

# Macro-Finance: Class 8

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## Taylor Rule

Proposes that the Fed should adjust interest rates in response to two main variables:

- ▶ gap between actual and target inflation
- ▶ gap between actual and potential output

$$i_t = r^* + \pi_t + a_1 \underbrace{(\pi_t - \pi_t^*)}_{\text{inflation gap}} + a_2 \underbrace{(y_t - y_t^*)}_{\text{output gap}} \quad (1)$$

- ▶  $r^*$  is the average (long-run) real interest rate.
- ▶ classic rule  $a_1 = 1.5$ ,  $a_2 = 0.5$

when either gap is positive, interest rate should explicitly rise:

- ▶ when  $y_t > y_t^*$
- ▶ when  $\pi_t > \pi_t^*$

when actual output and/or inflation are below target values, interest rates should fall (economy is weak, and interest rates should decline).

Implementation has drawbacks:

- ▶ requires a 'steady state'
- ▶ limited use when close to ZLB
- ▶ real interest rate is not observable and measuring/estimating it is not easy, so deciding the 'normal' (or 'neutral') level of nominal rates is difficult too. Deciding what inflation measure to use, and measuring the output gap, also present practical obstacles to the Taylor rule.

Q — A sudden increase in inflation expectations by one percent, should increase short term nominal interest rates by around ... if a central bank follows a Taylor rule. Investors expecting the higher interest rates to persist for a while might require a ... expected return to invest in the stock market.

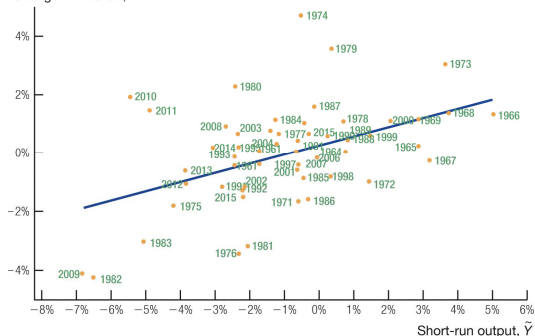
1. 0.5%, higher
2. 0.5%, lower
3. 1.5%, higher
4. 1.5%, lower
5. None of the above

# Philips Curve

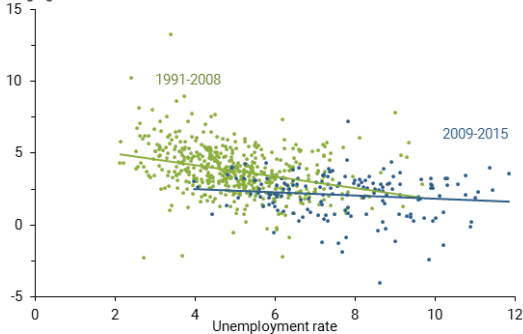
higher output negatively (lower unemployment) related to inflation In recent times it tends to be flatter, i.e. big fluctuations in output lead to small changes in inflation:

Measuring the Phillips Curve, 1960–2015

Change in inflation,  $\Delta\pi$



Wage growth



# Money Measures

Common measurements:

- ▶ M0: currency + reserves
- ▶ M1: M0 + demand deposits, checkable deposits
- ▶ M2: M1 + short time deposits and saving deposits
- ▶ M3: M2 + time deposits
- ▶ M4: M3 + illiquid assets e.g. long term bonds

Withdrawing \$100 from your checking account and depositing it in your savings account:

1. M1 rises and M2 falls.
2. the monetary base rises.
3. both M1 and M2 rise.
4. M1 falls and M2 rises.
5. M1 falls by \$50 and M2 rises by \$50.

## Central Bank Role

1. Controls the money supply, but not entirely!
2. Done via monetary policy
3. In many countries, monetary policy delegated to partially independent central banks (BOE, FED, ECB)

Money supply equals currency plus demand deposits (deposits in current accounts):

$$M = C + D$$

Banking system interacts with monetary policy (via demand deposits):

- ▶ Reserves (R): the fraction of deposits that banks have not lent  
(= required reserves RR + excess reserves ER)
- ▶ 100%-reserve banking: a system in which banks hold all deposits as reserves
- ▶ Fractional-reserve banking: a system in which banks hold a fraction of their deposits as reserves

# Banks & Monetary System

To understand the role of banks, we will consider two scenarios:

- ▶ 100%-reserve banking (banks hold all deposits as reserves)
- ▶ Fractional-reserve banking

In each scenario, we assume  $C = £1,000$ .

## Scenario I: 100%-reserve banking

Initially  $C = £1,000$ ,  $D = £0$ ,  $M = £1,000$ .

1. Now suppose households deposit the £1,000 at FirstBank
2. After the deposit,  $C = £0$ ,  $D = £1,000$ ,  $M = £1,000$ .
3. 100%-reserve banking has no impact on size of money supply

## Question

Scenario I is trivial but motivates:

why do banks (fractional-reserve banking) exist?

# Bank Functions

In the real world there are many frictions and market imperfections justify their existence:  
Informational asymmetries, Asset transformations because of liquidity mismatches,  
Indivisibilities, Various costs

## **(1) Offering liquidity and payment services**

- ▶ Safekeeping of deposits
- ▶ Management of clients' accounts
- ▶ Finalising payments
- ▶ systems are safe and efficient

## **(2) Transforming assets**

- ▶ Intermediaries that collect many small deposits (e.g. from households) and turn them into large loans
- ▶ Bank deposits offer better risk-return characteristics than direct investments, due to indivisibilities in investment: small investors cannot diversify their portfolios
- ▶ asymmetric information: banks have better information than depositors
- ▶ Transforming securities with short maturity into securities with long maturity (liquidity risk?)



### **(3) Managing credit, interest rate and liquidity risks**

- ▶ Credit risk: the risk that a borrower is not able to repay their debt (To make their loans more secure, banks use collateral, or assignment of creditors' rights or public/government endorsement)
- ▶ Liquidity and interest rate risk: due to maturity transformation
- ▶ Unexpected withdrawals of deposits may force banks to seek more expensive sources of funds
- ▶ Banks have to manage the combination of interest rate risk (due to the difference in maturity) and liquidity risk (due to the difference in the marketability of the claims issued and of the claims held).

### **(4) Processing information and monitoring borrowers**

- ▶ Screening loan applicants and monitoring their projects.
- ▶ Monitoring activity relates to a special ability of banks in screening loan demand and/or realized returns of debtors relative to individual consumers
- ▶ It affects the quality of the assets held at a bank
- ▶ A main difference between bank financing and trading securities in financial markets

## Scenario II: Fractional-reserve banking

1. Suppose banks hold 20% of deposits in reserve, issuing loans with the rest
2. FirstBank will issue £800 in loans
3. The money supply now equals £1,800
4. Depositor has £1,000 in demand deposits
5. Borrower holds £800 in currency

in a fractional-reserve banking system, banks create money

1. Suppose the borrower deposits the £800 in SecondBank.
2. Initially, SecondBank's balance sheet is:
3. SecondBank will loan 80% of this deposit.
4. If this £640 is eventually deposited in ThirdBank,
5. then ThirdBank will keep 20% of it in reserve and lent the rest

## Money Supply Change

Credit expands in the following way:

Original Deposit	= £1000
FirstBank lending	= £800
SecondBank lending	= £640
ThirdBank lending	= £512
⋮	⋮

Sum to obtain total money supply:

$$M = £1,000 \times \left( 1 + (1 - 20\%) + (1 - 20\%)^2 + \dots \right) = £1,000 \times \frac{1}{1 - (1 - 20\%)}$$

- ▶ Total money supply is  $\frac{1}{\rho} \times £1,000 = £5,000$  where  $\rho$  is 20%
- ▶ A fractional-reserve banking system creates money
- ▶ It doesn't create real wealth

## Money Supply in Practice

1. Monetary base,  $B = C + R$  'controlled' by the central bank
2. Required Reserve Deposit ratio, depends on regulations & bank policies
3. Excess Reserve Deposit ratio,  $er = ER/D$  depends on regulations & bank policies
4. Currency-deposit ratio,  $cr = C/D$  depends on households' preferences

$$M = C + D = \frac{(C + D)B}{B} = \frac{C + D}{C + R}B$$

then

$$\frac{C + D}{C + R} = \frac{C + D}{C + RR + ER} = \frac{\frac{C}{D} + 1}{\frac{C}{D} + \frac{RR}{D} + \frac{ER}{D}} = \frac{1 + cr}{cr + rr + er}$$

therefore

$$M = \underbrace{\left( \frac{1 + cr}{cr + rr + er} \right)}_{\mu} B$$

where  $\mu$  is the money multiplier.

The increase in the money supply from a one pound increase in the monetary base

- $rr + er < 1$  implies  $\mu > 1$

Fundamental determinants of the money multiplier

1. Reserve requirements decided by the central bank, matters for rr ratio
2. Willingness of banks to hold excess reserves (liquidity risk, credit risk, foregone interest earnings) matters for er ratio
3. Willingness of households and firms to hold cash instead of deposits (liquidity risks, foregone interest earnings) matters for cr ratio

## Question

Central Bank has an exact figure for the currency deposit and the excess reserves ratios.  
True or False?

## Effective Change

Suppose that the Central Bank considers implementing a policy that will double the money supply, by increasing the monetary base, while keeping their headline interest rate low.

- ▶ current money supply in the economy is 120 billion units
- ▶ all commercial banks must maintain a 20% reserve-deposit ratio
- ▶ approximated currency-deposit ratio is 0.5%.

by how many units should the Central Bank increase the monetary base?

$$\begin{aligned}\mu &= \frac{1 + cr}{cr + rr} = \frac{1.005}{0.205} = 4.902 \\ \Delta M &= M_2 - M_1 = 2M_1 - M_1 = 120 \text{ billion}\end{aligned}$$

Then

$$\begin{aligned}\Delta M &= \mu \cdot \Delta B \\ 120 &= 4.902 \times \Delta B\end{aligned}$$

## Practical control of money

### Open market operations:

1. National currency is circulated or withdrawn by buying or selling government securities (i.e. gov bonds, foreign currency, gold)
2. Increase money: use new currency to buy assets
3. Reduce money: redeem old currency by selling assets
4. This is done with debt-instruments, commercial paper and treasury bills with maturity of less than one year

### Repo/Refinance/Discount rate:

1. Interest rate that the BoE/ECB/Fed charges for loans to banks
2. Low repo rate means banks borrow more from CB and monetary base increases
3. Note: different from Libor/Euribor (=interbank rate: banks borrowing and lending to each other to smooth out large variations in excess reserves; unsecured borrowing)

## **Reserve requirements**

1. The CB may impose a minimum reserve deposit ratio (required reserves)
2. Lowering the rr ratio requirement increases money
3. Bank of England does not have a reserve requirement, but keeps a check on reserves via averaging reserves over a given period and agreeing a 'target' with banks

## **Interest on excess reserves**

1. The CB has 'current accounts' for banks to hold their excess reserves, which pays interest usually in line with the bank rate
2. If interest paid on excess reserves is low, then banks want to keep less excess reserves deposited at the CB and the er ratio decreases (money supply increases)



## Central Bank Independence

Government uses pure money printing to spend more, without raising taxes (raising tax revenue) or selling bonds (issuing debt)

1. Seignorage or the inflation tax: Printing money to raise revenue causes inflation
2. Inflation is like a tax on people who hold money

Q — With an inflation tax:

- ▶ everybody loses.
- ▶ all individuals in an economy feel the pressures equitably.
- ▶ there is a redistribution of income from owners of real assets to income earners.
- ▶ there is a redistribution of income from currency holders to owners of real assets (\*).
- ▶ the government has a lot of debt to repay.

Q — A government that relies on seignorage to finance excess government expenditures is the foundation for the following quote:

- ▶ Inflation is always zero in the long run.
- ▶ Inflation is always and everywhere a monetary phenomenon.
- ▶ Inflation is always and everywhere a fiscal phenomenon (\*).