

IZA DP No. 3822

## Wage Bargaining and the (Dynamic) Mincer Equation

Corrado Andini

November 2008

# Wage Bargaining and the (Dynamic) Mincer Equation

**Corrado Andini**  
*Universidade da Madeira,  
CEEApIA and IZA*

Discussion Paper No. 3822  
November 2008

IZA

P.O. Box 7240  
53072 Bonn  
Germany

Phone: +49-228-3894-0  
Fax: +49-228-3894-180  
E-mail: [iza@iza.org](mailto:iza@iza.org)

Any opinions expressed here are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit organization supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its international network, workshops and conferences, data service, project support, research visits and doctoral program. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

## ABSTRACT

### Wage Bargaining and the (Dynamic) Mincer Equation<sup>\*</sup>

This paper shows that, if observed earnings are the result of employer-employee wage bargaining, under a set of specific assumptions, the standard static Mincer equation can be thought as a particular case of a dynamic wage equation. Particularly, we argue that the standard static Mincer equation is implicitly based on the hypothesis that the employee has full bargaining power, and provide (further) empirical evidence against this hypothesis.

JEL Classification: I21, J31

Keywords: Mincer equation, return to schooling, wage bargaining

Corresponding author:

Corrado Andini  
Universidade da Madeira  
Campus da Penteada  
9000-390, Funchal  
Portugal  
E-mail: [andini@uma.pt](mailto:andini@uma.pt)

---

<sup>\*</sup> Financial support from the European Commission (EDWIN Project, HPSE-CT-2002-00108) is gratefully acknowledged. For valuable comments, I would like to thank Pedro Telhado Pereira, Santiago Budría, Ricardo Cabral, José Cabral Vieira, Günther Lang, Joop Hartog, Rudolf Winter-Ebmer, Erling Barth, Ali Skalli, the participants at the 6th Meeting of the EDWIN Project and the participants at the 2nd Italian Congress of Econometrics and Empirical Economics. The usual disclaimer applies.

## 1. Introduction

A seminal book by Jacob Mincer (1974) is the starting point of a large body of literature dealing with the estimation of a wage equation where the logarithm of the hourly observed earnings of an individual is explained by his/her schooling years  $s$  and by his/her potential labor-market experience  $z$ .

As argued by Heckman et al. (2003), the standard Mincerian framework has two main features. First, it provides an explanation why the logarithm of the net potential earnings of an individual at time  $t = s + z$ , say  $\ln npe_t$ , can be approximately represented as a function of  $s$  and  $z$ , where  $z$  keeps the post-schooling investment in human capital into account ( $\alpha$  is a scalar):

$$\ln npe_t \approx \alpha_0 + \alpha_1 s + \alpha_2 z + \alpha_3 z^2 \quad (1)$$

Second, it is based on the *assumption* that, at any time  $t \geq s$ , the observed earnings of an individual, say  $\ln w_t$ , are equal to the monetary value of the individual net productivity, measured by his/her net potential earnings, i.e.:

$$\ln w_t = \ln npe_t \quad (2)$$

Replacing (1) into (2) provides the standard static Mincer equation, i.e.:

$$\ln w_t \approx \alpha_0 + \alpha_1 s + \alpha_2 z + \alpha_3 z^2 \quad (3)$$

This paper does not question expression (1) and focuses on assumption (2). From a theoretical point of view, assumption (2) fits within the perfect-competition framework where the nominal wage equals the monetary value of the marginal labor productivity. However, if one believes that the imperfect-competition framework is a more realistic view of the labor market<sup>1</sup>, then *several* arguments can support the statement that assumption (2) is unlikely to hold. This manuscript focuses on *one* of the possible arguments: the existence of wage bargaining at employer-employee level. Additional arguments (asymmetric information, role of unions and efficiency wages) will be briefly discussed in the last Section of this paper.

## **2. Theory**

The standard Mincerian model puts too much emphasis on the supply side: the more an individual invests in his/her human-capital development, the higher his/her wage is. The model that is presented in this Section aims at enhancing the role played by demand factors in determining wages, without diminishing the one played by supply factors. More explicitly, the argument is that schooling and post-schooling investments provide individuals with *net potential* earnings, meaning skills required to earn a given amount of money. However, *observed* earnings are likely to be the result of both employee's skills (supply) and employer's willingness to pay (demand). Since real-life labor markets are characterized by wage bargaining, the possibility of a margin-formation between observed earnings and net potential earnings should not be ruled out a-priori. This implies that observed earnings may not coincide with net potential earnings, although the former generally depend on the latter.

---

<sup>1</sup> A general reference is the New Keynesian view of the labor market.

As additional feature, the model keeps into account the stylized fact that observed earnings exhibit path-dependence. To the best of our knowledge, this feature is novel because the existing (micro and macro) evidence on the autoregressive nature of observed earnings<sup>2</sup> has not received attention in Mincerian studies so far.

To anticipate the model's conclusion, current observed earnings are shown to be dependent on both past observed earnings and current net potential earnings.

Let us assume that the logarithm of the observed earnings of an employee arises from a simple, decentralized Nash bargaining between an employee and an employer and that:

- Employee objective function: the employee maximizes his/her observed earnings at time  $t^3$ , namely the employee maximizes  $U_t^{\text{employee}} = \ln w_t$  ;
- Employer objective function: the employer maximizes the difference between the monetary value of the employee's net productivity at time  $t$  and the salary that he/she has to pay to the employee, namely the employer maximizes  $U_t^{\text{employer}} = \ln npe_t - \ln w_t$  ;
- Employee outside option: if bargaining fails, the outside option for the employee is the unemployment benefit at time  $t$ , i.e.  $\tilde{U}_t^{\text{employee}} = \ln b_t$  ;

---

<sup>2</sup> See Taylor (1999) for a good survey.

<sup>3</sup> Note that both observed and net potential earnings must be measured in logarithms to be consistent with the Mincerian assumption (2).

- Employer outside option: if bargaining fails, the outside option for the employer is  $\tilde{U}_t^{\text{employer}} = 0$  because the employer neither gets the monetary value of the employee's net productivity nor pays a salary;
- Nash bargaining function: the Nash bargaining function has a Cobb-Douglas specification, i.e.  $U_t = (U_t^{\text{employee}} - \tilde{U}_t^{\text{employee}})^\rho (U_t^{\text{employer}} - \tilde{U}_t^{\text{employer}})^{1-\rho}$ .

As usual in the literature, the coefficient  $\rho \in [0,1]$  in the Nash bargaining function is interpreted as the bargaining power of the employee, while  $1-\rho$  is the bargaining power of the employer.

Following common practice, let us further assume that the unemployment benefit at time  $t$  is calculated as a share of the salary of the employee at time  $t-1$ , i.e.  $b_t = \lambda w_{t-1}$  where  $\lambda \in (0,1)$  is the so-called replacement rate.

Solving the employer-employee bargaining problem provides the following first-order condition:

$$\frac{\rho}{\ln w_t - \ln \lambda - \ln w_{t-1}} = \frac{1-\rho}{\ln n p_t - \ln w_t} \quad (4)$$

which, in turn, gives:

$$\ln w_t = (1-\rho) \ln \lambda + (1-\rho) \ln w_{t-1} + \rho \ln n p_t \quad (5)$$

Hence, if the employee has full bargaining power ( $\rho = 1$ ), then expression (5) becomes expression (2) and the standard Mincerian model holds. Intuitively, only when the employee has full bargaining power, he/she is actually able to earn all his/her net potential earnings. In this case, the employer is indifferent between employing and not employing because  $U_t^{\text{employer}} = \tilde{U}_t^{\text{employer}} = 0$ .

On the other hand, if the employee has zero bargaining power ( $\rho = 0$ ), then expression (5) implies  $\ln w_t = \ln \lambda + \ln w_{t-1}$  which, in turn, implies  $\ln w_t = \ln \lambda w_{t-1} = \ln ub_t$ . In this case, the employee is indifferent between working and being unemployed because  $U_t^{\text{employee}} = \tilde{U}_t^{\text{employee}}$ .

In general, when the bargaining power of the employee is neither null nor full ( $0 < \rho < 1$ ), replacing expression (1) into (5) gives:

$$\ln w_t \approx (1-\rho)\ln \lambda + (1-\rho)\ln w_{t-1} + \rho(\alpha_0 + \alpha_1 s + \alpha_2 z + \alpha_3 z^2) \quad (6)$$

or alternatively:

$$\ln w_t \approx \beta_0 + \beta_1 \ln w_{t-1} + \beta_2 s + \beta_3 z + \beta_4 z^2 \quad (7)$$

where  $\beta_0 = (1-\rho)\ln \lambda + \rho\alpha_0$ ,  $\beta_1 = 1-\rho$ ,  $\beta_2 = \rho\alpha_1$ ,  $\beta_3 = \rho\alpha_2$  and  $\beta_4 = \rho\alpha_3$ .

Expression (7) is a dynamic version of the Mincer equation. Note that the bargaining power of the employer  $1-\rho$  can be estimated, when individual-level *longitudinal* data are available, and the theory underlying (7) can be tested. The main requirement for the



theory to be consistent with the data is to find that the coefficient  $\beta_1$  is significantly different from zero. The next Section provides empirical evidence supporting (7).

### 3. Evidence

We use both ordinary least squares (OLS) and quantile-regression techniques<sup>4</sup> (QR) to explore 1994-2001 data on Spanish male workers extracted from the European Community Household Panel (ECHP). Sample statistics are in Table 1. Table 2 presents estimates based on model (3), i.e. the static Mincer equation. Table 3 contains estimates based on model (7), i.e. the dynamic Mincer equation.

The main point of this Section, presented in Table 3, is that the employee does not have full bargaining power because the estimated bargaining power of the employer ( $\beta_1$ ) is significantly different from zero, both on average (OLS) and along the conditional wage distribution (QR). Therefore, the standard Mincerian assumption (2) is unlikely to hold. This empirical finding, based on Spanish data, is consistent with previous evidence concerning both Portuguese<sup>5</sup> (see Andini, forthcoming) and U.S. data<sup>6</sup> (see Andini, 2007).

It is worth noting that the estimated bargaining power of the employer is higher than one-half, both on average (0.7178) and along the conditional wage distribution. This is consistent with the common belief that, in general, the bargaining power of the

---

<sup>4</sup> We present estimates from the 10<sup>th</sup> to the 90<sup>th</sup> quantile of the conditional wage distribution, with a step of ten quantiles.

<sup>5</sup> Data on male workers aged between 16 and 65 from the European Community Household Panel, 1994-2001.

<sup>6</sup> Data on male workers aged between 17 and 30 from the National Longitudinal Survey of Youth, 1980-1987.

employer is higher than the bargaining power of the employee (the implicit bargaining power of the employee is estimated at 0.2822, on average).

Another interesting finding, presented in Figure 1, is that pattern of the estimated bargaining power of the employer, along the conditional earnings distribution, is consistent with earlier results provided by Andini (2007) and Andini (forthcoming). On the one hand, as one would reasonably expect, the bargaining power of the employer is lower at the highest deciles of the conditional wage distribution. On the other hand, minimum-wage regulation, reducing the bargaining power of the employer at the lowest deciles, may explain why the pattern in Figure 1 is a bit inverse-U shaped.

Finally note that, from a theoretical point of view, the static-model return to schooling  $\alpha_1$  is exactly equivalent to the dynamic-model return to schooling  $\frac{\beta_2}{1-\beta_1}$  because

$$\frac{\beta_2}{1-\beta_1} = \frac{\rho\alpha_1}{1-(1-\rho)} = \alpha_1.$$

The OLS estimation in Table 2 and 3 confirms the equivalence prediction<sup>7</sup>. An explanation of why the QR estimates of these two returns may not coincide has been provided by Andini (2007)<sup>8</sup>.

#### 4. Conclusion

We do not claim for generality. The theoretical model in Section 2 holds under a set of specific assumptions. The main issue is whether these assumptions bring us closer to

---

<sup>7</sup> Andini (forthcoming) argues that both these two returns *should not* be interpreted as returns in terms of observed earnings. They should be interpreted as returns in terms of *net potential* earnings. The return to schooling in terms of observed earnings is given by  $\frac{\partial \ln w_t}{\partial s} = \frac{\partial \ln w_{s+z}}{\partial s} = \beta_2 (1 + \beta_1 + \beta_1^2 + \beta_1^3 + \dots + \beta_1^z)$ .

<sup>8</sup> The QR estimator is based on stricter assumptions of correct model-specification than the OLS estimator. Therefore, not controlling for lagged observed earnings in the standard static Mincer equation implies that QR estimates are more likely to be seriously biased than OLS estimates.

reality (enhanced role of demand factors in determining wages) or not. In any case, there seems to be substantial empirical evidence supporting the argument that past observed earnings, *together with* accumulated human capital (schooling and post-schooling investments), play an important role in explaining current observed earnings. This finding should open the door to new research effort looking for alternative, and perhaps more general, micro-foundations of a dynamic Mincer equation. Issues related to asymmetric information (for instance, the case where the employer does not observe the net potential earnings of the employee), role of unions (wage bargaining at collective level and insider-outsider considerations) and efficiency wages (the employer cannot observe the employee's effort) are interesting topics for future investigation.

## References

Andini, C. (forthcoming) A Dynamic Mincer Equation with an Application to Portuguese Data, Applied Economics, draft available at: <<http://www.uma.pt/andini>>

Andini, C. (2007) Returns to Education and Wage Equations: a Dynamic Approach, Applied Economics Letters, 14, 577-579.

Heckman, J.J, Lochner, L.J., and Todd, P.E. (2003) Fifty Years of Mincer Earnings Regressions, NBER Working Papers, n° 9732, National Bureau of Economic Research.

Mincer, J. (1974) Schooling, Experience and Earnings, National Bureau of Economic Research, Cambridge MA.

Taylor, J.B. (1999) Staggered Price and Wage Setting in Macroeconomics, in: J.B. Taylor and M. Woodford (eds.) Handbook of Macroeconomics, North-Holland, New York.

**Table 1. Sample Statistics**

	Obs	Mean	St Dev	Min	Max
Logarithm of hourly wage	15040	6.83	0.53	2.31	9.38
Schooling years	15040	10.54	3.75	2.00	27.00
Potential labor-market experience	15040	17.57	12.41	0.00	55.00
Age	15040	36.10	11.27	16.00	65.00

**Table 2. Static Mincer Equation**

	$\alpha_0$	$\alpha_1$	$\alpha_2$	$\alpha_3$	R-squared
QR(10)	5.1181	0.0675	0.0459	-0.00070	0.1329
QR(20)	5.2990	0.0694	0.0437	-0.00064	0.1450
QR(30)	5.4009	0.0732	0.0419	-0.00059	0.1572
QR(40)	5.4967	0.0742	0.0415	-0.00058	0.1707
QR(50)	5.5747	0.0759	0.0413	-0.00056	0.1880
QR(60)	5.6401	0.0793	0.0407	-0.00054	0.2096
QR(70)	5.7153	0.0814	0.0406	-0.00052	0.2333
QR(80)	5.8325	0.0829	0.0392	-0.00049	0.2535
QR(90)	5.9925	0.0846	0.0389	-0.00047	0.2674
OLS	5.5407	0.0767	0.0433	-0.00060	0.3502

All the estimated coefficients are significant at 1% level

**Table 3. Dynamic Mincer Equation**

	$\beta_0$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\frac{\beta_2}{1 - \beta_1}$	R-squared
QR(10)	1.0240	0.7663	0.0178	0.0113	-0.00015	0.0761	0.3933
QR(20)	1.1317	0.7729	0.0186	0.0087	-0.00011	0.0819	0.4269
QR(30)	1.2432	0.7734	0.0168	0.0074	-0.00009	0.0741	0.4523
QR(40)	1.2805	0.7769	0.0174	0.0061	-0.00006	0.0779	0.4727
QR(50)	1.3724	0.7753	0.0163	0.0047	-0.00003*	0.0725	0.4904
QR(60)	1.5410	0.7556	0.0182	0.0045	-0.00003*	0.0744	0.5051
QR(70)	1.7095	0.7415	0.0190	0.0027	-0.00000**	0.0735	0.5143
QR(80)	1.9044	0.7196	0.0216	0.0030	-0.00000**	0.0770	0.5160
QR(90)	2.2594	0.6762	0.0274	0.0034	-0.00001**	0.0846	0.5099
OLS	1.6788	0.7187	0.0216	0.0066	-0.00006	0.0767	0.7094

All the estimated coefficients are significant at 1% level, but those marked with \* or \*\*  
\* = significant at 5% level \*\* = not significant

Figure 1. Bargaining Power of the Employer

