# *Are chronically unemployed workers less likely to get hired?*

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*Preliminary draft*
*For discussion only*

## *Introduction*

Employers may balk at hiring someone who has long been out of work. Women who can take long family leaves only by quitting their jobs may thus face a hard choice. This note outlines a model for determining whether, in fact, long-unemployed workers are less likely to get hired than other workers.

## *Model*

The model roots in one familiar from probability theory (Feller, 1968, chapter 8). Suppose that a worker may boost significantly her chances of finding work if her record shows α straight months of employment rather than β straight months of unemployment. In this model, α is a threshold. Fewer than α consecutive months of employment will not markedly boost her chances of finding more work. Fewer than β straight months of unemployment will not markedly reduce her chances of finding more work. The model thus describes new workers.

For a new worker, who has not yet built a strong record of employment, the probability of working for another month may be taken as independent of whether or not she had worked in preceding months. Let the probability of employment for another month be $p$. Denote as $x$ the probability that the worker racks up α straight months of employment before accumulating β straight months of unemployment. Denote that event as $A$.

$A$ may occur in either of two ways: The worker is employed in the first month or she is not. Suppose that she is employed for the first month and then achieves $A$. Denote that event as $u$. Suppose now that she is not employed for the first month and yet achieves $A$. Denote that event as $v$. Then the probability of $A$ is

$$x = pu + (1 - p)v.$$

Consider $u$. It may occur in either of two ways: The worker is employed for α-1 straight months more, or she is not. In the latter event, she must have been unemployed for at least one month in the period that extends from Month 2 through Month α. Thus the latter event must occur in one of α-1 ways; each way is characterized by which of the α-1 months of the period is the first of unemployment. The probability that the first month of unemployment occurs in Month $g$ is $p^{g-2}(1-p)$, where $2 \leq g \leq \alpha$. Denote this

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event as $H_g$. Once it occurs, the probability that the worker will nevertheless work for α straight months before being out of work for β straight months is conditional: $P\{A|H_g\}$.

To determine this probability, we may interpret Month $g$ as the first of a new series of months. Since the probability of employment in any month is independent of other months, we may designate the probability that $A$ now occurs, given that the worker was not employed in Month $g$ of the old series, as simply the probability that $A$ occurs given unemployment in Month 1 of the new series. That probability is $v$. Thus $P\{A|H_g\} = v$.

The event $A$, given that the worker works for the first month, is either conditional upon $H_g$ or it is not. Denote the event $A$ given that the worker works for the first month as $A_1$. Then

$$P\{A_1\} \equiv u = P\{A_1 \mid not\ H_g\} + P\{A_1 \mid H_g\}$$
$$= p^{\alpha-1} + \sum_{g=2}^{\alpha} p^{g-2}(1-p)v.$$

Solving the latter term as a geometric sum renders

$$u = p^{\alpha-1} + v[1 - p^{\alpha-1}].$$

The probability $v$, in which the worker is unemployed in the first month, results from a similar calculation. Denote the event $A$ given that the worker does not work in Month 1 as $A_2$. It can occur only if the worker works for at least one month of the first β months. Thus $A_2$ must occur in one of $\beta$-1 ways, where we may characterize each way by the number of the month in which the worker first works. The probability that $A$ occurs, given that the worker first works in month $g$, is $(1-p)^{g-2}pu$. (The use of $u$ arises from the fact that we may treat the first month of employment as also the first of a new series of months, in which the worker achieves $A$.) Then

$$v = \sum_{g=2}^{\beta} (1-p)^{g-2} pu = u[1-(1-p)^{\beta-1}].$$

Using the calculations for $u$ and $v$ renders

$$x = pu + qv$$
$$= (1-v)p^{\alpha-1} + v - (1-p)^{\beta}[(1-v)p^{\alpha-1} + v].$$

One may loosely interpret this equation. The event $A$ may occur in either of two ways. One: The employee worked for α straight months. The probability of that event is included in the term $(1-v)p^{\alpha-1}$. Two: She did not work in the first month but nonetheless worked for α straight months before being out of work for β straight months. The probability of that event is $v$. The last term in the equation subtracts the probability of events in which she was out of work for β straight months before working for α straight months.

Since every month is independent of other months in the period studied by the model, any preceding event like $H_g$ will not affect $x$, the long-run probability of $A$. Thus, $A$ is just as likely in a given period whether or not that period was preceded by a month of unemployment. This suggests that $v = x$. Making that substitution leads to

$$x = \frac{[1-(1-p)^{\beta}]p^{\alpha-1}}{[1-(1-p)^{\beta}]p^{\alpha-1} + (1-p)^{\beta}}.$$

For example, consider a worker within the first three years of her career. Suppose that employers would regard her as reliable if she has worked for a year – or as unreliable if she has remained out of work for two straight years. Then set $\alpha = 12$ and $\beta = 24$. Suppose that the probability of unemployment is twice as high for this entry-level worker as for the United States economy in the late 1990s. Thus set $p = .9$. Then the model implies that it is practically certain that the worker would secure a marked boost in the prospects of employment: $x \approx 1$. One may interpret $x$ as the probability of long-term employment: Having demonstrated that she is a reliable employee, the worker is more likely to obtain a permanent job. (One should define "permanence" here in terms of months.)

Estimates of $x$ exceed .9 for probabilities of immediate employment ($p$) of .4 or higher. Model simulations imply that .4 is a critical minimum, however. For lower values of $p$, $x$ nears 0, implying that the new worker has virtually no chance of procuring long-term work. Moreover, $x$ is sensitive to the length of sustained employment, α. For $\alpha = 15$, $x$ is about one-third. For values of α as great as 17, $x$ drops below one-tenth.

### *Conclusions and reflections*

The model is too simple to provide precise implications for policy. It does suggest this: The probability of permanent employment may be more sensitive to the expectations of employers than to the probability of current employment.

The critical assumption behind the model is that the probability of hiring a worker in one month is independent of hiring in other months. This seems most likely to hold for workers in low-skill jobs in industries accustomed to short cycles of activity, such as construction, retail trade and restaurants. Such firms do not highly value the sustained accumulation of work skills.

An empirical test of the model is whether workers who complete a long stretch of employment early in their careers are less likely to undergo long periods of unemployment later in their careers than are workers who complete only short stretches early in their careers.

*References*

Feller, William. 1968. *An introduction to probability theory and its applications.* Volume I, third edition revised, New York: John Wiley & Sons.