OVS452 Intermediate Economics II
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Lecture Notes #4
Eva Hromádková

5 Money and inflation

5.1 Motivation

Main focus: **inflation = the percentage change in overall level of prices**[1]

- **mechanism:** inflation - level of prices - rate of exchange of money for G & S
- ass.: prices are fully flexible (long run)

Overview:

1. Money: definition + typology, demand & supply side
2. Inflation mechanism: money supply -> prices -> inflation
3. Determinants and channels of inflation - nominal interest rate
4. Costs of inflation - expected and unexpected
5. Hyperinflation

5.2 Money - what is it, how is the amount determined ?

Wide definition = stock of assets that can be readily used for transactions
(value + liquidity + exchange)

5.2.1 Functions of money:

1. **store of value:** in time, imperfect (inflation)
2. **unit of account:** terms in which prices are quoted - measurement of value)
3. **medium of exchange:** acceptable for purchase
   - liquidity - how fast you can convert money to G & S
   - barter $\Leftrightarrow$ double coincidence of needs

[1] For an overview of rates of inflation over the world, see linked map.

5.2.2 Types of money:

- Historical evolution: barter -> commodity money -> fiat money
- **commodity money:** has intrinsic value (valuable on its own)
  - goods that are highly durable, accessible in limited amount (not few, not too much), small and easy to transport, widely valued and accepted
  - gold, silver, salt (African tribes, 15^{th} century)
  - funny examples: cigarettes (POW camps), stones fei (island Yap)
- **fiat money:** with no intrinsic value - matter of general acceptance as means of payment
  - first fiat money - probably China

5.2.3 Money supply = amount of money

- commodity money - quantity of given commodity, fiat money - # of printed banknotes, coins + other liquid assets
- Agent of government = **central bank** (in Czech republic = CNB)
- direct + indirect tools to regulate

Measure = **Monetary aggregates** (Czech National Bank data, by 31.1.2009):

	Definition	Amount (CZK millions)
C	currency in circulation	362 815.6
M1	C + overnight deposits	1 665 559.1
M2	M1 + deposits with maturity < 2 years	
	+ deposits redeemable up to 3 months	2 645 565.6
M3	M2 + repurchase agreements + money market	
	fund shares + debt securities (up to 2 years)	2 713 673.8

- C and M1 - store of value + medium of exchange
- M2 and M3 - only store of value

Role of banks in determination of money supply:

- Banks use deposits made by customers to make loans (mortgages, etc.)
- **Reserves**: deposits that banks have received but did not lend out, goal = availability in case when depositors want to make withdrawal

- Example: let us assume reserve-deposit ratio (rr) = 20%

Assets		Liabilities	
Reserves	200	Deposits	1 000
Loans	800		

- Borrower can post it in another bank => resources for further loans
- **Banks can "create money"** = create assets (loans) that are part of money supply => $M = 1000 + 800$
- Total money supply = $\frac{1}{rr} \times \text{initial} M$

MODEL:

- **reserve-deposit** ratio (rr) - determined by banks + regulating laws (min. level)
- **currency-deposit** ratio (cr) - HH's preferences over their money holdings

$$\begin{aligned} B(\textbf{monetary base}) &= C(\text{currency}) + R(\text{reserves}) \\ M(\text{money supply}) &= C(\text{currency}) + D(\text{deposits}) \\ \frac{M}{B} &= \frac{C+D}{C+R} = \frac{\frac{C}{D}+1}{\frac{C}{D}+\frac{R}{D}} = \frac{1+cr}{cr+rr} \\ M &= \frac{1+cr}{cr+rr} \times B \end{aligned}$$

- $\nearrow B \Rightarrow \searrow M; \quad \nearrow rr \Rightarrow \searrow M; \quad \nearrow cr \Rightarrow \searrow M$

Instruments of monetary policy: indirect

- **open-market conditions:** purchases & sales of government bonds
  - buys bonds => increase in M; sells bonds => decrease in M
- **reserve requirements:** minimum reserve-deposit ratio
  - affects creation of new money through banks
- **discount rate:** charged on loans by CB for banks - in case they have too low reserves to meet reserve requirements

5.3 Quantity theory of money

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

$$M \times V = P \times T$$

where M - money supply, V - transaction velocity of money, P - price level, T - # of transactions

$$M \times V = P \times Y$$

where M - money supply, V - income velocity of money, P - price level, Y - real GDP

Money demand function:

- M - nominal value of money, $\frac{M}{P}$ - real money balances = how much can one buy

$$\left(\frac{M}{P}\right)^D = kY$$

- we can rewrite it to the form of quantity equation

$$\frac{M}{P} = kY \quad \rightarrow \quad \frac{M}{k} = PY \quad \rightarrow \quad V = \frac{1}{k}$$

- $\nearrow k \quad \rightarrow \searrow V$ (k is small => holdings of money are small => velocity is high)
- **assumption:** velocity V is constant => $\mathbf{M\bar{V} = PY}$
- How is price level determined: V is constant and Y is determined by real variables => changes in P depends on changes in M primarly

$$\pi = \frac{\Delta P}{P} = \frac{\delta M}{M} - \frac{\delta Y}{Y}$$

5.4 Inflation and interest rates

Two types of interest rates:

- **nominal** interest rate i: what bank pays, not adjusted for inflation
- **real** interest rate r: adjusted for inflation, real return to investment

Relationship = **Fisher equation**

$$i = r + \pi$$

- as r is determined on market for loanable funds ($I = S$), then nominal int. rate accommodates for inflation => increase in π equals increase in i = **Fisher effect**

Role of expectations - two real interest rates:

- **ex ante** real interest rate $= i - \pi^e$, where π^e is inflation rate expected at the time when people buy bond/take out loan
- **ex post** real interest rate $= i - \pi$, where π is inflation rate realized at the time of selling the bond/repayment of loan

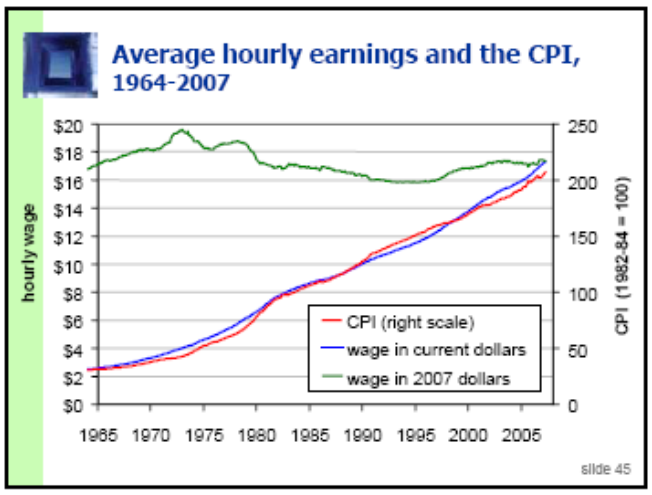
How this translates into **money demand**?

- nominal interest rate = opportunity cost of holding money => $\left(\frac{M}{P}\right)^D = L(Y, i)$
- relevant is expected inflation rate π^e => $\left(\frac{M}{P}\right)^D = L(Y, r + \pi^e)$
- **price level** does not only depend on **current money supply** BUT also on **money supply expected** in the future (through π^e)

5.5 Costs of inflation

Question = Why is inflation bad?

- Common opinion: Inflation reduces real wages !
- BUT - In the long run, real wage is determined by labor supply and labor demand, that is derived from marg. product of labor (not by price or inflation rate)



- change in price level = change in units of measurement
- Why, then, is inflation such a social problem?

5.5.1 Costs of expected inflation

1. **shoeleather costs**
    - costs related to reducing money balances held, to avoid the inflation tax
    - $\nearrow \pi \Rightarrow \nearrow i \Rightarrow \searrow \frac{M}{P}$ (opportunity costs of holding money are high)
    - same monthly spending + lower average money holding = more frequent trips to bank (time, fixed fees, etc.)
2. **menu costs**
    - costs of changing prices for firms - new menus, new catalogues, repricing
3. **variation in relative prices**
    - firms change their prices at different times => relative price distortions
    - microeconomic inefficiencies in allocation of resources
4. **unfair tax treatment**
    - some taxes are not adjusted for inflation - e.g. capital gains tax
5. **general inconvenience**
    - hard to compare nominal values from different time periods => hard to do financial planning

5.5.2 Costs of unexpected inflation

1. **Arbitrary redistribution of wealth:** when contracts are based on expected inflation π^e and π turns out different, e.g. debts (debtor vs. lenders:
    - if $\pi > \pi^e$ => debtor is better off than lender (lender gets lower real interest rate)
    - if $\pi < \pi^e$ => debtor is worse off than lender (debtor has to pay higher interest rate
2. **Higher uncertainty** - due to risk aversion, people are worse off

5.5.3 Benefits :-) of inflation

- positive effect on labor market - as nominal wages are rarely cut, without inflation real wages would be above the equilibrium level implied by lower demand
- "taxation" of underground economy

5.6 Hyperinflation

Definition: if $\pi >$ **50% in a month** (i.e. 100x increase in prices over a year)

- money loses function of a store of value => affects other functions (mainly as medium of exchange)
- all costs become huuuuuuge
- return back to barter, commodity money or use of foreign currency

Highest monthly inflation rates in history:

Country	Month of highest π	highest π (monthly)	daily π	time needed for prices to double
Hungary	July 1946	1.30×10^{16} %	195 %	15.6 hours
Zimbabwe	Nov 2008	79 600 000 000 %	98 %	24.7 hours
Yugoslavia	Jan 1994	313 000 000 %	64.6 %	1.4 days
Germany	Oct 1923	29 500 %	20.9 %	3.7 days
Greece	Nov 1994	11 300 %	17.1 %	4.5 days
China	May 1949	4 210 %	13.4 %	5.6 days

Cause: excessive money printing by government

- government needs to cover its expenditures (**seignorage**), and it cannot raise taxes or get the financing by issuing bonds (bad credit risk)
- **self-enforcing:** more money is printed => lower value of tax revenue => need for further printing

End: strict and painful **fiscal reform** - both expenditure and revenue (taxes) side

5.7 Classical Dichotomy

- **real variables** = variables measured in physical units (e.g. real GDP, real wage)
- **nominal variables** = variables expressed in terms of money (e.g. nominal wage, nominal interest rate)

Classical dichotomy: theoretical separation of real and nominal variables in the classical model, which implies that nominal variables do not affect real variables

Neutrality of money: changes in the money supply do not affect real variables

- both approximately true in the long run