Kosmas Marinakis, Ph.D.

Lecture 9

Money & Banking

Economics & Society

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Previously in E&S...

- Definition of growth
  - exponential – catch-up – sustained growth
- History of growth
  - earlier societies – Industrial Revolution – Malthusian cycles
- Inequality and poverty
- The Solow growth model
  - production function – accumulation of capital – saving
- Causes of prosperity
  - climate, geography, culture, institutions, history and luck

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Money & Banking

Lecture 9

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Money

Money

- Every year, the value of global GDP totals about ***$80 trillion***
- The total quantity of money circulating around the globe amounts to around ***$6 trillion***
- Money is ***neither*** a ***good***, nor a ***service***
  - thus, its total face value is ***not included in GDP***
- Money is an ***asset*** used in ***facilitating*** our transactions
  - money is kind off the ***"lubricant"*** of the market system
- Money's basic role is to ***intermediate the transactions***:
  - Is the ***common denominator*** in economic activity
  - All transactions are ***converted*** into a monetary value

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Money

Strange money facts

- The paper currency you have on you today is most likely not going to be ***valid*** in a few decades
- Gold is not going to be very useful to you in ***Sahara dessert*** or even at the university food court
- Most apartment complexes in the US will not accept cash payments for the ***rent***
- You cannot pay the ***NJ turnpike tolls*** with an $100 bill!
- You cannot buy ***cocaine*** with a credit card

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Money

Functions of money

- Money per se is ***not income***, is ***not wealth***
- Alternatively, a ***barter system*** would ***require***:
  - Double coincidence of ***products***
  - Double coincidence of ***quantities***
  - Double coincidence of ***timing***.
- The ***3 roles*** of money:
  1. ***Medium of exchange***: an asset generally exchanged for goods and services
  2. ***Store of value:*** an asset used to transfer purchasing power into the future
  3. ***Unit of account***: a universal standard used to count the value, price or cost

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Money

Properties of money

- ***Money*** is ***anything that is generally accepted*** as a medium of exchange
- ***Various forms*** of money have existed throughout history
  silver, gold, goats, chickens, horses, alcohol, cigarettes
- Some ***general properties*** that money is desired to have:
  - Generally accepted
  - Portable
  - Durable
  - Controllable in quantity
  - Objective value carrier
  - Easily denominated
  - Difficult to counterfeit

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Money

Fiat money

- Paper money was ***invented*** around 1,000 AD in China
- Modern societies have switched to using ***fiat money***
  something that is used as ***legal tender by government*** decree and is ***not backed*** by a physical commodity
- Fiat money is valuable only because all people ***have agreed to accept it*** as money
- Its value is ***not intrinsic*** - we accumulate dollars for exchange, for storing value, and for keeping accounts
  because ***we trust*** that paper currency will be used for these purposes ***in the future***

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Money Supply

The money supply

- Money supply has ***various definitions*** depending on ***liquidity*** of assets included
- ***Transactions money (M1)*** is money acceptable for most transactions ***as is***

  M1 = cash held outside banks + checkable accounts
- ***Broad money (M2)*** additionally includes relatively ***less liquid*** assets than *M1*

  M2 = M1 + fixed-term accounts + semi-liquid financial assets
- The ***main advantage*** of *M2* versus *M1* is that *M2* is more ***stable***
  a transfer from a checkable account to a mutual fund will ***decrease M1*** but ***leave M2 unchanged***

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Money Supply

The Central Bank

- In every country, the monetary system is ***run*** by a ***central bank (CB)***
  a ***government institution*** for ***monetary authority***
- The central bank operates ***almost completely autonomously*** from the rest of the government
- The ***roles*** of the central bank are:
  1. To monitor the ***financial institutions***
  2. To set the ***money supply***
  3. To control the ***interest rate***.
- These activities are jointly described as ***monetary policy***

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The functions of the Central Bank

- The CB is the ***coordinator*** of the banking system
- It performs ***important functions*** for banks:
  - ***Regulates*** the banking system
  - ***Assists banks*** in a difficult financial position
  - ***Manages exchange rates*** and foreign exchange reserves
  - ***Clears complex inter–bank*** payments
  - ***Sets the reserve requirements*** for all financial institutions.
- CB ***requires*** that every commercial bank ***keeps a portion*** of the total deposits as ***reserves*** at the CB or as cash
- This is known as ***required reserve ratio (RR)*** and is defined as a percentage of a commercial bank's total deposits

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The commercial banks

- Commercial banks are ***financial intermediaries*** that act as a ***link*** between savers and investors
- Accepting deposits is a ***cost*** for banks
  profit comes from loans (and more recently, from transaction fees)
- Thus, in normal times, when a bank ***receives a deposit***, it tries to ***immediately loan*** this money out
- Every bank tries to loan out the ***maximum possible amount*** of deposits:
  $$(1 - RR) \cdot deposits$$
- The process of lending money out, in a way, ***creates additional money***

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How banks create money

Assume that the ***RR*** is 10% and I walk into a bank to ***deposit*** $100

1. The bank will ***reserve*** $10 and ***loan out*** $90 in cash ..... $\Delta M1 = +\$90$
   this $90 will be spent and eventually will end up ***deposited*** to a bank
2. That bank will, too, ***reserve*** $9 and ***loan out*** $81 in cash ..... $\Delta M1 = +\$81$
   this $81 will also eventually be ***deposited*** to a bank
3. That bank will ***reserve*** $8.1 and ***loan out*** $72.9 in cash ..... $\Delta M1 = +\$72.9$
   the $72.9 will eventually be ***deposited*** to a bank
4. Again, that bank will ***reserve*** $7.92 and ***loan out*** $65.61 ..... $\Delta M1 = +\$65.61$

   this process will ***keep going*** so, ***how much money*** can be generated in total from the $100 initial deposit? $\$309.51 + \cdots ?$

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Total money creation

- The ***total money creation*** is
  $$100 + (1 - RR) \cdot 100 + (1 - RR)^2 \cdot 100 + (1 - RR)^3 \cdot 100 + \cdots$$
- That is
  $$\sum_{i=0}^{\infty} (1 - RR)^i \cdot 100$$
- And because this is a ***geometric sequence*** the sum is
  $$100 \cdot \frac{1}{RR} = 100 \cdot \frac{1}{0.1} = 100 \cdot 10 = 1{,}000$$
- $1/RR$ is often referred to as the ***money multiplier*** (MM)
  the multiple by which ***money supply*** can increase for every dollar increase in deposits

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How CB controls the supply of money

The CB can control the money supply in ***four ways***:

1. ***Printing*** new or withdrawing existing money
   printing of fresh paper ***bills*** and ***coins***
2. ***Changing*** the *RR*
   changing the RR ***inversely*** affects the *money supply*
3. ***Adjusting*** the discount rate
   the discount rate is the interest rate ***banks pay to borrow from the CB*** in case they ***cannot meet the RR*** on their own – High discount rates incentivize banks to hold ***reserves above the RR*** to avoid borrowing from the CB, decreasing the MM
4. ***Engaging*** in Open Market Operations

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Open market operations

- Open market operations is the ***purchase and sale*** by the CB of ***government securities*** in the open market
- Open Market Sale: the CB ***sells*** securities ***to firms and households***
  the ***withdrawal*** of money from the system ***decreases the money supply***
- Open Market Purchase: the CB ***buys back*** outstanding securities ***from firms and households*** in exchange for ***fresh money***
  the ***inflow*** of money to the system ***increases money supply***
- OMOs is the ***preferred means*** by the CB of controlling supply of money
  it is ***precise***, ***flexible***, and fairly ***predictable*** by the market

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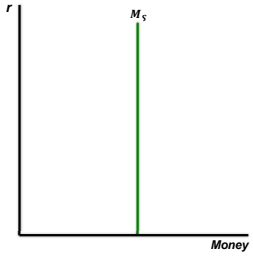
Money Supply

The money supply

- Through OMOs, the CB can ***set*** the ***money supply*** to whatever value it wants
- We will be ***plotting*** the money supply versus the ***"price" of money***:
  the ***real interest rate***, r



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Money Demand

The demand for money

- Money Demand (M_D) is the quantity of money firms and households in the economy ***want to hold***
- There are ***3 reasons*** for which firms and households demand money:
  1. Money held for ***transactions***
  2. Money held for ***precautionary reasons***
  3. Money held for ***speculation***.
- Next, we will investigate the ***relationship*** between:
  - ***Total quantity of money*** demanded
  - And the price of money (the ***real interest rate***).
- In order to do this we must first ***decompose*** the money demand into its ***3 constituent parts***

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Money Demand Transactions

Money demand for transactions

- For firms and households money ***inflows*** and ***outflows*** are not synchronized
- They have ***two alternatives*** for their disposable income until they spend it:
  1. Keep it liquid in ***cash*** or ***checking*** accounts:
     - Income is ***conveniently available*** for spending
     - ***No interest*** is gained.
  2. Place it to interest bearing assets (***fixed-term*** accounts or ***bonds*** etc.)
     - ***Interest*** will be earned
     - A ***transaction cost*** must be incurred to ***convert*** it back to spendable money
- Firms and households choose the distribution between ***cash*** and ***assets*** which ***minimizes the sum*** of the interest forgone cost plus the conversion cost

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Money Demand Transactions

Optimal cash holdings example

- Assume that you have allocated ***$400*** to uniformly ***spend*** over the next 4 weeks and say that each $100 bond ***yields 2%*** per week and ***costs $5*** to cash it:
  - The 1st week's $100, you must keep in ***cash***
  - The 2nd week's $100, you will keep in ***cash*** because the bond yields $2 < $5
  - The 3rd week's $100, you will keep in ***cash*** because the bond yields 2·$2 = $4 < $5
  - The 4th week's $100, you can place in a ***bond*** to yield 3·$2 = $6 > $5.
- Thus, with $r = 2\%$, in total, you will hold ***$300 in cash*** and $100 in bonds
- But if the ***interest rate increases*** to 3%, you will now hold ***only $200*** in cash:
  because the 3rd week's $100 will yield 2·$3 = $6 in ***bonds*** > $5
  and the 4rd week's $100 will yield 3·$3 = $9 in ***bonds*** > $5.
- Thus, money demand for transactions is ***inversely related*** to the interest rate

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Money Demand Precaution

Money demand for precaution

- Households want to hold money for ***unplanned spending***
- Holding ***more money*** for precaution:
  - Feel ***more security*** for future unplanned expenses
  - ***Interest*** is forgone.
- That is, the opportunity cost of holding money ***applies*** to the precautionary motive, too
- As a result, money demand for precaution can reasonably be assumed to be ***inversely related*** to the interest rate

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Money Demand | Speculation

Speculation

- A large amount of money in the economy is held stand-by for ***short term profit opportunities***
- Speculation is mainly conducted by ***flipping*** various ***financial assets***, such as bonds, securities etc.
- A ***bond*** is just a promissory note for the payment of a debt
  - The creditor provides the ***initial capital (face value)*** and receives by the debtor a bond of a ***pre-specified duration***
  - The bond contains ***coupons*** that each defines a ***fixed interest payment*** to the creditor for every period
  - After the ***expiration*** of the bond, the debtor pays back the ***initial capital*** to the creditor

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Money Demand | Speculation

Bonds and interest rate

- If a bond's ***face value*** is $100 and it contains a coupon per year with a fixed $10 ***interest payment***
  the ***interest rate*** of such a bond is 10%
- Often, bonds are ***re-sold*** (liquidized) by their owners in the ***secondary market*** before they mature
- If this bond is ***re-sold*** in the secondary market for $125
  the coupon is ***still*** $10, so its ***interest rate has fallen*** to 8%
- If the bond is ***re-sold*** in the secondary market for $80
  the coupon is ***still*** $10, so its ***interest rate has risen*** to 12.5%
- The price of the bond is ***inversely related*** to the interest rate because the ***coupon is fixed***

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Money Demand | Speculation

Money demand for speculation

- In the secondary market, bond prices ***depend*** on ***supply*** and ***demand***
  how many bonds are ***placed for sale*** in relation to how many ***buyers*** there are
- Also, as we saw, the prices of bonds are ***inversely related*** to the interest rate
- When the ***prices of bonds*** are high, the ***interest rate*** is low
  speculators want to ***sell bonds*** and hold more money
- When the ***prices of bonds*** are low, the ***interest rate*** is high
  speculators want to ***buy bonds*** and hold less money
- As a result, money demand for speculation is ***inversely related*** to the interest rate

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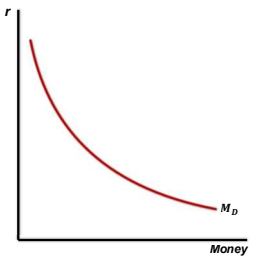
Money Demand

Money demand

- All ***three constituent*** money demands are ***negatively related*** to the interest rate
- Therefore, their sum, money demand (M_D), is also ***negatively sloped***



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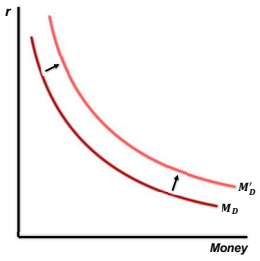
Money Demand

Money demand shifters

- Money demand will shift if people want to hold ***more money at every interest rate***
- This can happen for various ***reasons***:
  - If ***real GDP increases***, people will want to hold more money for their transactions ***[L1]***
  - If ***prices increase***, money demand will increase
  - If ***public safety*** is at risk, money demand will rise.
- The interest rate affects the quantity of money demanded but ***not the M_D***



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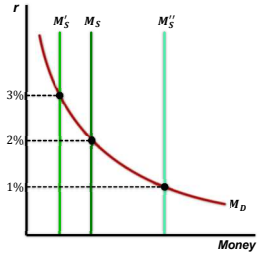
Interest rate

Equilibrium interest rate

- The CB can effectively ***set*** the desired interest rate in the money market
  by appropriately ***setting the money supply***
- If, for instance, it wishes $r = 2\%$,
  it will set M_S
- If, it wishes $r = 3\%$,
  it will set M_S'
- If, it wishes $r = 1\%$,
  it will set M_S''



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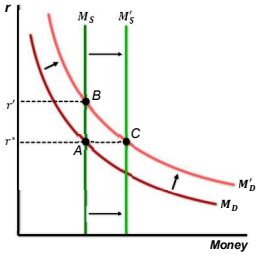
Interest rate

Monetary policy

- Assume that the CB has ***committed*** to r^*
  by setting M_S which meets M_D at A
- Then, an ***unexpected*** increase in prices causes M_D to ***shift*** to M_D'
- Money becomes more ***scarce*** and the interest rate will ***tend to increase*** to r'
- The CB can still ***maintain*** r^* by ***adjusting the money supply***
- Increasing money supply to M_S' will ***stabilize*** the interest rate at r^*



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Money & GDP

Money & GDP

- From the formula for the calculation for ***real GDP***, we know that:

$$real\ GDP = {}^{GDP}/_{CPI} \quad \text{or} \quad CPI = {}^{GDP}/_{real\ GDP}$$

- This implies that those two ***must be growing at the same rate***

$$growth(CPI) = growth\left({}^{GDP}/_{real\ GDP}\right)$$

- From ***growth math*** we have that "*the growth of a ratio is the difference of the growth of the numerator minus that of the denominator*", thus:

$$growth(CPI) = growth(GDP) - growth(real\ GDP)$$

- Economists ***have observed*** that steadily $growth(GDP) = growth(M_S)$, hence:

$$growth(CPI) = growth(M_S) - growth(real\ GDP)$$

or ***inflation rate = growth of M_S − growth of real GDP***

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Money & GDP

Inflation

$$inflation\ rate = growth\ of\ M_S - growth\ of\ real\ GDP$$

- This means that inflation is ***equal to the gap*** between:
  - The growth rate of the ***money supply***
  - The growth rate of ***real GDP***.
- When this ***gap widens***, the ***inflation rate increases***
- Inflation will result when the CB prints ***disproportionally more money*** than the change in real output requires
- This equation makes ***clear predictions*** that we can test with economic data

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Inflation

The consequences of inflation

- If all ***prices moved freely*** when there is inflation, moderate inflation might ***not pose a serious problem***:
  - ***Prices*** increase by 5%
  - ***Rents*** increase by 5%
  - ***Salaries*** increase by 5%.
- ***Purchasing power*** still remains the ***same***
- Yet, all prices and wages ***do not*** always ***move in sync***
  at least ***not in the short-run***
- An increase in the inflation rate generates ***losses to some*** and ***gains to others***

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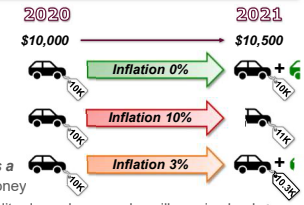
Inflation and credit

- Unanticipated inflation ***distorts credit relations***
- Consider a ***credit agreement*** for a car loan of $10K to be returned in one year with $500 interest
  - With no inflation, the creditor will receive back, the ***full value*** of the car (10K) ***plus a premium*** for not having access to his money
  - With unanticipated inflation 10%, the creditor loses because he will receive back ***less than the full value*** of the car ($11K, now)
  - Even with unanticipated inflation less than 5%, the creditor would receive back the ***full value*** of the car, but would lose ***part of the $500 premium***, that was agreed



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Social costs of inflation I

1. Inflation ***affects the distribution of income***:
   - Individuals on fixed incomes (collective contract employees, pensioners, public servants) cannot ***re-negotiate their income*** after inflation occurs
   - ***Relative purchasing power changes*** to the benefit of those who can re-adjust their incomes (free-lancers, contractors, entrepreneurs).
2. Inflation creates ***administrative costs*** and ***inefficiencies***:
   - For many firms who sell a large number of products, constantly ***changing the prices***, requires ***time*** or ***resources*** that could have been used in production
   - Such costs are often referred to as ***"menu costs"***.
3. Inflation ***ruins*** the economic environment
   - Unanticipated inflation ***causes uncertainty*** to firms ***discouraging*** business activity

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Social costs of inflation II

4. Inflation changes the ***relative prices*** causing ***market distortion***:
   - Vendors who buy supplies with ***long-term contracts*** will be able to ***keep their prices lower*** than their competition
   - Competitors may be ***driven out*** of the market, ***changing the industry structure***.
5. Inflation causes ***misinformation about prices***:
   - Under inflation, consumers may have ***trouble keeping up*** with the price changes
   - This may cause them to ***misallocate their income*** among products.
6. Stopping inflation ***requires counterproductive policies***:
   - Governments tend to fight inflation with ***price controls*** (price ceilings)
   - This lowers market ***efficiency***, creates ***DWL*** and causes ***shortages*** and ***black markets***

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Hyperinflation

- Hyperinflation refers to ***particularly high*** rates of inflation
- ***Germany*** in 1922-23 after the end of World War I
  inflation at **3.25×10^6 %** (takes 49 hours for prices to double)
- ***Hungary*** in 1946 after the end of World War II
  inflation at **4.19×10^{15} %** (prices double every 15 hours)
- ***Yugoslavia*** in 1993-94 after the civil war
  inflation at **5×10^{15} %** (prices double every 14 hours)
- ***Venezuela*** in 2018 after the political crisis
  inflation at **130,060%** (prices double every 7 days)
  projected to be at 9,586% in 2019

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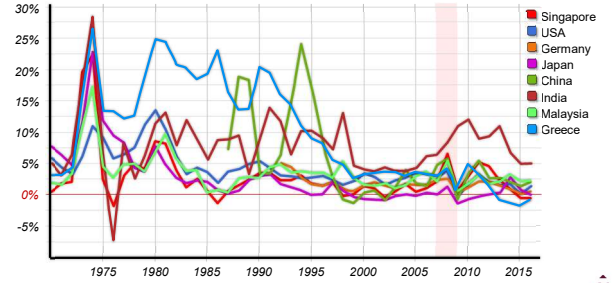
Inflation rates



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Inflation as a tax

- Through the CB, the government can exercise the ***printing privilege***
  that is, the government can have the CB ***print more money*** in order to ***fund government spending*** or ***pay back debt***
- This is referred to as ***seignorage***
- Seignorage will ***generate revenue*** for the government but it will ***create inflation***
  - When the increase in quantity of money is ***not accompanied*** by an equal increase in real GDP, ***prices will increase***
  - Those who hold money, ***lose purchasing power*** from the inflation
  - This purchasing power ***goes to the government***, as it spends newly printed money.
- Seignorage acts like a ***tax*** to all money holders
  indiscriminately where their money have ***come from***

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Inflation and economic activity

- In periods of high inflation, the ***real cost of labor decreases***
  this is because firms can ***raise their prices*** without having to ***raise wages*** of contract workers
- Revenue ***adjusts upwards*** for inflation, while cost tends to be ***sticky***
- This increases profitability and ***stimulates economic activity***
- Firms want to ***increase production***, and thus, try to ***hire more*** workers
  causing a ***decrease in unemployment***
- Thus, unemployment and inflation are ***negatively correlated***:
  this is known as the ***"Phillips relationship"***
- However, the Phillips relationship is a ***S-R effect***
  because labor contracts ***expire in the L-R***

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Thank you!

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