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THE UNEMPLOYMENT RATES OF MEN AND WOMEN: A TRANSITION PROBABILITY ANALYSIS

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Women's unemployment rates were considerably higher than men's for many years, but during the 1980s this difference has virtually disappeared. This study is the first to examine that change through an analysis of trends in the probabilities of labor force transitions—movements between employment, unemployment, and nonparticipation in the labor force. Using BLS data, the authors find that about half of the narrowing of the unemployment rate differential during the 1968–85 period was due to the increasing labor force attachment of women and the decreasing attachment of men. The other half reflects changes in men's and women's tendencies to move between employment and unemployment, which the authors attribute primarily to the secular decline of male-dominated industries.

THE relationship between male and female unemployment rates has changed. As recently as 1978 the female rate was nearly two percentage points higher than the male rate, a differential close to that of the previous decade (see Figure 1). Since then, however, the differential has narrowed significantly. The average male and female unemployment rates during the 1980s are nearly identical, and in the recession years 1982 and 1983, the male rate exceeded the female rate for the first time since World War II.

Several explanations for the improvement in the female unemployment rate relative to the male rate will be explored in this paper. First, trends in male and female mobility into and out of the labor force in recent years indicate that the labor force attachment of women has increased. It is possible that as the participation patterns of women become more like those of men, female employment rates may also more closely approximate male rates. Second, trends in mobility between employment and unemployment have caused female rates to improve relative to male rates. The most plausible explanation for this phenomenon is that sectoral shifts in industry-specific demand have, in recent years, favored service-oriented industries, in which women constitute a relatively large proportion of total employment. Third, the changing unemployment rate relationship may be a cyclical phenomenon. In this paper we assess these explanations using labor force transition probabilities derived from Bureau of Labor Statistics data on gross flows between employment, unemployment, and nonparticipation in the labor force.

Although others have examined the

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male-female unemployment differential, none have done so using transition probabilities. Niemi (1974) explained the widening differential of the 1960s largely as the result of low female labor force attachment. Seeborg and DeBoer (1987) found that the decline of male-dominated industries increased the relative male unemployment rate, narrowing the differential. Ehrenberg (1980), Smith and Vanski (1978), and Williams (1985) examined trends in transition probabilities, but did not explore long-term changes in relative male and female unemployment rates.

Labor Force Attachment

Previous research on male-female unemployment differentials has emphasized the importance of relatively high female mobility into and out of the labor force as an explanation for why female rates have historically exceeded male rates (Niemi 1974, 1977). The relationship between labor force attachment and unemployment levels is not, however, self-evident. On the one hand, when labor force attachment increases, the resulting decrease in the rate at which employed individuals withdraw from the labor force will tend to reduce unemployment rates. But another implication of an increase in labor force attachment is that unemployed individuals are less likely to withdraw from the labor force, a change that will tend to *increase* unemployment rates. Greater labor force attachment by labor force participants (both employed and unemployed) could lead to either an increase or a decrease in the group's unemployment rate.

Similarly, it is not clear how greater labor force attachment will affect labor force entrants. New entrants may be increasingly willing to suffer long periods of unemployment before withdrawing from the labor force. On the other hand, re-entrants will have more work experience than prior generations did, and will be more likely to secure employment quickly upon reentry into the labor force. Once again, there are two offsetting effects on unemployment.

Blau and Ferber (1986) reviewed empirical studies that relate labor force attachment to male-female unemployment rate differentials, and concluded that the weaker labor force attachment of women raises their unemployment rates relative to those of men. Additional evidence that increased labor force attachment may reduce female unemployment was found by Jones (1983) in a study of unemployment among re-entrants. She found that the amount of prior work experience directly influences the probability that a woman who is temporarily out of the labor force will re-enter the work force without suffering a spell of unemployment. As the work experience of women increases, the probability that they will experience unemployment upon re-entry to the labor force falls. Jones concluded that "increases in participation that come from women developing a more continuous labor market attachment should reduce the level of re-entrant unemployment in future years" (1983:73).

Employment-Unemployment Transitions

Trends in the distribution of employment by industry have favored women in recent years, with female-dominated service industries increasing employment at much faster rates than male-dominated industries such as durable manufacturing, mining, and construction. These trends would, *ceteris paribus,* decrease the probability that women would involuntarily move from employment to unemployment. This sectoral shift in employment patterns should also decrease the duration of involuntary unemployment among women, thus increasing the probability of moving from unemployment to employment. Both of these changes would cause female unemployment rates to decline relative to male rates.

The observed male-female trends in the movement between employment and unemployment could also be affected by factors other than sectoral shifts in labor demand. Increases in female firm-specific training and decreases in employment

discrimination would also tend to reduce the amount of female unemployment. Blau and Kahn (1981b) and Viscusi (1980) noted that one reason for higher female quit rates is that women are concentrated in occupations in which both men and women have a higher propensity to quit. As occupational distributions become more similar over time, so should male and female quit rates, and this in turn would improve the female unemployment rate relative to the male rate.

But recent evidence indicates that sectoral shifts are a dominant factor in explaining trends in employment-unemployment transitions. Horvath (1987) analyzed a survey of displaced workers (in his study, those who permanently lost jobs after three or more years' tenure) over the 1981–85 period. Almost two-thirds of these displaced workers were men, whereas only about 55 percent of the labor force was male. Displaced workers from durable manufacturing, mining, and construction accounted for 42 percent of the total, a rate double the percentage of total employment represented by these industries. As of January 1986, 18.6 percent of displaced men were unemployed, compared to only 16.2 percent of displaced women. The female rate was lower mainly because a much greater percentage of displaced women than of displaced men left the labor force. Horvath's results show that displacement resulted largely from declines in male-dominated industries, so that a disproportionate number of displaced workers were men. This pattern, in conjunction with the greater tendency of displaced women to leave the labor force, will cause a rise in the male unemployment rate relative to the female rate.

DeBoer and Seeborg (1984) and Seeborg and DeBoer (1987) showed that the relative decline of male-dominated industries has significantly reduced the male-female unemployment differential. In addition, Blau and Kahn (1981a) provided evidence that women are less likely than men to experience involuntary layoffs. Thus, we expect the changing composition of employment over time to have increased the tendency of men to move from employment to unemployment, relative to women, and decreased the relative tendency of men to move from unemployment to employment.

The Business Cycle

Much of the recent narrowing in the male-female unemployment rate differential occurred in the recession years of the early 1980s (Figure 1). It may be that the narrowing is a cyclical phenomenon, more than the result of long-term trends. The influence of the business cycle on relative

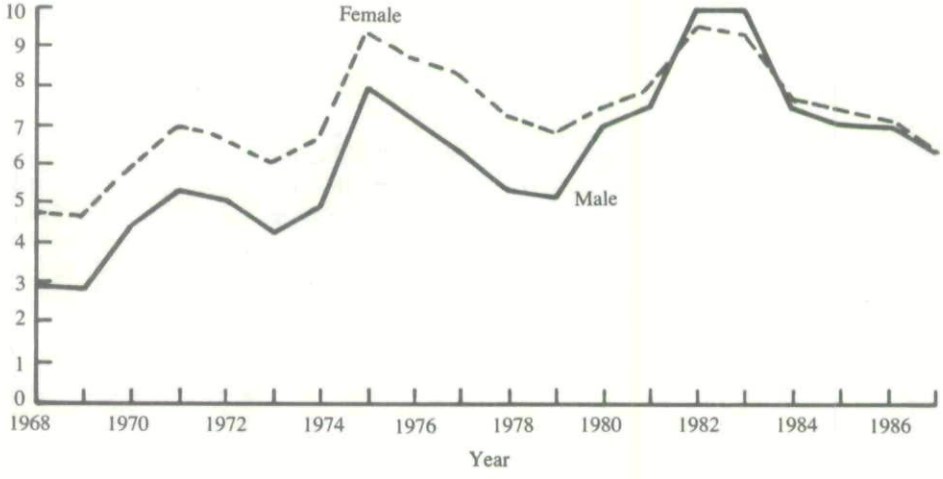

Figure 1. Male and Female Unemployment Rates, 1968–87.

unemployment rates is well recognized (Nielsen 1984; Williams 1985). Men are concentrated in industries that are more sensitive to cyclical changes in aggregate demand, so a recession will cause the male unemployment rate to increase relative to the female rate, and a recovery will cause relative male unemployment rates to decrease. In addition, women may be more subject than men to the "discouraged worker" effect in recessions. Unemployed women are more likely to withdraw from the labor force. Since discouraged workers are not counted as unemployed, this effect tends to reduce female unemployment rates relative to male rates (Blau and Ferber 1986).

Transition Probabilities and Unemployment Rates

We make use of Bureau of Labor Statistics gross flow data to explore the relative importance of the above explanations of recent trends in male and female unemployment rates. This unpublished data base is derived from the monthly Current Population Survey.[1] The gross-flow data are estimates of the number of people who move among the labor market states from one month to the next. The three labor market states are: not in the labor force (N), employed (E), and unemployed (U). Changes in the flows between any two of these employment states can cause changes in the overall unemployment rate.

Dividing the gross flow by the appropriate stock variable yields the transition probability of moving from one labor force state to another. For example, the transition probability of moving from employment to out of the labor force (denoted "P_{en}") is derived by dividing the average monthly gross flow from employment to out of the labor force during a year by the average level of employment before the transition. Similarly, the transition probability of moving from unemployment to employment (P_{ue}) is derived by dividing the average monthly gross flow from unemployment to employment by the average level of unemployment before the transition. Given three labor force states, six transition probabilities can be computed (P_{eu}, P_{en}, P_{ue}, P_{un}, P_{ne}, and P_{nu}). Table 1 presents transition probabilities calculated from the annual averages of month-to-month labor force flows for 1968 to 1986.

The unemployment rate can be expressed as a function of transition probabilities if the labor market is in a "steady state" (Marston 1976; Ehrenberg 1980). That is, if the flows into and out of employment are equal,

$$(1)\quad (P_{ue})U + (P_{ne})N = (P_{eu} + P_{en})E,$$

and the flows into and out of unemployment are equal,

$$(2)\quad (P_{eu})E + (P_{nu})N = (P_{ue} + P_{un})U,$$

then the unemployment rate (UR) can be expressed as[2]

$$(3)\quad UR = 1/\left(1 + \left[\frac{(P_{ne} + P_{nu})P_{ue} + (P_{ne})(P_{un})}{(P_{ne} + P_{nu})P_{eu} + (P_{en})(P_{nu})}\right]\right).$$

The unemployment rate expressed in (3) will differ from the actual rate due to biases in the gross flow data (Flaim and Hogue 1985) and to the fact that the labor force may not be in steady state. Nonetheless, male and female unemployment rates derived from (3) are quite close to the actual rates, never differing by more than 10 percent (see Table 2). The biases inherent in the gross-flow data do not appear serious at this level of aggregation. Equation (3) is useful in determining the effects of transition probability changes on the unemployment rates of men and women. Increases in P_{eu}, P_{en}, and P_{nu}

[1] Annual average gross flow data are available from the Bureau of Labor Statistics. Flaim and Hogue (1985) review the history of these data and detail some of their problems. No attempt was made here to adjust gross flows for consistency with published net labor force flows.

[2] Equations (1) and (2) are solved for N and set equal, eliminating N from the equation. The resulting equation is solved for the unemployment rate, U/(E + U), to get (3).

Table 1. Annual Averages of Monthly Transition Probabilities[a] by Gender, 1968–86.

	P_{eu}		P_{en}		P_{ue}		P_{un}		P_{ne}		P_{nu}	
Year	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
1968	.010	.010	.024	.073	.410	.303	.205	.358	.079	.040	.025	.013
1969	.010	.010	.024	.069	.404	.305	.215	.359	.080	.042	.025	.014
1970	.014	.013	.022	.064	.352	.271	.170	.330	.075	.042	.031	.016
1971	.015	.013	.021	.062	.307	.241	.171	.324	.070	.040	.036	.018
1972	.014	.012	.022	.062	.323	.253	.175	.324	.072	.041	.034	.018
1973	.012	.012	.023	.062	.343	.268	.198	.340	.075	.043	.032	.017
1974	.015	.014	.022	.059	.332	.260	.172	.318	.070	.042	.033	.019
1975	.020	.017	.022	.055	.255	.208	.143	.277	.063	.038	.039	.023
1976	.017	.015	.022	.055	.266	.216	.150	.281	.063	.041	.040	.023
1977	.016	.015	.022	.052	.291	.231	.158	.284	.064	.040	.036	.023
1978	.015	.014	.022	.052	.314	.257	.177	.287	.064	.043	.034	.022
1979	.015	.014	.022	.051	.316	.266	.171	.285	.065	.044	.031	.021
1980	.020	.015	.022	.047	.282	.246	.148	.277	.061	.041	.034	.023
1981	.020	.016	.021	.045	.266	.226	.151	.269	.058	.040	.037	.023
1982	.025	.018	.021	.042	.223	.195	.133	.250	.053	.038	.042	.026
1983	.022	.016	.020	.041	.217	.199	.127	.257	.052	.038	.040	.026
1984	.019	.014	.022	.043	.259	.221	.152	.272	.057	.040	.037	.025
1985	.019	.015	.022	.043	.273	.231	.159	.271	.056	.042	.035	.024
1986	.019	.014	.021	.041	.274	.232	.151	.276	.056	.041	.032	.023

[a] P_{eu}, P_{en}, P_{ue}, P_{un}, P_{ne}, and P_{nu} denote the probabilities of moving from one labor force state to another, where e = employment, u = unemployment, and n = not in the labor force.

Source: U.S. Bureau of Labor Statistics, unpublished data.

increase the unemployment rate, whereas increases in P_{ue}, P_{un}, and P_{ne} reduce it.

Each of the three explanations of the relative decline in female unemployment can be stated as a trend in a transition probability over time or as a response of a transition probability to the business cycle. To examine these effects we estimate the following regression equation for each transition probability for both men and women:

$$(4)\quad P_{ij} = a_0 + a_1(\text{TREND}) + a_2(\text{HELP}) + a_3(\text{DEFENSE}),$$

where P_{ij} = the average monthly transition probability of moving from labor market state i to labor market state j; TREND = a linear time variable, where 1968 = 1, . . . , 1985 = 18; HELP = the adjusted index of help-wanted advertising in newspapers (a business cycle indicator); and DEFENSE = the percentage of national defense purchases in Gross National Product. Ehrenberg (1980), Smith and Vanski (1978), and Williams (1985) have also estimated transition probabilities as functions of trend and cycle variables.

The coefficient on TREND will reflect secular changes, if any, occurring in each transition probability. The HELP coefficient (from the help-wanted index) will show the response to recessions and expansions—increased labor demand during expansions and decreased demand during recessions. Abraham (1987) adjusted the help-wanted index for three factors that reflect changes in newspaper advertising practices rather than underlying employment demand. First, the help-wanted index has risen over time due to the increased share of white-collar employment in total employment, since white-collar jobs are advertised in newspapers more often than are blue-collar jobs. Second, the index has also risen due to affirmative action laws, which often require employers to advertise jobs. Finally, competition in the newspaper industry has declined. Employers are more likely to advertise in the particular newspaper used by the index, once its competitors no longer exist. Abraham adjusts the index downward for each of these factors. In addition, she normalizes the index by dividing it by total nonagricultural employment. Abraham's adjusted, normal-

Table 2. Actual and Estimated Unemployment Rates, by Gender, 1968–86.

	Male		*Female*	
Year	*Actual*	*Estimated*[a]	*Actual*	*Estimated*[a]
1968	2.9	2.6	4.8	4.7
1969	2.8	2.7	4.7	4.5
1970	4.4	4.2	5.9	5.6
1971	5.3	4.9	6.9	6.4
1972	5.0	4.5	6.6	6.1
1973	4.2	3.9	6.0	5.5
1974	4.9	4.7	6.7	6.5
1975	7.9	7.7	9.3	9.0
1976	7.1	6.6	8.6	8.0
1977	6.3	5.8	8.2	7.6
1978	5.3	4.9	7.2	6.6
1979	5.1	4.9	6.8	6.3
1980	6.9	6.8	7.4	6.9
1981	7.4	7.3	7.9	7.6
1982	9.9	10.1	9.4	9.3
1983	9.9	9.6	9.2	8.5
1984	7.4	7.2	7.6	7.3
1985	7.0	6.9	7.4	7.1
1986	6.9	6.7	7.1	6.6

[a] Calculated from transition probabilities using Marston-Ehrenberg equation (3).

Source: U.S. Bureau of Labor Statistics, unpublished data and *Employment and Earnings*, various issues.

ized help-wanted index is used as our business cycle indicator.

The DEFENSE variable is included to control for the labor market effects of the end of the Vietnam War over the 1968–73 period and the Reagan defense buildup in the 1980s. Smith and Vanski (1978) found that the Vietnam buildup in the 1960s apparently increased the probability of moving from unemployment to employment (P_{ue}). We expect, then, that the demobilization toward the war's end should reduce P_{ue}, especially for men, since more men than women left the armed forces, but also for women, since an increase in the civilian labor force would provide more competition for all job seekers. The defense buildup in the 1980s has included an increase in military manpower levels. The buildup has also likely increased labor demand by durable manufacturing industries, the sector that benefits from most defense contracts. Since men form the greater part of durable goods employment, their probability of moving from unemployment to employment may rise relative to women's with the rise in the percentage of the GNP represented by defense purchases.

The coefficients estimated in (4) for each transition probability for men and women are used to evaluate six hypotheses about transition probabilities derived from the unemployment explanations. The first three hypotheses follow from the "labor force attachment" explanation, the fourth from the "employment-unemployment transitions" explanation, and the fifth and sixth from the "business cycle" explanation:

1. Female P_{en} should decrease (or grow less rapidly) with TREND relative to male P_{en}, if women have increasing career continuity.
2. Female P_{un} should decrease with TREND relative to male P_{un}, if women's labor force attachment is increasing.
3. Probabilities P_{ne} and P_{nu} should increase more for women than men with TREND if women are increasingly entering the labor force.
4. Female P_{ue} should increase more rapidly (or decrease less rapidly) with TREND than male P_{ue}, and female P_{eu} should fall relative to male P_{eu}, partly because sectoral changes in industry labor demand have generally favored female-dominated industries.
5. Recessions should increase male P_{eu} relative to female P_{eu}, and decrease male P_{ue} relative to female P_{ue}, if men are employed in more cyclically sensitive industries than are women.
6. Recessions should increase female P_{un} more than male P_{un} if unemployed women are more likely to withdraw from the labor force.

In addition, changes in transition probabilities due to TREND, HELP, and DEFENSE changes are incorporated one by one into equation (3) to test their effects on the unemployment rate. In this way we measure not only the direction of the effect of a probability change on the unemployment rate, but its relative size as well. The effects of transition probabilities on the unemployment rate will also show the relative importance of the various expla-

Table 3. Transition Probabilities by Gender, 1968–86: Regression Results. (t-statistics in parentheses)

Dependent Variable[a]	*Constant*	TREND	HELP	DEFENSE	$\bar{R}^2$	DW[b]
P_{eu} FEMALE	0.02469*	0.00005	−0.00641*	−0.00069*	.88	1.98
	(12.62)	(1.08)	(6.27)	(3.73)		
P_{eu} MALE	0.02896*	0.00026*	−0.01261*	−0.00026	.94	1.88
	(10.74)	(4.12)	(8.95)	(1.04)		
P_{en} FEMALE[c]	0.05352*	−0.00148*	0.00783*	0.00107*	.98	1.08
	(14.82)	(−16.27)	(4.81)	(2.91)		
P_{en} MALE	0.1775*	−0.00001	0.00288*	0.00021	.73	1.49
	(14.26)	(0.45)	(4.43)	(1.80)		
P_{ue} FEMALE	0.08220*	−0.00061	0.12051*	0.00647*	.95	1.52
	(4.12)	(1.29)	(11.56)	(3.44)		
P_{ue} MALE	0.08392*	−0.00294*	0.1678*	0.01100*	.97	2.10
	(3.41)	(5.02)	(13.06)	(4.74)		
P_{un} FEMALE[c]	0.21512*	−0.00326*	0.06994*	0.00643*	.94	1.10
	(9.27)	(5.51)	(6.91)	(2.68)		
P_{un} MALE[c]	0.05778*	−0.00081*	0.08314*	0.00435*	.98	2.82
	(5.51)	(3.32)	(14.61)	(4.62)		
P_{ne} FEMALE	0.03386*	0.00009	0.00823*	−0.00044	.77	2.19
	(15.48)	(1.80)	(7.20)	(2.12)		
P_{ne} MALE	0.05547*	−0.00108*	0.01583*	0.00053*	.99	1.57
	(22.00)	(17.95)	(12.02)	(2.23)		
P_{nu} FEMALE[c]	0.02871*	0.00044*	−0.00698*	−0.00077*	.97	1.20
	(13.62)	(8.26)	(7.40)	(3.57)		
P_{nu} MALE	0.06443*	−0.00006	−0.01845*	−0.00158*	.93	1.62
	(19.14)	(0.72)	(10.49)	(4.97)		

[a] For definitions of dependent variables, see note to Table 1.
[b] Durbin-Watson statistics calculated from OLS residuals.
[c] Equation re-estimated using Prais-Winsten technique to control for autocorrelation. The Durbin-Watson statistic is from the original OLS residuals.
* Significant at the 5 percent level.

nations of the declining male-female unemployment differential.

Estimation Results

Results of the transition probability regressions are reported in Table 3 for men and women. Annual data for the 1968–85 period were used.[3] In four equations Durbin-Watson statistics indicated the possibility of autocorrelation in the Ordinary Least Squares estimates, so these equations were reestimated using the Prais-Winsten procedure (Maddala 1977).[4]

As expected, the TREND coefficient for the female employment–not in the labor force transition probability (P_{en}) is much larger absolutely than the corresponding male coefficient, which is not significant. This result supports hypothesis 1, that women's increasing career continuity is reducing their unemployment rate relative to the male rate. Likewise, the trend decrease in the probability that unemployed women will leave the labor force (P_{un}) is about four times as large as the trend decrease for men, supporting hypothesis 2. This relative increase in female labor force attachment increases the female unemployment rate relative to the male rate. Male and female trends in P_{en}

[3] Transition probability data for 1986 are excluded due to the unavailability of Abraham's (1987) adjusted help-wanted index for that year.

[4] In the Prais-Winsten procedure, an estimate of the first-order autocorrelation parameter (ρ) is obtained using the Cochrane-Orcutt method, then the variables are transformed using $X_t - \rho X_{t-1}$. The first observation is preserved with the transformation $(1-\rho^2)^{1/2}X_1$. This procedure is equivalent to generalized least squares (Maddala 1977:277–78).

and P_{un} are also consistent with the observation that the trend toward early retirement is stronger for men than for women.

Supporting hypothesis 3, the trend increases in P_{ne} and P_{nu} are larger for women than for men. In particular, the probability of moving from nonparticipation in the labor force to employment shows a significant downward trend for men, whereas for women the trend is positive, though not significant; and the P_{nu} trend coefficient is positive and significant for women, but negative and not significant for men. Women are evidently increasingly willing to enter the labor force, even if doing so means suffering a period of unemployment. The strong decline in male P_{ne} indicates decreasing male labor force attachment, due, perhaps, to the decay of employment in male-dominated industries. Trends in P_{ne} and P_{nu} are consistent with hypothesis 3, but they have offsetting effects on male-female unemployment differentials.

The probability of a move from employment to unemployment (P_{eu}) shows a significant trend increase for men, but not for women. Similarly, the male P_{ue} probability has a significant negative trend coefficient, whereas the female coefficient is not significant. These findings support hypothesis 4, which is based on the argument that male-dominated industries such as mining, construction, and durable manufacturing are declining or growing slowly relative to the female-dominated service sector. More generally, they support the "employment-unemployment transitions" hypothesis that sectoral changes in labor demand are largely responsible for reducing the female unemployment rate relative to the male rate.

When the economy expands, causing labor demand to increase and the adjusted help-wanted index to rise, male unemployment falls relative to female unemployment. This pattern is shown in the HELP coefficients for P_{eu} and P_{ue}: the male P_{eu} HELP coefficient is negative and nearly twice the corresponding coefficient for women, and the male P_{ue} coefficient is positive and greater than the female P_{ue} coefficient. These results, confirming the greater cyclical sensitivity of male-dominated industries, support hypothesis 5.

The discouraged worker effect leads us to expect P_{un} to rise in recessions; that is, during recessions, the HELP coefficient on P_{un} should be negative. On the contrary, however, the HELP coefficients on transition probability P_{un} are positive and significant for both men and women, meaning that workers are more likely to leave the labor force from unemployment in expansions than in recessions. This finding is consistent with the results of Williams (1985). Note that the number of people leaving the labor force from unemployment may still rise during recessions, despite the decline in P_{un}, because of the larger pool of unemployed people.

Our hypothesis 6 is not supported by these results. It may be that in expansions, higher wages and greater job security encourage one or the other member of two-income households to leave the labor force. This result does imply, however, that the reason the male unemployment rate appears to be more cyclically sensitive than the female rate is the relative cyclical sensitivity of male-dominated industries, not a greater tendency of women than of men to leave the labor force from unemployment during recessions.

Effects on Unemployment Rates

In order to determine the relative influence of each of the coefficients reported in Table 3 on unemployment rates, we use the Marston-Ehrenberg unemployment rate equation (3). The actual 1985 transition probabilities are used in (3), yielding base year unemployment rates of 6.9 percent for men and 7.1 percent for women (actual rates were 7.0 and 7.4, respectively).[5] Unemployment

[5] Economic conditions in 1985 can be assumed to be "steady-state," as the Marston-Ehrenberg equations require. According to estimates by Holloway (1986), the GNP gaps for 1984 and 1985 were near zero, and the total unemployment rate was near its middle expansion trend.

rates are then recalculated after applying a trend, help-wanted, or defense change to each individual transition probability coefficient. The difference between the recalculated unemployment rate and the base rate shows the impact of the transition probability on unemployment. These differences are reported in Table 4.

For example, the trend change in male P_{eu} is .00026 annually (see Table 3). This trend increases male P_{eu} from its 1985 value of .01950 to .01976, resulting in the .06 percentage point rise in the male unemployment rate shown in Table 4. A recessionary change is simulated by a .30 fall in the adjusted help-wanted index, which is similar to the actual reductions that occurred in 1975, 1980, and 1982. Although a single year's change in trend has a much smaller effect on unemployment rates than a single year's recession in the help-wanted index, it should be remembered that trend changes are cumulative over the years, whereas cyclical changes are often reversed. Over many years, the trend effect will dominate. The DEFENSE change is a .23 percentage point rise in the defense share in GNP, the average annual increase from 1980 to 1986. Note that the sum of the six individual effects will not ordinarily equal the unemployment rate change produced when all probabilities are changed at once, since the latter change incorporates interaction effects.

The trend changes in transition probabilities appear to be reducing the female unemployment rate relative to the male rate by nearly two-tenths of one percent per year.[6] This value is consistent with the results of DeBoer and Seeborg (1984). Near equal contributions to the upward trend in the male rate are made by the P_{eu}, P_{ue}, and P_{ne} trends. All of these trends are probably attributable to the deteriorating employment opportunities in male-dominated industries. The strong effects of trends in P_{eu} and P_{ue} on male-female unemployment differentials support the hypothesis that the relative improvement of women's unemployment in recent years has been primarily due to sectoral changes in labor demand (the "employment-unemployment transitions" explanation).

Table 4. Effects of Trend, Cyclical, and Defense Changes on Male and Female Unemployment Rates: Simulation Results.

Independent Variable	*Transition Probability*	*Change in Male Unemployment Rate*	*Change in Female Unemployment Rate*
TREND:	P_{eu}	.06	.01
Change from	P_{en}	0	−.12
1985 to 1986	P_{ue}	.05	.01
	P_{un}	.01	.03
	P_{ne}	.04	−.01
	P_{nu}	0	.06
	ALL	.16	−.02
HELP:	P_{eu}	.89	.41
Recessionary drop	P_{en}	−.08	−.19
of .30 in Adjusted	P_{ue}	1.05	.65
Help-Wanted Index	P_{un}	.29	.22
	P_{ne}	.17	.20
	P_{nu}	.29	.26
	ALL	2.96	1.68
DEFENSE:	P_{eu}	−.01	−.03
0.23 percentage	P_{en}	0	.02
point rise in	P_{ue}	−.05	−.02
defense share	P_{un}	−.01	−.02
of GNP	P_{ne}	0	.01
	P_{nu}	−.02	−.02
	ALL	−.09	−.07

The trend fall in the probability of women leaving the labor force from employment (P_{en}) exerts strong negative pressure on the female unemployment rate. The increasing tendency for women to stay in the labor force even when unemployed (P_{un} falling), however, and the rising propensity of women to join the labor force even if it means unemployment (P_{nu} rising), nearly offset the P_{en} effect. Trends in the four transition probabilities that indicate change in female labor force attachment (P_{en}, P_{un}, P_{ne}, and P_{nu}) result in a fall in the female

[6] Using the mean value for the help-wanted index and the 1985 defense percentage, the 1986 unemployment rate estimates for men and women are nearly identical: 6.67 percent for men, 6.69 percent for women. Apart from cyclical influences, there is now little difference between these rates; indeed, male and female unemployment rates were identical in 1987 (see Figure 1). If current trends continue, the rate for women should fall below that for men in the near future.

unemployment rate of .04 per year. These results provide some support for studies suggesting that the increasing labor force attachment of women has contributed to lower female unemployment rates. The four labor force attachment trends increase the male unemployment rate by .05 per year. This effect is due especially to the significant TREND decline in P_{ne} for men. Decreasing male labor force attachment is contributing as much to the declining male-female unemployment differential as is increasing female attachment.

A recessionary fall in the adjusted help-wanted index creates a much larger rise in the male unemployment rate than in the female rate. This differential effect primarily reflects the greater cyclical responsiveness of male P_{eu} and P_{ue}; all other male and female effects are similar. It appears that the greater cyclical sensitivity of male-dominated industries than of female-dominated industries explains the historic narrowing of the female-male differential in recessions.

The defense buildup of the 1980s has reduced male and female unemployment rates by similar amounts. This similarity suggests that the effect may be due to the increasing number of military personnel, which tightens the labor market for both men and women, rather than an increase in employment demand by male-dominated defense industries.

Conclusion

We have sought to explain the narrowing male-female unemployment rate by examining the changing labor force transition probabilities over the 1968–85 period. Although other studies have examined changes in relative unemployment rates, none have used transition probabilities to examine long-term trends. Our results show a trend narrowing of the unemployment rate differential by .18 percentage points per year.

We have explored the effects of changes in labor force attachment, as measured by trends in four transition probabilities: employment to not-in-labor force (P_{en}), unemployment to not-in-labor force (P_{un}), not-in-labor force to employment (P_{ne}), and not-in-labor force to unemployment (P_{nu}). The net effect of these trends was to lower the female unemployment rate by .04 percentage points per year and to raise the male unemployment rate by .05 percentage points per year. Increasing female and decreasing male labor force attachment accounts for half of the trend narrowing of the male-female unemployment differential.

Trends in the probabilities of moving from employment to unemployment and from unemployment to employment have also been important in closing the unemployment gap between men and women. The employment-unemployment probability (P_{eu}) has increased, and the unemployment-employment probability (P_{ue}) has decreased, for men relative to women. The net effect of these two trends was to raise the unemployment rate of men by .11 percentage points per year and to raise the unemployment rate of women by a much smaller .02 percentage points per year. These changes in the employment-unemployment transitions contribute the other half of the long-term narrowing in the male-female unemployment differential. Other empirical studies suggest that the most plausible explanation for the observed changes in the probabilities of moving between employment and unemployment is that there have been significant sectoral shifts in labor demand toward female-dominated service industries and away from male-dominated industries such as mining, construction, and durable manufacturing.

The often-noted greater cyclical sensitivity of the male unemployment rate is due to the greater cyclical sensitivity of male employment-unemployment transition probabilities. We found no significant difference between male and female tendencies to leave the labor force from unemployment during recessions. In fact, the tendency for both men and women to leave the labor force from unemployment declines during recessions, causing a greater cyclical rise in unemployment rates than would otherwise occur.

REFERENCES

Abraham, Katharine G. 1987. "Help-Wanted Advertising, Job Vacancies and Unemployment." *Brookings Papers on Economic Activity,* No. 1, pp. 207–43.

Blau, Francine D., and Marianne A. Ferber. 1986. *The Economics of Women, Men and Work.* Englewood Cliffs, N.J.: Prentice-Hall.

Blau, Francine D., and Lawrence M. Kahn. 1981a. "Causes and Consequences of Layoffs." *Economic Inquiry,* Vol. 19, No. 2 (April), pp. 270–96.

———. 1981b. "Race and Sex Differences in Quits by Young Workers." *Industrial and Labor Relations Review,* Vol. 34, No. 4 (July), pp. 563–77.

DeBoer, Larry, and Michael C. Seeborg. 1984. "The Female-Male Unemployment Differential: Effects of Changes in Industry Employment." *Monthly Labor Review,* Vol. 107, No. 11 (November), pp. 8–15.

Ehrenberg, Ronald D. 1980. "The Demographic Structure of Unemployment Rates and Labor Market Transition Probabilities." in Ronald G. Ehrenberg, ed., *Research in Labor Economics,* Vol. 4. Greenwich, Conn.: JAI.

Flaim, Paul O., and Carma R. Hogue. 1985. "Measuring Labor Force Flows: A Conference Examines the Problems." *Monthly Labor Review,* Vol. 108, No. 7 (July), pp. 7–17.

Grant, James H., and Daniel S. Hamermesh. 1981. "Labor Market Competition Among Youths, White Women and Others." *The Review of Economics and Statistics,* Vol. 63, No. 3 (August), pp. 354–60.

Holloway, Thomas M. 1986. "The Cyclically Adjusted Federal Budget and Federal Debt: Revised and Updated Estimates." *Survey of Current Business,* Vol. 66, No. 3 (March), pp. 11–17.

Horvath, Francis W. 1987. "The Pulse of Economic Change: Displaced Workers of 1981–85." *Monthly Labor Review,* Vol. 110, No. 6 (June), pp. 3–12.

Jones, Ethel B. 1983. *Determinants of Female Reentrant Unemployment.* Kalamazoo, Mich.: W.E. Upjohn Institute for Employment Research.

Lloyd, Cynthia B., and Beth T. Niemi. 1979. *The Economics of Sex Differentials.* New York: Columbia University Press.

Maddala, G.S. 1977. *Econometrics.* New York: McGraw-Hill.

Marston, Stephen T. 1976. "Employment Instability and High Unemployment Rates." *Brookings Papers on Economic Activity,* No. 1, pp. 169–203.

Niemi, Beth. 1974. "The Female-Male Differential in Unemployment Rates." *Industrial and Labor Relations Review,* Vol. 27, No. 3 (April), pp. 331–350.

———. 1977. "Recent Changes in Differential Unemployment." *Growth and Change,* Vol. 8, No. 3 (July), pp. 22–30.

Nilsen, Sigurd R. 1984. "Recessionary Impacts on the Unemployment of Men and Women." *Monthly Labor Review,* Vol. 107, No. 5 (May), pp. 21–25.

Seeborg, Michael E., and Larry DeBoer. 1987. "The Narrowing Male-Female Unemployment Differential." *Growth and Change,* Vol. 18, No. 2 (Spring), pp. 24–37.

Smith, Ralph, and Jean Vanski. 1978. "The Volatility of the Teenage Labor Market: Labor Force Entry, Exit and Unemployment Flows." In U.S. Department of Labor, *Conference Report on Youth Unemployment: Its Measurement and Meaning.* Washington, D.C.: GPO.

Viscusi, Kip W. 1980. "Sex Differences in Worker Quitting." *The Review of Economics and Statistics,* Vol. 62, No. 3 (August), pp. 388–98.

Williams, Donald R. 1985. "Employment in Recession and Recovery: A Demographic Flow Analysis." *Monthly Labor Review,* Vol. 108, No. 3 (March), p. 35–42.