AN ECONOMICAL BUSINESS-CYCLE MODEL

Pascal Michaillat, Emmanuel Saez

Oxford Economic Papers, 2021

Paper available at https://www.pascalmichaillat.org/7.html
LIMITATIONS OF THE NEW KEYNESIAN MODEL

1. lacks conceptual economy
   - not taught to undergraduates
   - not used in related fields, outside of macroeconomics
   - not used by policymakers for day-to-day thinking (Krugman 2000, 2018)

2. does not describe business cycles well
   - does not feature unemployment
   - makes anomalous predictions about long-lasting ZLB episodes (Michaillat, Saez 2021)
1. is more economical
   - solved with an AD-AS diagram
   - effects of shocks derived by comparative statics
   - efficient unemployment & optimal policies described by sufficient-statistic formulas
   - most complicated step: derivation of Euler equation

2. describes business cycles better
   - features unemployment: fluctuating & generally inefficient
   - behaves well during long/permanent ZLB episodes
ASSUMPTIONS
SERVICE ECONOMY, WITHOUT FIRMS
SERVICE ECONOMY, WITHOUT FIRMS
MATCHING FUNCTION (MICHAILLAT, SAEZ 2015)
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MATCHING FUNCTION (MICHAILLAT, SAEZ 2015)

- Idleness, non-manufacturing
- Idleness, manufacturing
- Unemployment
Thinking about all the money you have in financial accounts over the course of your retirement, do you plan to ...?

Survey of 2,000 Americans aged 62 to 75, conducted in September 2020

Source: Employee Benefit Research Institute
Which of the following are reasons you plan not to spend down your assets in retirement?

Survey of 2,000 Americans aged 62 to 75, conducted September 2020

- Saving for unforeseen costs
- Spending down isn't necessary
- Bequest motive
- Makes me feel better
- Afraid of running out of money
- Once assets are spent, can't be recovered
- Concern about inflation
- Don't know
- Other

Employee Benefit Research Institute
Saving as much as I can makes me feel happy and fulfilled.
Survey of 2,000 Americans aged 62 to 75, conducted September 2000.

Source: Employee Benefit Research Institute
SOLUTION
MATCHING FUNCTION $\rightarrow$ BEVERIDGE CURVE

**Beveridge curve:**
inflow into unemployment = outflow from unemployment

![Diagram showing the Beveridge curve with axes labeled Unemployment rate on the x-axis and Vacancy rate on the y-axis.](image-url)
UNEMPLOYMENT: ALWAYS ON BEVERIDGE CURVE

Unemployment rate

- Beveridgean
- Actual

Year:
- 1951
- 1970
- 1985
- 2000
- 2019

Unemployment rate:
- 0%
- 3%
- 6%
- 9%
- 12%
Tightness = vacancy / unemployment
WEALTH IN UTILITY ~ EULER EQUATION

\[ \gamma = \text{costate variable on real wealth in household's Hamiltonian} \]
EULER EQUATION \rightleftharpoons AGGREGATE DEMAND

\begin{align*}
\text{Tightness} & \quad \text{Output} \\
\text{AD} & \quad \text{AS}
\end{align*}

\begin{align*}
\text{Capacity} & \quad \text{Output}
\end{align*}
PRICE NORM: FIXED INFLATION

- any model with a matching function needs a price mechanism
- we assume that prices grow at a fixed rate of inflation
  - interpretation: fixed inflation is a social norm (Hall 2005)
- fixed inflation is realistic:
  - inflation does not respond to unemployment (Stock, Watson 2010, 2019)
  - inflation does not respond to monetary policy (Christiano, Eichenbaum, Evans 1999)
- fixed inflation does not create bilaterally inefficiencies:
  - buyers & sellers are happy to transact at the given price
SOLUTION OF THE MODEL

Tightness

AD

Capacity

AS

Output

θ

0

y

Capacity
SOLUTION OF THE MODEL

Output

AD

Tightness

AS

Unemployment

Capacity

θ

0

y
KEYNESIAN VS. FRICTIONAL UNEMPLOYMENT

![Graph showing the relationship between output and capacity, with AD and AS curves intersecting at a point labeled 'y'. A line marked 'Keynesian' is drawn from the point of intersection to the capacity axis.]
KEYNESIAN VS. FRICTIONAL UNEMPLOYMENT

Output
AD
Tightness
AS
Keynesian
Capacity
Frictional

Frictional
Keynesian

0
Output
Capacity
INEFFICIENCY
EFFICIENT ALLOCATION (MICHAILLAT, SAEZ 2020)

Beveridge curve

Vacancy rate

Unemployment rate

0

0
EFFICIENT ALLOCATION (MICHAILLAT, SAEZ 2020)

Isowelfare curve: 
$1 - u - \text{recruiting cost} \times v = \text{const.}$
EFFICIENT ALLOCATION (MICHAILLAT, SAEZ 2020)
EFFICIENT ALLOCATION (MICHAILLAT, SAEZ 2020)

- Beveridge curve
- Efficiency
- Efficient tightness
- Unemployment rate
- Vacancy rate
- Isowelfare curve

Diagram showing the relationship between vacancy rate and unemployment rate, with the Beveridge curve, efficiency point, efficient tightness, and isowelfare curve indicated.
INEFFICIENT ALLOCATIONS

- Beveridge curve
- Inefficiently low tightness
- Unemployment rate
- Vacancy rate
- Isowelfare curve

Graph showing the relationship between vacancy rate and unemployment rate with indicated areas for inefficient allocation.
EFFICIENT TIGHTNESS

![Graph showing the relationship between Tightness and Capacity with a point labeled \( \theta^* \).]
BUSINESS CYCLES
NEGATIVE DEMAND SHOCK
NEGATIVE DEMAND SHOCK

Diagram showing the relationship between Tightness, Capacity, Output, and AD and AS curves. The diagram illustrates how a negative demand shock affects the economy.
NEGATIVE SUPPLY SHOCK
NEGATIVE SUPPLY SHOCK

![Graph showing the relationship between Tightness, Output, and Capacity with AD and AS curves.](image-url)

Natural Rates Based on HPF with $\lambda = 100$

**NOTE:** HPF denotes Hodrick–Prescott filter. This figure reports change in unemployment rate and in log of real GDP in percentage points, and output gap and unemployment gap in percent.

Natural rates based on HPF with $\lambda = 1,000$

**Note:** HPF denotes Hodrick–Prescott filter. This figure reports change in unemployment rate and in log of real GDP in percentage points, and output gap and unemployment gap in percent.
MONETARY POLICY
REDUCTION IN INTEREST RATE

Output

Tightness

AS

AD

Capacity
REDUCTION IN INTEREST RATE

Graph showing the relationship between Tightness and Output, with an intersection point at Output 0 and Capacity 0, marked as the point of equilibrium.
ZERO LOWER BOUND

![Graph showing AD and AS curves with AD @ ZLB and Output, Capacity axes.](image)
ZERO LOWER BOUND

![Graph showing the relationship between Tightness and Capacity with points indicating AD @ ZLB and AS.](image)

- **Tightness** on the vertical axis.
- **Output** on the horizontal axis.
- **Capacity** on the right vertical axis.

The graph illustrates the bounds and interactions between Tightness and Capacity, with specific points marked as AD @ ZLB and AS.
INCREASE IN WEALTH TAX

Output
Tightness
AS
AD
Capacity

Tightness
Output
Capacity

0

AD
AS
INCREASE IN WEALTH TAX

Graph showing the relationship between Tightness and Output, with Capacity on the x-axis.
OPTIMAL MONETARY POLICY: BOOM

The diagram illustrates the relationship between tightness and output in the context of optimal monetary policy during a boom. The graph shows two curves:

- **AD (Aggregate Demand)**: A downward-sloping line indicating that as output increases, the demand decreases.
- **AS (Aggregate Supply)**: An upward-sloping curve suggesting that as capacity increases, the supply increases.

The intersection of these curves represents the optimal point of policy adjustment, marked by the point $\theta^*$, which balances the tension between demand and supply to achieve maximum output without exceeding capacity.
OPTIMAL MONETARY POLICY: BOOM

![Graph showing the relationship between Tightness, Capacity, AD, and AS. The graph illustrates the equilibrium output and capacity.](image)
OPTIMAL MONETARY POLICY: SMALL SLUMP

The diagram illustrates the relationship between tightness and output. The AD curve represents the aggregate demand, while the AS curve represents the aggregate supply. The point of intersection indicates the optimal monetary policy setting, denoted by θ*.
OPTIMAL MONETARY POLICY: SMALL SLUMP

The graph illustrates the relationship between Tightness and Output, with the AD schedule and the AS schedule intersecting at a point labeled "AD @ ZLB." The diagram also indicates that the optimal point is marked by θ*. The Capacity axis is also shown on the right side of the graph.
OPTIMAL MONETARY POLICY: SMALL SLUMP
OPTIMAL MONETARY POLICY: LARGE SLUMP

Tightness

Output

AD

AS

AD @ ZLB

Capacity

0

θ

θ*

AD @ ZLB
OPTIMAL MONETARY POLICY: LARGE SLUMP

Tightness

Output

AD @ ZLB

Capacity

\[ \theta^* \]

\[ \theta^Z \]

AD @ ZLB

0

Output

Capacity
LARGE SLUMP: ROLE FOR WEALTH TAX

Tightness vs. Output

AD with wealth tax

\( \theta^* \)

Capacity vs. Output

AS
**MONETARY MULTIPLIER:** $du/di = 0.5$

<table>
<thead>
<tr>
<th>study</th>
<th>$du/di$</th>
<th>method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernanke, Blinder (1992)</td>
<td>0.6</td>
<td>VAR</td>
</tr>
<tr>
<td>Leeper, Sims, Zha (1996)</td>
<td>0.1</td>
<td>VAR</td>
</tr>
<tr>
<td>Christiano, Eichenbaum, Evans (1996)</td>
<td>0.1</td>
<td>VAR</td>
</tr>
<tr>
<td>Romer, Romer (2003)</td>
<td>0.9</td>
<td>narrative</td>
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<tr>
<td>Bernanke, Boivin, Eliasz (2005)</td>
<td>0.2</td>
<td>FAVAR</td>
</tr>
<tr>
<td>Coibion (2012)</td>
<td>0.5</td>
<td>narrative &amp; VAR</td>
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</tbody>
</table>
OPTIMAL MONETARY POLICY FORMULA

- linear expansion around suboptimal \([i, u]\) assessed at optimal \([i^*, u^*]\): 
  \[u^* \approx u + (du/di) \cdot (i^* - i)\]

- sufficient-statistic formula:
  \[i - i^* \approx \frac{u - u^*}{du/di}\]

\[\implies\] Fed should reduce interest rate by 2 percentage points for each percentage point of unemployment gap

\[\implies\] in line with observed Fed behavior (Bernanke, Blinder 1992)
CONCLUSION
<table>
<thead>
<tr>
<th>property</th>
<th>NK model</th>
<th>this model</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD relation</td>
<td>Euler equation</td>
<td>discounted Euler equation</td>
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<tr>
<td>AS relation</td>
<td>Phillips curve</td>
<td>Beveridge curve</td>
</tr>
<tr>
<td>inflation</td>
<td>fluctuating</td>
<td>fixed</td>
</tr>
<tr>
<td>unemployment</td>
<td>zero</td>
<td>fluctuating</td>
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<tr>
<td>ZLB world</td>
<td>topsy-turvy</td>
<td>normal</td>
</tr>
<tr>
<td>ZLB duration</td>
<td>must be short</td>
<td>can be permanent</td>
</tr>
<tr>
<td>property</td>
<td>NK model</td>
<td>this model</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>response to inflation</td>
<td>must be strong (Taylor principle)</td>
<td>not required (interest-rate peg works)</td>
</tr>
<tr>
<td>policy target</td>
<td>inflation rate</td>
<td>unemployment rate</td>
</tr>
<tr>
<td>optimal rule</td>
<td>not implementable</td>
<td>implementable w/ sufficient statistics</td>
</tr>
<tr>
<td>multiplier $du/di$</td>
<td>useless</td>
<td>key statistic</td>
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<tr>
<td>forward guidance</td>
<td>very powerful at ZLB</td>
<td>less &amp; less potent as ZLB lasts longer</td>
</tr>
<tr>
<td>isomorphic policy</td>
<td>–</td>
<td>wealth tax</td>
</tr>
</tbody>
</table>
OTHER POLICIES

• public hiring or spending (Michaillat 2014; Michaillat, Saez 2019)
  – multiplier is higher when unemployment is higher
  – optimal policy deviates from the Samuelson rule to reduce the unemployment gap

• unemployment insurance (Landais, Michaillat, Saez 2018)
  – optimal policy deviates from the Baily-Chetty rule to reduce the tightness gap