Unemployment, Education and Earnings Growth*

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Abstract

I use the European Community Household Panel to show that individuals with lower education have more to lose in terms of subsequent earnings growth from the experience of unemployment than similar individuals with higher education. This fact adds to the well known fact that higher education reduces the incidence of unemployment: unemployment is less likely among the more educated, and its occurrence has smaller effects on their subsequent earnings growth.

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- JEL: J24, J31

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1 Introduction

Despite the huge empirical literature on the private returns to education (see the reviews by Psacharopoulos [1985] and Card [1999]), relatively little research has been devoted to the relationship between unemployment, education and earnings. A well known result in this area is that, ceteris paribus, more education reduces the risk of unemployment (Mincer [1991]). An implication of this finding, first noted by Nickell [1979] and Ashenfelter and Ham [1979], is that education pays off not only because it yields higher wages but also because it increases the probability of gainful employment.

More education reduces but cannot eliminate the risk of unemployment. In the OECD area, the unemployment rate in 1995 was 10.1% for individuals with primary and lower secondary education, 7.0% for individuals with upper secondary education and 4.0% for individuals with a college degree (OECD [1997]). Unemployment was much higher among the young: in 1995 the unemployment rate of individuals aged between 25 to 29 with less than upper secondary, upper secondary and tertiary education was 16.9%, 9.8% and 8.5% respectively. These numbers suggest that slightly less than 1 out of 12 European young college graduates was unemployed in 1995, a significant risk.

As shown by the large literature on job displacement (see Kletzer [1998] and Gregory and Jukes [2001] for recent reviews), the experience of unemployment not only affects earnings when unemployment takes place but also can influence subsequent earnings growth. Economic theory does not give clear - cut predictions on the relationship between unemployment and subsequent earnings. According to human capital theory, unemployment has a negative effect on subsequent earnings when it brings the depreciation of general or specific skills. The economic analysis of labor markets with asymmetric information suggests that the experience of unemployment can generate a negative labor market signal when the employer has limited information about the worker's ability and productivity. While these two approaches point to a negative relationship, the job matching approach suggests that workers may change jobs and incur a period of unemployment to search in an

efficient way for a better match with employers, which could mean both higher earnings and higher earnings growth.

The purpose of this paper is to investigate whether the effects of unemployment on subsequent earnings vary with educational attainment. There are reasons to believe this to be the case. On the one hand, the experience of unemployment is likely to affect the training opportunities of better educated workers to a smaller extent if there is complementarity between education and employer - provided training. On the other hand, the higher incidence of unemployment among the less educated might reduce the information on individual quality conveyed to prospective employers by an unemployment spell.

In the presence of unemployment, private returns to education can be adjusted upwards by weighting earnings by degree with the estimated probability of employment, which varies by education, and by adding unemployment benefits, properly weighted with the probability of unemployment (see Nickell [1979]). When education affects the relationship between unemployment and subsequent earnings growth, however, this adjustment overlooks the fact that unemployment can influence future earnings differently depending on educational attainment.

In this paper, I use the European Community Household Panel, a large survey covering the majority of European countries, to show that individuals with higher education have less to lose from unemployment in terms of subsequent earnings growth than individuals with lower education. More precisely, I find that individuals in the sample with less than upper secondary education who were employed in 1994 but were unemployed at least once between 1989 and 1993 experienced a 4 percent reduction in earnings growth between 1994 and 1997 compared to similar individuals without a record of unemployment between 1989 and 1993. This reduction in earnings growth was significantly lower among high school graduates (-0.9%) and turned into a small increase (+0.9%) among college graduates.

The size of these differences is substantially higher in the subsample of young individuals. For this group I find that the differential in earnings growth between 1994 and 1997 induced by previous unemployment

was about -22%, -10% and -11% for individuals with less than upper secondary education, high school and college respectively. In the subsample of individuals with more than 30 years of age, I find instead that previous unemployment increased the earnings growth of college graduates by 4.4%. While the data used in this paper cannot tell whether the large losses in earnings growth incurred by the young are temporary or permanent, they do suggest that more education can be valuable not only because it reduces the risk of unemployment, but also because it limits the negative consequences of unemployment on future earnings.

The paper is organized as follows: Section 2 presents the basic theory and Section 3 introduces the data. The empirical model is discussed in Section 4 and the results are shown in Section 5. Conclusions follow.

2 Theory

In their model of optimal investment in human capital under uncertainty, Groot and Oosterbeek (1992) include the probability of unemployment in the definition of the expected returns to education but ignore that unemployment affects subsequent earnings. I illustrate how the influence of unemployment on future earnings affects returns to education by means of a simple infinite horizon model. In the first period the individual invests in years of education S at the cost c per year; in the second period she enters the labor market and is unemployed with probability $\pi(S) \in (0,1)$ and income b and employed with probability $1-\pi(S)$ and wage $w(S)$. There is no unemployment in the remaining periods, but unemployment in the second period affects subsequent earnings. Let wages in the events of employment and unemployment grow at the rate g^E and g^U respectively, and define ρ as the replacement rate, $w_0(S)$ as the wage after unemployment and λ as $\frac{w_0(S)}{w(S)}$. The net expected returns V from S years of education are

$$V(S) = -cS + \frac{w(S)}{r-g^E(S)} - \pi(S)w(S)\left\{\frac{1}{r-g^E(S)}\left[1-\beta\lambda(S)\left(\frac{r-g^E(S)}{r-g^U(S)}\right)\right]-\beta\rho\right\} \quad (1)$$

where β is the discount factor and r is the real rate of interest, which I assume to be strictly higher than earnings growth. The last term on

the right hand side of (1) is the loss of expected returns associated to a nonzero probability of unemployment. This loss is equal to zero in a perfectly competitive labor market with no unemployment, but can be significant in an economy characterized by unemployment. Educational attainment S can affect this term by influencing a) the probability of unemployment $\pi(S)$; b) the wage at labor market entry $w(S)$; c) the ratio between the wage after unemployment and the wage at labor market entry, $\lambda(S)$; d) subsequent earnings growth in the event of continuous employment, $g^E(S)$, and of unemployment, $g^U(S)$. The loss associated to the risk of unemployment is positive if $\frac{\beta\lambda(S)}{r-g^U(S)} + \beta\rho < \frac{1}{r-g^E(S)}$. Notice that this condition is not necessarily satisfied. As suggested by the theory of job matching, individuals who become unemployed to search more efficiently for a better job can end up with both a higher wage after unemployment ($\lambda > 1$) and higher earnings growth ($g^U(S) > g^E(S)$). In this case, unemployment can even increase the net returns to education.

3 The Data

The data used in this paper are drawn from the 1994 and 1997 waves of the European Community Household Panel, a household survey that covers 14 European countries[1]. The main advantage of these data is that the same "community" questionnaire is adopted by the national data collection units in each participating country, which obviously increases comparability. Each wave includes a household and a personal file, and the same households and individuals are interviewed over time[2].

I consider only individuals aged between 15 and 65 who at the time of the survey have completed schooling and are working in paid employment more than 15 and less than 60 hours per week. The ECHP survey asks each individual about the highest level of general education completed, and codes the answers into three categories: less than second stage level or lower secondary education (E_1 : ISCED 0-2), second stage

[1]The countries included in this study are only 11: Germany, Denmark, Netherlands, Belgium, France, UK, Ireland, Italy, Greece, Spain and Portugal. I exclude Luxembourg because of its small size. Austrai and Finland did not participate to the first wave. The release of ECHP used in the paper is December 2001 (contract 14/99).

[2]See European Commission [1999].

level or upper secondary education (E_2 : ISCED3); recognized third level education (E_3 : ISCED 5-7).

The questionnaire include three questions on unemployment incidence. The first is "Please think back over the past 5 years. Have you ever been unemployed during this time?". I use this question to define the dummy $U5$, equal to 1 if the answer is yes and to 0 otherwise. Conditional on having been unemployed, the survey also asks a) the number of times the person has been unemployed during the past 5 years ($Ut5$); b) whether any of the experienced unemployment spells lasted 12 months or more ($Ul5 = 1$ if yes; 0 if no).

A drawback of retrospective questions is that they introduce measurement error, as respondents may suffer from recollection problems, which are expected to increase with the period of time between the unemployment spell and the interview and with the detail of the question (see Beckett et al [2001]). These problems are more severe when individuals are asked to recall the number of unemployment spells and their duration than when they are asked whether they have been unemployed at least once during the period. Therefore, in the empirical analysis I focus on the variable $U5$.

The percentage of individuals who have been unemployed at least once in the five years before 1997 is 0.167. I estimate a probit model with $U5$ as the dependent variable and country dummies, age, age squared, a gender dummy and two education dummies as controls and compute predicted values. Females are more likely to have been unemployed than males (0.182 versus 0.155). The incidence of unemployment declines with age (0.320 for individuals with less than 30 years, 0.187 for those aged between 30 and 45 and 0.088 for those aged mor than 45). Incidence also varies across countries and is highest in Spain (0.253) and lowest in the Netherlands (0.126). As expected, incidence is lowest for the better educated and is highest in the youngest age group: its predicted value is 0.274 for young college graduates, 0.303 for young high school graduates and 0.360 for young individuals with lower education. These percentages are less than half as high for individuals older than 30 years.

4 The Empirical Model

I study how the effect of unemployment on subsequent wages varies with education by looking at the empirical relationship between unemployment incidence in the interval 1989 to 1993 and earnings growth between 1994 and 1997. I restrict my attention to the sub-sample of individuals employed in both years and define the following Mincerian earnings function

$$\ln W_{ti} = f_i + \alpha t + \beta U5_{94i} + \rho X_{ti} + \upsilon X_{ti}^2 + \sum_h \gamma_h E_{hi} + \sum_h \delta_h E_{hi} U5_{94i}$$

$$+ \sum_h f_h E_{hi} X_{ti} + \sum_h g_h E_{hi} X_{ti}^2 + \sigma X_{ti} U5_{94i} + \varsigma X_{ti}^2 U5_{94i} + \sum_h q_h E_{hi} X_{ti} U5_{94i} + \epsilon_{ti} \tag{2}$$

where $h = 1, 2$, $t = 1994, 97$, i is the subscript for the individual, $U5_{94}$ is unemployment incidence between 1989 and 1993, W is hourly gross earnings[3] in year t, t is a linear time trend, X is potential labor market experience, defined as age minus age when working life began[4], and the error term is composed of two parts, a time invariant individual effect f_i and a time varying effect, ϵ_{ti}.

I have added to the standard Mincer equation, which associates log earnings to schooling and potential labor market experience, the dummy $U5_{94}$ and the interactions between $U5_{94}$ and education, experience, experience squared and between education, experience and unemployment. The interaction terms including previous unemployment and education capture how educational attainment affects the relationship between $U5_{94}$ and earnings growth. The use of gross hourly earnings as the dependent variable is standard in the literature on the private returns to education. Since unemployment can affect working hours (see Ashenfelter and Ham [1979]), however, I also use gross monthly earnings, which include hours worked.

[3]The original data on monthly gross earnings are transformed into hourly earnings by using the information on hours worked.

[4]This definition of potential experience is slightly unconventional. The usual definition is age minus years of schooling minus age when school starts. The two definitions coincide if labor market entry takes place just after graduation.

The individual fixed effect includes unobserved characteristics, such as ability, and is clearly correlated with education, experience and unemployment (see Card [1999]). Panel data can be used to eliminate this effect by taking first differences over time. Using the fact that $X_{97} = X_{94} + 3$ I obtain

$$\Delta \ln W_{ti} = \lambda_0 + \lambda_1 U5_{94i} + \sum_h \lambda_{2h} E_{hi} + \lambda_3 X_{94i} + \sum_h \lambda_{4h} E_{hi} X_{94i}$$

$$+ \sum_h \lambda_{5h} E_{hi} U5_{94i} + \lambda_6 X_{94i} U5_{94i} + \Delta\epsilon_{ti} \qquad (3)$$

where X_{94} is labor market experience in 1994, $\lambda_1 = (3\sigma + 9\varsigma)$, $\lambda_{2h} = (3f_h + 9g_h)$, $\lambda_3 = 6\upsilon$, $\lambda_{4h} = 6g_h$, $\lambda_{5h} = 3q_h$, $\lambda_6 = 6\varsigma$ and λ_0 is a constant. Notice that all the parameters in (2) associated to time varying variables can be retrieved from the estimated parameters in (3). Previous unemployment affects subsequent earnings growth if λ_1 is different from zero. The effect of unemployment varies with potential labor market experience if λ_6 is different from zero, and with education if λ_{5h}, $h = 1, 2$, are different from zero. Clearly, the latter parameters are of particular interest for the purposes of this paper.

The transitory shock $\Delta\epsilon_{ti}$ in (3) is uncorrelated with education, labor market experience and previous unemployment, but can affect turnover decisions and employment status in 1997 (see Blundell, Dearden and Meghir [1994]). I define L_{97} as a dummy equal to 1 in the event of employment and to zero otherwise. Next I posit the following selection model

$$L_{97i} = 1 \quad \text{iff} \quad \gamma' Z_i \geq u_i$$

$$L_{97i} = 0 \quad \text{otherwise} \qquad (4)$$

where Z is a vector of explanatory variables drawn from the 1994 wave, including marital status (*married*) and health conditions (*health*), unemployment incidence, age, age squared, gender, educational attainment

Table 1. Employment probit. Dependent variable: L_{97}

	Coef.	Std. Err.
$Gender$	.076*	.003
High School	.021*	.004
College	.058*	.003
Age	.024*	.001
Age^2	-.0003	.000
$Married$	-.009*	.003
$U5_{94}$	-.096*	.008
$Health$	.093*	.009
High School$*U5_{94}$	.021*	.007
College$*U5_{94}$	.018§	.008
$Nobs$	42839	
$Pseudo\ R^2$	0.150	

Health: dummy equal to 1 if health in 1994 was fair, 0 otherwise; Married: dummy equal to 1 if married in 1994 and 0 otherwise. Robust standard errors. Nobs: number of observations. The regression includes a constant and country dummies. One star if the estimated coefficient is statistically significant at the 1 percent level of confidence; §if the estimated coefficient is statistically significant at the 5 percent level of confidence

and interactions between education and unemployment incidence. Together with age squared, the variables *married* and *health* are included in Z but not in (3), because they are time invariant. Assuming that the error term u is normally distributed, I estimate a probit for employment in 1997 and report the results in Table 1.

As expected, I find that the probability of employment in 1997 is higher for the better educated. I also find that this probability is lower among those who have experienced at least one unemployment spell in the five years before 1994. The impact of previous unemployment, however, is smaller among the better educated. Therefore, previous unemployment affects the probability of current employment and this effect is higher when educational attainment is below college. I use the estimates of the probit model to compute the employment selection term

θ_E as

$$\theta_E = E\left[\Delta\epsilon_{ti}|\ \ \gamma' Z_i \geq u_i\right] = -\frac{\phi(\gamma' Z)}{\Phi(\gamma' Z)} \tag{5}$$

and add it to the earnings growth equation (3).

5 The Results

Table A in the Appendix shows the summary statistics of the variables used in (3) and Table 2 presents the estimates of the wage growth regression for the full sample. While the first column in the table presents the results in the absence of interaction terms, the next column adds the interactions between educational attainment and unemployment and the final column adds also the interactions with potential labor market experience. Since only the former set of interactions is statistically significant, I focus hereafter on the results in column (2).

The key result is that individuals with a record of unemployment during 1989-93 have experienced lower earnings growth during 1994-97 than individuals without such a record. There is also evidence that the impact of $U5_{94}$ on earnings growth has varied with educational attainment. Individuals with less than upper secondary education and previous unemployment have had a rate of earnings growth during 1994-97 that is 4 percent lower than the rate experienced by similar individuals without previous unemployment. This negative differential falls to 0.9 $(4.1 - 3.2)$ percent for individuals with upper secondary education and turns into a small $(0.9 = 4.1 - 5$ percent) positive differential among college graduates.

Previous unemployment affects earnings growth also indirectly by influencing the probability of employment. The large and significantly negative coefficient attracted by the inverse Mills ratio indicates that, conditional on employment in 1994, the individuals who were employed in 1997 enjoyed higher earnings growth than a randomly selected individual. The probability of employment in 1997 was lower among those who were unemployed before 1994, but the negative impact of unemployment was mitigated by educational attainment.

I also find that earnings growth declines with labor market experi-

ence, a standard result that can be explained with decreasing investments in human capital over the working life (see Willis [1986]). Finally, there is some evidence that earnings profiles are not parallel and that earnings growth is slightly slower among individuals with upper secondary education.

It is reasonable to expect that not only the incidence but also the duration and the frequency of unemployment can affect subsequent earnings growth. I have added to the specifications estimated in Table 2 either the dummy $Ul5_{94}$, which capture the presence of long term unemployment between 1989 and 1993, or the number of unemployment spells $Ut5_{94}$, and their interactions with education. These experiments show that both unemployment duration and unemployment frequency do not significantly affect earnings growth.

Table 3 presents the results of the estimates when I separate males from females and allocate individuals into three age groups, the younger than 30, those aged between 30 and 45 and the older than 45. The table reports only the preferred specification, without interactions with labor market experience, both for the full sample and by subsample. I find evidence of a significant relationship between previous unemployment and earnings growth for males but not for females. The earnings growth enjoyed by less educated males with previous unemployment is 6.7% lower than that experienced by similar individuals without previous unemployment. As in the full sample, this reduction in earnings growth turns into a 1.7% increase among college graduates.

Turning to the results by age group, I find a sharp contrast between the youngest age group, for whom previous unemployment has a significant and large negative effect on subsequent earnings, and the older groups, for whom the effect is either not significantly different from zero or positive (for college graduates). In particular, the evidence suggests that young individuals with less than upper secondary education and a record of unemployment between 1989 and 1993 have had a 22.3% loss in earnings growth compared to similar individuals without such a record. This loss falls to 10.7% among high school graduates and to 11.3% among college graduates. Compared to the young group, the in-

Table 2. Earnings growth regressions. Dependent variable: $\Delta \ln$ hourly earnings

	(1)	(2)	(3)
College	.006	-.000	-.009
	(.005)	(.006)	(.012)
High School	-.009	-.014*	-.010
	(.005)	(.005)	(.011)
Experience	-.004*	-.005*	-.004*
	(.0003)	(.000)	(.000)
$U5_{94}$	-.014§	-.041*	-.029
	(.007)	(.010)	(.015)
θ_E	-.251*	-.267*	-.263*
	(.028)	(.029)	(.029)
$U5_{94}*$ College		.050*	.050*
		(.014)	(.014)
$U5_{94}*$ High School		.032§	.028§
		(.013)	(.013)
Experience∗College			.000
			(.000)
Experience∗High School			-.000
			(.000)
$U5_{94}*$Esperience			-.000
			(.000)
$Nobs$	25672	25672	25672
R^2	0.072	0.072	0.073

Robust standard errors within parentheses. Nobs: number of observations. Each regression includes a constant, country dummies and a gender dummy. * if the estimated coefficient is statistically significant at the 1 percent level of confidence; §if the estimated coefficient is statistically significant at the 5 percent level of confidence

Table 3. Earnings growth regressions. Dependent variable: $\Delta \ln$ hourly earnings

	All	*M*	*F*	$age < 30$	$age \in (30, 45)$	$age > 45$
College	-.000	-.002	.008	.085§	.008	.002
	(.006)	(.007)	(.010)	(.033)	(.011)	(.008)
High School	-.014*	-.018*	-.005	-.014	-.005	-.006
	(.005)	(.006)	(.008)	(.021)	(.007)	(.007)
Experience	-.005§	-.005	-.004*	-.021*	-.001*	-.000
	(.000)	(.003)	(.000)	(.003)	(.000)	(.000)
$U5_{94}$	-.041§	-.067*	-.009	-.223*	.000	.010
	(.010)	(.009)	(.016)	(.038)	(.021)	(.017)
College$*U5_{94}$	.050*	.084*	.011	.110*	.044§	.013
	(.014)	(.019)	(.020)	(.038)	(.021)	(.029)
High School$*U5_{94}$	.032*	.051§	.007	.117*	.016	-.000
	(.013)	(.019)	(.019)	(.034)	(.018)	(.023)
θ_E	-.267*	-.373*	-.197*	-1.164*	-.052	.024
	(.029)	(.043)	(.039)	(.185)	(.109)	(.034)
$Nobs$	25672	15129	10543	3437	12614	9621
R^2	.072	.072	.071	.111	.062	.060

See Table 2.

termediate age group with previous unemployment and a college degree experienced a 4.4 percent premium in earnings growth with respect to similar individuals with no previous unemployment between 1989 and 1993.

When I consider gross monthly earnings rather than hourly earnings as the dependent variable to take into account the influence of previous unemployment on working hours, I find that the results are qualitatively similar, as illustrated in Table 4. These findings suggest that unemployment is particularly damaging when individuals are in the first part of their working life. This is also the period when the risk of unemployment is highest. By investing in further education, young Europeans can reduce but not eliminate the risk of unemployment, which remains high, with about 1 out of 4 college graduates in the ECHP data having been through at least one unemployment spell over a five year interval. The reduction in the risk of unemployment has two important effects, which influence the perceived expected returns to education. First, it

Table 4. Earnings growth regressions. Dependent variable: Δ ln monthly earnings

	All	*M*	*F*	$age < 30$	$age \in (30, 45)$	$age > 45$
College	-.006	-.013	.001	.108*	.015	-.016§
	(.006	(.010)	(.007)	(.037)	(.011)	(.008)
High School	-.019*	-.017	-.018*	-.009	-.006	-.012
	(.005)	(.009)	(.006)	(.023)	(.007)	(.007)
Experience	-.005*	-.003*	-.006*	-.023*	-.000	-.000
	(.000)	(.000)	(.000)	(.003)	(.000)	(.000)
$U5_{94}$	-.025§	.008	-.052*	-.264*	.014	.043§
	(.010)	(.017)	(.013)	(.042)	(.022)	(.017)
College$*U5_{94}$	.057*	.035	.081*	.136*	.052§	.015
	(.014)	(.022)	(.018)	(.041)	(.025)	(.029)
High School$*U5_{94}$	.027§	.011	.041§	.149*	.011	-.022
	(.013)	(.020)	(.018)	(.035)	(.018)	(.025)
θ_E	-.224*	-.104*	-.361*	-1.325*	-.039	.083§
	(.030)	(.042)	(.044)	(.207)	(.111)	(.037)
$Nobs$	25672	10543	15129	3437	12614	9621
R^2	.078	.067	.091	.115	.070	.068

See Table 2

increases significantly the probability that individuals are employed in 1997. Second, the expected loss in terms of earnings growth due to previous unemployment is significantly lower with higher education.

As individuals age in the labor market, recent unemployment spells can even improve earnings growth, as suggested by the theory of job matching. Therefore, not only are older individuals less likely to be unemployed, but they also can expect to gain from a recent spell of unemployment, especially if they have a college degree.

Putting this evidence together, I conclude that investing in college education reduces the losses in earnings growth associated to the experience of unemployment during the first part of an individual career and produces gains in earnings growth, albeit to a smaller extent, from a similar experience later on. I hasten to add to this conclusion an important caveat. The data do not tell whether the effect of unemployment on earnings growth is temporary or permanent. Therefore, I cannot rule out the possibility that the substantial losses incurred between 1994 and

1997 by young individuals with low education and a record of unemployment between 1989 and 1993 completely disappear over a longer span of time. To sort out temporary and permanent effects, one would need individual data which cover a longer horizon. In spite of this shortcoming, however, my results clarify the importance of considering the impact of unemployment on future earnings growth when attempting to evaluate the returns to education in an economic environment characterized by frequent and high unemployment.

6 Conclusions

I conclude that individuals with higher education have less to lose in terms of subsequent earnings growth from the experience of unemployment. This result adds to the fact that more education reduces the incidence of unemployment: unemployment is less likely among the better educated, and its occurrence has smaller effects on subsequent earnings growth.

An important implication is that ignoring unemployment in the computation of the private returns to higher education has two effects on these returns: first, as mentioned by Nickell, it underestimates them, because the better educated have a lower risk of unemployment; second, it further underestimates them, because it ignores that unemployment damages less the subsequent earnings of individuals with more education.

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7 Appendix

ECHP codes for the main variables:

- $pi211mg$: monthly earnings in the current year
- $pe005$: monthly hours worked
- $pe039$: age when first job was started
- $pu002$: unemployment during the five years before the survey

Table A. Summary statistics of the variables in the earnings growth regression.

	Mean	Stand. Dvt.
Δ lnW (hourly)	.150	.313
Δ lnW (monthly)	.147	.321
Age	41.03	9.864
Exp	22.33	10.86
High School	.387	-
College	.282	-
Gender	.587	-

Note: Gender is equal to 1 for males and to 0 for females.