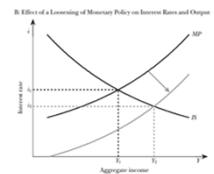
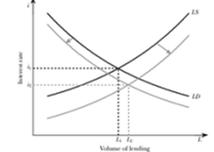


## Woodford's model with "financial intermediation and frictions"

- Extend the basic model with intermediation
- Introduce spreads
- Study different effects of financial distress
- Monetary policy and financial stability
- Note. Buiter's housing no wealth and aggregation

Figure 2  
Interest-Rate and Output Determination in the Standard Model

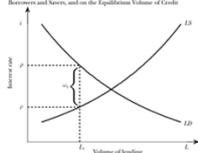
A. Effect of an Increase in Aggregate Income on Loan Supply and Demand



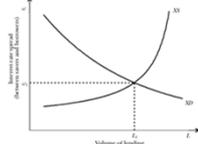
Note: In panel A,  $IS$  is the loan supply schedule and  $DD$  is the loan demand schedule, which are specified holding constant aggregate income,  $Y$ . The arrows show how the curves shift with an increase in  $Y$ . Panel B shows an  $IS$  schedule, derived by tracing out the equilibrium interest rate for any assumed level of current income  $Y$ , and a monetary policy reaction function ( $MP$ ), showing how the central bank's interest rate response will vary with the level of economic activity. The  $MP$  curve is drawn for a given inflation rate. The curve shows the consequence of an exogenous shift in the policy reaction function that implies a lower interest rate for any given level of economic activity.

Figure 3  
Credit Market Equilibrium with Credit Supply Frictions

A. Effect of a Credit Spread  $\omega$  on the Equilibrium Interest Rate for Borrowers and Savers, and on the Equilibrium Volume of Credit



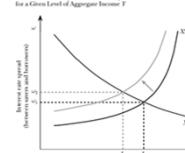
B. Determination of the Equilibrium Credit Spread



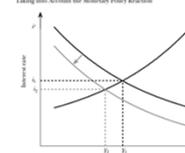
Note:  $i^*$  is the interest rate paid to savers, as which intermediaries are able to fund themselves, and  $i'$  is the interest rate (the borrowing or loan rate) which ultimate borrowers are able to finance additional investment expenditures. In this figure,  $IS$  schedule represents the supply of funding for intermediaries, the  $DD$  schedule is the loan demand schedule, and  $IS'$  and  $DD'$  are the supply and demand for credit, respectively, for a given level of lending  $L$ .  $i'$  and  $i$  are the interest rates for savers and borrowers, respectively. The spread between  $i'$  and  $i$  is the credit spread. Given the  $IS$  and  $DD$  curves we can determine the unique volume of intermediation that is consistent with any given spread. This relation between the quantity of intermediated credit and the credit spread is graphed in the curve  $IS'$  in panel B, which we can think of as the "demand for intermediation." The corresponding "supply of intermediation" schedule,  $DD'$ , indicates the credit spread required to induce financial institutions to intercede at a certain volume of credit between savers and ultimate borrowers.

Figure 4  
Effects of a Disruption of Credit Supply

A. Effects on the Equilibrium Credit Spread  $\omega$  and Volume of Lending  $L$  for a Given Level of Aggregate Income  $Y$



B. Effects on the Equilibrium Policy Rate and Aggregate Income, Taking into Account the Monetary Policy Reaction



Note:  $IS$  and  $DD$  are the supply and demand for intermediation,  $\omega$  is the spread between  $i'$ , the interest rate for savers, and  $i$ , the interest rate for borrowers. The  $IS$  schedule shows the equilibrium interest rate for any assumed level of current income  $Y$ , and  $MP$  is the monetary policy reaction function ( $MP$ ).

## Policy environment

- Legislation (commitment)
- Central bank independence (Sweden, UK)
  - Credibility
    - Transparency, information to the public (Sweden, ECB)
    - Commitment
    - Evaluation
      - by central bank
      - independent
      - loss function?
  - Accountability
    - responsible to the parliament
    - official target, measurable

## Legislation

- Example: Sweden
- Central bank law
  - Price level stability, + others in preparatory work
  - Independent central bank
- Target 2% determined by the central bank
- Flexible inflation targeting determined by the central bank

## Different in other countries

- UK
  - ultimate target and specific target by parliament
- USA
  - only ultimate targets in Federal Reserve Act
- ECB
  - ultimate target and specific target set by governing council of ECB

## Legislation, Swedish example

- Legislation
- Interpretation by the central bank (Riksbank)

## Independence

The independence of the Executive Board is also emphasized in the Sveriges Riksbank Act, which states that the members of the Executive Board may neither seek nor take instructions when fulfilling their monetary policy duties.

## Legislation

Price stability remains the overriding objective for monetary policy under the flexible exchange rate.

The Riksbank will, through monetary policy, defend the results achieved in the struggle against inflation. The Riksbank specifies that the objective of monetary policy is to limit the annual increase in the consumer price index in 1995 and onwards to 2 per cent, with a degree of tolerance of  $\pm 1$  per cent.

This objective corresponds to the current underlying rate of inflation.

## also said

Price stability is a prerequisite for sustained economic growth as well as full employment and it prevents an arbitrary redistribution of income and wealth.

## Law & CB July 2008

The statutory objective of monetary policy is to maintain price stability.

Monetary policy acts with a lag and is normally focused on achieving the inflation target within a two-year period. The two-year time horizon also provides scope for taking fluctuations in the real economy into consideration.

The Riksbank routinely takes into consideration changes in asset prices and other financial variables (exchange rates, house prices, share prices, household and corporate indebtedness, etc.) in monetary policy decisions.

## Flexibility

- The two-year horizon can be interpreted as a restriction as to how much consideration can normally be given to real economic developments, a restriction which – like the specified inflation target – the Riksbank has imposed on itself to make the target of maintaining price stability credible

## and...

The Riksbank's forecasts are based on the assumption that the repo rate (the Riksbank's policy rate) will develop in such a way that monetary policy can be regarded as well-balanced. Normally, a well-balanced monetary policy means that inflation is close to the inflation target within two years while inflation and the real economy are not showing excessive fluctuations.

## 1993 & 2008

Price stability is a prerequisite for sustained economic growth as well as full employment and it prevents an arbitrary redistribution of income and wealth.

Also, monetary policy does not have the task of, and cannot be used for, achieving lasting higher employment or growth. What monetary policy can achieve, however, is to ensure an inflation rate which over a number of years is well in line with the inflation target and to contribute to dampening the fluctuations in the real economy. In this way, monetary policy can create good conditions for an efficiently functioning economy and a favourable, stable macroeconomic development.

## and recently...

- Risk that housing prices increase too fast
- Unbalanced increase in asset prices
- => change policy rate
- Not in contradiction with other targets (inflation and real target)
- Confusion...

## Inflation targeting in practice

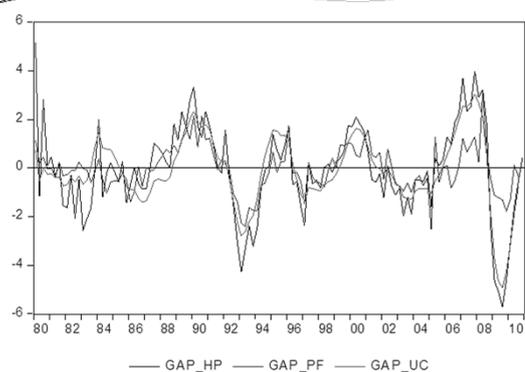
- Inflation measure, different aspects
- Theory: depends on price stickyness
- Practice
  - CPI
  - GDP deflator
  - other indexes
    - asset prices
    - wages

## Target variables: Inflation

- Inflation measure
  - CPI or CPI-X or?
  - Wages?
  - Producer prices?
- CPI deficiencies
  - Too narrow measure
  - Quality changes, 2% is stable price level?
  - Interest rates, capital gains, durables

## Target variables: Output gap

- Measure of potential or trend
- Mechanic or based on theory
- Different mechanical measures
  - Hodrick-Prescott (HP gap)
- Theoretical measures model dependent
  - Production function approach
    - $F(K,H) = F(K, (l*pop)^{(1-u)} * m)$
  - UC-gap
  - Flex-price gap
- No consensus



## Transmission mechanism

- Policy rate
  - Short & long market rates
  - Credibility & expectations
  - Interest rates and demand
    - Consumption
    - Investments
    - Asset prices
    - Exchange rates and trade
  - Public sector & fiscal policy
  - Effects with considerable delay
    - 2 year foresight

## Decisions based on forecasts

- Models
  - NK model, general equilibrium
  - Riksbank as example
    - RAMSES, NK interpretation
    - Supported by other models, time-series models (VARs), "without interpretations", sectoral experts
    - Forecast horizon
      - RAMSES long horizon
      - Supporting models shorter horizon
- Model uncertainty
  - What model?
  - Rational expectations and changing models
  - Different opinions

## RAMSES – DSGE model

- NK model
- Bayesian econometrics
- Small model – 12 data variables
- Open economy
- Sticky prices, wages, import prices, different markups
- Hours worked, no unemployment
- Simple fiscal policy, no policy rule
- Estimated Taylor rule

## Extensions in RAMSES

- Habit formation, backward-looking consumption
- Phillips curve backward and forward looking
- Adjustment costs in investments (capital stock adjustment)
- CPI-X ("core") inflation
- Taylor rule for policy
- Ongoing research

## Major alternatives

- 2nd generation neoknesian models with rational expectations, forward-looking behavior, not fully microfounded big size
- NK models, fully microfounded small size
- time-series models, no theory
- alternative theories

## Sectoral experts and judgement

- Sectoral experts, needed to answer many questions
- Inconsistency in forecasts by sectoral experts => check with model
- Judgement
  - By decision maker
  - By staff

## Decision unit

- Governor (New Zealand)
- Board (Sweden)
- Governor + committee (UK)

## Policy evaluation

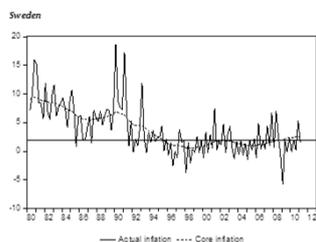
- Forecast error
  - Biased forecasts
  - Completely unforeseen
  - Sequence of shocks => inflation persistently below target

## Policy evaluation

- Inflation close to target?
  - What inflation measure
    - Confusion in Sweden
- Alternative measure to determine interest rate (CPI-X)
- Loss function?
  - What measures?
  - What loss function? Should measure consumer's welfare

Country/region	Estimated parameters		Estimated p-value Lagged inflation (p-value)
	$\beta$	$\kappa$	
Australia	0.987 (0.015)	0.225 (0.057)	0.956
Euro zone	0.937 (0.015)	0.102 (0.035)	0.217
South Korea	0.972 (0.025)	0.071 (0.008)	0.176
Sweden	0.991 (0.032)	0.156 (0.032)	0.111
UK	0.973 (0.064)	0.092 (0.026)	0.087
Canada	0.980 (0.053)	0.017 (0.010)	0.660
Norway	0.966 (0.032)	0.043 (0.018)	0.003
New Zealand	0.958 (0.064)	0.055 (0.014)	0.092

Table 1. Estimated new Keynesian Phillips curves based on (2) and estimated with GMM. Note: Estimated p-values is for the hypothesis that lagged inflation is independent of inflation (old or backward-looking Phillips curve). Standard errors in parentheses



## Policy evaluation

- Target not so explicit
- How to interpret "flexible targeting"? Bring in more targets => harder tradeoffs => more difficult to evaluate
- Inflation target: CPI but including wage inflation advantageous: should one ignore wage inflation in evaluation?
- Accountability
  - Who evaluates and how?

## Problems with accountability

- Specific targets not determined by principal but by agent
- Targets difficult to measure
- Decisions by board or individual
  - Independent decisions by board members
  - Majority decisions
- Evaluation ex post or ex ante

## Inflation targeting era

- Inflation low
- Inflation less volatile
- Output growth high
- Output volatility lower
- Does this depend on inflation targeting?
  - Compare countries
    - Denmark vs Sweden
- Experts on Sweden, Giavazzi & Mishkin, 2006 and Goodhart & Rochet 2011

## Time to write essay

- Deadline 20/1 for both essays and extra assignments
- Advise by e-mail or by appointment