

Comment W. Kip Viscusi

Several recent analyses have documented the effects of age and firm-specific experience on worker turnover and unemployment. The principal contribution of the Leighton-Mincer chapter is that it greatly extends our knowledge of both the direction and convexity of these relationships. With the exception of some aberrant age-separation results,¹ the empirical patterns of interest are established quite firmly.

What is less clear is how one should interpret these findings. Most particularly, the age-related decline in worker separations is due largely to the increase in firm-specific experience (tenure) with age, which in turn diminishes turnover. Although the econometric effects are clear-cut, age nevertheless may be important. Workers who are older may be more mature, better motivated, and better matched to appropriate jobs. Even though tenure *per se* may have no substantive impact, these age-related effects would diminish worker turnover, increase the value of the tenure variable, and generate the observed relationship. Indeed, it is impossible to construct any model with age affecting turnover in which tenure also doesn't increase, since lower turnover increases one's firm-specific experience.

The substantive impact of the pivotal tenure variable is difficult to assess. However, as I will note later, excessive attention to this issue may lead one to ignore the primary insight provided by the human capital literature regarding worker turnover.

Search, Experience, and Age

One of the more intriguing findings is the lengthening of the duration of unemployment for older workers. Although this effect may be attributable in part to an adverse selection problem, it may also reflect an important aspect of the employment process. Considerable recent attention has been devoted to job search among alternative wage offers. In reality, workers are choosing among jobs with uncertain implications, such as the likelihood of promotion or being injured. Here I will sketch a simple model which is the first analysis to incorporate both job search among lotteries and adaptive worker behavior once on the job.² A major implication of this framework is that workers may substitute labor market search for on-the-job experimentation as they age. This behavior would generate both the observed relationship between age and the duration of unemployment as well as the higher turnover by youths.

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Consider the following model with three periods and two types of jobs. In each period the worker can choose to remain on his job or search for an alternative job. Search takes one period, is associated with a cost of $-c$ (where c may be negative if the value of leisure exceeds direct search costs), and offers a probability q that a type 1 job will be found and $1 - q$ that a type 2 job will be found.

In every period, each job offers some probability of a successful job outcome with wage w and a probability of an unsuccessful outcome with wage w' , where $w > w'$. Job 2 is preferred since it offers a prior probability of success p_2 , which exceeds the comparable value p_1 for type 1 jobs.³ These independent priors are updated in Bayesian fashion based on experiences with that type of job. Let γ_i be a measure of the worker's prior information for job i . For probabilities belonging to the beta family, the posterior probability of success $p_i(m, n)$ after m successful outcomes and n unsuccessful outcomes on that job type is given by

$$p_i(m, n) = \frac{\gamma_i p_i + m}{\gamma_i + m + n}$$

so that

$$\frac{\partial p_i(1, 0)}{\partial \gamma_i} < 0 \text{ and } \frac{\partial p_i(0, 1)}{\partial \gamma_i} > 0$$

The final bit of notation is that β is the discount factor.

Several features of the optimal strategy should be noted at the outset.⁴ First, one never leaves an uncertain job after a favorable job outcome. Workers will be motivated to quit and undertake a job search only after unfavorable experiences. Second, since search takes a period of time, it will never be optimal to search in period 3. Searchers in period 2 will accept whatever job is generated by their search in that period since continued search will be unattractive. Third, workers will never leave a job because of an adverse experience after period 1. The period required by search makes quitting followed by subsequent search unproductive after the initial period. In short, search may be optimal in periods 1 and 2, whereas on-the-job experimentation may only be optimal in period 1. Time horizon effects create a bias toward search as opposed to on-the-job experimentation as the worker ages. The analysis below will focus on other age-related effects that reinforce this pattern.

Suppose the worker has the option of choosing between job 1 or job search with three periods remaining. Utilizing the above results regarding the nature of behavior, the value V' of job 1 is given below.

$$\begin{aligned} V' = & [p_1 w + (1 - p_1)w'] + \beta p_1 [p_1(1, 0)w \\ & + (1 - p_1(1, 0))w'](1 + \beta) \\ & + (1 - p_1)\beta \text{ Max } \{[p_1(0, 1)w \end{aligned}$$

$$\begin{aligned}
 &+ (1 - p_1(1, 0))w'](1 + \beta), \\
 &- c + q\beta[p_1(0, 1)w + (1 - p_1(0, 1))w']
 \end{aligned}$$

where the first bracketed expression is the expected first period reward, the second is the discounted expected reward in periods 2 and 3 following a successful period 1 outcome, and the final term represents the only subsequent decision facing the worker who starts on job 1. Following an unfavorable outcome, the worker must choose whether he will remain on job 1 thereafter or search for an alternative job in period 2. The condition for undertaking a job search simplifies to

$$\begin{aligned}
 (1) \quad p_2w + (1 - p_2)w' &> \frac{c + p_1(0, 1)w + (1 - p_1(0, 1))w'}{\beta(1 - q)} \\
 &+ p_1(0, 1)w + (1 - p_1(0, 1))w'
 \end{aligned}$$

If the worker chooses instead to begin period 1 by searching, the discounted expected value V^s of his choice is given by

$$\begin{aligned}
 V^s = &- c + \beta(1 - q)[p_2w + (1 - p_2)w'](1 + b) \\
 &+ \beta q \text{Max}\{-c + q\beta[p_1w + (1 - p_1)w'] \\
 &+ (1 - q)\beta[p_2w + (1 - p_2)w'], [p_1w \\
 &+ (1 - p_1)w'](1 + \beta)\}
 \end{aligned}$$

where the worker incurs a search cost c , has a probability $(1 - q)$ of finding a job of type 2 for work in periods 2 and 3, and a probability q of finding a type 1 job that he either accepts or rejects in favor of continued search. The unsuccessful searcher will continue his search in period 2 if

$$\begin{aligned}
 (2) \quad p_2w + (1 - p_2)w' &> \frac{c + p_1w + (1 - p_1)w'}{\beta(1 - q)} \\
 &+ p_1w + (1 - p_1)w'
 \end{aligned}$$

Consider the search decision in period 2. Since $p_1(0, 1) < p_1$, the worker is more likely to search after an unfavorable job experience than after search in period 1, as comparison of equations 1 and 2 indicates. Work on the job provides a motivation for additional job search.

A particularly striking feature of equations 1 and 2 is that V^s is independent of the sharpness γ_i of either prior probability, whereas V_1 is independent of γ_i only if the worker will never find it optimal to leave his job, as one can verify by substituting for the beta values of $p_1(0, 1)$ and $p_1(1, 0)$. If job search is preferred to remaining on job 1 after an unfavorable job 1 outcome, then $\partial V^1 / \partial \gamma_1 < 0$. The attractiveness of work on job 1 declines with the precision of the worker's prior beliefs. To the extent that the worker's experiences lead to a sharpening of γ_i with age, the attractiveness of on-the-job experimentation V^1 will be diminished. Abstracting

from the change in one's time horizon with age, there will be an age-related experience effect that diminishes the value of on-the-job experimentation and has no effect on the value of search, so that search will become a relatively more attractive mechanism for finding an optimal job match.

Both the high turnover of youths and the greater longevity of search by older workers are consistent with a hybrid model of search and adaptive behavior. The shortening time horizon with age will diminish the attractiveness of on-the-job experimentation before it makes search unattractive. Moreover, independent of any time horizon effect is the role of worker learning, which enhances the relative value of search as a form of information acquisition and labor market sorting.

Toward a General Theory of Turnover

Leighton and Mincer are quite eclectic in their discussion of the theoretical underpinnings of turnover, utilizing diverse insights from human capital theory, search theory, and sorting and matching theories. A central issue in any analysis is the substantive effect of the tenure variable on separations. Consider two extreme models. In a standard human capital framework, the tenure variable would reflect specific training that enhanced the worker's firm-specific productivity. In a pure sorting model, the worker's productivity may not have been altered with experience, but he is more likely to be matched optimally to a job as his on-the-job experience increases.⁵ Workers who discover that the job match is inappropriate have left the enterprise, and the optimally matched individuals remain.

Although these theories differ sharply in the process generating the tenure effect (training versus a lottery outcome), they share a common feature. Let us define "specific information" as experiences that affect one's probabilistic beliefs, only regarding the attractiveness of work at the firm, while "general information" also affects one's probabilistic beliefs about work elsewhere.⁶ The learning in the adaptive model presented earlier was specific.

Specific information reduces the worker's incentive to quit since subsequent adverse experiences are less likely to diminish the job's attractiveness and lead him to quit. In contrast, general information has an ambiguous effect.⁷ Even favorable experiences may lead to worker turnover since the relative attractiveness of work elsewhere may have increased. Moreover, worker turnover is always greater with general information than specific information. A firm's learning about the worker's productivity is quite similar. The firm is less likely to terminate an employment relationship if it has substantial knowledge about the worker's firm-specific capabilities, whereas knowledge concerning the worker's capabilities elsewhere is irrelevant. Information acquired regarding the pro-

ductivity of other workers in the employment situation may lead to greater termination of the economic matchups by the firm. As with worker learning, turnover is negatively related to the specific information component.

These parallels suggest that the elusive search for a determination of the operative mechanism in the human capital theory may not be the appropriate focus. The theory's primary insight relating to turnover is the importance of specific as opposed to general learning. This distinction plays a pivotal role in pure sorting and adaptive behavior models as well as in analyses of actual training processes.

Notes

1. See, for example, the findings for young black men in tables 8.15 and 8.16.
2. This model extends my earlier work in which a search process was not included as part of the job choice problem. See, for example, *Employment Hazards: An Investigation of Market Performance*, Harvard Economic Studies Series no. 148. Cambridge: Harvard University Press, 1979.
3. The precision of each prior is also assumed to be such that job 2 is preferred. As the discussion below indicates, in the case considered, only the precision γ_1 is of consequence.
4. Many of these properties are formalized in my earlier work cited in n. 2.
5. Sorting models may include specific human capital investment as part of the process, but they need not.
6. This analysis is developed more fully in my paper, "Specific Information, General Information, and Employment Matches under Uncertainty," NBER Working Paper no. 394 (1979).
7. This is the case of interdependent prior beliefs considered in chapter 4 of my *Employment Hazards* volume cited in n. 2.