Macroeconomics ECO 110/1, AAU
Lecture 5

MONEY AND INFLATION

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Overview of Lecture 5

Money:

- Definition and typology
- Money supply and money demand
- Link: money -> price -> inflation

Inflation:

- Definition + measurement
- Consequences
- Causes
- Hyperinflation

Money

Definitions and functions

Money = stock of assets that can be readily used in transactions

Functions of money:

1. Store of value – over time, imperfect
2. Unit of account – quotation of prices
3. Medium of exchange
   - Liquidity – how fast you can convert money to goods and services

Money

Types

Historical evolution:

Barter -> commodity money -> fiat money

Barter: double coincidence of needs; exchange

Commodity money: intrinsic value - valuable

- Highly durable goods, accessible in limited amounts, small and easy to transport, widely accepted (gold, silver, salt, cigarettes, wampum)

Fiat money: no intrinsic value – general acceptance

- First fiat money - China

Money supply

Monetary aggregates

Central bank = agent of government

C	currency in circulation
M1	C + overnight deposits
M2	M1 + deposits with maturity<2 years + deposits redeemable up to 3 months
M3	M2 + repurchase agreements + money market fund shares + debt securities

- C and M1 – store of value + medium of exchange
- M2 and M3 – only store of value (no liquidity)

Money supply

Role of banks

- Banks use deposits made by customers to make loans
- Reserves = deposits received but not lend out
  - Goal = availability for withdrawal
  - Reserve-deposit ratio given by central bank

Ex.1: reserve-deposit ratio (rr) =20%, 1,000$ in deposits

Bank's A balance sheet:

Assets		Liabilities	
Reserves	200	Deposits	1000
Loans	800		

Money supply

Role of banks II

- BUT, borrower can post it in another bank

Bank's B balance sheet:

Assets		Liabilities	
Reserves	160	Deposits	800
Loans	640		

- Banks can "create money", but they cannot create wealth
- **Total money supply = 1/rr*initial M**

Money supply

Simple model

Exogenous variables:

- the **monetary base**, $B = C + R$
  controlled by the central bank
- the **reserve-deposit ratio**, $rr = R/D$
  depends on regulations & bank policies
- the **currency-deposit ratio**, $cr = C/D$
  depends on households' preferences

Money supply

Simple model II

$$M = C + D = \frac{C + D}{B} \times B = m \times B$$

where

$$m = \frac{C + D}{B}$$

$$= \frac{C + D}{C + R} = \frac{C/D + D/D}{C/D + R/D} = \frac{cr + 1}{cr + rr}$$

Money supply

Simple model III

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- If $rr < 1$, then $m > 1$
- m is the **money multiplier**,
  the increase in the money supply resulting from a one-dollar increase in the monetary base.
- Higher cr => lower **M**; higher rr => lower **M**
- If monetary base changes by ΔB,
  then $\Delta M = m \times \Delta B$

Money supply

Instruments of monetary policy

1. Open market operations: CB purchases and sells government bonds
   - Increases / decreases **M** through change of **B**
2. Reserve requirements: CB sets minimum
   - Affects creation of money by banks (***rr***)
3. Discount rate: charged on loans by CB for banks (if do not have enough R, or want more loans)
   - Affects amount of money available for loans

- Mostly used = open market operations
- CB, however, cannot fully control money supply

Money demand

Macro view – Quantity theory of money

- Quantity equation – identity relating amount of money in the economy with number of transactions / income

$$M*V = P*T \iff M*V = P*Y$$

  - M – money supply
  - V – velocity of money
  - P – price level
  - T - # of transactions
  - Y – real GDP

Money demand

Macro view – Quantity theory of money II

Related money demand function:

$$\left(\frac{M}{P}\right)^{D} = kY \qquad \text{where } k = 1/V$$

Ass.: velocity is constant

Implication: changes in P (inflation) are primarily determined by changes in money supply

Money demand

Role of interest rate and expectations

2 types of interest rate:

nominal (i) – what banks pay you

real (r)– adjusted for price change, real return

Fisher equation

i = r + π - Nominal interest rate accommodates for inflation

Ex-ante real interest rate – counts with inflation rate expected at the time when investment is made

Ex-post real interest rate – counts with realized inflation at the time of repayment of investment

Money demand

Role of interest rate and expectations II

- Nominal interest rate as opportunity costs of holding money
- Relevant is expected – ex-ante inflation rate

- Resulting money demand function

$$\left(\frac{M}{P}\right)^{D} = L(Y, r + \pi^{e})$$

- Price level does not only depend on current money supply, BUT also on money supply expected in the future

Money demand

Micro foundations I

- Portfolio theories
  - emphasize “store of value” function
  - relevant for M2, M3
  - not relevant for M1. (As a store of value, M1 is **dominated** by other assets.)
- Transactions theories
  - emphasize “medium of exchange” function
  - also relevant for M1

Money demand

Micro foundations II

Portfolio theory of money demand

$$\left(\frac{M}{P}\right)^{D} = L(Y, r_s, r_b, \pi^e, W)$$

- Cash, stocks and bonds as part of the portfolio of assets
- Return x uncertainty trade-off

Money demand

Micro foundations III

Transaction theory of money demand

- Based on the trade-off between the need for liquidity and opportunity costs of interest income
- Ex.1: Baumol Tobin model
- Ex.2: Cash-in-Advance models – we only allow agents to buy for as much as the level of their real money balance holdings
- Ex.3: Money in the utility function models

Inflation

What is inflation and how we measure it?

Why is inflation bad?

The overview of inflation levels around world

Inflation

Definition

Inflation = an increase in the average level of prices of goods and services

- Focus on aggregate prices, not relative
- Relative prices are always changing – main part of market mechanism
- Even in case of inflation, some prices are decreasing
  - e.g. TV, calculators, MP3 players, contact lenses

Deflation = a decrease in the average level of prices

e.g. Japan in 2003, Ireland in 2009

Inflation

Measuriement - CPI

Consumer price index measures change in average price of consumer goods and services

Construction: (CR, but similar everywhere)

- Source = Czech Statistical office
- Basket of 750 goods and services purchased by consumers (based on expenditure survey) at base year
  - Fix basket at base year
- Weighted average of individual prices
  - Weights according to share of household expenditure

$$\mathrm{CPI} = \frac{\sum_i^{750} Q_i P_{i,2010}}{\sum_i^{750} Q_i P_{i,BASE=2005}}$$

Inflation

Measurement – GDP deflator

GDP deflator – price of output today relative to its price in the base year

- Evaluate current output at today's and yesterday's prices – take current output

GDP deflator = Nominal GDP/Real GDP

$$GDPdefl_{2010} = \frac{\sum_i^N P_{i,2010} \times Q_{i,2010}}{\sum_i^N P_{i,BASE} \times Q_{i,2010}}$$

Inflation

Comparison of CPI and GDP deflator

CPI	GDP deflator
1. Prices of goods and services bought by consumers	1. Prices of all goods and services produced
2. Domestic + imported G&S	2. Only domestically produced G&S
3. Basket of goods fixed at base year	3. Changing goods basket
4. Overstates inflation (neglects substitution effect)	4. Understates inflation (neglects income effect)

Inflation

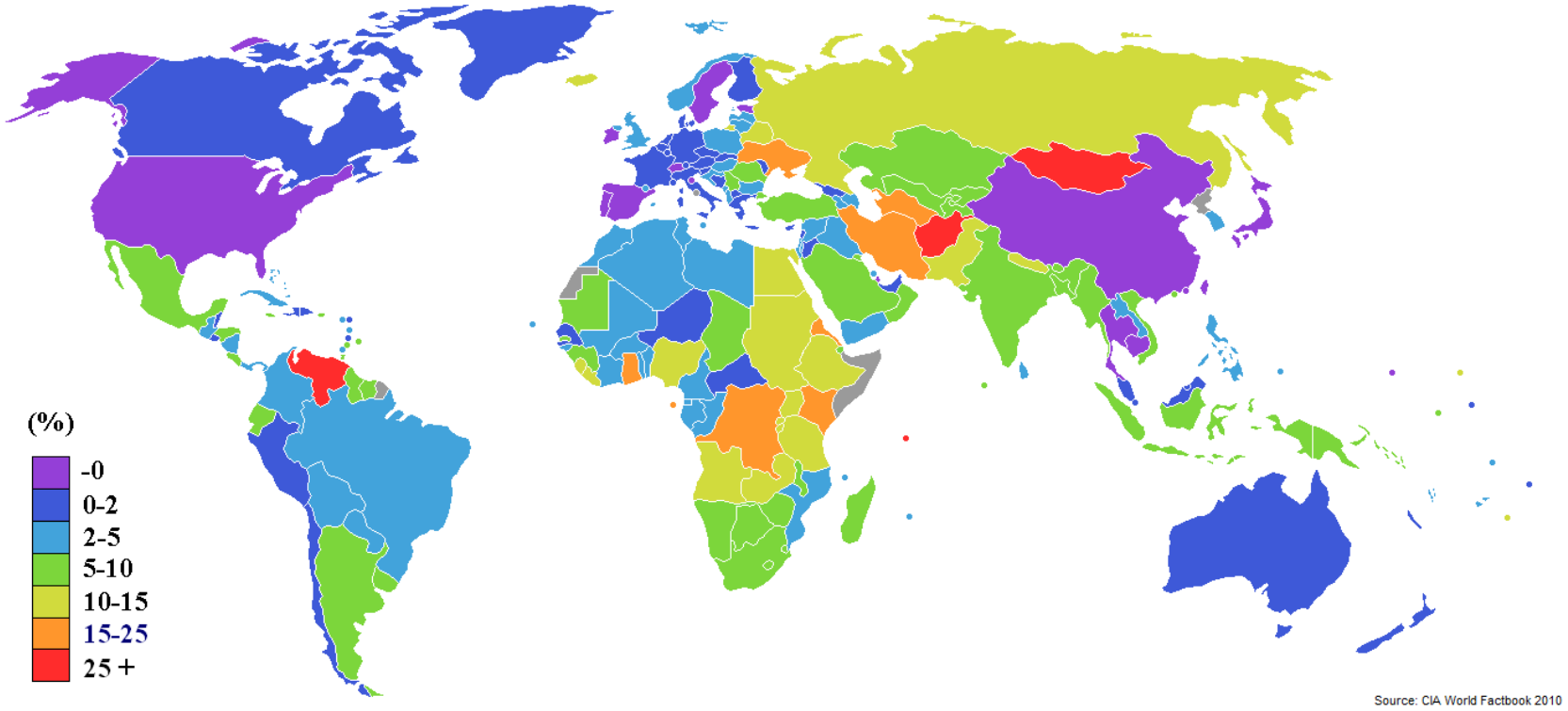
Measurement – other indices

- Core inflation rate: excludes changes in energy and food prices – highest variation

Other indices:

- Producer price index:
  - US: raw materials, intermediate goods, final goods
  - CR: industry, construction work, market services, agricultural producers
  - Leading index- when producers' prices increase, it takes time until it is reflected in consumers' prices

Inflation rates around world - 2007

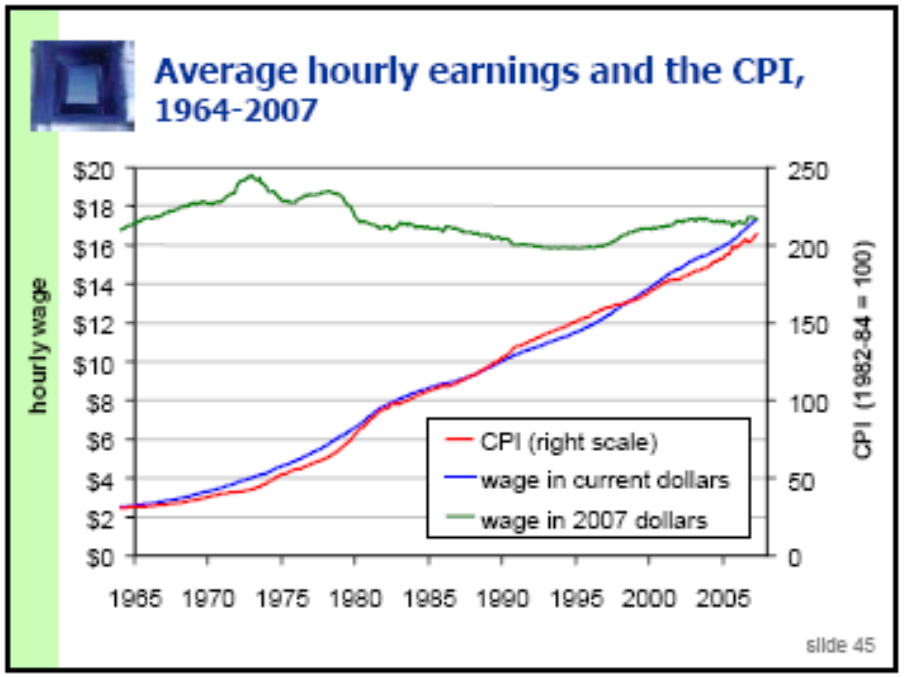


http://en.wikipedia.org/wiki/File:World_Inflation_rate_2007.PNG

Inflation

Why is inflation bad?

- Common opinion – decrease in real wages – I can buy less for my money
- BUT! In the long run incomes rise as prices!



Inflation

Effects

- Not all prices rise at the same rate during an inflation
- Not everyone suffers equally from inflation

3 main effects of inflation on micro-level:

- Price effect – based on differential increase in relative prices
- Income effect – based on changing values of income flows
- Wealth effect – based on changing value of stock of wealth

ALL lead to REDISTRIBUTION

Inflation

Price effects

Variation in relative prices

- How much a person suffers from inflation depends on what happens to prices of G&S that he purchases
  - Income effect => lower utility level
- Some firms change their prices at different times => relative price distortions
  - Inefficient allocation of resources
- Menu costs: small costs of changing prices
  - New menus, new catalogues, repricing
- Shoeleather costs: costs related to reducing money balances held; more frequent trips to bank

Inflation

Income effect

- Income = flow
- Nominal x real income

NOTE!

Purchase of product always is an income for someone
=> when prices are rising, incomes rise too

- People whose nominal income rise more slowly than the rate of inflation end up with less real income
- And vice versa ☺

Inflation

Wealth effect

- Wealth = stock
- If interest rate is smaller than rate of inflation => real value of savings is reduced

Redistribution between lenders and debtors:

- Contracts are based on expected inflation
- If real inflation is higher than expected => debtor is better off than lender
- If real inflation is lower than expected => lender is better of than debtor

Inflation

Macro consequences -

Uncertainty:

- Economic decisions become more difficult (mainly long-term)
  - E.g. investment into education (HHs), new production capacities (firm)

Speculations:

- When expecting higher price, people tend to buy now and sell later + lower production
- Further reinforces inflationary pressures

Social tensions: people feel that they are being cheated

Inflation

General causes of inflation

- Demand-pull inflation:
  - Consumers demand more output than economy was producing
  - Cause: accumulated savings, easy access to credit, increase in money supply
- Cost-push inflation:
  - Increase in production cost
  - E.g. increase in oil prices – used both in production and transportation
  - Increase in labor productivity and wages

Hyperinflation

- If inflation > 50% in a month (i.e. 100x increase over a year)
- Effects:
  - Money loses “store of value” function – affects other functions, mainly “medium of exchange”
  - All costs become huge
  - Return back to barter, commodity money, or use of foreign currency

Hyperinflation

Examples

Country	Month of highest infl.	Daily inflation	Time needed for prices to double
Hungary	July, 1946	195%	15.6 hours
Zimbabwe	Nov, 2008	98%	24.7 hours
Yugoslavia	Jan, 1994	65%	1.4 days
Germany	Oct, 1923	21%	3.7 days
Greece	Nov, 1994	17%	5.6 days

Hyperinflation

Causes and remedies

Usually, excessive money printing by government:

- Government needs to cover is expenditures – seignorage, wouldn't raise taxes / issue bonds (bad credit risk)
- Self-enforcing: higher inflation => lower value of tax revenue => need for further printing
- Reinforced by speculations of people
- End: strict and painful fiscal reform
  - Cut expenditures & increase taxes

Inflation

Goal of price stability

- Summing up:
  - Change in prices (inflation) is primarily implied by changes in monetary supply
  - Central bank can affect money supply through its tools: open market operations, reserve requirements, discount rate
  - Goal: price stability – relatively stable and predictable level of inflation
  - **Not 0!** Remember that his would be connected with high unemployment rate (low investments + low consumption => low production)