Male–Female Lifetime Earnings Differentials and Labor Force History

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1. INTRODUCTION

Sweden has an international reputation for relatively high standards of equity between the sexes. This reputation is justified formally by our family legislation. But is it justified as well by achieved smaller earnings differentials? This paper analyzes the effects of work experience and other human capital variables on earnings for men and women. Using these results, sex earnings differentials are calculated. Comparisons are then made between the results for Sweden and results from earlier studies for the U.S.

The human capital approach to income determination has been implemented by means of an earnings function which was developed by Jacob Mincer (1974). Studies on sex differentials in earnings using this approach are, e.g., Oaxaca (1973), and Malkiel and Malkiel (1973) and for Swedish data Gustafsson (1976). The earnings function was developed for the case of an interrupted career in Mincer and Polachek (1974) and has already been applied to different sets of data with information on work histories. (See Sandell and Shapiro, 1978; Mincer and Polachek, 1978; Corcoran and Duncan, 1979; and Mincer and Ofek, 1980.)

2. EFFECTS OF LABOR FORCE INTERRUPTIONS ON FUTURE EARNINGS

Schooling and on the job training may be seen as productive investments in human capital that increase the earnings capacity of the individual. The general form of the lifetime earnings profile for a continuous work history may be approximated by the well known log-linear earnings function developed by Mincer (1974):

$$\ln(y) = \beta_0 + \beta_1 S + \beta_2 e + \beta_3 e^2 \quad (1)$$

where the logarithm of earnings (y) is regressed on schooling (s), experience (e) and a squared experience term (e^2).

Not all individuals work continuously in the labor market but some drop out for various reasons, e.g., unemployment, health or child care.

There are three reasons why we may expect lower earnings if the individual experiences labor force interruptions. First, the opportunity to make post-school investments in earnings capacity by on-the-job-training is sacrificed. Second, there may be depreciation of human capital due to nonuse because a person may forget what was once learned or because the accumulated human capital becomes obsolete. Third, expectations of lower labor force participation imply fewer periods in which to collect returns. This may lead to low investment in the preinterruption period.

The work history of the individual is segmented into periods of market activity e_j and periods of non-market activity h_i:

$$h_1 + e_1 + h_2 + e_2 ... + h_K + e_\ell = \sum_{i=1}^{K} h_i + \sum_{j=1}^{\ell} e_j \qquad (2)$$

if there are K periods of home time and ℓ periods of labor force experience.

A major determinant of the size of investment in any particular period is the potential number of years of working life in the future. If individuals who work continuously and individuals who made labor force interruptions have an equal number of years of potential remaining working life until retirement there is a reason to believe that the earnings profiles in the last continuous period of work experience before retirement should be parallel.[1] As will be shown empirically later this may be achieved by letting the slope of the earnings function depend on age and combining (1) and (2):

$$\ln(y) = \alpha+\beta s+ \sum_{i=1}^{K} \gamma_i h_i + \sum_{j=1}^{\ell} \delta_j e_j+\varepsilon_1 a+\varepsilon_2 a^2 \qquad (3)$$

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[1] In Mincer and Ofek (1980) one hypothesis which may lead to more rapidly increasing earnings for returning individuals is that the human capital that was depreciated or became obsolete can be fairly easily repaired to restore its previous value.

3. DATA AND VARIABLE DEFINITIONS

The data consist of a one in ten random sample of white-collar workers in the private sector of Sweden. The sample includes 32,287 individuals of whom 23,366 are men and 8,921 women.

The set of data was arranged by matching salary statistics of 1974 on an individual basis with a one in ten random sample of pension funds data for the Swedish population. The pension funds data make a time series of pension points "ATP" for every year from 1960-74 (see Eriksen, 1973). The salary statistics are collected jointly by the Swedish Employers' Confederation (SAF) and the employee organizations in the private sector. Most white-collar workers in the Swedish private sector, industry, retail trade and services are covered by this set of data.

For each individual there is the time series of pension points "ATP" and cross sectional data for 1974 of monthly salary, education, hours of work per week, occupation, industry branch, size of the company and geographical location[1].

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[1] Occupation is recorded according to the "Position Classification System for Salaried Employees", worked out in cooperation by the Employer and Employee organizations. The classification system is a 4-digit system where the first 3 digits give an occupation. The first 3 digits thus give the horizontal dimension distinguishing about 60 occupations. By the first digit occupations are grouped together in ten occupational fields. The 4th digit contains a vertical classification of jobs into job levels of 7 different degrees of difficulty.

Education is given by a 3-digit code, the Swedish Educational Nomenclature (SUN). Although the SAF

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Work histories have been calculated from the time series of ATP scores.[1] In the pension funds data ATP points are calculated from annual earnings of the individual and the "base amount" according to the formula:

$$ATP = \frac{y - b}{b} \qquad (4)$$

where y = annual earned income

b = "base amount".

An individual is defined to be a labor force participant if:

ATP > 0

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cont.

types of education shorter than 11 years the code comprises 200 different values in this set of data. Education has been coded 000 in most cases where employees have compulsory schooling because SAF has not bothered to collect educational information according to the SUN code on these people.

[1] ATP means **A**llmänna **T**illäggs**p**ensioneringen. The scores of ATP-points are given by three digits in the data. The ATP are real incomes because they are deflated by the base amount (b) which is altered discretionarily by Swedish authorities to take account of price increases. The base amount is used not only for calculating the basis on which old age pensions are paid but also for the current income taxation and in the determination of minimum standards for welfare. The ATP are truncated from above at 6.50 since incomes higher than 7.5 times the base amount do not increase pensions further above this level. It is also clear by the definition of an ATP-point that it is truncated from below. The base amount, one b, in August 1974 was 8 500 Skr.

This definition of labor force participation is dependent on earnings, which means that a labor force interruption must be a whole year in order to be observed. One advantage of these data is that they are recorded rather than calculated retrospectively.

Years in which the individual is a labor force participant according to definition (5) are defined as years of experience (e). Years in which the individual is not a labor force participant can be either years of schooling (s) or years of home time (h).

Years of schooling are separated from years of experience by making use of two identities and information on type of education completed and age.[1]

The following identities are valid:

$$g + e + h \equiv a$$

and (5)

$$s \equiv g - 7,$$

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[1] The third digit in the Swedish Educational Nomenclature (SUN) gives number of years of schooling required to complete the education. This is given in seven steps which have been aggregated to compulsory schooling (1-2), secondary schooling (3-4) and university graduates (5-7). The quality of the educational coding in the salary statistics does not really admit distinguishing all the different steps. This is particularly true of the shorter educations. A majority of those not having a longer education are coded 0 instead of 1 or 2.

where g = age at graduation from school, e = number of years of experience, h = years of schooling.

We have assumed that:[1]:

g = 16 for compulsory schooling
g ≤ 19 for secondary schooling (6)
g ≤ 25 for university schooling

If a person is young enough to have finished school not more than 15 years ago there is full knowledge of the labor force experience and nonexperience per year since the end of schooling. For older women we focus on the effects of the last 15 years of actual experience on earnings.

The time series of ATP makes possible the calculation not only of years of home time (h), but also of the individual movements into and out of the labor force during the 15 year period. A year (i) of labor force entrance occurs if:

$$ATP_{i-1} = 0 \text{ and } ATP_i > 0 \qquad (7)$$

and a year (j) of labor force exit occurs if:

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[1] The weak inequalities have been chosen in order to avoid counting as a year of schooling if it is actually known by the data that a person has been working. This may be observed for young persons who finished school not more than 15 years ago.

An earlier attempt to put g = 24 for young female university graduates resulted in a number of negative observations on h. Allowing g to vary resulted in a variation of s from a minimum of 9 years to a maximum of 18 years and a mean of 15.3 years for the young female university graduates.

$$ATP_{j-1} > 0 \text{ and } ATP_j = 0 \quad (8)$$

By computing the years of entrance by (7) and the years of exits from the labor force by (8) it is possible to calculate the number of years spent in and out of the labor force in different segments.[1] The first segment of home time (h_1) is calculated in the following way:

$$h_1 = i_1 - b - g \quad (9)$$

where i_1 = the year of the first entrance into the labor market

b = the year of birth of the individual

g = age of graduation.

If the person is old enough to have graduated more than 15 years ago h_1 is a truncated variable and is calculated:

$$h_1 = i_1 - 1960 + 1 \quad (10)$$

where i_1 = the calendar year (i) of the first labor force entrance in the observed period.

Because individuals in the sample are labor force participants in 1974 the last continuous period of labor force participation e_ℓ is calculated:

$$e_\ell = 1974 - i_\ell + 1 \quad (11)$$

where i_ℓ is the calendar year of the last intrance. For the individuals who made no labor force interruption:

$$i_1 = i_\ell \text{ and } e_1 = e_\ell. \quad (12)$$

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[1] Since there are 15 years, the maximum number of entrances and exits if the person works every second year are seven of each. Most of the individuals have much smaller mobility into and out of the labor force. Only 2 individuals had left the labor market for a fourth time and only one had left the labor market for a fifth time and entered again.

4. WORK HISTORIES OF SWEDISH WOMEN

Out of the 6,745 fulltime working women in the sample more than one fourth were in the labor force in 1960 and stayed in all the following 15 years without any labor force interruption. If all women are distributed according to the number of labor force interruptions they made during the 15 years period we find that 5,278 made no interruptions, 1,221 made one labor force interruption of varying length, 221 women made 2 labor force interruptions and 22 women made 3 labor force interruptions. Twenty-two per cent of the women made one or more labor force interruptions and the average number of years out of the labor market was 2.34. Half of those who made a labor force interruption were out only one year and only one fifth were out more than three years.

In Table 1 work histories are given. The largest proportions of total experience of the Swedish women occurs in the last period of uninterrupted labor force experience. The women spent 9.5 years in the labor market and 8.9 of these were spent in the last period. Years out of the labor market were most common in the form of delayed entrances rather than labor force interruptions.

Comparisons with work histories for American women are difficult because American studies do not cover the same period, have different definitions of labor force interruptions and are not restricted to private sector white collar workers. But some crude comparisons are possible.

There are two sources of American data to compare with. The Michigan panel data used by Corcoran and

Table 1. Work history 1960-74. Full time female workers in private sector of Sweden in 1974. Means of variables.

	n	h_1	e_1	h_2	e_{2+}	h_{3+}	e_ℓ	h	e
Age 16-64									
All educations	6745	1.83	0.55	0.44	0.07	0.07	8.89	2.34	9.51
Compulsory education	5110	1.94	0.57	0.44	0.07	0.07	9.22	2.45	9.86
Secondary education	1432	1.55	0.47	0.41	0.07	0.06	8.11	2.02	8.65
University education	203	1.06	0.61	0.57	0.05	0.04	6.12	1.67	6.78
Age									
16-19	321	1.56	0.00	0.00	0.00	0.00	1.69	1.56	1.69
20-24	1393	2.04	0.14	0.10	0.01	0.01	4.20	2.15	4.35
25-29	1422	2.17	0.60	0.51	0.07	0.06	7.48	2.74	8.15
30-34	854	2.45	1.24	0.94	0.19	0.18	10.19	3.57	11.62
35-39	548	1.58	0.91	0.99	0.19	0.17	11.18	2.74	12.28
40-44	600	1.99	0.58	0.57	0.08	0.10	11.68	2.66	12.34
45-49	555	1.48	0.55	0.26	0.06	0.05	12.59	1.79	13.20
50-54	546	1.05	0.38	0.25	0.04	0.06	13.22	1.36	13.64
55-59	354	0.60	0.29	0.19	0.01	0.00	13.87	0.79	14.17
60-	116	0.75	0.43	0.16	0.02	0.03	13.61	0.94	14.06

Definitions of variables:

n = number of observations,

h_1 = years of delayed entrance to the labor market after schooling,

e_1 = years of first labor force experience,

h_2 = years of hometime in the first labor force interruption,

e_{2+} = years of labor force experience between labor force interruptions,

h_{3+} = years of labor force interruption (hometime) for the second or subsequent time,

r years of labor force experience in the last continuous period up to e_ℓ 1974.

Duncan (1979) show that white American women who were working in 1975 had spent 5.8 years out of the labor force since finishing school and 10.4 years in the labor force, or 36% of the total period in non-market activities. Swedish women according to Table 1 spent 20% out of the labor force but then the labor force histories of older women are truncated.

Mincer and Polachek (1974), provide work histories from the NLS of women 30-44 years old broken down by three educational groups and by five years age intervals. By this comparison American women of the same age and approximately the same length of education seem to have spent more years out of the labor force than the Swedish women. American women with less than 12 years of education have spent more than half of the available number of years since leaving school out of the labor market. The proportion of years spent out of the labor force decreases with length of education but is still .4 for university graduates. Note that this is higher than .2 reported for Swedish women 30-34 years of age.

Differences in definition may be one reason for the small amount of time spent out of the labor force by Swedish women. Maternity leave with sick security payment for most of the covered period is six months.

Half a year of market earnings is enough to earn a positive ATP and to be considered a labor force participant for the year. However, the impression that Swedish women spend less time out of the labor force than American women is consistent with the fact that female labor force participation in Sweden is higher than in the U.S. (Gustafsson, 1980).

The general impression of this comparison is that Swedish women work a larger proportion of the available number of years and are less inclined to make labor force interruptions and stay out for any extended period of time.

5. IS THERE DEPRECIATION FROM LABOR FORCE INTERRUPTIONS?

Mincer and Polachek (1974) found that for every additional year out of the labor force, wages diminished by 1.5 percent at return, i.e., a depreciation rate of -.015. Sandell and Shapiro argued that the rate of depreciation was overstated by Mincer and Polachek and that a more correct figure is -.005. Mincer and Polachek (1978) in their reply to Sandell and Shapiro claimed that the estimates of the two studies are not significantly different by standard statistical tests. Corcoran and Duncan (1979) report a depreciation rate for white women of -.005 which is statistically significant. None of the American studies have shown positive coefficients on home time.

In Table 2 estimates of earnings functions for Swedish women are reported. The most striking result is that the coefficient of home time is negative and significant only for the earnings function where women 30-44 years of age were subselected. In all other regressions the coefficient of home time is positive and significant implying

Table 2. Earnings functions for Swedish full time working women with different specifications of experience and for different age groups. Dependent variable: logarithm of monthly salaries.

	All aged 16-44		All aged 30-44	Young, labor force history fully known e = exp	Aged 16-64 with no labor force interruption h = 0
	(1)	(2)	(3)	(4)	(5)
Intercept	6.9191 (0.0152)	7.0155 (0.0150)	7.5412 (0.0578)	6.7780	6.9566 (0.0215)
s	0.0598 (0.0013)	0.0583 (0.0014)	0.0476 (0.0026)	0.0673 (0.0014)	0.0632 (0.0018)
h	0.0210 (0.0008)	0.0101 (0.0008)	-0.0106 (0.0020)	0.0315 (0.0012)	
e	0.0598 (0.0021)			0.0813 (0.0029)	
e^2	-0.0011 (0.0001)			-0.0025 (0.0002)	
exp		0.0398 (0.0007)	0.0081 (0.0041)		0.0443 (0.0009)
$(exp)^2$		-0.0006 (0.0000)	-0.0001 (0.0001)		-0.0007 (0.0000)
R^2	0.5786	0.5221	0.2519	0.6471	0.5644
n	6745	6745	2038	3656	3197

Note: The regressions are numbered so that reference can be made to them in the text. Numbers in parentheses are standard errors.

that reentering women have higher salaries than women with the same number of years of experience with continuous careers. In regression (1) only the last 15 years of experience are allowed to influence the results. In regression (2) women who finished school more than 15 years ago are assumed to have had an equal proportion of years out of the labor force in the unknown period as in the known period:

$$exp = (1 - \frac{h}{e+h})(a-g-1) \qquad (13)$$

Assumption (13) is also made for the subsample of women 30-44 in equation (3). For the young women whose labor force history is fully known the home time coefficient is likewise positive and significant.

The marginal effect of an additional year of schooling is about 5-6%. The estimates have t-values of close to 50 for schooling and experience. The schooling and experience variables explain a great deal of the variation in earnings, R^2:s are above 50% for the full sample, which is high for micro data.

The results may be explored further by segmenting the earnings function. Results for men and women according to the segmented earnings function controlling for age are given in Table 3. We consider the effects of only the last 15 years but it matters how old the individual is when the labor force interruption takes place. It also means that investment is affected by the remaining horizon since the slope of the earnings function is determined by age.

Table 3. Segmented labor force history.
Estimates for all men and all women.

	Women		Men	
	Regression estimate (6)	Mean of variable	Regression estimate (7)	Mean of variable
ln(y)		7.98		8.38
Intercept	6.6351* (0.0301)		6.5250* (0.0558)	
s	0.0534* (0.0014)	9.74	0.0657* (0.0010)	10.88
h_1	0.0129* (0.0012)	1.83	0.0179* (0.0022)	0.76
e_1	0.0189* (0.0019)	0.54	0.0229* (0.0029)	0.52
h_2	0.0107* (0.0021)	0.44	0.0107 (0.0038)	0.33
e_2	0.0080 (0.0054)	0.07	0.0195* (0.0084)	0.05
h_3	0.0178* (0.0059)	0.06	0.0107 (0.0119)	0.04
e_3	0.0211 (0.0331)	0.01	-0.0341 (0.0725)	0.00
h_{4+}	-0.0074 (0.0300)	0.00	0.0571 (0.0757)	0.00
e_ℓ	0.0299* (0.0013)	8.90	0.0376* (0.0018)	12.1
a	0.0274* (0.0023)	34.2	0.0300* (0.0035)	41.2
a^2	-0.0003 (0.0000)	1170	-0.0003 (0.0000)	1697
R^2	0.5853		0.5010	
n	6745		7048	

* Significant at the 5% level.

Not all the coefficients of this function are statistically significant probably because there are few observations of individuals who make several labor force interruptions. One of the results of Mincer and Polachek (1974) is that the coefficient of preinterruption experience periods is smaller than the coefficient of postinterruption experience periods. The interpretation is that individuals invest more in on-the-job-training during a period in which they expect their labor force participation to be continuous than is the case during a period which they expect to be terminated soon. The first experience period is about half a year on the average for men and women alike. The regression coefficient for this period (e_1) is significant. The regression coefficients for the last continuous period of work experience are highly significant for both men and women and show higher increases in earnings capacity during the last period than during the first experience period (e_ℓ is 8.9 years on the average for women and 12.1 years on the average for men). This result conforms to the Mincer and Polachek result.

Years of schooling would be more likely to be included in h_1 than in h_2-h_4. Table 3 shows, however, that the coefficients of all the home time segments are positive ruling out the possibility that fulltime investment activities explain the positive coefficients of hometime in Table 2.

Corcoran and Duncan (1979) ran segmented earnings functions for men and women and concluded that by segmenting the work history they get more similar regression coefficients across sex and race groups than are obtained when years of experience are measured as a single variable. In Table 3 the experience variables have very similar effects on earnings between the sexes.

In Table 4 earnings functions for separate educational groups are given. The segmented earnings function does not work for subsamples broken down by education because there are too few observations of people who had several entries and exits into the labor force. Instead traditional earnings functions are given. The coefficients of the experience variables are more similar between the sexes than is the case across the educational groups.

One result of Mincer and Polachek is that the depreciation of human capital increases with schooling. The coefficients of home time in Table 4 are positive but they show a decreasing pattern with length of schooling. Also the experience variables increase with length of education implying that there is a higher penalty to home time the higher education an individual has.

In all regressions the marginal effect of a year of experience is larger than the marginal effect of a year of home time. In regressions on Swedish earnings data the net effect on future earnings of a year of home time is positive rather than negative. This implies that investment during home time has taken place to such an extent as to exceed negative depreciation. Another explanation is that wages and salaries are to such a large extent determined by central negotiations that investments in skills do not entirely determine wages. (Gustafsson, 1976).

Table 4. Earnings functions for men and women of different educational groups

	Compulsory		Secondary		University	
	Women (8)	Men (9)	Women (10)	Men (11)	Women (12)	Men (13)
Intercept	7.5372	7.6947*	6.9596*	7.2358*	7.2237*	7.1510*
s	-	-	0.0600*	0.0434*	0.0386*	0.0514*
h	0.0129*	0.0219*	0.0028	0.0259*	-0.0185*	0.0150*
exp	0.0382*	0.0391*	0.0505*	0.0552*	0.0693*	0.0767*
$(exp)^2$	-0.0006*	-0.0006*	-0.0009*	-0.0009*	-0.0017*	-0.0016*
R^2	0.4947	0.1554	0.5591	0.4137	0.4191	0.5324
n	5 100	2 620	1 428	2 124	203	2 322
Means of variables:						
ln(y)	7.9500	8.2600	8.0537	8.4422	8.2175	8.6363
a	34	43	32	40	32	37
s	9	9	11.5	11.8	15.7	16.5
h	1.88	0.72	1.26	0.72	0.51	0.30
exp	17.3	27.3	13.1	21.3	9.3	13.7

* Significant at the 5% level.

$$exp = (1 - \frac{h}{e+h})(a-g-1)$$

where h = years of hometime

e = years of experience

a = age

g = age at graduation

6. PREDICTED LIFETIME EARNINGS FOR INDIVIDUALS WITH DIFFERENT LABOR FORCE HISTORIES

The fact that home time does not result in a net depreciation of human capital does not mean that it is costless to the individual to make labor force interruptions. There are costs of lost investment opportunities. In Table 5 predicted earnings at age 35 for women with secondary education are given, according to different specifications of the earnings function. All specifications show lower earnings after labor force interruptions than for continuous careers as predicted by theory.

In panel 1 predicted earnings for women with continuous careers are given. At age 35 earnings range between the logarithm of 8.21 and 8.37. When only the past 15 years of experience have an influence the estimated earnings are higher than when the older women are assumed to have worked in the market in the same proportion in the unknown period as in the known period.

In panel 2 earnings of women who made one labor force interruption of differing length 2, 5 or 10 years, are compared.

Only by the segmented earnings function of Table 3 it is possible to make the distinction between one or two spells of the same length. Five years of hometime in one spell reduces earnings less than five years in two spells (2+3 years), which is seen by comparing the third column of panels 2 and 3.

Table 5. Predicted log of salary at age 35 for a woman with secondary schooling (s=12)

Predicted from Tables 2-4. Equation No.	(1)	(2)	(6)	(10)
1. Continuous career	8.3354	8.2183	8.3757	8.2730
2. Interrupted career one spell				
Left at age 25 for:				
a) 2 years	8.3284	8.1973	8.2713	8.2352
b) 5 years	8.3009	8.1568	8.2137	8.1650
c) 10 years	8.2114	8.0653	8.1177	8.0120
3. Interrupted career two spells				
left at age 25 and 30 (2+3 years)	8.3009	8.1568	8.1693	8.1650
4. Marginal differential between a year of experience and a year of nonexperience				
a) $\partial \ln(y)/\partial e - \partial \ln(y)/\partial h_2$ at age 25	0.0256	0.0319	0.0192[a]	0.0397
b) $\partial \ln(y)/\partial e - \partial \ln(y)/\partial h_2$ at age 35	0.0224	0.0194	0.0192[a]	0.0199
5. Total differential between a continuous career and a career with 10 years of home time				
a) total differential	0.1240	0.1530	0.2580	0.2610
b) percent	11.7	14.2	22.8	23.0

[a] $\frac{\partial \ln(y)}{\partial e_\ell} - \frac{\partial \ln(y)}{\partial h_2}$.

The marginal differential between a year of experience and a year of nonexperience is calculated. In panel 4 the differential is constant according to equation (6) but varies over the life cycle according to the other equations because of the second order term of experience. From equation (6) foregone opportunity of investment in human capital results in an opportunity loss of about 2% per year (0.0192) for an individual chosing a year of hometime. In equation (10) the opportunity loss is almost 4% at age 25 but only 2% at age 35.

In the bottom panel the total earnings differential between the continuous career and a career with ten years of home time is calculated. The estimate varies between 11.7% and 23.0% lower earnings at age 35 if 10 years of potential working life has been spent out of the labor force.

In Figure 1 predicted earnings from regressions 6 and 7 of Table 3 are drawn. As seen in panel 4 of Table 5 the only specification of the earnings function that gives parallel logarithmic earnings functions between continuous and interrupted careers is the one where the slope of the earnings function depends on age rather than on experience. The other specifications give interrupted careers that approach the continuous career. The parallelity of the continuous with the interrupted careers for women is seen in Figure 1A. In Figure 1B the same age earnings curves are transformed into Skr. The earnings curves are not parallel when measured in absolute rather than relative terms.

Figure 1A. Predicted logarithmic earnings from regression estimates (6) and (7)

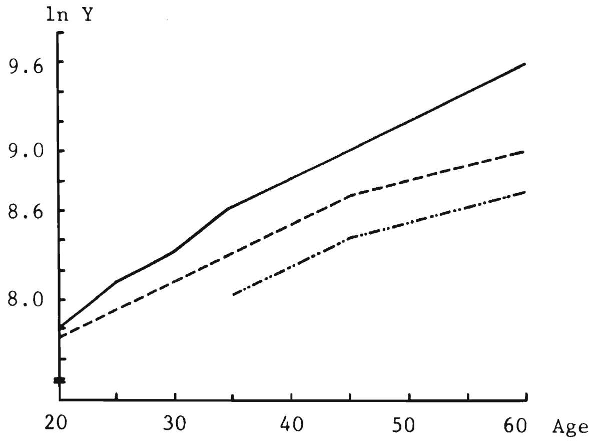
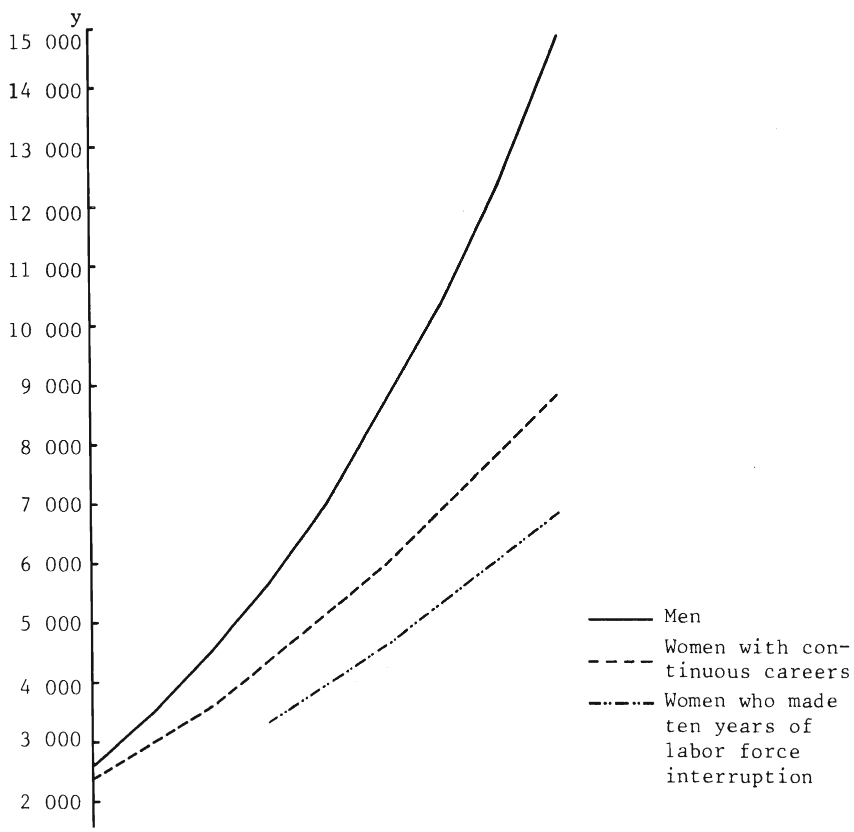


Figure 1B. Predicted earnings in Skr from regressions estimates (6) and (7)



7. MALE-FEMALE EARNINGS DIFFERENTIALS

One of the purposes of this paper is to determine whether earnings differentials between the sexes are smaller in Sweden than in the United States. In comparing the earnings differentials we want to assess what part of it is due to different coefficients of the earnings function and what part is due to different work histories.

A comparison of equations (6) and (7) of Table 3 shows that there is a great deal of similarity in the earnings functions for men and women. However, earnings of men rise at a steeper rate than earnings of women. The difference in steep is:

$$\left[\frac{\delta \ln y}{\delta a} + \frac{\delta \ln y}{\delta e_{\ell}}\right]^{M} - \left[\frac{\delta \ln y}{\delta a} + \frac{\delta \ln y}{\delta e_{\ell}}\right]^{F} = 0.0103 \qquad (14)$$

i.e., male earnings of the continuous career increase by 1% per year faster than female earnings of the continuous career. At age 60 women following a continuous career earn 59% of what men earn according to these estimates. If they made one labor force interruption of 10 years they earn 46% of what men following a continuous career earn at age 60. These estimates are in accordance with the general observed pattern of age-earnings curves (see Gustafsson, 1976). The difference in the increase in earnings power by a marginal year of experience between American white men and white women reported by Corcoran and Duncan (1979) is smaller than the differential between Swedish men and women reported here. Mincer and Polachek (1974 and 1978) and Sandell and Shapiro (1978) do not report male earnings functions.

The mean earnings differential may be decomposed according to:

$$\ln(\bar{y}^M) - \ln(\bar{y}^F) = (C^M - C^F) + (\bar{X}^M - \bar{X}^F)b^M + \bar{X}^F(b^M - b^F) \tag{15}$$

where the proportion explained by different characteristics is:

$$(\bar{X}^M - \bar{X}^F)b^M$$

The C:s are estimated intercepts, the b:s are vectors of estimated regression coefficients for men and women respectively, the X:s are vectors of mean characteristics of men and women respectively. The decomposition may also be done by comparing earnings standardized at the means of male work history data and using the female regression equation in the standardizing procedure:

$$\ln(\bar{y}^M) - \ln(\bar{y}^F) = (C^M - C^F) + (\bar{X}^M - \bar{X}^F)b^F + \bar{X}^M(b^M - b^F) \tag{16}$$

Earnings differentials between the sexes in Sweden and the U.S. can now be compared using the above formulas for the estimates of Table 3 equations (6) and (7) and for the data reported in Corcoran and Duncan.

The results are given in Table 6. Total earnings differentials between men and women are only slightly smaller in Sweden than in the U.S.

The regression estimates of Table 3 are less similar between the sexes than is the case for the American data. This results in different standardized earnings differentials when the standardiza-

Table 6. Earnings differentials between men and women in Sweden and the U.S.

	Sweden 1974 Regression estimates (6) and (7)		U.S. 1975 Corcoran and Duncan (1979)	
Total differential				
$\ln(y^M)-\ln(y^F)$	0.400	0.400	0.438	0.438
Explained differential				
Schooling:[a]				
$b^F(S^M-S^F)$	0.0587		0.009	
$b^M(S^M-S^F)$		0.0749		0.007
Work history:				
$b^F(X^M-X^F)$	0.0803		0.155	
$b^M(X^M-X^F)$		0.1027		0.157
Age:				
$b^F(A^F-A^M)$	0.0337			
$b^M(A^F-A^M)$		0.0519		
Residual standardized differential				
$X^M(b^M-b^F)+C^M-C^F$	0.2273		0.274	
$X^F(b^M-b^F)+C^M-C^F$		0.1725		0.2744
Female earnings in percent of male earnings				
a) total differential	67	67	65	65
b) standardized by schooling	71	72	65	65
c) standardized by schooling and work history	77	80	(76)	(76)
d) standardized by schooling, work history and age	80	84	76	76

[a] S and A are components of the vector of X:es in (15)
S = the average number of years of schooling
A = the average age.

tion is done at the means of male characteristics than from a standardization at the mean of female charasteristics. Differentials in schooling in Sweden reduces the earnings differentials whereas it has almost no effect for the U.S. The effect of age is sizable in the Swedish data. The female employees are considerably younger than the male employees.

The American data includes full work histories which means that a comparison with age included in the Swedish standardization is relevant.[1]

In the lower panel of Table 6 the results of standardization are given in percent. Swedish women earn 67% of what Swedish men earn and the corresponding proportion for the U.S. is 65%.[2] For the same age and work history female earnings as a percent of male earnings is 80-84% for Sweden and 76% for the U.S. The Swedish standardized earnings differential is rather an overestimate than an underestimate because individuals may have had hometime during the unobserved period that if taken account of would have decreased the standardized differential still more. Furthermore we are dealing exclusively with private sector white collar workers and the government sector shows smaller sex differentials in earnings (Gustafsson, 1976).

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[1] Since $\Sigma h + \Sigma e + s + 7 = a$ for individuals for whom we know the full work history.

[2] $e^{-0.4} = 0.67$, $e^{-0.438} = 0.645$.

8. HOW MUCH DOES LABOR FORCE HISTORY EXPLAIN?

The smaller accumulation of human capital on the part of women explains between 43 and 57% of the total male-female earnings differentials and labor force history variables make up the larger part of this. (See Table 6).[1]

In estimating the effect of labor force interruptions there is a simultaneity problem. Are lower earnings the result of labor force interruptions or do people that have low earnings drop out of the labor force more frequently? It is certainly less costly to drop out of the labor force if the alternative earnings foregone are smaller than if they are larger. One can thus read the earnings function with causation running the opposite way as a lifetime labor supply function.

One way of coping with the simultaneity problem is to employ two stage least squares (TSLS). The simultaneity problem and its implications are discussed and TSLS estimates are given in Mincer and Polachek (1974, 1978), and in Sandell and Shapiro (1978). The idea in TSLS is to find instrument variables that are uncorrelated with the stochastic terms. Mincer and Polachek use health, geographical area of residence, number of children, own education and husband's education as exogenous instrumental variables. They also remark that the occupational choice may be simultaneous. All of their TSLS estimates come out with more deprecia-

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[1] (0.0587 + 0.0803 + 0.0337)/0.4 = 0.1727/0.4 = 0.43175 = 43% or alternatively: (0.0749 + 0.1027 + 0.0519)/0.4 = 0.2295/0.4 = 0.5737 = 57%.

tion than OLS estimates do and consequently with a larger part of the male-female earnings differentials explained by the models.

In Table 7 instrumental equations for hometime and experience time are given with the second stage estimates of the earnings function. Most coefficients of the instrumental equations are significant and have expected signs. Schooling also reduces experience, a result probably due to the truncated work history data. The occupations do not have the expected effects. Being a general office worker significantly reduces hometime contrary to expectation. Total previous (MEANATP) earnings has the expected effects. Being a general office worker significantly reduces hometime and increases experience time. Age increases hometime which is consistent with the observation that older cohorts participate less in the labor force (Gustafsson, 1980) but it also increases experience probably because of the truncation of the work history data.

Living in a big city does not have any effect. Estimates not reported here have shown that the effect of CITY differs between the first hometime period of delayed entrance to the labor market (h_1) for which it is insignificant and for periods of withdrawal from the labor market after periods of experience (h_2, h_3, etc.), for which it is positively significant.

The structural earnings equation of the TSLS estimates differs sharply from earlier OLS results in that the coefficient of home time is negative, large in absolute value and strongly significant.

Table 7. TSLS-estimates of earnings functions for full-time working women

Structural equation		Instrumental equations			
Dependent variable	ln(y)	Dependent variable	h	e	ln(y)
Intercept	7.1125* (0.0288)	Intercept	-4.3760* (0.3761)	-12.148* (0.3991)	6.6502 (0.0166)
s	0.0522* (0.0025)	s	-0.0647* (0.0207)	-0.4738* (0.0230)	0.0104* (0.0009)
h	-0.0685* (0.0052)	OFFICE	-0.1869* (0.0731)	0.0900 (0.0776)	-0.0280* (0,0032)
e	0.0470* (0.0017)	SECR	-0.0046 (0.0890)	0.0326 (0.0945)	0.0175* (0.0004)
e^2	0.0003* (0.0000)	MEAN-ATP	-0.0067* (0.0004)	0.0074* (0.0005)	0.0017* (0.0000)
R^2	0.5919	AGE	0.4551* (0.0187)	1.1927* (0.0199)	0.0457* (0.0008)
n	6 745	AGESQ	-0.0056* (0.0002)	-0.0123* (0.0003)	-0.0005* (0.0000)
		CITY	0.1135 (0.0632)	-0.0880 (0.0670)	0.0270* (0.0028)
		R^2	0.0977	0.6877	0.8079
		n	6 745	6 745	6 745

*Significant at the 5% level.

MEANATP = $(\Sigma\ ATP_i)/15$, i = 1960, 1961,...,1974 for all years including zeroes.

OFFICE = dummy variable = 1 if the woman is coded "general office worker".

SECR = dummy variable = 1 if the woman is coded "secretary".

CITY = dummy variable = 1 if the woman lives in Stockholm, Gothenburg or Malmö with suburbs.

9. CONCLUDING REMARKS

Sweden has a very modern family legislation with separate taxation of husband's and wife's earnings and the right for fathers as well as mothers to take paid parental leaves for child care as important and internationally advanced features. This study has shown that when it comes to earnings differentials between men and women Sweden is only slightly more equal than the U.S. Average earnings of women are 65% of average earnings of men in the U.S. and the corresponding figure for Sweden is 67%.

If women can by their own choices affect their earnings this is less serious than if they can not. A reason for their lower earnings can be that they have chosen a smaller lifecycle labor force participation and correspondingly smaller investments in human capital. It turns out that in Sweden women earn 80-84% of what men earn if schooling and labor force history are held constant. American women earn 76% of what American men earn when schooling and labor force history are held constant.

Swedish women seem to have worked a larger proportion of the available time than American women.

Appendix 1. THE TIME SERIES OF ATP SCORES USED TO CALCULATE EARNINGS

In this paper ATP-scores have been used only to build variables on the work history. We have not used the information on earnings contained in this variable. Panel data on earnings helps in finding a better solution to the simultaneity problem: "If wage setbacks due to interruptions were attributable solely to the loss of work experience (foregone on the job investments) wages of returnees would be lower than wages of stayers but not lower than their own wages at exit." (Mincer and Ofek, 1980).

ATP is a truncated function of annual earnings but we do not know how many hours the individual has worked. The range of the ATP is 0 through 650 because earnings higher than 6.5 times the base amount are not included.

In Table A.1 the average ATP at the start of different work history intervals has been calculated in order to assess its relevance as an earnings variable. At the start of the first experience period the average ATP-score for women aged 16-64 is 99.9. At the end of the first work experience period, however, ATP is lower than at the start. If the earnings potential increased during the first work experience period, earnings per hour would be higher at the end of the first work experience period than is the case at the end of this period. However, it is very likely that the person who enters a period of home time finished working in the market sometime in the middle of the last year for which we observe earnings.

Earnings at the start of the second work history period are in most cases higher than earnings at the start of the first experience period. The conclusion of this exercise is that the time series earnings information in the ATP scores is useless as long as hours of work are not known.

Table A.1 Mean earnings according to work history for fulltime female workers in the private sector

		Mean earnings at the start of				
	n	e_1	h_2	e_2	h_2	e_3
Age 16-64						
All women	6 745	99.9	84.3	118.6	85.5	135.1
Compulsory education	5 110	96.4	81.6	112.0	82.0	124.3
Secondary education	1 432	106.0	92.5	135.8	99.3	168.4
University education	203	145.0	96.0	159.1	73.0	186.8
Age						
30-34	854	66.4	100.2	117.7	105.7	123.2
35-39	584	108.0	80.0	117.7	105.7	123.1
40-44	600	126.8	114.7	104.9	47.5	65.0

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