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EMPLOYER-INITIATED JOB TERMINATIONS

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ABSTRACT

Recent interest in pension reform and mandatory retirement has led to questions concerning the productivity of the older workers who are being eased out of the labor markets. Specifically, are these older workers more or less productive than their replacements? This paper applies standard neoclassical analysis to deduce the shape of the older worker's productivity profile when he or she is terminated. I conclude that older workers may be terminated before they reach their peak productivity years. This is more likely to happen if turnover costs are small or wage profiles are relatively steep compared to productivity profiles.

Employer-Initiated Job Terminations

Recent interest in pension reform and mandatory retirement has led to a considerable body of literature on job separation. The analysis has, however, focused primarily on the employee's reasons for, and reaction to, job separation. Much less attention has been paid to the theoretical factors influencing the employer's decision to terminate a person's employment.[1]

Much of the debate centers on questions concerning the productivity of older workers. Representatives of the elderly not only argue that members of their constituency want to continue to work but that they are highly productive. The implication is that if employers terminate older workers it must reflect employer discrimination against equal productive but older workers. Others argue that the case for age discrimination is weak. Competitive markets would lead to nondiscriminating firms driving out the discriminatory firms. (See Becker (1957)). Furthermore, since employers will someday become old they are less likely to discriminate on the basis of age than other factors such as race or sex. The implication is that if older workers are being terminated this must reflect that their productivities have dropped below their wages.

This paper deduces the relationship between productivities and wages paid by a nondiscriminatory employer who terminates older workers. The analysis yields answers to the following types of questions.

At what point will a firm decide to terminate the employment of a person embodying the employer's investment in specific training? If productivities vary with age, how does the productivity of an older (terminated) worker compare with that of a younger worker?--have older workers passed their peak productivity years?

The model developed shows that the employer's behavior depends crucially on two factors: (1) the size of turnover costs; and (2) the shape of the worker's wage and productivity profiles.

That turnover costs may be large and have a substantial impact on creating a lasting employment relationship has long been recognized.[2] Recent labor market analysis has shown that once firm attachment is introduced, wage and productivity profiles may follow different paths over a person's work life. There are at least three theoretical reasons to believe that workers are systematically underpaid in early years and overpaid in later years. Becker (1964) and Cymrot (1977) suggest that part of labor's payment takes the form of pensions which are not immediately vested to induce the employee to stay with the firm. Lazear (1979) offers an alternative explanation: employers withhold payment until late in the worker's life as ransom against the worker shirking or cheating the firm. Through competitive labor markets, the worker ends up sharing in the gains from the delayed payment. Finally, Freeman (1977) suggests that firms offer wages below productivities to young workers in order to generate a net surplus which the firm uses to overcompensate highly productive older workers. What all these models suggest is that market forces may yield equilibrium wage profiles which differ from productivity profiles.

Given turnover costs and differences between wages and productivity profiles, when is it advantageous for an employer to terminate an employee who embodies specific training?[3] Employers hire workers and in return get labor services which, along with other inputs such as capital, produce output. I assume that firms want to maximize the amount of labor service flow they receive for any given expenditure on labor. The question facing the employer is whether it is better to replace older workers, possibly before their productivities start to decline, or whether it is better to lower turnover costs by keeping workers a longer period of time.

The questions facing the firm are readily translated into standard neoclassical concepts. I assume that the firm wants to operate on its lowest average cost curve. The usual question asked is how firms mix labor and other inputs to maximize production, given their budget constraints. But there is a prior question, and that is the one that I ask: How do firms set termination policies so as to maximize labor service flow, given a labor cost constraint? The technique that I apply is to derive isoquants (which show combinations of termination ages and number of workers) yielding equal amounts of labor service flow. Tangencies of these isoquants with the labor cost constraints yield the desired termination age and minimum entry requirement.

1. THE MODEL

An employee's productivity is summarized in his or her age productivity profile. Productivity is a function of worker quality, which gives the position of the profile, and the worker's age, which determines the point on the profile.

Employers attempt to maximize labor service flow for any given labor cost by adjusting two variables: the termination age, t, and the number of workers, N. These variables determine a labor cost budget constraint and a set of isoquants which define the tradeoff between hiring many workers for short periods of time or fewer workers for longer periods in order to generate the same amount of labor service flow. Tangencies of these budget constraints and isoquants determine points on the lowest average labor cost curve. The shape of the two functions and the factors which shift the functions will be explored.

The analysis does not assume profit maximization. It will be shown that all firms which operate on their lowest cost curves will follow the same termination policy. In the special case of profit maximization, the firm will follow (in addition to the rules set out in this paper) the rule that marginal revenue products and marginal labor costs must be equal. This will be achieved by buying more labor service flow, that is, by shifting the budget constraint until the marginal revenue product is driven down to the wage. The parallel with standard production theory is straightforward. I give the necessary conditions for finding the lowest cost curve. Equalizing marginal factor costs and productivities determines the profit maximizing point.[4]

In the following sections I describe the key functions underlying the model and give a heuristic explanation of the results.

2. NOTATION

The employer starts with a pool of applicants who differ in the number of years they would want to stay with the firm if all terminations were voluntary. A(a) is the proportion of employees who would be age a or less if all terminations were voluntary. A'(a)/A(t) is, therefore, the proportion of employees of age a once the termination age has been set at t.

3. LABOR SERVICE FLOW

The yearly labor service flow (i.e., labor productivity) of workers of age a is y(a). The average productivity of the work force is the weighted average of individual productivities, where the weights are given by the proportion of people at each age:

$$\bar{y}(t) = \int_{a_o}^{t} y(a) \frac{A'(a)}{A(t)} da \qquad (1)$$

where a_o is the entry level age.[6] Note that $\bar{y}$ is a function of t, a decision parameter. Total labor service flow, TY, is given by

$$TY(N, t) = N \cdot \bar{y}(t). \qquad (2)$$

Setting the total differential of equation 2 equal to zero gives the equation for the isoquant (showing equal quantities of labor service flow) in terms of N, and t:

$$0 = \frac{\partial TY}{\partial N} dN + \frac{\partial TY}{\partial t} dt. \qquad (3)$$

Taking the appropriate derivatives of equation (2) yields

$$0 = \bar{y}\ (t) dN + N \left\{ \frac{A'(t)}{A(t)} \left[y(t)\ - \bar{y}(t) \right] dt \right\}, \qquad (4)$$

where y(t) is the productivity of terminal year workers. Solving equation (4) for dN/dt yields the slope of the isoquant, showing the tradeoff between the termination date and the number of workers necessary to generate a constant amount of labor service flow:

$$\frac{dN}{dt} = - \frac{\left[y\ (t)\ - \bar{y}(t) \right] \cdot \frac{A'(t)}{A(t)} \cdot N}{\bar{y}(t)} . \qquad (5)$$

As long as yearly productivity in the terminal year--that is, y(t)--is greater than the average lifetime productivity, $\bar{y}(t)$, the slope of the isoquant is negative.

Figure 1 illustrates the relationship described in equation (5). Figure 1a shows the total (lifetime) labor service flow generated by a worker who is with the firm for a years. The slope representes the worker's yearly productivity at each age, y(a). It reaches a peak at a_{yp}. The slope of the ray from the origin represents the worker's average productivity over all the years he or she has been with the firm, $\bar{y}(a)$. It reaches a peak at a_{1p}. The two slopes are shown in figure 1b. Equation (5) shows that the isoquant between N and t, shown in figure 1c, reaches

$$\int_{a_o}^{a} y(x)\, dx$$

Figure 1a

Total lifetime productivity:

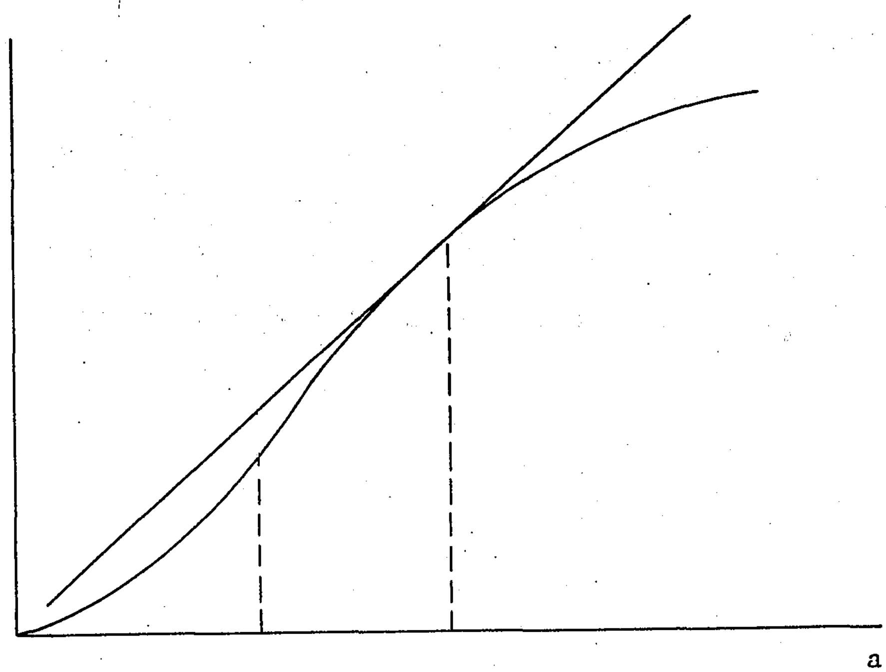


Figure 1b

Yearly and average lifetime productivity

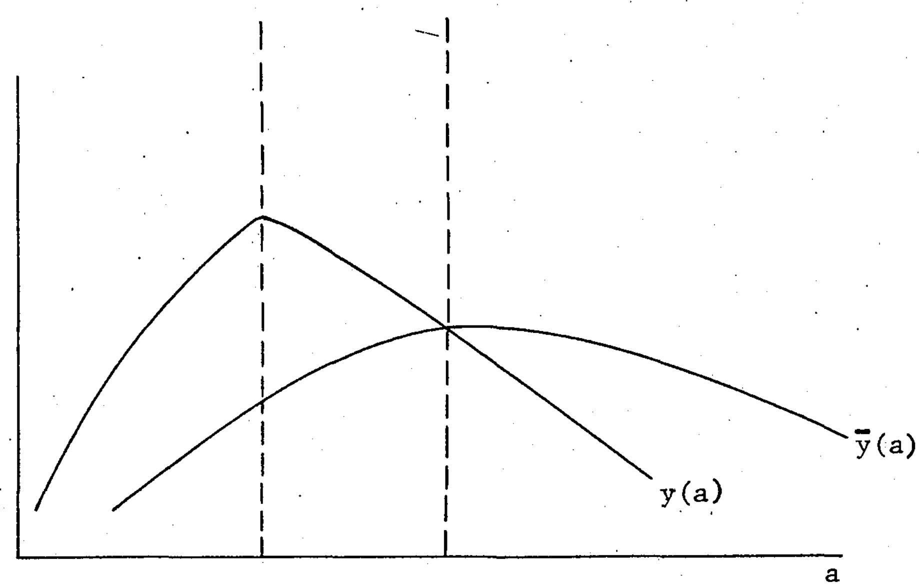
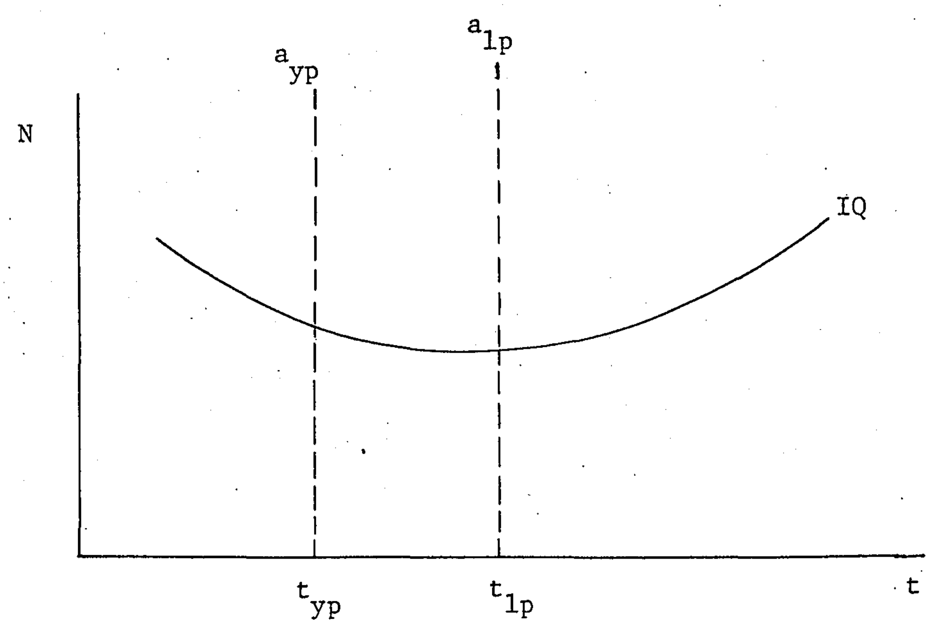


Figure 1c

Isoquant



a minimum when the worker's yearly productivity falls back to his or her lifetime average productivity. This makes intuitive sense since, if labor service flow is to stay constant along the isoquant, extending a person of below average productivity one more year would require an increase in N to counteract the decreased productivity.

4. COSTS

The firm must also consider wage and turnover cost in determining the optimal N and t. These are analyzed in turn.

Wage Bill

Wages are assumed to vary with the firm's termination policy as well as the worker's age--employees may demand a premium to work in a firm with an early termination age. The profile of wages is given by w(a, t) and the resulting average wage paid to all employees is

$$\bar{w}(t) = \int_{a_o}^{t} w(a, t) \frac{A'(a)}{A(t)} da, \tag{6}$$

The total wage bill is therefore

$$TW(N, t) = N \cdot \bar{w}(t). \tag{7}$$

Turnover Costs

Termination costs, T, and costs of hiring and training qualified workers, H, make up total turnover costs, TU:

$$TU(N, t) = T(N, t) + H(N, t). \tag{8}$$

It is assumed that the costs of voluntary terminations, which include the cost of non-vested pensions and any other separation costs (such as gold watches) are lower than the costs of involuntary terminations. The latter would include litigation costs if the termination were contested, and indirect costs caused by decreased employee morale. The average termination costs, g(t), therefore, decrease with the termination age, as the proportion of terminations which are voluntary can only increase with age.

The proportion of the workforce terminated in every year, R(t), also decreases with the termination age--in the extreme, if all employees were terminated at the end of one year, R(t) would be equal to one.

The termination costs are therefore

$$T(N,t) = R(t) \cdot N \cdot g(t). \tag{9}$$

Termination costs clearly decline with increases in t.

Finally, hiring and specific training costs are h per new employee. Total hiring costs are therefore

$$H(N, t) = R(t) \cdot N \cdot h \tag{10}$$

Substituting equations (9) and (10) into (8) and differentiating yields

$$\frac{\partial TU}{\partial t} = N\left[R'(t)\ (g(t) + h) + R(t)\ g'(t)\right] < 0 \tag{11}$$

This indicates that turnover costs decrease as employers raise the termination age.

Budget Constraint

The constant labor cost budget constraint is obtained by adding equations (7) and (8) to obtain total labor cost and setting its total differential equal to zero:

$$0 = \left\{ \bar{w}(t) + R(t)\ (g(t) + h) \right\} dN + \left\{ N \left[\frac{A'(t)}{A(t)} (\bar{w}^*(t) - \bar{w}(t)) + R'(t)(g(t) + h) + R(t)g'(t) \right] \right\} dt \qquad (13)$$

where $\bar{w}^*$ (t) is

$$\bar{w}^*(t) = w(t,\ t) + \int_{a_0}^{t} A'(a)\ \frac{\partial w(a,\ t)}{\partial t}\, da \qquad (14)$$

This is just the terminal year wage plus an adjustment for the change in the premium necessary to attract workers to a firm with a higher terminal age policy.

The slope of the labor cost constraint is given by:

$$\frac{dN}{dt} = \frac{N \left\{ \left[\frac{A'(t)}{A(t)} (\bar{w}^*(t) - \bar{w}(t)) \right] + \left[R'(t)\ (g(t) + R(t)\ g'(t) \right] \right\}}{\bar{w}(t) + R(t)\ (g(t) + h)} . \qquad (15)$$

The denominator is always positive. By equation (11), the second term within brackets in the numerator in equation (15) is the change in the turnover costs from extending the termination age by one year. It is always negative. The first term in brackets is the difference between the terminal year wage and the average lifetime wage. It is always positive if wages increase with age. Therefore, there are two opposing forces which result from extending the termination age. Turnover costs decline while wage costs increase. Given a fixed budget constraint, the firm can continue to hire more workers by extending the termination date as long as the turnover cost savings are larger than the increased wages.

This is shown in figure 2a where lifetime labor cost is mapped against length of tenure with the firm. The slope of the function shows the yearly labor cost, which depends on the wage rate and the change in turnover cost as fewer workers have to be involuntarily terminated. The slope of the ray from the origin to the function shows the average labor cost per year spent with the firm. Figure 2b shows the yearly labor cost, $c(a, t)$, and the average lifetime labor cost, $\bar{c}(a, t)$. The latter reaches a minimum at a_{1c}. With a given budget constraint, the firm can hire the largest number of worker by terminating employment where the average lifetime labor bill is a minimum. This defines the peak of the budget constraint, drawn in figure 2c.

5. EQUILIBRIUM

Labor service flow per dollar of labor cost is maximized where the isoquant and budget constraint are tangent. Two possible outcomes are shown in figures 3a and 3b. In the first instance, the worker is terminated after the isoquant starts to rise.[8] Referring back to figure 1, one can see that the person is terminated not only after his or her yearly productivity starts to decline (that is, past t_{yp}) but also past the point where yearly productivity is below the expected average lifetime productivity, that is, past t_{1p}. Under these circumstances, it is difficult to give much operational meaning to the statement that terminations initiated by the firm deny employment to highly productive older individuals.[9]

Situations such as the one shown in figure 3a will occur if screening costs are high, voluntary retirements increase rapidly with age, wages do

Figure 2a

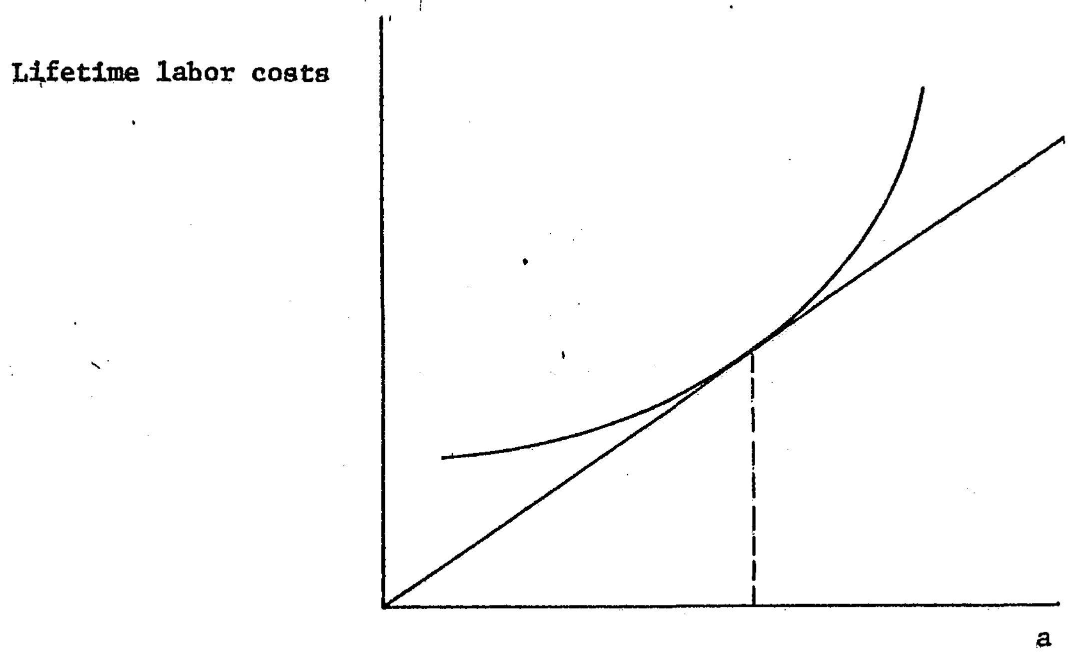


Figure 2b

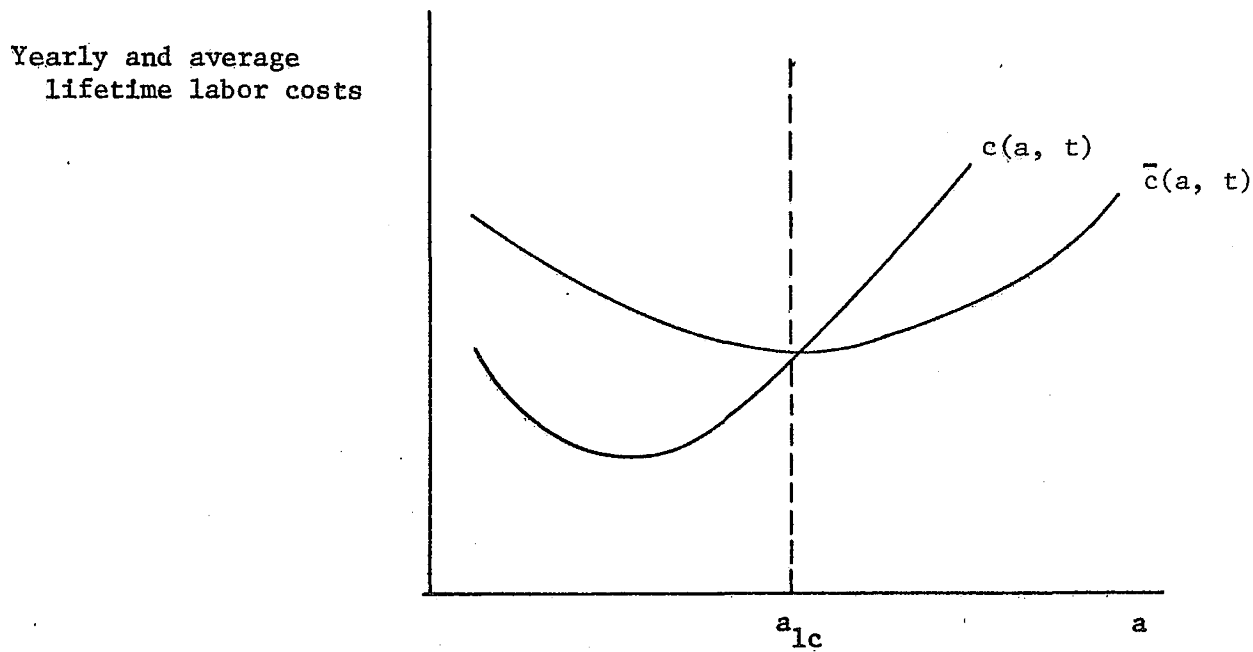
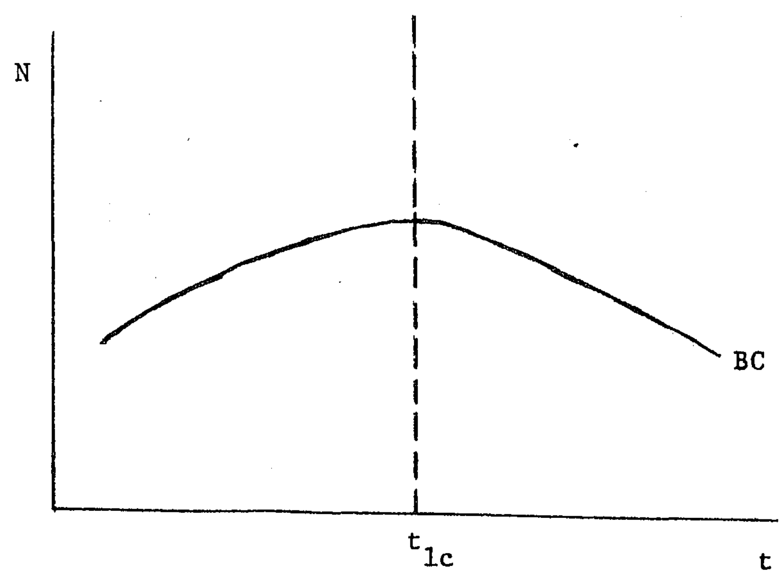


Figure 2c



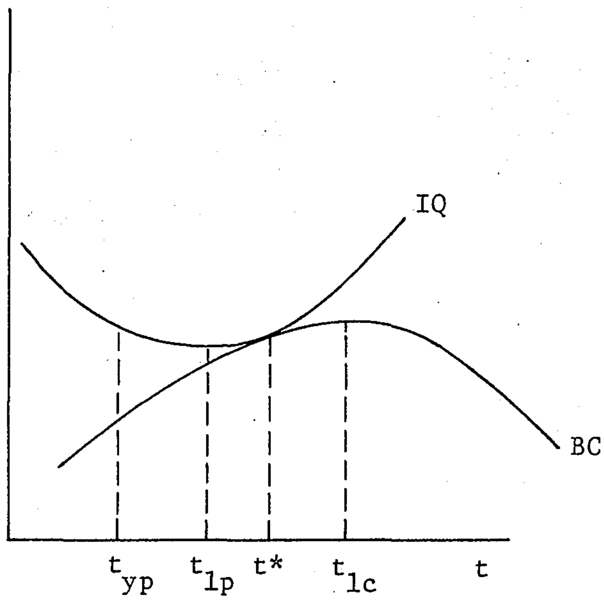


Figure 3a

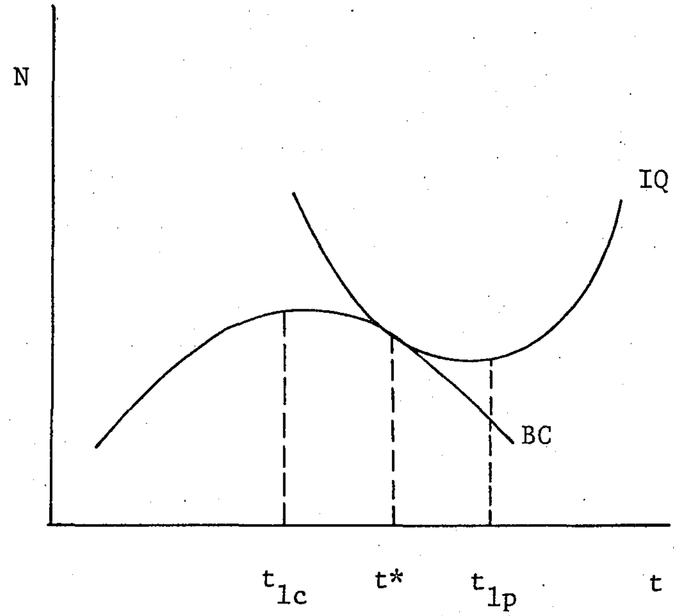


Figure 3b

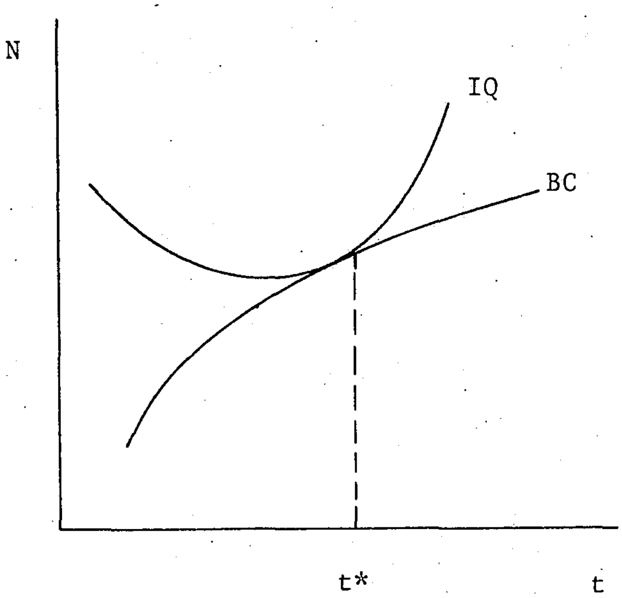


Figure 4a

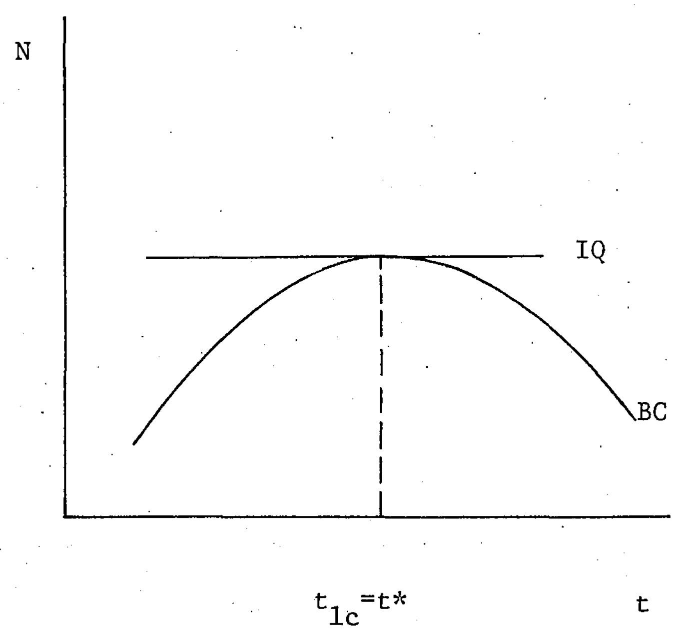


Figure 4b

not rise rapidly, or productivity does not decline rapidly with age. All these tend to raise the cost minimizing separation age.

Figure 3b shows the result of the opposite set of conditions. In this case, workers are terminated before they reach their peak lifetime productivity, t_{1p}. This results from the fact that costs of extending employment by a year increase faster than the resulting increase in productivity.[10]

An important point to note is that the determination of the optimal mix between N and t depends on <u>changes</u> in wages plus turnover costs and productivities, not on their level. Upon reflection, this makes intuitive sense. The level of these two variables determines the cost of labor, while the changes in these variables indicate whether the cost of labor increases or decreases.

One can gain a better understanding of the model by considering several special cases. I will look at three of these: constant yearly costs; constant yearly productivity; and constant yearly wage to productivity ratio.

If firms paid the same wage to all workers, no matter how long they had been with the firm, and if employees did not demand a compensating wage differential for early termination, then workers would be kept past the point where their average lifetime productivity reached a peak. This is shown in figure 4a, where the budget constraint has a positive slope throughout. Since turnover costs are reduced by replacing a smaller proportion of the work force when t is increased, one can buy more N for any given expenditure on labor. Since the budget constraint has a positive slope, it will be tangent to the rising portion of the isoquant. Hence, people will be kept past their peak production years.

In the second special case, productivity is constant at all ages. The isoquant is, therefore, horizontal as in figure 4b, and the optimal t is at the point where average lifetime labor costs are a minimum. This special case is useful in illustrating that termination is not likely to occur at either maximum average lifetime productivity or minimum average lifetime cost. Also note, once again, that the size of the (constant) productivity does not determine the optimal t; although increasing the level of the productivity would increase productivity without changing the labor cost, it would not change the optimal t.

Finally, consider the case where wages and productivity grow at the same rates. Under these circumstances firms would not terminate an employee involuntarily at any age. Unit labor costs would be at a minimum by allowing all terminations to be voluntary and keeping average job tenure as long as possible to minimize turnover costs.

6. CONCLUSION

Turnover costs make labor a quasi-fixed factor, but differences in the slopes of the wage and productivity profiles may induce the employer to terminate employment before the employee voluntarily retires. Some older workers may indeed be terminated before they reach their peak productivity. The smaller the turnover costs and the larger the difference between the growth in wage and productivity profiles, the more likely the chances of terminating older workers.

NOTES

[1]Employer-initiated termination is a broader concept than simply firing and so may include less authoritarian means such as induced retirement.

[2]For example, see Oi (1962), Becker (1964), and Parsons (1972).

[3]Three other studies deal tangentially with this question. Freeman (1977) asks how employers manipulate wages and termination policies in order to attract workers of high quality. But he does not focus on the impact of aging on productivity and wages; he is concerned only with the employer's reactions as he or she uncovers the worker's (constant) productivity. His analysis is most relevant to workers early in their careers. Lazear (1978) builds on the notion that employees and employers will both benefit if wages are below productivities in early years and above in later years. His analysis, however, takes the termination date as exogenously given. Medoff and Abram (1980a) give empirical evidence that older workers are overpaid and younger workers are underpaid. They argue that this causes older workers to be laid off unless the employees are protected under an explicit or implicit contract (See Medoff and Abram (1980b)). They focus on short run cyclical changes in employment while the model developed in this paper determines the "normal" termination age of a firm with steady demand.

[4]For simplicity's sake, I assume throughout this paper that the number of workers being terminated, and hence being replaced, each year does not change over time. This clarifying assumption is, however, not crucial. If job terminations come in lumps, possibly due to a small work force, the firm

fn 4 cont.

will have varying wage bills, termination costs, and productivities for different years. To discount for differences in timing of costs and revenues, the firm would calculate present discounted values of each. The symbols for these variables would be defined in terms of present discounted values and the analysis would go through unchanged.

5 Employers are assumed to face given lifetime wage and productivity profiles for newly hired worked. This is analogous to given production functions and factor prices in standard static neoclassical analysis.

6 The distinction between chronological age and years with the firm is ignored in the simple model. I also assume that all people enter at age a_o. Both assumptions could be relaxed.

7 This may include the net loss from hiring a person during a probationary period.

8 The question arises why market forces don't alter the shape of the wage profile to insure that no worker is involuntarily terminated. One answer, given by Lazear (1978), is that a mutually beneficial contract may require a termination date. An alternative explanation is that all workers do not have the same preferences about when to retire voluntarily. This heterogeneity in tastes and the constraint that all workers of the same quality must have the same wage profile insures that some workers will be terminated involuntarily.

9 Note that older workers might even be kept if their productivites drop below the first year production of new workers.

10 Note that peak yearly productivity may occur before or after t^*.

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