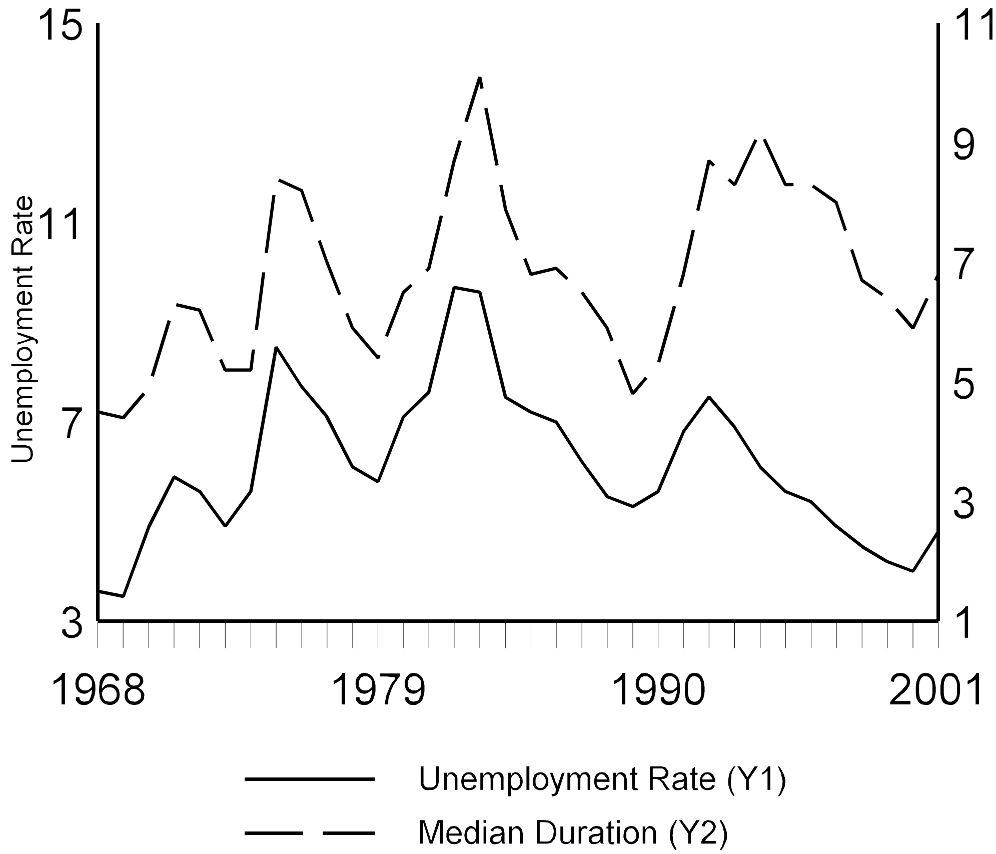
# Unemployment and Job Search Theory

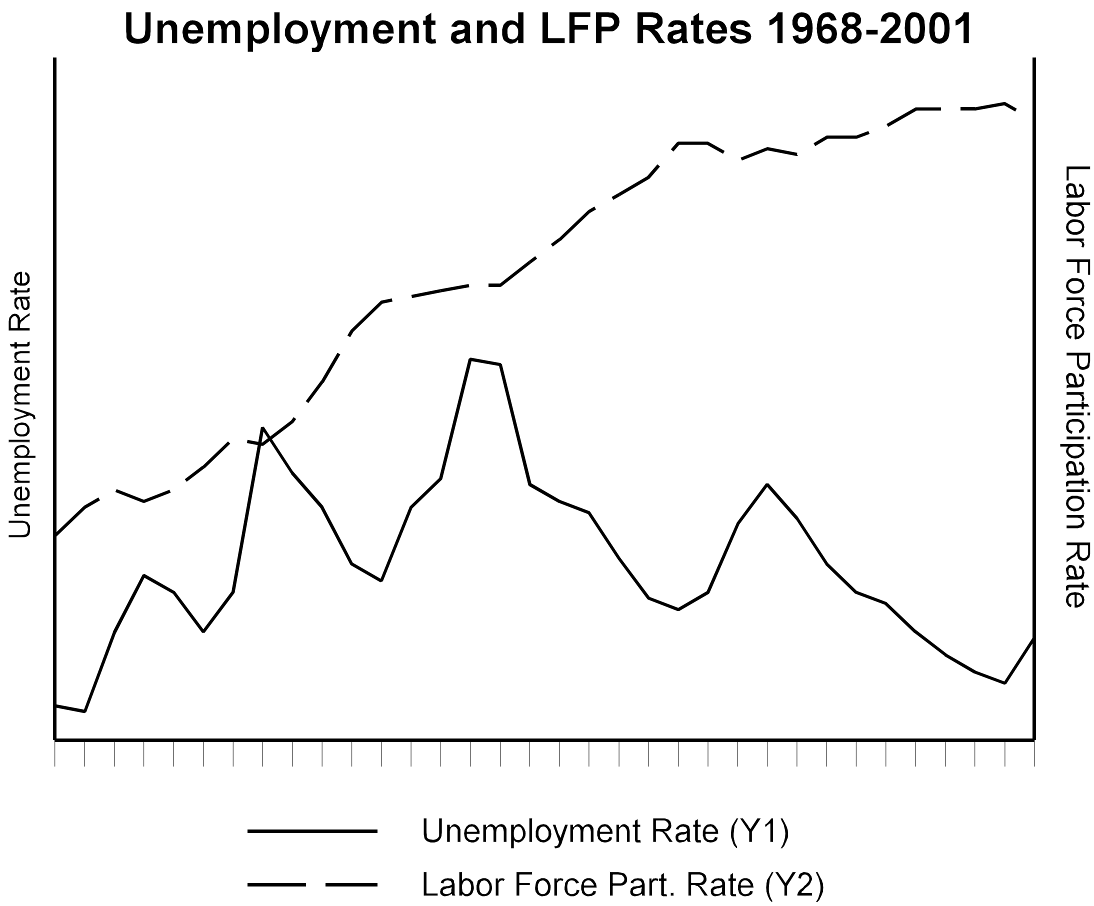
A. Introduction

1. Definitions and measurement concepts
   a. Unemployed – without a job but looking for work
   b. In the labor force – employed or not working but actively looking for work
   c. Unemployment rate – percent of the labor force that is unemployed; note: this rate changes due to changes in both employment and the labor force
2. Trends in Unemployment

**Incidence, Duration of Unemployment 1968-2001**




Source: *Economic Report of the President, 2002*




a. Incidence and duration of unemployment are closely related
b. Relative to the incidence of unemployment, durations have grown longer in recent years; suggests changes in the nature of unemployment
c. Labor force participation has grown steadily over time
d. Labor force participation is slightly counter-cyclical (decreases when unemployment increases)

3. Characteristics of the unemployed as of Dec. 2001

| Duration of Unemployment | % |
|---|---|
| Less than 5 weeks | 37.1 |
| 5-14 weeks | 33.4 |
| 15-26 weeks | 15.9 |
| More than 26 weeks | 13.7 |

| Reason for Unemployment | % |
|---|---|
| On layoff | 13.4 |
| Other job losers | 41.0 |
| Job leavers | 11.0 |
| Re-entrants | 28.6 |
| New entrants | 6.0 |

Source: *Economic Report of the President, 2002*

4. Fit with neoclassical model
   a. Simple static model only accounts for two states: working or out of the labor force; it not account for unemployment
   b. To account for unemployment, economists have instead developed “job search” models
      1) models are dynamic (typically explain the length of time required to find a job)
      2) models also typically incorporate uncertainty

B. Basic Job Search Model

1. Assumptions
   a. Will work in continuous time; denote time periods $t$, each of length $h$
   b. Assume people have infinite life-times
   c. Assume that during the period of unemployment, each person receives one job offer per period; each job offer has an associated wage
   d. Wages associated with future job offers are unknown; however, the probability distribution of potential offers, $f(w)$, is known
   e. Job offers are independent over time
   f. Individuals accept or reject job offers as they arrive;
      1) once an offer has been rejected, it cannot be recalled
      2) once an offer is accepted, it leads to permanent employment at a fixed, per-period wage, $w$
   g. Job search entails some per-period cost, $c$
2. Job search strategy
   a. Individuals follow a sequential strategy in which they decide to accept or reject offers as they arrive
   b. Let $V_t$ denote the present value of life-time wealth associated with future search; in the next period
      1) if the individual accepts the job offer, the present value of life-time wealth will be $-ch + e^{-rh} W(w)$
      2) if the individual rejects the job offer, the present

value of life-time wealth will be $-ch$ + $\mathrm{e}^{-rh}\,\mathrm{E}V_{t+1}$

c. Thus, the present value of life-time wealth will be

$$V_t = -ch + e^{-rh}\,\mathrm{E}\{\mathrm{Max}(W(w), V_{t+1})\}$$

d. Because of the infinite life-times assumption and because nothing in the environment is changing over time (the wage distribution stays the same, costs remain the same, etc.), the value of future search remains constant

   1) i.e., $V_t = V_{t+1}$

   2) can rewrite $V_t = V_{t+1} = V$

e. Then

$$V = -ch + e^{-rh}\,\mathrm{E}\{\mathrm{Max}(W(w), V)\}$$

f. Rearranging terms

$$(1 - e^{-rh})V = -ch + e^{-rh}\,\mathrm{E}\{\mathrm{Max}(W(w) - V, 0)\}$$

g. To simplify the math, consider the continuous time analog

$$rV = -c + \mathrm{E}\left\{\mathrm{Max}\left(\frac{w}{r} - V, 0\right)\right\}$$

h. Individual's decision rule is to

   1) accept job if $w/r \geq V$, and

   2) reject job if $w/r < V$

i. Let $w^* = r\,V$ denote the reservation wage (individuals accept or reject offers if they are above or below the reservation wage)

j. How do we evaluate E{Max ($w/r - V$, 0)}? Note that

$$\mathrm{E}\left\{\mathrm{Max}\left(\frac{w}{r} - V, 0\right)\right\} = \int_{rV}^{\infty}\left(\frac{w}{r} - V\right) f(w)\,\mathrm{d}w$$

$$= \frac{1}{r}\int_{rV}^{\infty}(w - rV)\, f(w)\,\mathrm{d}w$$

k. Substituting into the present value of life-time wealth equation, we get

$$rV = -c + \frac{1}{r}\int_{rV}^{\infty}(w - rV)\, f(w)\,\mathrm{d}w$$

$$w^* = -c + \frac{1}{r}\int_{w^*}^{\infty}\left(w - w^*\right) f(w)\,\mathrm{d}w$$

l. In this expression, we can interpret

   1) $w^* + c$ as the marginal cost associated with extra search (opportunity costs and direct costs)

   2) The rest of the expression as the marginal return to additional search

   3) Can view job search as a type of investment with short-term direct and opportunity costs and long-term pay-offs

m. Here the reservation wage is constant

   1) The probability of accepting a job (of

employment) is $1 - F(w^*)$

2) The probability of being unemployed $u$ weeks is $[F(w^*)]^u\,[1 - F(w^*)]$

n. Comparative statics

1) An increase in the direct costs of search, $c$, reduces the reservation wage and decreases the expected length of unemployment

2) An increase in the interest rate, $r$, decreases $w^*$

3) For a change in the average of the wage distribution,

$$1 > \frac{\partial w^*}{\partial \overline{w}} > 0$$

4) An increase in the variance of the wage distribution also leads to an increase in the reservation wage

C. Modifications to stationary model

1. Allow recall

a. In the basic model, the reservation wage does not change over time; individual makes the same decision in each period

b. Accordingly, a wage that is rejected today will be rejected in all future periods and allowing recall makes no difference

c. In some other models where reservation wages change over time, recall might make a difference

2. Allow for benefits of search
   a. could come from several sources
      1) utility of non-market time
      2) permanent unemployment benefits
   b. replace costs $-c$ in model with net benefits $b - c$
3. Allow variation in the arrival rate of job offers
   a. Assume that the number of job offers in each period, $n$, follows a Poisson process with expected value $\lambda$

$$g(n) = \lambda^n \frac{e^{-\lambda}}{n!}$$

   b. In this case, the arrival rate of job offers is exogenous (e.g., does not vary with effort)
   c. Reservation wage is given by

$$w^* = -c + \frac{\lambda}{r} \int_{w^*}^{\infty} \left(w - w^*\right) f(w) \, \mathrm{d}w$$

   d. Results are very similar to single job case
4. Allow for search costs
   a. could assume that search intensity varies and that
      1) cost of search increases with intensity $c(s)$
      2) number of job offers increase with intensity $\lambda s$
   b. reservation wage becomes

$$w^* = -c(s) + \frac{\lambda s}{r} \int_{w^*}^{\infty} \left(w - w^*\right) f(w) \, \mathrm{d}w$$

D. Non-stationary extensions

1. Finite horizon
   a. if a finite horizon is introduced, the present value of future wealth changes from $(1+r)^{-1}w/r$ to $\sum_{m=t+1}^{T} (1+r)^{t-m} w$ which decreases as $t$ increases
   b. more importantly, $V_t$ also changes with $t$
      1) in last decision period, no value associated with future search
      2) in second to last decision period, value is limited because you only have one more period to draw from
      3) can use an inductive proof to show that the value of search decreases over time and that the reservation wage falls
   c. net result is that people become less choosy over time
2. Can show similar effects when there are liquidity constraints or time-limited unemployment insurance
3. A different set of changes is to allow the information set to vary over time