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Up the Down Staircase: Women's Upward Mobility and the Wage Penalty for Occupational Feminization, 1970-2007

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This study examines the long-term trends of two parallel and related gender effects, in light of the hypothesis that highly rewarded occupations will be the most penalized by the process of feminization. Using multilevel models of the Integrated Public Use Microdata Series data from 1970 to 2007, the study analyzes trends in women's occupational mobility and juxtaposes these trends with trends in the effects of feminization on occupational pay across diverse occupational wage groups. The findings reveal two opposing processes of gender (in)equality: during this period, many women had impressive success in entering highly rewarded occupations. Simultaneously, however, the negative effect of feminization on the pay levels of these occupations intensified, particularly in high-paid and male-typed occupations. Consequently, women found themselves moving "up the down staircase." The findings confirm the dynamic nature of gender discrimination and have broad implications for our understanding of the devaluation and exclusion mechanisms discussed in earlier literature.

Introduction

The economic rewards of occupations in which women's representation is high are lower than those in which women's representation is low. A common explanation for this association is found in devaluation theory, according to which women's work suffers from discrimination in pay because the traits and skills identified with femininity are valued less than are masculine traits (England 1992). Thus, with the entry of women into occupations, the value of these occupations and, subsequently, their relative pay levels are reduced.

Much scholarly attention has been devoted so far to the association between occupational feminization and pay levels (e.g., Reskin and Roos 1990). Nevertheless, most empirical studies have engaged primarily with the causal

I thank Michael Shalev and Yinon Cohen for helpful comments and advice, and Dvora Birger for valuable help in the data analysis. I also thank the Israel Foundations Trustees for their generous financial support.

Social Forces 91(4) 1183–1207, June 2013
doi: 10.1093/sf/sot018
Advance Access publication on 4 May 2013

mechanisms between the two, leaving other important issues undeveloped, such as the three questions that this paper spotlights. The first inquires after trends in the occupational mobility of women, asking which occupations have become more feminized during the years 1970-2007. The second question inquires which occupations are most vulnerable to earnings erosion after feminization. And the third inquires whether the effect of feminization on occupational wages, across the different groups of occupations, remained stable over the last decades.

To subject these questions to an empirical test, the present study analyzes long-term trends in occupational feminization in parallel to the effect of feminization on occupational pay across diverse occupational groups. Specifically, in the empirical analyses I will first document changes over time in women's standing on the occupational pay ladder. I then divide occupations into groups according to their pay and feminization levels, and test the hypothesis that devaluation is most severe in the upper echelons of the occupational hierarchy, particularly in male-dominated occupations. Because this analysis covers a period of almost four decades, it will also allow testing whether over-time trends in the effect of feminization on occupational pay differ between the occupational groups.

This analysis makes a theoretical as well as empirical contribution to the existing literature. First, prior studies have tended to overlook the differences between groups of occupations when testing the effect of feminization on occupational pay. They have also detached women's occupational mobility from the corrosive effect of feminization on occupational pay as two separate fields of study (but see Reskin and Roos 1990). By contrast, this study shows the tight connections between these two processes, and the importance of the distinction between groups of occupations for the devaluation process. Second, the present study offers an analysis of long-term trends of these two processes, which is almost entirely absent from earlier empirical studies.

The findings of this paper show that when trends in mobility and wage erosion are juxtaposed, their mutual relationship becomes apparent, specifically the paradox—embodied in the title of this article—that women have been moving "up the down staircase." Specifically, during the period 1970-2007, American women substantially improved their representation in occupations with high economic rewards. As I theoretically anticipate and empirically demonstrate, however, in parallel to this remarkable process, the negative effect of feminization on occupational wages has intensified in this specific group of occupations–highly paid occupations, particularly male-typed–which is most vulnerable to wage erosion after feminization. These two parallel trends—declining discrimination against women as individual workers, and rising discrimination against occupations after the entry of women—affirm the dynamic nature of gender discrimination and have broad implications for our understanding of the mechanisms that produce and reshape gender inequality.

Trends in Women's Occupational Mobility

In contrast to the extensive scholarly attention devoted to the decline in gender wage gaps and occupational sex segregation, relatively few studies have attended

to trends in women's occupational mobility. Those that have, however, clearly point to an improvement in women's occupational standing, a trend that gained momentum during the 1970s and continued into the 1980s and 1990s. Cotter, Hermsen and Vanneman (2004) report a dramatic decline in sex segregation, as well as improvement in women's occupational standing. Between 1950 and 2000, sex segregation declined by more than 14 points in the index of dissimilarity. This process was spearheaded by the integration of women in previously male-dominated occupations, such as their entry into high-status professional occupations in medicine and law, and their integration in managerial positions and high-level elective office (see also Weeden 2004, 1998).

Similar findings are detailed in Jacobs' (1992) study, which finds a dramatic increase in women's representation in managerial positions. Whereas in 1970 only one in six American managers was a woman, less than 20 years later more than two out of five were women. This increase is expected to further fuel the desegregation process because workers under female managers are less gender-segregated (Huffman, Cohen and Pearlman 2010). The integration of women in previously male high-paid professional and managerial occupations benefits women above and beyond their higher economic rewards. Women attain higher occupational status and prestige, enjoy more autonomy and authority, and get better working conditions and greater protection (Reskin and McBrier 2000).

Changes in contextual conditions during the last five decades may explain the trends described above. The most prominent are the expansion of the educational system, the growing returns to education and experience, and the sharp rise in wage inequality. These changes were followed by structural shifts in supply and demand, shifts in public opinion towards gender equality, and welfare state conditions. As detailed below, all of these changes have favored women, and thus have contributed to eroding barriers to their upward occupational mobility, and to an improvement in their economic rewards vis-à-vis men's.

The expansion of education was perhaps the dominant factor driving this process. During the 1970s alone, the share of young women with a college degree grew very rapidly, outstripping the increase among men. Among bachelor's and master's graduates, women's share exceeded that of men by the 1980s (Cotter, Hermasen and Vanneman 2004; Morris and Western 1999). By 2000, women were the recipients of more than 40 percent of the doctoral and professional degrees in the United States. This proliferation was characterized by a considerable expansion in women's preferred fields of study, while their representation in fields traditionally dominated by men increased significantly (Cotter, Hermsen and Vanneman 2004; Weeden 2004).

In parallel to this, the premium for education—which decreased during the 1970s—increased considerably during the 1980s and 1990s (Goldin 2002; Katz and Autor 1999; Morris and Western 1999; Blau and Kahn 1999). The rising premium for education has improved the relative standing of white collar occupations, especially professional and semiprofessional occupations, in which women have traditionally had a high representation (Mandel 2012; Cotter, Hermsen and Vanneman 2004). This process also contributed to a reduction

in the relative pay of male-dominated blue collar occupations, so in this sense women have benefitted as a result of "men's losses" (Bernhardt, Morris and Handcock 1995; McCall 2007; Katz and Autor 1999). From both sides of the occupational structure, then, the high premium for education has improved the relative position of women.

Those broad contextual changes join structural and compositional changes like changes in supply and demand (Cotter, Hermsen and Vanneman 2004). Reskin and Roos (1990) argue that the rapid growth of professional and managerial occupations during the 1970s and 1980s, compounded by the high-qualification requirements of such positions, prompted employers to hire women because the supply of qualified workers was limited and because women were relatively highly qualified. The increasing demand for professional workers overlapped with the growing participation of women in higher education at all levels.

Shifts in public opinion towards gender equality have also advanced women's occupational attainments and support their integration in prestigious jobs. More egalitarian public opinion has mainly resulted from more liberal recent cohorts replacing more conservative older cohorts (Bolzendahl and Myers 2004; Cotter, Hermsen and Vanneman 2004). This shift is important because more egalitarian public opinion reflects a less stereotypic view of gender roles, which in turn erodes the barriers to women's entry into male-typed jobs. At the same time, less stereotypic opinions may also weaken the devaluation of women's traits, and consequently also the risk of losing prestige following occupational feminization.

Last, the market-oriented welfare regime of the United States also supports women's economic and occupational attainments, although this is true mainly for advantaged women. The liberal welfare state—which leans on market solutions in providing services and benefits—is committed to removing obstacles by legislating against discrimination, with the aim of ensuring equal competition for jobs and earnings (Orloff 2006). These conditions indeed improve women's occupational and earnings attainments: women in the liberal labor markets, first and foremost in the United States, were found to be in a better position to compete for lucrative, high-status managerial jobs than are their counterparts in other welfare regimes (Mandel 2009; Mandel and Semyonov 2006; Orloff 2006; Wright, Baxter and Birkelund 1995).

To summarize, the contextual conditions described above affect the association between gender composition and pay level because they all stimulate women's upward occupational mobility. More egalitarian public opinion and antidiscrimination legislation of equal opportunity erode the barriers to women's entry into attractive occupations. This converged with the higher qualifications gained by women (from the supply side), and with the rapid growth of professional and managerial occupations (from the demand side). Moreover, not only did women attain greater access to these occupations, but also those very occupations improved their relative position on the occupational wage ladder, due to the combination of relatively higher educational levels and the growing returns to education.

The Implications of Devaluation Theory

Devaluation refers to a dynamic process that occurs as a result of women's entry into prestigious occupations. Thus, it should take place during periods of women's upward occupational mobility, like the one described above. Devaluation theory is largely identified with the work of Paula England (1992) and her collaborators (England et al. 2007; Karlin, England and Richardson 2002; Levanon et al. 2009), but can also be found in the work of many other scholars (Cohen and Huffman 2003; Steinberg 1990; Tomaskovic-Devey 1993). The theory suggests that the remuneration for traditional women's work and other work done primarily by women suffers because employers underestimate the traits and skills identified with femininity. The lower social valuation of women's work prompts decision makers in organizations to devalue the relative pay in occupations dominated by women. Thus, women's entry into a male-dominated occupation would diminish the value of this occupation and, consequently, its relative wage.

In *A Pollution Theory of Discrimination*, Claudia Goldin (2002) describes a similar process, claiming that male employees discriminate against female employees to protect their occupational status from being "polluted" by the entry of women. While Goldin set out to explain the rationale underlying the exclusion of women in hiring, the logic of her theory is very much akin to the devaluation thesis: men want to keep women out of occupations to prevent the possible undermining of their status, prestige and earnings.

The significance of devaluation to women's economic attainment has been highlighted by several studies. Cohen and Huffman (2003) found that the process of occupational feminization is detrimental to women's economic gains not only because occupations or jobs dominated by women suffer from lower average wages, but also because the gender wage gaps in feminized occupations are larger (see also Huffman 2004). Others, however, did not find greater gender wage gaps within feminized occupations (Cotter et al. 1997). In this study, however, I focus only on the relationship between gender composition and occupational pay. My contributions to this topic are different from those of previous studies. Specifically, I ask whether the devaluation process varies by groups of occupations, and how it changes over time within each group of occupations.

In evaluating these two questions, the rationale of devaluation points to two potential theoretical and empirical implications. The first is related to a distinction between groups of occupations, while the second refers to the different expectations that the devaluation process yields for long-term trends, relative to the expectations deriving from alternative processes.

Distinction between Groups of Occupations

Because devaluation is believed to occur as a result of women's entry into "valuable" or "prestigious" occupations, it ought to be most pronounced among highly paid, particularly male-typed, occupations. Thus, I argue that to detect whether devaluation/pollution is at work, researchers need to distinguish between different types of occupations. Occupations with higher initial earnings and status

ought to suffer the severest reduction in relative wages because men have more to lose if their reputation for productivity is polluted by women's entry. By contrast, occupations that require little or no education and skills should be less affected by women's entry because their initial social "value" or reputation is already low. In addition, because wage erosion is believed to result from the lower value attributed to women's work, or by women's polluting the reputation of men, devaluation and pollution should affect male-dominated occupations most strongly. Female-dominated occupations have already paid the price of devaluation, and are therefore less expected to suffer serious damage.

Despite the strong theoretical reasoning for disaggregating the effect of feminization on occupational pay, I am aware of only one empirical study that has addressed this issue, which found no evidence that this effect is intensified as the occupational wage ladder is ascended (Huffman 2004). Nevertheless, Huffman used a unique definition of jobs, rather than occupations, as the unit of analysis, and tested the effect of job rank by its interaction with gender composition, instead of conducting separate analyses for different occupational groups. Because this interaction represents the *average* effect across *all* occupations, it can mask the effects in each occupational group. For example, if gender composition has little or no effect on occupational wages in low- and middle-paid occupations, but does have a significant effect in high-paid occupations, as this study indeed assumes, then the average effect (i.e., the interaction term) might be insignificant, despite notable effects in the distinct occupational groups.[1]

Devaluation versus Exclusion within a Long-Term Perspective

Based on the trends described above, the last four decades provide an ideal context for testing and evaluating the explanatory power of devaluation versus other explanations that implicate different mechanisms and, as a result, generate different expectations.

The most common alternative explanation for the association between feminization and pay is discrimination against women in hiring. The idea is that women are excluded from the more attractive occupations, although the reasons and means are disputed. The more dominant among them include social closure (Parkin 1974), statistical discrimination (Tomaskovic-Devey and Skaggs 1999) and social stigmas (Reskin and Roos 1990). Exclusion not only limits women's entry into lucrative jobs, but also lowers wage levels in female-dominated occupations by forcing women to crowd into a limited range of occupations (Bergmann 1986; Catanzarite 2003; Reskin and Roos 1990).

Organizations use different exclusion practices, depending on their recruitment and promotion procedures. Large and bureaucratic firms, for example, as well as firms within the public sector, tend to use more formal recruitment procedures, while small and private firms tend to rely more on informal methods, such as recommendations from existing staff (Carroll et al. 1999). The latter are in a better position to inhibit the opportunity structure of women because they give more power to current employees. Indeed, Reskin and McBrier (2000) have

showed that open recruitment like advertising, or promotion based on seniority, increases women's representation in managerial jobs. By contrast, the use of informal networking increases ascription-based recruitment and promotion.

Systematic barriers to women's recruitment or promotion may also vary by fields within occupations. In the case of the former, a specific field within an occupation may enjoy greater protection from wage reduction compared with other subfields within the same occupation. Such occupational subfield differences cannot be revealed, however, when occupations are the unit of analysis.

Where practices of exclusion are effective they prevent devaluation; when organizations or occupations do inhibit the recruitment or promotion of women, they are also protected from being "polluted." Paradoxically, however, the more attractive organizations, occupations or specific fields within occupations are, the more likely they are to attract women and, consequently, to become a target of devaluation once women manage to get in.

Paula England and her colleagues (England 1992; England, Allison and Wu 2007; Karlin, England and Richardson 2002; Levanon et al. 2009) have devoted much scholarly attention to testing the causal dynamics of devaluation, versus exclusion-based theories. Their findings provide considerable support for the devaluation thesis, and scant evidence of the effect in the other direction (see also Semyonov and Lewin-Epstein 1989; Snyder and Hudis 1976). Because most studies on this issue have focused on the causal dynamics, they have tended to disregard the behavior of the effect over time. Levanon et al. (2009: Table 6), however, do provide some evidence of an increased effect of feminization on wages until 1990.[2]

Nevertheless, the basic assumptions underlying devaluation lead to certain over-time expectations. Devaluation theory assumes that women's entry into highly rewarded occupations damages the pay in these occupations. Women's occupational mobility may, therefore, fuel the association between feminization and occupational pay. This expectation joins the expectation developed above. Based on the trends in women's occupational mobility, and the type of occupations that are subject to devaluation, devaluation is expected to be aggravated in highly paid, male-dominated occupations–those that absorbed more women in recent decades, and those that have the higher "value."

In view of this, while the entry of women into high-paid occupations is a sign of a reduction in exclusionary practices, in the presence of devaluation, these very occupations are expected to suffer greater wage penalties in the long run.

Data and Variables

For both individual and occupational variables, I combine data from the 5 percent sample censuses of 1980, 1990, and 2000, the 1 percent census of 1970, and the American Community Survey sample of 2007. Effective sample sizes range from more than 700,000 cases in the smallest sample (1970) to over 6 million cases in the largest (2000). All datasets were harmonized and distributed by the Integrated Public Use Microdata Series (IPUMS; Ruggles et al. 2010). To perform over-time analyses of occupations, IPUMS has reconciled

the occupational classifications on the basis of how the occupational coding scheme of each census differed from that of the previous census. Two modified variables computed by IPUMS, OCC1950 and OCC1990 (based on the 1950's and 1990's classification codes, respectively), standardize the occupational codes used in all other censuses either forward or backward. The variable OCC1990 is recommended as preferable for analyses of the samples from 1980 onward, and will therefore be used here.[3]

While IPUMS has done a valuable effort to "harmonize" the occupational codes over time, not all occupations appear in all censuses. In the present analysis this problem is less acute, as separate regressions are analyzed for each decade, which minimizes the loss of occupations. To verify that the occupational coding of OCC1990 is not sensitive to the effect at focus, I compared the correlations between female percentage in occupations and wage levels a first time when the two variables were computed using the original variable (OCC), and again using the standardized variable (OCC1990). The resulting correlations were very similar. In the dynamic models—which measure changes between two periods, and thus include only the occupations that appear in both—I compared the averages of the two variables (female percentage and wage levels in occupations) between occupations that were included in the analysis and those that were excluded.[4] No significant differences were found between the groups.

The large samples of individual-level data make it possible to generate reliable measures even at the three-digit occupational level. Thus, all occupational-level variables were computed by aggregation after selecting labor force participants aged 18 to 65 years.[5] The net average number of cases in an occupation varies from more than 2,400 in the smallest sample (1970) to almost 19,000 in the largest (2000). Small occupations (less than 30 cases) were excluded from the analysis.

For estimating wage equations at the individual level, I select wage earners aged 25-59 years. The dependent variable in this analysis is pretax wage and salary income for the year prior to the survey, divided by the number of weeks the individual worked in that year. This variable is adjusted for inflation and converted to natural logarithms.[6] Gender is coded 1 for female and 0 for male. Control variables at the individual level include: race (white = 1, other = 0), marital status (married = 1, other = 0), number of children, weekly working hours, education and potential work experience. Education is measured by years of schooling as well as by highest level of schooling achieved aggregated to four categories: less than high school (omitted category), high school graduate, some college (1-3 years) and college graduate or higher (at least 4 years). Potential work experience is calculated by subtracting years of education plus 6 (school age) from age. A polynomial term of experience is also used in the models.

At the occupational level, the key independent variable is the share of women in an occupation. As noted above, the most important intervening variables are the educational requirements of occupations. Therefore, I control for education by introducing the average years of schooling in occupations and the percentage of workers from each of the four schooling categories above (again, the "less than high school" category is omitted). I also control for percentage of whites

and average years of work experience. Appendix 1 presents descriptive statistics for the variables used in the analysis.

Methodology

Analytical Strategy

The first stage of the analysis covers the over-time trends in women's occupational mobility. Given the gender desegregation trends in prestigious occupations (Cotter, Hermsen and Vanneman 2004; Jacobs 1992; Reskin and Roos 1990; Weeden 1998, 2004), I examined the levels of sex segregation, as well as the extent to which women's standing on the occupational wage hierarchy has improved. For this purpose, I calculate the distribution of men and women on the occupational wage ladder, by decade, after adjustment for their levels of labor market participation. To examine the over-time trends, I summarize the changing representation of women in the upper and lower echelons of the occupational wage hierarchy, as well as the correlation between gender composition and occupational wages along the entire occupational distribution, by decade.

To measure devaluation processes, the effect of gender composition on occupational pay levels is analyzed—for each occupational group—by a set of regressions. Comparisons are made between occupational groups and decades, by summarizing the coefficients yielded by the separate regressions. Finally, the effect of *changes* in gender composition on *changes* in pay levels is analyzed by dynamic models for each occupational group, in two separate periods: 1970-90 and 1990-2007.

Multilevel Models

Because individual as well as occupational characteristics are involved, I use multilevel regression models (Bryk and Raudenbush 1992; Kreft and Leeuw 1998), in which the dependent variable is an individual's log weekly wage, and both individual- and occupational-level variables serve as independent variables. The most obvious intervening variables are at the individual level, for within occupations women as individuals earn, on average, less than men. This compositional effect alone would generate a negative relationship between the wage levels of occupations and their gender compositions. However because gender is introduced to the model at the individual level (i.e., controlled for), the lower pay of women relative to men is captured by the gender coefficient and the effect of gender composition at the second level is on *male* wages in occupations (see also Catanzarite 2003; Huffman 2004).

The two-level model is formally defined by the following set of equations. A separate model is fitted for each period and for each group of occupations. The within-occupation equation models wages as a function of individual characteristics:

$$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Female}_{ij} + \beta_{2j}X_{2ij} \cdots + \beta_{kj}X_{kij} + r_{ij}, \quad (1)$$

where the dependent variable Y_{ij} is the log wage of person i in occupation j; β_{0j} is the intercept for occupation j, and β_{1j} (female) denotes the effect of gender on wages in occupation j. X_{2ij} through X_{kij} are the individual-level control variables (education, work experience, race, etc.), each centered around its grand mean (by year and occupational wage group); and β_{2j} through β_{kj} are the corresponding regression coefficients for occupation j (see the rationale of centering in Bryk and Raudenbush, 1992, and Kreft and De Leeuw, 1998). The error term, r_{ij}, is assumed to be normally distributed with mean zero and variance σ^2.

The individual-level variables can be modeled as having either random or fixed effects across occupations. In the current model, the effects of the individual-level control variables are constrained to be the same across occupations. However, the model allows both the average wage and the gender wage gap (the intercept β_{0j} and the gender coefficient β_{1j}) to vary across occupations (i.e., to be random), as shown by the following equations:

$$\beta_{0j} = g_{00} + g_{01}(\text{proportion female})_j + g_{02}Z_{2j} \cdots + g_{0p}Z_{pj} + u_{0j} \quad (2)$$

$$\beta_{1j} = g_{10} + u_{1j} \quad (3)$$

In these equations, the β coefficients derived from Equation 1 constitute the dependent variables; $(\text{proportion female})_j$ is the main covariate, and $g_{02}Z_{2j} \ldots + g_{0p}Z_{pj}$ are p occupational-level control variables (centered around their grand mean). The dependent variable in Equation 3 is gender differences in pay within occupations. My theoretical interest is in Equations 2 and 2a (below). The dependent variable β_{0j} represents the wage of males (who are coded as 0) in occupation j, net of both individual- and occupational-level effects. A negative sign of g_{01} would indicate that the average wage of males in an occupation decreases with increases in the female proportion.

To estimate the dynamic effect of *changes* in gender composition on *changes* in male wage, I regress the male wage in occupations on changes in their gender composition, using lagged-Y as an additional regressor, as presented in Equation 2a below:

$$\begin{aligned}\beta_{1j} = {} & g_{00}+g_{01}\Delta(\text{female proportion})_j + g_{02}(\text{lagged male-wage})_j \\ & + g_{03}(\text{lagged female proportion})_j + g_{04}\,\Delta(Z)_j \cdots + g_{0k}\,\Delta(Z)_j + u_{0j}\end{aligned} \quad (2a)$$

In this equation, Δ(female proportion) refers to the absolute change in the proportion of women between periods. Lagged gender composition (i.e., gender composition in the previous period) and lagged male wage are added as additional controls for the other occupational-level controls, which are also computed in terms of the absolute changes between the two periods. (Again, each variable is centered around its grand mean [mean change].) The occupational-level random effects, u_{0j} and u_{1j}, are assumed to be uncorrelated normal variables with mean zero and variance τ_{00} and τ_{11}, respectively.

The use of a lagged-Y model reduces the risk of omitted variable bias (Finkel, 1995; Keele and Kelly 2006) and has thus been adopted by most studies. In the

equation presented above, it indicates whether *changes* in male wages (rather than the male wages in a given period) are associated with changing levels of feminization (Baron and Newman 1989; Pfeffer and Davis-Blake 1987). More recently, England et al. (2007) and Levanon et al. (2009) used a fixed-effects model with lagged independent variables to further control for omitted variables. While all the above methods are implemented to control for the unmeasured characteristics of occupations, the advantage of this study—which uses multilevel models—is that it also controls for individual-level characteristics. This is important because if, for example, the relative education of men and women changes over time (as was indeed the case), then this could affect the occupational structure as well as the effect of gender composition on occupational wages. Because a central aim of this study is to compare over-time effects, and because the focus is on occupational-level effects (beyond that of individual characteristics), I control for intervening variables at both levels.

In my multilevel analysis, I will first compare cross-sectional effects as in Equation 2 above, and then use a lagged-Y model with change in female proportion between two periods as the main covariate, as in Equation 2a above. These two models will allow me to understand the cross sections as well as the dynamic effects of feminization on occupational wages, and to compare them over time and across groups of occupations.

Findings

Trends in Women's Upward Occupational Mobility

The first goal of the analysis is to describe over-time trends in women's occupational mobility. First, I computed the index of dissimilarity to compare segregation levels over time. The findings—which appear at the bottom of Table 1—show that between 1970 and 2007 the levels of sex segregation in occupations declined substantially, supporting previous findings. The figures imply that, in 1970, 66 percent of either men or women would have had to change occupations (at the

Table 1. Relative Proportion of Women in Occupations by Male Wage Deciles, and the Index of Dissimilarity, 1970-2007

Wage Deciles	1970	1980	1990	2000	2007
1	1.81	1.52	1.46	1.41	1.45
2	1.53	1.50	1.43	1.34	1.35
9	0.90	0.64	0.94	1.02	1.13
10	0.25	0.49	0.62	0.75	0.81
Index of dissimilarity[a]	66	58	53	52	50
n	300	379	381	335	331

Note: [a] The index of dissimilarity is computed based on the detailed occupations.

detailed three-digit classification level) to reach equal occupational distributions, compared with "only" 50 percent in 2007.[7]

Declining levels of segregation per se, however, are not an indication of declining occupational inequality. To explicitly estimate whether the changing representation of women in occupations is related to improvement in their economic attainments, I compare the representation of women across the occupational wage hierarchy between decades. In the first stage, occupations were divided into equal groups (deciles) in each year according to their average male wage. I then calculated the average percentage of women in each occupational category in each period, and adjusted it to the female participation rate.[8] Thus, a ratio of 1 indicates equal representation of men and women in a wage decile, considering their relative representation in the labor market, while values below or above 1 indicate the underrepresentation or overrepresentation of women, respectively, in a wage decile.

The findings indicate an impressive increase in female representation in high-paid occupations concurrently with their decreased representation in lower paid occupations over the period studied.[9] This is true across the entire occupational distribution (not presented), but is most clearly shown at the two poles of the distribution, where the most dramatic changes have occurred. Table 1, which displays these changes, reveals a dramatic increase in women's representation in the two upper wage deciles, particularly among the group of occupations located in the 10th occupational wage decile. Whereas in 1970 women's representation within this privileged group was only 25 percent (compared with their average representation across all occupations), by 2007 their representation exceeded 80 percent. From 1980 onward, there is a consistent and impressive rise in women's representation in both the ninth and tenth occupational wage deciles. In fact, in the ninth decile, women's representation had exceeded men's by 2000. At the opposite pole, the representation of women is consistently in decline, at least until 2000. Nevertheless, the overrepresentation of women in lower wage occupations is still very evident, especially at the very bottom of the occupational wage structure.

The next question is whether women's ascents to the higher range of the occupational ladder affects their relative pay levels. In the following sections, this effect is tested by comparing the coefficients of separate multilevel regressions in separate groups of occupations, first in cross section and then dynamically. According to the rationale of devaluation, the negative effect of feminization on occupational wages is expected to vary among occupations in accordance with their "value." Thus, in the following analysis the sample is divided into groups of occupations according to their wage level.

Devaluation Effects

Cross-Sectional Comparison

The first results of the multilevel analysis are presented in Table 2a. Occupations are divided into tertiles according to their average male wage. All models display

Table 2a. Hierarchical Linear Regression of Logged Earnings on Gender Composition and Controls[a] by Occupational Wage Categories, 1970-2007

	1970			1980			1990			2000			2007		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Intercept (g_{00})	6.29**	6.57**	6.91**	6.19**	6.48*	6.89**	6.13**	6.42**	6.92**	6.11**	6.44**	6.96**	6.12**	6.41**	7.05**
Female Intercept (g_{10})	-0.49**	-0.44**	-0.40**	-0.35**	-0.37**	-0.35**	-0.25**	-0.27**	-0.23**	-0.21**	-0.21**	-0.18**	-0.18**	-0.19**	-0.15**
Effect on the Intercept (β_0)															
Proportion female (g_{01})	**-0.12****	**-0.08****	**-0.28****	**-0.13****	**-0.05^**	**-0.33****	**-0.15****	**-0.04**	**-0.36****	**-0.07^**	**-0.06^**	**-0.35****	**-0.19****	**-0.03**	**-0.42****
Proportion full college	-1.65**	-0.69**	-0.21	-0.33	0.25	0.96**	-0.35	-0.53	1.46**	-1.45**	-0.08	1.00^	-0.79^	-0.45	0.42
Proportion some college	-1.54*	-0.40**	0.45**	-0.44^	0.03	0.54**	-0.40^	-0.11	0.93**	-0.51^	0.30	0.74	0.38	0.11	0.39
Proportion high school	-0.41	-0.20^	-0.07	0.34	0.25^	0.55*	0.50^	0.07	0.87*	-0.67*	0.09	0.41	-0.63*	-0.03	-0.18
Mean years of schooling	0.18**	0.07**	-0.04	0.06^	-0.03^	-0.10**	0.15**	0.06^	-0.14**	0.15**	0.01	-0.07*	0.05	0.08^	-0.02
Proportion white	0.49**	-0.33**	0.44	0.12	0.22	-0.24	-0.05	0.09	-0.24	0.26*	0.09	-0.28	0.35*	0.20	-0.46*
Average work experience	-0.01^	-0.01*	0.00	0.00	-0.01**	0.00	0.00	-0.01**	0.00	0.01*	-0.01*	0.00	0.02**	-0.01**	0.00
Variance Components															
Level-1 variance (σ^2)	0.37	0.26	0.28	0.37	0.33	0.29	0.31	0.29	0.28	0.33	0.27	0.32	0.32	0.28	0.31
Intercept ($\tau 00$)	0.02	0.00	0.01	0.02	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.03

(Continued)

Table 2a. ***continued***

	1970			1980			1990			2000			2007		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
N Occupations	98	100	102	125	126	129	124	126	130	110	111	114	108	110	113
N Individuals	173, 119	164, 335	135, 049	940, 838	974, 574	1,07 1, 955	1, 243, 998	1,102, 707	1,441, 255	1,403, 876	1, 102, 215	1, 813, 458	301, 934	213, 564	416, 391

^p < 0.10 *p < 0.05 **p < 0.01 (one-tailed)

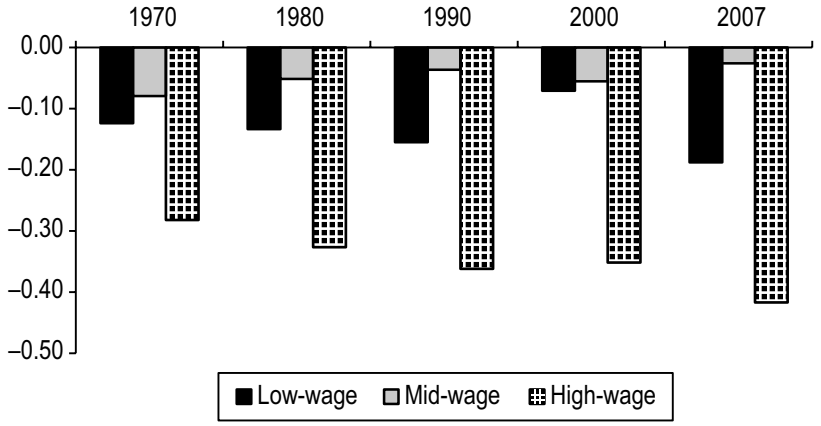
Note: [a]All models control for higher educational level, average years of schooling, potential work experience and its square, weekly working hours, marital status, number of children and race at the individual level.

Table 2b. Significance Tests for Differences Between Groups and Decades (*t* Values)

	1970		1980		1990		2000		2007		Between 1970-2007
	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	
High	-2.92**	-1.97*	-4.28**	-2.67**	-4.55**	-3.03**	-3.94**	-3.66**	-4.67**	-2.65**	**1.46^**
Medium		0.72		1.38^		1.88*		0.26		2.34**	-0.93
Low											0.87

^p < 0.10 *p < 0.05 **p < 0.01 (one-tailed)

Figure 1. Effect of Gender Composition in Occupations on Average Male Wage, by Occupational Wage Categories



the effect of female proportion in occupations (g_{01}) and controls at the occupational level. The effects of individual-level controls, which are constrained to be the same across occupations, are not shown. The main covariate in the table (in bold) represents the effect of the gender composition of occupations on average male earnings. This effect, compared across time and occupational groups, is presented graphically in Figure 1.

Three noticeable observations emerge from this comparison. First, in almost all decades and across all groups (except among mid-wage occupations in 1990 and 2007), a higher proportion of women in an occupation is negatively and significantly associated with the average earnings of men in that occupation, net of both individual- and occupational-level variables. These findings provide additional support for the robustness of the effect of feminization on occupational wages, stressing its persistence over time and across occupational groups.

Second, in line with this study's predictions, the effect of feminization on occupational wages is most pronounced among high-wage occupations. Table 2b, which displays the significance tests for differences between groups and decades, shows that the differences between the high-wage group and each of the other two groups are highly significant. Nevertheless, contrary to the prediction, the effect is larger among low-wage occupations than among mid-wage occupations. This may be the result of the higher gender segregation among the blue collar and pink collar occupations, which are concentrated in the low-wage group (Cotter, Hermsen and Vanneman 2004), and the relatively wide wage differentials between feminine and masculine occupations in this group.[10]

Third, among high-wage occupations, the negative effect of women's representation on occupational wages becomes more severe over time, from g = -0.28 to g = -0.42, although significant only at $p > .10$ (see Table 2b). To convey a sense of the magnitude of these trends, among low-wage occupations in 1970, the estimated gap between occupations occupied solely by women and those occupied solely by men was about 12 percent (g = -0.12), while among high-wage

occupations in this period the gap was as high as 25 percent (g-0.28). By 2007, these gaps had grown to 17 percent (g = -0.19) and 34 percent (g = -0.42), respectively.

Dynamic Comparison

The effect of feminization on occupational wages is robust even after controlling for potential intervening variables, at both the individual and occupational levels. Nevertheless, a more direct examination of the devaluation or pollution processes can be achieved by looking at the dynamic relationships between feminization and occupational wage. The next analysis therefore tests the effect of *changes* in gender composition on *changes* in male wage. It should be noted that changes in gender composition across occupations over time are unrelated to the distribution of gender composition at any given time (i.e., occupations with a high representation of women do not necessarily undergo greater changes, and vice versa). Also, changes in male wage across occupations are only weakly related to their initial or later wage levels (correlations range from -0.15 to 0.20). So both the dependent and independent variables, in these models, are entirely different from those in the above table.

The dynamic models that follow cover changes during two periods: between 1970 and 1990, hereafter the early period, and between 1990 and 2007, hereafter the late period. The large increase in female labor force participation, characteristic of the early period, has been markedly attenuated since 1990 (Goldin 2006: Figure 3.1). The slowdown in the growth of female participation rates suppresses the magnitude of the changes in female percentage across occupations because these changes are caused by not only women's occupational mobility but also the entry of new women into the labor force. The smaller changes in female labor market participation, however, did not hinder the effect of gender composition on occupational pay in the late period. In Table 3a the effect of the (absolute) change in female proportion between 1970-90 and 1990-2007 on the (absolute) change in male wages (see Equation 2a in the methodology section) is examined, by multilevel analysis. In these models, lagged female proportion is added as an additional covariate, and all other controls are computed in terms of absolute changes.[11]

As can be seen in Tables 3a and 3b, some trends resemble the results of the cross-sectional analysis. Except among low-wage occupations in the late period, all the effects are negative and significant. Also, the negative impact of change is stronger in magnitude among high-wage occupations, and it becomes stronger over time, although not significantly stronger in the high-wage group (Table 3b). This comparison is graphically displayed in Figure 2.

Among low-wage and mid-wage occupational categories, however, the cross-sectional trends differ from those observed in the dynamic models. Among mid-wage occupations, changes in female percentage significantly affect changes in male wages, and this effect became stronger in the late period. By contrast, among low-wage occupations, by 2007 neither earlier levels of feminization nor changes in these levels affect changes in male wage.

Table 3a. Hierarchical Linear Regression of Changes in Logged Earnings on Changes in Gender Composition and Controls[a] by Occupational Wage Categories and among Male-Typed Occupations, 1970-90 &1990-2007

	By Wage Groups						High-Wage Group Male-Typed	
	1970-1990			1990-2007			1970-1990	1990-2007
	Low	Medium	High	Low	Medium	High		
Intercept (g_{00})	6.10**	6.44*	6.87**	5.97**	6.40**	-6.95**	6.93**	6.97**
Female intercept (g_{10})	-0.25**	-0.28**	-0.23**	-0.18**	-0.19**	-0.15**	-0.24**	-0.16**
Effect on the Intercept (β_0)								
Δ Proportion female (g_{01})	**-0.22***	**-0.10***	**-0.40****	**0.17**	**-0.33****	**-0.53****	**-0.50***	**-0.74****
Lagged proportion female	-0.10**	0.01	-0.24**	-0.01	-0.01	-0.14**	-0.34^	-0.10
Lagged male wage	0.35**	0.53**	0.33**	0.37**	0.40**	0.63**	0.35**	0.63**
Δ Proportion full college	-0.49	0.26	0.67**	-0.01	-1.21**	1.36**	0.57**	0.70
Δ Proportion some college	-0.38^	0.42*	0.38*	-0.42^	-0.81**	0.83*	0.03	0.13
Δ Proportion high school	-0.37*	0.20	0.15	-0.87**	-1.02**	0.63^	0.22^	0.18
Δ Average years of schooling	0.06^	0.09*	-0.01	0.04	0.15**	-0.03	-0.01	-0.08^
Δ Proportion white	-0.22*	-0.30*	-0.86*	0.11	0.26	-0.10	-1.13*	0.44
Δ Average work experience	0.01*	0.01**	-0.01*	0.01*	0.00	0.02**	-0.01*	0.00
Variance Components								
Level-1 variance (σ^2)	0.31	0.30	0.27	0.32	0.26	0.31	0.26	0.32
Intercept ($\tau 00$)	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.02
N Occupations	100	95	103	108	109	113	73	68
N Individuals	1,197,348	1,012,604	1,186,138	301,934	212,239	416,391	633,137	212,831

^p < 0.10 *p < 0.05 **p < 0.01 (one-tailed)

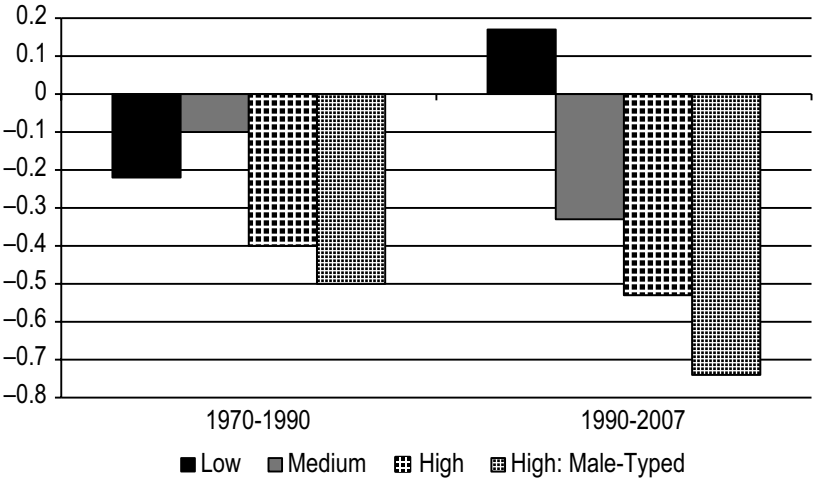
Note: [a] All models control for higher educational levels, average years of schooling, potential work experience and its square, weekly working hours, marital status, number of children, and race at the individual level.

Table 3b. Significance Tests for Differences between Groups and Time Periods (t Values)

	1970-90		1990-2007		Between the Two Periods
	Medium	Low	Medium	Low	
High	-1.76*	-0.96	-0.97	-3.08**	-0.55
Medium		0.87		-3.05**	-1.89*
Low					2.23*

*p < 0.05 **p < 0.01 (one-tailed)

Figure 2. Effect of Change in Gender Composition on Change in Male Wage, by Occupational Wage Categories and among Male-Typed Occupations



To summarize, as expected, high-paid occupations—which absorbed more women than did others—are also those most penalized by feminization, in the static as well as the dynamic analyses. Because I consider this an important message for understanding the devaluation dynamics, my final analysis elaborates further on this effect by concentrating on high-wage occupations alone. To more fully understand which occupations are most vulnerable to feminization, I disaggregate the high-wage occupations by their gender composition. In keeping with the devaluation explanation, we would assume that the wage penalty associated with feminization would be more severe in male-typed occupations.

In the two last models of Table 3, then, the sample is limited to male-typed occupations in the high-wage group alone.[12] The results show that in both periods, the negative effect of changes in female percentage on changes in male wage across occupations is stronger among male-typed occupations (see also Figure 2). And, once again, the effect is more notable during the late period. We can therefore conclude that the negative effect of change in female percentage shown in the previous models is mainly due to its effect among male-typed occupations.

Female-typed occupations that are already devalued are not expected to be effected by the entry of new women.[13] By contrast, high-paid male-typed occupations are the ones most obviously penalized by the entry of new women, as both the devaluation and pollution theories predict.

Discussion

Building on leading theories that explain the association between gender composition and occupational pay, this paper has examined long-term trends in two parallel and related "gendered processes." Its findings point to the impressive upward occupational mobility of American women from 1970 to 2007, in parallel to the growing wage penalty associated with occupational feminization among high-paid occupations, particularly lucrative male-typed occupations.

Specifically, the paper shows that American women have made real upward progress on the occupational ladder. Over the last four decades, they have largely increased their share in the upper reaches of the occupational hierarchy, so much so that by 2007 women's relative proportion in the top wage decile almost reached parity with men's, and even exceeded men's in the ninth occupational wage decile. These findings support previous studies that show an impressive improvement in women's representation at the top of the occupational earnings ladder and in male-typed occupations since the mid-1970s (Cotter, Hermsen and Vanneman 2004; Mandel 2012).

While women's increased access to high-paid occupations implies a weakening of gender discrimination in hiring, an ongoing cultural devaluation of feminine traits and activities is found in the wage-depressing effects of occupational feminization in highly paid occupations. As the findings show, the negative effect of the percentage of women in occupations on their wage levels increased between 1970 and 2007, among highly paid occupations. Under the logic of devaluation theory this may not be surprising because devaluation is believed to occur as a result of women's entry into "valuable" or "prestigious" occupations, and because the theory considers prejudice against women and women's activity to be deeply rooted in society.

Nevertheless, the conclusion that the growing wage penalty for occupational feminization is evidence of a devaluation process should be taken with some degree of caution. Although the present study uses multilevel models to control for both individual- and occupational-level factors, it uses only five points in time, so over-time changes (in the static models) cannot be eliminated. Thus, the present study cannot fully resolve the problem of endogeneity, which suggests that (due to unmeasured changes) wage reduction in occupations may have occurred before women's entry (Reskin and Roos 1990).

Moreover, occupations vary in terms of not only pay level but also other dimensions such as whether they are in the public or private sector, whether they are white collar or blue collar, whether they have a high or low proportion of unionized workers, etc. These qualitative features, which were not taking into consideration here, could be very relevant to understanding devaluation processes, as occupations differ in their recruitment and promotion procedures, as

well as their pay determination systems, both of which are crucial to exclusion practices on the one hand, and to the risk of wage reduction on the other hand.

These limitations call for other studies to further examine the link between gender composition and occupational wages, in accordance with the goals highlighted here. Specifically, the present study calls for future investigations to distinguish between groups of occupations, based on different criteria that are relevant to understanding the effect of feminization on occupational wages. Also, further investigation is required to explicate the mechanisms underlying the over-time trends of this effect, and to probe the differences between specific fields within the same occupations in levels of exclusion and, consequently, devaluation. In a period of rising penetration of women into highly rewarded occupations, these points are particularly important, but surprisingly neglected. Moreover, although devaluation processes derive from the cultural underappreciation of feminine traits, which is deeply rooted in the basic organization of social relations in all advanced societies, the liberal labor market of the United States may provide better conditions for devaluation to occur, due to its unregulated wage determination systems, which makes occupation more vulnerable to pay reduction. Thus, a cross-national comparison might also be helpful to further explore devaluation dynamics in future research.

Notes

1. To test this explanation, I implemented Huffman's analysis of the 1990 census. Using occupations (rather than jobs), I introduced to the equation (in addition to control variables) the occupational rank on the wage hierarchy, and its interaction with gender composition (instead of dividing the sample into groups of occupations). The interaction coefficient was indeed insignificant.
2. Because the theoretical question at focus of Levanon, England and Allison (2009). is also the causal order, it is the study's model design advantages (fixed-effect models) that receive attention, not the comparison of over-time trends. Also, no distinction is drawn between groups of occupations, and the models are run separately for men and women, so it is actually impossible to compare their findings or use them for establishing empirical expectations of over-time trends.
3. For more details, see https://usa.ipums.org/usa-action/variables/OCC1990#description_tab
4. Eighty-two occupations that were available in 1990 but not in 1970 and 50 occupations that were available in 1990 but not in 2007 were not included in the analysis.
5. While the age range of 25-59 years is selected for analyzing the earnings equations, it is problematic for measuring occupation characteristics because in many occupations a high share of workers are very young. For example, in almost 10 percent of the occupations (e.g., cashiers, announcers, hotel clerks, waiters/waitresses, bank tellers), more than one third of the workers are younger than 25 years of age.
6. The top and bottom percentiles of the wage distribution were eliminated before being converted into logs.
7. The index is sensitive to the number of occupations; the more detailed the classification, the higher the levels of estimated segregation produced. Nonetheless, the variation in occupational categories across decades is rather small, and even though the

number of occupations is higher in 1980 and 1990, the reduction is consistent across the whole period.

8. The adjusted relative proportion of women was calculated by the formula $\frac{1}{n} = \sum_i PF_{gti} / PF_t$, where n is the number of occupations in wage group g at year t, PF_{gti} is the percentage of women in occupation i in year t and in group g, and PF_t is the average of the percentage of women in all occupations in year t.
9. Occupations may change location on the occupational structure during the period (move between deciles). However, adjusting the occupational wage structure either forward or backward (i.e., calculating wage deciles according to 1970 or 2007) yields very similar trends in women's occupational mobility.
10. The most heavily feminine occupations (with more than 80% female) are in the low-wage group (e.g., childcare workers, typists, dental assistants, telephone operators).
11. The question of whether to use absolute or relative changes in female percentage posed a dilemma. The advantage of the latter is that it is more sensitive to the entry of women into occupations with initial low shares of women. However, because there are a number of occupations in which women were almost absent, even small changes produced enormous values, which biased the results. I therefore decided to use absolute changes, while controlling for the initial levels of gender composition.
12. The percentage of women in the labor force in each decade was multiplied by 0.9 to yield the maximum percentage of women in "male" occupations.
13. I also computed separate models for female-typed occupations. The effect in those models was, as expected, insignificant in both periods. I decided not to present them, however, because first, explaining the average male wage in occupations dominated by women could be problematic, and second, the total number of occupations in those models was very limited (20 and 29, respectively).

Table A1. Descriptive Statistics for Variables in the Analysis

	M	SD	M	SD	M	SD	M	SD	M	SD
Year	1970		1980		1990		2000		2007	
Individuals[a]	(N = 472,503)		(N = 2,987,367)		(N = 3,787,960)		(N = 4,319,549)		(N = 931,889)	
Weekly wage (logged)	6.34	0.73	6.32	0.75	6.30	0.74	6.36	0.76	6.39	0.79
Female (=1)	0.37	0.48	0.43	0.50	0.47	0.50	0.48	0.50	0.49	0.50
College graduate (=1)	0.15	0.35	0.22	0.42	0.26	0.44	0.30	0.46	0.35	0.48
Some college (=1)	0.12	0.33	0.19	0.39	0.30	0.46	0.32	0.47	0.31	0.46
High school graduate (=1)	0.37	0.48	0.38	0.49	0.34	0.47	0.31	0.46	0.28	0.45
Less than high school (=1)	0.37	0.48	0.20	0.40	0.10	0.31	0.08	0.27	0.06	0.24
Years of schooling (=1)	11.64	3.10	12.81	3.04	13.24	2.52	13.49	2.42	13.86	2.50
Potential work experience	23.57	11.01	20.48	11.08	19.89	9.81	21.33	9.57	22.55	10.03
Potential work experience sq.	676.80	539.69	542.09	510.83	491.89	443.50	546.64	430.00	609.21	454.69
Weekly working hours	39.40	12.71	39.61	9.35	40.47	9.48	41.28	9.78	41.16	9.75
White (=1)	0.89	0.32	0.85	0.35	0.84	0.36	0.80	0.40	0.79	0.40
Married (=1)	0.80	0.40	0.73	0.44	0.69	0.46	0.66	0.47	0.66	0.47
Number of children	1.55	1.61	1.24	1.32	1.08	1.18	1.01	1.16	0.97	1.15
Occupations	(N = 300)		(N = 380)	(N = 380)		(N = 335)		(N = 331)		
Proportion female	0.29	0.31	0.35	0.30	0.38	0.29	0.39	0.29	0.36	0.30
Proportion college graduate	0.22	0.31	0.25	0.30	0.26	0.30	0.27	0.27	0.26	0.30
Proportion some college	0.12	0.10	0.18	0.10	0.27	0.14	0.30	0.14	0.23	0.14
Proportion high school	0.33	0.17	0.35	0.17	0.34	0.18	0.33	0.19	0.34	0.18
Proportion less than high school	0.33	0.26	0.22	0.18	0.12	0.12	0.09	0.10	0.17	0.18
Proportion white	0.89	0.10	0.85	0.09	0.84	0.08	0.80	0.09	0.83	0.09
Years of schooling	12.18	2.48	12.96	2.35	13.26	1.94	13.34	1.75	13.07	2.13
Potential work experience	22.46	4.33	19.98	3.67	19.62	2.51	21.32	2.40	21.11	3.45

Note: M = mean; SD = standard deviation. [a]Cases are limited to those used in the regression analysis.

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