\[ u^* = \sqrt{uv} \]

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Available at https://pascalmichaillat.org/13/
US GOVERNMENT’S FULL-EMPLOYMENT MANDATE

• Employment Act of 1946
  – “policy and responsibility of the federal government…to promote maximum employment”

• Federal Reserve Reform Act of 1977
  – responsibility of the Federal Reserve “to promote effectively the goals of maximum employment, stable prices”

• Full Employment and Balanced Growth Act of 1978
  – “responsibility of the federal government…to foster and promote…full employment”

• goal: compute the full-employment rate of unemployment (FERU)
HOW TO INTERPRET LEGAL CONCEPT OF FULL EMPLOYMENT?

- Employment Act of 1946:
  - full employment allows “to foster … the general welfare”

- Full Employment and Balanced Growth Act of 1978:
  - away from full employment, the economy “is deprived of the full supply of goods and services, the full utilization of labor … and the related increases in economic well-being that would occur under conditions of genuine full employment”

  full employment = social efficiency = maximum social output
  - same efficiency concept as in Hosios (1990), Pissarides (2000)
NAIRU ≠ FERU

• Joint Economic Committee (2019):
  “Today, full employment is considered by many to be synonymous with the non-accelerating inflationary rate of unemployment (NAIRU)—the rate of unemployment that neither stokes nor slows inflation.”

• Council of Economic Advisors (2024):
  “Modern economics has generally defined full employment by citing the theoretical concept of the lowest unemployment rate consistent with stable inflation, which is referred to as $u^*$, … the non-accelerating inflationary rate of unemployment (NAIRU).”

• but the NAIRU does not mark labor-market efficiency (Rogerson 1997)
NRU ≠ FERU

• Boston Fed President Rosengren (2014):
  – measures the departure of the Fed from its full-employment mandate by “the squared deviations of unemployment from an estimate of full employment utilizing the Congressional Budget Office assessment of the natural rate for each year.”

• but the CBO’s natural/noncyclical rate of unemployment (NRU) is a slow-moving average of unemployment, which is generally not socially efficient (Pissarides 2000)
THEORY OF FULL EMPLOYMENT
LABOR AVAILABLE FOR MARKET PRODUCTION = LABOR FORCE

- Employment Act of 1946:
  - “promote employment opportunities for those able, willing, and seeking to work”
- labor force: pool of workers that can be tapped for market production
  - people out of the labor force: in school or training, retired, looking after their family
- labor-force size is taken as given
  - labor-force participation rate is acyclical (Rees 1957; Shimer 2009; Rogerson, Shimer 2011)
  - impulse response of labor-force participation rate to productivity shock is 0 for 2 years (Cairo, Fujita, Morales-Jimenez 2022)
US LABOR-FORCE PARTICIPATION RATE $\approx$ ACYCLICAL

Labor-force participation rate

25–54 years
SOCIAL PRODUCT OF UNEMPLOYED LABOR $\approx 0$

- share $u$ of labor force is unemployed
- contributions to social output:
  - zero from jobseeking
  - positive from home production
  - negative from idleness: psychological cost from unemployment
- psychological cost offsets home production (Borgschulte, Martorell 2018) $\Rightarrow$ social product of unemployed labor $= 0$
- mechanisms behind large psychological cost of unemployment:
  - Jahoda (1981): loss of daily routine, regular social interactions, pursuit of overarching goals, personal status & identity
  - Hussam et al (2022): work + cash preferred to cash alone
SOCIAL PRODUCT OF EMPLOYED LABOR

• share $v$ of labor force is employed and recruiting
  \[ \sim \] social product of recruiting = 0

• number of recruiters = number of vacancies
  – National Employer Survey (1997): large survey by Census Bureau
  – 1 vacancy requires $\approx 1$ full-time recruiter

• share $1 - (u + v)$ of labor force is employed and producing
  \[ \sim \] social product of producing $> 0$
US BEVERIDGE CURVE \approx HYPERBOLA (MICHAILLAT, SAEZ 2021)

slope = – 0.85
US BEVERIDGE CURVE $\approx$ HYPERBOLA (MICHAILLAT, SAEZ 2021)

<table>
<thead>
<tr>
<th>Year</th>
<th>Log Unemployment Rate</th>
<th>Log Vacancy Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>-3.7</td>
<td>-3.9</td>
</tr>
<tr>
<td>1971</td>
<td>-3.4</td>
<td>-3.6</td>
</tr>
</tbody>
</table>

slope = – 1.02
US BEVERIDGE CURVE $\approx$ HYPERBOLA (MICHAILLAT, SAEZ 2021)

Log unemployment rate

Log vacancy rate

1972

1989

slope = −0.84
US BEVERIDGE CURVE $\approx$ HYPERBOLA (MICHAILLAT, SAEZ 2021)

Log vacancy rate

1989, 1999

slope = $-0.94$
US BEVERIDGE CURVE $\approx$ HYPERBOLA (MICHAILLAT, SAEZ 2021)

-3.7 -3.4 -3.1 -2.8 -2.5 -2.2
Log unemployment rate
-4.2 -3.9 -3.6 -3.3 -3.0
Log vacancy rate
1999
2009
slope = – 1.00
US BEVERIDGE CURVE $\approx$ HYPERBOLA (MICHAILLAT, SAEZ 2021)

```
-3.7 -3.4 -3.1 -2.8 -2.5 -2.2
Log unemployment rate
-4.2 -3.9 -3.6 -3.3 -3.0
Log vacancy rate
2009
2019
slope = $-0.84$
```
US BEVERIDGE CURVE ≈ HYPERBOLA: LOG SCALE

Share of labor force

Unemployment

Vacancy


1%
2%
4%
8%
16%
COMPUTING THE FERU

• minimize socially nonproductive use of labor $u + v$
• subject to hyperbolic Beveridge curve $uv = A$, with $A > 0$
• unconstrained minimization with convex objective: $u + A/u$
• first-order condition gives minimum point:

$$\frac{d[u + A/u]}{du} = 0 \implies 1 - \frac{A}{u^2} = 0$$

• minimum point is FERU:

$$u^* = \sqrt{A} \implies u^* = \sqrt{uv}$$

• FERU is $> 0$, determined by location of Beveridge curve
CRITERION FOR FULL EMPLOYMENT

- $u^*$ is geometric average of $u$ and $v$
- economy is at full employment when $u = u^*$
  - at full employment when $u = v$
- economy is above full employment, inefficiently tight when $u < u^*$
  - inefficiently tight when $u < v$
- economy is below full employment, inefficiently slack when $u > u^*$
  - inefficiently slack when $u > v$
POSTWAR IN THE UNITED STATES
VACANCY RATE (BARNICHON 2010, JOLTS)

Share of labor force

Vacancy

Unemployment


0%

3%

6%

9%

12%
LABOR MARKET IS GENERALLY TOO SLACK...
AND IS ESPECIALLY SLACK IN SLUMPS
LABOR MARKET IS TOO TIGHT DURING WARS

- Korean War
- Vietnam War
- Trump
TIGHTNESS $v/u$ SUMMARIZES STATE OF LABOR MARKET

- Korean War
- Vietnam War
- Oil Crisis
- Volcker Recession
- Great Recession
- Trump
- Full employment
$u^*$ REMAINS IN 3.0%–5.3%, AVERAGES 4.2%

$u^* = \sqrt{uv}$

Share of labor force

Unemployment $u$

Vacancy $v$

GREAT DEPRESSION IN THE UNITED STATES
LABOR MARKET WAS TOO SLACK UNTIL WW2

Unemployment
Great Depression
Vacancy
World War 2

Share of labor force
0%
5%
10%
15%
20%
25%
30%

1930 1935 1940 1945 1950
LOWEST AND HIGHEST TIGHTNESS ON RECORD

- World War 2
- Great Depression
- Full employment
\( u^* \) REMAINS IN 2.5\%–4.6\%, AVERAGES 3.5\%
MOST EXTREME UNEMPLOYMENT GAPS ON RECORD

\[ u - u^* = +20.9\text{pp} \]

\[ u - u^* = -1.6\text{pp} \]
PANDEMIC IN THE UNITED STATES
LABOR MARKET HAS BEEN TOO TIGHT SINCE 2021Q3...
...BUT IT HAS BEEN COOLING SINCE 2022Q2
CURRENT TARGET FOR MONETARY POLICY: $u^* = 4.5\%$

![Graph showing unemployment and vacancy trends from 2020 to 2023. The graph indicates that unemployment and vacancy rates are influenced by the formula $u^* = \sqrt{uv}$.](image-url)
MOST EXTREME UNEMPLOYMENT GAPS SINCE WW2

- $u - u^* = +6.4 \text{pp}$
- $u - u^* = -1.5 \text{pp}$
- $u - u^* = -0.8 \text{pp}$
WHY DID $u^*$ INCREASE SO MUCH IN 2020?

Unemployment $u$

Vacancy $v$

$u^* = \sqrt{uv}$
BECAUSE OF LARGE SHIFT OF BEVERIDGE CURVE IN 2020Q2
ROBUSTNESS
FERU WITH DIFFERENT MEASURES OF UNEMPLOYMENT

Share of labor force

-2pp - 0pp - 2pp - 4pp - 6pp - 8pp

1994 2005 2015 2023
MORE GENERAL FERU FORMULA (MICHAILLAT, SAEZ 2021)

- home production net of psychological cost of idleness: $0 \rightarrow \zeta$
- recruiters per vacancy: $1 \rightarrow \kappa$
- elasticity of Beveridge curve: $\nu = \frac{A}{u} \rightarrow \nu = \frac{A}{u^\epsilon}$
- FERU formula:

$$u^* = \sqrt{uv} \quad \rightarrow \quad u^* = \left( \frac{\kappa \cdot \epsilon}{1 - \zeta \cdot \nu \cdot u^\epsilon} \right)^{1/(1+\epsilon)}$$

- US calibration in of general formula:
  - $\zeta = 0.26$
  - $\kappa = 0.92$
  - $\epsilon$ given by Bai, Perron (1998) algorithm
SIMPLE VERSUS GENERALIZED FERU FORMULA

Efficient unemployment rate

Generalized $u^*$ formula
Efficient unemployment rate 

\( u^* = \sqrt{uv} \)

Generalized \( u^* \) formula
WHY HAS THE US LABOR MARKET BEEN SO SLACK IN THE PAST CENTURY?
$u^* = \sqrt{uv}$ AVERAGES 4.1% OVER 1930–2023
US LABOR MARKET IS GENERALLY INEFFECTIVELY SLACK

Unemployment

Inefficiently slack

Inefficiently tight

Vacancy

Share of labor force
US LABOR MARKET IS GENERALLY INEFFICIENTLY SLACK

- World War 2
- Korean War
- Vietnam War
- Coronavirus Pandemic
- Full employment

Tightness

$u^* = \sqrt{uv}$ IS LOWER THAN EXISTING TARGETS
$u^* = \sqrt{uv}$ is lower than existing targets.
OTHER REASONS FOR DEPARTURES FROM FULL EMPLOYMENT

• Great Depression:
  – gold standard (Eichengreen, Temin 2000)
  – policy errors (Friedman, Schwartz 1963)

• World War 2, Korean War, Vietnam War:
  – pressure from White House to keep interest rates low to help finance war effort (Bernanke 2022)

• Volker–Greenspan era:
  – priority given to inflation at the expense of unemployment (Thornton 2011; Kaya et al 2019; Hess, Shelton 2016)

• Great Recession, pandemic:
  – zero lower bound on nominal interest rate