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The economic model underlying the WageIndicator salary checks

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1 Introduction

This paper elaborates on the economic model underlying the WageIndicator salary checks. Let us assume that the wages we observe in the labor market are the outcome of the interaction of demand and supply in that market.

So, the first step is to identify the variables that determine firms' demands for labor, on the one hand, and the variables which determine workers' supply, on the other.

Let us start with the demand side.

2 The demand for labor

The demand for labor is a derived demand. It depends on the firms' level of output and the wages they have to pay.

From the first order profit-maximizing conditions we get

$$\frac{\partial R}{\partial L} = \frac{\partial C}{\partial L}$$

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Firms hire labor so that the marginal revenue product of labor equals the marginal cost of hiring it. On the other hand,

$$\frac{\partial R(q)}{\partial L} = \frac{\partial R}{\partial q} \cdot \frac{\partial q}{\partial L} = MR \cdot MP_L$$

$$\frac{\partial R}{\partial L} = \frac{\partial C}{\partial L}$$

where MP_L is the marginal product of labor.

If the wage (W) is given for the firm,

$$\frac{\partial C}{\partial L} = W$$

$$\frac{\partial R}{\partial L} = W$$

Then, the amount of labor the firm will hire is given by

$$MR \cdot MP_L = W$$

So, the quantity demanded depends on the level of the wages the firm has to pay.

Jobs are heterogeneous; firms will pay higher wages for those jobs which require skilled workers. Firms usually take as a signal of qualification the level of studies attained by the worker.

So, other things being equal, firms will be inclined to pay higher wages as the level of education attained by the candidate increases.

In other words, the negatively sloped demand curve will move from left to right with the level of education.

Productivity is also a reason why firms pay higher wages for supervisory positions.

Another variable which influences demand is workers' experience. In principle, the more experienced, the more productive the worker is. So, the demand curve also moves to the right increasingly with experience.

Firms are also heterogeneous. Big firms are usually more productive; so, they are able to pay higher wages than smaller ones.

Size is then another argument of the market labor demand.

Finally, there is a gender preference for each position. This means that the firm will choose who will fill the vacancy according with that preference, unless there is someone of the other gender who will accept a lower wage, other things being equal.

So, we can write the demand function as

$$D = f(W, E, Sp, Ex, Sz, G)$$

where W stands for wages; E , for level of education; Sp , for supervision; Ex , for years of experience; Sz , for size, and G , for Gender.

3 Labor supply

The market supply curve for each kind of labor is assumed to be increasing in wages up to a point in which it may become backward bending. This is because it is assumed that there is a certain high wage rate which may lead to less labor being supplied because the opportunity cost of leisure encourages to substitute leisure for work.

Labor is as heterogeneous as jobs are. That is why we have a supply curve for each kind of labor. So, from unskilled labor up to the highly skilled one we have a whole array of supply curves.

We also have a supply function for males and another one for women. For cultural reasons, women tend to accept lower wages than men for the same job.

Combining both attributes we have a supply function for male unskilled workers, another one for female unskilled workers, and so on.

Finally, jobs differ in the degree they attract people to them. There are pleasant jobs and unpleasant ones. People will demand higher wages for unpleasant jobs. So, we have a supply curve for pleasant jobs and another one for unpleasant ones.

We have so different labor submarkets in each of which the intersection of demand and supply determines the equilibrium wage.

So, for submarket i , we have

$$D_i = f(W_i, E_i, Sp_i, Ex_i, Sz_i, G_i) \text{ and}$$

$$S_i = g(W_i)$$

Let us suppose that both functions have the form of a Cobb-Douglas¹, i.e.:

$$D = a W^\beta E^\gamma Sp^\delta Ex^\epsilon Sz^\zeta G^\eta$$

$$S = \chi W^\tau$$

The market will clear when

$$D = S$$

That is

$$a W^\beta E^\gamma Sp^\delta Ex^\epsilon Sz^\zeta G^\eta = \chi W^\tau$$

¹ We omit the sub index i for the sake of simplicity in notation

which may be rewritten as

$$W^{1-\beta} = \underline{a} E^\gamma Sp^\delta Ex^\epsilon Sz^\zeta G^\eta$$
$$X$$

taking logs of both sides, gives

$$(\tau - \beta) \log W = \log \underline{a} + \gamma \log E + \delta \log Sp + \epsilon \log Ex + \zeta \log Sz + \eta \log G$$
$$X$$

which, with appropriate transformations, may be written as

$$\log W = \pi + \rho \log E + \varsigma \log Sp + \sigma \log Ex + \upsilon \log Sz + \wp \log G \quad (1)$$

which is a linear equation in logarithms.

The least-squares estimators of the coefficients can be used to predict the value of $\log W$, and hence of W , for different values of the independent variables.

4 The Mincer earnings function²

Another approach is the one developed by Jacob Mincer (1958, 1974). He was the first to derive an empirical formulation of earnings over the lifecycle.

His model is based on the theory of human capital. Mincer's model assumes that individuals work fully over their lifetime and that they know (with certainty) how many years they will work over their lifetime.

Individuals accumulate skills by spending a fraction s of their available time learning those skills.

² This section is based on Solomon W. Polachek. Earnings Over the Lifecycle: The Mincer Earnings Function and Its Applications .Discussion Paper, IZA DP No. 3181, November 2007.

Accordingly, they seek to maximize the present value of lifetime earnings by appropriately choosing the time they spend investing in human capital.

If $K(t)$ is human capital stock at time t ; and w is the rental rate (or wage) per unit of human capital; then $wK(t)$ represents one's potential (though not necessarily actual) earnings.

Actual earnings (the pay cheque one actually receives) are potential earnings $[wK(t)]$ minus investment costs³ $s(t)wK(t)$ where $s(t)$ is the time spent in period t investing in human capital, i.e.:

$$W(t) = [1-s(t)] w K(t)$$

the model assumes the rental rate per unit of human capital w to be exogenously fixed over one's entire lifetime. Indeed how the human capital rental rate (w) is determined is

neglected in the human capital literature.

In Mincer's formulation, at any point (t) in an individual's lifetime, observed earnings $W(t)$ can be depicted as a concave function of one's labor market experience.

Assuming that the schooling phase of investment lasts S years and that on-the-job

training declines linearly over the lifecycle, log-earnings are a quadratic function of labor market experience:

$$\ln W_i(t) = a_0 + a_1 S_i + a_2 t_i + a_3 t_i^2 + \epsilon_i$$

Here a_0 is related to initial earnings capacity, a_1 is the rate of return to education (assuming all schooling costs are opportunity costs), and a_2 and a_3 are related to both the amount and the financial return to on-the-job training.

Equation (4) is often referred to as the Mincer earnings function⁴.

Nowadays most earnings functions include numerous supplementary variables in addition to the schooling and potential experience terms used by Mincer. These include race, gender, regional dummy categorical variables, health status, ethnicity, marital

³ For the sake of simplicity it is assumed that investments costs are opportunity costs.

⁴ For the derivation of Mincer earnings function, see Polachek, *op. cit.* pp. 14-18.

status, children, union membership, city size, and numerous other variables. They essentially shift the earnings function upward or downward depending on sign.

5 The WageIndicator salary checker

A type of Mincer earnings function is used in the estimations of the WageIndicator salary checker.

Instead of equation (1), we use, following Mincer's formulation, the following one:

$$\log W = \pi' + \rho' E + \zeta' Sp + \sigma' Ex + \nu' Sz + \varphi' G$$

where the coefficients are no longer elasticities as in (1) but semi-elasticities, i.e.

$$\frac{d \log (W)}{dE} = \rho'$$

where ρ' measures the proportional change in W when E changes in one unit.
