Understanding the Keynesian Model: Applications and Extensions

• Questions:
  1. How does monetary policy affect nominal interest rates over time?
     - Keynesian reasoning: $\% \Delta M \uparrow \Rightarrow i \downarrow$ (liquidity preference diagram)
     - Classical reasoning: $\% \Delta M \uparrow \Rightarrow \pi \uparrow \Rightarrow \pi^e \uparrow \Rightarrow i \uparrow$
     - Reconciliation: Keynesian short-run & Classical long-run answers
  2. What goes wrong when a central bank violates the Taylor Principle?
  3. What can monetary policy do when nominal interest rates hit zero?
     => Monetary policy with Zero Lower Bound (ZLB)
  4. Generalizing the MP-curve: How does the model work when monetary policy responds systematically to the output gap? => The Taylor Rule.
How does monetary policy affect interest rates over time?

- Task: Reconcile Classical and Keynesian reasoning.
  Combine Liquidity Preference diagram, MP-curve, and AD-AS diagram.
- Keynesian monetary reasoning is framed in terms of interest rates:
  - Money supply is in the background: set $M$ in whatever way needed so the nominal interest rate is consistent with the desired MP curve.
  - Market for money equilibrium $M \cdot V(i) = Y \cdot P$ still applies.

- Example of Monetary Expansion:
  - Start with $Y = Y^P$, $\pi = \pi_0$, $r = r_0 = \bar{r} + \lambda \pi_0$.
  - In market for money: $M^d$ and $M^s$ shift to the right at rate $\%\Delta M = \pi_0$ with intersections at $i = r + \pi^e = r_0 + \pi_0$ (To simplify, assume no growth in $Y$ and $V$.)
  - Suppose the central bank decides to shift the MP curve down: $\bar{r} \downarrow$.
  - How? Implemented by open market purchase => Extra shift in $M^s$ right, so $i$ declines by $\Delta i = \Delta \bar{r}$. The Liquidity Effect.
  - Time horizon: Instantaneous. Macroeconomy still unchanged.
  - Macro implications?
Monetary Expansion Example: Graphs

MP curve

Market for Money

IS curve

AD-AS diagram
Notes on the Monetary Expansion Example: Economic Reasoning

• Macro Short run: MP curve down => AD curve shifts right => Y↑, π↑.
  - In market for money:
    (a) Y↑ => Extra shift in M^d to the right, raising i: The Income Effect.
    (b) π↑ => P increases more quickly => Shift in M^d more: The Price Effect.
  - Time horizon: Macroeconomic “short run” ~ several months.
  - How big are these effects? Use long run as benchmark…
• Macro Long run: AS curve shifts up until Y = Y^P at inflation rate π = π_1
  - Note unchanged IS curve => Real interest rate must return to r = r_0.
  - Return to r = r_0 on MP curve => Δr + λΔπ = 0, π_1 − π_0 = (−Δr)/λ > 0.
    => No real changes (Y,r) in the long run. Money is neutral.
  - Expectations adjust, so i = r_0 + π_1 increases: The Expected Inflation Effect.
  - Note that Δi = Δπ = Δπ^e: Fisher effect.
  - Graph in market for money: M^d and M^s shift to the right at rate %ΔM = π_1 with intersections at i = r + π^e = r_0 + π_1. Shift in MP = Change in money growth.
• Compare SR and LR: Y > Y^P in short run implies r < r_0, π < π_1 and i < r_0 + π_1.
Money & Interest Rates in Mishkin ch.5

- Mishkin presents three cases.

**Lessons from macroeconomics:**

1. **Money is neutral in the long run:**
   - => Real rate returns to initial value
   - => Rules out case (a)

2. **Sticky prices imply a Liquidity effect:** i down in short run
   - => Rules out case (c)

3. **Money growth causes inflation**
   - => Fisher effect in the long run:
     \[
     \% \Delta M = \Delta \pi = \Delta \pi^e = \Delta i
     \]
   - All other “effects” must cancel.

- Conclude: only case (b) is consistent with liquidity effect & LR-neutrality.
What goes wrong when central banks violate the Taylor Principle?

• Suppose a central bank sets $\lambda=0$. Then $Y = Y^d(\bar{r},...) \Rightarrow$ vertical AD curve
  - If $Y^d(\bar{r},...) > Y^P$, obtain cycle of rising inflation as firms try to set $\pi > \pi^e$, expected inflation rising, actual inflation rising $\Rightarrow$ Run-away inflation.
  - If $Y^d(\bar{r},...) < Y^P$, obtain cycle of firms trying to set $\pi < \pi^e$, expected inflation falling, actual inflation falling $\Rightarrow$ deflation and zero nominal interest rate.

• Suppose a central bank sets a nominal interest rate target $i = \bar{i}$. Then $r = \bar{i} - \pi^e$.
  - If $Y^d(\bar{i} - \pi^e, ...) > Y^P$, obtain cycle of rising inflation as firms try to set $\pi > \pi^e$, expected inflation rising $\Rightarrow$ real rate falling and actual inflation rising more
    $\Rightarrow$ Run-away inflation accelerated by declining real rate.

• **Lesson:** Taylor Principle requires that central banks respond aggressively to changes in actual and expected inflation.
  - Keynesian model assumes well-working, responsible central banks.
  - Contrast to classical recommendation: constant money growth avoids both high inflation and severe deflation, provided velocity is stable.
How does monetary policy work when \( i = 0 \)?

**Macroeconomics at the Zero Lower Bound**

- **Nominal interest rates cannot be negative** if money can be held at zero cost.  
  \[ \iff \text{Nominal interest rates have a zero lower bound (ZLB): } i \geq 0. \]  
  \[ \iff \text{The real interest rate is bounded by minus expected inflation: } r \geq -\pi^e \]  

  [Practical detail: for large investors holding money safely is costly \( \Rightarrow \) Nominal interest rates can be slightly negative, bounded by the cost of holding money—small, approximate by zero.]

- **Problem:** ZLB implies that the MP-curve is horizontal at low inflation rates.

1. **Argument for Keynesian fiscal stimulus:** ZLB limits central banks’ ability to reduce \( r \).  
   If \( Y < Y^p \) and \( i = 0 \), only fiscal stimulus can raise output.  
   *Caveat: Rising government debt \( \Rightarrow \) expectations of future taxes.*

2. **Argument for “unconventional” Fed policy:** Expand the money supply. Rely on rational investors to know that money growth is inflationary in the long run.  
   Holding \( i = 0 \) constant, higher \( \pi^e \) reduces the real interest rate.  
   *Caveat: Uncertainty when and by how much expectations will respond.*
Notes on the Zero Lower Bound: A Simple Graphical Analysis

[Mishkin’s analysis is unnecessarily complicated – disregard & use the assumptions here.]

- ZLB implies horizontal section of the MP curve at level \( r = -\pi^e \).
- Horizontal section of the MP curve implies a vertical section of the AD curve.
  - Vertical section is irrelevant under normal conditions (starts at \( Y >> Y^P \))
  - Vertical section is shift left whenever IS shifts left \( \Rightarrow \) Relevant when aggregate demand declines by a large amount, e.g., in a financial crisis.
- Short run equilibrium at the ZLB: AS intersects the vertical section of AD.
  - Resulting inflation is on the horizontal section of the MP curve
  - Resulting output is less than potential output
- Long run equilibrium does not exist – instead obtain downward spiral:
  - Given \( Y < Y^P \) \( \Rightarrow \) AS \( \downarrow \Rightarrow \pi \downarrow \Rightarrow \pi^e \downarrow \Rightarrow MP \uparrow \Rightarrow \) AD shifts left \( \Rightarrow Y \downarrow \)
What if monetary policy responds systematically to the output gap?

The Taylor Rule

• Famous regression by John Taylor (1993) provides evidence on the Taylor principle and on how U.S. monetary policy has responded to disturbances

\[
\text{Fed Funds rate} = \text{Equilibrium real rate} + \text{Inflation rate} + 0.5 \times \text{Inflation Gap} + 0.5 \times \text{Output Gap}
\]

- Equilibrium real rate (estimate of long run r*) \(\sim\) 2%
- Inflation Gap = Actual Inflation – Target, using Target = 2%
- Output Gap = (-2) \times (\text{Unemployment rate} – \text{Natural rate}), using Natural Rate \(\sim\) 5.5%

• Implications:

1. Evidence that U.S. policy has satisfied the Taylor principle
   1% higher inflation \(\Rightarrow\) 1.5% higher Fed Funds rate \(\Rightarrow\) 0.5% higher real rate.

2. Evidence of a systematic response to the output gap suggest the Fed usually tries to stabilize output: MP shifts down in recessions & up in booms.

3. Sophisticated rules blur the distinction between activist & non-activist policy
   - Definition of “active” or “discretionary” depends on what changes are considered normal/non-active responses to changes in other variables.
   - Keynesian textbook answer: active = shifting the basic MP curve.
   - Monetarist answer: active = change in \(\%\Delta M\). Taylor: active = shift in rule.