The Acceleration in Women's Wages*

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The American labor market has been transformed in many ways during this century, but perhaps the most far reaching is its growing feminization. At the beginning of this century, less than one woman in five was a member of the labor force; by 1981 more than six in ten were.[1] In spite of these dramatic changes in numbers, the rewards from work for the "typical" woman has scarcely changed. Throughout most of this century, female wages were a constant fraction of those of men.

In this paper, we address the issue of the apparent conflict between the stability of relative female wages alongside an enormous increase in female market participation. Many have argued that a conflict exists because increases in labor force participation would translate into additional labor market experience. This added experience would in turn enlarge market skills of women; directly because such skills increase with length of time on the job and, indirectly, since longer expected labor market durations encourage investments in human capital. And as their market skills increased so, the argument concluded, would women's wages. But standard published wage series indicate that the last link in this chain apparently did not occur. Using these series, female wages have not accelerated relative to males as a consequence of their greatly expanded levels of market work. Our aim in this paper is to offer a resolution to this puzzle.

Because they did not exist, our resolution required the construction of skill distributions for all post-World-War II labor market cohorts. The skill distributions we constructed consist of two

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[1] Statistics refer to all women 20-64 years old. See Smith-Ward (1984).

dimensions--years of schooling and years of labor market experience. Our indices show that convergence between the sexes in skill related characteristics among workers differs greatly from trends in market related skills of men and women, evaluated independently of their current work status. Among workers there is little evidence that either skill or wage disparities between men and women have narrowed over time. However, skill differences by sex in the entire population have converged, especially during the last decade. Correspondingly, our estimate of relative wages of all women indicates more rapid wage improvement for women than for men. The chain of argument from expanded female labor force participation to additional market experience and higher wages is valid, as long as one looks at population averages and not labor force means.

INCOME

In this section we describe what happened to male and female wages during the twentieth century. Because historical data on wages at a national level are sparse,[2] we were forced to opt for indirect methods to develop a long term income series. The series we have assembled places men and women into one of 60 occupational categories for the entire period 1890 to 1979.[3] Based on this occupational taxonomy, female-male income ratios were calculated for each birth cohort at different points in their life cycles. Each occupation was assigned a

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[2] For example, the 1940 Census was the first to include income questions.

[3] The sixty groups were chosen because they allowed for the construction of a set of consistent occupation categories that we could use over this long time span. The procedures used and the difficulties involved in constructing this series are described in Smith (1984).

sex, age, and race specific average income based on 1970 Census incomes for the 35-49 year old age group.[4]

Table 1 presents our estimates of female-male income ratios by five-year birth cohorts from 1826 to 1956. Our estimates of the aggregate female-male income ratio in each Census year are listed in the last two rows of this table. This aggregate series implies that relative female income rose rather sharply from 1890 to 1920. During these 30 years, the relative income of all working women increased by 16 percent, with most of this improvement concentrated on younger women.[5] After calendar year 1920, Table 1 indicates that relative female incomes drifted slowly downward until 1960. There is some suggestion in Table 1 of a recent reversal in this downward trend, but any recent wage advancement for women seems modest. Indeed, our occupation based income series shows slightly lower relative female incomes in 1980 than those in 1920. This essentially constant male-female income ratio over the last 50 years has become the central fact that all research on wage disparities by gender must confront.

Our long term summary is confirmed by data from the post World War II period, when income information stratified by sex and other demographic variables became routinely available. To illustrate, Table 2 lists ratios of weekly wages starting in 1950. Across all ages, Table

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[4] The use of other weights, in terms of different base year (1960 or 1979) or age specific incomes did not alter the patterns we describe here. By construction, our long term wage index will be sensitive only to changes in distributions of men and women across occupational categories. The index ignores time series fluctuations that reflect either changes in the occupational wage structure or within occupation swings in relative income by sex.

[5] From a cohort perspective, this acceleration in relative female wages was confined principally to those women born between 1876 and the first 5 or 10 years of this century.

Table 1

ESTIMATED FEMALE-MALE INCOME RATIOS
BY BIRTH COHORTS (WHITES)

Census Year

Birth Cohort	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980
1956-60										.514
1951-55										.483
1946-50									.517	.448
1941-45									.474	.434
1936-40								.524	.442	.434
1931-35								.472	.429	.432
1926-30							.547	.443	.432	.427
1921-25							.484	.427	.429	.424
1916-20						.522	.451	.429	.429	.422
1911-15						.490	.442	.438	.430	
1906-10					.559	.474		.433	.432	
1901-05					.503	.454	.433	.427		
1896-1900				.575	.464	.439		.415		
1891-95					.439	.424	.420			
1886-90					.421	.416	.410			
1881-85		.500		.458	.406	.406				
1876-80					.392	.395				
1871-75	.462	.428			.380					
1866-70					.368					
1856-65	.410	.375		.376						
1846-55	.370	.346								
1836-45	.344	.336								
1826-35	.335									
All ages 10-75	.395	.412	.423	.470	.463	.455	.457	.442	.447	.450
Ages 20-64	.398	.413		.462	.463	.458	.458	.443	.447	.452

Table 2

FEMALE WEEKLY WAGES AS A PERCENT OF MALES

	Age Group						
Year	All Ages	20-24	25-29	30-34	35-44	45-54	55-64
1950	55.9	77.8	68.6	58.8	48.5	48.7	49.0
1955	54.9	77.1	62.7	54.2	49.6	50.2	49.1
1960	51.2	80.0	61.1	50.8	45.0	46.1	44.1
1965	51.3	84.3	62.9	52.9	49.9	48.7	49.7
1970	50.2	71.9	54.8	46.6	44.4	48.2	52.0
1975	50.3	71.6	61.3	48.2	44.1	45.7	48.2
1980	52.7	70.6	64.3	54.6	47.5	46.0	49.6

SOURCE: Derived from CPS tapes 1968-1982, and published Census sources for earlier period.

2 depicts a slow downward drift in female wages as a percent of male weekly wages until the mid 1970s. After 1975, wages of women rose more rapidly than those of men. Relative wages of women less than age 35 declined until 1970,[6] but during the last decade some of these wage losses were recouped. For women 35 and older, rough stability prevailed in their relative wages.

[6] Over the 1950-1980 time period, the general trends depicted in Table 2 using actual wage data are consistent with those in Table 1 that rely on our occupation imputation method. Among younger age groups, both show a u-shaped trend with the largest female-male income ratios occurring in 1950 and 1980. For older age groups there is general stability between 1950 and 1980. Not surprisingly, the magnitude of the swings are much larger in Table 2, suggesting that occupation based wage shifts are reinforced by other factors.

Education

The first of the two skill characteristics we examine is education. Table 3 presents our estimates of average education by sex for all five-year birth cohorts born after the civil war.[7] While to a large extent, boys and girls share a common heritage in the history of American schools, there are some differences. Male schooling levels rose

Table 3

MEAN SCHOOLING LEVELS BY BIRTH COHORTS

(Years of schooling)

Birth Cohort	Males	Females
1951-1954	12.57	12.65
1946-1950	12.62	12.39
1941-1945	12.21	12.05
1936-1940	11.85	11.70
1931-1935	11.50	11.39
1926-1930	11.17	11.16
1921-1925	10.89	10.97
1916-1920	10.46	10.56
1911-1915	9.83	10.09
1906-1910	9.41	9.75
1901-1905	8.85	9.15
1896-1900	8.44	8.71
1891-1895	7.92	8.19
1886-1890	7.51	7.89
1881-1885	7.31	7.70
1876-1880	7.20	7.65
1871-1875	6.92	7.27
1866-1870	6.79	7.16

[7] Our estimates are based on published census data from the 1940 through 1970 Census and the 1979 CPS. Published data include single year of schooling distributions by five-year age groups separately by race and sex. Each cross-section provides an estimate of schooling distributions for a set of birth cohorts. By linking and blending these five cross-sections, we can span the birth cohorts listed in Table 3. See Smith (1984) for a more detailed discussion.

slightly faster than did female, so that among more recent birth cohorts, men have more schooling than women. This trend in favor of men was quite small until the 1911-15 birth cohorts. For generations born after 1911, men's education rose one-half a year more than women's.[8]

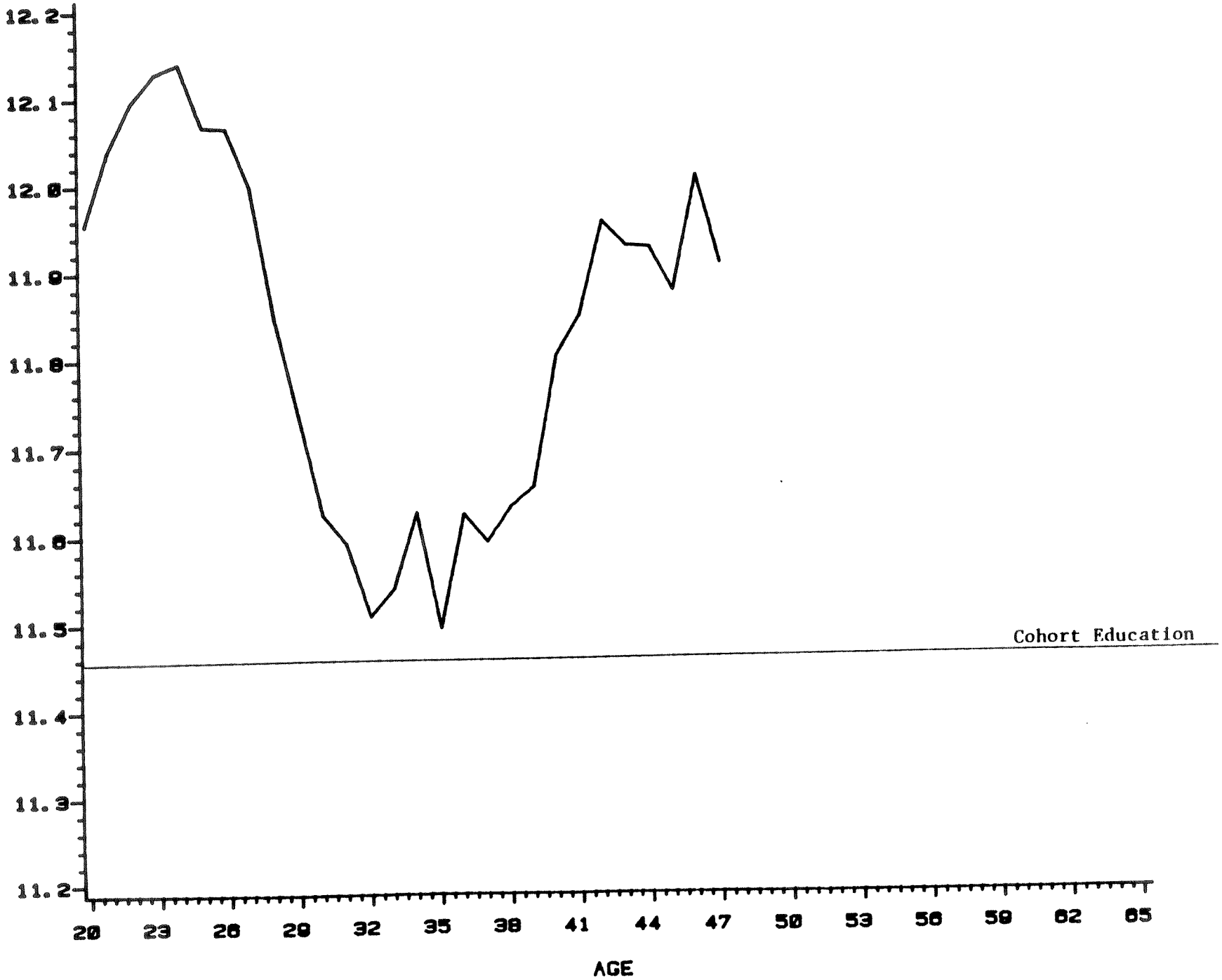
One complication in linking observed labor market outcomes to female schooling is that trends in education among female workers can be quite different from trends for all women. Two aspects of this distinction between the education of the work force and that of all women concern us. The first involves within-cohort movement over life cycles. After school completion ages, the educational distribution of a cohort of women is essentially fixed over their lifetime. However, the education distribution of the female work force for that cohort may and does vary over ages. Because it is the female work force that generates observed life cycle wage patterns, wage variation due to within cohort variation in the education of the work force should be netted out to retrieve true wage experience profiles.

Figure 1, which plots the mean education of the female work force for the 1934 birth cohort, indicates that this concern is not misplaced. Although the mean schooling of the female work force always exceeds the average education of all women in this birth cohort, there are pronounced life cycle swings. After reaching its peak at age 23, the education of the work force declines continuously into the mid-thirties. The peak to trough change is more than half a year of schooling. After the mid-thirties, mean education of the work force rises rapidly, almost

[8] The reason for this differential trend in favor of men appears to be a earlier and more rapid expansion in college attendance for men.

Education of the Female Work Force

1934 Birth Cohort



achieving its previous high.[9] Given the magnitude of these life-ycle swings, correcting for the changing education composition of the workforce is essential before isolating true experience wage profiles.

The second and most important dimension in which this distinction between the education of the workforce and of the population concerns us involves changes across-cohorts. The growth in average schooling across generations of women has typically been larger than the observed increase in mean education of the female work force. While this may result from more rapid increases in labor market participation at lower schooling levels, rising education levels of the female population will translate into a smaller rise in average education of all female workers even if participation rates within education cells remain constant over time.[10]

To illustrate this point, Table 4 lists time series changes in average education of all women (the population average) and of women who were members of the work force (the labor force average). With the exception of black women, the rise in the population average between

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[9] The shape in Fig. 1 reflects life-cycle participation patterns by education level. Between ages 23 and 35, participation rates decline most rapidly for more educated women. Similarly, after age 35, the increase in participation is greatest for women with a college degree. For a analysis of these life-cycle patterns by education, see Smith (1977).

[10] The mean education of the labor force is $Ed^{LF} = \Sigma\ iLF_i \delta_i$ / LFPR where i represents years of schooling, LF_i is the labor force participation rate in education cell i, δ_i is the fraction of the population with education level i, and LFPR is the aggregate labor force participation rate. The mean education of all women is $Ed = \Sigma\ i\ \delta_i$. Thus, even if labor force participation rates within all education cells remained the same, an increase in average schooling in the population would raise the aggregate participation rate. As the above formula demonstrates, the mean education of the workforce would not grow as rapidly as the mean education of the population. The only assumption needed is that participation rates rise with education, a well-established empirical fact.

Table 4

CHANGE IN MEAN EDUCATION OF WOMEN BY WORK FORCE STATUS

	All Races		*White*		*Non White*	
Ages	All	Workers Only	All	Workers Only	All	Workers Only
			1940-1970			
20-24	2.03	1.85	1.83	1.62	3.56	3.64
25-34	2.07	1.75	1.85	1.35	3.47	3.67
35-44	2.25	1.98	2.04	1.39	3.56	3.90
45-54	2.31	2.09	2.21	1.60	3.28	3.67
55-64	1.89	1.86	1.86	1.51	2.85	3.39
			1970-1980			
20-24	.23	.16	.18	.09	.63	.67
25-34	.84	.94	.82	.89	1.07	1.14
35-44	.87	1.01	.85	.98	1.02	1.13
45-54	.65	.77	.57	.67	1.51	1.68
55-64	.87	.83	.82	.75	1.52	1.61

1940 and 1970 always exceeded the increase in the labor force average. These differences between the population and labor force means were not trivial. Among white women, the expansion in average schooling of the population often exceeds by a half year the growth in education in the work force.[11]

[11] Between 1940 and 1970, participation rates rose slightly more among less educated white women, particularly younger women. This distributional effect was supplemented by the general rise in labor force participation, the argument we outlined in footnote [8]. In contrast, among black women, growth in participation was skewed towards the more educated and the increase in overall participation was smaller. These two account for the larger growth in mean education of the black labor force compared to the black female population.

The eventual impact on the education dimension of relative skills that men and women brought with them to the labor market are summarized in Table 5. This table indexes the extent to which male education grew faster than female education both among the population as well as among those in the workforce. Between 1940 and 1970, male education did increase more than female education, but the growing discrepancy between the sexes was considerably larger using workforce averages. Among white workers, male schooling rose by almost one year more than the education of the female workforce. If the work forces means are used, we add almost two-thirds of a year of additional schooling to the advantage of men than if we had monitored change between 1940-1970 with population based averages.[12]

The bottom half of Table 4 indicates that this pattern reversed during the last decade. During the 1970s, the rise in mean education of female labor force actually exceeded that of the population of women. The reason for this reversal is that recently labor force participation rates have risen so much more rapidly among more educated women, that this distributional effect offset the counter influence of the general rise in labor force participation.

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[12] Among men, the education of the workforce also exceeds the education of the population. Since male mean participation rates exceed 90 percent, the difference between the male population and labor force averages is considerably smaller. Moreover, the growth in mean education of the male workforce was slightly larger than in the male population. The reason is that participation rates actually declined somewhat among less schooled men. However, the trends in female-male differences documented in Table 4 were dominated by secular changes that occurred among women.

Table 5

THE DEGREE TO WHICH MALE EDUCATION GREW
MORE RAPIDLY THAN FEMALE EDUCATION

	1940-1970								
	All Races			*White*			*Non White*		
Ages	All	Workers Only	Difference Between Workers And All	All	Workers Only	Difference Between Workers And All	All	Workers Only	Difference Between Workers And All
20-24	.26	.64	.37	.27	.62	.35	.92	.86	-.96
25-34	.65	.92	.26	.67	1.09	.43	.88	.72	-.17
35-44	.50	.81	.31	.55	1.23	.68	.32	.03	-.29
45-54	.36	.61	.25	.39	.99	.60	.16	-.11	-.26
55-64	-.05	.31	.35	-.04	.57	.61	-.28	-.59	-.31

Years of Market Experience

Skills are acquired on the job as well as in schools and as a result wages typically increase with duration of time in the labor force. Unfortunately, until recently labor force statistics have largely ignored accumulated labor market experience and have concentrated instead on contemporaneous measures of labor force involvement. However, these contemporaneous measures defined over different time dimensions can be used to derive the experience duration consistent with them. In this section, we describe our time series of women's labor market experience and the methodology we used to construct it.

The distinction we made above between labor force and population means of education is even more critical when we consider the experience dimension of skill. Because of the tendency to stick in one's current labor force state, the labor market experience of workers will accumulate faster than the labor market experience of the population. For example, suppose that this stickiness is generated by an extreme model of heterogeneity in working probabilities, (Heckman and Willis, 1977) such that workers always work and nonworkers never work. In that case the fraction of the population that is currently working (O(t)) will accumulate a year's worth of experience for each calendar year that passes. After n years the cohort of workers will have n years of experience and the population will have an average of 1*n years. This divergence between the experience accumulation of the population and that of the workforce means that the observed wages of workers will rise along a path consistent with the higher rate of accumulation of experience of workers.

If, during the course of this cohort's life, some of the nonworkers enter the labor force, they will bring with them zero experience and the associated wages of a new labor market entrant. The experience of the workforce will fall and so will its average wage, but the experience of the population will rise. Misleading inferences would then be drawn between the experience accumulation of the population and the average wage observed for workers.

Our estimates of the experience of the female workforce are derived from a mover-stayer model of labor force transition that is a simple combination of Markov and heterogeneity models. We consider two labor force states: working and nonworking. For individuals currently working, a fraction, sw, are "stayers" in the working state. This fraction has zero probability of leaving that state. Nonworkers have a stayer fraction sn, the fraction with zero probability of leaving the nonwork state. The remaining proportion of the population, $(1 - sw)\ell(t) + (1 - \ell(t))(1 - sn)$, are "movers" who transit between the work and nonwork states according to the simple two-state Markov model. Movers who are currently working have a probability p_w of working in the succeeding period, and nonworkers have a probability q_n of remaining as nonworkers in the succeeding period.

Let p be the probability of being a worker next period given current work. This probability may be expressed as $sw + (1 - sw)\, p_w$, an average of the transition probabilities for stayers and nonstayers. Similarly, q is the probability of being a nonworker next period given nonwork, $sn + (1 - sn)q_n$. If l(t) is the current fraction of workers in the population, then the equation of motion describing the evolution of l(t) is given by

$$(1) \qquad l(t) = p * l(t - 1) + (1 - q) * (1 - l(t - 1))$$

The fraction of the population working can rise away from its steady state level if p rises or q falls. That is, workers can become more attached to the work state or nonworkers less attached to the nonwork

state. These two movements have very different implications for the experience of the work force.

Denote by ew(t) the experience of workers and by en(t) the experience of nonworkers. The accumulation of worker experience is described by

$$(2)\quad ew(t) = \frac{p * l(t-1) * ew(t-1) + (1-q) * (1-l(t-1)) * en(t-1)}{p * l(t-1) + (1-q) * (1-l(t-1))} + 1 .$$

The experience of the workforce is a weighted average of the experience of workers and nonworkers with weights proportional to the probability of being a worker in period t. To this average is added one period of experience accumulated during period t. For nonworkers, experience accumulation is generated by

$$(3)\quad en(t) = \frac{(1-p) * l(t-1) * ew(t-1) + q * (1-l(t-1)) * en(t-1)}{(1-p) * l(t-1) + q * (1-l(t-1))} .$$

The experience accumulation of the population is given (after some algebra) by

$$(4)\quad ep(t) = l(t) * ew(t) + (1 - l(t)) * en(t)$$

$$= l(t) + l(t-1) * ew(t-1) + (1 - l(t-1)) * en(t-1)$$

$$= l(t) + ep(t-1)$$

Note in Eq. (2) that an increase in 1 - q, representing an increase in the probability of moving out of the nonworking state, will increase the weight attached to the experience of nonworkers in calculating next period's experience for workers. In other words, if the fraction of the population working rises because of an increased movement of nonworkers to workers, the experience of the work force will initially decline as long as nonworkers have less initial experience than workers. If the fraction working rises because of workers "sticking" to the work force, then the experience of the workforce will rise.[13]

Estimates of the parameters of this model can be had with measurements of duration in these states. We obtain these data from three sources that, when combined, span the post war period: (1) the *Current Population Survey* estimates of employment and weeks worked during the year; (2) tenure on current job, obtained from special CPS labor force questionnares; and (3) continuous time out of the labor force estimated from the Social Security Administration's Longitudinal

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[13] In our exploratory empirical work, we rejected the two special cases of a pure heterogeneity model and a pure one period Markov. If both p and q were equal to one, this model of accumulation would reduce to a model of extreme heterogeneity. In the Markov model, unlike the pure heterogeneity model, the population members are homogeneous except for their current work status. Eventually, as the process evolves, workers and nonworkers will transit between these states so that the experience of the workforce and the experience of the population converge toward one another regardless of their initial differences. Our investigation of the duration of "stays' in the work or the nonwork status showed that the Markov model did not describe these data accurately. For example, lengths of time out of the workforce violated the Markov structure--given that a women did non work last year, the probability of her not working for the preceding two years was much higher than the geometric decline rate predicted by the Markov model.

Employee-Employer Data file (LEED). Briefly, information on weeks worked during the year and the employment rate at the beginning of the year allow for estimation of the annual probability of continuous employment, $sw + (1 - sw)*p_w$, and continuous nonemployment, $sn + (1 - sn)*q_n$. These parameters are estimated from the fraction of the workforce that worked 50-52 weeks and the fraction of the nonworkforce who worked zero weeks. From data on the tenure distribution we can form estimates of the fraction continuously employed for one year and for two years. These two data estimate $sw + (1 - sw)*p_w$ and $sw + (1 - sw)p_w**2$ respectively, from which estimates of sw can be obtained. With this estimate, we return to CPS weeks distributions to calculate p_w. A similar set of observations on the fraction continuously out of work leads to estimates of sn.

The calculation of labor market experience uses the features of the mover- stayer model to accumulate time spent working over the career from age 16 forward. Within a year, the estimated fraction of worker-stayers are assumed to accumulate 52 weeks of experience and nonworker-stayers accumulate zero experience. The fraction who are movers $(1 - sw)\ \ell(t) + (1 - \ell(t))\ (1 - s(n))$ move according to the transition rates described above where, for purposes of calculation, the model is updated weekly and all transition probabilities are appropriately rescaled.[14]

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[14] At the end of the year we must make some assumptions about the transition of stayers into other states. If the fraction of the population who are worker-stayers, sw*l(t), rises, we assume that this subpopulation is augmented from the pool of worker-movers. We further assume that the experience of workers switching from mover to stayer status is the mean of current worker-movers--a randomly chosen worker-mover becomes a worker-stayer. This means that the average experience of worker-stayers will have declined, while that of worker-movers remains unchanged. This calculation appropriately constrains the experience of the aggregate of workers to remain unchanged when a worker-mover is designated as a worker-stayer.

Similar recalculations of average experience are made if the worker-

The probability that a working woman remains employed for a year is $sw+(1- sw)*p_w$. In order to depict lifecycle patterns, Figure 2 shows with solid lines these probabilities for cohorts born in 1930, 1940, and 1950. Secular trends in these probabilities are illustrated in Figure 3, evaluated at ages 25, 35, and 40. The dotted lines in these figures illustrate the corresponding probability that a non-working woman remains out of the labor force for another year, $sn + (1 - sn) * q_w$. The lifecycle paths for these birth cohorts indicate that the transition probabilities from work to work decline initially from age 16 to 20 and rise gradually thereafter throughout the lifecycle. This U shape movement is due to the entry into the labor force of high school graduates and the subsequent exit of women during childbearing. Those women who remain in the labor force tend to have high probabilities of continuing to work, a tendency that rises with age.

A similar lifecycle path is shown for the probability of a non-worker remaining in the nonwork state. This shows the same early career decline and subsequent sharp rise, but the fraction reaches its asymptote around age 30. As women end their child rearing years and reenter the work force, those who remain out of the work force represent a subpopulation of women who have very low probabilities of ever working

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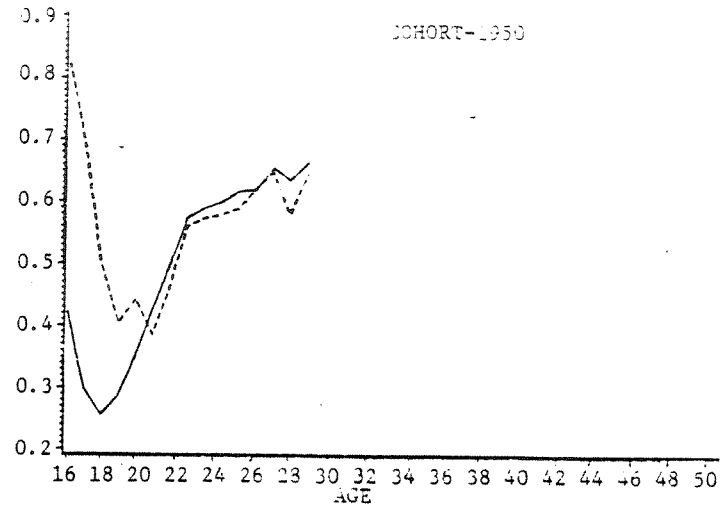
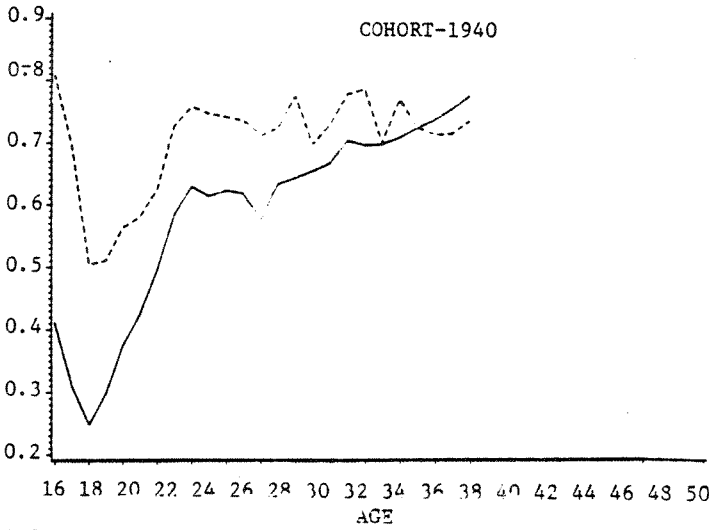
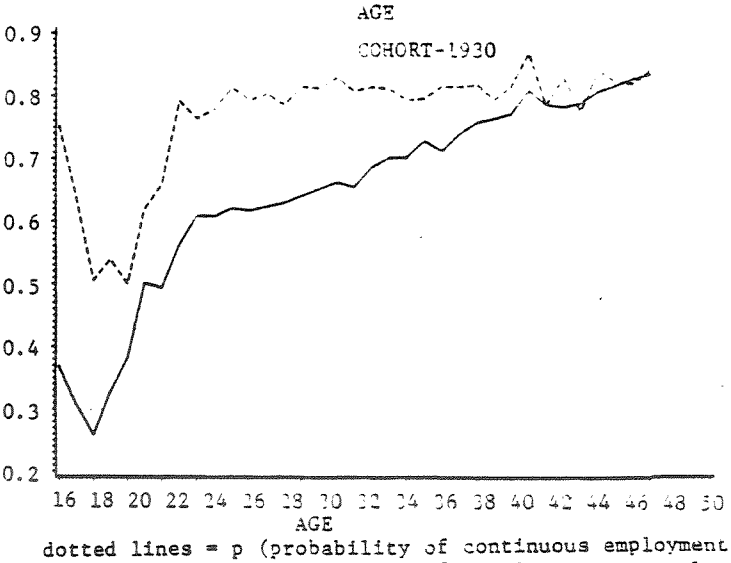
stayer fraction should decline. In this case, we assume that a randomly chosen worker-stayer moves to worker-mover status. In general this move will increase the average experience of both groups while keeping the experience of workers unchanged. Changes in the fraction of stayer-nonworkers, $sn*(1 - l(t))$, are treated similarly. We assume that stayer-nonworkers move only to mover-nonworkers and vice versa. The average experience of the origin group is assumed to be unchanged if one of its randomly chosen members leaves. The destination group's average experience will change so as to preserve the average experience of nonworkers.

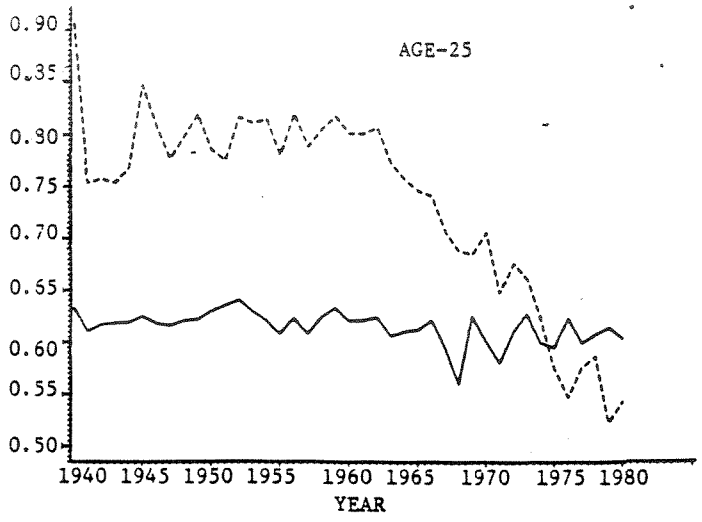


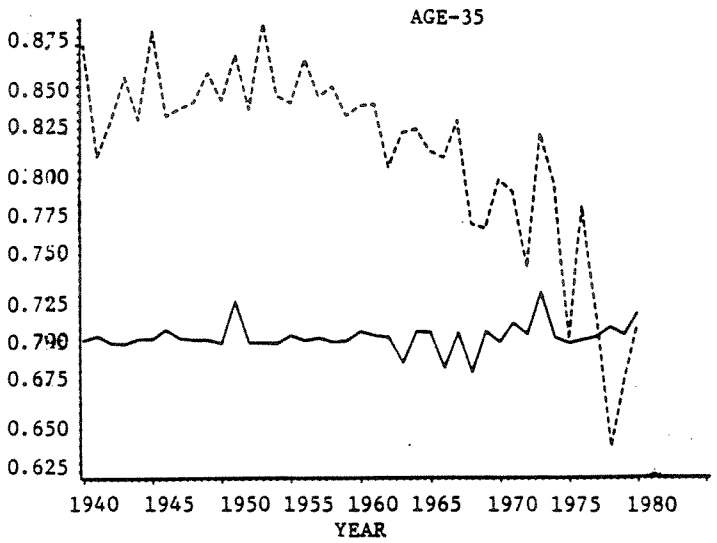


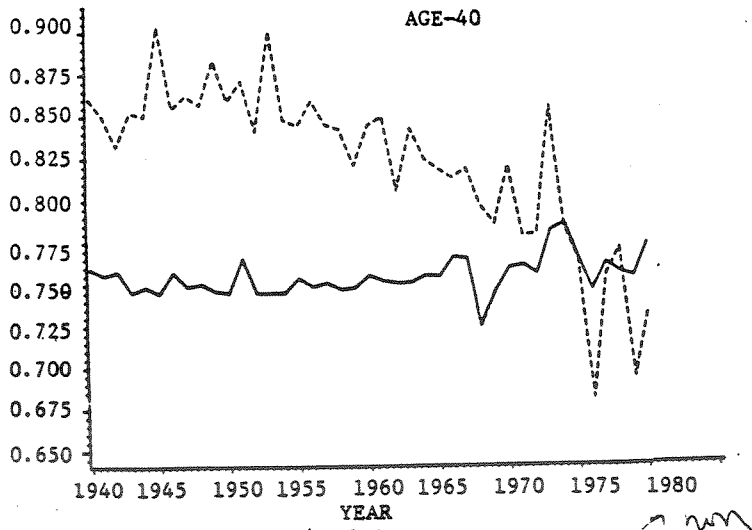


dotted lines = p (probability of continuous employment for a year)
solid lines = q (probability of continuous non-employment for a year)

Figure 2







dotted lines = p (probability of continuous employment for a year)
solid lines = q (probability of continuous non-employment for a year)

Figure 3

again. Combined, these probabilities in Figure 2 are a manifestation of the growing differentiation of workers from nonworkers as a cohort ages. As we move towards later stages of the lifecycle, current labor force status becomes an increasingly more accurate predictor of longer time labor force attachment.

Secular increases in participation rates can correspond to a greater attachment of workers to the labor force or a lower probability of current nonworkers staying out of the workforce. Figure 3 demonstrates that almost all of increase in the employment ratio for women was due to the decline in the probability of nonworkers remaining in the non-work state. The probability of exiting from the work state did not change over this 30 year period. Despite the enormous increase in employment, women workers exhibit the same attachment to the workforce in 1980 as in 1950. The increasing levels of participation are associated primarily with large numbers of new female workers with little prior labor market experience.

The implications of such trends for our experience time series are illustrated in Figures 4 and 5. Figure 4a shows a typical lifecycle evolution of market experience of three groups. The experience of the population is simply the summation of all past employment ratios. The experience of workers and nonworkers reflects the average experience for those groups at the date of measurement. Even though the identity of workers and nonworkers is changing constantly, the mover-stayer framework generates divergence between the experience accumulation of the population and the workforce. Because the stayer fractions for both workers and nonworkers rise throughout the lifecycle, there is a growing

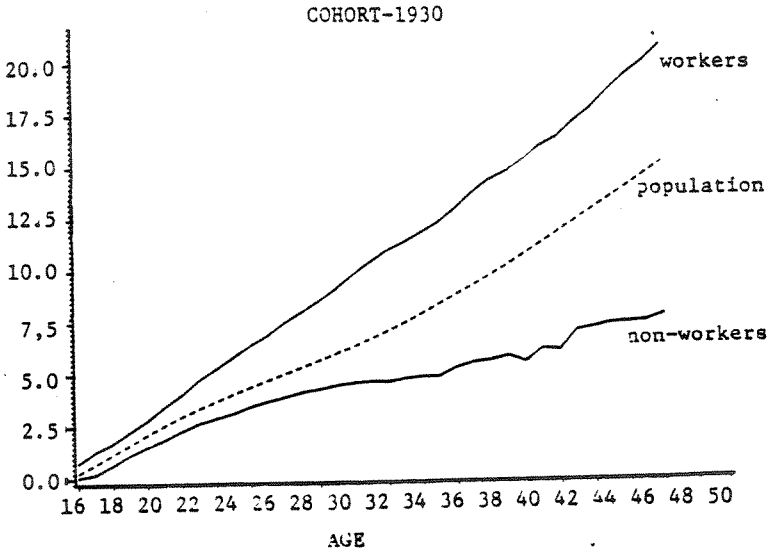


Figure 4.A

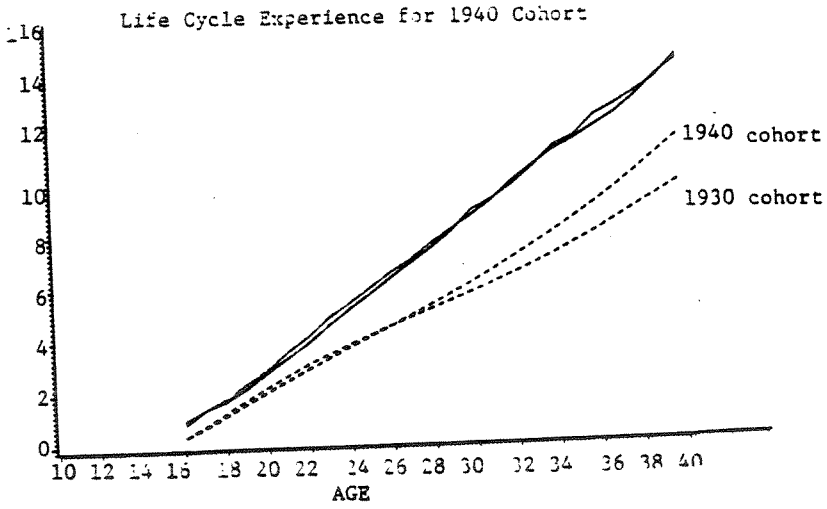
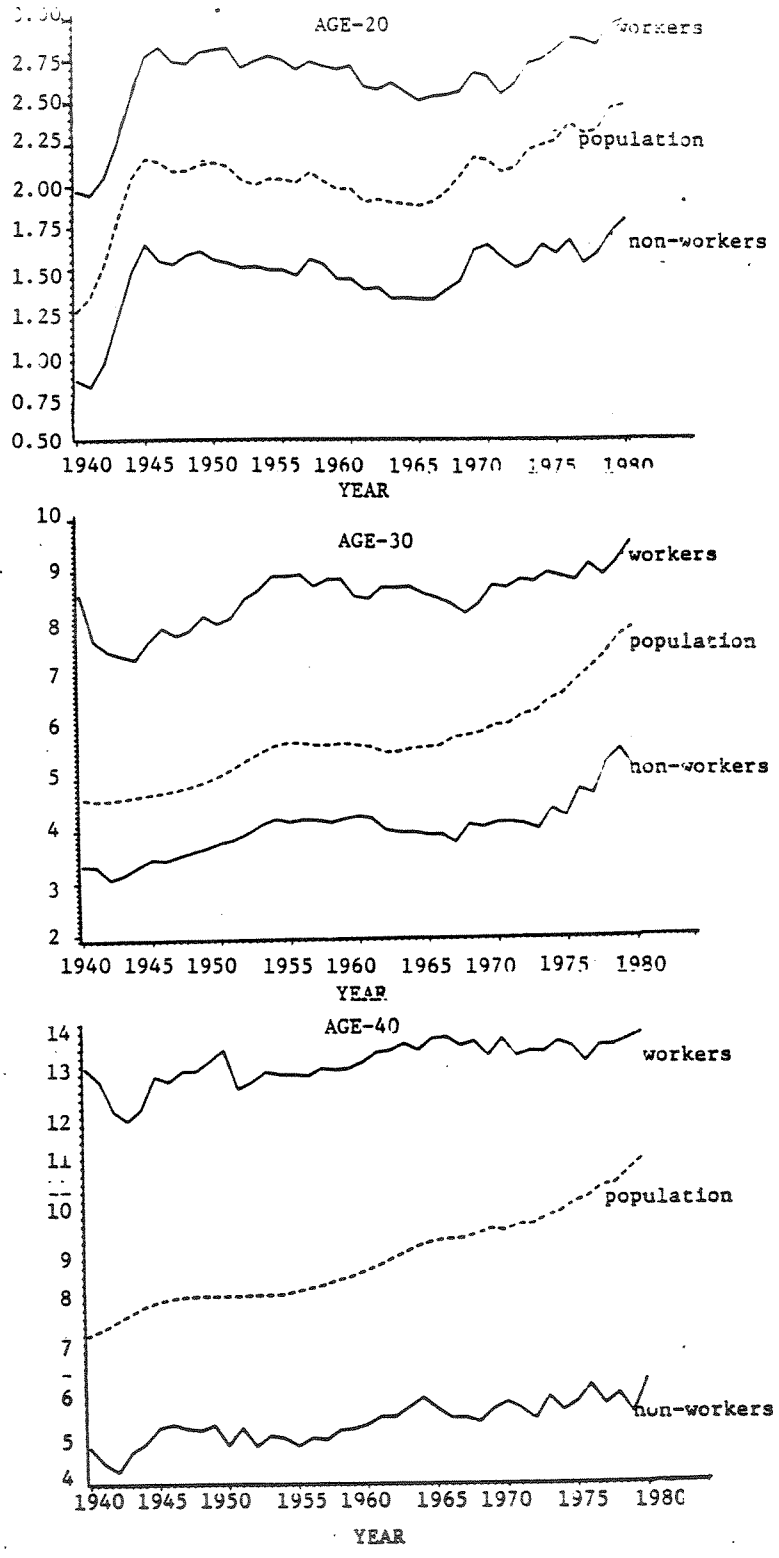


Figure 4.B

Life Cycle Experience for two cohorts

dotted line - workforce
solid line - population



Secular Trends in Experience Evaluated at Selected Ages

Figure 5

divergence between the experience accumulation of current workers and nonworkers. Toward the end of the career, the accumulation of experience for workers approaches the accumulation of age.

Figure 4b overlays the experience accumulations for workers and for the population for two cohorts. A comparison of the 1930 and 1940 cohorts shows the effect on the experience of the population of rising employment ratios. Especially as we move further out into the lifecycle, the average experience of the 1940 birth cohort diverges from that of the 1930 cohort. However, the experience of the workforce is the same at every age for these two birth cohorts. The entry of additional women into the workforce acted to hold down the average experience of workers for the 1940 birth cohort.

We conclude this section by examining in Figure 5 the key issue of secular trends in women's experience. For 20-year-old women, the movement of experience in the labor force and in the population over time has been identical. This is because the younger group exhibits much greater churning between worker and nonworker status, so that rising employment is quickly translated into rising experience for workers and nonworkers alike. For 30-year-old women, the experience accumulation of workers is damped as low experience nonworkers enter worker status. For 40-year-old women, this damping is so severe that the experience of both workers and nonworkers has remained unchanged over the last 40 years while that of the population has been rising throughout.

WHAT REALLY HAPPENED TO FEMALE WAGES

In this section, we summarize the implications of our new measures of the education and experience distributions of the female work force and population on recent trends in relative female wages. In doing so, we return our attention to the puzzle that originally motivated our research--why have relative female wages remained constant in spite of the large expansion in the female labor market participation?

The analysis that we report here are based on disaggregated time series data over the period 1950-1980. Over this 31 year time span, our observations consist of mean values at single years of age of education, experience and weekly wages.[15] Our measures of education and years of market experience for the work force and population are those discussed in the previous two sections. Weekly wages are defined as yearly income divided by weeks worked. For purposes of analysis, our data is arranged as a set of life-cycle histories for individual birth cohorts.

Table 6 lists a simple version of our wage function. The dependent variable is the first difference in the On female weekly wage within each cohort from one age to the next. The regressors are also first differences within cohorts of mean education and work experience (as a quadratic) of the female *work* force. We attempt to capture year effects on the demand side by controlling for the average male wage in each year.[16]

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[15] For the subperiod 1967-1980, we used CPS micro files to calculate means at single years of age. Over the subperiod 1950-1966, CPS published tables exist on distributions of weeks worked and income. However, these published tables are provided only in 5 and 10 year age groups. We smoothed this series using cubic splines approximations to obtain values at single year of age.

[16] Defined as the sum of the age-specific On male wages in each year. All nominal variables are expressed in 1964 dollars.

Table 6

DEPENDENT VARIABLE: ℓ n FEMALE WEEKLY WAGE
(FIRST DIFFERENCE WITHIN COHORT)

Variable	Coefficient
Δ education of female labor force	.0950
	(8.80)
Δ experience of female labor force	.0839
	(6.52)
Δ experience^2 of female labor force	-.00214
	(10.8)
Δ mean n male wage in year	.5620
	(8.28)
Intercept	.0119
	(2.11)
R^2	.179

The estimates we obtained are conventional. An additional year of schooling raises female income by 10 percent. Wages increase with accumulated market experience, but this effect decays over careers. An extra year of market work raises incomes until the 20th year on the job, which covers most of the labor force segment of their lifecycles for women. The coefficients of the yearly changes in male wages and the intercept should be read together. They are parcelling out the growth in real income over time, half of which is apparently absorbed by yearly changes in male wages.

Using our estimated wage function in Table 6, we have assigned a mean wage to all women in all age-year cells in our data. Our estimate of the mean wage offer to all women will differ from the observed average wage of all working women for three reasons. First, with positive correlation in participation probabilities across years, women who do not work this year will have less accumulated market experience than women who are currently working. Second, working women have more schooling than the sample of women from whom they are drawn. Finally, for a host of other unobservable (to us) reasons, currently working women may receive higher wage offers than nonworkers would if they worked.[17] In combination, the forces represented by these three reasons are sufficiently important that time series trends in relative wages in the work force and in the population are quite dissimilar. The reason is that the convergence between the sexes in skill-related characteristics among workers differs greatly from the convergence in skills of men and women, evaluated independently of their current work status.

To calculate the mean wage of all women, we adjusted the mean wage of working women for differences in average experience and education between of current workers and the population.[18] The results of these

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[17] The final catch all category is the theme of much of the recent wage selectivity literature.

[18] We also applied a simple wage selectivity correction using an "λ" coefficient of .089, i.e. the coefficient on the inverse of Mill's ratio. .089 is the average of the estimates presented in Smith (1980). The implication of this wage selectivity in unobservables is that wages of working women and of all women will converge as participation levels rise over time. Put differently, wages of the population will rise more rapidly than wages of the work force. However, it turns out that this wage selectivity in unobservables is only a minor part of our total wage adjustment. Thus, the patterns described in Table 7 would be very much the same without this adjustment.

Table 7

FEMALE WEEKLY WAGE AS A PERCENT OF MALE WEEKLY WAGES

	Age					
Year	20	25	30	35	40	45
	Sample: Working Women					
50	83.0	73.2	62.4	53.9	49.1	48.3
55	86.8	68.1	56.7	51.5	49.7	49.9
60	88.7	68.3	53.7	47.4	45.0	45.6
65	92.0	71.0	55.1	51.3	50.3	49.2
70	73.1	64.6	49.3	44.6	45.3	44.4
75	72.5	65.5	52.9	46.8	44.5	41.1
80	74.8	68.3	58.4	47.4	49.6	45.4
	Sample: All Women					
50	71.7	57.5	47.3	39.5	35.5	35.4
55	75.0	54.2	43.5	39.5	37.7	37.9
60	78.1	53.8	40.4	35.4	34.9	36.1
65	81.2	56.4	42.9	40.1	39.7	39.5
70	67.1	52.7	39.5	35.0	35.5	37.2
75	67.3	55.3	42.9	39.0	36.1	33.6
80	75.0	59.4	50.2	40.5	42.1	38.7

adjustments are presented in Table 7, which lists female wages as a percent of male wages for working women as well as for all women. As a companion, we present our estimates of the accumulated market experience of the female work force and of the female population in Table 8. We also summarize our earlier findings regarding changes in schooling of the female work force and population in Table 9.

The first half of Table 7 which lists relative wages among workers confirms our earlier characterization of post-war trends in female wages. Overall, relative female wages showed little change between 1950 and 1980, with a U-shaped pattern between these years. This wage series

Table 8

YEARS OF LABOR MARKET EXPERIENCE

Year	Age 20	25	30	35	40	45
Sample: Working Women						
50	2.81	5.87	7.97	10.57	13.99	16.43
55	2.74	5.80	8.88	10.72	13.39	16.95
60	2.70	5.76	8.48	11.83	13.68	16.58
65	2.49	5.58	8.53	11.29	14.24	16.52
70	2.63	5.69	8.68	11.21	14.24	17.21
75	2.81	6.02	8.83	11.39	14.06	17.05
80	3.00	6.23	9.50	11.70	14.39	16.97
Sample: All Women						
50	2.14	4.08	5.04	6.29	8.13	9.87
55	2.02	4.03	5.67	6.73	8.23	10.20
60	1.96	3.92	5.61	7.38	8.71	10.43
65	1.86	3.97	5.57	7.40	9.42	10.99
70	2.13	4.29	5.98	7.68	9.66	11.91
75	2.25	4.93	6.58	8.37	10.32	12.28
80	2.47	5.27	7.85	9.46	11.40	13.35

Table 9

CHANGE IN MALE EDUCATION RELATIVE
TO FEMALE EDUCATION

Year	Age 20	25	30	35	40
Sample: Workforce					
1970-1950	.43	.60	.36	.42	.66
1980-1970	-1.1	.16	.11	.14	.18
Sample: All Women					
1970-1950	.05	-.0001	.05	.16	.27
1980-1970	-.32	-.32	-.24	-.17	-.15

among workers parallels trends in education and years of market experience of the work force. If we combine the effect of education and market experience, there has been little convergence in the underlying skill distributions of men and *working* women. Between 1950 and 1970, years of labor market experience for female "workers" increased on average by less than half a year. Over the same time span, the education of men rose by about one-third of a year more than did mean education of the female work force. The stability in observed relative wages is consistent with the absence of any convergence in the skills of men and working women.

While the sex disparity in skills of the work force was relatively stable, the skill differences between men and women were in fact changing. We know that the expansion in market participation of women must raise the average experience of all women. However, as new labor entrants with less experience are blended into the current work force,

Table 10

CHANGE IN WOMEN'S MARKET EXPERIENCE

Years	Age 25	30	35	40	45
Sample: All Workers					
1970-1950	-.18	.71	.64	.25	.78
1980-1950	.36	1.53	1.13	.40	.54
Sample: All Women					
1970-1950	.21	.94	1.39	1.53	2.04
1980-1950	1.19	2.81	3.17	3.27	3.48

average experience of all workers can decline. That is the story told in Table 8. Between 1950 and 1980, the increase in experience of the total female population is two to three years larger than that observed for the average female worker.

The disparity in trends between the work force and population in years of work experience is also reflected in the relative wage series. In all cases but one in Table 7, relative wages of female workers were lower in 1980 than in 1950. In contrast, in every single case, our calculated wage of all women rose relative to male wages. This was especially true during the 1970s when the rate of wage growth of all women was twice as large as we observe for working women. However, it is important to remember that there is a downside to this relatively optimistic message of progress in the economic rewards to women. Women's wages may be rising more rapidly than commonly believed, but they are also lower relative to men than most economists thought.

CONCLUSION

How unique were the last thirty years and will the trend of women's wages for the remainder of this century replicate that experience? We conclude this paper with an attempt at answering these questions. To do so, we forecast and backcast our models to create education and work experience distributions of the labor force and population for all twentieth century work cohorts.[19] For all birth cohorts who were in

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[19]To construct our experience series, we went back to first principals by creating future and past values for the basic parameters of model summarized in eqs. 1-4. That is, we imputed values for the stayers fractions, s_w and s_n, and the Markov transition probabilities, p_w and q_n. We used female employment rates from decennial Census data to fix past values of female employment rates. With these parameter values, the model of eqs. 1-4 was used to forecast and backcast work experience for all work cohorts.

the labor market at any time during 1950-1980, we estimated regressions for each of our underlying series. These regressions contained a set of 5 year birth cohort dummies and a 5 year segmented age spline starting at age 16 to trace the average life cycle path.[20] Initial (1950) and final (1980) observed values for each cohort were used to establish their life cycle position.[21] From that position, we moved a cohort backward or forward using the estimated life-cycle function for that series. Table 11 contains the results of our simulations for women's work experience while the relative wages[22] of women are listed in Table 12.

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[20]We explored the possibility that the life-cycle path may have varied significantly by cohort. The only variables that did so were employment and participation rates. The average life-cycle path has altered in that the traditional decline in participation during childbearing years is much attenuated relative to the past. Because of this, we included for our employment and participation equations interactions of the early segments of the experience spline with more recent cohorts.

[21]To reduce error variance in the starting values, we actually use a three year average to obtain the initial values. The R^2 in all the predicting equations were all well in excess of .9. Therefore, at least over the period of real data these forecasting equations described the actual series very well. Finally, we usually inspected each projection and backcast to insure that predictions appear reasonable.

[22] To value education and experience, we estimated a wage function with a set of cohort dummies and an experience spline. For the purposes of this exercise, we found that a more precise description (than an experience quadratic) of the true life cycle wage path was required.

Table 11

PROJECTED YEARS OF LABOR MARKET EXPERIENCE

Year	Age 20	25	30	35	40	45	50
			Sample: Working Women				
1910	2.53	5.34					
1920	2.62	5.57	8.74	11.80			
1930	2.34	5.55	8.97	12.04	15.38	18.51	
1940	1.98	5.05	8.54	11.08	13.55	15.85	17.54
1950	2.81	5.87	7.97	10.57	13.99	16.43	19.31
1980	3.00	6.23	9.50	11.70	14.39	16.97	20.64
1990			10.44	15.06	17.24	18.76	22.17
2000					19.63	24.07	26.57
			Sample: All Women				
1910	1.73	3.19					
1920	1.81	3.40	4.53	5.31			
1930	1.55	3.57	4.90	5.82	6.65	7.39	
1940	1.25	3.08	4.63	6.11	7.19	7.94	8.59
1950	2.14	4.08	5.04	6.29	8.13	9.87	10.85
1980	2.47	5.27	7.85	9.46	11.40	13.35	15.04
1990			8.66	11.57	14.74	16.23	18.04
2000					15.57	19.16	22.90

First, consider the past. The absence of skill convergence among workers alongside the steady narrowing of skill disparities by sex in the population, that characterized the 1950-1980 time period span, becomes even more pronounced when we backcast our model. While women have steadily added to their work experience over time, we find that

snapshots of the female work force in 1920 or 1930 would look amazingly similar to those that existed in 1950 and 1980. Based on our simulations, the typical female worker in 1930 actually had more accumulated labor market experience by age 40 than the average forty-year old female worker fifty years later in 1980. In contrast, between 1930 and 1980 there was almost a five year increment in the total number of years worked for the average 40 year old woman.

These trends in experience are translated into similar trends in relative wages in Table 12. Calculated over the workforce, relative wages of women in 1920 and 1930 are almost identical to those that prevailed in 1950. The lack of any long term narrowing of the gender wage gap since 1920 as indexed by these simulations over the female work force parallels the relative wage series of Table 1, with which we began this paper.[23] Using either their relative occupational position or their relative education and experience, these two independently derived series both point to little aggregate change in the relative labor market position of female *workers* between 1920 and 1980. However, the bottom chart in Table 12 indicates that during this time period significant changes in the relative wages of women were actually taking place. Relative wages of women were 15 to 25 percent higher in 1980 than they were in 1920 and 1930. These sample composition effects,

[23] The sharp increase in relative wages of women before 1920 in Table 1 is due to the emergence during the first twenty years of this century of the clerical sector. During these years, the clerical group went from a relatively minor part of the female work force to one employing more than one-third of all female workers. See Smith-Ward (1984).

Table 12

PROJECTED FEMALE WEEKLY WAGES AS A PERCENT OF MALE WEEKLY WAGES

	Age						
Year	20	25	30	35	40	45	50
	Sample: Working Women						
1910	74.8	71.2					
1920	77.4	72.6	63.7	55.6			
1930	69.7	72.5	64.2	56.2	50.3	49.1	
1940	61.0	71.6	63.4	54.7	48.5	47.7	46.7
1950	83.0	73.2	62.4	53.9	49.1	48.3	48.8
1980	74.8	68.3	58.4	47.4	49.6	45.4	47.4
1990			60.0	52.2	53.3	47.4	48.3
2000					56.5	52.1	50.3
	Sample: All Women						
1910	61.1	51.6					
1920	63.2	52.5	43.3	35.9			
1930	58.2	53.5	44.4	37.1	32.6	31.6	
1940	52.0	54.0	45.0	38.1	33.3	32.1	31.7
1950	71.7	57.5	47.3	39.5	35.5	35.4	35.9
1980	75.0	59.4	50.2	40.5	42.1	38.7	42.0
1990			52.2	43.7	45.2	40.6	42.4
2000				44.7	48.6	47.6	44.9

which have camouflaged reality for some time, have essentially run their course.[24] Table 11 indicates that for the first time in the twentieth

We have already witnessed using standard government statistics a significant rise in the relative wages of women during the last half of the 1970s and early 1980s. In 1975, among full-time workers women earned 58 percent as much as men. By 1983, this ratio had risen to .64. This increase in the actual relative wage of women is consistent with our evidence that the experience of the female workforce increased sharply after 1975. In addition, because participation rates rose more rapidly among more educated women, the education of the female workforce increased at least as much as the male workforce.

century the average experience of the female workforce and the population will both increase significantly over the next 20 years. A forty year old working woman in the year 2000 will have 5.2 more years of work experience than a 40 year old worker in 1980. The story on reported female wages during the 1980s and 1990s will also be far different than what has occurred to date. For the remainder of this century, based on our simulations, we predict that, using either workforce or population based means, wages of women will accelerate relative to those of men. As Table 12 indicates, this is especially true for those young women who entered the labor market in the 1970s. By the year 2000, relative wages of those new young female workers should rise approximately 15 percent faster than those of young male workers.

Our projections of the future path of relative wages of women will probably prove to be too conservative. These projections are based on parameters and behaviors that are already in place in 1980. Essentially, we are assuming that women continue on their current life-cycle path, paths that represent averages over the last thirty years. However, the early indications are that participation rates will continue to rise at the more rapid pace of the 1970s for the cohorts of women who first enter the labor market during the final twenty years of this century. Consequently, over the next 20 years, relative wages for women less than 30 years old should increase more rapidly than they will for older age groups. Similarly, women in cohorts who entered the labor force during the 1970s probably will have a deeper commitment to the

labor market, characterized by higher levels and more continuity, than the future we project for them based on averages of past life-cycles.

More important, the increased length and continuity of women's future work experience should steepen wage-experience profiles. This is likely because of added incentives to invest in market-oriented skills and less skill obsolescence associated with absences from the labor force. If so, the historically based experience-wage coefficients used in our simulations are too low. All these considerations suggest that the gender wage gap should narrow even more than is indicated in Table 12.

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