# Topic for Today

1.) Search and Unemployment

- The DMP Model

# Search + Unemployment

- We have talked a lot about what determines employment (N). However, our model viewed fluctuations in N as fluctuations in the hours worked by a "representative household". In the real world, most cyclical variation in hours worked represents changes in the number of people who have jobs.

- A complete picture of the labor market requires an understanding of unemployment. Why is it that some people want to work, but cannot find jobs?

## Definitions

1.) Unemployment Rate $= \dfrac{U}{E+U}$

2.) Participation Rate $= \dfrac{E+U}{E+U+NL}$

- The unemployment rate exhibits both slowly evolving trends, and sharp cyclical changes. It is a highly countercyclical and lagging variable.

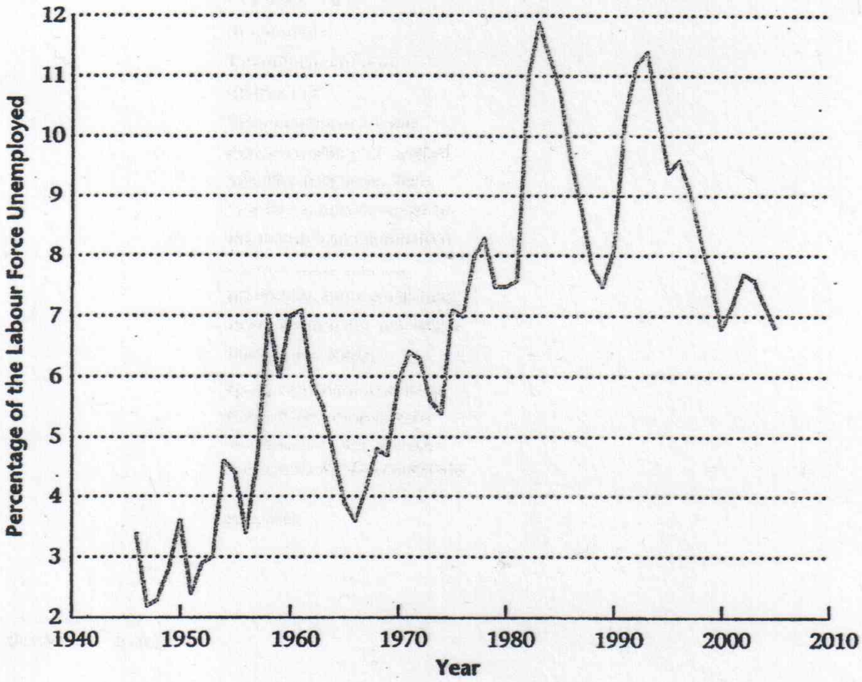



**FIGURE 16.1**

**The Canadian Unemployment Rate, 1946–2005**

The unemployment rate shows considerable cyclical volatility. In Canada, there was also a trend increase in the unemployment rate from the late 1960s until the mid-1980s, and a small trend decrease from the mid-1980s through the 1990s.

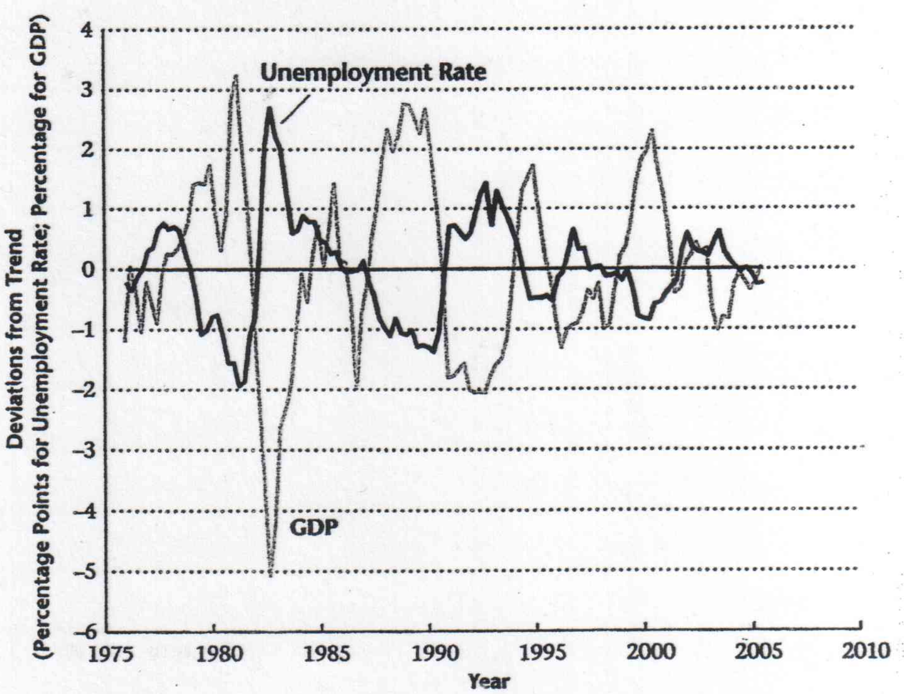
Source: Adapted from the Statistics Canada CANSIM database, Series v2461224, and from the Statistics Canada publication *Historical Statistics of Canada*, Catalogue 11-516, 1983, Series D491.

**FIGURE 16.2**

**Deviations from Trend in the Unemployment Rate, and Percentage Deviations from Trend in Real GDP for 1976–2005**

The unemployment rate is countercyclical, as it tends to be above (below) trend when real GDP is below (above) trend.

Source: Adapted from the Statistics Canada CANSIM database, Series v2062815, v1992067.



- There are two main theories of unemployment:

1.) **Wage Rigidity** - The idea here is that for some reason the market wage is above the market-clearing level. The resulting excess supply of labor is a form of unemployment. In Keynesian models, wages are thought to be slow to adjust, so that unemployment is *temporary*. In more recent models of "efficiency wages", based on asymmetric information, wages can be persistently above the market-clearing level.

2.) **Search Frictions** - In the real world, there is heterogeneity on both sides of the labor market. Individuals have different skills and preferences, while firms require different kinds of workers. As a result, it often takes time for workers to find jobs and for firms to fill vacancies. While this search + matching process takes place there is unemployment. Note that search models regard unemployment as an *activity*.

# The DMP Model

- The DMP model attempts to formalize the process of search + matching in the labor market. It assumes that <u>both</u> workers + firms must engage in search.
- The model's key theoretical construct is a "<u>matching function</u>" which determines the flow of matches as a function of the number of searching workers + firms.
- The model's key endogenous variable is "<u>labor market tightness</u>", defined as the ratio of job vacancies to unemployed workers. This ratio determines the matching probabilities.

## <u>Assumptions</u>

1.) Just one period. (Not important. Just simplifies the math).

2.) There is a 'large' number (N) of consumers who decide whether to search for a job or stay home & engage in "home production".
$Q$ = Number of job searchers (endogenous variable).

3.) Consumers are heterogeneous (i.e., they have different values of 'home production').

4.) If a consumer's search is unsuccessful, they are 'unemployed', and receive unemployment compensation of $b$.

5.) Firms must search for workers. Each firm must pay a "vacancy cost" of $k$ to post a vacancy.

$A$ = Number of searching firms. (endogenous variable).

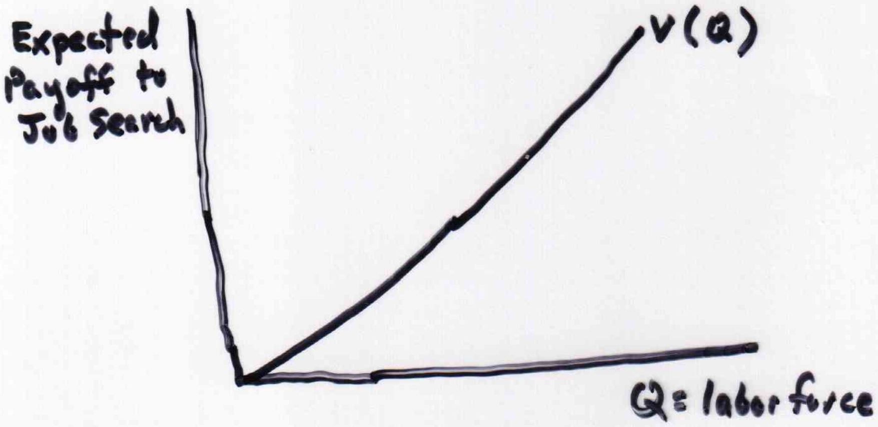
6.) When a firm + worker meet, they agree to form a match. They use Nash bargaining to split the match surplus.

7.) Matches are mediated through a Constant Returns to Scale "matching function", $M = e \cdot m(Q, A)$, where $e$ indexes the efficiency of the matching technology.

Example: $m(Q, A) = Q^{\alpha} A^{1-\alpha}$

$$\Rightarrow \underset{\substack{\uparrow \\ \text{job finding probability}}}{\frac{M}{Q}} = e \cdot \underset{\substack{\uparrow \\ \text{labor market tightness}}}{\left(A/Q\right)}^{1-\alpha} = e \cdot j^{1-\alpha}$$

## Supply Curve of Searching Workers



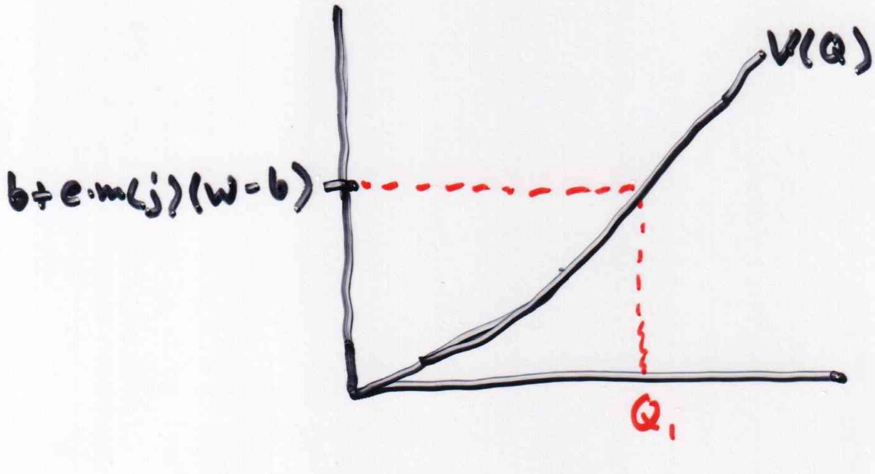

As expected payoff to search rises, more consumers are drawn into the labor market.

## Consumer Optimization

job finding probability $= P_e = e \cdot m(1, A/Q) = e \cdot m(j)$

Indifference/Entry Condition: $V(Q) = P_e \cdot W + (1 - P_e) \cdot b$

$$= b + e \cdot m(j)(w - b)$$

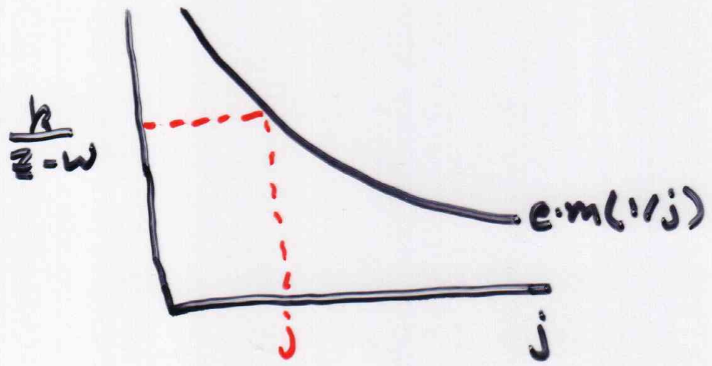


# Firm Optimization

Vacancy filling Prob. $= P_f = \frac{M}{A} = e \cdot m(a/A, 1) = e \cdot m(1/j)$

Zero Profit / Free Entry Condition: $P_f(z - w) - k = 0$

$$\Rightarrow \boxed{e \cdot m(1/j) = \frac{k}{z - w}}$$




As labor mkt. tightness (j) rises, firms search costs increase, since the prob. of meeting a worker declines. This must be offset by some combo. of lower vacancy costs (k↓), higher productivity (z↑), or lower wages (w↓).

# Nash Bargaining

When a worker and firm meet, they confront a bargaining problem. Both are better off if they agree to form a match (since they no longer have to pay search costs), but it's not clear how they should split this "match surplus."

$w - b =$ worker surplus

$z - w =$ firm surplus

$z - b =$ match surplus

$\boxed{w - b = a(z - b)}$ > Nash Bargaining $\quad a =$ Relative Bargaining Power of Workers

## Model Summary

1.) $V(Q) = b + e \cdot m(j)(w - b)$ > Consumer Optimality

2.) $e \cdot m(1/j) = \dfrac{k}{z - w}$ > Zero Profits

3.) $w = az + (1-a)b$ > Nash Bargaining

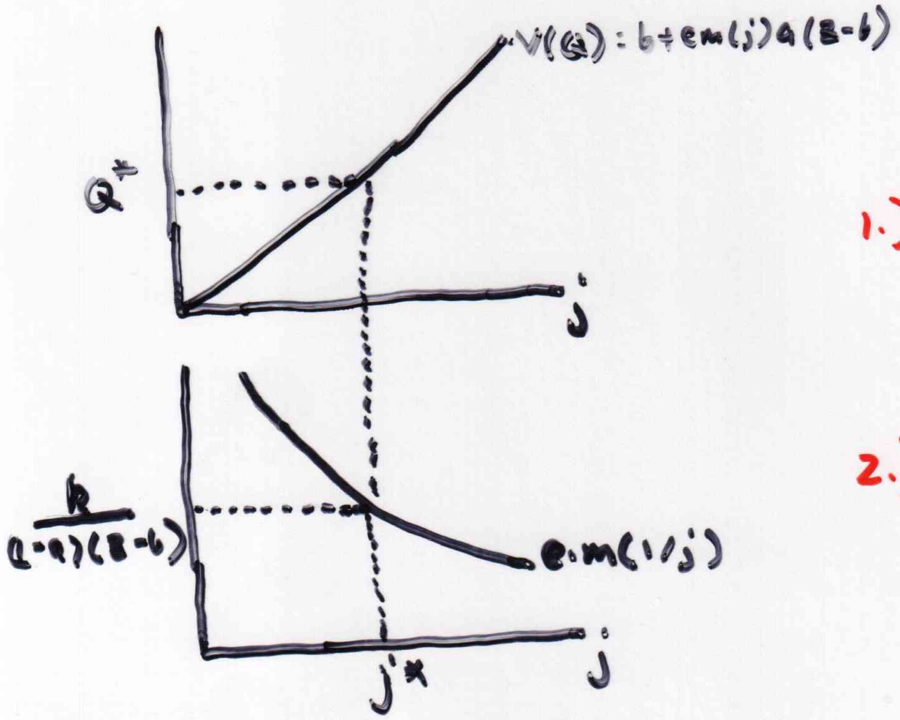
These 3 equations determine $(Q, j, w)$ as functions of $(b, z, k, a, e)$.

## Market Equilibrium

Use Nash Bargaining to sub out $w$. This yields 2 eqs. in $(Q, j)$:

$$V(Q) = b + e \cdot m(j)(z - b)a$$

$$e \cdot m(1/j) = \frac{k}{(1-a)(z-b)}$$




2 steps:

1.) Given $(k, a, z, b)$ determine $j^*$ from zero profit condition (bottom panel)

2.) Given $j^*$, determine $Q^*$ from consumer optimality condition (top panel).

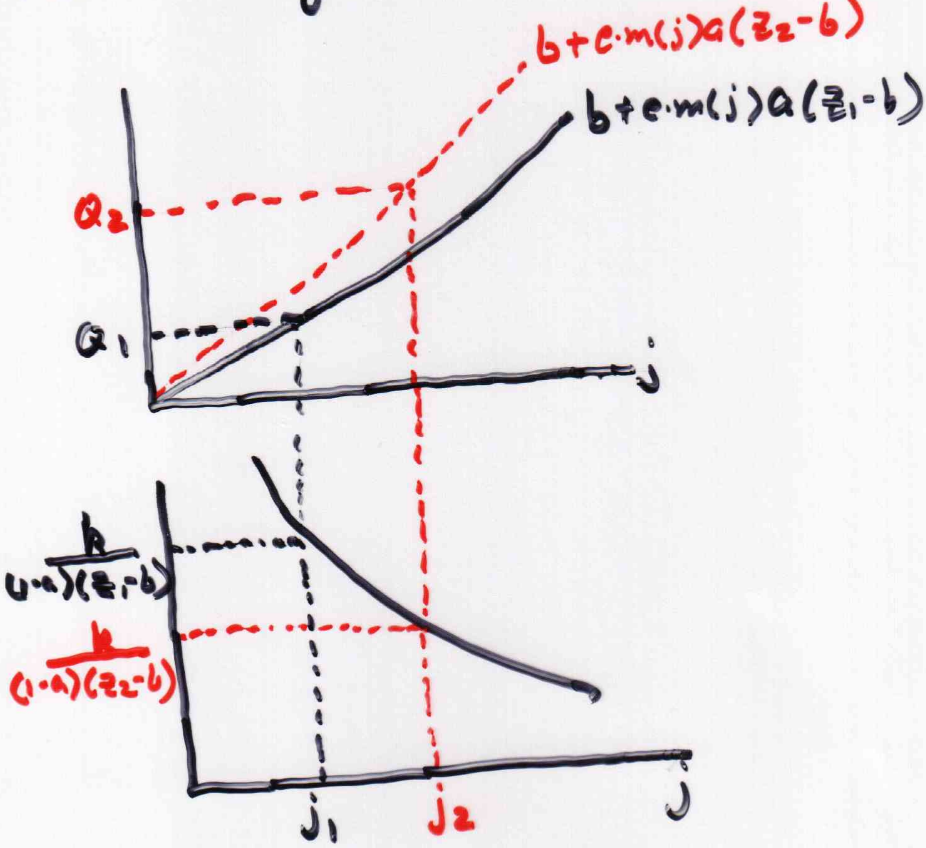
# Comparative Statics

$$u = \frac{Q(1-P_c)}{Q} = 1 - e \cdot m(j)$$

$$v = \frac{A(1-P_f)}{A} = 1 - e \cdot m(1/j)$$

$$Y = M \cdot Z = e \cdot m(j) \cdot Q \cdot Z$$

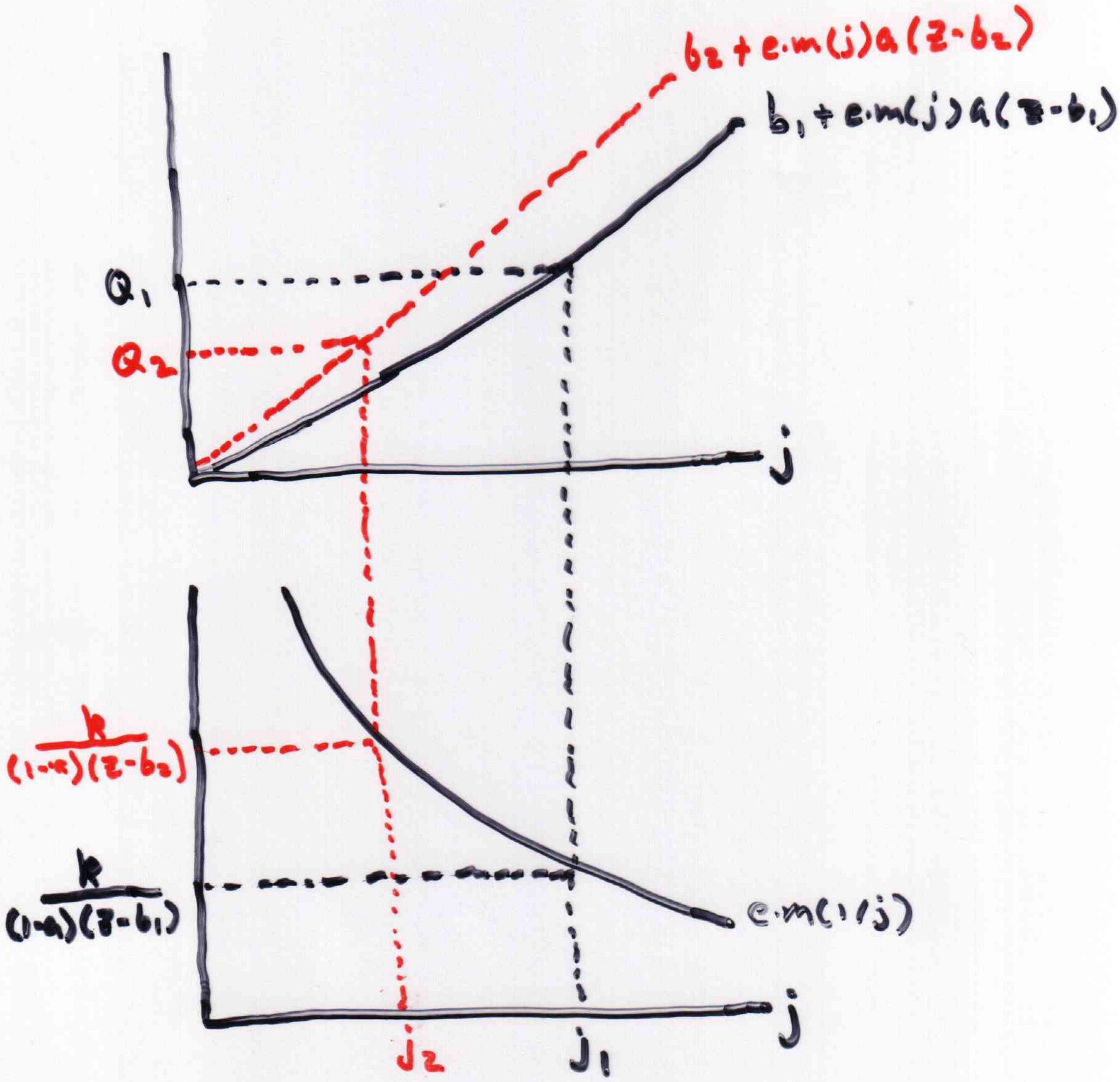
## 1.) Productivity Increase ($Z\uparrow$)




$Z\uparrow \Rightarrow j\uparrow,\ Q\uparrow,\ m(j)\uparrow \Rightarrow u\downarrow,\ m(1/j)\downarrow \Rightarrow v\uparrow$

$Y\uparrow$, $w\uparrow$ (but less than $Z\uparrow$)

# 2.) Unemployment Comp. Increase ($b\uparrow$)




$b\uparrow \Rightarrow j\downarrow \Rightarrow m(j)\downarrow \Rightarrow u\uparrow$

$m(1/j)\uparrow \Rightarrow v\downarrow$

Effect on Q is ambiguous in general

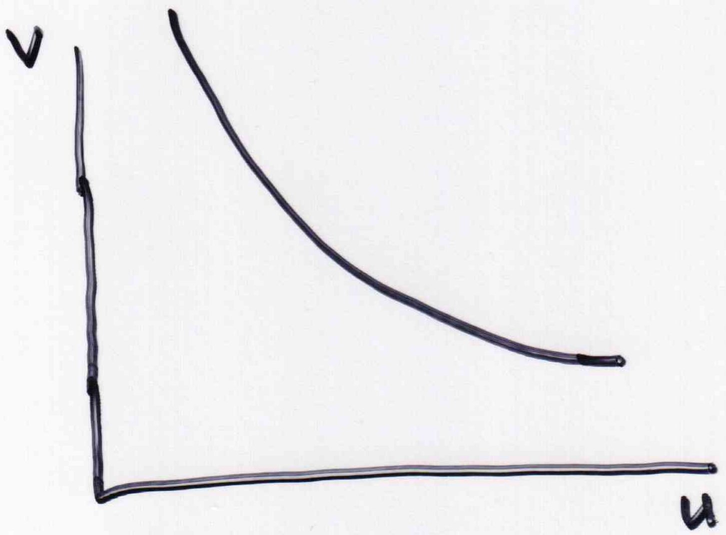
$b\uparrow \Rightarrow$ Unemp. less costly $\Rightarrow$ More Search $\Rightarrow Q\uparrow$

$\Rightarrow$ Decline in j makes it harder to find job $\Rightarrow Q\downarrow$

# The Beveridge Curve

- Notice that the previous 2 comparative static results predicted an inverse relationship between unemployment (u) and vacancies (v).

- This inverse relationship is apparent in the data, and is called the Beveridge Curve.




All else equal, when v↑ it's easier to find jobs, so u↓

- Shifts in the matching function will shift the Beveridge Curve, which can cause the inverse relationship between u and v to break down.