The Natural Behavior of Unemployment

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1. When inflation is steady, neither rising nor falling over time,
   a) Unemployment is above its natural rate
   b) Unemployment is at its natural rate
   c) Unemployment is below its natural rate

2. The natural rate of unemployment
   a) Is constant over time at around its long-term level of 5 percent.
   b) Has declined over time in recent decades, to 3.5 percent in February 2020, before the pandemic
   c) Behaves according to stable principles, rising sharply in crises and declining slowly during periods of economic calm.

3. High unemployment early in the pandemic (multiple choice)
   a) Completely departed from historical behavior--inflation remained stable at close to 2 percent.
   b) Was consistent with historical behavior if workers who retain jobs but are on temporary layoff are not considered to have a downward effect on inflation.
   c) Subsequently declined much faster than following other crises.
Unemployment rate – policy dependency

- **USA**
  - Breaks: job-worker matches

- **Europe**
  - maintain match: “Kurzarbeit”

See earlier webinar with Erik Hurst (ADP data)
Labor participation rate after GFC
German rise of socle/base unemployment

Unemployment rate

Economic miracle

Full employment

1st oil crisis

2nd oil crisis

German unification

Labor market reforms

GFC Lehman

Unemployment rate Germany


Quelle: Bundesagentur für Arbeit, Daten: Statistik der BA
- Is there a NAIRU?
  - Phillips curve
- How is it connected to $r^*$?
  (Menger, Wicksell, Laubach-Williams)
- How to $u^*$?
- Better matching technology?
  - Labor-search models?
    (Davis-Haltiwanger, Shimer,...)
Fed’s inclusion drive
No inflation explosion
- Greenspan inclusion drive
- Powell inclusion drive

New Fed policy framework
- Essentially eliminated NAIRU
Thank you!

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The Natural Behavior of Unemployment

Robert E. Hall  Marianna Kudlyak

Disclaimer: The opinions expressed are those of the authors and do not reflect those of the Federal Reserve Bank of San Francisco, the Federal Reserve System, or the National Bureau of Economic Research.

We thank Stephane Dupraz, Emi Nakamura, and Jón Steinsson for providing the code for their business-cycle chronology function and Marcelo Perlin for providing code for estimating hidden-Markov regime-switching models.
Milton Friedman, 1967, originates the natural rate of unemployment

The “natural rate of unemployment” ... is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on. (Friedman, 1967)
We take the non-accelerating-inflation rate of unemployment (NAIRU) to be a synonym for the natural rate.
In this paper

- We do not enter the thicket of general equilibrium models or empirical Phillips curves.
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- Rather, we study the behavior of unemployment in recoveries and document a regularity of the process.

- We believe that macro models should generate paths of unemployment with these properties.
The observed behavior of unemployment and the natural behavior

Our empirical work is descriptive—it finds a parsimonious statistical description of the observed evolution of unemployment.
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After describing our approach and its findings, we return to the problem of inferring the path of the natural rate from observed unemployment.
We find that the observed behavior of unemployment comprises occasional sharp upward movements in economic crises at other times, an inexorable downward glide at a low but reliable proportional rate. The glide continues until unemployment reaches approximately 3.5 percent or until another economic crisis interrupts the glide.
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- at other times, an inexorable downward glide at a low but reliable proportional rate.

The glide continues until unemployment reaches approximately 3.5 percent or until another economic crisis interrupts the glide.
The paths of log-unemployment during recoveries

Dupraz, Nakamura and Steinsson (2019) document the asymmetry of the business cycle and cite a large earlier literature on that subject.
Our place in the literature

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- We measure the rate of recovery of unemployment from recession-highs and demonstrate how uniform the rate is.
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- We measure the rate of recovery of unemployment from recession-highs and demonstrate how uniform the rate is.

- We develop a framework for inferring the natural rate from the observed behavior of unemployment.
Recent influential papers with many references

Crump, Nekarda, and Petrosky-Nadeau (2020); Crump, Giannoni, Eusepi, and Sahin (2019); Barnichon and Matthes, (2017); Coibion and Gorodnichenko (2015); Jorgensen and Lansing (2019); Hazell, Herreno, Nakamura and Steinsson (2020); Laubach (2001); and Staiger, Stock and Watson (1997)
Measurement
Measuring the business cycle

Two issues:
1. What measure: output, unemployment, or latent “economic activity”? 

Following Romer & Romer (2019), we consider unemployment as an indicator little affected by forces other than the business cycle, so that choice of measure obviates filtering.
Measuring the business cycle

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2. Do we need to use a bandpass filter to remove a non-cyclical slower-moving trend?

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Following Romer & Romer (2019), we consider unemployment as an indicator little affected by forces other than the business cycle, so that choice of measure obviates filtering.
We consider the general class of statistical models

\[ f(u_t) = x_t + \epsilon_t, \]

where \( f(\cdot) \) is a monotonic transformation, \( x_t \) is the systematic trend component capturing the business cycle, and \( \epsilon_t \) is the random unsystematic component, taken to be uncorrelated with \( x_t \).
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We pick the log transformation.

We use two econometric approaches:
• a chronology-based approach
• Hamilton’s (1989) Markov regime-switching model
**Chronology-based approach**

Given a chronology, one can approximate the systematic component $x_t$ by interpolating between the turning points and measuring the noise $\epsilon_t$ as the residual between $\log u_t$ and $x_t$. The systematic trend component $x_t$ is a smooth function of $t$. We take it to be a straight line between the turning points of the series, so $x_t$ has equal increments over time, between the turning points. Overall, the trend component is a linear spline.
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We take it to be a straight line between the turning points of the series, so \( x_t \) has equal increments over time, between the turning points.

Overall, the trend component is a linear spline.
Model for a single recovery

\[ 12(\log u_T - \log u_0) = -\beta T + \epsilon_T - \epsilon_0 \]

We include the 12 so that the recovery rate \( \beta \) of the recovery that starts in month \( T \) (high point) and ends in month 0 (low point) is in log points per year.
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\[ \hat{\beta} = -12(\log u_T - \log u_0) / T \]

We use a quasi-bootstrap procedure to approximate the sampling distribution of \( \hat{\beta} \).
Available chronologies

1. NBER turning points in economic activity.
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2. The output of a chronology-finding algorithm of Dupraz-Nakamura-Steinsson (DNS) applied to unemployment.
Available chronologies

1. NBER turning points in economic activity.

2. The output of a chronology-finding algorithm of Dupraz-Nakamura-Steinsson (DNS) applied to unemployment.

3. A chronology of the unemployment rate based on observed business cycle peaks and troughs (HK).
   - Dates are similar to DNS; however, we pick the latest points for peaks and troughs, consistently with our definition of the recovery.
   - Results are quite similar to DNS.
Results
## Estimated Annual Log Unemployment Recovery Rate, Chronology-Based

<table>
<thead>
<tr>
<th>Chronology</th>
<th>NBER</th>
<th>Dupraz-Nakamura-Steinsson</th>
<th>Hall-Kudlyak</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual recovery rate, log points</td>
<td>0.087</td>
<td>0.132</td>
<td>0.129</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Standard deviation of recovery rate across recoveries</td>
<td>0.076</td>
<td>0.084</td>
<td>0.084</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.119)</td>
<td>(0.117)</td>
<td>(0.115)</td>
</tr>
<tr>
<td><strong>After 1959</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual recovery rate, log points</td>
<td>0.067</td>
<td>0.106</td>
<td>0.103</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.013)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Standard deviation of recovery rate across recoveries</td>
<td>0.025</td>
<td>0.011</td>
<td>0.016</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.038)</td>
<td>(0.039)</td>
<td>(0.038)</td>
</tr>
</tbody>
</table>
Estimated Annual Log Unemployment Recovery Rate, by Recovery

![Graph showing estimated annual log unemployment recovery rate by recovery year](image-url)
**Fitted Linear Trends in Log Unemployment, by Recovery and Contraction**
## Estimated Annual Log Unemployment Recovery and Contraction Rates, Hidden-Markov-Based

<table>
<thead>
<tr>
<th></th>
<th>Full sample</th>
<th>After 1959</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting observation</td>
<td>Oct-49</td>
<td>May-61</td>
</tr>
<tr>
<td>Ending observation</td>
<td>Feb-20</td>
<td>Feb-20</td>
</tr>
<tr>
<td>Annual recovery rate, log points</td>
<td>0.066</td>
<td>0.070</td>
</tr>
<tr>
<td>Standard error, quasi-bootstrap</td>
<td>(0.042)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Standard error, information matrix</td>
<td>(0.015)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Annual contraction rate, log points</td>
<td>0.700</td>
<td>0.433</td>
</tr>
<tr>
<td>Standard error, quasi-bootstrap</td>
<td>(0.103)</td>
<td>(0.051)</td>
</tr>
<tr>
<td>Standard error, information matrix</td>
<td>(0.078)</td>
<td>(0.053)</td>
</tr>
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</table>
**Comparison of Chronology- and Hidden-Markov-Based Log Unemployment Recovery Rate Estimates**

<table>
<thead>
<tr>
<th></th>
<th>Full sample</th>
<th>Later sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return rate, chronology based</td>
<td>0.132</td>
<td>0.106</td>
</tr>
<tr>
<td>Return rate, hidden-Markov based</td>
<td>0.066</td>
<td>0.070</td>
</tr>
<tr>
<td>Difference</td>
<td>0.066</td>
<td>0.036</td>
</tr>
<tr>
<td>Quasi-bootstrap standard error of difference</td>
<td>(0.015)</td>
<td>(0.012)</td>
</tr>
</tbody>
</table>

The key difference between the two approaches is the precision of information about turning points. In the regime-switching model, turning points are latent unobserved events and the model yields a probability that a given month is a turning point. Chronologies, instead, treat turning points as unambiguous events.
Inferring the natural behavior of unemployment from the observed behavior
We suggest that a notion of the natural behavior of unemployment should replace the notion of a single natural rate fixed over time.
Behavior of Unemployment vs a Constant Natural Rate

- We suggest that a notion of the natural behavior of unemployment should replace the notion of a single natural rate fixed over time.

- The natural behavior of unemployment differs from the observed behavior according to principles similar to the literature on short-run deviations of actual unemployment from the natural rate of unemployment.
Friedman’s analysis implies that years of stable inflation are years when the unemployment rate is at its natural level.
Volatile Unemployment and Stable Inflation in the Past 30 Years

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- High volatility of unemployment and highly stable inflation over the past 30 years suggest that most of the movement in unemployment is movement of the natural rate.
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- Friedman’s analysis implies that years of stable inflation are years when the unemployment rate is at its natural level.

- High volatility of unemployment and highly stable inflation over the past 30 years suggest that most of the movement in unemployment is movement of the natural rate.

- So one idea would be to take actual unemployment rate as a good approximation to the natural rate.
Existing Approaches to Measuring the Natural Rate of Unemployment over Time

1. A longer-run average of the actual unemployment rate
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2. A rate backed out of the Phillips curve
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1. A longer-run average of the actual unemployment rate

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3. A solution from a model with nominal frictions removed
Our view on measurement

Methods 2 and 3 are likely to find large variations in the natural rate, tracking actual unemployment.
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That conclusion should be taken seriously.
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Our results suggest that all types of crises set a similar path of unemployment in motion, once the initial impulse to unemployment occurs.
Conclusions
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It describes:
(1) occasional sharp upward movements in unemployment in times of economic crisis, and
(2) an inexorable downward glide at a low but reliable proportional rate at all other times.

The glide continues until unemployment reaches approximately 3.5 percent or until another economic crisis interrupts the glide.
The natural rate of unemployment derived from this model would be state-dependent. It would be contingent on the severity of the most recent crisis shock and the number of months into the recovery.
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In other words, the natural rate of unemployment in a given month is the average over history conditional on the level at its most recent business-cycle high level and number of months that have elapsed from the trough to the given month.
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In other words, the natural rate of unemployment in a given month is the average over history conditional on the level at its most recent business-cycle high level and number of months that have elapsed from the trough to the given month.

We don’t yet have a position on the non-contingent natural rate.
As for policy,

The Fed’s new policy of not resisting the downward glide in unemployment during periods of calm is consistent with our conclusions.
Recovery from the 2020 Pandemic
The 2020 Pandemic Put Spotlight on the Unemployed with and without Jobs

Both *jobless-unemployment* and *recall-unemployment* are associated with lower aggregate work effort and corresponding loss of earnings.
The 2020 Pandemic Put Spotlight on the Unemployed with and without Jobs

Both *jobless-unemployment* and *recall-unemployment* are associated with lower aggregate work effort and corresponding loss of earnings.

Jobless-unemployment follows the principles of modern search-and-matching models, while workers suffering recall unemployment are waiting for recall.
Findings

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• The pandemic caused an explosion of recall unemployment.

• In the pandemic, recall-unemployment returned rapidly toward normal while jobless-unemployment rose somewhat.

• We are monitoring the evolution of jobless-unemployment and recall-unemployment to gauge the recovery.
Historical recall- and jobless-unemployment

Unemployment rate from temporary layoff, SA

Unemployment rate for reasons other than temporary layoff, SA
Unemployment rate from temporary layoff, SA
Unemployment rate for reasons other than temporary layoff, SA