The New-Keynesian approach to fluctuations

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Introduction - the three paradigms

Macroeconomics:

$$\left.\begin{array}{l}\text{Economies fluctuate}\\ \text{Growth is not steady}\end{array}\right\} \text{ why ?}$$

Three paradigms:

- Shocks to fundamentals
- Endogenous fluctuations
- Animal spirits

Introduction - Shocks to fundamentals

$$y_t = a + by_{t-1} + \varepsilon_t$$

- Productivity shocks (computers)
- Government spending shocks (Vietnam)
- Monetary shocks
- Institutional shocks ...

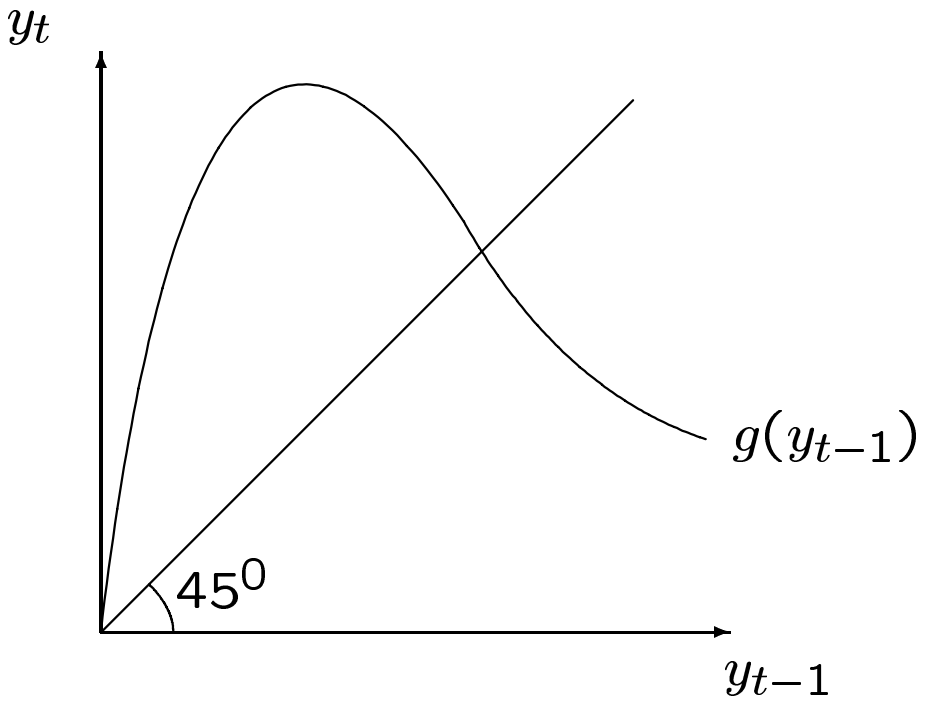
Introduction - Endogenous fluctuations

$$y_t = g(y_{t-1})$$

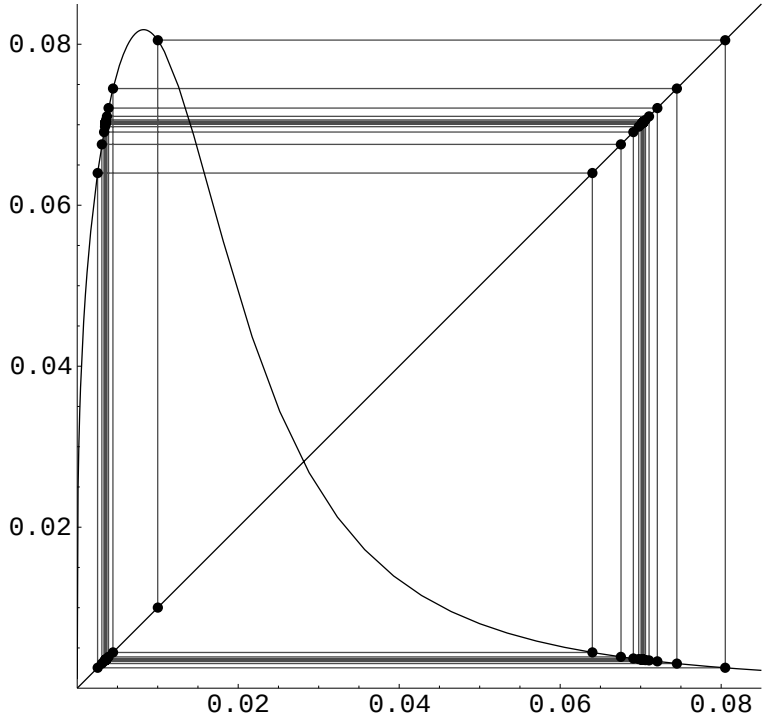
the structure of the economy should be non-linear

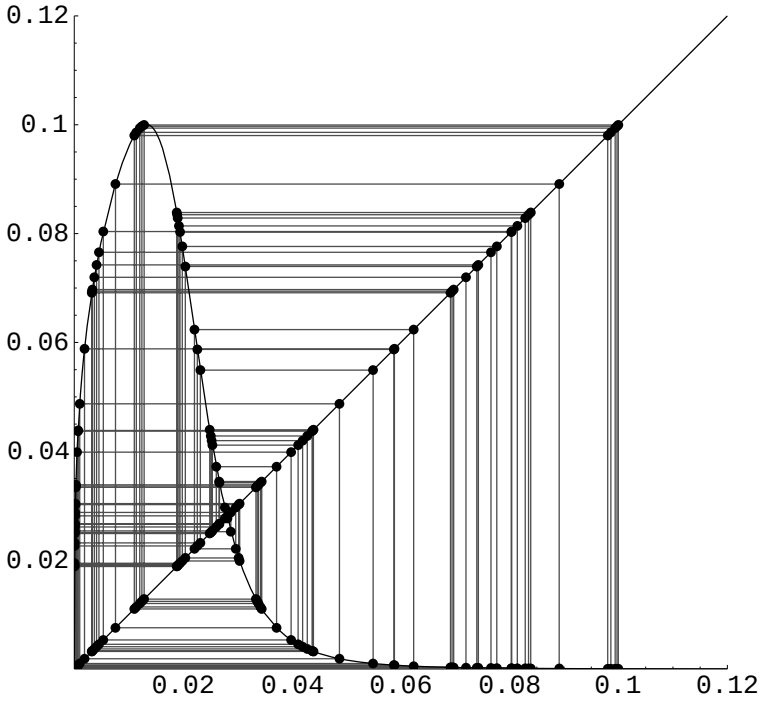
no exogenous shocks needed.

Introduction - Endogenous fluctuations - picture



Introduction - Endogenous fluctuations - example





Introduction - Animal spirits

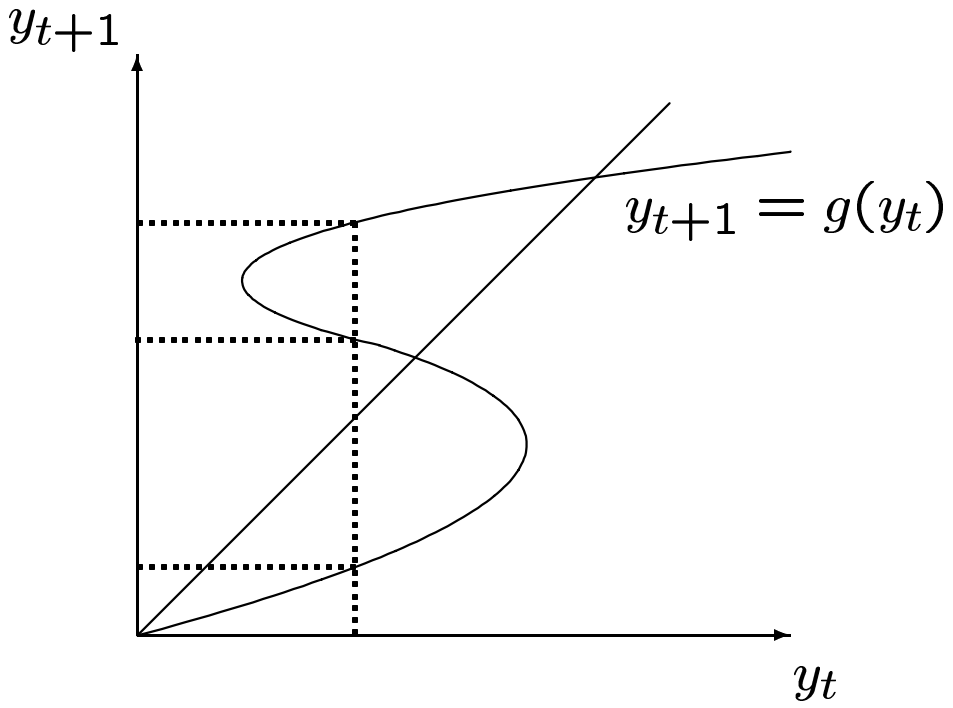
the equilibrium is undetermined

$$y_{t-1} \mapsto \begin{cases} \widehat{y}_t \\ \text{or} \\ \bar{y}_t \\ \text{or} \\ \tilde{y}_t \end{cases}$$

How do expectations coordinate ?
Need for a coordination device (sunspot)

self-fullfilling propheties

Introduction - Animal spirits - picture



Introduction - the IS-LM model

We consider only shocks to fundamentals.

Consensus model until the seventies: ISLM + Phillips curve.

Heavily criticized since then.

Introduction - the lack of microfoundations

It is fair to warn the reader that the once very popular IS-LM framework by now belongs to the history of economic thought as an unsuccessful attempt to analyze purely short-run macroeoconomic events, often by mean of reasonable-looking behavioral relationships such as the aggregate consumption function, the investment function and the liquidity preference schedule. Because none of these schedules follows from any small set of consistent axioms about rational economic behavior, economists often say that IS-LM structure lacks microeconomic foundations – Azariadis.

Introduction - the two approaches to microfoundations

Bottom up approach: Develop the microfoundations of the agents' behavior. Look at the characteristics of each market (imperfect competition on goods market ...,labor market,...) Assemble the pieces with the objective of achieving, at some later stage, a legitimate dynamic general equilibrium successor to IS-LM.

Top dow approach: Start from a dynamic general equilibrium model with a production sector. Progressively add some macro features. Hope to connect with the key observations made by those who have invested in the bottom up approach.

See Danthine (1997)

Introduction - the New Keynesian programme

We follow the bottom up approach, i.e., the New Keynesian literature.

We develop the microfoundations of the ISLM-Phillips curve model.

This model is the main implicit frame of analysis in IMF, OECD etc

Good empirical performance (paper Bruno & Portier)

Traditional IS-LM - goods

Three goods:
a composite physical good
money
bonds

Household budget constraint:

$$P\,C + \Delta M^d + \Delta O^d = P\,Y + (R + \dot{P}^e)\,O - P\,T$$

Government budget constraint:

$$P\,G + (R + \dot{P}^e)\,O - P\,T = \Delta M^s + \Delta O^s$$

Traditional IS-LM - behavior

Consumption

$$C = C_0 + C_1\,(Y - T) - C_2\,R$$

Investment

$$I = I_0 + I_1\,Y - I_2\,R$$

Money demand

$$\frac{M^d}{P} = M_0 + M_1\,Y - M_2\,(R + \dot{P}^e)$$

Expectations are exogenous.

Traditional IS-LM - equilibrium

Physical good market (IS):

$$Y = C + I + G$$

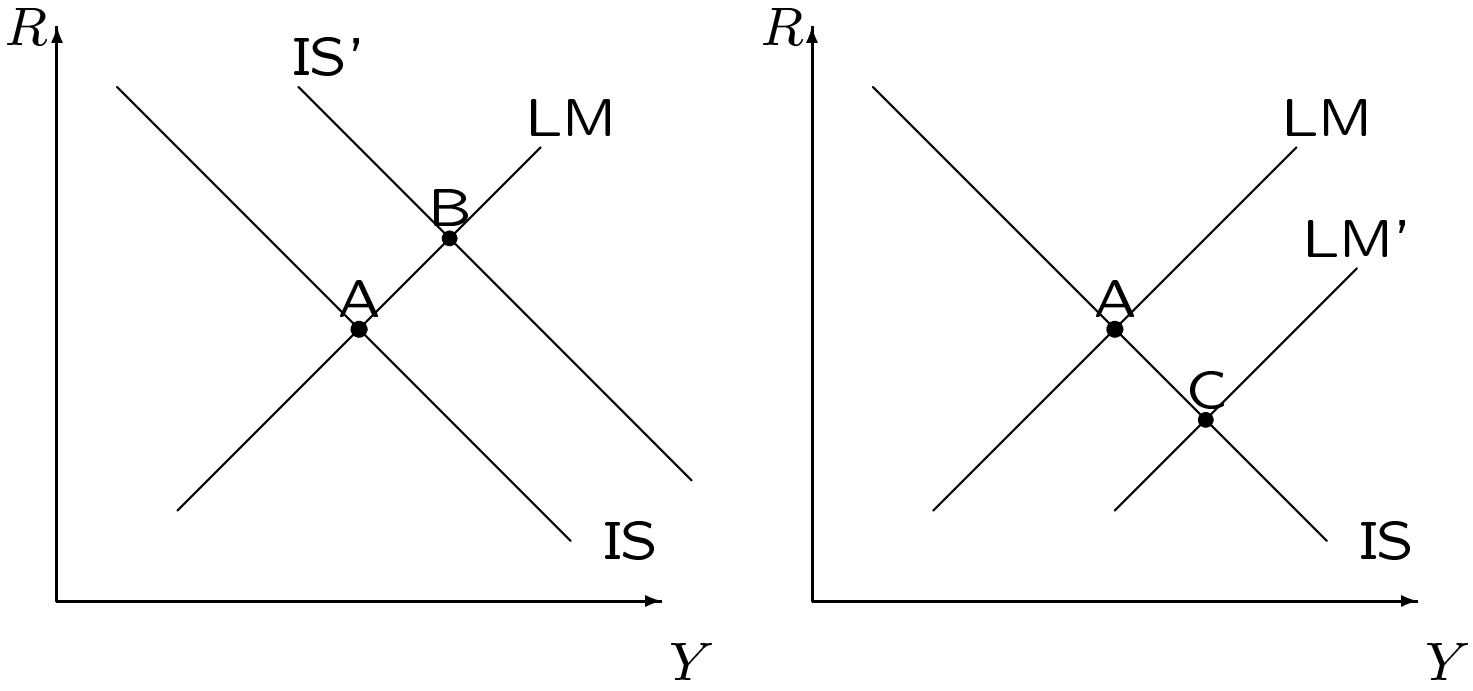
Money market (LM):

$$\frac{M^s}{P} = \frac{M^d}{P}$$

by Walras Law, bonds market:

$$\Delta O^d = \Delta O^s$$

Traditional IS-LM - picture



Traditional IS-LM - extention to an open-economy (1)

Two types of bonds: domestic and foreign.

Exports and Imports:

$$X = X_0 + X_1 Y^\star + X_2 \Theta$$

$$M = M_0 + M_1 Y - M_2 \Theta$$

Balance of trade

Nominal: $PX - P^\star EM$ Real: $X - \Theta M$.

Traditional IS-LM - extention to an open-economy (2)

An improvement in competitiveness Θ improves the trade balance if the Marshall-Lerner condition holds – The BT line.

Discussion on the mobility of capital.

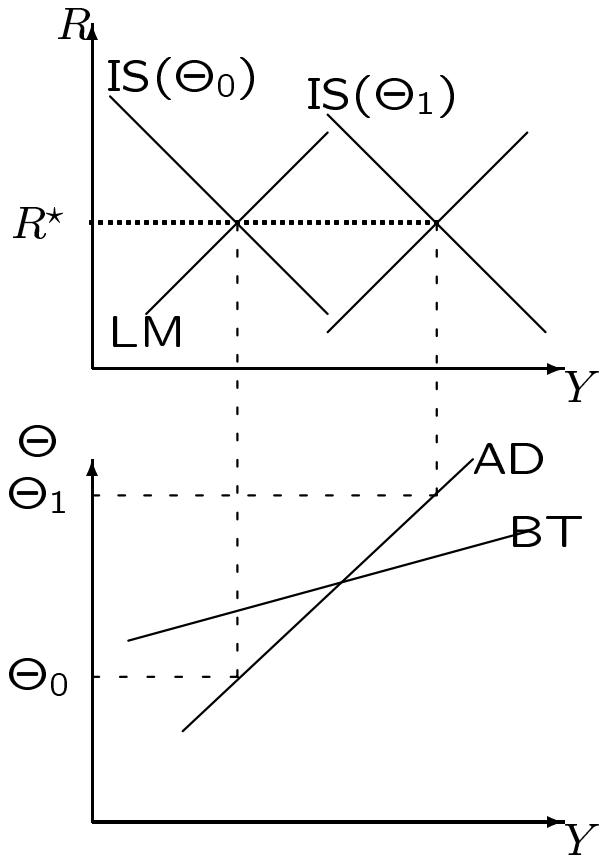
Discussion on the exchange rate regime.

Discussion on how exchange rate expectations are formed.

With a fixed exchange rate, the central bank detains exchange reserves that vary to balance the external account.

The effectiveness of policies depend on the mobility of capital and the exchange rate regime.

Traditional IS-LM - Salter/Swan diagram



Inter-temporal household behavior - the model

2-period model

Utility:

$$\ln c_t + \beta \ln c_{t+1} + \gamma \ln(m_t/p_t)$$

Budget constraints:

$$p_t c_t + m_t + b_t = p_t y_t$$

$$p_{t+1} c_{t+1} = p_{t+1} y_{t+1} + m_t + (1 + i_t) b_t$$

(money in the utility - logarithmic form to simplify)

Inter-temporal household behavior - optimality conditions

The optimal demand schedules are given by

$$\begin{aligned} c_t &= \frac{1}{1+\beta+\gamma}\left(y_t + \frac{y_{t+1}}{1+r_t}\right) \\ \frac{m_t}{p_t} &= \frac{\gamma}{1+\beta+\gamma}\left(1+\frac{1}{i_t}\right)\left(y_t + \frac{y_{t+1}}{1+r_t}\right). \end{aligned}$$

where the real interest rate is $1 + r_t = p_t(1 + i_t)/p_{t+1}$

Conditions to retrieve IS-LM
– Prices are fixed, i_t and r_t are equivalent.
– Expectations on y_{t+1} are fixed.

Inter-temporal household behavior - balanced budget policies

Budget constraints:

$$p_t c_t + m_t + b_t + p_t g_t = p_t y_t$$

$$p_{t+1} c_{t+1} = p_{t+1} y_{t+1} + m_t + (1 + i_t) b_t$$

The optimal demand schedules are given by

$$\begin{aligned} c_t &= \frac{1}{1+\beta+\gamma}\left(y_t - g_t + \frac{y_{t+1}}{1+r_t}\right) \\ \frac{m_t}{p_t} &= \frac{\gamma}{1+\beta+\gamma}\left(1+\frac{1}{i_t}\right)\left(y_t - g_t + \frac{y_{t+1}}{1+r_t}\right). \end{aligned}$$

Inter-temporal household behavior - debt financing

Budget constraints:

$$p_t c_t + m_t + b_t + p_t g_t = p_t y_t$$

$$p_{t+1} c_{t+1} + p_t g_t (1 + i_t) = p_{t+1} y_{t+1} + m_t + (1 + i_t) b_t$$

The optimal demand schedules are given by

$$\begin{aligned} c_t &= \frac{1}{1 + \beta + \gamma} \left(y_t - g_t + \frac{y_{t+1}}{1 + r_t} \right) \\ \frac{m_t}{p_t} &= \frac{\gamma}{1 + \beta + \gamma} \left(1 + \frac{1}{i_t} \right) \left(y_t - g_t + \frac{y_{t+1}}{1 + r_t} \right). \end{aligned}$$

Inter-temporal household behavior - Ricardian equivalence

When consumers take into account the government inter-temporal budget constraint, tax financing and debt financing is equivalent.

This is not the case is IS-LM.

Required assumptions: consumers anticipate, taxes are lump-sum, government reimburses its debt, perfect capital market.

Price formation - the feasible wage

Nominal wages are observed by each firm.

Each firm chooses its output price p_i, labor input l_i and production y_i so as to maximize its profit.

Assuming that all the firms are identical (representative agent) we can compute the aggregate price level and the corresponding real wage.

We call this wage the feasible wage: it is the macroeconomic real wage that underlies the price formation mechanism.

We consider two different models of price formation.

Price formation - the production function

The short-run production function is:

$$y_i = \min\{\tau l_i, \zeta m_i\}$$

Optimal factor inputs:

$$l_i = \frac{y_i}{\tau}$$

$$m_i = \frac{y_i}{\zeta}$$

Price formation - monopolistic competition

Market structure: each firm produces a single good. Goods are imperfect substitutes.

Demand function:

$$y_i = \left(\frac{p_i}{P}\right)^{-\epsilon} D$$

Intermediate imports are bought at price $P^{\star}E$.

Profit maximization:

$$\max_{p_i} \left(\frac{p_i}{P}\right)^{-\epsilon} D \left(p_i - \frac{w_i}{\tau} - \frac{P^{*}\ E}{\zeta}\right)$$

Price formation - monopolistic competition - mark-ups

Optimal price:

$$p_i = \frac{1}{1 - \frac{1}{\epsilon}} \left(\frac{w_i}{\tau} + \frac{P^* \, E}{\zeta} \right)$$

Share of profits in production : $1/\epsilon$

Price formation - monopolistic competition - labor demand

Labor demand function:

$$l_i = \left(\frac{1}{1 - \frac{1}{\epsilon}} \left(\frac{w_i}{\tau P} + \frac{P^* \, E}{\zeta P} \right) \right)^{-\epsilon} \frac{D}{\tau}$$

Productivity is good for employment.

Firms are ready to serve additional demand at given wages.

Price formation - monopolistic competition - feasible wage

We aggregate:

$$p_i = P \ \ \forall i \quad w_i = W \ \ \forall i$$

We define competitiveness as:

$$\Theta = \frac{P^{\star} E}{P}$$

The feasible real wage:

$$\Omega_p = \frac{W}{P} = \left(1 - \frac{1}{\epsilon} - \frac{\Theta}{\zeta}\right) \tau$$

Price formation - monopolistic competition - feasible wage (2)

The feasible wage thus depends on

- productivity,
- competitiveness,
- goods demand elasticity.

Price formation - customer markets

Market structure: each firm produces a single good. Goods are imperfect substitutes.
Consumers react slowly to price changes (here, they take one period to react).

Two-period model. The price is fixed once for all.

The possibilities for the firm are
– high price: high profit margins today but low market share tomorrow.
– low price: low profit margins today but high market share tomorrow.

Role of the interest rate.

Price formation - customer markets - the model

Demand:

$$y_{it} = \bar{d}$$

$$y_{it+1} = \left(\frac{p_i}{P}\right)^{-\epsilon} \bar{d}$$

Firms have the same technology as above and maximize the discounted sum of profit

$$\pi_t + \frac{1}{1+R}\pi_{t+1}$$

Price formation - customer markets - mark-ups

Considering only stationary economies, the problem is

$$\max_{p_i} \left(p_i - \frac{w_i}{\tau} - \frac{P^\star E}{\zeta} \right) \bar{d} + \frac{1}{1+R} \left(p_i - \frac{w_i}{\tau} - \frac{P^\star E}{\zeta} \right) \left(\frac{p_i}{P} \right)^{-\epsilon} \bar{d}$$

The optimal price p_i is solution to:

$$0 = \left(\frac{P}{p_i} \right)^{\epsilon} (R+1) + 1 - \epsilon \left(1 - \frac{w_i}{\tau p_i} - \frac{P^\star E}{\zeta} \right)$$

Price formation - customer markets - profits

At the macroeconomic level:

$$P = \frac{1}{1 - \frac{R+2}{\epsilon}} \left(\frac{W}{\tau} + \frac{P^{\star} E}{\zeta} \right)$$

The share of profits is equal to

$$\frac{R+2}{\epsilon}$$

and depend positively on the real interest rate.

Price formation - customer markets - feasible wage

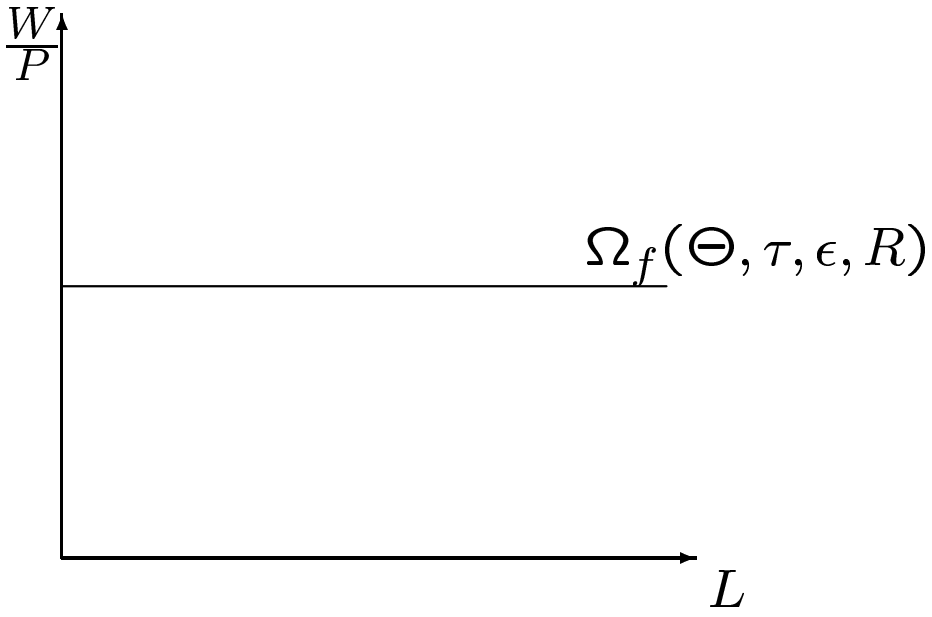
The feasible real wage:

$$\Omega_p = \frac{W}{P} = \left(1 - \frac{R+2}{\epsilon} - \frac{\Theta}{\zeta}\right)\tau$$

The feasible wage thus depends on

- productivity, competitiveness, goods demand elasticity,
- real interest rate.

Price formation - picture



Wage formation - monopoly union - assumptions

Timing: nominal wages are set first, before the decision on employment and prices by firms (right-to-manage model)

Decentralized bargaining: one union in each firm.

The union pursues the interest of its members. It maximizes the expected utility of the representative member.

Once the nominal wage has been fixed, and given the expected aggregate price level, we can define the desired wage: it is the macroeconomic real wage that underlies the wage formation scheme.

Wage formation - monopoly union - objective

Expected utility:

$$\frac{l_i}{n_i}\,\mathcal{U}(w_i/P^e) + \left(1 - \frac{l_i}{n_i}\right)\,\mathcal{U}(Z)$$

To simplify, risk-neutral individuals:

$$\mathcal{U}(x) = x$$

Key arbitrage: the union anticipate the labor demand function:

$$l_i = l_i(w_i/P^e) \quad \text{with} \quad l_i'(.) < 0.$$

Wage formation - monopoly union - optimal condition

The problem becomes

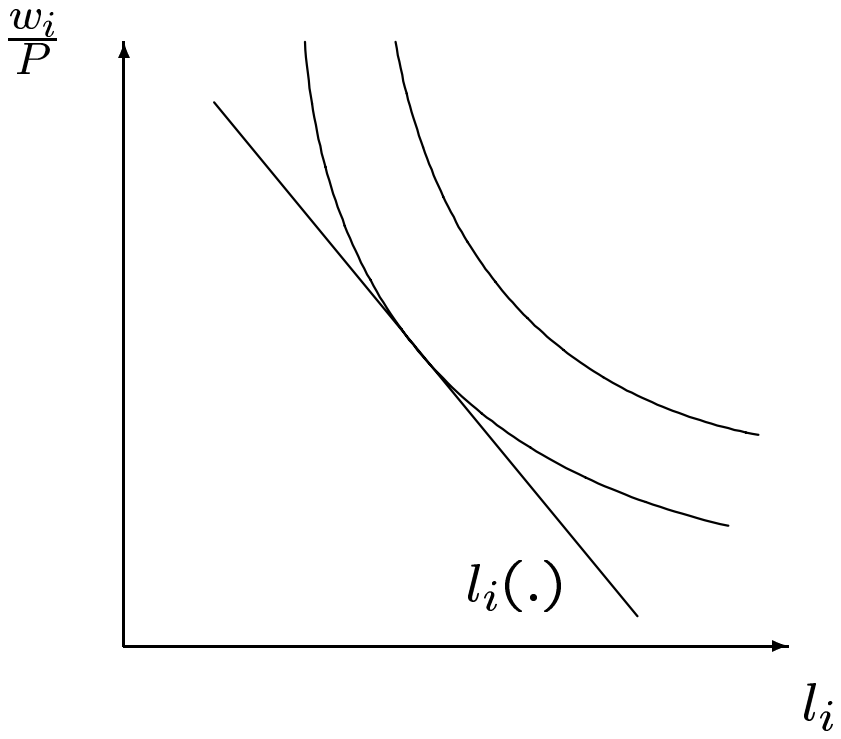
$$\max_{w_i} \frac{l_i(w_i/P^e)}{n_i} \frac{w_i}{P^e} + \left(1 - \frac{l_i(w_i/P^e)}{n_i}\right) Z$$

P, Z and n_i given.

The optimal wage is

$$\frac{w_i}{P^e} = Z - \frac{l_i}{l_i'}$$

Wage formation - monopoly union - picture



Wage formation - monopoly union - desired wage

Aggregation: all firms are alike $\rightarrow w_i = W \ \ \forall i$.

Alternative wage:

$$Z = (1 - U)\, W/P^e + U\ B$$

The elasticity of firms' labor demand to real wages:

$$\eta = \mid l_i' \, \frac{w_i/P^e}{l_i} \mid$$

Wage formation - monopoly union - desired wage (2)

The desired wage:

$$\Omega_d = \frac{W}{P^e} = \left(\frac{U}{U - 1/\eta}\right) B$$

It depends on unemployment, unemployment benefits, and the elasticity of the labor demand to wages.

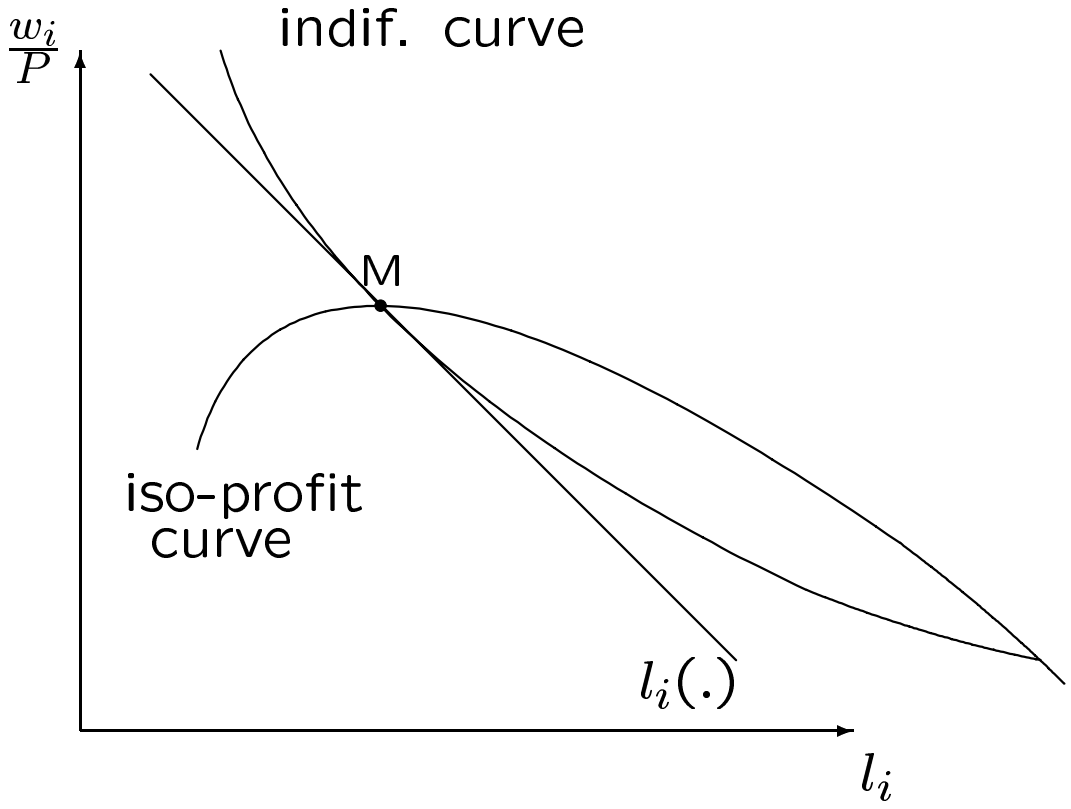
Further refinements will help to include union power, structure of unemployment benefits, social security contributions, ...

Wage formation - efficient bargaining - principle

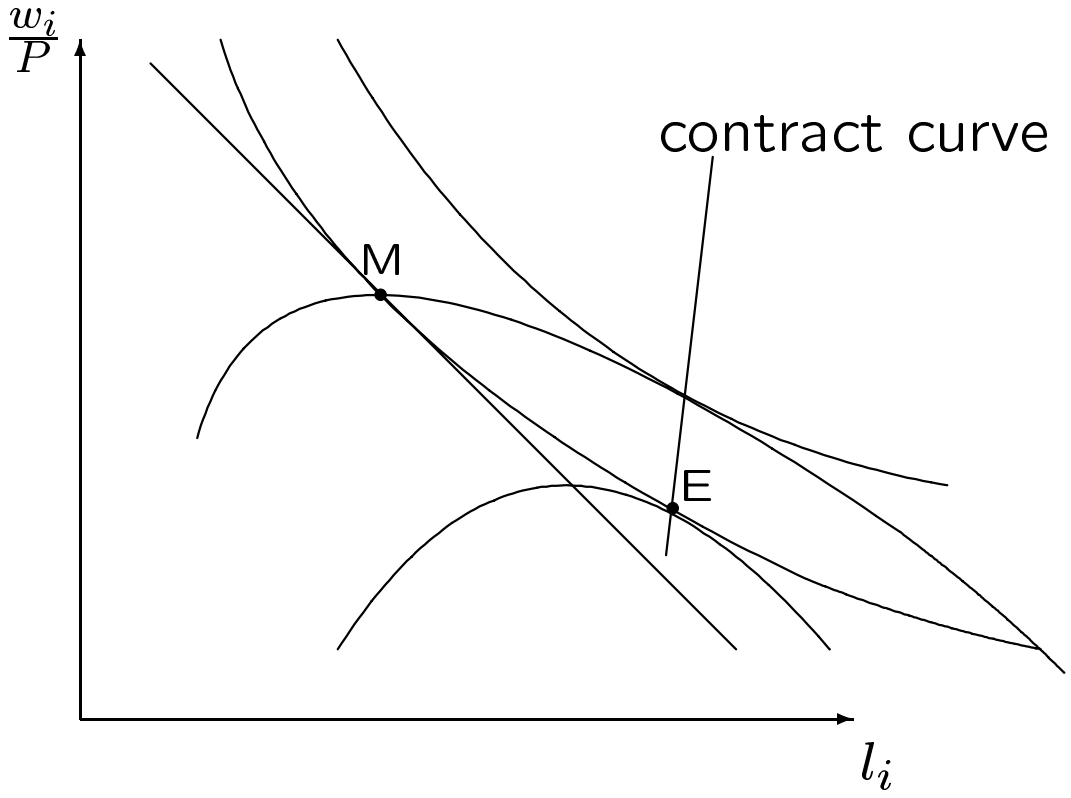
Main criticism to the right-to-manage model: the outcome w_i, l_i is not bilaterally optimal – graphical argument.

Bilaterally optimal contract should lie at the tangency points between indifference curves and isoprofit curves.

Wage formation - efficient bargaining - picture (1)



Wage formation - efficient bargaining - picture (2)



Wage formation - efficient bargaining - criticisms

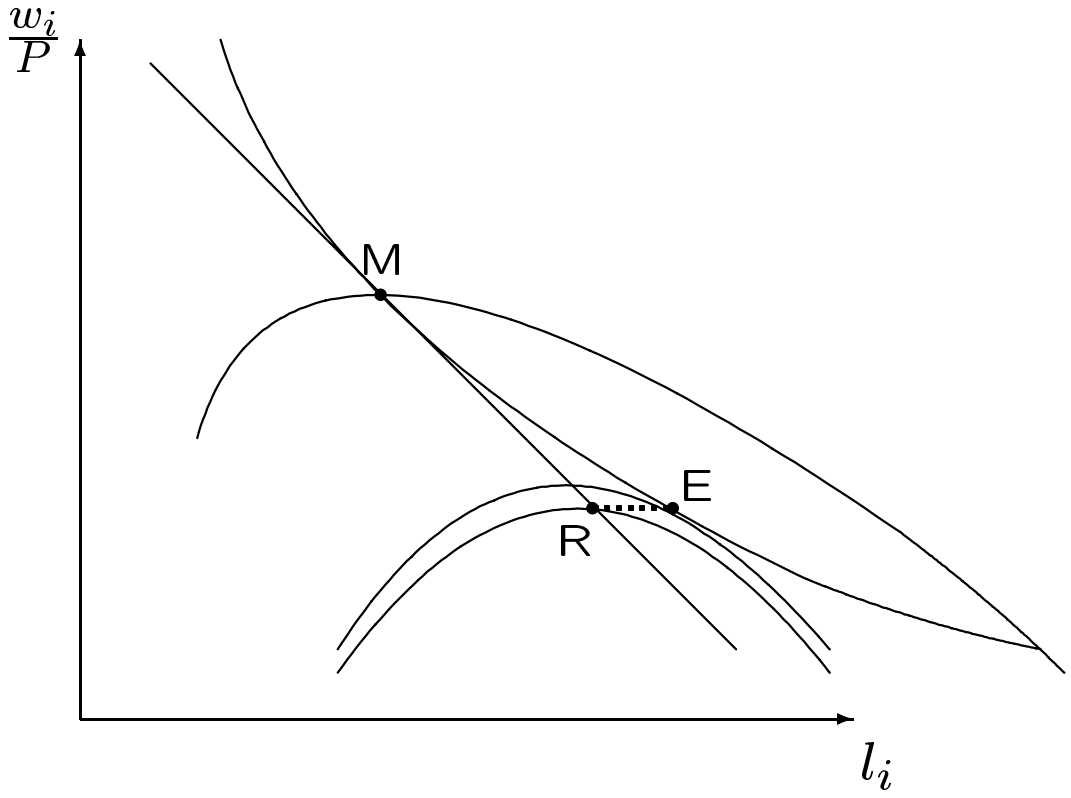
Efficient outcomes do no lie on the labor demand schedule.

Firms have an incentive to deviate from the contract.

Which union is ready to sign a contract with a firm that has an incentive to renege?

Moreover we rarely observe contracts on employment.

Wage formation - efficient bargaining - picture (3)



Wage formation - dynamic model of bargaining (1)

Repeated game: unions and firms negotiate each period.

If they do not reach an agreement on an efficient contract, the monopoly union will set the wage and the firm will set the employment level.

If the firm deviates from an efficient outcome, then the union will never again sign such a contract.

Wage formation - dynamic model of bargaining (2)

The choice of the firm:
A – To sign an efficient contract and stick to it in the future.
B – To sign an efficient contract, deviate from it, and endure the non-cooperative equilibrium in the future.

The solution B maximizes today's profits.
The solution A is better for future profits.

The interest rate plays a role.

When R rises, it can be optimal for the firm to promote short-run profits, and to deviate from the efficient contract.

The desired wage can thus be a function of the interest rate.

Wage formation - turn-over costs

An alternative to union models: the efficiency wage models.

The firm chooses the wage of its employees in order to

- Increase the effort provided by the workers; (gift exchange)
- Reduce shirking; (shirking model)
- Improve the applicants pool; (screening)
- Reduce the turn-over; (turn-over cost model).

Wage formation - turn-over costs - assumptions

Workers quit the firm at a rate d_i that depends negatively on the wage paid by the firm.

$$d_i\left(\frac{w_i}{P^e}, Z\right)$$

Employment is kept constant.

There is a hiring cost per person: ψ. Total hiring costs:

$$d_i\left(\frac{w_i}{P^e}, Z\right)\ \psi\ l_i$$

Wage formation - turn-over costs - solution

The firm minimizes its real costs:

$$\min_{w_i} \frac{w_i}{P^e} l_i + d_i \left(\frac{w_i}{P^e}, Z \right) \psi l_i$$

Giving to the quit function as specific form:

$$d_i = 1 - \frac{1}{\phi} \left(\frac{w_i}{P^e} - Z \right)^{\phi}$$

The optimal wage is

$$w_i = P^e \left(Z + \psi^{\frac{1}{1-\phi}} \right)$$

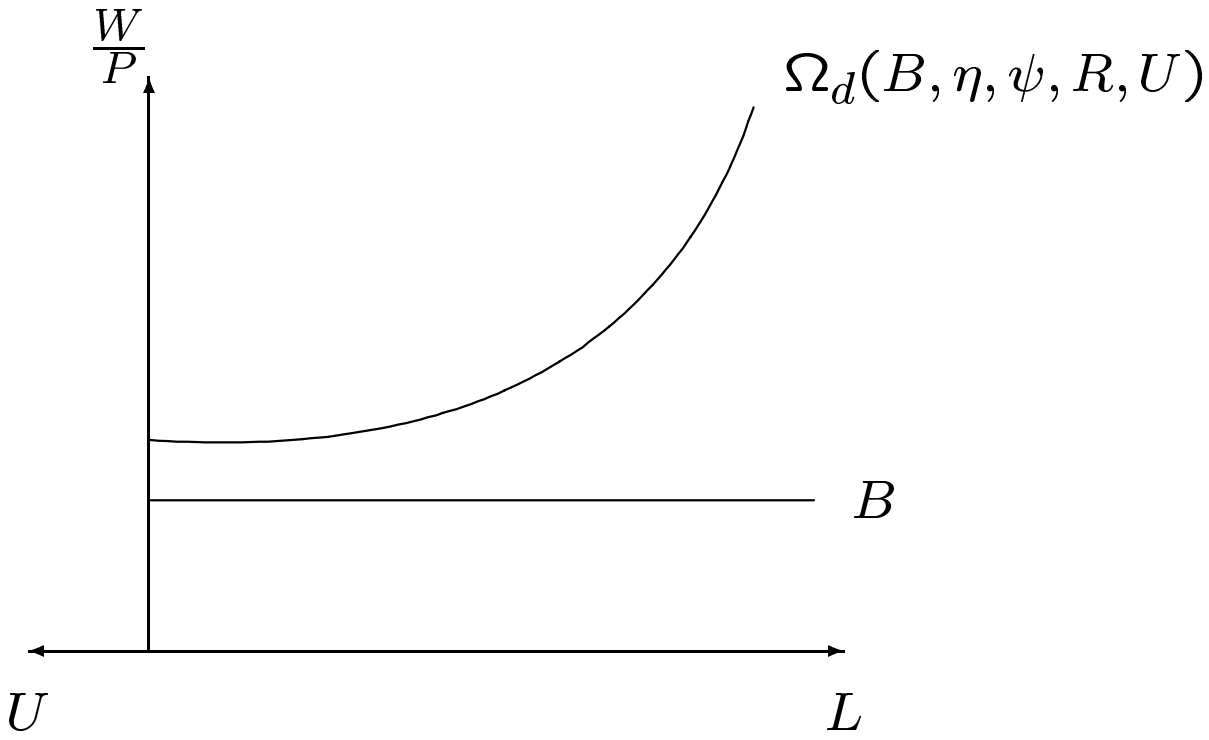
Wage formation - turn-over costs - desired wage

Aggregating and replacing Z by its value:

$$\Omega_d = \frac{W}{P^e} = B + \frac{\psi^{\frac{1}{1-\phi}}}{U}$$

The desired wage depends on unemployment benefits, hiring costs and the unemployment rate.

Wage formation - the desired wage



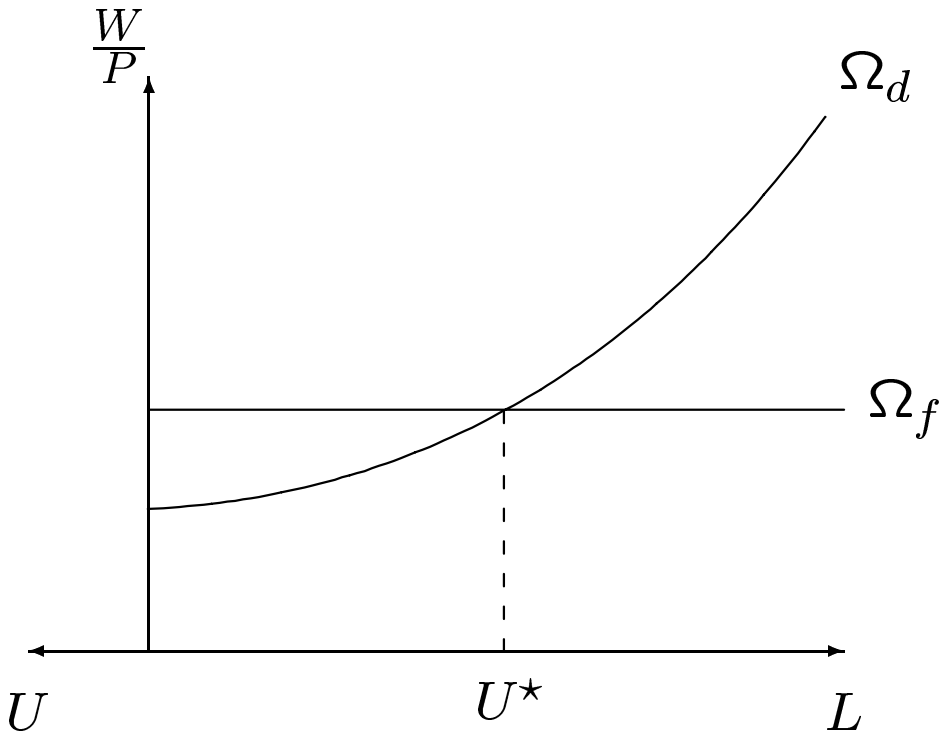
Equilibrium unemployment

Definition: the equilibrium unemployment $U^\star$ is the unemployment rate for which the desired wage is equal to the feasible wage:

$$\Omega_f(\Theta, \tau, \epsilon, R) = \Omega_d(B, \eta, \psi, R, U^\star)$$

It thus depend on the structural parameters τ, ϵ, ψ, η, on competitiveness and on the interest rate (under the assumption of customer markets and/or dynamic bargaining).

Equilibrium unemployment - picture

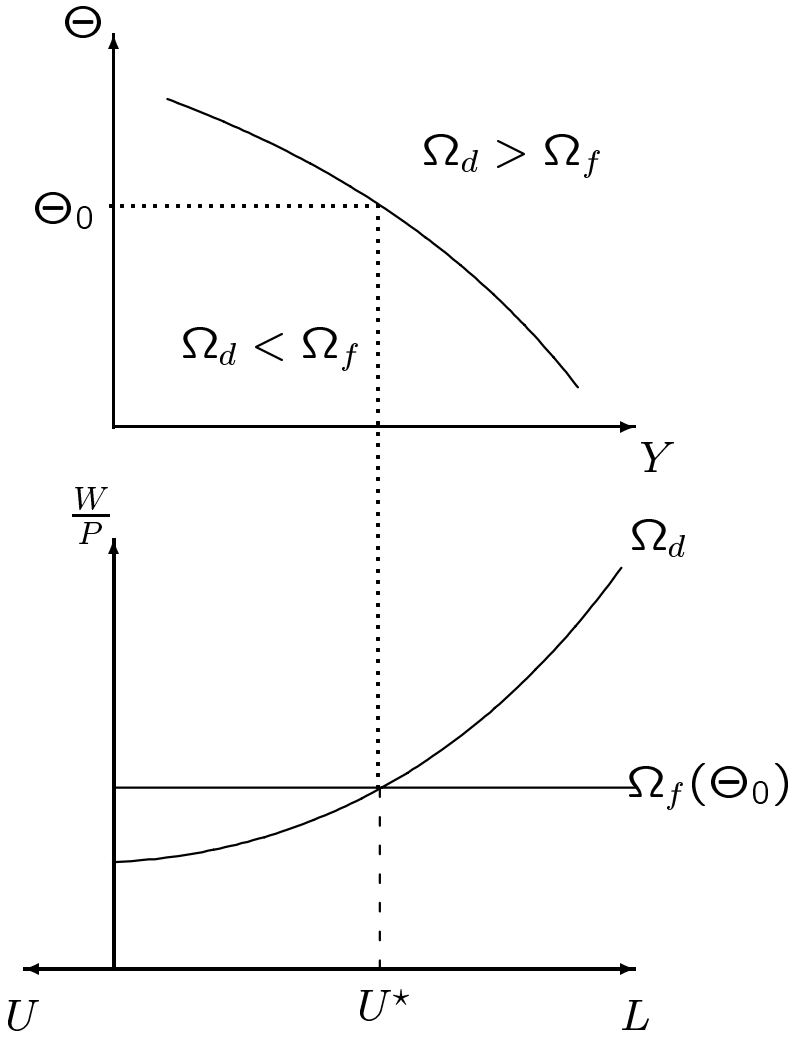


Equilibrium unemployment - the CCE curve

As there is one equilibrium unemployment rate for each possible level of competitiveness there is an infinity of possible equilibrium unemployment rates.

We define the CCE curve as the locus of points (Θ, L) such that the desired wage is equal to the feasible wage.

Above the curve, L is "too" high compared to its equilibrium level and the desired wage is above the feasible wage.


Θ
$\Omega_d > \Omega_f$
Θ_0
$\Omega_d < \Omega_f$
Y
$\frac{W}{P}$
Ω_d
$\Omega_f(\Theta_0)$
U
$U^\star$
L

Actual unemployment

In the monopolistic competition model with constant returns, the firms are ready to serve the demand at given prices and wages. Output and actual unemployment are determined by the demand side.

Actual unemployment thus depends on demand conditions, like government spending, money supply, world demand ...

A priori, actual unemployment can be above or below equilibrium unemployment.

Is the economy going to adjust and actual unemployment converge to equilibrium unemployment? The adjustment process will depend on the exchange rate regime.

Fixed exchange rate - inflation (1)

When fixing the nominal wage, the agents follow a real objective, the desired wage: Ω_d. However, they can only fix the nominal wage in order to meet this target. At a given period t, wage inflation will be

$$\dot{W}_t = \dot{P}_t^e + \frac{\Omega_d(.) - \frac{W_{t-1}}{P_{t-1}}}{\frac{W_{t-1}}{P_{t-1}}}$$

Nominal wage increases in order to compensate for expected inflation and for the gap between the desired wage and the actual wage of the previous period.

Fixed exchange rate - inflation (2)

In a fixed exchange rate regime, we assume that agents look at foreign inflation in order to compute the expected inflation rate:

$$\dot{P}_t^e = \dot{P}_t^\star$$

This is rational in the long-run: indeed, in the long run, $\dot{\Theta} = 0$ which implies $\dot{P} = \dot{P}^\star$.

In the short run this ad-hoc assumption introduces a nominal rigidity.

Fixed exchange rate - inflation (3)

As firms determine price after the fixation of nominal wages, the actual real wage is determined by the feasible wage:

$$\frac{W}{P} = \Omega_f(.)$$

The linearized mark-up rule implies:

$$\dot{P}_t = \kappa \dot{W}_t + (1-\kappa)\dot{P}_t^{\star}$$

where κ represents the share of labor in total costs and $1-\kappa$ represents the share of imported intermediate inputs.

Fixed exchange rate - inflation (4)

Putting the various equations together, we obtain

$$\dot{P}_t = \dot{P}_t^{\star} + \kappa \frac{\Omega_d(.) - \Omega_f(.)}{\Omega_f(.)}$$

which implies that

$$\dot{\Theta}_t = \dot{P}_t^{\star} - \dot{P}_t = \kappa \frac{\Omega_f(.) - \Omega_d(.)}{\Omega_f(.)}$$

Hence, competitiveness increases over time when the feasible wage is larger than the desired wage.

Fixed exchange rate - dynamics of competitiveness

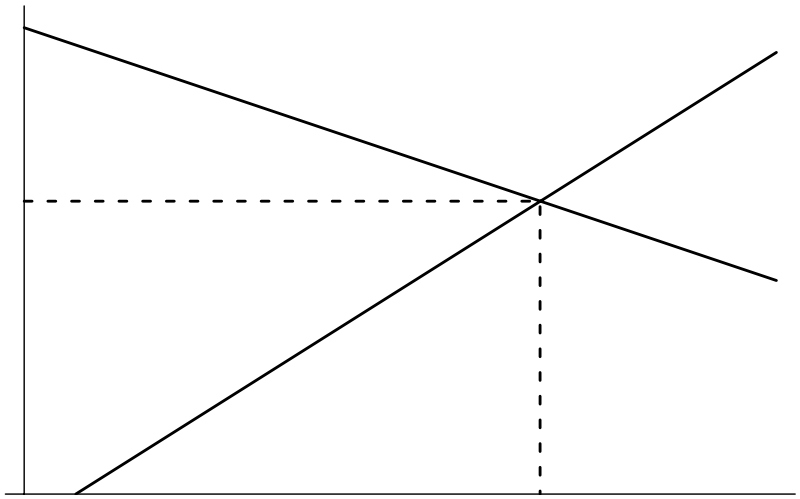
Replacing the desired and feasible wage by their expression:

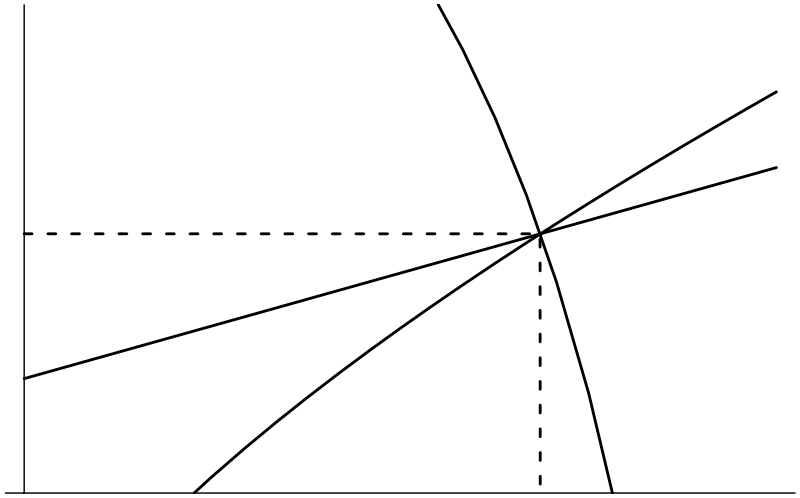
$$\dot{\Theta} = \kappa \left(1 - \frac{B + \frac{\psi^{\frac{1}{1-\phi}}}{U}}{\left(1 - \frac{1}{\epsilon} - \frac{\Theta}{\zeta}\right)\tau} \right)$$

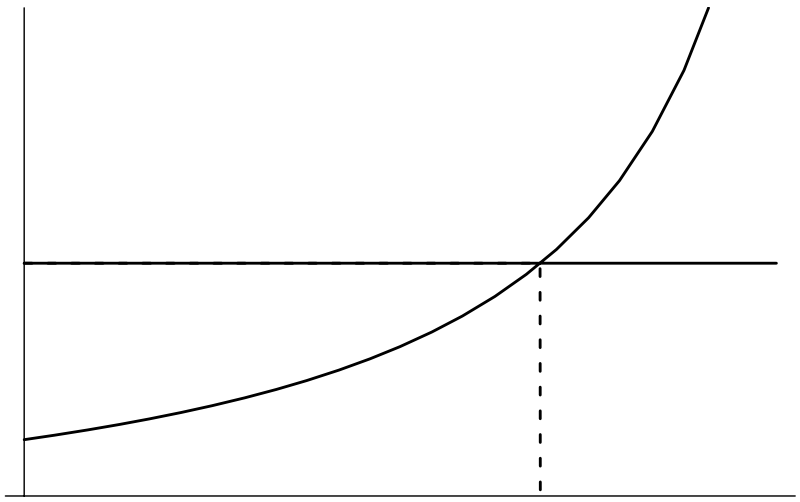
Change in competitiveness is positively affected by actual unemployment.

$$\left| \begin{array}{l|l|l|l} \Omega_d > \Omega_f & U < U^\star & \dot{P} > \dot{P}^\star & \dot{\Theta} < 0 \\ \Omega_d = \Omega_f & U = U^\star & \dot{P} = \dot{P}^\star & \dot{\Theta} = 0 \\ \Omega_d < \Omega_f & U > U^\star & \dot{P} < \dot{P}^\star & \dot{\Theta} > 0 \end{array} \right|$$

Fixed rate – numerical example







Fixed exchange rate – fiscal policy (1)

We assume perfect capital mobility.

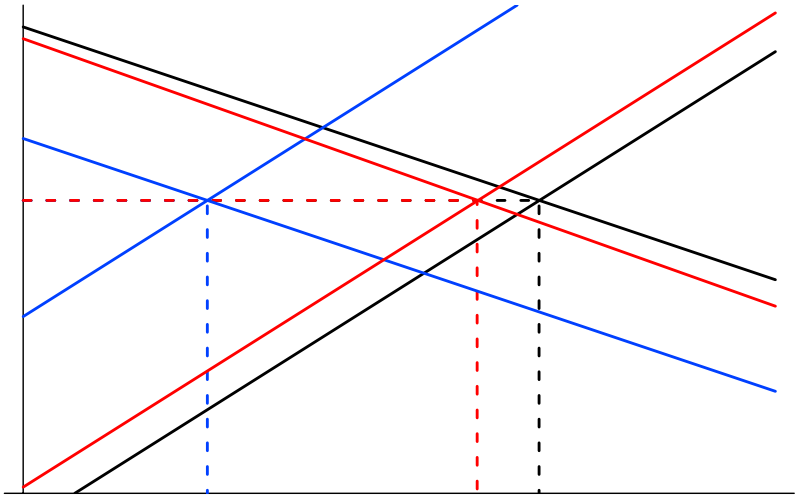
The model allows us to consider a wide variety of policies / shocks:
– spending policy
– monetary policy
– incomes policy
– exchange rates realignements
– shocks to productivity
– changes in the size of the active population
– rise in foreign interest rate.

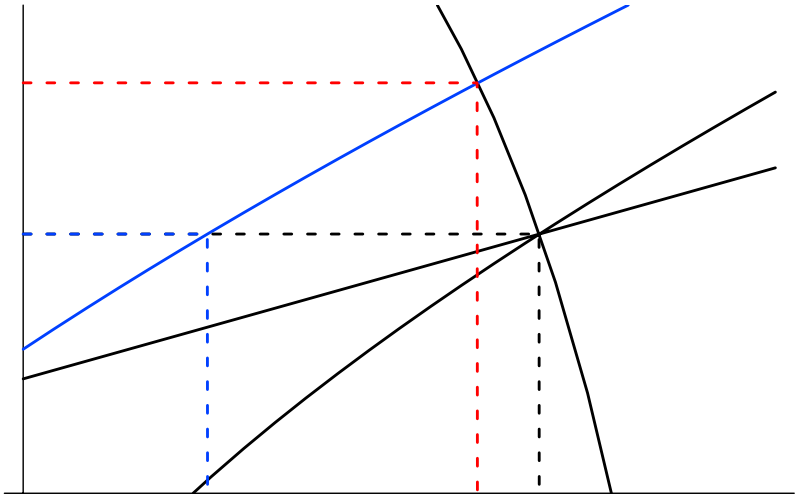
Fixed exchange rate – fiscal policy (1)

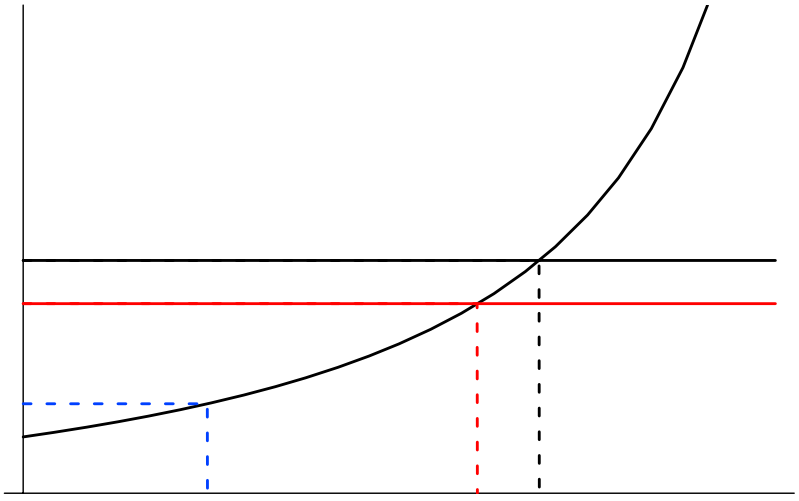
In the face of a negative spending shock, data suggests that:
-output drop instantaneously,
-nominal interest rates decline,
-inflation is slowed down,
-trade surplus increases.

In the model, the initial drop in output is partially compensated in the medium run by an increase in competitiveness. The net effect remains however negative ($\neq$ Mundell-Fleming).

Fixed rate – fiscal policy (2)







Fixed exchange rate – monetary policy

With perfect capital mobility and fixed exchange rate, monetary policy has no effect.

This Mundell-Fleming result remains true in the New-Keynesian world.

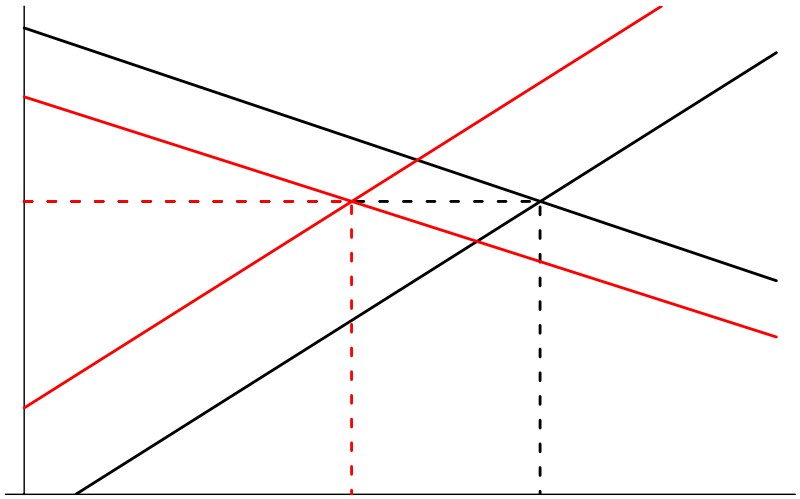
Fixed exchange rate – incomes policy (1)

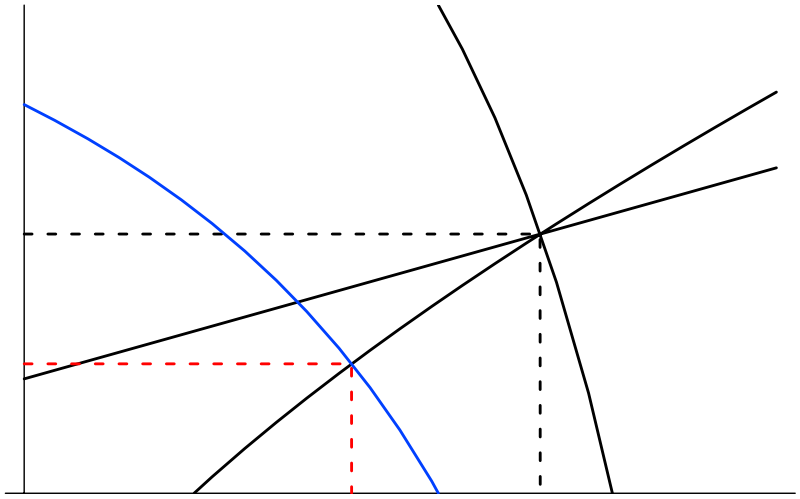
Incomes policy are now one central tool of macroeconomic adjustment policies.

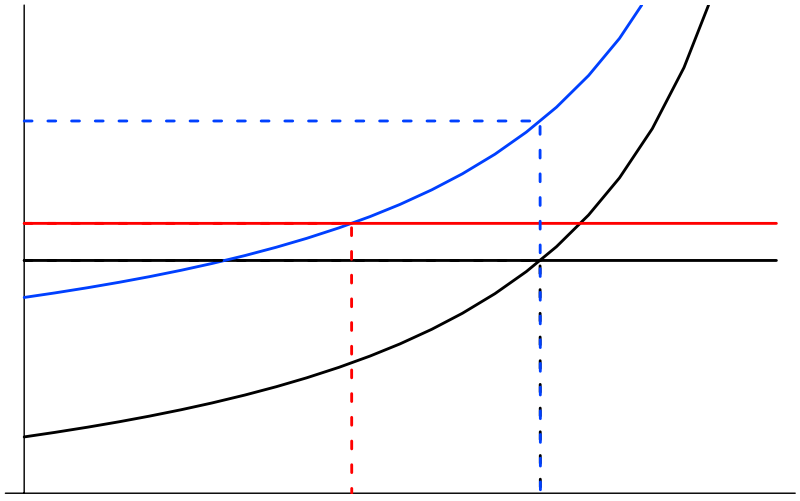
They include: the design of social security, the design of labor market institutions (centralization...), training policies (see the turn-over cost model).

They affect the equilibrium unemployment rate directly. This affects inflation and competitiveness in the medium run.

Fixed rate – incomes policy (2)







Fixed exchange rate – realignements

An exogenous shift in the exchange rate has a short-run effect on competitiveness and output.

In the medium run, competitiveness is brought back to the level that corresponds to equilibrium unemployment.

Exchange rate realignments alone are thus inoperative in the medium-run.

Exchange rate shifts are however useful to speed up an adjustment process, following for instance an incomes policy.

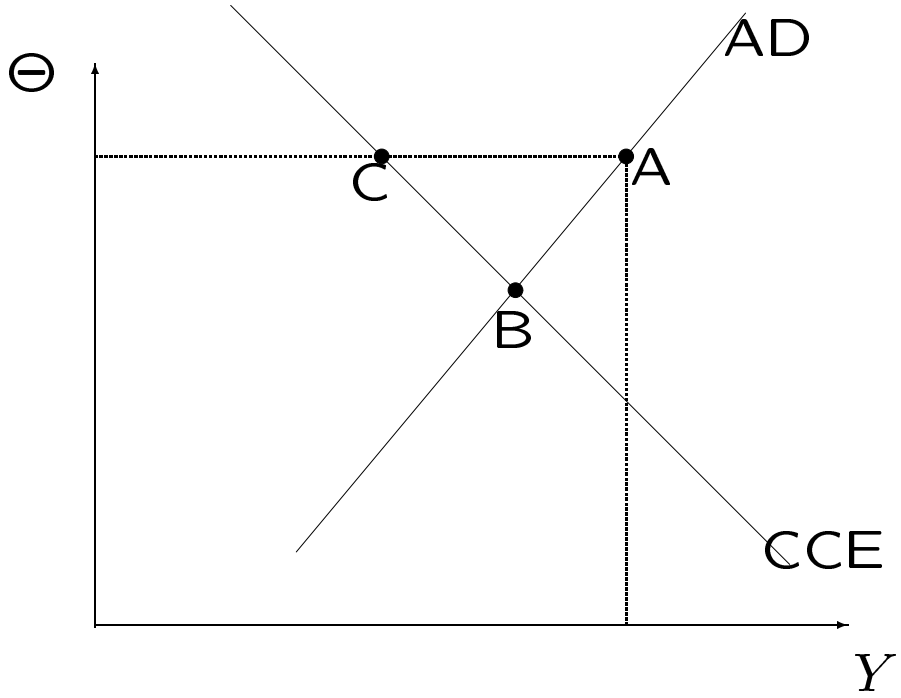
Fixed exchange rate – fighting inflation (1)

When inflation is higher than abroad, it means that the desired wage is above the feasible wage.

Three possible policies:

- a reevaluation
- restrictive incomes policy
- restrictive fiscal policy

Fixed exchange rate – fighting inflation (2)



Fixed exchange rate – rise in productivity (1)

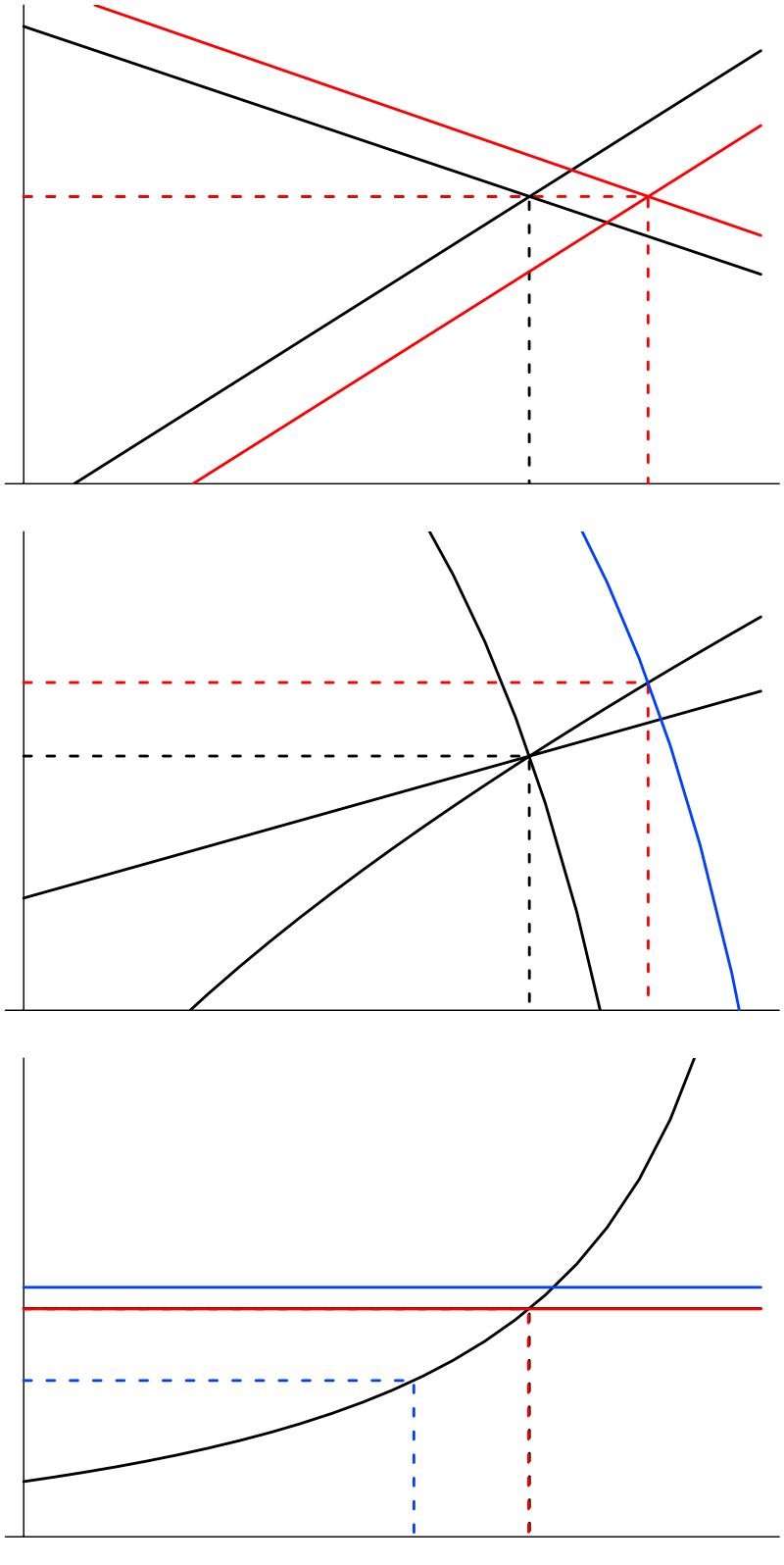
Is productivity bad or good for employment is this model ?

The short-run effect is to leave output unchanged and reduce actual employment. One needs less workers to satisfy the current level of demand.

The rise in unemployment reduces the desired wage. The rise in productivity increases the feasible wage. Both imply that inflation slows down and competitiveness increases.

In the medium-run, the rise in competitiveness increases output and perfectly offset the initial negative effect on employment.

Fixed rate – rise in productivity (2)



Fixed exchange rate – changes in labor supply

Many policies have been oriented towards modifying the size of the active population:
– early retirement
– restrictive immigration policy.

The short-run effect will be indeed to reduce actual unemployment at given output.

In the medium-run, the lower unemployment rate will foster inflation. Competitiveness drops until the unemployment rate returns to its equilibrium level.

These policies are thus useless to reduce unemployment.

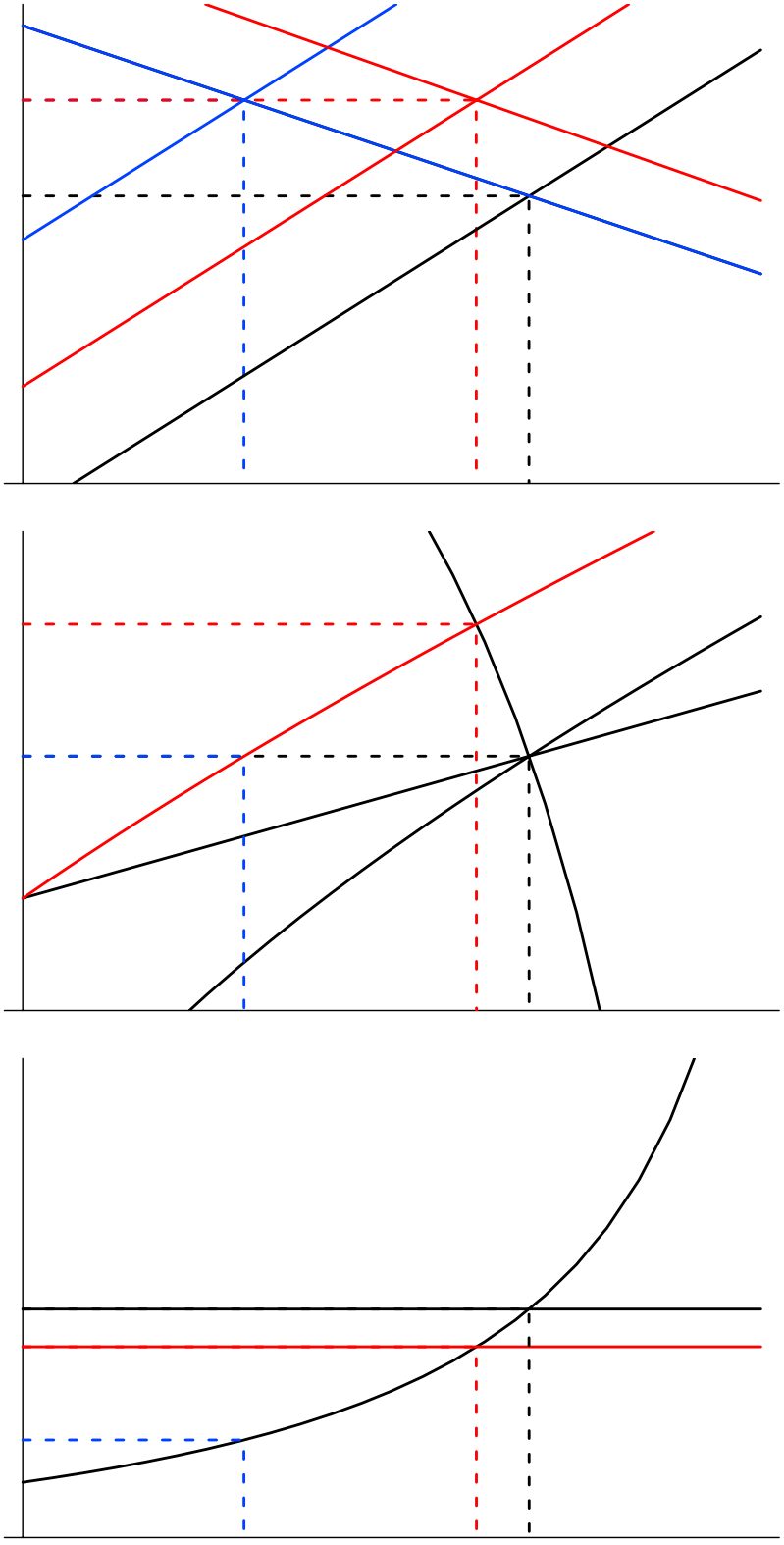
Fixed exchange rate – rise in foreign interest rate

In the short-run: drop in the money supply, rise in the domestic interest rate and large negative effect on output and employment.

If equilibrium unemployment is not affected (e.g. when there is monopolistic competition and efficiency wage), inflation drops, competitiveness rises and the initial drop in output is partly compensated by a rise in exports.

If equilibrium unemployment is affected (e.g. if customer market theories or dynamic bargaining are right), the large initial recession may persist – hysteresis.

Fixed rate – rise in foreign interest rate



Flexible exchange rate - current account

In the pure flexible regime, the central bank does not need to detain exchange reserves

$$\Delta M^s = \Delta M_g^s$$

The exchange rate is such that the external account clears

$$PX - P^*EM + R^*O^* - \Delta O^{*s} = 0$$

An inflow of capital implies thus an appreciation of the currency.

The arbitrage condition between foreign and domestic assets imply:

$$R - R^* = \frac{E_{t+1}^e - E_t}{E_t}$$

Key point: how are exchange rate expectations E_{t+1}^e determined ?

Flexible exchange rate - exchange rate expectations (1)

Exchange rate expectations:

- fixed
- adaptative (Mundell-Fleming)
- rational (Dornsbush)
- fixed in terms of real objectives, like the trade balance

Flexible exchange rate - exchange rate expectations (2)

Difficult to integrate in the New-Keynesian set-up. The literature on international (monetary) economics and the one on imperfect competition have few interactions.

Assume that exchange rate expectations depends on the trade balance. This amounts to assume that a country can hardly sustain a trade deficit or surplus permanently.

Hence, if there is a trade deficit, the agents will expect a depreciation. This will induce a capital outflow and an effective depreciation.

Competitiveness thus adjusts to balance the trade account.

Flexible exchange rate - inflation (1)

At a given period t, wage inflation follows the same rule as above

$$\dot{W}_t = \dot{P}_t^e + \frac{\Omega_d(.) - \frac{W_{t-1}}{P_{t-1}}}{\frac{W_{t-1}}{P_{t-1}}}$$

In a flexible exchange rate regime, we assume that agents look at past inflation in order to compute the expected inflation rate:

$$\dot{P}_t^e = \dot{P}_{t-1}$$

this adaptative expectation hypothesis is the simplest way to introduce a nominal rigidity in the model.

Flexible exchange rate - inflation (2)

The linearized mark-up rule implies:

$$\dot{P}_t = \kappa \dot{W}_t + (1-\kappa)(\dot{P}_t^{\star} + \dot{E}_t)$$

Putting the various equations together, we obtain

$$\dot{P}_t = \kappa \dot{P}_{t-1} + \kappa \frac{\Omega_d(.) - \Omega_f(.)}{\Omega_f(.)} + (1-\kappa)(\dot{P}_t^{\star} + \dot{E}_t)$$

which implies that

$$\dot{P}_t = \dot{P}_{t-1} + \frac{\Omega_d(.) - \Omega_f(.)}{\Omega_f(.)} + \frac{1-\kappa}{\kappa} \dot{\Theta}_t$$

Flexible exchange rate - inflation (3)

Hence, inflation accelerates when the feasible wage is larger than the desired wage.

Equilibrium unemployment = Non accelerating-inflation rate of unemployment (NAIRU).

$$\left| \begin{array}{l|l|l} \Omega_d > \Omega_f & U < U^\star & \dot{P} > \dot{P}_{t-1} \\ \Omega_d = \Omega_f & U = U^\star & \dot{P} = \dot{P}_{t-1} \\ \Omega_d < \Omega_f & U > U^\star & \dot{P} < \dot{P}_{t-1} \end{array} \right|$$

This will in turn have an effect on real money supply.

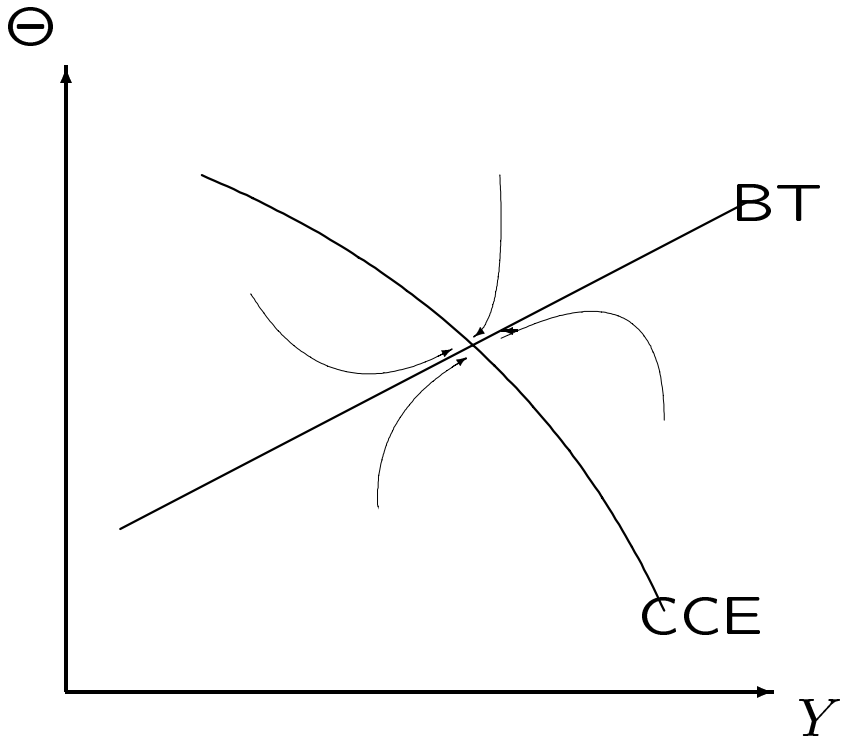
Flexible exchange rate - adjustment (1)

When the economy lies above the CCE curve, inflation accelerates, the money supply decreases and output drops.

When the economy lies below the BT curve, the agents expect a depreciation, inducing a capital outflow and an effective depreciation. Exports rises.

The second effect is probably quicker than the first one.

Flexible exchange rate - adjustment (2)



Flexible exchange rate - the sustainable unemployment rate

Definition: The sustainable unemployment rate is the equilibrium unemployment rate for which the trade balance is in equilibrium.
It is thus at the intersection $BT \bigcap CCE$.

The double adjustment mechanism always lead the economy to the sustainable unemployment rate.

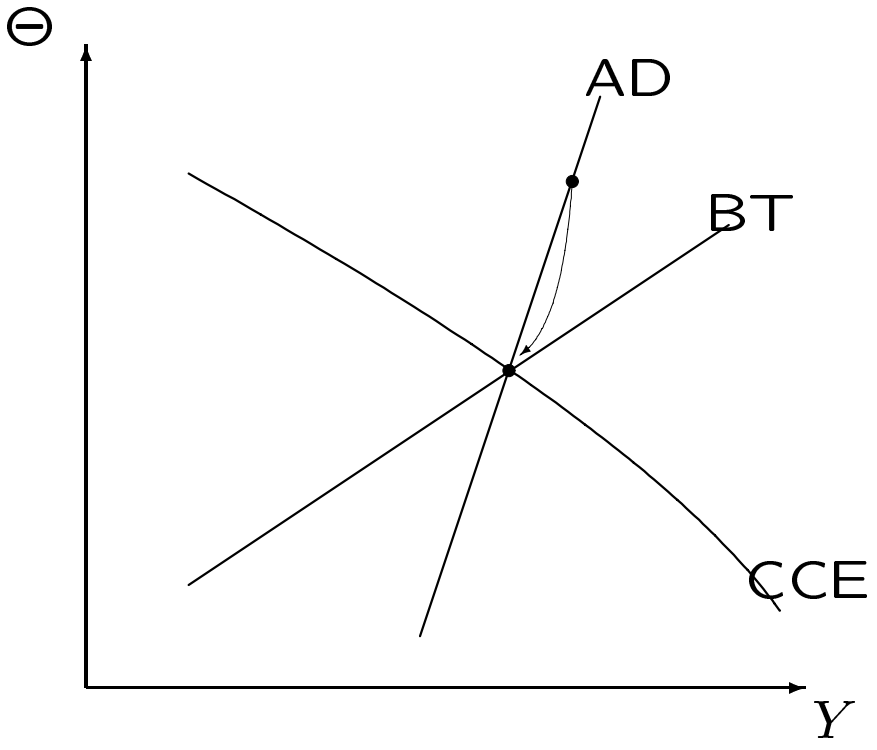
Hence the only way to move permanently the level of unemployment is either to move CCE (incomes policy) or to move BT.

Flexible exchange rate - increase in foreign interest rate

Short-run:
outflow of capital
depreciation of the exchange rate.
export rises (IS moves).
There is thus a transitory positive effect on output ($\neq$ fixed exchange rate).

Adjustment:
As the trade balance is in surplus, we expect an appreciation of the currency. Inflow of capital. Appreciation follows.
As unemployment is below the equilibrium level, inflation accelerates.
Real money supply falls and output decreases.

Flexible rate - increase in foreign interest rate (2)



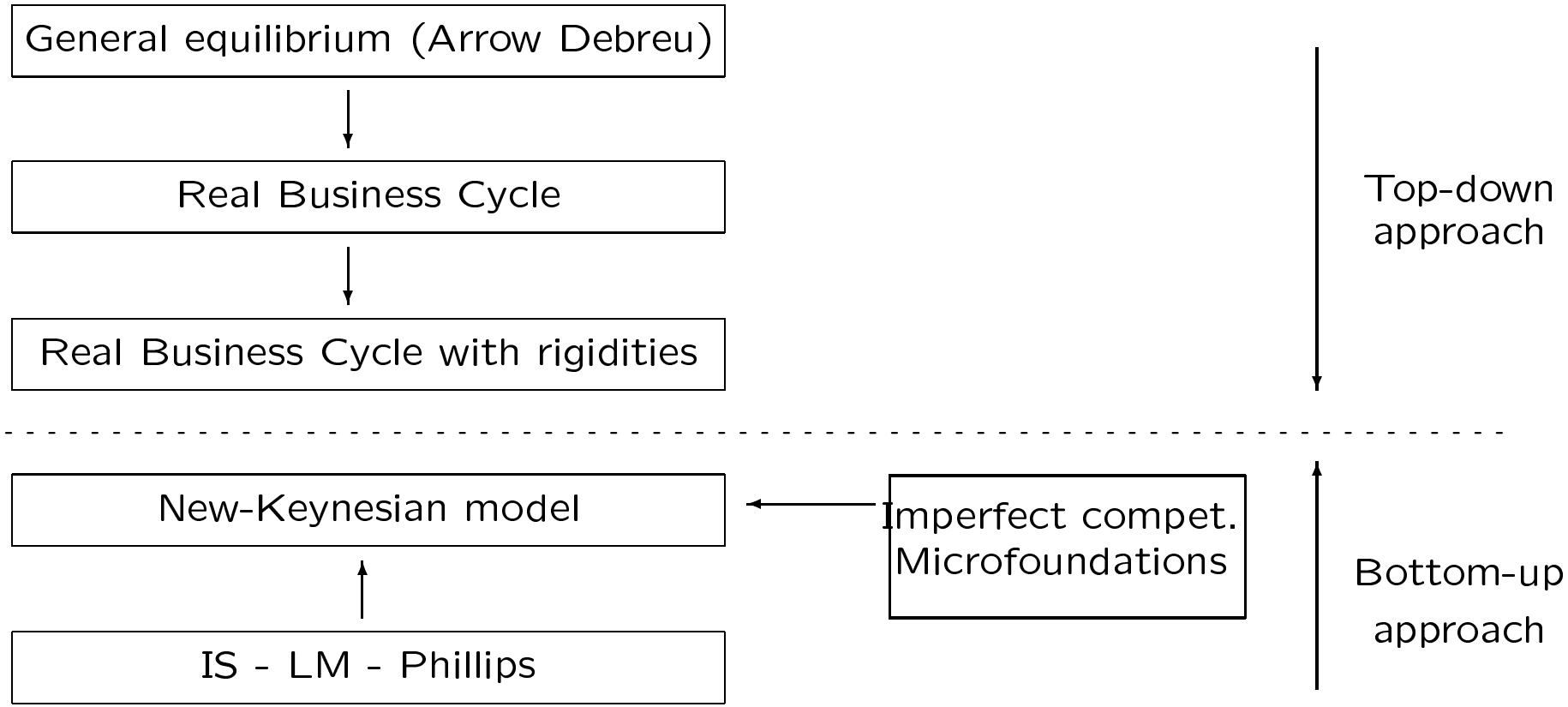
Flexible rate - monetary policy

A reduction in money supply increases the domestic interest rate. The consecutive inflow of capital induces an appreciation of the currency $\rightarrow$ loss in exports and output. Unemployment rises.

In the medium-run however, the drop in inflation compensates the initial effect.

Monetary policy can best be used to accelerate adjustment processes. For instance, after a restrictive incomes policy designed to lower unemployment, an expansionary monetary policy can speed up the adjustment (and replace the deceleration of inflation).

Conclusion


General equilibrium (Arrow Debreu)
Real Business Cycle
Real Business Cycle with rigidities
Top-down
approach
New-Keynesian model
Imperfect compet.
Microfoundations
IS - LM - Phillips
Bottom-up
approach