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An Application of the Efficiency-Wage Hypothesis to the Modelling of LDC Labour Problems: A Comment*

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This paper attempts to correct the errors appearing in Ezeala-Harrison's (1988) analysis regarding the determination of wages and employment in the efficiency wage model. The corrections include: (i) regardless of the output market stuructures and output demand elasticities, the combination of labor employed and wage offer, which safisfy both marginal profit of labor and marginal profit of wage equal to zero, difinitely has a negative relation; (ii) there is no labor demand curve in the efficiency wage model; (iii) the efficiency wage is solely determined by the effort function; (iv) the efficency wage model cannot deal with the situation where the effort put forth by the labor has nothing to do with the wage.

I. Introduction

Some studies [e.g., Blaug (1973) and Fields (1974)] have observed that wage rates do not adjust quickly to the market-clearing level, and accordingly result in unemployment as the common consequence in most less developed countries (LDCs). The economists can not find a suitable vehicle to explain the observed wage inflexibility and non-market-clearing phenomena in LDCs until the appearance of the efficiency wage hypothesis (EWH).

The EWH is now regarded as a powerful tool to shed light on the persistence of involuntary unemployment in the labor market [see, for example, Stiglitz (1976), Solow (1979), Salop (1979), Malcomson (1981), Yellen (1984) Lindbeck and Snower (1989).][1] As

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claimed by Malcomson (1981) and Lindbeck and Snower (1989, pp. 62-63), the EWH rests on the following two assumptions: (i) the firm possesses market power in determining the wage offer; (ii) the worker's efforts depend on the real wage they receive. Based on these tenets, the EWH can explain why the firm has an incentive to prevent underbidding the wage offer and why involuntary unemployment is persistent.

In a recetn article published in this *Journal*, Ezeala-Harrison (1988) utilized the EHW to explain the determination of wages employment under different output market structures in LDC labor markets. Although Ezeala-Harrison (1988) has pointed out some observations concerning the application of the EHW to labor markets in the LDCS, there are some serious errors involving the basic concepts of the EHW and the working of the mode. The purpose of this paper does not attempt to exhaust the errors, but just to illustrate some critical mistakes in the Ezeala-Harrison (1988) paper.

The remainder of the paper proceeds as follows. Sections Ⅱ will correctly restate the Ezeala-Harrison (1988) model. Section Ⅲ will illustrate some errors in Ezeala-Harrison (1988) and discuss how his conclusions should be modified. Finally, the concluding remarks are presented in section Ⅳ.

Ⅱ. The Ezeala-Harrison (1988) Model

The Ezeala-Harrison (1988) model can be correctly restated as follows. Define e to be the effort per employee, L the number of employees, W the nominal wage rate. When the general price level is constant, W can also be viewed as the real wage rate.[2] According to the basic tenet of the EWH, the productivity of the employees increases as the real wage received by them is increased. The effort

[1] Among the theories devoted to explaining persistent involuntary unemployment in the labor market, Blinder (1988, p. 290) claims that "The simplest, and to me the most appealing of these, is the efficiency wage model. It also seems to accord best with common sense."

[2] There are two kinds of model specification which represent different economic meaning but lead to the same outcome. One is that the firm is a representative one of a certain industry, the other is that the firm is a representative one of the whole economy. In the former case, the output price of the industry has a small proportion related to the general price of the whole economy, and the firm should treat the general price as an exogeneous variable. In the latter case, the output price of the firm is the general price, and should be regarded as an endogenous variable. Following the Ezeala-Harrison (1988) analysis, we adopt the former specification. In the Appendix, it is shown that both specifications will lead to the same result.

function thus can be expressed as:

(1) $e = e(W);\ e' > 0,\ e'' < 0,$

The representative firm of an industry has a short-run effort-augmented production function:

(2) $Q = Q[Le\ (W)];\ Q' > 0,\ Q'' < 0.$

The objective of the firm is to choose L and W so as to maximize profits, Π, which equals excess revenue over factor cost:

(3) $\max\ \Pi = p(Q)Q - WL,$

where $p(Q)$ is the output price of the industry, and $p' = 0$ under perfect competition, $p' < 0$ otherwise.

The first-order condition for equation (3) are:

(4) $\Pi_L = (p + p'Q)\ Q'e - W = 0,$
(5) $\Pi_W = (p + p'Q)\ Q'eL - L = 0,$
Rearranging the first-order conditions we have:

(6) $e'(W)\ \dfrac{W}{e(W)} = 1.$

Equation (6) is the well-known "Solow condition" in the efficiency wage literature.[3] It implies that the firm should set the wage rate such that the elasticity of effort with respect to the real wage rate is unity. The solution is also known as the efficiency wage" since it is the wage" rate that minimizes labor costs per efficiency unit of labor.

The results reported in equations (4), (5), and (6) can be illustrated graphically. In Figure 1 the LL curve depicts all combinations of L and W that keep the marginal revenue product of L eqaul the marginal cost of L, and the SS curve represents the pairs of L and W that satisfy the Solow condition. It is clear from equations (4) and (6) that the slopes of LL and SS are:

$$(7)\ \left.\frac{dW}{dL}\right|_{LL} = -\frac{e^2[2p' + p''Q)(Q')^2 + (p+p'Q)Q'']}{ee'L[(2p'+p''Q)(Q')^2 + (p+p'Q)Q'']+[(p+p'Q)Q'e'-1]}$$

[3] The Solow condition is named by Akerlof and Yallen (1986, p. 3). Recently, the Solow condition is challenged in a variety of ways. Among the literature, Schmidt-Srensen (1990) introduces fixed employment costs, Pisauro (1991) incorporates a specific tax on labor, and Lin and Lai (1994) take into account turnover costs of labor.

$$= - \frac{e}{e' L} < 0 \text{ [by equation (5)]},$$

(8) $$\left.\frac{dW}{dL}\right|_{SS} = 0.$$

As is evident in Figure 1, the *SS* curve (the Solow condition) solely determines the efficiency wage rate W^*. Combining the *SS* curve and the *LL* curve, we can further determine the employment L^*. It is clear that the determination of the efficiency wage and the slope of the *LL* curve are independent of the output market structures as well as output demand elasticities. As a consequence, even though Ezeala-Harrison (1988) explicitly formulates different structures of output market, his results are the same as those of the rudimentary efficiency wage model in Yellen (1984).

Ⅲ. Some Comments

We are now ready to point out several serious errors in the Ezeala-Harrison (1988) paper.

A. $\frac{dW}{dL}$ Is Definitely Negative No Matter What the Output Market Structure Is

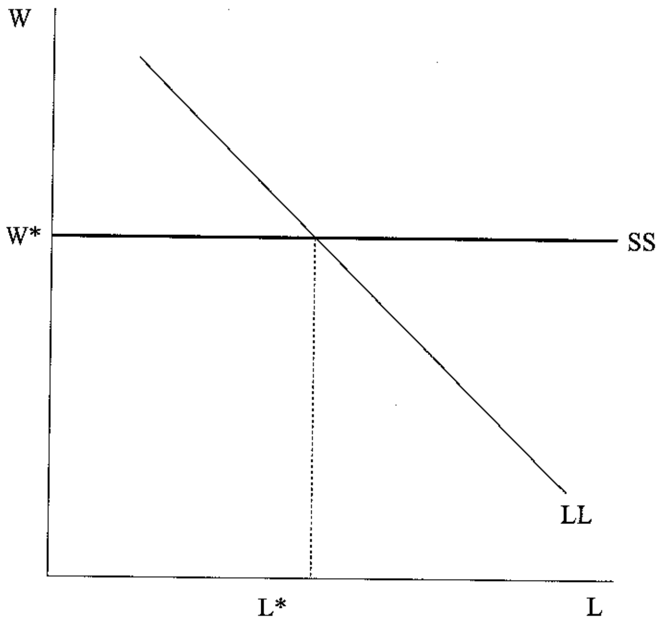
Ezeala-Harrison (1988) treats $\frac{dW}{dL}$ as the inverse slope of the labor demand curve of a representative firm.[4] He then shows that the sign of $\frac{dW}{dL}$ is "not unequivocally negative" in the case of perfect competition (p. 79), and "indeterminate" in the case of imperfect competition (p. 82). In effect, $\frac{dW}{dL}$ is the slope of the *LL* curve in Figure 1. It traces the locus of *L* and *W* that keeps the marginal profit of *L* and of *W* equal to zero, rather than the inverse slope of the labor demand curve. As shown in equation (7), the sign of $\frac{dW}{dL}$, which meets the conditions $\Pi_L = 0$ and $\Pi_W = 0$, is definitely negative no matter what the output market structures and demand elasticities are.[5]

B. There is No Labor Demand Curve in the Efficiency Wage Model.

[4] In effect, the firm does not have a labor demand schedule. Comment B provides a detailed explnation.

[5] In fact, Ezeala-Harrison (1988) can also derive the result $\frac{dW}{dL} = -\frac{e}{e' L} < 0$ if he

Figure 1



It is the basic knowledge in microeconomics textbooks that a monopolistic firm does not have a output supply curve. Landsburg (1992) gives this result an excellent explanation: 'Where is the monopolist's supply curve? Points on the supply curve answer questions such as "How much would you produce at a going market

correctly simplifies his expression. In the case of perfect competition p′ = 0, substituting the relation $pQ'e' = 1$ stated in equation (3b) into the expression displayed at lint 17 on page 79:

$$\frac{dW}{dL} = \frac{pQ''e^2}{1\text{-}pe'\ (eQ''L+Q'),}$$

we have:

$$\frac{dW}{dL} = -\frac{e}{e'L} < 0.$$

In the case of imperfect competition p′ < 0, Ezeala-Harrison's (1988) equation (3b) indicates that:

$$pQ'e' + Qp'Q'e' = 1.$$

Ezeala-Harriso (1988) defines $\eta = \frac{p}{p'Q}$ and $\phi = \frac{1+\eta}{\eta}$, the above equation then can be rewritten as:

$$pQ'e'(1+\frac{p'Q}{p}) = pQ'e'(1+\frac{1}{\eta}) = pQ'e'\phi{=}1.$$

Substituting the above result into his equation (10) and rearranging the terms, we obtain:

$$\frac{dW}{dL} = \frac{e^2\phi[pQ''+p'(Q')^2]}{1-\phi pe'Q\text{-}ee'L\phi[pQ''+p'(Q')^2]} = -\frac{e}{e'L} < 0.$$

price of $1?" and "How much would you produce at a going market price of $2?" and so on. These are questions that a monopolist is never asked, because he never faces a going market price. The price is a consequence of the monopolist's actions, rather than a datum to which he must react. Therefore, a monopolist has no supply curve; a supply curve presumes the existence of a goint market price.' (p. 344) For the same reasoning, we can conclude that there is no labor demand curve for a firm in the efficiency wage model. As indicated in equations (4) and (5), both L and W are simultaneouly determined by the firm. The wage rate thus is the consequence of the firm's decision, rather than an datum to which it must face. On this account, the firm does not have a labor demand curve in the efficiency wage model. Consequently, it does not make sense to discuss the slope of labor demand curve in Ezeala-Harrison (1988).

C. The Efficiency Wage is Solely Determined by the Effort Function.

It is clear from the Solow condition [equation (6) or equation (3c) in Ezeala-Harrison (1988)] that the efficiency wage rate is solely determined by the effort function. This result implies that the efficiency wage is independent of the production technology, the output market structures, and the output demand elasticities. We can explicitly solve the efficiency wage if and only if the effort function is explicitly specified. We thus can conclude that the Ezeala-Harrison (1988) analysis about the determination of efficiency wage under different market structures is meaningless.

D. The Case $e'(W) = 0$ is Not a Special Case of EWH.

Ezeala-Harrison (1988) considers the situation where $e' = 0$ and $e = 1$ as a special case of EWH. Given $e'=0$ and $e=1$, the condition of the firm's power on the optimal wage setting [equation (5)] reduces to:

(5a) $\Pi_W = -L < 0.$

Equation (5a) implies that the firm will set the efficiency wage equal to zero (i.e., the firm will choose a corner solution) as L must be a positive value for any meaningful analysis.

Substituting $e = 1$ and $W = 0$ into equation (4) we have:

(4a) $\Pi_L = (p + p'Q)\,Q' > 0.$

It implies that the optimal labor employed should be positively infinite. As the outcomes $W=0$ and $L\rightarrow\ \infty$ are definitely a meaningless solution, $e'=0$ and $e=1$ thus cannot coexist with the EWH.

The analysis can be operated in the *traditional* derivation of the labor hired when $e'=0$ and $e=1$. Under this situation, the firm only chooses the labor employed given the wage rate is set at a fixed level.[6]

Ⅳ. Concluding Remarks

By using the efficiency wage model, Ezeala-Harrison (1988) attempts to explain the determination of wages and employment under different output market structures in the LDCs. In this comment, we have pointed out that there are some errors in the Ezeala-Harrison (1988) work. Based on our analysis, four points should be noticed in his article:

(i) In the efficiency wage model, the labor employed and wage offer, which simultaneously keep the marginal profit of labor and that of wage equal to zero, definitely display a negative relation, no matter what the output market structure and output demand elasticities are.

(ii) In the efficiency wage world, the firm does not have a labor demand curve.

(iii) The efficiency wage is solely determined by the effort function.

(iv) The case where the effort put forth by the labor has nothing to do with the wage is not a special situation of EWH.

Appendix

If the firm is a representative one of the whole economy, the model will be modified as follows:

(A1) $\max\limits_{L,W}\ \Pi = \ p(Q)Q - WL,$

(A2) $Q = Q[Le(\frac{W}{p(Q)})].$

The corresponding first-order conditions are:

(A3) $\Pi_L = (p + p'Q)\,\frac{\partial Q}{\partial L} - W = 0.$

[6] For the difference in determining the labor employed between the efficiency wage model and the traditional model, see Lai (1990).

$$\text{(A4)}\quad \Pi_W = (p + p'Q)\,\frac{\partial Q}{\partial W} - L = 0.$$

It is clear from the production function [equation (A2)] that

$$\text{(A5)}\quad \frac{\partial Q}{\partial L} = Q'e - Q'e'L\frac{W}{p^2}\,p'\,\frac{\partial Q}{\partial L},$$

$$\text{(A6)}\quad \frac{\partial Q}{\partial W} = \frac{1}{p}\,Q'e'L - Q'e'L\frac{W}{p^2}\,p'\frac{\partial Q}{\partial W}.$$

Equations (A5) and (A6) can be respectively rearranged as follows:

$$\text{(A7)}\quad \frac{\partial Q}{\partial L} = \frac{Q'e}{1+Q'e'Lp'\,\frac{W}{p^2}},$$

$$\text{(A8)}\quad \frac{\partial Q}{\partial W} = \frac{Q'e'L}{p+Q'e'Lp'\,\frac{W}{p}}$$

Substituting equation (A7) into (A3) and (A8) into (A4), we have

$$\text{(A9)}\quad e'\left(\frac{W}{p}\right)\frac{W/p}{e(W/p)} = 1.$$

Equation (A9) confirms that, if the frim is a representative one of the whole economy, the Solow conditions is valid still.

References

Akerlof, G. A. and J. L. Yellen, *Efficiency Wage Models of the Labor Market*, Cambridge University Press, Cambridge, 1986.

Blaugm M., *Education and the Employment Problem in Developing Countries,* International Labour Office, Geneva, 1973.

Blinder, A. S., "The Fall and Rise of Keynesian Economics," *Economic Record*, 65, Dec., 1988, 278-294.

Ezeala-Harrison, F., "An Application of the Efficiency-Wage Hypothesis to the Modelling of LDC Labour Problems," *Journal of Economic Development*, 13, June, 1988, 71-94.

Fields, G. S., "The Private Demand for Education in Relation to Labour Market Conditions in Less Developed Countries," *Economic Journal*, 84, Dec., 1974, 906-925.

Lai, C. C., "Efficiency Wages and Currency Devaluation," *Economics Letters*, 33, Aug., 1990, 353-357.

Landsburg, S. E., *Price Theory and Application,* 2nd Edition, Dryden Press, Orlando, 1992.

Lin, C. C. and C. C. Lai, "The Turnover Costs and the Solow Condition in an Efficiency Wage Model with Intertemporal Optimization," *Economics Letters,* 45, Aug., 1994, 501-505.

Lindbeck, A. and D. J. Snower, *The Insider-Outsider Theory of Employment and Unemployment,* The MIT Press, cambridge, Mass., 1989.

Malcomson, J. M., "Unemployment and the Efficiency Wage Hypothesis," *Economic Journal,* 91, Dec., 1981, 848-866.

Pisauro, G., "The Effect of Taxes on Labour in Efficiency Wage Models," *Journal of Public Economics,* 46, Dec., 1991, 329-345.

Salop, S. C., "A Model of the Natural Rate of Unemployment," *American Economic Review,* 69. Mar., 1979, 117-125.

Schmidt-Srensen, J. B., "The Equilibrium-Wage Elasticity in Efficiency-Wage Models," *Economics Letters*, 32, Apr., 1990, 365-369.

Solow, R. A., "Another Possible Source of Wage Stickiness," *Journal of Macroeconomics*, 1, Winter 1979, 79-82.

Stiglitz, J., "The Efficiency Wage Hypothesis, Surplus Labor, and the Distribution of Income in L.D.C.s," *Oxford Economic Papers,* 28, July, 1976, 185-207.

Yellen, J. L., "Efficiency Wage Models of Employment," *American Economic Review Proceeding* 74, May, 1984, 200-205.