flexible work arrangements

and scheduling with better nonwage amenities, regardless of their human capital and other traits.[14] Our results are also consistent with those of John Robst and Jennifer Van Gilder, who find that women who choose "female" occupations incur lower wage penalties for intermittent labor force participation than women employed in predominantly "male" occupations.[15] Thus, the reluctance of women to choose blue-collar occupations may result from a rational assessment of the potential labor market losses from activities such as child rearing.

Recent work from the sociology literature also supports the finding of stable gender differences in occupational employment patterns. Robert Blackburn and colleagues find that the persistence of gender employment differences in occupational structures is common in more developed countries such as Britain and the United States.[16] They attribute this phenomenon to several factors. One factor is the long-term change in occupational labor markets in which the growth in women's labor force participation is correlated with the relative increase in the proportion of white-collar occupations in the labor force. Thus, as more women have entered the labor market with education levels that equal or surpass their male colleagues, they have found employment in the rapidly growing white-collar occupations in the professional, technical, and clerical fields.

DO WOMEN AND MEN ENCOUNTER unequal employment prospects across occupations, given their personal characteristics? Empirical evidence presented in this article indicates that gender differences in occupational distributions remained stable during the 1990s at levels comparable to those of the 1980s. The multinomial logit model of occupational attainment set forth here also detected a significant shift of women across occupational categories if their characteristics are evaluated according to the men's occupational structure. These shifts did not change significantly throughout the 1990s and are similar to comparable estimates from the late 1970s and 1980s. A more detailed examination of the occupational shifts reveals that the expected ("discrimination-free") women's occupational distribution predicts a movement of women from white-collar to blue-collar jobs. This is unlikely, however, especially in light of recent literature on occupational employment patterns and choice by gender. Thus, U.S. women in their thirties and forties do not appear to encounter significant levels of involuntary segregation across broad occupational categories. Although gender differences in occupational attainment persist, they apparently result from voluntary choices of men and women and from long-term changes in labor markets, such as the simultaneous growth of white-collar occupations and women's labor force participation rates. □

Notes

[1] Francine D. Blau, Marianne A. Ferber, and Anne E. Winkler, *The Economics of Women, Men, and Work*, 4th ed. (Upper Saddle River, NJ, Prentice Hall, 2002).

[2] Peter J. Schmidt and Robert P. Strauss, "The Prediction of Occupation Using Multiple Logit Models," *International Economic Review,* June 1975, pp. 471–86; and Solomon Polacheck, "Occupational Self-selection: A Human Capital Approach to Sex Differences in Occupational Structures," *Review of Economics and Statistics*, February 1981, pp. 60–69.

[3] Schmidt and Strauss, "The Prediction of Occupation"; Paul W. Miller and Paul A. Volker, "On the Determination of Occupational Attainment and Mobility," *Journal of Human Resources*, spring 1985, pp. 197–213; Andrew M. Gill, "Incorporating the Causes of Occupational Differences in Studies of Racial Wage Differentials," *Journal of Human Resources*, winter 1994, pp. 20–41; and Paul E. Gabriel, Susanne Schmitz, and Donald R. Williams, "The Relative Occupational Attainment of Young Blacks, Whites, and Hispanics," *Southern Economic Journal*, July 1990, pp. 35–46.

[4] Schmidt and Strauss, "The Prediction of Occupation"; and Gabriel and others, "The Relative Occupational Attainment."

[5] Following the standard approach, equation (4) is based on the assumption that men, as a group, encounter the "discrimination-free" occupational structure. The expected occupational distribution of women is obtained by summing the estimates from (4) across all workers in the women's sample. (For a discussion of this approach, see Miller and Volker, "On the Determination of Occupational Attainment"; and Gabriel and others, "The Relative Occupational Attainment.")

[6] Miller and Volker, "On the Determination of Occupational Attainment"; and Schmidt and Strauss, "The Prediction of Occupation."

[7] Gary S. Becker, *The Economics of Discrimination*, 2d ed. (Chicago, University of Chicago Press, 1971); and Polacheck, "Occupational Self-selection."

[8] For a summary of alternative explanations of gender employment patterns based on sociological theories of labor market outcomes, see Robert M. Blackburn, Jude Browne, Bradley Brooks, and Jennifer Jarman, "Explaining Gender Segregation," *British Journal of Sociology*, December 2002, pp. 513–36.

[9] The 1994 wave of the NLSY79 was selected because it is the last of the annual surveys; beginning in 1994, the NLSY was conducted on a biannual basis. Thus, 1994 represents the last year in which we have continuous information on labor force participation. The year 2000 was selected because it is the most recent wave available.

[10] The age distribution (35–43 years) of the NLSY sample used in this analysis falls within the standard classification of "prime-age" workers (generally considered to be between 35 and 54 years old).

[11] *Employment and Earnings* (Bureau of Labor Statistics, 2002), pp. 209–10.

[12] The multinomial logit estimates used to derive the expected occupational distributions in table 2 are available from the authors upon request. For a discussion of the multinomial logit estimation technique, see G. S. Maddala, *Limited-Dependent and Qualitative Variables in Econometrics* (New York, Cambridge University Press, 1983). Also, the Index of Dissimilarity value for 2001 (in table 1) refers to the entire U.S. labor force (age 20 and older). The figures for 1994 and 2000 (in table 2) are based on samples drawn from the National Longitudinal Survey of Youth (ages 34–43). Thus, the Index of Dissimilarity values for 2001 are not directly comparable with those for 1994 and 2000.

[13] Blau and others, *The Economics of Women, Men, and Work.*

[14] Catherine Hakim, *Work–Lifestyle Choices in the 21st Century* (Oxford, U.K., Oxford University Press, 2000).

[15] John Robst and Jennifer Van Gilder, "Atrophy Rates in Male and Female Occupations," *Economics Letters,* December 2000, pp. 407–13.

[16] Blackburn and others, "Explaining Gender Segregation."

Exhibit 1. **Occupational categories**

Occupation	Occupations included
Service	Service, including private household
Laborers	Handlers, equipment cleaners, helpers, and laborers
Clerical	Administrative support
Operatives	Machine operators, assemblers, inspectors, material movers
Craft	Precision production, craft, and repair
Sales	Sales
Managerial	Executive, administrative, and managerial
Professional and technical	Professional specialty; technicians and related support

Exhibit 2. **Independent variables (X_j) for the multiple logit occupational attainment model**

	Individual characteristic
HIGRADE:	Highest grade of schooling completed by respondent in survey year.
YRFTEXP:	Total years of year-round full-time equivalent labor market experience since 1979—calculated as (total annual hours of labor market activity)/1,750.
DISAB:	Set equal to 1 if an individual reports a disability that limits labor force participation, 0 otherwise.
MSP:	Set equal to 1 if an individual is married with spouse present, 0 otherwise.
AFQT:	Percentile score on the Armed Forces Qualifications Test, administered in 1980.
MHGRADE:	Highest grade of schooling completed by respondent's mother.
FHGRADE:	Highest grade of schooling completed by respondent's father.
SMSA:	Equal to 1 if an individual lives within a Standard Metropolitan Statistical area, 0 otherwise.
UNION:	Set equal to 1 if an individual reports that his or her workplace is covered by a collective bargaining agreement, 0 otherwise.
BLACK:	Set equal to 1 if an individual is black, and non-Hispanic, 0 otherwise.
HISPANIC:	Set equal to 1 if an individual is Hispanic, 0 otherwise.