Coping with the Zero Nominal Bound

April 3, 2012
A Couple of Ground Rules

• No electronic devices.
• I expect you to participate.
I. INTRODUCTION
Unemployment has been very high for more than 3 years. It is falling, but only slowly, and it is still far above its pre-crisis level.
The Federal Reserve’s key policy interest rate has been virtually zero since late 2008.
II. The IS-MP-IA Model Extended
The Baseline IS-MP-IA Model

The IS Curve:

• $E = C + I + G + NX$

• $E = Y$

• When $r$ falls, $I$ rises (and $C$ and $NX$ may rise as well)

• $C$ depends positively on $Y$ (and $I$ may as well).

• So:
The IS Curve

Graph showing the IS curve on a coordinate axis with the Y-axis labeled as Y and the r-axis labeled as r.
The Baseline IS-MP-IA Model (2)

The MP Curve:

- The central bank conducts policy so that \( r = r(Y, \pi) \)
- \( r(Y, \pi) \) is increasing in both arguments
- Thus, for a given \( \pi \), \( r \) depends positively on \( Y \)
- So:
The IS-MP Diagram: The Determination of $r$ and $Y$ at a given $\pi$
The Baseline IS-MP-IA Model (3): The AD Curve

The diagram illustrates the relationship between the nominal interest rate ($r_0$) and real GDP ($Y_0$) along with the inflation rate ($\pi_0$) and real GDP ($Y_0$). The IS curve ($IS_0$) and the money supply curve ($MP_0$) intersect at the equilibrium point, indicating the level of real GDP and the interest rate at which the market clears in terms of both goods and money markets.
The Baseline IS-MP-IA Model (3, cont.): The AD Curve
The Baseline IS-MP-IA Model (3, cont.): The AD Curve
The Baseline IS-MP-IA Model (4)

The IA Curve:

- At a point in time, the inflation rate is given and does not respond to the state of the economy.
- Let $\overline{Y}$ denote the economy’s normal or potential level of output.
- If $Y > \overline{Y}$, inflation is rising.
- If $Y < \overline{Y}$, inflation is falling.
- If $Y = \overline{Y}$, inflation is steady.
The AD-IA Diagram: The Determination of $Y$ and $\pi$
The Baseline IS-MP-IA Model: Long-Run Equilibrium

![Diagram showing the Baseline IS-MP-IA Model](image-url)
(1) The nominal interest rate cannot be negative

• The central bank would like to set \( r = r(Y, \pi) \).

• Since the real interest rate, \( r \), equals \( i - \pi^e \), this means that \( r \) cannot be less than \( 0 - \pi^e \).

• Thus:

\[
 r = \begin{cases} 
 r(Y, \pi) & \text{if } r(Y, \pi) + \pi^e \geq 0 \\
 0 - \pi^e & \text{otherwise} 
\end{cases}
\]
Changes to the Baseline Model

(2) In the baseline model, expected inflation follows actual inflation

- That is, $\pi^e = \pi$.
- (An alternative would be $\pi^e = \pi^e(\pi)$, with the function increasing.)
Where We Are Headed: The Aggregate Demand Curve Accounting for the Zero Lower Bound
The IS and MP Curves

Accounting for the Zero Lower Bound: Step 1

\[ r(Y, \pi) \]
The IS and MP Curves

Accounting for the Zero Lower Bound: Step 2
Deriving the AD Curve

$r$

$MP(\pi_0)$

$-\pi_0$

$IS_0$

$\pi$

$\pi_0$

$Y$

$Y_0$
Deriving the AD Curve

\[ MP(\pi_0) > MP(\pi_1) > MP(\pi_2) \]

\[ Y_0 > Y_1 > Y_2 \]
Deriving the AD Curve (continued)
Deriving the AD Curve (continued)

\[ IS_0 \]

\[ r \]

\[ -\pi_3 \]
\[ -\pi_2 \]

\[ MP(\pi_2) \]
\[ MP(\pi_3) \]

\[ IS_0 \]

\[ \pi \]

\[ \pi_2 \]
\[ \pi_3 \]

\[ Y_3 \]
\[ Y_2 \]
\[ Y \]

\[ \pi_2 > \pi_3 \]
Deriving the Aggregate Demand Curve: Conclusion
III. EXAMPLES
Example: A Large, Long-Lasting Fall in Planned Expenditure
Example: A Large, Long-Lasting Fall in Planned Expenditure
A Large, Long-Lasting Fall in Planned Expenditure (cont.)
A Large, Long-Lasting Fall in Planned Expenditure (cont.)

\[
\begin{align*}
\text{IS}_1 &= MP(\pi_1) - \pi_1 Y \\
\text{IA}_2 &= MP(\pi_2) - \pi_2 Y \\
\text{AD}_1 &= Y_2 Y_1 \\
\text{IA}_1 &= Y_1 \bar{Y} \\
\text{IA}_2 &= \bar{Y} Y_2 \\
\end{align*}
\]
The Effects of a Large Rebound in Planned Expenditure
How Seriously Should We Take This?

The main message: When the economy is at the zero lower bound, a key force keeping the economy stable is inoperative.
“Saving Your Ammunition”: The Initial Situation
Saving Your Ammunition: The Dynamics of the Economy

\[ \text{Graph showing the relationship between } \pi \text{ and } Y \text{ with } AD_0, \pi_0, \pi_2, \pi_3, \pi_4, \text{ and various IA levels including } IA_0, IA_2, IA_3, IA_4. \]
Using Your Ammunition

\[
\begin{align*}
\pi & \quad r \\
-\pi_0 & \quad \text{MP}_0 \\
\pi_0 & \quad \text{IS}_0 \\
\end{align*}
\]

\[
\begin{align*}
\pi & \quad \text{AD}_0 \quad \text{AD}_1 \\
\end{align*}
\]

\[
\begin{align*}
Y_0 & \quad Y & \quad Y_1 \\
\end{align*}
\]

\[
\begin{align*}
\pi_0 & \quad \text{IA}_0, \text{IA}_1 \\
\end{align*}
\]
Using Your Ammunition (cont.)

\[ \pi \]

\[ r \]

\[ -\pi_0 \]

\[ \text{MP}_0 \]

\[ \text{IS}_0 \]

\[ \text{MP}_1 \]

\[ \pi \]

\[ \pi_{LR} \]

\[ \pi_0 \]

\[ \text{AD}_0 \]

\[ \text{AD}_1 \]

\[ \text{IA}_{LR} \]

\[ \text{IA}_0, \text{IA}_1 \]

\[ Y \]

\[ Y_0 \]

\[ \bar{Y} \]

\[ Y_1 \]
INTERMISSION
Plan for the second part of the lecture

• Discuss strategies for escaping from a liquidity trap at a general level.

• Japanese experience in the 1990s and 2000s.

• U.S. experience in the 1930s.

• U.S. experience since 2008.
IV. Strategies for Dealing with the Zero Lower Bound
Suppose we are at the zero lower bound because of a collapse of IS:

\[ r = 0 - \pi^e_0 \]

\[ Y_0 \]

\[ Y \]
Solution 1: Expansionary Fiscal Policy
Quantitative Easing

• Non-standard open market operations.
• Central bank usually buys short-term government bonds.
• Could buy long-term government bonds, mortgage-backed securities, private bonds, etc.
• Typically done with the short-term policy rate is at zero.
Effects of Quantitative Easing

• Raise the price of assets being purchased.
  • This will likely have a wealth or balance sheet effect.

• Lower longer-term interest rates.
  • Flatten the yield curve. Typically done with the short-term policy rate is at zero.

• Raise expected inflation.
Solution 2: Lower Long-Term Rates through Quantitative Easing
Communications Policy

• Central bank commits itself to certain actions.

• For example, it might promise to keep short-term rates low for longer than it normally would.

• This could lower long-term rates through the expectations theory of the term structure.

• It could also change expectations of future inflation and future real growth.
Currency Depreciation

• A specific kind of non-standard open market operation.
• Central bank buys foreign currency.
• Shifts out IS by increasing net exports.
Solution 3: Raise Expected Inflation

$$\pi^e_1 > \pi^e_0$$
How can we raise expected inflation?

• Communications policy.
• Inflation or price-level target.
• Regime change.
• Rapid money growth.
Raising Expected Inflation to Escape from a Liquidity Trap: A Complication

• It may be that policymakers want expected inflation to rise, but do not want actual inflation to rise. Thus, they may be tempted to renege on their statements about future policy.
Same methods may raise expectations of future growth.

- Expected future growth could raise spending today.
- This could increase investment as firms gear up to produce more.
- Consumer spending might rise as people feel their jobs and incomes are more secure.
Solution 4: Raise Expected Future Growth

\[ r = 0 - \pi^e_0 \]

\[ \text{IS} \quad \text{MP}_0 \]

\[ Y_0 \quad Y_1 \]
Evans’s Idea: Targeting a Price Level Path

Figure 2: State-contingent Price Level Targeting

Core PCE Price Index and Inflation
(Index, 2005=100, Q4/Q4 inflation)

- Price Level
- Dec. 2007
- Y/Y Inflation

- 2% Price Level Target

Current FOMC Inflation Forecasts
- Example Inflation Path Consistent with Price Level Target

- 2% Inflation Target
V. JAPAN IN THE 1990S AND 2000S
Table 7.1  Measures of inflation in Japan, 1991-99

<table>
<thead>
<tr>
<th>Year</th>
<th>(1) GDP deflator (% change)</th>
<th>(2) PCE deflator (% change)</th>
<th>(3) CPI deflator (% change)</th>
<th>(4) Nominal GDP (% change)</th>
<th>(5) Monthly earnings (% change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>2.89</td>
<td>2.13</td>
<td>2.30</td>
<td>5.30</td>
<td>2.84</td>
</tr>
<tr>
<td>1992</td>
<td>0.94</td>
<td>1.44</td>
<td>2.08</td>
<td>1.09</td>
<td>1.78</td>
</tr>
<tr>
<td>1993</td>
<td>0.44</td>
<td>0.96</td>
<td>0.91</td>
<td>0.91</td>
<td>1.82</td>
</tr>
<tr>
<td>1994</td>
<td>-0.62</td>
<td>0.60</td>
<td>0.50</td>
<td>0.04</td>
<td>2.70</td>
</tr>
<tr>
<td>1995</td>
<td>-0.38</td>
<td>-0.90</td>
<td>0.07</td>
<td>0.79</td>
<td>1.87</td>
</tr>
<tr>
<td>1996</td>
<td>-2.23</td>
<td>0.34</td>
<td>0.30</td>
<td>2.43</td>
<td>1.87</td>
</tr>
<tr>
<td>1997</td>
<td>1.00</td>
<td>1.91</td>
<td>2.23</td>
<td>0.39</td>
<td>0.81</td>
</tr>
<tr>
<td>1998</td>
<td>0.17</td>
<td>-0.02</td>
<td>-0.32</td>
<td>-2.78</td>
<td>-0.10</td>
</tr>
<tr>
<td>1999</td>
<td>-0.79</td>
<td>-0.14</td>
<td>0.00</td>
<td>0.12</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Source: Ben Bernanke, “Japanese Monetary Policy: A Case of Self-Induced Paralysis?”
Peak in stock prices was in 1989; real estate peak was a little later.
Bernanke’s Critique of Bank of Japan’s Policy

• Too slow to act.
• Communications policy vague and ineffective.
• Afraid to create inflationary expectations.
• Refused to depreciate the Yen.
Bank of Japan was slow to cut rates, and then raised rates in both 2000-2001 and 2006-2008.
GDP leveled off in 1990 and growth has remained anemic.
VI. **United States in the 1930s**
Real GDP growth was both fast and slow in the recovery from the Great Depression.


It was fast in an absolute sense, but slow relative to the recovery needed.
Safe interest rates have been approximately zero two times: the mid- and late 1930s and today.
Roosevelt’s Regime Shift

• A regime shift is an abrupt and dramatic change in government economic policy.

• Roosevelt replaced Hoover’s fiscal and monetary austerity with expansionary policy.

• Most obvious signal of the regime shift was abandoning the gold standard.
Devaluation raised the price of tradable goods, especially agricultural products, and hence farm incomes.

Price of Cotton and the Exchange Rate, 1930-36

Auto and steel production took off after devaluation.

TABLE 2
Monthly Growth Rates, 1933
(Percent per Month; Seasonally Adjusted)

<table>
<thead>
<tr>
<th>Month</th>
<th>Autos</th>
<th>Steel</th>
<th>Industrial production</th>
<th>Purged industrial production</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>-02</td>
<td>07</td>
<td>00</td>
<td>-00</td>
</tr>
<tr>
<td>February</td>
<td>-29</td>
<td>00</td>
<td>-02</td>
<td>-01</td>
</tr>
<tr>
<td>March</td>
<td>-20</td>
<td>-26</td>
<td>-05</td>
<td>-04</td>
</tr>
<tr>
<td>April</td>
<td>42</td>
<td>46</td>
<td>07</td>
<td>04</td>
</tr>
<tr>
<td>May</td>
<td>18</td>
<td>35</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>June</td>
<td>19</td>
<td>35</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>July</td>
<td>14</td>
<td>29</td>
<td>10</td>
<td>07</td>
</tr>
<tr>
<td>August</td>
<td>06</td>
<td>-20</td>
<td>-05</td>
<td>-03</td>
</tr>
<tr>
<td>September</td>
<td>03</td>
<td>-21</td>
<td>-06</td>
<td>-05</td>
</tr>
<tr>
<td>October</td>
<td>-03</td>
<td>-09</td>
<td>-05</td>
<td>-05</td>
</tr>
<tr>
<td>November</td>
<td>-72</td>
<td>-28</td>
<td>-06</td>
<td>-01</td>
</tr>
<tr>
<td>December</td>
<td>03</td>
<td>24</td>
<td>01</td>
<td>-01</td>
</tr>
</tbody>
</table>

Jump in stock prices could be a sign of a change in expectations.
Investment spending rises almost exactly when the U.S. suspends the gold standard.

Steel rose so much, Temin and Wigmore say it must reflect a big change in expectations of future demand.

Money growth was very rapid in the mid-1930s.


DEVIATIONS OF MONEY GROWTH RATE FROM NORMAL, 1923–1942

Money growth was very rapid in the mid-1930s.
Gold inflows surged starting in 1934, and were a key source of monetary expansion.
Expected inflation rose and real interest rates fell beginning in 1933.

Interest-sensitive spending recovered quickly in 1933.

Movements in spending appear to be correlated with real interest rate changes.

VII. United States since 2008
Funds rate target was 0 to .25% starting in December 2008.
Where would the Fed have liked to set the nominal rate?

Figure 2
Federal funds rate
Percent

Fed's target rate
Recommended target rate from a Taylor rule

Monetary policy funds rate shortfall

[Diagram showing the Federal funds rate over time with Fed's target rate and recommended target rate from a Taylor rule, along with a shaded area indicating monetary policy funds rate shortfall.]
How did the Fed try to deal with the zero bound?

• Large-scale asset purchases

• Communications policy
First Round of Quantitative Easing (QE1)

In all, the Fed bought about $1.7 trillion of assets.

Event Study Approach

• Identify news events.

• Look at the response of interest rates on the day of the news.

• What are the benefits and pitfalls of this approach?
Five of Eight Key Announcement Dates

- the initial LSAP announcement on November 25, 2008, in which the Federal Reserve announced it would purchase up to $100 billion in agency debt and up to $500 billion in agency MBS;
- Chairman Bernanke’s December 1, 2008 speech, in which he stated that in order to influence financial conditions, the Federal Reserve “could purchase longer-term Treasury securities... in substantial quantities”;
- the December 2008 and January 2009 FOMC statements, which indicated that the FOMC was considering expanding purchases of agency securities and initiating purchases of longer-term Treasury securities;
- the March 2009 FOMC statement, in which the FOMC announced the decision to purchase “up to” $300 billion of longer-term Treasury securities and to increase the size of agency debt and agency MBS purchases to “up to” $200 billion and $1.25 trillion, respectively;
Table 1. Interest Rate Changes around Baseline and Extended Event Set Announcements

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>2y UST</th>
<th>10y UST</th>
<th>10y Agy</th>
<th>Agy MBS$^b$</th>
<th>10y TP</th>
<th>10y Swap</th>
<th>Baa Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/1/2008$^a$</td>
<td>Chairman Speech</td>
<td>-8</td>
<td>-19</td>
<td>-39</td>
<td>-15</td>
<td>-17</td>
<td>-17</td>
<td>-12</td>
</tr>
<tr>
<td>12/16/2008$^a$</td>
<td>FOMC Statement</td>
<td>-9</td>
<td>-26</td>
<td>-29</td>
<td>-37</td>
<td>-12</td>
<td>-32</td>
<td>-11</td>
</tr>
<tr>
<td>1/28/2009$^a$</td>
<td>FOMC Statement</td>
<td>10</td>
<td>14</td>
<td>14</td>
<td>11</td>
<td>9</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>8/12/2009$^a$</td>
<td>FOMC Statement</td>
<td>-2</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9/23/2009$^a$</td>
<td>FOMC Statement</td>
<td>1</td>
<td>-3</td>
<td>-3</td>
<td>-1</td>
<td>-1</td>
<td>-5</td>
<td>-4</td>
</tr>
<tr>
<td>11/4/2009$^a$</td>
<td>FOMC Statement</td>
<td>-2</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

**Baseline Event Set**

Baseline Event Set + All FOMC

Cumulative Change:
11/24/08 to 3/31/2010

Std Dev of Daily Changes:
11/24/08 to 3/31/10

Effect of QE1

Figure 5. Cumulative Interest Changes on Baseline Event Set Days

Effect of QE1

Figure 6. Cumulative Changes since November 2008, Event vs. Non-Event Days

Communications Policy

• Inflation target

• Forward guidance
The longer-run forecasts are supposed to give an indication of where the Fed would like inflation to be.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Central tendency¹</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
<td>2014</td>
<td>Longer run</td>
</tr>
<tr>
<td>Change in real GDP</td>
<td>2.2 to 2.7</td>
<td>2.8 to 3.2</td>
<td>3.3 to 4.0</td>
<td>2.3 to 2.6</td>
</tr>
<tr>
<td>November projection</td>
<td>2.5 to 2.9</td>
<td>3.0 to 3.5</td>
<td>3.0 to 3.9</td>
<td>2.4 to 2.7</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>8.2 to 8.5</td>
<td>7.4 to 8.1</td>
<td>6.7 to 7.6</td>
<td>5.2 to 6.0</td>
</tr>
<tr>
<td>November projection</td>
<td>8.5 to 8.7</td>
<td>7.8 to 8.2</td>
<td>6.8 to 7.7</td>
<td>5.2 to 6.0</td>
</tr>
<tr>
<td>PCE inflation</td>
<td>1.4 to 1.8</td>
<td>1.4 to 2.0</td>
<td>1.6 to 2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>November projection</td>
<td>1.4 to 2.0</td>
<td>1.5 to 2.0</td>
<td>1.5 to 2.0</td>
<td>1.7 to 2.0</td>
</tr>
<tr>
<td>Core PCE inflation</td>
<td>1.5 to 1.8</td>
<td>1.5 to 2.0</td>
<td>1.6 to 2.0</td>
<td></td>
</tr>
<tr>
<td>November projection</td>
<td>1.5 to 2.0</td>
<td>1.4 to 1.9</td>
<td>1.5 to 2.0</td>
<td></td>
</tr>
</tbody>
</table>
Fed isn’t promising to keep rates low even if output is back to normal; they are saying they expect to want to keep rates low because output will be low. Their statements about future interest rates are “Delphic,” not “Odyssean.”
Where would the Fed have liked to set the nominal rate?