Intermediate Macroeconomics (UN3213)
Recitation 2

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Quick review

- The IS and PC curves constitute a sytem of two equations in 3 unknowns $\hat{y}, \hat{\pi}, \hat{i}$

$$\hat{\pi} = \beta \hat{\pi}^e + \kappa \hat{y} + \epsilon^{CP}$$

$$\hat{y} = -\gamma(\hat{i} - \hat{\pi}^e) + \epsilon^d$$

  Need to know one of them to solve for the equilibrium.

- Dual mandate of the central bank
  - Output stabilization
  - Price stabilization
- When the central bank specifies a monetary policy (sets a value for i), this allows us to solve for equilibrium values of $\hat{y}, \hat{\pi}$.
- Equivalently, the central bank decides on a target for either $\hat{y}$ or $\hat{\pi}$, and this allows us to back out the value for i needed to achieve that target.

Zero lower bound

- In the simple example with anchored inflation expectations and no shocks, a target of $\hat{y} = 0$ results in an equilibrium where also $\hat{\pi} = 0$

$$\hat{\pi} = \kappa \hat{y}$$

$$\hat{y} = -\gamma \hat{i}$$

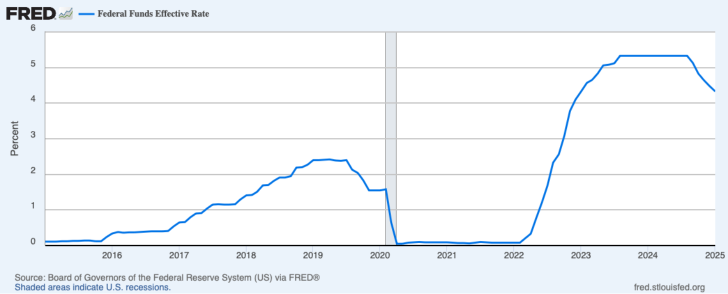
Setting $i = \bar{i}$ ensures $\hat{y} = \hat{\pi} = 0$ (the central bank meets both its targets)

- Suppose there is a large negative demand shock to the IS curve.

$$\hat{y} = -\gamma \hat{i} + \epsilon^d$$

Now to meet its targets, the central bank has to set $i = \bar{i} + \frac{\epsilon^d}{\gamma}$. If ϵ^d is sufficiently negative, then $i < 0$. The central bank runs into the zero lower bound constraint (also known as liquidity trap)

ZLB in practice



- The nominal interest that the Fed targets is the *federal funds rate* (the rate at which banks can borrow and lend from each other overnight)
- Under conventional monetary policy, the Fed conducts open market operations (OMOs) where they buy/sell government bonds from banks, which raises/lowers bank reserves, and this affects the rate at which they lend overnight.

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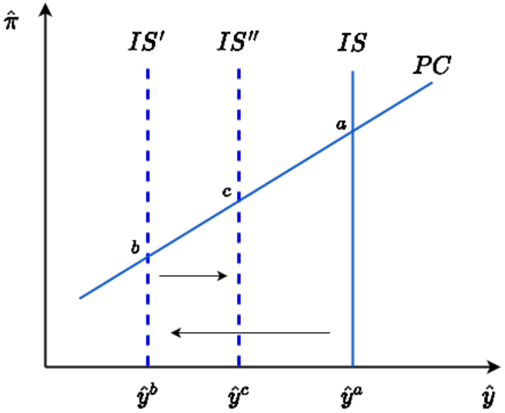
Example 1: Demand shock under ZLB

Consider the case of a large negative demand shock such that the ZLB becomes relevant.

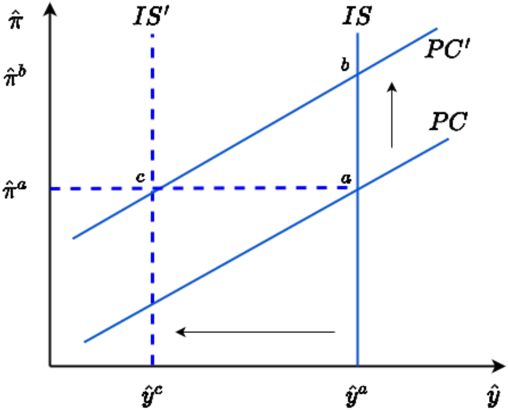


Example 1: Demand shock under ZLB

- At a, monetary policy is specified ($\hat{i}$ is known). Therefore, we can solve the IS and PC curves to get the initial equilibrium, $\hat{y}^a = -\gamma(\hat{i} - \hat{\pi}^e), \hat{\pi}^a = (\beta + \kappa\gamma)\hat{\pi}^e - \kappa\gamma\hat{i}$
- At b, there is a large negative demand shock $\epsilon^d < 0$, but monetary policy is still unchanged. We can solve IS and PC curves to get the new equilibrium. $\hat{y}^b = -\gamma(\hat{i} - \hat{\pi}^e) + \epsilon^d$, $\hat{\pi}^b = (\beta + \kappa\gamma)\hat{\pi}^e - \kappa\gamma\hat{i} + \kappa\epsilon^d$. Note that $\hat{y}^b < \hat{y}^a$ and $\hat{\pi}^b < \hat{\pi}^a$.
- To bring the economy back to a, the central bank needs to cut interest rates from $\hat{i}$ to $\hat{i} + \frac{\epsilon^d}{\gamma}$. However, this may not be possible because of the zero lower bound. Interest rate cannot be lowered below zero
- At the ZLB (c in the figure), $\hat{i} = 0$. Again, solve IS and PC equations to solve for the equilibrium that is feasible to the central bank. This is $\hat{y}^c = \gamma\hat{\pi}^e + \epsilon^d$ and $\hat{\pi}^c = (\beta + \kappa\gamma)\hat{\pi}^e + \kappa\epsilon^d$. Verify that these are actually lower than $\hat{y}^a$ and $\hat{\pi}^a$

Example 2: Cost push shock

Consider the case of a positive cost push shock. The ZLB is not relevant here



Example 2: Cost push shock

- At a, monetary policy is specified ($\hat{i}$ is known). Therefore, we can solve the IS and PC curves to get the initial equilibrium, $\hat{y}^a = -\gamma(\hat{i} - \hat{\pi}^e), \hat{\pi}^a = (\beta + \kappa\gamma)\hat{\pi}^e - \kappa\gamma\hat{i}$
- At b, there is a large positive cost push shock $\epsilon^{CP} > 0$, but monetary policy is initially unchanged (CB is dovish). Solve IS and PC' to get the new equilibrium, $\hat{y}^a = -\gamma(\hat{i} - \hat{\pi}^e), \hat{\pi}^a = (\beta + \kappa\gamma)\hat{\pi}^e - \kappa\gamma\hat{i} + \epsilon^{CP}$
- At c, the central bank raises the nominal interest rate from $\hat{i}$ to $\hat{i} + \frac{\epsilon^{CP}}{\kappa\gamma}$ to bring inflation back to original level $\hat{\pi}^a$. Therefore, $\hat{\pi}^a = \hat{\pi}^c$, and $\hat{y}^c = -\gamma\left(\hat{i} + \frac{\epsilon^{CP}}{\kappa\gamma} - \hat{\pi}^e\right)$

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The Fisher equation

- The nominal return on savings should compensate savers for inflation (π) and their willingness to postpone current consumption (denoted r, the real interest rate).

  $$(1+i) = (1+\pi)(1+r)$$

  Since π and r are typically small, the above can be approximated as

  $$1 + i = 1 + \pi + r$$
  $$\iff \ i = \pi + r$$

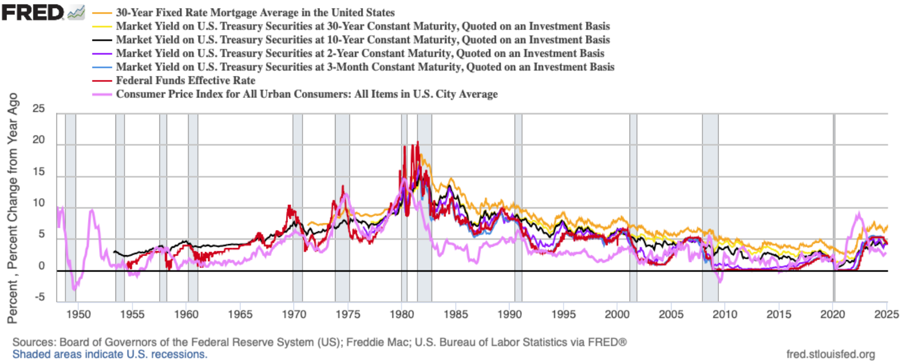
- The normal level of the nominal interest rate $\bar{i}$ is determined by the Fisher equation in *normal* times.

  $$\bar{i} = \bar{\pi} + \bar{r}$$

- Central banks use it to set interest rates in response to inflation expectations. Investors use it to assess the real rate of return on assets and savings.

- *Treasury Inflation-Protected Securities* (TIPS): Returns are indexed to inflation. Guarantees some positive real return to investors.

US Treasury yields vs. CPI inflation



The yield curve

- Interest rates on treasury securities with different maturities
- Usually upward-sloping (term-premium to compensate for risk)
- Sometimes downward-sloping (if investors expect short-term rates to go down in the future)