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STRUCTURAL UNEMPLOYMENT AND THE PRODUCTIVITY OF WOMEN*

by

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"Structural Unemployment and the Productivity of Women"

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ABSTRACT

Males aged 25 and over experienced the same unemployment rates in 1956 and 1974, but the aggregate unemployment rate increased over the interval from 4.1 to 5.6 percent. The paper attempts to measure the effect on social welfare of this "structural shift" in unemployment. The result is most assuredly not the "Okun's Law" result that output falls by 4.5 percent when unemployment increases by 1.5 percentage points. Instead, surprisingly enough, society enjoyed a net benefit equal to more than one percent of GNP resulting from the shift.

The structural shift was caused by an increase in the labor-force shares of teenagers and adult women, which both raised the weights of these high-unemployment groups and further increased the teenage and female unemployment rates relative to men. The extra unemployment of teenagers did impose a social cost, as teenage person-hours were shifted from work into less-valuable unemployment and home time. But this cost was swamped by the social benefit of the movement of women from home activity to market work, assumed to have been caused primarily by improved consumer durables and contraceptive technology. Society gained from this movement because the extra work hours generated higher government revenues from the "wedge" of income, payroll, and sales taxes which stands between the value of home time and the gross market wage.

The final measurements are presented after an extensive discussion of two basic ingredients, the effect of the minimum wage on teenage unemployment, and the effect of the gap between female productivity and wages introduced by anti-female discrimination.

The paper also examines the time-series behavior of wage change to determine whether the natural rate of unemployment has increased by the full amount of the structural shift. The data fail to provide a definite answer to this question.

STRUCTURAL UNEMPLOYMENT AND THE PRODUCTIVITY OF WOMEN

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I. Introduction

During the past decade the framework of macroeconomic policymaking in the United States has been altered by two major developments, both of which appear revolutionary when viewed in the context of policy analyses written in the 1964-66 era. First, the economics profession has been almost universally converted to the "Natural Rate Hypothesis" (NRH), which states that macro policy cannot permanently "buy" lower unemployment and higher output by generating a higher inflation rate. Instead, the unemployment rate is independent of the inflation rate in the long run, and any employment stimulus associated with faster inflation is purely transitory (there remains strong disagreement over the length of the transition). The NRH introduces caution as a new ingredient in policy recommendations, since unemployment cannot be pushed below the natural rate of unemployment without creating an acceleration of inflation.

The second development, originally proposed by George Perry (1970) in a wage equation which denied the NRH, and since then accepted as well by most proponents of the NRH, is a "structural shift" in unemployment, which has caused a rightward shift in the long-run Phillips curve (whether negatively sloped or vertical). Wage change, given expected inflation, appears to display much more stable behavior relative to the unemployment rate of prime-age adult males than to the broader official unemployment rate, which includes teenagers and adult women as well. In a recent test by Wachter (1976) a stable relationship is assumed between wage change and the unemployment rate of males aged 25 to 54; since the assumed (2.9 percent) natural unemployment rate of these prime-age adult males was achieved in both 1956 and 1974, the natural unemployment rate for the aggregate unemployment concept shifted upwards from 4.1 percent, the total rate actually achieved in 1956, to 5.6 percent, the total rate achieved in 1974.

The implications of the "Structural Shift Hypothesis" (SSH) are pervasive. Combining NRH and SSH, one concludes that the U. S. economy could have been safely pushed to an aggregate unemployment rate of 4.1 percent in 1956 without an acceleration in inflation, whereas in 1974 any attempt to stimulate the economy and push the aggregate unemployment rate below 5.6 percent would have accelerated the inflation rate. As long as NRH is valid, unemployment rates below the natural rate cannot be maintained for more than a transition period, implying that published offical estimates of the nation's "potential" output at an assumed 4 percent unemployment rate should be scrapped as unrealistic, along with the associated "full employment surplus" series based on hypothetical government revenues and expenditures at 4 percent unemployment.[1] Also rejected as unrealistic are legislative proposals like the 1976 "Humphrey-Hawkins Bill," which proclaims a goal of 3.0 percent unemployment for adults aged 20 and over, far below the 4.5 percent unemployment rate for this group achieved in 1972 and 1974 when prime-age male unemployment was approximately at its "natural rate."

This paper assesses the "welfare cost" of the 1956-74 structural shift in unemployment. A previous paper (Gordon, 1973) evaluated the loss of welfare resulting from a hypothetical increase in the unemployment rate caused by a decline in aggregate demand, taking account not only of the resulting decline in the value of market output but also of the partially offsetting increase in the value of nonmarket activity. A one-percentage-point temporary demand-induced increase in the unemployment rate was estimated to cause a substantial 2.3 percent reduction in the value of total market and nonmarket welfare, but a much smaller 0.7 percent reduction when the one-percentage-point increase in unemployment was assumed to be permanent. The simple "Okun's Law" technique, which associates a one-percentage-point increase in the unemployment rate with a 3.0 percent decline in output, very seriously exaggerates the welfare cost of a permanent shift in unemployment caused by lower aggregate demand.

The welfare effects of a structural unemployment shift depend on the causes of the shift. High unemployment groups, teenagers and women, have substantially increased their share in the labor force at the expense of adult men. The added number of teenagers reflects the "hump" in the U. S. age distribution caused by a high fertility rate between the mid 1940's and early 1960's. If we assume that fertility decisions are voluntary, and if we consider the "welfare" of society to be that of the individuals which comprise it, then a mere change in the age distribution has no welfare consequences, holding constant the wage rate, hours worked, and unemployment rate of each age group. Under these assumptions, the lower per-capita income of society during the period when the "hump" cohort is young is a mere phenomenon of aggregation, since the welfare of each individual is unchanged.

The higher number of women in the labor force reflects the voluntary response of women to a variety of stimuli, including technical improvements in contraceptive devices, technological innovations which have reduced the time needed to perform a given amount of housework, increased social acceptance of working women, and the substitution effect of higher real wages. Even if each working woman earns less than each man, causing the average wage rate per employee to decline as the share of women in the labor force increases, nevertheless society may benefit if the marginal product of an extra woman (net of the capital investment required to equip her) exceeds the value of her previous home activity. A major task of this paper is to measure the marginal product of market work by females. Do women really produce less than men by a proportion equal to the female-male wage differential, or are female wages held below the "true" female marginal product by economic discrimination?

If the unemployment and wage rates of teenagers, women, and men had all remained unaffected by their increasing shares in the labor force, then social welfare might actually have increased as the result of an upward structural shift in unemployment. Men would be just as well off as before; teenagers would be greater in numbers but individually unaffected; women would have gained by their voluntary shift into market work, and, in addition, their additional woman-hours would have generated government tax revenues which would have allowed tax reductions for those previously in the labor force.

Thus the case for an adverse welfare effect of an upward structural shift in unemployment rests on the fact that between the mid 1950's and early 1970's, the unemployment rates of teenagers and women have not remained constant, as assumed above, but have increased relative to adult men. Today's teenager is worse off than the teenager of the mid 1950's if there has been a decline in the sum of his "full income" from market work, unemployed time, and home time (including school). The case for an adverse effect of the higher relative unemployment rate of women is less clear, however. The fact that extra women have chosen voluntarily to enter the labor force indicates that the market wage rate, adjusted for the probability of unemployment, still outweighs the value of time at home, leaving intact our deduction that women must have achieved an improvement in welfare by their voluntary shift into market activity.

The basic task of this paper is an assessment of the welfare cost (or benefit) of the structural shift which occurred in the U. S. between 1956 and 1974, as a result of the increased labor force shares of teenagers and women, groups with higher unemployment rates than adult men, and also as a result of a further increase in the teenage and female unemployment rates relative to men. Most of the discussion is conceptual, and the empirical estimates of the welfare cost attempt only to produce suggestive orders of magnitude. As we shall see, precise calculations are impossible on several issues where the data do not give strong signals, and where previous papers have been unable to reach definitive conclusions. For instance, the benefit to society of the shift of one woman from housework to market work requires an estimate of the woman's market productivity, requiring in turn the difficult and controversal allocation of the female-male earnings differential between economic discrimination and "true" differences in productivity. Similarly, the cost to teenagers of higher unemployment depends on the value of learning inherent in experimentation as teenagers shift from job to job.

The policy implications of this study of structural unemployment are less obvious than of the previous paper (Gordon, 1973) on the welfare costs of a reduction in aggregate demand. There the numerical estimates of the costs of a temporary increase in unemployment were directly relevant to the perpetual debate about the costs of creating a temporary recession to achieve the benefits of a lower future inflation rate.[2] The conclusions of the present paper are relevant for the evaluation of two types of policy proposals:

(1) Some economists still do not believe that the natural rate hypothesis is valid and believe that the costs of the 1956-74 increase in unemployment from 4.1 to 5.6 percent are sufficiently high to warrant taking the risk of a demand stimulus which would push the unemployment rate below 5.6 percent. A demonstration in this paper that the welfare costs of the 1956-74 structural shift have been negligible or minor could be used as an argument against such a demand stimulus.

(2) Numerous plans, e.g., manpower training, a better employment service, and public-service employment, have been proposed as uses of government funds which might reduce the natural rate of unemployment.

The impetus for these plans comes partly from the widespread feeling that the 1956-74 increase in the total natural unemployment rate must have imposed substantial costs on society. If the benefits of reversing the structural unemployment shift are judged in this paper to be minor, then the benefit-cost ratio of some or all of the proposed programs may be small.

2. The Anatomy of the Structural Shift

Table 1 displays the main ingredients of the structural shift which occurred between 1956 and 1974. The labor force is divided by age and sex into four groups. The dividing line by age is set at 25 years, rather than the traditional boundary of 20 years, because the behavior of the relative unemployment rates and labor force shares of the group aged 20-24 followed patterns much closer to the teenagers than to the adults aged 25+.[3]

The contrast in the group unemployment rates is especially interesting, because in each of the two years the unemployment rate of the "super-prime-aged" 35-44 year male group was identical at 2.6 percent. The overall unemployment rate of men 25+ fell slightly from 3.07 to 2.98 percent (line 1a in Table 1). Nevertheless, the total unemployment rate rose from 4.13 to 5.58 percent, as a result both of an increase in the unemployment rates and labor-force shares of adult women and young people. The labor-force share of adult women resulted entirely from an increase in their labor-force participation rate (line 2b); the population share of adult women declined as a result of the shift

TABLE 1

Unemployment Rates, Labor Force Participation Rates, and Population Shares of Major Groups, 1956 and 1974

	1956	1974
1. Unemployment Rates (u_i)		
a. Males 25+	3.07	2.98
b. Females 25+	3.95	4.60
c. Males 16-24	8.60	11.44
d. Females 16-24	8.43	12.34
e. Total	4.13	5.58
2. Labor Force Participation Rates (f_i)		
a. Males 25+	.876	.803
b. Females 25+	.353	.425
c. Males 16-24	.741	.737
d. Females 16-24	.444	.564
e. Total	.600	.613
3. Population Shares (P_i/P)		
a. Males 25+	.403	.361
b. Females 25+	.437	.411
c. Males 16-24	.072	.110
d. Females 16-24	.088	.117
e. Total	1.000	.999

Source: Calculated from Handbook of Labor Statistics, 1975, Tables 3, 4, 61.

in the age distribution caused by the "hump" in the fertility rate. Young males increased their labor-force share entirely as a result of a higher share of the population (line 3c), while their labor-force participation rate declined slightly (line 2c). The labor-force share of young women was boosted by a substantially higher labor-force participation rate <u>and</u> a higher population share.

The number of unemployed individuals in a labor-force group (X_i) can be rewritten as the product of the group's unemployment rate (u_i), the ratio of the number of unemployed to the group labor force ($u_i = X_i/F_i$), times the group's labor-force participation rate as a ratio to group population ($f_i = F_i/P_i$), times the group's population (P_i):

$$(1) \qquad X_i = \frac{X_i F_i P_i}{F_i P_i} = u_i f_i P_i .$$

The total unemployment rate is the sum of the unemployed individuals in each group ($\sum_i X_i$) divided by the total labor force ($F = fP$):

$$(2) \qquad u = \frac{\sum_i X_i}{F} = \frac{\sum_i u_i f_i P_i}{f\,P} .$$

A structural shift in unemployment (ds) is defined as a change in the total unemployment rate when the unemployment rate of a given group, say u_1, remains fixed. When we differentiate (2) totally, and measure the change in each group unemployment rate (u_i) relative to the employment rate of the base group (u_1), we obtain the following decomposition of the structural shift:

$$(3) \qquad ds = \sum_{i=2}^{n} \frac{f_i P_i}{f\ P} u_1 d\left(\frac{u_i}{u_1}\right) + \sum_{i=1}^{n} \left[\frac{u_i P_i}{P} d\left(\frac{f_i}{f}\right) + \frac{u_i f_i}{f} d\left(\frac{P_i}{P}\right)\right].$$

Numerical values for each of the terms in (3) for the 1956-74 structural shift are presented in Table 2. If the unemployment rate of males 25+ had remained constant at 3.07 percent between 1956 and 1974, instead of falling from 3.07 to 2.98 percent, and if the relative unemployment rates (u_i/u_1) had retained their 1974 values, the overall unemployment rate in 1974 would have been 5.70 percent, instead of the actual 5.58 percent. This structural shift of 1.57 percentage points (1.57 = 5.70 - 4.13) is decomposed in Table 2 into the contribution of higher group relative unemployment rates (0.92 points, or 58.6 percent of the structural shift); the contribution of the shift in labor force participation rates towards higher unemployment groups (0.18 points, or 11.5 percent of the shift); and the contribution of the shift in population shares towards higher unemployment groups (0.47 points, or 30.0 percent of the shift).

When we add together the contribution to the three terms of each of the four separate demographic groups, we can attribute responsibility to the groups as follows:

	Percentage Points	Share of Structural Shift
Males 25+	-0.36	-22.9
Females 25+	0.35	22.3
Males 16-24	0.77	49.0
Females 16-24	0.81	51.6
	1.57	100.0

We conclude that the structural shift has been predominately a phenomenon

TABLE 2

Decomposition of Sources of Structural Shift in Unemployment, 1956-74

(All Figures are percentages)

1.	1956 Total Unemployment Rate		4.13
2.	Contribution to Higher Unemployment Rate of Increased Group Unemployment Rates Relative to Unemployment Rate of Males 25+: $\frac{f_i P_i u_1}{f\, P} d\left(\frac{u_i}{u_1}\right)$		
	a. Males 25+	0.00	
	b. Females 25+	0.23	
	c. Males 16-24	0.34	
	d. Females 16-24	0.35	
			0.92
3.	Contribution to Higher Unemployment Rate of Changed Group Labor Force Participation Rates Relative to Average Labor Force Participation Rate: $\frac{u_i P_i}{P} d\left(\frac{f_i}{f}\right)$		
	a. Males 25+	-0.18	
	b. Females 25+	0.19	
	c. Males 16-24	-0.03	
	d. Females 16-24	0.20	
			0.18
4.	Contribution to Higher Unemployment Rate of Changed Group Population Shares: $\frac{u_i f_i}{f} d\left(\frac{P_i}{P}\right)$		
	a. Males 25+	-0.18	
	b. Females 25+	-0.07	
	c. Males 16-24	0.46	
	d. Females 16-24	0.26	
			0.47
5.	Hypothetical 1974 Unemployment Rate with Actual 1974 Values of u_i/u_1, f_i/f, and P_i/P, but 1956 value of u_1		5.70
6.	Actual 1974 Unemployment Rate		5.58

Source: Calculated from Table 1.

attributable to the 16-24 group, with approximately equal contributions within that group of young men and young women. The contribution of adult women has been relatively minor.

3. How Robust is the Conclusion that the Natural Rate of Unemployment Has Shifted?

The decomposition of the structural shift in Table 2 does not in itself identify the extent of the increase in the natural unemployment rate (u^N) over the 1956-74 period. A three-step procedure is required to estimate u^N. First, the rate of growth of the wage rate (w_t) relative to expected inflation (p_t^e) must be tied to a particular unemployment concept (u_{jt}):

$$(4) \qquad w_t = \alpha_0 + \alpha_1 u_{jt}^{-1} + p_t^e.$$

Note that in (4) the coefficient on p_t^e is <u>assumed</u> to be unity, thus embodying the natural rate hypothesis. Second, the natural unemployment rate for that group unemployment rate (u_j^N) is calculated from the estimated coefficients of (4):

$$(5) \qquad \hat{u}_j^N = \frac{\hat{\alpha}_1}{q^* - \hat{\alpha}_0},$$

where q^* is the long run productivity trend, the extent to which wage growth can exceed expected inflation without causing inflation to accelerate. Finally, the natural rate for the total unemployment concept must be calculated by estimating the value of the other group unemployment rates ($u_k, k \neq j$) relative to u_j:

(6) $$u_{kt} = u_{kt}(u_{jt}, S_{kt}),$$

where S_{kt} is a structural variable, e.g., the relative labor-force share of the kth group, which explains secular movements of u_{kt} relative to u_{jt}. The aggregate natural rate ($\hat{u}_t^N$) is then:

(7) $$\hat{u}_t^N = \frac{\hat{u}_j^N F_{jt}}{F_t} + \sum_k \frac{\hat{u}_{kt}^N F_{kt}}{F_t}$$

where $\hat{u}_{kt}^N$ is calculated by computing the predicted value of (6) for $\hat{u}_j^N$ and S_{kt}.

The estimated 1956-74 increase in $\hat{u}_t^N$ is very sensitive to the particular choice of the unemployment concept "j". For instance, at one extreme the choice of the aggregate unemployment rate as u_{jt} in equation (4) eliminates the other "k" groups, leading to the conclusion that the aggregate natural unemployment rate has remained constant as the solution to equation (5). This result is illustrated in line 8 of Table 3, for two different estimates of the rate of expected inflation based on different speeds of adjustment of adaptive expectations. The standard errors of the two estimates are displayed in columns (1) and (2), and the estimated natural unemployment rates ($\hat{u}_j^N$) of about 4.8 percent are exhibited in columns (3) and (4). According to this equation, actual aggregate unemployment was 0.6 percentage points below the natural rate in 1956, but was 0.8 percentage points above the natural rate in 1974.

At the other extreme is the estimate in line 4, where group "j" is chosen to be males aged 25+. Now the economy is estimated to have been roughly at the group natural rate $\hat{u}_j^N$ in 1956, but about 0.1 percentage points <u>below</u> $\hat{u}_j^N$ in 1974. The resulting estimate of the <u>aggregate</u>

TABLE 3

Phillips Curves Estimated for
Alternative Unemployment Definitions,
Annual Observations, 1954-71

Group J	Standard Errors		Estimated $\hat{u}^N_j$		Actual u_{jt}		Estimated $\hat{u}^N_t$ (for p^e Long)		$\hat{u}^N_{1974} - \hat{u}^N_{1956}$
	p^e Short	p^e Long	p^e Short	p^e Long	1956	1974	1956	1974	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Males 35-44	.475	.414	2.69	2.70	2.60	2.55	4.18	5.71	1.53
2. Males 25-54	.458	.404	2.95	2.96	2.97	3.05	4.13	5.42	1.29
3. All 25-54	.451	.405	3.53	3.54	3.31	3.76	4.36	5.25	0.89
4. Males 25+	.471	.413	3.06	3.07	3.09	2.99	4.11	5.72	1.61
5. All 25+	.462	.406	3.49	3.50	3.34	3.60	4.28	5.43	1.15
6. All 20+	.456	.427	3.97	3.99	3.65	4.47	4.43	5.01	0.58
7. Perry Weighted	.457	.426	3.92	3.93	3.60	4.37	4.43	5.06	0.63
8. All	.474	.491	4.76	4.77	4.13	5.59	4.77	4.77	0.00

Extrapolation of Lines 2 and 3, p^e long equation, 1972-76

	1972	1973	1974	1975	1976[e]	Total 72-76
9. Actual w	6.68	6.62	9.11	8.14	6.87	37.42
10. Predicted, Males 25-54, line 2	5.62	6.97	8.74	9.37	7.53	38.23
11. Predicted, All 25-54, line 3	5.54	6.92	8.66	9.16	7.30	37.58
12. Actual Minus Predicted, line 2	1.06	-0.35	0.37	-1.23	- .66	- 0.81
13. Actual Minus Predicted, line 3	1.14	-0.30	0.45	-1.02	- .43	- 0.16

Table 3, continued.

Sources and Methods:

1. All unemployment rates are annual averages.
2. Wage change (w_t) is the total of the quarterly percentage changes over the four quarters of each calendar year of the hourly earnings index for the private nonfarm economy, adjusted for changes in overtime and the interindustry employment mix, pre-1964 from Gordon (1971) and post-1964 from the Bureau of Labor Statistics.
3. Expected price change (p^e_t): A quarterly polynomial distributed lag regression of the Moody's Aaa bond rate on the quarterly rate of change in Gordon's (1975b) "nonfood net-of-energy" deflator for the period 1953Q1 to 1975Q4 yielded a set of lag coefficients, which were then constrained to sum to 1.0 and subtracted from the left-hand side of equation (4) in the text to form the dependent variable ($w - p^e$). Two versions were used, one from a 10-quarter estimated lag distribution in the interest rate equation (the column labelled "p^e short") and another from a 20-quarter estimated lag distribution (the column labelled "p^e long"). The respective mean lags are 2.8 and 5.3 quarters.
4. Predictions were estimated using a price deflator both net and gross of energy and food prices to calculate p^e, using the lag distribution described in note 3. The gross deflator worked considerably better and was used to calculate the

Table 3, continued.

Sources and Methods:

predicted values listed in lines 10 and 11 of the table. Estimated 1976 annual values were based on: annual rate of change between August 1975 and May 1976 for wages; annual rate of change between 1975Q3 and 1976Q2 for prices; March values of unemployment (when the aggregate unemployment rate was 7.5 percent).

5. q* in equation (5), needed for the calculation of u^N_{jt}, is the average of $w_t - p^e_t$ over the entire sample period.

natural rate thus rises more than the actual total, from 4.11 to 5.72 percent. Limitation of group "j" to the relatively narrow 25+ male group thus provides a pessimistic conclusion that the total natural rate has shifted up a great deal, and that prudent policymakers cannot allow the aggregate unemployment rate to fall below 5.7 percent without running the risk of an accelerating inflation. The same pessimistic conclusion that the natural rate has risen by more than 1.5 percentage points was recently reached by Wachter (1976).

But other less pessimistic conclusions are possible. Several previous investigations have followed Perry's (1970) lead by measuring unemployment concept "j" as a "weighted unemployment rate," with the unemployment rate of each demographic subgroup weighted by its wage rate and weekly hours relative to prime-age males, on the ground that the contribution to effective labor supply of one unemployed member of each group is proportional to the average productivity and hours of that group. Since teenagers and women are given much lower weights than adult men, the Perry weighted unemployment rate rises by only 0.77 percentage points between 1956 and 1974, compared to the 1.45 increase in the aggregate rate. The actual aggregate rate thus shifts up much less relative to the Perry weighted rate than relative to the 25+ male rate, and so the estimated aggregate natural rate ($\hat{u}_t^N$) shifts up by less (only 0.63 points) on line 7 when group "j" is Perry's weighted rate than the 1.61 aggregate natural rate shift on line 4 when group "j" is defined as males 25+.

Previous studies of the upward shift in the natural rate have erred by assuming a particular definition of group "j" without testing for the ability of the data to discriminate among different definitions.

Perry's estimated upward shift is much less than Wachter's, because Perry assumed the weighted unemployment concept as group "j" while Wachter assumed a prime-age male concept. The remaining lines in Table 3 demonstrate that the data cannot find a statistically significant difference between several widely varying estimates of the natural rate shift. If we concentrate on the standard errors in column (2) for the better-fitting "long lag" version of expected inflation ("p^e long"), we note that the evidence for special treatment of prime-aged males is very weak. For the age group 25-54, the standard errors for the male (line 2) and "all" (line 3) equations are almost identical. For the age group 25+, the inclusion of females in line 5 actually improves the fit over the male-only version in line 4, although not significantly. In fact, the only difference in Table 3 which _is_ statistically significant is between lines 1-7, on the one hand, and the aggregate equation in line 8, on the other hand.

When we examine only the best-fitting equations on lines 1-5, we may conclude that the aggregate natural rate has shifted up by as much as 1.61 points on line 4, a figure roughly equal to Wachter's, or we may choose the much smaller figure of 0.89 points on line 3. The inclusion of adult females, as on lines 3 and 5, may be supported for at least two reasons beyond the normal claims of equal opportunity for females. First, the equations on lines 3 and 5 suggest that the economy was operating below its natural rate in 1956, whereas the male-only equations on lines 2 and 4 do not. The male-only equations leave us with the puzzle as to why wage and price increases accelerated in 1956. Second, 1972-76 postsample extrapolations for the male-only equation on line 2 and the "all" equation on line 3 yield better results for the latter.

The results in Table 3 were tested for their sensitivity to several other variations. The lagged effect of unemployment on wages, emphasized by Wachter, was tested by adding a lagged value of U^{-1}_{jt} to all equations but in no case were the lagged variables significant. Second, separate versions were tested for the 1954-75 sample period, including as extra variables a wage-control dummy and/or a trend term (the latter as a test of the hypothesis that even the natural rate for prime-age males may have shifted up as a consequence of liberalized unemployment compensation). No significant coefficients could be found for the extra variables.[4] Extra versions were also fitted with the coefficient on p^e_t estimated freely, rather than constrained to equal unity. The results (for p^e long) were almost identical, with estimates of the p^e_t coefficient ranging from 0.95 to 1.05.

4. The Welfare Cost of a Structural Shift in Unemployment

As in my earlier paper (1973) on aggregate demand unemployment, we assume here that the aggregate welfare of households depends on their total output of "final commodities" (Z), which they produce by combining goods purchased on the market (Q), together with their own hours of time spent searching for new jobs while unemployed (U), and hours spent on "home activity" (N), which includes time devoted to consumption, household production, and sleep:

$$(8) \qquad Z = Z(Q,U,N).$$

The production of a meal, for example, requires purchased groceries (part of Q) and hours spent in shopping and cooking (part of N). The search time of unemployed individuals (U) is also productive in raising future income, monetary or psychic.

Since our aim is to measure the effect of a structural shift which involves differences among family members in labor force behavior, we shall define the output of "final commodities" of the members of a particular demographic group as depending only on market goods purchased with their own wage income, and on their hours spent in nonmarket activity:

$$(9) \qquad Z_i = Z_i(Q_i, U_i, N_i).$$

The form of (9) embodies the important simplification that there are no intra-family interdependencies of household production and consumption, e.g., that there is no reduction in the value of a husband's home time when his wife takes a job and forces him to spend more hours feeding the dog and washing dishes, nor is there any increase enjoyed by the husband when his wife's extra income allows the family to purchase an extra TV set or a new car.

Market output (Q_i) is assumed to be produced by "market manhours" (M_i) and capital (K_i):

$$(10) \qquad Q_i = Q_i(M_i, K_i).$$

Substituting (10) into (9), we can write:

$$(11) \qquad Z_i = Z_i(Q_i(M_i, K_i), U_i, N_i).$$

The effect on group welfare of a specified structural shift in unemployment (ds_i) depends on the change in the group output of "final commodities":

$$(12) \qquad \frac{dZ_i}{ds_i} = Z_{Q_i} Q_{M_i} \left(\frac{dM_i}{ds_i}\right) + Z_{U_i} \left(\frac{dU_i}{ds_i}\right) + Z_{N_i} \left(\frac{dN_i}{ds_i}\right),$$

where Z_{Q_i}, Z_{U_i}, and Z_{N_i} are the group marginal products of market goods, unemployed time, and home time, respectively, in producing final commodities. Q_{M_i} is the group marginal product of market manhours in producing market output. The effect of the structural unemployment shift on the capital stock (K_i) is ignored. The economy's group market production functions are assumed to exhibit constant returns; the average productivity of a group's market manhours is a function of the ratio of manhours to capital, but not of the scale of operations. Additional labor input when a structural shift increases the market manhours of, for instance, women or teenagers, is assumed to stimulate investment until the capital stock is raised sufficiently to equip the new workers in the group with the same capital-labor ratio as those working previously. Since the higher capital stock must be maintained by larger depreciation deductions and returns to owners of capital, the marginal product of the extra capital stimulated by the structural shift is unavailable for consumption and hence is not a net social benefit.[5]

In equilibrium the three marginal products in the production of final commodities are equal to, respectively, the price of market goods relative to final commodities (P_Q/P_Z), and the relative "shadow wages" per unit of unemployed time (W_{U_i}/P_Z) and home time (W_{N_i}/P_Z):

$$(13) \qquad Z_{Q_i} = \frac{P_Q}{P_Z}; \quad Z_{U_i} = \frac{W_{U_i}}{P_Z}; \quad Z_{N_i} = \frac{W_{N_i}}{P_Z}.$$

The term W_{N_i} is sometimes called "the price of time" or "the price of home time," and its determinants have been explored by Becker (1965) and others. We do not at this stage assume that the market for final output is in equilibrium with the marginal product of manhours equal to the real wage rate, since the validity of this assumption is a matter to be investigated. When the relative prices in (13) are substituted into (12), we obtain:

$$(14) \qquad \frac{dZ_i}{ds_i} = \frac{P_Q}{P_Z}\left[Q_{M_i}\left(\frac{dM_i}{ds_i}\right) + \frac{W_{U_i}}{P_Q}\left(\frac{dU_i}{ds_i}\right) + \frac{W_{N_i}}{P_Q}\left(\frac{dN_i}{ds_i}\right)\right].$$

What changes in market manhours (M_i), unemployed time (U_i), and home time (N_i) have been caused by the 1956-74 structural shift of unemployment in the U. S.? Our welfare concept is the change in the consumption of final commodities <u>per member</u> of a given demographic group (Z_i/P_i). Thus we ignore the portion of the structural shift directly attributable in line 4 of Table 2 to changes in group populations. If the "fertility hump" had simply caused an increased population of teenagers in the 1960's and 1970's without any resulting changes in unemployment, wage rates, or labor force participation, then the welfare of each individual teenager would have been unaffected. We shall also simplify the discussion by ignoring the declining labor force participation of adult men, due primarily to earlier retirement. Thus the analysis will be limited to the effects of, first, the increasing labor force participation rates of a given population of young females and adult females, and second, the higher relative unemployment rates of females and young males relative to adult males.

Since the population of each demographic group is held constant, we can make use of the identity that the total time spent in market and nonmarket activity exhausts the total time available, and thus an increase in the time spent in any one activity must be balanced by a decrease in one or both of the other activities:

$$(15) \qquad dM_i + dU_i + dN_i \equiv 0.$$

The substitution of (15) into (14) allows the group change in welfare to be written in the following simple form:

$$(16) \qquad \frac{dZ_i}{ds_i} = \frac{P_Q}{P_Z}\left[\left(\frac{Q_{M_i} - W_{N_i}}{P_Q}\right)\left(\frac{dM_i}{ds_i}\right) + \left(\frac{W_{U_i} - W_{N_i}}{P_Q}\right)\left(\frac{dU_i}{ds_i}\right)\right].$$

The total effect of the structural shift within a demographic group (ds_i) is divided into two parts. The first term inside the brackets represents the change in market manhours (dM_i), valued at the difference between the group's marginal product (Q_{M_i}) minus the shadow price (W_{N_i}) attached to the offsetting change in home time. The second term represents the change in hours spent in job search (dU_i), valued at the difference between the shadow price of unemployed time (W_{U_i}) minus the shadow price of home time (W_{N_i}).

As an example of the operation of equation (16) in an artificial case, imagine that an increase in labor force participation raised the market manhours of adult females (dM_i) by one billion manhours annually, and hours spent in job search by 50 million, while reducing home time by 1.05 billion. If the marginal product of women in market activity was \$4.00, the shadow price of time spent in job search was \$1.00, and the shadow price of home time was \$2.00, then the effect on the "full income" of women (dZ_i) would be:[6]

$$(\$4 - \$2)(1.0) + (\$0 - \$2)(0.05) = \$1.9 \text{ billion.}$$

In the example, the structural shift in unemployment caused by the flow of women into the labor force actually makes women better off, not worse off, by a total of \$1.9 billion.

The estimation of the components of (16) for the actual 1956-74 U. S. structural unemployment shift involves two basic tasks, one easy and one difficult. First, the observed changes in labor force participation rates (df_i) and relative unemployment rates $[d(u_i/u_1]$, quantified above in Table 1, must be translated into changes in manhours of market and nonmarket activity. The translation is relatively straightforward, requiring only estimates of average annual hours spent by the demographic groups on the job and in job search, since the changes in participation and unemployment rates are taken as basic data and need not be estimated.

The manhour estimates are presented in Table 4. For each demographic group four numbers are calculated, the effect on market and unemployed

TABLE 4

Estimated Change in Manhours, 1974, Attributable to 1956-74 Change in Group Labor Force Participation Rate (df_i) and in Group Relative Unemployment Rates (du_i^*)

(billions of manhours annually)

	Effect of df_i	Effect of du_i^*
1. Males 16-24		
a. dM_i	-.250	-.592
b. dU_i	-.009	.155
c. dN_i (= $-dM_i - dU_i$)	.259	.437
2. Females 16-24		
a. dM_i	2.772	-.646
b. dU_i	.077	.127
c. dN_i (=$-dM_i - dU_i$)	-2.849	.519
3. Females 25+		
a. dM_i	7.718	-.311
b. dU_i	.072	.060
c. dN_i (= $-dM_i - dU_i$)	-7.790	.251

Sources and Methods:

1. dM_i was calculated starting from the identity that $M \equiv EH \equiv (1-u)fPH$, where E is employed workers, H is annual hours of work, the other symbols are the same as before, and the "i" subscripts are dropped for convenience. The

total change in manhours resulting from a change in labor force participation (df) and in relative unemployment rates (du*) is dM = (1-u) PHdf - fPHdu*. Sources are as follows: P, f, and u are actual 1974 figures from the Handbook of Labor Statistics 1974--Reference Edition (Washington, 1975) and from the Manpower Report of the President (Washington, 1975). df and du* are from Table 2. H is calculated as wH2000/w, where 2000 is the assumed annual hours for prime-aged males, wH is Perry's (1970, Appendix A) set of weights of demographic group wages times hours relative to prime-age adult males, and w is the 1974 relative median full-time year-round wage of each demographic group relative to prime-age adult males, from the Current Population Survey, Series P-60. The resulting estimates of H are 1542 for males 16-24, 1501 for females 16-24, and 1534 for females 25+.

2. dU_i was calculated starting from the identity that $U \equiv XH_U \equiv ufPH_U$, where the only new symbol is H_U, annual hours of search per unemployed worker, and where once again the "i" subscripts are dropped for convenience. The total change in search manhours resulting from a change in labor force participation (df) and in relative unemployment rates (du*) is $dU = uPH_U df + fPH_U du^*$. Data for u, P, f, dF, and du* are the same as in note 1 for this table. Weekly hours of search are taken to be 8.1 for men and 5.9 for women, based on the evidence compiled in U. S. Bureau of Labor Statistics, Jobseeking Methods Used by American Workers, BLS Bulletin 1886 (Washington, 1975), Table H-2, p. 51. This source reports that hours of search do not vary appreciably with age.

manhours of changes in labor force participation (dM_i/df_i and dU_i/df_i), and the effect on market and unemployed manhours of changes in unemployment rates of the demographic groups relative to adult males (dM_i/du_i^* and dU_i/du_i^*).[7] The only surprising ingredient of Table 4 is the estimate, based on a U. S. government survey conducted in 1973, that men spend only 8 hours per week on average in job search activity while unemployed, and women spend only 6 hours. The remainder of the time of unemployed individuals is counted as "home time." Thus the increase in the relative unemployment rates in the right column of Table 4 mainly had the effect of shifting hours away from market work into home time. But the effects of du^* are swamped by the shift of hours from home time to market work activity caused by the substantial increase in the labor force participation rates of women in both the 16-24 and 25+ group.

The second and more difficult portion of the calculation of the elements of equation (16) requires estimates of the group marginal products of market activity and of the shadow prices of unemployed and home time, raising the following issues for discussion in the rest of the paper:

1. What is the value of the <u>extra</u> search engaged in by young workers and adult women as a consequence of their higher relative unemployment rates (du_i^*)? An answer requires an interpretation of the cause of du_i^*; the value of the extra hours may have been substantial if they resulted from a voluntary decision responding to a change in the benefits and costs of search, but, on the other hand, the value of the extra hours may have been zero if the extra unemployment was totally involuntary.

2. On what basis can a value be placed on a marginal hour of home time? Is the "waiting time" of the unemployed as valuable as other uses of home time?

3. Is the marginal product of young workers and adult women accurately measured by their gross before-tax wage? If there is economic discrimination, then wage rates may be held moderately or substantially below marginal products.

5. Interpretations of the Shift in Relative Unemployment Rates

The idea that there is a positive value attributable to at least a part of the time of an unemployed worker, introduced by Mortensen (1970) and others in the late 1960's as an ingredient in the "new microeconomics of unemployment," seemed a novelty to a generation raised on the idea of involuntary Keynesian unemployment as a pure waste of time. Workers and jobs are assumed to differ in their characteristics, and much unemployment involves a search by workers for a job possessing the best possible combination of pecuniary and nonpecuniary rewards. Workers will not necessarily accept the first job offer they receive if they judge that the present value of the return to further search, including expected future wage increments and unemployment benefits, net of the cost of search, outweighs the return of accepting a job now, net of taxes and commuting expenses.

Figure 1 is a diagram designed to examine the consequences of an upward shift in the supply of labor of a given demographic group relative to a "base" group, say prime-age males, on the assumption that the groups

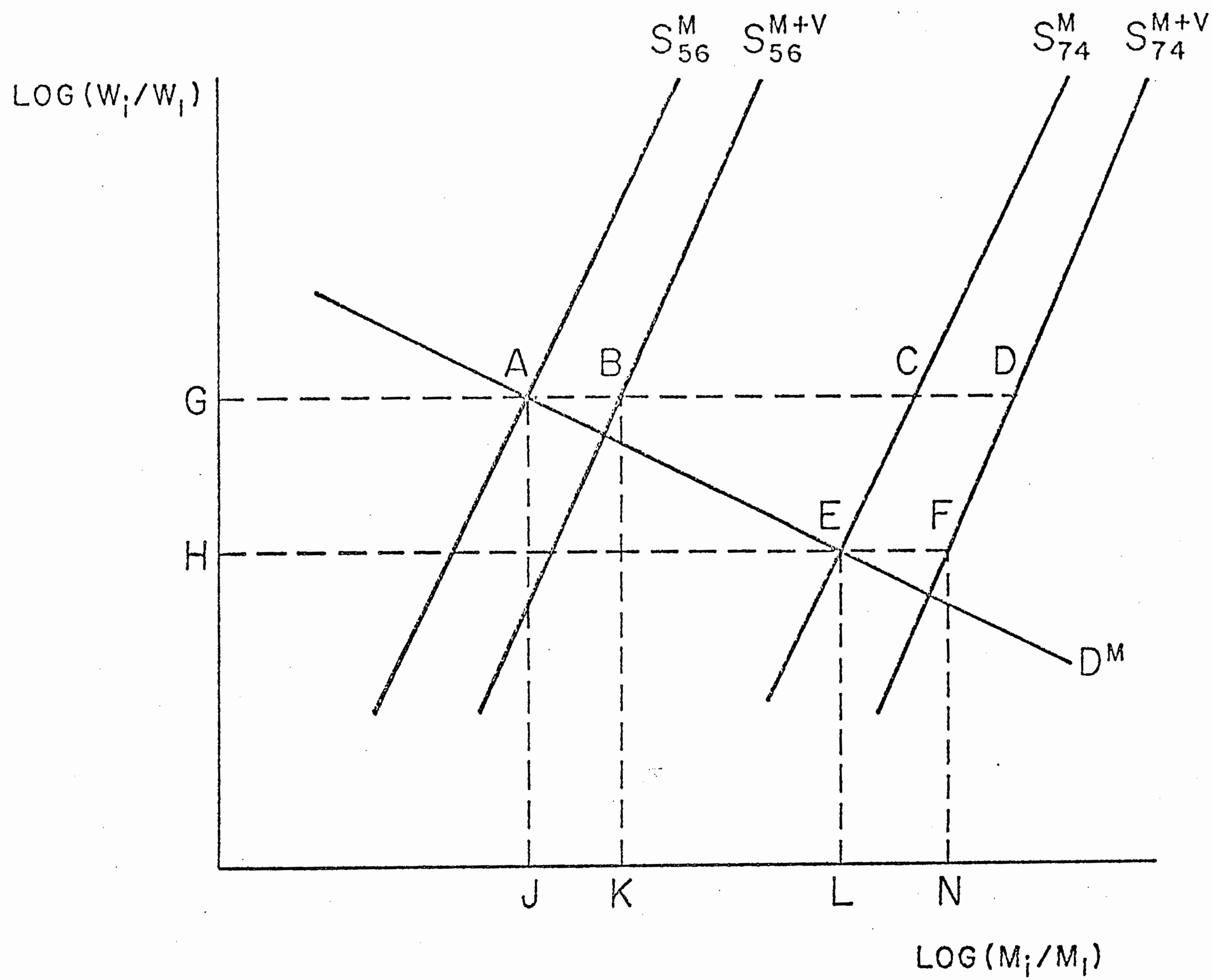

FIGURE 1

are imperfect substitutes in production. The horizontal axis is the M_i/M_1 ratio, and the vertical axis is w_i/w_1, and the variables on both axes are measured as natural logs, and all of the supply curves are drawn to have constant elasticities. The initial situation in 1956 is described by the two left hand curves. S_{56}^{M+V} is the group's relative supply of manhours to labor force activity, and S_{56}^{M} is the supply of employed manhours. The horizontal distance between the two curves represents the supply of "voluntary search manhours" (V), the outcome of the worker's rational balancing of the marginal benefits and costs of search. As a point of reference, it is assumed that all 1956 unemployment is voluntary, and that point A represents an equilibrium position at the crossing point of S_{56}^{M} with D^M, the demand curve for group manhour input.[8] Note that the two supply curves are drawn so that the percentage unemployment rate (for instance, the ratio AB at the initial 1956 wage rate OG), depends inversely on the wage rate. Although most determinants of the benefits and costs of search should be unit-elastic functions of the wage rate in the long run (unemployment compensation, taxes, bus fares, pay telephone charges), nevertheless a permanent wage reduction could cause a substitution away from market work toward the joint activity of "searching and waiting."[9] Another possibility, not drawn in Figure 1, would be a reduction in both employed and unemployed hours in response to a lower wage.

Now, let us examine the effects of an increase in the relative group supply of labor, shown as a shift to the new pair of supply curves S_{74}^{M} and S_{74}^{M+V}. The new curves are drawn to exhibit the same voluntary unemployment rate as in 1956 at the initial 1956 wage rate (CD = AB on the logarithmic scale). Two extreme possibilities are suggested as the net effect of the labor supply shift, on the assumption that there has been no change in the relative demand for labor. First, the relative wage might drop from G to H, stimulating an increase in the demand for manhours from J to L. The decline in the wage rate, relative to the value of home time, could induce an increase in the voluntary unemployment rate (EF > AB). The second extreme case would occur if the relative group wage were fixed at G, for instance by a minimum wage with universal coverage set by the legislature as a constant fraction of the prime-age group wage rate. The relative demand for group manhour input would remain fixed at A, creating a new higher unemployment rate AD, consisting of the voluntary segment CD (=AB) and the involuntary segment AC.

If the first case were correct, we should observe a negative statistical correlation between the change in group relative wage rates between 1956 and 1974 and the change in group shares in the labor force. As the curves are drawn, we should also observe a positive correlation between the change in the relative unemployment rates and change in group shares in the labor force. The extra unemployment, as noted above, is purely voluntary and stems from the assumption that the market wage declines relative to the value of home time which the unemployed enjoy during the "waiting period" of their unemployment. If the second case were correct, we should observe the same positive correlation between group rates and labor force shares.

A preview of our findings is displayed in Figure 2 and 3, depicting the changes between 1956 and 1974 of relative unemployment rates and wage

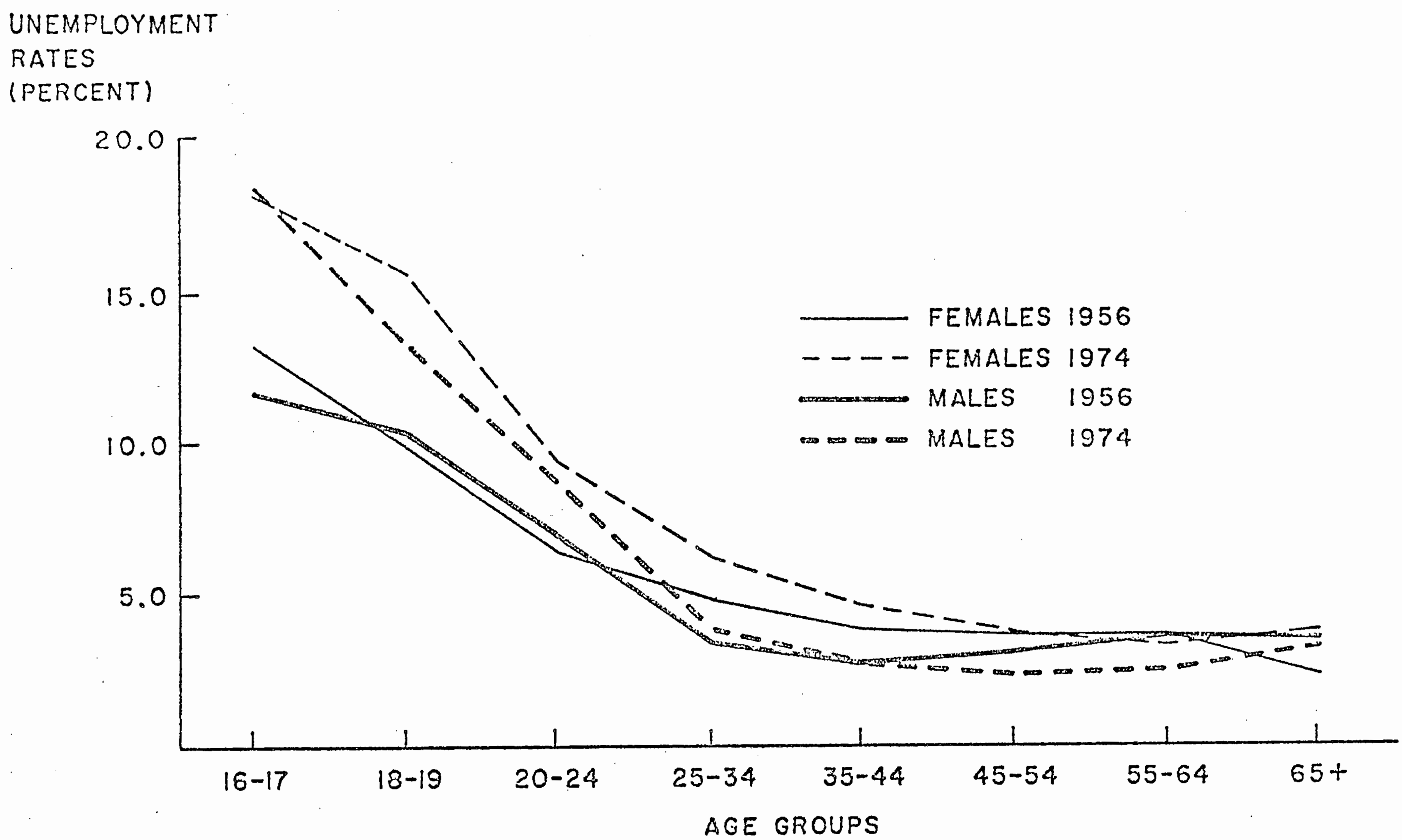

FIGURE 2

UNEMPLOYMENT RATES BY AGE AND SEX,

1956 and 1974

rates by age-sex group. Between these two years, the labor force shares of each adult male group (25-34, 35-44, etc.) declined, while the share of every other group increased with the two exceptions of females 35-44 (the Depression babies) and females 65+. In Figure 2, actual 1974 unemployment rates appear to have increased in every female age group except 55-64, whereas the males display a systematic increase in the young age groups (16-34), and a decrease in the 45-64 groups. A regression equation indicates a strong positive correlation between the unemployment and labor force share changes:

$$(17) \quad LRU_i = \underset{[2.058]}{.104} + \underset{[8.129]}{.463}\, LRS_i \qquad R^2 = .412,\ SEE = .194$$

Here the numbers in brackets are t-statistics, and

$$LRU_i = \text{Log}\left(\frac{u_{i_{74}}}{u_{i_{56}}}\right) \quad \text{and} \quad LRS_i = \text{Log}\left(\frac{f_{i_{74}}/f_{74}}{f_{i_{56}}/f_{56}}\right).$$

As an example, the labor force share of male youth aged 20-24 increased by 51.0 percent. The equation predicts an increase in the group unemployment rate by 23.6 percent, as compared to the actual increase of 26.1 percent (from an actual figure in 1956 of 6.9 percent to 8.7 percent in 1974).

The behavior of relative wage rates is illustrated in Figure 3. Relative wage rates increased for exactly those male groups whose unemployment rates decreased. For females, the relationship is almost as

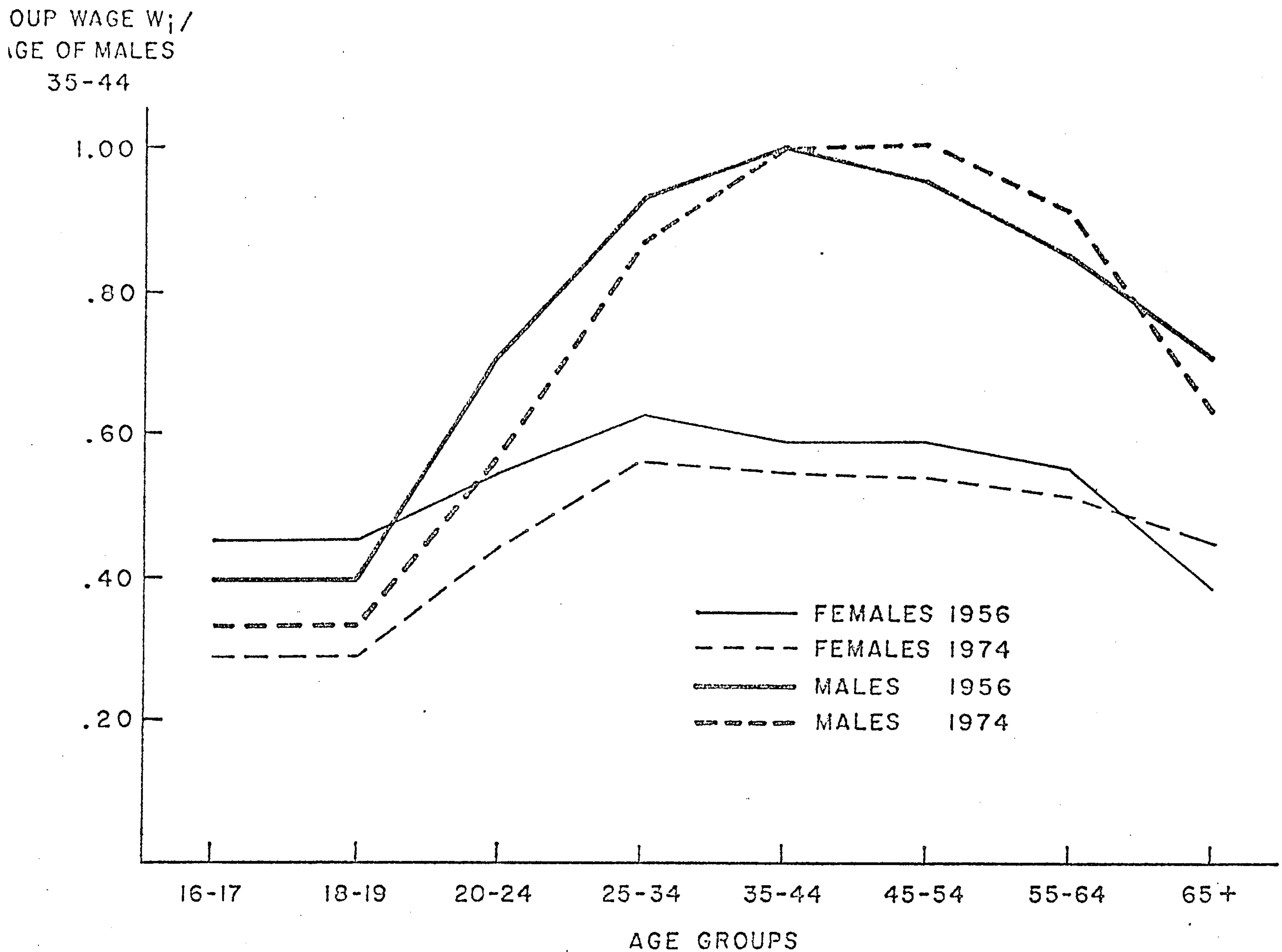

FIGURE 3

FULL-TIME YEAR-ROUND MEDIAN INCOME RELATIVE TO MALES, 35-44, IN 1956 AND 1974 systematic, with relative wage rates dropping for all female groups aged 16-64, whereas unemployment rates increased for all female groups except for 55-64. A regression equation indicates a strong negative correlation between the relative wage rate and labor force share changes.

$$\text{(18)} \qquad LRW_i = \underset{[-2.721]}{-.088} - \underset{[-3.768]}{.355}\, LRS_i \qquad R^2 = .504, \; SEE = .124$$

Here the symbol LRS_i is the same variable as in (17), and:

$$LRW_i = \text{Log}\left(\frac{W_{i_{74}}/W_{1_{74}}}{W_{i_{56}}/W_{1_{56}}}\right), \text{ where group "1" is males aged 35-44.}$$

As an example, the labor force share of male youth aged 20-24 increased by 51.0 percent. The equation predicts a decrease in the relative wage rate by 18.1 percent, as compared to the actual decrease of 20.4 percent (from an actual ratio in 1956 of 71.2 percent of the male 35-44 wage to 56.7 percent in 1974).

The decline in relative wage rates in the context of Figure 1 rules out the second extreme case, that of completely inflexible relative wage rates. But how close to validity is the first extreme case, in which relative wages decline sufficiently to clear the market, and all unemployment is voluntary? The positive correlation between changes in relative shares and unemployment rates in (17) could describe the substitution between market and search hours caused by a lower wage rate, but one would expect this substitution to be accompanied by a reduction in the intensity of search and an increase in the duration of a spell of unemployment. Perry's (1972) evidence, however, indicates exactly the opposite. The average duration of an unemployment spell fell between 1956 and 1972 (a year almost identical to 1974 in its labor market characteristics) for all the groups which experienced higher unemployment rates between 1956 and 1974.[10] The higher 1972 unemployment rates of young people and women were entirely attributable to more spells of unemployment per year, with a 1956-72 increase in annual spells of 50, 29, 73, and 43 percent, respectively, for males 16-19, males 20-24, females 16-19, and females 20-24.

The fact that higher youth and adult female unemployment was caused by more annual spells, not by the same number of longer lasting spells, does not by itself demonstrate that the extra unemployment was involuntary rather than the result of voluntary choice. Much has been made of the prominent role of labor-force entry and reentry as the source of high relative teenage and adult female unemployment rates. More than two-thirds of teenage unemployment, and more than 40 percent of adult female unemployment, occurs for the "reason" of entry or reentry.[11] The 1956-72 (or 1974) increase in teenage relative unemployment rates could have been entirely due to the voluntary choice by teenagers of more frequent spells out of the labor force to pursue schooling or traveling opportunities made possible by growing affluence.

Nevertheless several pieces of evidence dispute the interpretation of the extra unemployment as purely voluntary. First, exit from the labor force and subsequent reentry need not be voluntary. Perry's data suggest that a substantial number of labor force dropouts was previously unemployed; the sequence employment-to-dropout becomes less common than the sequence employment-to-unemployment-to-dropout as age increases for both men and women. In fact, the monthly probability for an unemployed person of dropping out of the labor force is greater than the probability of being hired for males 16-19 and females 16-19 and 25-59.

> "Once these reasons [school enrollment and having babies] are allowed for, most people plainly leave the work force only after first becoming unemployed. Rather than being an important cause of unemployment, such transitions appear to result from it."[12]

In Figure 1 we assumed that all unemployment of group "i" in 1956 was voluntary, and that extra involuntary unemployment in 1974 could have occurred if the group "i" wage rate had been held up by some institutional barrier which prevented the group relative wage from falling sufficiently. A considerable literature has developed on the effect of higher minimum wages on teenage unemployment, enough, indeed, to warrant several recent surveys and summaries.[13] Unfortunately, while most of the recent studies agree that teenage employment is reduced by increases in the minimum wage rate, the quantitative estimates of the total effect vary widely.

A set of strong conclusions is implied by Mincer's (1976) results. He finds that the elasticity of the employment/ population ratio of teenagers to an increase in the effective ratio of the minimum wage to hourly earnings is -.24, and for males aged 20-24 is -.21. Although Mincer's sample period extends only through 1969, and thus does not apply directly to our comparison of 1956-74, we can make a rough comparison by calculating an effective minimum wage ratio for 1974.[14] Calculations on this basis are presented in Table 5 for two labor force groups, all teenagers 16-19 and males 20-24, the groups for which Mincer found significant coefficients on the minimum-wage elasticity. For both groups the estimated elasticities are high enough to over-explain slightly the actual 1956-74 change in unemployment rates. With 1956 values of the minimum wage ratio, the 1974 unemployment rates of both teenagers 16-19 and males 20-24 would have been below actual 1956 values. Softening the conclusion slightly to allow for time lags in the effect of the May, 1974 minimum wage increase, we can derive from Mincer the conclusion that the 1956-74 minimum wage increase is sufficient at least to explain fully the 1956-74 increase in the unemployment of teenagers 16-19 and males 20-24.

Unfortunately, some studies find much weaker effects than Mincer. Mincer's teenage elasticity of -.24 is on the high end of the results surveyed by Goldfarb (1974). In a recent study covering quarterly data over the entire postwar period, 1948-75, Gramlich (1976) finds an elasticity of only -.10. More important, Gramlich concludes that only changes in the basic minimum wage rate influence employment, and that changes in coverage do not matter. The elimination of the coverage effect completely destroys the conclusion of Table 5. Between 1956 and 1974 the ratio of the basic minimum wage to teenage full-time median earnings (converted to an hourly basis) fell from 103 to 96 percent and should have stimulated rather then depressed teenage employment. Gramlich concludes from additional regression equations that the major impact of the minimum wage has been to shift teenagers from full-time to part-time employment, with little effect on the total number employed.

TABLE 5

Actual 1956-74 Changes in
Unemployment, Employment, and Labor Force Ratios,
and Changes Attributable to Increase in Effective Minimum Wage Ratio

	u_i	f_i	E_i/P_i
1. Teenagers, 16-19			
a. Actual 1956	11.5%	50.9%	45.1%
b. Actual 1974	16.0	55.2	46.4
c. Calculated 1974 with 1956 Minimum Wage Ratio[a/]	11.0	65.2	58.2
2. Males, 20-24			
a. Actual 1956	6.9	87.8	81.8
b. Actual 1974	8.7	86.0	78.5
c. Calculated 1974 with 1956 Minimum Wage Ratio[b/]	6.6	89.5	83.7

Notes: a. Uses 90.9 percent 1956-68 increase in BLS teenage effective minimum wage ratio, from Mincer (1975), Table 2, column 4, p. S102, multiplied by .925 factor for 1968-74 derived in text footnote.

b. Uses 30.7 percent 1956-68 increase in BLS total effective minimum wage ratio, from Mincer (1975), Table 2, column 3, p. S102, multiplied by .925 factor for 1968-74 derived in text footnote.

Can Gramlich's conclusion denying any effect for coverage increases be believed? Part of the problem may be multicollinearity in the particular specification of Gramlich's regressions. The effect of the basic minimum wage (MW) is measured as a ratio to average hourly earnings (AHE). The MW/AHE ratio has a "sawtooth" appearance, increasing sharply in years of minimum wage increases, and declining thereafter as AHE grows. The effect of coverage changes is represented by a set of "0-1" dummy variables, equal to 0 before the date of the coverage change and 1 thereafter. The three coverage dummies, stacked on top of each other, represent a "step" variable:

0	0	0	0	0	0	1	1	1
0	0	0	0	1	1	1	1	1
0	0	1	1	1	1	1	1	1

Since the dates of most of the coverage changes coincide with the dates of the minimum wage changes, the net effect of the coverage variable may be approximated by a linear combination of the MW/AHE ratio and a time trend, both of which are included as right-hand variables in Gramlich' regressions.[15] Because of this multicollinearity, it may be impossible to obtain a significant estimate of the separate effect of coverage, and it may be necessary to assume, as did Mincer, that the proper minimum wage variable is the product of the coverage ratio and MW/AHE. Overall, I lean toward acceptance of the Mincer results summarized in Table 5, because I fail to see any *a priori* reason why changes in the MW/AHE ratio within a given industry should have a strong effect, but an extension of minimum wage coverage to a new industry should have no effect on the employment of low-wage workers in that industry.

The strong adverse effect on teenage employment of increasing minimum wage coverage estimated by Mincer, and the defects in Gramlich's tests for the coverage effect, point toward acceptance of the conclusion in Table 5 that the entire increase in teenage unemployment between 1956 and 1974 was involuntary. This conclusion might overstate the involuntary portion of the increase if Mincer's elasticities are too high, a possibility raised by lower estimates produced in some other studies, as summarized in Goldfarb's survey. On the other hand, Table 5 disguises the additional deterioration in teenage welfare as teenagers have been pushed by the higher minimum wage from full-time into part-time work, a conclusion of Gramlich's study which appears to be relatively robust. Since our interest in this paper lies in order-of-magnitude estimates, we shall assume that the possible upward bias in Mincer's elasticities is just balanced by the consequences of the full-time to part-time shift.

As a result, the full 1956-74 increase in the teenage relative unemployment rate will be taken to be involuntary. Because the minimum wage prevents employers from offering young workers the opportunity to "buy" specific human capital by working for a very low wage during a training period, a substantial number of teenagers are pushed against their will into "dead-end" jobs without any concomitant training or promotion possibilities. Since there is no incentive to remain on a single job, teenagers have a strong incentive to change jobs frequently and to drop out of the labor force frequently to enjoy spells of leisure between spells of time in the labor force.

Recall that an estimate of the value of hours spent in job search is required for the estimation of the term $(W_{U_i} - W_{N_i})$ in (16) below, because the shift of an hour into search time from home time changes welfare by the difference between the value per hour of the two activities. Since we assume from the above analysis that all of the increase in teenage job search is involuntary, W_{U_i} for both males and females aged 16-24 is set equal to zero.

On the other hand, previous studies have found little if any adverse effect of the minimum wage on adult female employment, and so we shall treat the additional hours of adult female job search time (Table 4, line 3b) as voluntary. This is a corollary of our basic underlying assumption that the 1956-74 increase in adult female labor-force participation was voluntary. Female entrants and re-entrants chose to spend time searching for the best possible job, given the costs of search, rather than to accept the unsatisfactory low-paying jobs which in many cases may have been immediately available (e.g., waitress in the neighborhood coffee shop).

In an earlier paper (1973) we noted that for married women with no access to welfare payments or unemployment benefits, the price of home time at the margin would equal the value of search time and would be equal in turn to the value of average gross hourly earnings, less taxes, commuting costs, and search costs. A review of the evidence yielded a deduction of about 50 percent for these three items.[16] Thus in our final calculations below, we shall take the value of the difference between the value of search time and home time for adult females $(W_{U_i} - W_{N_i})$ to be zero, and the value of home time itself to be $.5W_i$, where W_i is average adult female hourly earnings.

6. A Model of "Rational" Occupational Crowding

The final ingredient required for insertion into equation (16) above is the marginal product of women and teenagers. This cannot without further investigation be proxied by before-tax group average hourly earnings, because a number of writers have suggested, at least in the case of adult females, that earnings are held below marginal products by pure economic discrimination. We shall attempt to determine where the truth lies between two extremes, first, that the entire male-female earnings differential reflects discrimination, in which case the female marginal product should be measured by the male wage, and, second, that females produce only what they are paid, so that their marginal product should be measured not by the male wage but by the female wage.

Two basic classes of models have been developed to explain why the ratio of female to male wage rates is so low, below 60 percent for the age group 35-54 (see Figure 2 above). Becker's (1971) classic analysis is the starting point for the first class of models which attempts to explain the wage differential between two groups (blacks vs. whites, females vs. males) which are assumed to have equal productivities. The second class of models attributes the wage differential not to pure economic discrimination, but rather to a "real" difference in productivity between males and females, due to the higher turnover and shorter expected job tenure of females. Discrimination may still exist in the second class of models but takes the form of "social discrimination" which forces females to drop out of the labor force and take care of children, rather than "economic discrimination" which holds wage rates below productivity.

The Becker (1971) framework explains low female wages by the male "taste for discrimination," a desire to minimize economic transactions with women. Efficient production requires that the marginal products of males and females be equated to their marginal cost, consisting for females of a pecuniary wage and a nonpecuniary cost imposed on female-averse males. If the discriminatory "wedge" between male and female wage rates is proportional rather than absolute, the female/male wage ratio is unaffected by a shift in the demand for labor.[17] At one semantic level the Becker approach implies that the female marginal product should be measured by the male wage. But at a deeper level the female marginal product should be reduced by the nonpecuniary cost they impose on males. This cost is just as "real" as any other cost, for otherwise nondiscriminating firms could drive discriminating firms out of business.[18] The only argument for excluding it is that the national accounts at present exclude other nonpecuniary costs, e.g., pollution and congestion. But in principle our welfare measure in (16) above is based on "full income", including both pecuniary and nonpecuniary benefits net of costs, and should be adjusted for the nonpecuniary costs imposed by the presence of females.

The phrase "female-averse males" has a false ring, and indeed there is little to recommend the Becker-type theories as an explanation of low female earnings. The most important flaw is the absence of any explanation of the decline with age of the female/male wage ratio depicted above in Figure 2. Why should the male aversion to adult females be so marked, but the male aversion to teenage females relative to teenage males be so minor? To explain Figure 2, Becker would have to argue that adult males are averse not only to adult females but to <u>all</u> teenagers.

A weaker version of the Becker approach is taken by Arrow (1972) and Phelps (1972), both of whom invoke imperfect information to explain why employers, who are deterred by the high cost of direct measurement, classify as inferior all members of a group (blacks, women) despite the fact that only some members are actually less productive than the members of the favored group. This theory, which Phelps calls the "statistical theory of sexual discrimination," can be regarded as describing "partial economic discrimination." The members of the subordinate group who are actually inferior are paid their marginal product; economic discrimination only affects the subgroup who are not inferior. This approach is incomplete, lacking an explanation of the "true inferiority" of the workers who give their non-inferior group-mates a bad name.

This paper amalgamates two strands in the literature on female earnings. The first is associated with Bergmann (1974), who specializes the Becker approach by introducing the idea that men "crowd" women into a small number of occupations, driving down the wage of those occupations relative to those dominated by men. Weisskopf (1972, p. 163) has calculated that "well over half of all working women in both 1900 and 1960 were employed in jobs in which 70 percent or more of the workers were female." The second strand is the application of human capital theory to the explanation of low relative female earnings. Mincer and Polachek (1974) have explained the flat age-earnings profile of women relative to men as a result of the smaller accumulation by women of on-the-job training, caused by short spells in the labor force followed by the depreciation of skills during spells out of the labor force. Polachek (1975) has extended this idea by classifying occupations on the basis of their "expected rate of atrophy," i.e., the expected rate of depreciation of market skills during periods of non-participation in the labor force.

Women choose to enter into occupations which allow acquired skills to be remembered rather than lost.

Both the Bergmann and Polachek contributions are incomplete. Bergmann follows Becker by assuming either that employers push the less favored group into lower-paying occupations because of pure prejudice or because they may be loyal "to the employers' group which may be making a good thing financially out of discrimination."[19] There is nothing in her model which would explain why the female/male wage ratios of Figure 2 are inversely proportional to age. Polachek's model describes the maximization problem which leads employees with expectations of intermittent labor force behavior to avoid jobs with rapid "atrophy," but does not explain the sources of the differential atrophy rates nor the general-equilibrium response of relative wages across occupations to employee occupational choices.

Our model describes an economy of many firms and workers in which only two occupations exist, differing from each other in the process by which knowledge and skills are acquired. In the "firm specific human capital" (FSHC) occupation skills are unique to each firm, must be learned on-the-job, and cannot be transferred to other firms. The marginal product (θ) of all workers, whether male or female, rises with job tenure (τ) as more on-the-job skills are acquired. When other factors of production are held fixed, an increase in the share (ρ) of the labor force working in the occupation reduces the marginal product of labor:

$$(19) \qquad \theta = \theta(\tau,\rho), \ \theta_{\tau}>o, \ \theta_{\rho}<o$$

In the "general human capital" (GHC) occupation workers must make an initial investment (I_0) to obtain a wage $W_0(1-\rho)$ which is fixed for any given participating share ($1-\rho$) of the labor force. Both men and women are perfect substitutes in production in both occupations and receive the same wage in GHC, and the same wage for any given tenure in FSHC. The only difference between the sexes is an expected tenure $\tau = 1$ in both occupations for men, and a shorter expected tenure $\tau = \gamma$ ($\gamma<1$) for women. A complete model would specify productivity functions for successive spells of labor-force participation by women, allowing for the depreciation of skills between spells. To simplify the exposition, we assume that women experience a single spell of participation for the period γ and then leave the labor force for the remaining period $1-\gamma$. This abstraction does not alter the qualitative results if future spells of participation provide the same choices as the first spell. In particular, we implicitly assume that women cannot retain their accumulated skills and seniority in FSHC. Instead, skills depreciate with sufficient rapidity for firms to treat a female labor-force re-entrant as identical to any other job applicant, even if she has previous experience with the firm. This is quite realistic for the straightforward reason that the woman's previous job slot will have been occupied in the interim by a new employee who will have acquired her former skills, and in many cases the woman will have to take a job in a new firm. GHC skills do not depreciate, however. If upon re-entry females can resume their previous GHC job without repeating the initial investment in skill accumulation (I_0), then the following one-spell analysis understates the attraction for women of the GHC occupation.

Figure 4(a) contrasts the flat relationship between the wage rate (productivity) and tenure in GHC with the positively sloped $\theta(\tau,\rho)$ schedule in FSHC for an assumed value of $\rho = 1$. The present value of future wage income available to men in GHC is:

$$(20) \qquad \eta_m = \eta(I_0,1,\rho,r) = -I_0 + \int_{\tau=0}^{1} W_0(1-\rho)e^{-r\tau}d\tau.$$

For women GHC offers:

$$(21) \qquad \eta_w = \eta(I_0,\gamma,\rho,r) = -I_0 + \int_{\tau=0}^{\gamma} W_0(1-\rho)e^{-r\tau}d\tau.$$

The present value of the marginal product of men in FSHC is:

$$(22) \qquad \lambda_m = \lambda(\theta,1,\rho,r) = \int_{\tau=0}^{1} \theta(\tau,\rho)e^{-r\tau}d\tau.$$

As we shall see, there is nothing to keep λ_m from exceeding the return to the alternative occupation η_m once males are completely concentrated in FSHC. If so, the excess of λ_m over η_m is a rent which is divided between FSHC workers and firms in a proportion β and $(1-\beta)$, respectively. The value of β is indeterminate in the present model and is determined as the outcome of a process of bilateral bargaining. A more complex model can provide enough structure to allow a determinate solution for β. For instance, Mortensen (1976) analyzes a labor market in which firms face a distribution of native ability across present and prospective employees, and employees face a distribution of nonpecuniary job attractiveness across present and prospective employers. A high value of β gives firms the incentive to fire present employees and search for more able replacements, whereas the firm is deterred from pushing β too low in order to deter employees from quitting to search for a more attractive job.

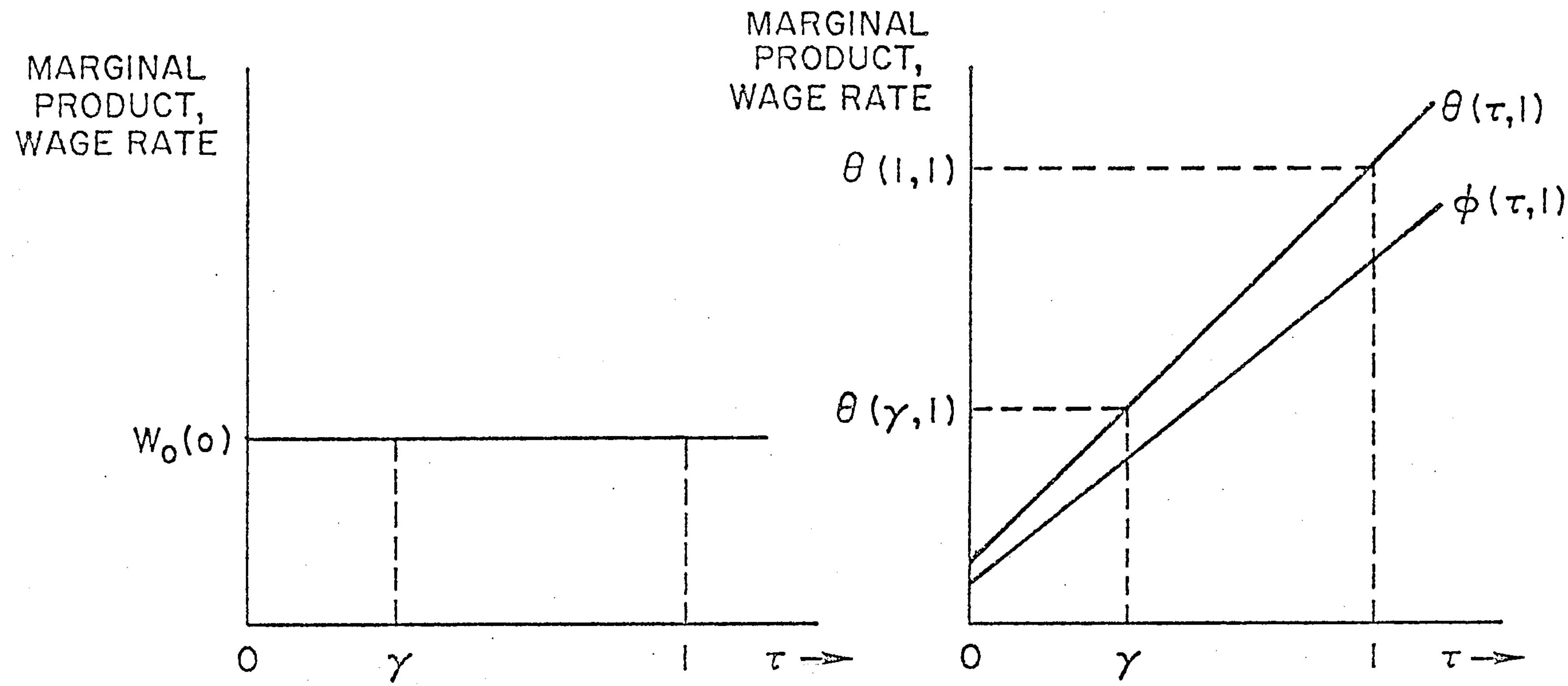
MARGINAL
PRODUCT,
WAGE RATE
$W_0(o)$
0
γ
1
τ
MARGINAL
PRODUCT,
WAGE RATE
$\theta(1,1)$
$\theta(\gamma,1)$
$\theta(\tau,1)$
$\phi(\tau,1)$
0
γ
1
τ

FIGURE 4(a)

In the present model we shall take β to be predetermined and fixed, since our basic conclusions are not sensitive to the particular process by which β is set.

The present value of FSHC wage income of men can be written:

$$(23) \qquad \mu_m = \mu(I_0,\theta,1,\rho,r,\beta) = \eta_m + \beta(\lambda_m - \eta_m) = \int_{\tau=0}^{1} \phi(\tau,\rho)e^{-r\tau}d\tau .$$

In (23) the present value (μ_m) depends on the determinants of the GHC wage, since this is the alternative occupation, and in addition on the determinants of productivity θ and on β, the surplus-dividing proportion. $\phi(\tau,\rho)$ is the wage schedule which satisfies (23) and is drawn as the lower line in the right frame of Figure 4(a).

If firms pay men and women the same wage for any level of tenure, then the wage available to women in FSHC is the value of (23) for the shorter tenure length γ:

$$(24) \qquad \mu_w = \mu(I_0,\theta,\gamma,\rho,r,\beta).$$

Equilibrium in the economy occurs when the present value of future wage income for women in the two occupations is equal:

$$(25) \qquad \eta(I_0,\gamma,\rho,r) = \mu(I_0,\theta,\gamma,\rho,r,\beta).$$

Figure 4(b) depicts a situation in which the economy is out of equilibrium when all workers are in the FSHC occupation. Women will shift out of FSHC into GHC, reducing ρ until (25) is satisfied at the equilibrium value ρ^*:

$$(26) \qquad \rho^* = \rho(I_0,\theta,\gamma,r,\beta)$$

Figure 4(b) is drawn for the special case where the GHC occupation is sufficiently unattractive to result in complete specialization of men

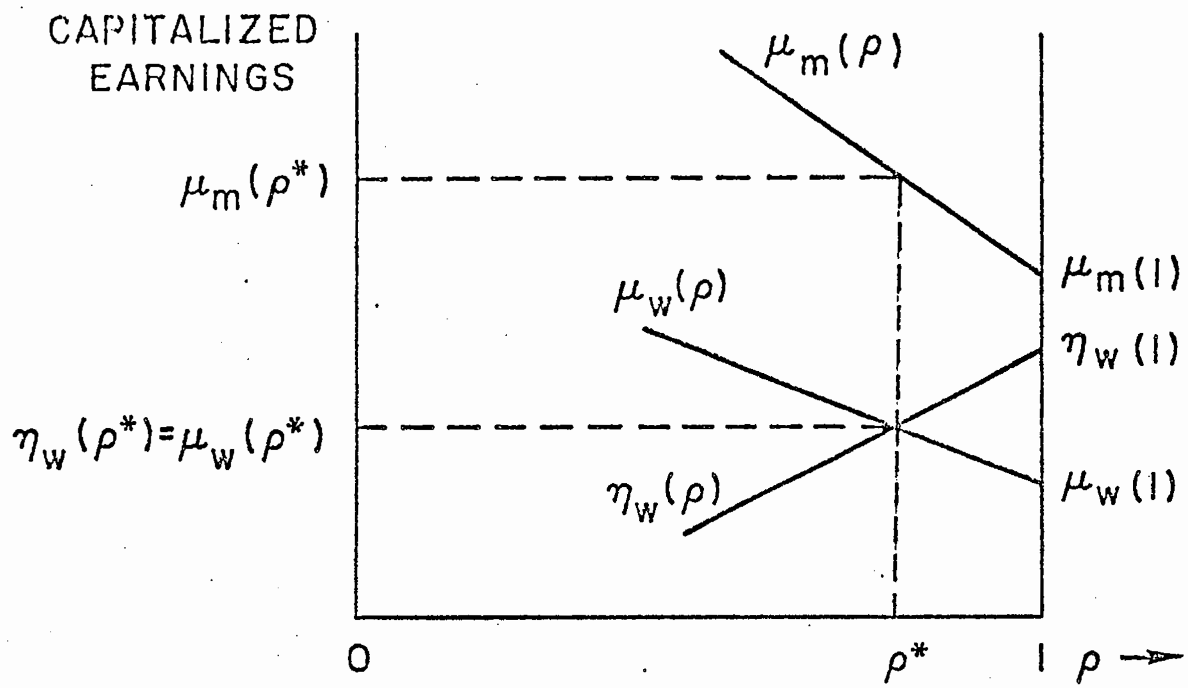
CAPITALIZED
EARNINGS
μm(ρ)
μm(ρ*)
μm(1)
μw(ρ)
ηw(1)
ηw(ρ*)=μw(ρ*)
ηw(ρ)
μw(1)
0
ρ*
1
ρ

FIGURE 4(b)

within FSHC. Because of longer tenure of men in GHC, the present value of their GHC wage in (20) is higher than η_w for women in (21), and so it is possible that male as well as female employment will be divided between the two occupations. The positive slope of the wage function in FSHC guarantees, however, that the share of female employees in GHC will always be greater than that of males.

In reality females are not all "crowded" into a single occupation. Instead there is a hierarchy of occupations into which females have been crowded and in which the overwhelming share of employees is female. Examples, in roughly ascending order of wage rates and GHC skill requirements, are household domestic workers, retail sales clerks, typists, secretaries, elementary school teachers, and registered nurses. All of these occupations share the common feature of general skills which can be transferred from firm to firm. The model would predict that females whose expected job tenure is relatively long, and who plan only short spells of non-participation, would be willing to make a greater initial investment (I_0) in skill acquisition. A full explanation of female occupational choice would have to take account as well of native intelligence and schooling attainment, since individuals lacking minimum requirements cannot voluntarily choose to train for the better female occupations, even if they plan on permanent labor force attachment.

Up to this point the model has no place for pure economic discrimination. Females in GHC occupations are paid their marginal products, and the excess of productivity over the wage in FSHC occupations results not from discrimination, but rather is a rent which firms earn on the specific human capital of all employees, both men and women.

But an amalgamation of the model with Phelpsian (1972) "statistical discrimination" is more realistic. If there are positive costs to turnover, firms may calculate that women with low expected tenure should not be hired for the FSHC occupation. They may thereby overlook the minority of women who participate without any interruption in tenure, screening them out simply because its too expensive to try to predict tenure in advance. These high tenure-women are then the victims of pure economic discrimination, rejected from the job window simply because their final identity labels them with the low expected tenure of the majority of women.

7. Evidence on the Sources of the Male-Female Wage Differential

A study of the association between female earnings and on-the-job experience has recently been completed by Mincer and Polachek (1974). They test a human capital model in which current earnings (W_t) depend on the earnings of "brute-force" labor with no education or experience (W_0), years of schooling (s), and the duration of i separate segments of experience (e_i):

$$\text{(27)} \qquad \ln W_t = \ln W_0 + rs + \sum_i (rk_i^* - \delta_i)e_i,$$

where k_i is the ratio of on-the-job investment expenditures to gross earnings during the ith segment, r is the rate of return, and δ_i is the rate of depreciation. During periods of work experience investment is relatively high compared to depreciation, and earnings tend to grow. Current earnings are reduced, however, by spells of nonparticipation in the labor force, when net investment is negative.

Although Mincer and Polachek cannot identify the separate contributions of investment and depreciation for spells of work experience, they estimate the depreciation rate during spells of nonparticipation (when k_i^* is assumed zero) to be about 1.5 percent per year for married women.[20] Table 6 illustrates the net contribution of experience to the white male-female "wage gap" for the age group 30-44, which was 34.3 percent of male wages in 1966 for white married women and 14.2 percent for white single women. Both female groups had less work experience than the males, only about half as much in the case of married women. Line 4 indicates the wage rates which women would have earned if their shortfall in experience is evaluated by the male coefficient on experience in the estimated version of (27). The wage gap for both groups is reduced to around 10 percent of male earnings, which can be considered an upper limit on the extent of "direct" discrimination (paying different wages to individuals with identical endowments). To the extent that the remaining 10 percent gap is caused by other objective determinants of productivity omitted from the equation, the extent of direct discrimination may be smaller.

The extent of direct discrimination is larger in the Mincer-Polachek sample when the net contribution of experience is estimated from the female coefficients on experience. This occurs as a result of the relatively flat age-earnings profiles for women, as illustrated in Figure 3 above. The choice between the male and female coefficients on experience for the calculation of the extent of discrimination depends on the underlying causes of the relatively flat female profile. Bergmann's approach treats the lower female experience coefficients as entirely caused by discrimination which takes the form of occupational crowding into occupations which provide little reward for experience. An alternative interpretation is provided by our model; a substantial number of women prefer to work in GHC occupations which do not provide a markedly higher wage for

TABLE 6

Contribution of Job Experience
to the Wage Differential Between
Men and Women, Age 30-44

(Data: 1966 Survey of Economic Opportunity)

	White Married Males	White Married Females	White Unmarried Females
1. Average Hourly Wage Rate	$3.18	$2.09	$2.73
2. Line (1), percent of males	1.000	0.657	0.858
3. Years of Job Experience Since Completion of School	19.4	9.6	15.6
4. Wage Rate Calculated with Male Years of Job Experience and Male Coefficients on Experience	$3.18	$2.85	$2.91
5. Line (4), percent of males	1.000	0.896	0.915

Source: Computed from Mincer and Polachek (1974, pp. 590-593).

more experienced workers. The small male-female earnings differential of unmarried white females in Table 6 supports the second interpretation, and suggests that the low return to experience of married females is caused by their own rational choice, and rational choices by firms, in response to their low expected job tenure, and is not caused by discrimination against <u>all</u> females.

In a study of the same data used in the Mincer-Polachek paper, Oaxaca (1973) arrives at a completely different conclusion, that 78 percent of the raw male-female wage differential is caused by direct discrimination, as compared to the 29 percent finding by Mincer-Polachek. The conflict between the cross-section wage equations of the respective studies appears to center on their divergent estimates of the effect of experience on male earnings. Only 2.1 percent of the raw differential is due to differences in the experience of males and females in the white subsample when calculated with the white male experience coefficients in the Oaxaca paper (1973, Table 4, p. 144), as opposed to about 70 percent in the Mincer-Polachek study. The discrepancy appears to be explained by a simple mistake made by Oaxaca. Lacking the separate "spells of experience" variables used by Mincer-Polachek, Oaxaca estimates the effect of experience by two variables, (1) age minus school years and (2) number of children. But in calculating the difference in experience to be multiplied by the male weights, Oaxaca takes account only of (1), i.e., he essentially measures differences in age rather than in experience, and he neglects to compute the gap between male and female levels of experience attributable to years spent raising children. I speculate that a proper recalculation of direct discrimination from the

Oaxaca regressions would yield results similar to those of Mincer-Polachek.

Other cross-section studies are less systematic than the two just cited. Cohen (1971) reaches a finding of no direct discrimination in a sample of 900 individuals questioned in 1969 by the Michigan Survey Research Center, in the sense that there were no significant wage differences "between men and women with the same job." About half of the raw earnings differential was explained by differences in personal characteristics, the remaining half by "the presence of women in lower-paying occupations for whatever causes: less on-the-job training than men, the lesser choice of women as to geographic area of job, greater desire of women for specific hours, and more physical dangers or unhealthy conditions in the male jobs" (Cohen, 1971, p. 446). One notes that all of the reasons for occupational crowding cited by Cohen refer to male-female differences in productivity. Similarly Sanborn concludes that "within a wide range of occupations, market discrimination against women, if it exists at all, is under 10 percent" (Sanborn, 1964, p. 546). Unlike Cohen, Sanborn provides no explanation of the occupational distribution of women; in our model the occupational distribution of women results from low expected tenure and reflects social rather than economic discrimination.

Malkiel and Malkiel (1973) study data for a group of professionals (employees of the Educational Testing Service). The unadjusted wage rate of females is 66.3 percent of males, almost the same as the relative wage rate of married females in the Mincer-Polachek sample in Table 6. The regression coefficients from equations explaining earnings are used to calculate the wages of women on the condition that their endowments of schooling, experience, and other characteristics were equal to those of men. There is an "area of study" variable, roughly equivalent to a control for occupation.

The conclusion is that the relative wage rates of women would have risen from 66.3 percent to 88.8 percent if they had been endowed with the same characteristics as males, leaving a difference of 11.2 percent as attributable to pure discrimination. This is similar to the Mincer-Polachek estimate of 10.4 percent for pure discrimination for the married women in their more comprehensive sample.

Other studies of individual occupations are mainly limited to teachers (a comment on the ethnocentricity of academic research). In a sample of public school teachers taken from the 1965 Coleman Report, Antos and Rosen (1974) find a relatively small gross differential between men and women of only 13 percent, unsurprising since this is an occupation into which women are "crowded". Careful adjustment for a very extensive set of teacher and student characteristics accounts for about 60 percent of the gross differential, reducing the coefficient of direct discrimination to about 5 percent. Gordon, Morton, and Braden (1974) find a discrimination factor of 9.5 percent for the faculty of a single unidentified university, but one of the right-hand regression variables is faculty rank. The authors do not rule out the possibility of additional discrimination in the promotion of faculty, which would raise the discrimination estimate, although in the context of our model the failure of women to reach the higher faculty ranks could by and large reflect their weaker level of labor-force attachment. Finally, Johnson and Stafford (1974) estimate an average "salary disadvantage" for women faculty members in a 1970 NSF sample as only 6.9 percent, based on the female relative wage of of newly hired inexperienced faculty. Their study raises the same question as that of Gordon, Morton, and Braden--does the decline in the female/male wage ratio with experience occur because discrimination increases with experience, or because women fail to stay in the labor force regularly enough to accumulate experience. The latter interpretation is consistent with our model and with most of the evidence we have been surveying.

8. Conclusion

Most of the evidence in the previous section is consistent with the conclusion that pure economic discrimination against women reduces the female wage about 10 percent below the male wage. The rest of the female-male wage differential is due to numerous factors, but most particularly to the low return to added years of experience for females. The overriding fact limiting females to a flat experience-earnings profile is the expectation by employers, correct for most females but incorrect for a substantial and growing minority, that females will have a shorter job tenure than a man of the same age hired at the same time, as well as the realistic expectation by female employees that they are not likely to hold FSHC-type jobs long enough to acquire as much on-the-job training as men. Females choose jobs which require general training and may give a higher wage early in the job tenure, and firms prefer to hire and promote males in FSHC-type occupations if there are positive costs of turnover. Our simple model emphasized the possibility of "voluntary occupational crowding" by females making their own optimal choices and abstracted from the costs of turnover. A more complex model including the costs of turnover would lead firms to behave in a manner frequently observed in the real world, refusing female applications from the beginning, and refusing to promote existing female employees.

The estimate that "pure economic discrimination" amounts to "only" 10 percent of the male wage leaves the majority of the male-female wage differential to be explained by lower female productivity, due primarily to the economic consequences of shorter job tenure. This conclusion does not mean that women have not been the victims of discrimination but merely shifts the majority of the blame from economic to social discrimination which is responsible for the weak attachment of women to the labor force. Among the social factors which limit female economic opportunity are the absence of government-subsidized maternity leaves and child care for small children, and the inability or unwillingness of most wives to convince their husbands to contribute half of the time input required to raise children.

Table 7 completes the process of calculating the components of equation (16) above, the total effect on the consumption of "final commodities" of the 1956-74 structural shift in unemployment. The top portion of the Table inserts the results of sections 5 and 7 above. In line 1a the relative female marginal product is taken to be the ratio of the female to the male wage, plus 10 percent for pure economic discrimination. The productivity of teenagers is arbitrarily set equal to their wage, in the absence of any evidence of pure economic discrimination against teenagers. Lines 1b and 1c reflect the conclusions of section 5 above, that the value of extra search time of teenagers is zero, and that the value of extra search time by adult women is equal to the value of their home time.

The bottom portion of Table 7 provides the estimates of the separate

TABLE 7

Values Attached to Changes
in Employed, Unemployed, and Home
Time Caused by the
1956-74 Structural Shift in Unemployment

	Males and Females 16-24	Adult Females 25+
1. Fraction of Wage of Males 35-44		
a. Q_{M_i} (Marginal Product of Work)	$W_i/W_1 = .433$	$.10 + W_i/W_1 = .667$
b. W_{U_i} (Value of Search Time)	0	$0.5(W_i/W_1) = .284$
c. W_{N_i} (Value of Home Time)	$0.5(W_i/W_1) = .217$	$0.5(W_i/W_1) = .284$
2. Value of Shifts ($ Billion) Due to:		
a. Change in Participation		
i. Movement into Work	3.253	17.736
ii. Movement into Unemployment	-0.112	0.000
b. Change in Relative Unemployment Rates		
i. Loss of Work	-1.597	-0.714
ii. Increased Unemployment	-0.367	0.000
c. Total of 2a and 2b	1.177	17.022

Table 7, Sources:

1. W_i/W_1 is based on the ratios of group full-time earnings to those of males 35-44, from Figure 3 above, which is based on the Current Population Survey, Series P-60.

2. The dollar values are calculated by multiplying the values of Q_{M_i}, W_{U_i}, and W_{N_i} from the top of this Table by the appropriate changes in manhours, from Table 4 above, according to equation (16) in the text. The value of W_1 is taken to be \$6.00, the annual earnings of 35-44 aged males in 1974 divided by 2000 annual hours.

components of equation (16). The results are dominated by the large positive contributions of the movement of both young women and adult women from the home into employment. Society gains because the tax system and pure economic discrimination both insert a "wedge" between the productivity of women and the value of their home time. The basic underlying assumption is that women found it possible to enter the labor force as the result of improved contraceptive technology and of the time released by the presence of modern consumer durables. If women previously spent their workhours in "involuntary household captivity," taking care of children they did not want and performing household chores now made unnecessary by better appliances, we may have grossly understated the benefits of the structural shift. Instead of our procedure in Table 7 of valuing female released home time at the margin, as equal to the net-of-tax acceptance wage, a case can be made for valuing the home time at zero, or even a negative number if the household drudgery was sufficiently "more unpleasant" than work activity.

Line 2b of Table 7 measures the social cost (negative benefits) of the higher relative unemployment rates of young people and adult females. Partly because an unemployed teenager works fewer hours than an adult male, and partly because home time can still be enjoyed while 5-10 hours per week are devoted to search, the overall social cost of the higher relative unemployment rates is amazingly small. The total of line 2b for both groups is only $2.8 billion, or 0.2 percent of GNP. Thus the welfare cost of the structural shift in unemployment between 1956 and 1974 is not 4.5 percent of GNP, as a crude Okun's Law calculation would conclude, but rather is only a tiny fraction of that amount, even if the benefits of the increased female participation rate are ignored. The total impact of the structural shift, netting out the cost of the increased relative unemployment rates against the benefits of increasing participation, comes to $18.2 billion, or 1.4 percent of GNP, in improved welfare.

We conclude that if policymakers were satisfied with a 4.1 percent unemployment rate in 1956, they should be even more satisfied with a 5.6 percent unemployment as of 1974. This does not mean, however, that there is no case for considering government action to try to narrow the differential of unemployment rates between the secondary groups and prime-age adult males. The analysis of this paper provides an estimate that the increase in relative unemployment rates taken by itself, without counting the effects of higher female participation, has cost society at least $2.8 billion, without taking into account any costs of increased crime caused by unemployed youth. This measure of the benefits of reducing relative unemployment rates to 1956 levels should be set against the costs of proposed programs. If our analysis of section 5 is to be believed, however, the unemployment rates of teenagers and males aged 20-24 could be reduced to 1956 levels if the teenage minimum wage were set at a level equal to 54 percent of its 1974 value (see Table 5 above).

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FOOTNOTES

1. Applying Okun's Law that a 1.5 percentage point increase in the unemployment rate is associated with a 4.5 percent drop in output, the economy's "natural output rate" lies 4.5 percent below the official "potential output" series. The growth rate of "natural output" between 1955 and 1974 is only 3.49 percent per annum, compared to the 3.74 percent annual growth rate of potential output. Similarly, the government's "natural employment surplus" is about $20 billion below the "full employment surplus" and was in deficit continuously throughout the 1970-76 period.

2. Since the earlier paper was written, James Tobin has pointed out to me my omission of the future welfare loss resulting from the reduction in capital investment which occurs during a temporary recession.

3. In fact, the 1956-74 increase in the unemployment rate of women aged 20-24 (51 percent) exceeded the increase for women aged 16-17 (35 percent). For men the increase in the 20-24 group (26 percent) was almost identical to that in the 18-19 group (27 percent). The labor force shares of both men and women aged 20-24 increased more between 1956 and 1974 (41 and 74 percent , respectively) than the shares of men and women aged 16-17 (36 and 64 percent).

4. An important and totally unexpected conclusion, but one with implications outside the scope of this paper, is that wage changes during 1972-75 are far better explained by an expected inflation concept which <u>includes</u> food and energy prices than by one which excludes them. This implies, in the context of Gordon (1975a), that an attempt by the Federal Reserve to "accomodate" the supply shocks of 1973-74 would have made the inflation substantially worse.

5. This treatment of capital is the same as in the case of a permanent shift in aggregate unemployment caused by a change in aggregate demand.

6. The P_Q and P_Z terms can be ignored, since these price indexes can be arbitrarily set equal to 1.0 for the year in question.

7. $du_i^* = u_1 d(u_i/u_1)$, the same term as that used in equation (3) and Table 2 to compute the decomposition of the 1956-74 structural shift.

8. The device of two supply curves, with the supply of unemployment as the distance between them, was introduced by Hall (1975, p. 322).

9. See the expression for the marginal revenue from additional job search in Gordon (1973, p. 179, equation A-2). Since the shadow price of home time (W_N) appears only as a component of marginal revenue, and not as a component of marginal cost, a reduction in the market wage relative to W_N will raise marginal revenue relative to marginal cost, and thus extend the duration of job search. If this approach predicts correctly, a labor force group with an increasing share of supply should experience a higher duration of unemployment.

10. A single exception to the statement is males 20-24, who experienced a minor increase in duration from 4.6 to 4.8 weeks. The statement also refers to the groups defined by Perry's aggregated age definitions (duration decreased for males 16-19 and females 16-19, 20-24, 25-44, and 45-64).

11. Averages for the years 1968 through 1971, from Perry (1972, Table 6, p. 272).

12. Perry (1972, pp. 270-1).

13. See especially Goldfarb (1974) and Welch (1974).

14. The basic minimum wage remained at $1.60 between February 1968 and May 1974 and fell substantially over the interval as a share of average hourly earnings from an average of 55.6 percent in 1968 to 44.8 percent in the year 1974. Two partially offsetting actors were an increase in coverage in 1974 and a smaller rate of increase of average teenage earnings.

14. Cont. Gramlich (1976) estimates that coverage for teenagers (C_T) increased from 46.1 percent in 1973 (assumed equal to 1968) to 57.6 percent in 1975, or a 52.8 percent average rate for 1974 (when coverage changed on May 1). Multiplying by the ratio of the basic minimum wage to average hourly earnings (MW/AHE), we have:

1968	1974
$\frac{C_T MW}{AHE} = .256$	$\frac{C_T MW}{AHE} = .236,$

or a decline of 7.5 percent. The same factor was applied to males 20-24.

15. Gramlich's equations suffer from several trend-related misspecifications. He uses the ratio of MW to a price deflator, not MW/AHE, and his left-hand variable is total employment (E_i), not the ratio (E_i/P_i).

16. See Gordon (1973, p. 158, footnote 40). The combined deduction for taxes and commuting costs of 37.7 percent is derived in footnote 33 of that paper. The deduction for search costs is a further 19.4 percent of the net wage, based on an estimate of the ratio of the acceptance wage to the previous wage for adult women cited in footnote 40 of that paper.

17. This differs from the analysis of Arrow (1973, pp.7-13) and Freeman (1973, pp.92-6), where the discrimination coefficient is <u>absolute</u>, an assumption which implies that the <u>relative</u> discrimination coefficient will automatically be reduced toward zero by the process of real economic growth.

18. Freeman (1973) points out that discriminatory wage differentials can be maintained only if (a) there are no nondiscriminating firms, (b) u-shaped cost curves set a limit on the expansion of nondiscriminating firms, or (c) external costs (e.g., social pressure) prevent non-discriminatory behavior.

19. Bergmann (1974, footnote 6).

20. In the context of our model, this is the weighted average of the high depreciation rates in FSHC occupations and the low depreciation rates in GHC occupations.